APPENDIX A

NOP and Comments

CITY OF GRASS VALLEY
Community Development Department
Thomas Last, Community Development Director

125 East Main Street
Grass Valley, CA 95945

Building Division
530-274-4340
Planning Division
530-274-4330

A CENTENNIAL CITY

February 11, 2016

To: See Attached Agency List

Re: **Notice of Preparation for an Environmental Impact Report** for the Dorsey Marketplace Project

The City of Grass Valley will prepare an Environmental Impact Report (EIR) for the **Dorsey Marketplace Project** (proposed project, project) and is issuing this Notice of Preparation (NOP) pursuant to Section 15082 of the California Environmental Quality Act (CEQA) Guidelines. The City is requesting input from the public and your agency on environmental issues associated with development of the proposed project. As a responsible or trustee agency, your agency may need to use this EIR when considering issuance of a permit or other discretionary approval for the proposed project. Comments received during this public comment period will be used to focus the environmental analysis in the EIR.

Project Location and Description

The 26.9 acres are located at the southeast freeway interchange of Dorsey Drive and State Route 20/49 (SR 20/40) (**Figure 1, Regional Location Map**). Specifically in the southeast quarter of Section 23, and northeast quarter of Section 26, Township 16 North, Range 8 East, M.D.M The property contains three (3) Assessor Parcel Numbers, 35-260-62, 63, and 64.

The proposed Project consists of the following applications:

1) General Plan Amendment to change the land use designation on 26.9 acres from Business Park to 21.2 acres of Commercial and 5.7 acres of Residential Urban High Density;

2) Rezone from Corporate Business Park to 21.2 acres of C-2 and 5.7 acres of R-3;

3) Development Review application to review the site plan and architecture for 181,900 square feet of commercial and retail uses and 90 multifamily residential units: and

4) Use Permit to allow three (3) drive-through restaurants.

The commercial area is proposed to include nine buildings with multiple tenants ranging in size from 3,000 to 92,000 square feet. There would be four major tenant spaces ranging from 20,000 to 48,000 sq. ft. in size. The residential area is proposed to include six residential structures that are two or three stories in height, a 3,200 square foot clubhouse, and a pool.

Comment Period

The NOP comment period commences on **February 16, 2016**, and will end on **March 17, 2016**. When submitting comments, please be specific in describing your environmental concerns. In particular, if there are changes to the project or measures you believe the City should take that would reduce the environmental impact of the project or address issues of concern, please include them in your response to this NOP. Please also include contact information so that the City can follow up with questions regarding comments if necessary. Comments must be sent to:

Thomas Last
Community Development Director
City of Grass Valley
125 E. Main Street
Grass Valley, CA 95945
toml@cityofgrassvalley.com

Scoping Meeting

Two scoping meetings will be conducted on **March 2, 2016,** in the City of Grass Valley City Council Chambers at the address shown above. **The meetings will be at 3:00 p.m. (primarily for agencies) and 6:00 p.m. (primarily for the public)**. Two meetings are being held to provide the greatest opportunity for both agency staff and members of the public to attend/participate. The scoping meeting will provide public agencies and the public with the opportunity to learn more about the proposed project and to discuss environmental issues. The scoping meeting will include a presentation of the proposed project and a summary of the environmental issues to be analyzed in the EIR. Comments provided during the scoping meeting will assist the City in scoping the potential environmental effects of the project to be addressed by the EIR.

Probable Environmental Impacts of the Project

The City has determined that the proposed project will require preparation of an EIR. As permitted by CEQA Section 15060(d), the City will not prepare an Initial Study. The EIR will evaluate all of the topics in the CEQA checklist. Based on experience with similar projects, the City anticipates the project may result in the following significant environmental impacts:

Aesthetics: Though the site did contain the former Springhill Mine operation and is a Brownfield site, much of the site is now covered with vegetation. The project will alter the present visual character and views of the property. The EIR will evaluate the change in character along with the light and glare issues associated with the project. The EIR will also consider whether the economic activity generated at the project site could adversely affect other businesses in the City to the extent that the project could lead to urban decay conditions.

Air Quality: The proposed project will result in additional traffic traveling to and from the project area. This will result in air emissions that could impact the environment. The EIR will evaluate both the construction and operational air quality impacts associated with the proposed project.

Biological Resources: The proposed project could impact biological resources. The site does not contain any wetland or creek resources, but could contain special status species or sensitive natural communities. The EIR will evaluate these potential resources.

Cultural Resources: A cultural resources evaluation will be prepared to determine if there are any archeological or historic resources onsite and the EIR will evaluate potential impacts on any identified cultural resources.

Geology, Soils, Seismicity: The EIR will identify geologic, soils, and seismic conditions in the project area and evaluate whether the proposed development could result in adverse environmental effects associated with these conditions. This will include consideration of the areas of grading, cut and fill amounts, slopes, road grades, retaining walls, and driveway grading.

Greenhouse Gases: Construction and operation of the project would generate greenhouse gas emissions. The EIR will estimate the proposed project's potential to generate greenhouse gases, including those associated with mobile sources, natural gas and electricity usage, water supply, wastewater conveyance and treatment, and solid waste disposal. The EIR will identify measures contained in the California Building Code as well as existing policies in the General Plan that may reduce the proposed project's impacts related to greenhouse gases, and evaluate the significance of the project's contribution to greenhouse gas emissions.

Hazardous Materials: A majority of this property previously contained the Springhill Mine operations. Portions of the project area are known to have contamination created from historic mining operations and the property owner has received approval of a Removal Action Plan from DTSC. The EIR will review the hazards associated with the past mining in the area and the potential serpentine rock (containing asbestos).

Hydrology and Water Quality: The EIR will address potential downstream storm drainage impacts on Caltrans and City facilities and analyze the proposed onsite storm water detention and water quality measures.

Land Use: The EIR will consider whether the project, which includes a General Plan amendment and rezone, could lead to any land use conflicts and incompatibilities or inconsistencies with General Plan policies adopted for the purpose of avoiding environmental impacts.

Noise: The project has the potential to expose the public (apartments, hospital, and elder care facilities in vicinity) to additional noise levels on a temporary and permanent basis Increases in vehicle traffic and the addition of new residential and commercial uses may result in an increase in ambient noise near the project site and along transportation routes leading to the project site. The EIR will estimate noise impacts associated with the construction and operation of the proposed project.

Population/Employment/Housing: The EIR will evaluate the degree to which the project could alter population density and the jobs/housing balance and whether those changes could result in physical environmental effects.

Public Services and Utilities: The EIR will evaluate the impact on city services such as wastewater treatment and storm drainage. Water supply impacts will be evaluated with the Nevada Irrigation District. Impacts to educational and recreational facilities will also be evaluated.

Transportation: Traffic associated with the proposed project may result in impacts on area roadways, intersections, and transportation facilities. Improvements are planned for some of the area roadways, however the timing, extent of improvements and financing may be uncertain. The EIR will evaluate impacts to the transportation network resulting from construction and operational phases of the proposed project.

If you have any questions, please call me at the number listed above.

Sincerely,

Thomas Last
Community Development Director

Figure 1, Regional Location Map
[Agency Distribution List]

DEPARTMENT OF TRANSPORTATION
DISTRICT 3
703 B STREET
MARYSVILLE, CA 95901
PHONE (530) 741-4199
FAX (530) 741-4245
TTY 711
www.dot.ca.gov/dist3

Serious drought.
Help save water!

March 17, 2016

Mr. Thomas Last
Community Development Director
City of Grass Valley
125 E. Main Street
Grass Valley, CA 95945

Dorsey Marketplace Project

Dear Mr. Thomas Last:

Thank you for including California Department of Transportation (Caltrans) in the environmental review process for Dorsey Marketplace Project. Caltrans' new mission, vision, and goals signal a modernization of our approach to California's transportation system. We review this local development for impacts to the State Highway System in keeping with our mission, vision and goals for sustainability/livability/economy, and safety/heath. We provide these comments consistent with the state's mobility goals that support a vibrant economy, and build communities, not sprawl.

The proposed project is located on 26.9 acres at the southeast freeway interchange of Dorsey Drive and State Route (SR) 20/49. The commercial area is proposed to include nine buildings with multiple tenants ranging in size from 3,000 to 92,000 square feet (sq. ft.). There would be four major tenant spaces ranging from 20,000 to 48,000 sq. ft. in size. The residential area is proposed to include six residential structures that are two to three stories in height, a 3,200 sq. ft. clubhouse, and a pool. The following comments are based on the Notice of Preparation (NOP) received:

Transportation & Circulation

We note that the City of Grass Valley recognizes that the proposed project may result in impacts on area roadways, intersections, and transportation facilities. We also note that the Environmental Impact Report (EIR) will evaluate impacts to the transportation network resulting from construction and operational phases of the proposed project. However, this proposed project will generate more than 100 PM peak hour trips onto the State facilities, it will be necessary to adequately assess impacts on the State Highway System (SHS) through a Traffic Impact Study (TIS).

The analysis should include the following:

- Dorsey Drive/SR 20/SR 49 Interchange –
    - Evaluate the potential for queuing on the off ramps which could back up onto the mainline and create a potential for collisions
    - Analyze ramp intersection interactions
    - Consider impacts from the existing Springhill Garden Apartments driveway
    - Include evaluation of transit connections in the vicinity
    - Address bicycle and pedestrian needs along the project frontage
    - Evaluate all intersections, including ramp intersections for the most effective intersection control solutions, such as roundabouts, signalization, etc.

In addition to the Dorsey Drive Interchange, impacts to all nearby interchanges from Brunswick Road to the Empire Street/SR 20 interchange should also be analyzed.

Hydraulics/Hydrology

We note that the EIR will include a drainage study to address potential downstream storm drainage impacts on Caltrans and City facilities. Please provide a copy of the drainage study for our review to the address below:

Office of Transportation Planning
703 B Street
Marysville, CA 95901

Please provide our office with copies of any further actions regarding this project. We would appreciate the opportunity to review and comment on any changes related to this development.

We would be pleased to meet with the City of Grass Valley and the project proponent to further discuss our concerns.

If you have any question regarding these comments or require additional information, please contact Jennifer Jacobson, Intergovernmental Review Coordinator for Nevada County, by phone (530) 741-5435 or via email to jennifer.jacobson@dot.ca.gov.

Sincerely,

Susan Zanchi

SUSAN ZANCHI, Branch Chief
Transportation Planning—North

c: Scott Morgan, State Clearinghouse

FW: Dorsey Marketplace

Tom Last <toml@cityofgrassvalley.com>

Mon 3/21/2016 8:15 AM

To:Katherine Waugh <kwaugh@dudek.com>; Trisha Tillotson <trishat@cityofgrassvalley.com>;

1 attachments (15 KB)

Technical Memorandum.docx;

This is a little strange I think this includes different issues from the letter sent last week.

Thomas Last | Community Development Director
City of Grass Valley | Community Development Department | 125 E. Main Street | Grass Valley, CA 95945
Phone: (530) 274-4711Email: toml@cityofgrassvalley.com | Web: [www.cityofgrassvalley.com]
www.cityofgrassvalley.com

From: Earles, Marty B@DOT [mailto:marty.earles@dot.ca.gov]
Sent: Monday, March 21, 2016 8:02 AM
To: Tom Last
Subject: FW: Dorsey Marketplace

Mr. Last,

You will have received the email from Jennifer Jacobson, signed by Susan Zanchi of our Transportation Planning office.

In case the engineers performing the traffic impact study would like a bit more detail, attached is my memo:
My main concerns are:
That we have an early consultation on trip distribution, so there are no arguments and possible costly rework later.
There is no need to study the freeway mainline volumes and merging/diverging flows on this corridor.
There is no need to study queuing at off-ramps except at the Dorsey interchange.
The generic statement “In addition to the Dorsey Drive interchange, impacts to all nearby interchanges from Brunswick Road to the Empire Street/SR 20 interchange should also be studied” is limited to ramp intersections only.

The comment letter is the official correspondence. I’m just trying to clarify a few points so no unnecessary work is done. I hope that’s helpful.

Martin Earles
Associate Transportation Engineer
530-741-5744
Caltrans / District 3 / Highway Operations
703 B Street / Marysville, CA 95901

FW: Dorsey Marketplace Project environmental concerns

TL

Tom Last <toml@cityofgrassvalley.com>
Fri 3/18/2016, 11:25 AM
Katherine Waugh

Reply all |

Thomas Last | Community Development Director
City of Grass Valley | Community Development Department | 125 E. Main Street | Grass Valley, CA 95945
Phone: (530) 274-4711 Email: toml@cityofgrassvalley.com | Web: [www.cityofgrassvalley.com]
www.cityofgrassvalley.com

From: Dodie Johnston [mailto:dodieinchina@yahoo.com]
Sent: Wednesday, March 16, 2016 2:50 PM
To: Tom Last
Subject: Dorsey Marketplace Project environmental concerns

Dear Mr. Last: I am very sorry I was not able to attend previous meetings regarding the Dorsey Drive development. Please accept my written concerns about the project, below.

I must leave the specialized topics of hydrology geology, hazardous materials and biological resources to the experts as I have no training in these areas. What I do have is a strong sense of our community as a small rural one, happy with its identity, and not wishing to become just another cluster of houses surrounded by malls and parking lots.

First, please thank the developer for not naming it after the trees, habitat or landscape features that will be destroyed in the building of this shopping/business center (like Whispering Pines, Pine Creek, Quail Ridge, for instance). Bad enough that enough that these things will disappear without trying to soothe customers with faux-natural names. I beg the EIR report to also concern itself with the amount and type of vegetation surrounding and maybe even dotted throughout the development. For reasons of efficiency (less need for fancy fertilizers and watering systems) the landscaping should be native tress and plants, yes, even the much maligned manzanita. It doesn't catch fire on its own, you know, it's people who are the fire danger, not the vegetation. Could not some of the existing vegetation be spared, rather than re-planted? Ceaothus, Digger pines, manzanita, toyon, wild honeysuckle....many of our native plants have lovely little flowers in spring and berries in the fall and would harmonize with the local hillsides so much better than palm trees and showy bushes that would not adapt as well to our weather and elevation. Carol Singer, who specializes in native plants, could be consulted about planting and that move alone might provide a bridge to more community approval.

I realize the owner doesn't need community approval to build this, but wouldn't it be nice?

I also hope that big corporate signs and storefronts visually blasting their presence can be avoided. No neon, no searchlights, no trails of balloons, no billboards along 49 hyping the thrill of shopping here. I and many others breathe a sign of relief when we leave Auburn and the road become lined with ranches and farms only to rev up again at the outskirts of GV where we're greeted by K-Mart and the Pineless Creekless Center. Visual impacts can be kept to a minimum by limited signage and light pollution. Let's be discrete...we'll know where it is and what it's selling. The only sign I'd like to see in the parking lot is one to urge owners of big trucks and SUV's to turn off their engines while in the lot...I'm more concerned with the air quality of all of us than the temperature in an owner's vehicle.

You get the idea: I'd ditch the whole project if I could, but since I can't, I'd like it to generate as little visual, auditory, light and air pollution as possible. Vehicular trips to the center to cruise the shelves of clothes and kitchen gadgets, or pick up some little trinket for a birthday party, of buy dinner at the drive-through will naturally increase the traffic everywhere, contribute to air pollution and to our garbage dump where construction waste and made-in-China stuff ends up sooner rather than later. Any way to reduce traffic? I support any attempts to do so.

I could have done this in outline form and it would have made it simpler for you to read, but writing narrative makes me feel better. The fact that our chamber of commerces and our newspaper is urging more and more commercial growth doesn't. I have asked afew friends to contribute comments, too...hopefully they did and will populate future meetings with their bodies and their voices. Dorene Johnston, 11099 Nugget Lane, Grass Valley, CA 273-3639

Reply all | Delete Junk |

FW: Dorsey Marketplace Project

TL Tom Last <toml@cityofgrassvalley.com> Reply all |
Thu 3/31/2016, 10:39 AM
Katherine Waugh

Thomas Last | Community Development Director
City of Grass Valley | Community Development Department | 125 E. Main Street | Grass Valley, CA 95945
Phone: (530) 274-4711Email: toml@cityofgrassvalley.com | Web: [www.cityofgrassvalley.com]
www.cityofgrassvalley.com

From: Dan Landon [mailto:dlandon@nccn.net]
Sent: Thursday, March 31, 2016 10:29 AM
To: Tom Last
Subject: Dorsey Marketplace Project

Tom,

This email is a written response to the Notice of Preparation for an Environmental Impact Report for the Dorsey Marketplace Project.

The inclusion of a traffic study in the EIR to evaluate the impacts of the proposed project is what the Nevada County Transportation Commission will need.

With regard to The Nevada County Airport Land Use Commission, the project is in urban overlay portion of Compatibility Zone D. Therefore, airspace concerns would generally be regarding any objects with height greater than 100 feet above the runway elevation. The maximum density in the urban overlay portion of Zone D is 20 units per acre for residential use and no limit for other uses. A recorded overflight notice is required for projects in this zone and children's schools, hospitals, and nursing homes are discouraged.

Please feel free to contact me if you need any further information.

Daniel B Landon
Executive Director
Nevada County Transportation Commission
Nevada County Airport Land Use Commission
530-265-3202

HIGH SIERRA ELECTRONICS
environmental monitoring solutions

155 Springhill Drive, Suite 106
Grass Valley, California 95945
530.273.2080
Fax: 530.273.2089
www.highsierraelectronics.com
ISO 9001:2000

April 7, 2016

Mr. Tom Last
Community Development Director
City of Grass Valley

I am following up with our conversation from the Dorsey Marketplace meeting at the Event Center.

My concerns involve the traffic impacts upon Spring Hill Drive in the current business park. My wife and I are the owners of two condos at 155 Spring Hill Drive comprising of 13,500 sq. ft. Our two principle tenants are High Sierra Electronics, Inc., and Body Logic, a physical therapy clinic. High Sierra Electronics is a company that we own and has 35 employees. We have been in this location since August of 2004.

The EIR consultant's traffic study will certainly have much to say about Spring Hill drive. So, I may be redundant. They might also overlook the actual conditions that sometimes exist. So I want to make sure we have them out in front of all of us.

1) Many of the commercial spaces cannot handle the long tractor/trailers that deliver to the area. It is very common for drivers who know the area to stop in the uphill lanes to unload items for CED (electrical distributor). Ernie's Van and Storage will occasionally have long trucks parked on the street. On the other side of the coin, some drivers are unfamiliar with the complexes and pull in where they do not have enough room to maneuver. They are backing out onto a steep drive blocking traffic.
2) Due to the abrupt change from the flat Idaho Maryland Drive grade to the steep grade of Spring Hill Drive one can observe numerous gouges in the pavement on Idaho Maryland Drive due to the rear bumper dragging. This adds to some drivers not turning left onto Idaho Maryland even though they have the right of way.
3) Parking is sometimes a problem along Spring Hill Drive, as it adds to the general congestion. The Christmas season sees Fed Ex expanding the number of employees parking on the street. The auto repair business Eagle Automotive and JM Offroad park their customer's vehicles on the street. Businesses like Body Logic will have their employee's park on the street, leaving their assigned parking spaces for customer use.
4) The friction of the road way should be of some concern due to the steepness of Spring Hill Drive. Because of its southern exposure and lack of trees, significant snow accumulation has been rare.

My recommendations for mitigation of the impacts upon Spring Hill from the Dorsey Marketplace project include:

1) Some method of directing more traffic from the complex up to Dorsey Drive and away from Idaho Maryland Drive. One suggestion would be to force the occupants of the apartment buildings leaving via the lower exit to make a right turn only. This could be just a concrete barrier between the uphill and downhill lanes in the bottom part of Spring Hill in the vicinity of the lower exit. Additionally I propose that drivers coming up the hill on Spring Hill not be allowed to make a right turn into the apartment complex. This is very similar to the design where the Carl's Jr Restaurant exits onto Freeman Lane in Grass Valley. There, the prohibition for turning left is painted double-double lines. Some vehicles still turn left.

2) Improve the capacity of the Spring Hill – Idaho Maryland intersection. I suggest that the bottom of Spring Hill be made into 3 lanes – an uphill lane, a downhill turning right, and a downhill turning left. I have observed many drivers waiting for eastbound traffic on Idaho Maryland to be clear before turning left, when they could have used the merge lane in the center. Possibly Centennial Drive could be realigned through the Hap Warnke sawmill into a new intersection (traffic circle?) with wolf creek running underneath it.

Finally, I can live with the additional impacts of the Dorsey Marketplace that have no easy mitigation,

James Slouber
V.P. High Sierra Electronics, Inc.
155 Spring Hill Drive, Suite 106
Grass Valley, CA 95945

jslouber@highsierraelectronics.com
Work: (530) 273-2080 x14
Home: (530) 273-6534
Cell: (530) 362-0033

STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Edmund G. Brown Jr.
Governor

Ken Alex
Director

GRASS VALLEY
FEB 25 2016
Community Dev. Dept.

Notice of Preparation

February 18, 2016

To: Reviewing Agencies

Re: Dorsey Marketplace Project
SCH# 2016022053

Attached for your review and comment is the Notice of Preparation (NOP) for the Dorsey Marketplace Project draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Thomas Last
City of Grass Valley
125 East Main Street
Grass Valley, CA 95945

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

Document Details Report
State Clearinghouse Data Base

SCH#	**2016022053**
Project Title	Dorsey Marketplace Project
Lead Agency	Grass Valley, City of

Type **NOP** Notice of Preparation

Description The proposed project consists of the following applications:

1) General Plan Amendment to change the land use designation on 26.9 acres from Business Park to 21.2 acres of commercial and 5.7 acres of Residential Urban High Density;
2) Rezone from Corporate Business Park to 21.2 acres of C-2 and 5.7 acres of R-3;
3) Development Review application to review the site plan and architecture for 181,900 sf of commercial and retail uses and 90 multifamily residential units: and
4) Use Permit to allow three (3) drive-through restaurants.

The commercial area is proposed to include nine buildings with multiple tenants ranging in size from 3,000 to 92,000 sf. There would be four major tenant spaces ranging from 20,000 to 48,000 sf in size. The residential area is proposed to include six residential structures that are two or three stories in height, a 3,200 sf clubhouse, and a pool.

Lead Agency Contact

Name	Thomas Last		
Agency	City of Grass Valley		
Phone	(530) 274-4330	***Fax***	
email	toml@cityofgrassvalley.com		
Address	125 East Main Street		
City	Grass Valley	***State*** CA	***Zip*** 95945

Project Location

County	Nevada						
City	Grass Valley						
Region							
Cross Streets	Dorsey Drive						
Lat / Long							
Parcel No.	35-260-62,63, 64						
Township	16N	***Range***	8E	***Section***	23, 26	***Base***	MDB&M

Proximity to:

Highways	SR 20/49
Airports	
Railways	
Waterways	
Schools	
Land Use	

Project Issues Aesthetic/Visual; Air Quality; Biological Resources; Archaeologic-Historic; Geologic/Seismic; Other Issues; Toxic/Hazardous; Water Quality; Landuse; Noise; Population/Housing Balance; Public Services; Traffic/Circulation

Reviewing Agencies Resources Agency; Cal Fire; Office of Historic Preservation; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 2; Native American Heritage Commission; California Highway Patrol; Caltrans, District 3 N; Air Resources Board; State Water Resources Control Board, Division of Drinking Water; State Water Resources Control Board, Division of Water Rights; Regional Water Quality Control Bd., Region 5 (Sacramento)

Date Received 02/16/2016 *Start of Review* 02/17/2016 *End of Review* 03/17/2016

NOP Distribution List

of

County: Nevada

SCH# 2016022053

Resources Agency

- [x] **Resources Agency**
  Nadell Gayou
  - [ ] **Dept. of Boating & Waterways**
    Denise Peterson
  - [ ] **California Coastal Commission**
    Elizabeth A. Fuchs
  - [ ] **Colorado River Board**
    Lisa Johansen
  - [ ] **Dept. of Conservation**
    Elizabeth Carpenter
  - [ ] **California Energy Commission**
    Eric Knight
  - [x] **Cal Fire**
    Dan Foster
  - [ ] **Central Valley Flood Protection Board**
    James Herota
  - [x] **Office of Historic Preservation**
    Ron Parsons
- [x] **Dept of Parks & Recreation**
  Environmental Stewardship Section
  - [ ] **California Department of Resources, Recycling & Recovery**
    Sue O'Leary
  - [ ] **S.F. Bay Conservation & Dev't. Comm.**
    Steve McAdam
  - [x] **Dept. of Water Resources**
    Resources Agency
    Nadell Gayou

Fish and Game

- [ ] **Depart. of Fish & Wildlife**
  Scott Flint
  Environmental Services Division
- [ ] **Fish & Wildlife Region 1**
  Curt Babcock
- [ ] **Fish & Wildlife Region 1E**
  Laurie Harnsberger
- [x] **Fish & Wildlife Region 2**
  Jeff Drongesen
- [ ] **Fish & Wildlife Region 3**
  Craig Weightman
- [ ] **Fish & Wildlife Region 4**
  Julie Vance
- [ ] **Fish & Wildlife Region 5**
  Leslie Newton-Reed
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6**
  Tiffany Ellis
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
  Heidi Calvert
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
  Becky Ota
  Marine Region

Other Departments

- [ ] [illegible]
- [ ] [illegible]
- [ ] [illegible]
- [ ] [illegible]
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[illegible] Com[illegible]

- [ ] **Delta Protection Comm[illegible]**
  Michael Machado

- [ ] **OES (Office of Emergency Services)**
  Marcia Scully
- [x] **Native American Heritage Comm.**
  Debbie Treadway
  - [ ] **Public Utilities Commission**
    Supervisor
  - [ ] **Santa Monica Bay Restoration**
    Guangyu Wang
  - [ ] **State Lands Commission**
    Jennifer Deleong
  - [ ] **Tahoe Regional Planning Agency (TRPA)**
    Cherry Jacques

Cal State Transportation Agency CalSTA

- [ ] **Caltrans - Division of Aeronautics**
  Philip Crimmins
- [ ] **Caltrans – Planning HQ LD-IGR**
  Terri Pencovic
- [x] **California Highway Patrol**
  [illegible] Ikeuchi
  [illegible] Projects

[illegible]ion

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  [illegible]nchi - North
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  [illegible]ewland
- [ ] **[illegible]ns, District 6**
  [illegible]el Navarro
- [ ] **[illegible]ans, District 7**
  Dianna Watson
- [ ] **Caltrans, District 8**
  Mark Roberts
- [ ] **Caltrans, District 9**
  Gayle Rosander
- [ ] **Caltrans, District 10**
  Tom Dumas
- [ ] **Caltrans, District 11**
  Jacob Armstrong
- [ ] **Caltrans, District 12**
  Maureen El Harake

Cal EPA

Air Resources Board

- [x] All Other Projects
  Cathi Slaminski
  - [ ] Transportation Projects
    Nesamani Kalandiyur
  - [ ] Industrial/Energy Projects
    Mike Tollstrup
- [ ] **State Water Resources Control Board**
  Regional Programs Unit
  Division of Financial Assistance
- [x] **State Water Resources Control Board**
  Karen Larsen – Asst Deputy
  Division of Drinking Water
- [ ] **State Water Resources Control Board**
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [x] **State Water Resouces Control Board**
  Phil Crader
  Division of Water Rights
- [ ] **Dept. of Toxic Substances Control**
  CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**
  CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [ ] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [ ] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [x] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)

- [ ] **Other** ____________

- [ ] ____________
  Conservancy

Last Updated 2/9/2016

STATE OF CALIFORNIA Edmund G. Brown Jr., Governor
NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone (916) 373-3710
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Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

February 29, 2016

Thomas Last
City of Grass Valley
125 East Main Street
Grass Valley, CA 95945

RE: SCH#2016022053, Dorsey Marketplace Project, Nevada County

Dear Mr. Last:

The Native American Heritage Commission has received the Notice of Preparation (NOP) for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.), specifically Public Resources Code section 21084.1, states that a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, § 15064.5 (b) (CEQA Guidelines Section 15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an environmental impact report (EIR) shall be prepared. (Pub. Resources Code § 21080 (d); Cal. Code Regs., tit. 14, § 15064 subd.(a)(1) (CEQA Guidelines § 15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources with the area of project effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code § 21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code § 21084.3 (a)). **AB 52 applies to any project for which a notice of preparation or a notice of negative declaration or mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. § 800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments. **Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.**

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

a. A brief description of the project.
b. The lead agency contact information.
c. Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code § 21080.3.1 (d)).
d. A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code § 21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code § 21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or environmental impact report. (Pub. Resources Code § 21080.3.1(b)).
   a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code § 65352.4 (SB 18). (Pub. Resources Code § 21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
   a. Alternatives to the project.
   b. Recommended mitigation measures.
   c. Significant effects. (Pub. Resources Code § 21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
   a. Type of environmental review necessary.
   b. Significance of the tribal cultural resources.
   c. Significance of the project's impacts on tribal cultural resources.
   d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code § 21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code sections 6254 (r) and 6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code § 21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
   a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
   b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code section 21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code § 21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
   a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
   b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code § 21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code section 21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation

monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code section 21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code § 21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code section 21084.3 (b). (Pub. Resources Code § 21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    a. Avoidance and preservation of the resources in place, including, but not limited to:
        i. Planning and construction to avoid the resources and protect the cultural and natural context.
        ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
        i. Protecting the cultural character and integrity of the resource.
        ii. Protecting the traditional use of the resource.
        iii. Protecting the confidentiality of the resource.
    c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    d. Protecting the resource. (Pub. Resource Code § 21084.3 (b)).
    e. Please note that a federally recognized California Native American tribe or a nonfederally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code § 815.3 (c)).
    f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code § 5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An environmental impact report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code sections 21080.3.1 and 21080.3.2 and concluded pursuant to Public Resources Code section 21080.3.2.
    b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code section 21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code § 21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code § 65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code § 65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code section 65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code sections 5097.9 and 5097.993 that are within the city's or county's jurisdiction. (Gov. Code § 65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
    a. If part or all of the APE has been previously surveyed for cultural resources.
    b. If any known cultural resources have been already been recorded on or adjacent to the APE.
    c. If the probability is low, moderate, or high that cultural resources are located in the APE.
    d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
    b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
    a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
    b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
    a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, section 15064.5(f) (CEQA Guidelines section 15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
    b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
    c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code section 7050.5, Public Resources Code section 5097.98, and Cal. Code Regs., tit. 14, section 15064.5, subdivisions (d) and (e) (CEQA Guidelines section 15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions, please contact me at my email address: sharaya.souza@nahc.ca.gov.

Sincerely,

Sharaya Souza
Staff Services Analyst
cc: State Clearinghouse

CALIFORNIA
Water Boards

Edmund G. Brown Jr.
Governor

Matthew Rodriquez
Secretary for
Environmental Protection

Central Valley Regional Water Quality Control Board

10 March 2016

Thomas Last
City of Grass Valley
125 East Main Street
Grass Valley, CA 95945

CERTIFIED MAIL
91 7199 9991 7035 8364 4929

COMMENTS TO REQUEST FOR REVIEW FOR THE NOTICE OF PREPARATION FOR THE DRAFT ENVIRONMENTAL IMPACT REPORT, DORSEY MARKETPLACE PROJECT, SCH# 2016022053, NEVADA COUNTY

Pursuant to the State Clearinghouse's 18 February 2016 request, the Central Valley Regional Water Quality Control Board (Central Valley Water Board) has reviewed the *Request for Review for the Notice of Preparation for the Draft Environment Impact Report* for the Dorsey Marketplace Project, located in Nevada County.

Our agency is delegated with the responsibility of protecting the quality of surface and groundwaters of the state; therefore our comments will address concerns surrounding those issues.

I. Regulatory Setting

Basin Plan

The Central Valley Water Board is required to formulate and adopt Basin Plans for all areas within the Central Valley region under Section 13240 of the Porter-Cologne Water Quality Control Act. Each Basin Plan must contain water quality objectives to ensure the reasonable protection of beneficial uses, as well as a program of implementation for achieving water quality objectives with the Basin Plans. Federal regulations require each state to adopt water quality standards to protect the public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act. In California, the beneficial uses, water quality objectives, and the Antidegradation Policy are the State's water quality standards. Water quality standards are also contained in the National Toxics Rule, 40 CFR Section 131.36, and the California Toxics Rule, 40 CFR Section 131.38.

The Basin Plan is subject to modification as necessary, considering applicable laws, policies, technologies, water quality conditions and priorities. The original Basin Plans were adopted in 1975, and have been updated and revised periodically as required, using Basin Plan amendments. Once the Central Valley Water Board has adopted a Basin Plan amendment in noticed public hearings, it must be approved by the State Water Resources Control Board (State Water Board), Office of Administrative Law (OAL) and in some cases, the United States Environmental Protection Agency (USEPA). Basin Plan amendments only become effective after they have been approved by the OAL and in some cases, the USEPA. Every three (3) years, a review of the Basin Plan is completed that assesses the appropriateness of existing standards and evaluates and prioritizes Basin Planning issues.

For more information on the *Water Quality Control Plan for the Sacramento and San Joaquin River Basins*, please visit our website:
http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/.

Antidegradation Considerations

All wastewater discharges must comply with the Antidegradation Policy (State Water Board Resolution 68-16) and the Antidegradation Implementation Policy contained in the Basin Plan. The Antidegradation Policy is available on page IV-15.01 at:
http://www.waterboards.ca.gov/centralvalleywater_issues/basin_plans/sacsjr.pdf

In part it states:

> *Any discharge of waste to high quality waters must apply best practicable treatment or control not only to prevent a condition of pollution or nuisance from occurring, but also to maintain the highest water quality possible consistent with the maximum benefit to the people of the State.*
>
> *This information must be presented as an analysis of the impacts and potential impacts of the discharge on water quality, as measured by background concentrations and applicable water quality objectives.*

The antidegradation analysis is a mandatory element in the National Pollutant Discharge Elimination System and land discharge Waste Discharge Requirements (WDRs) permitting processes. The environmental review document should evaluate potential impacts to both surface and groundwater quality.

II. Permitting Requirements

Construction Storm Water General Permit

Dischargers whose project disturb one or more acres of soil or where projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Storm Water Discharges Associated with Construction Activities (Construction General Permit), Construction General Permit Order No. 2009-009-DWQ. Construction activity subject to this permit includes clearing, grading, grubbing, disturbances to the ground, such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan

(SWPPP).

For more information on the Construction General Permit, visit the State Water Resources Control Board website at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml.

Phase I and II Municipal Separate Storm Sewer System (MS4) Permits[1]
The Phase I and II MS4 permits require the Permittees reduce pollutants and runoff flows from new development and redevelopment using Best Management Practices (BMPs) to the maximum extent practicable (MEP). MS4 Permittees have their own development standards, also known as Low Impact Development (LID)/post-construction standards that include a hydromodification component. The MS4 permits also require specific design concepts for LID/post-construction BMPs in the early stages of a project during the entitlement and CEQA process and the development plan review process.

For more information on which Phase I MS4 Permit this project applies to, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/municipal_permits/.

For more information on the Caltrans Phase I MS4 Permit, visit the State Water Resources Control Board at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/caltrans.shtml.

For more information on the Phase II MS4 permit and who it applies to, visit the State Water Resources Control Board at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/phase_ii_municipal.shtml.

Industrial Storm Water General Permit
Storm water discharges associated with industrial sites must comply with the regulations contained in the Industrial Storm Water General Permit Order No. 2014-0057-DWQ.

For more information on the Industrial Storm Water General Permit, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/industrial_general_permits/index.shtml.

Clean Water Act Section 404 Permit
If the project will involve the discharge of dredged or fill material in navigable waters or wetlands, a permit pursuant to Section 404 of the Clean Water Act may be needed from the

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[1] Municipal Permits = The Phase I Municipal Separate Storm Water System (MS4) Permit covers medium sized Municipalities (serving between 100,000 and 250,000 people) and large sized municipalities (serving over 250,000 people). The Phase II MS4 provides coverage for small municipalities, including non-traditional Small MS4s, which include military bases, public campuses, prisons and hospitals.

United States Army Corps of Engineers (USACOE). If a Section 404 permit is required by the USACOE, the Central Valley Water Board will review the permit application to ensure that discharge will not violate water quality standards. If the project requires surface water drainage realignment, the applicant is advised to contact the Department of Fish and Game for information on Streambed Alteration Permit requirements.

If you have any questions regarding the Clean Water Act Section 404 permits, please contact the Regulatory Division of the Sacramento District of USACOE at (916) 557-5250.

Clean Water Act Section 401 Permit – Water Quality Certification

If an USACOE permit (e.g., Non-Reporting Nationwide Permit, Nationwide Permit, Letter of Permission, Individual Permit, Regional General Permit, Programmatic General Permit), or any other federal permit (e.g., Section 10 of the Rivers and Harbors Act or Section 9 from the United States Coast Guard), is required for this project due to the disturbance of waters of the United States (such as streams and wetlands), then a Water Quality Certification must be obtained from the Central Valley Water Board prior to initiation of project activities. There are no waivers for 401 Water Quality Certifications.

Waste Discharge Requirements – Discharges to Waters of the State

If USACOE determines that only non-jurisdictional waters of the State (i.e., "non-federal" waters of the State) are present in the proposed project area, the proposed project may require a Waste Discharge Requirement (WDR) permit to be issued by Central Valley Water Board. Under the California Porter-Cologne Water Quality Control Act, discharges to all waters of the State, including all wetlands and other waters of the State including, but not limited to, isolated wetlands, are subject to State regulation.

For more information on the Water Quality Certification and WDR processes, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/help/business_help/permit2.shtml.

Dewatering Permit

If the proposed project includes construction or groundwater dewatering to be discharged to land, the proponent may apply for coverage under State Water Board General Water Quality Order (Low Risk General Order) 2003-0003 or the Central Valley Water Board's Waiver of Report of Waste Discharge and Waste Discharge Requirements (Low Risk Waiver) R5-2013-0145. Small temporary construction dewatering projects are projects that discharge groundwater to land from excavation activities or dewatering of underground utility vaults. Dischargers seeking coverage under the General Order or Waiver must file a Notice of Intent with the Central Valley Water Board prior to beginning discharge.

For more information regarding the Low Risk General Order and the application process, visit the Central Valley Water Board website at:

http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2003/wqo/wqo2003-0003.pdf

For more information regarding the Low Risk Waiver and the application process, visit the Central Valley Water Board website at:

http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/waivers/r5-2013-0145_res.pdf

Regulatory Compliance for Commercially Irrigated Agriculture

If the property will be used for commercial irrigated agricultural, the discharger will be required to obtain regulatory coverage under the Irrigated Lands Regulatory Program. There are two options to comply:

1. **Obtain Coverage Under a Coalition Group.** Join the local Coalition Group that supports land owners with the implementation of the Irrigated Lands Regulatory Program. The Coalition Group conducts water quality monitoring and reporting to the Central Valley Water Board on behalf of its growers. The Coalition Groups charge an annual membership fee, which varies by Coalition Group. To find the Coalition Group in your area, visit the Central Valley Water Board's website at: http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/for_growers/apply_coalition_group/index.shtml or contact water board staff at (916) 464-4611 or via email at IrrLands@waterboards.ca.gov.

2. **Obtain Coverage Under the General Waste Discharge Requirements for Individual Growers, General Order R5-2013-0100.** Dischargers not participating in a third-party group (Coalition) are regulated individually. Depending on the specific site conditions, growers may be required to monitor runoff from their property, install monitoring wells, and submit a notice of intent, farm plan, and other action plans regarding their actions to comply with their General Order. Yearly costs would include State administrative fees (for example, annual fees for farm sizes from 10-100 acres are currently $1,084 + $6.70/Acre); the cost to prepare annual monitoring reports; and water quality monitoring costs. To enroll as an Individual Discharger under the Irrigated Lands Regulatory Program, call the Central Valley Water Board phone line at (916) 464-4611 or e-mail board staff at IrrLands@waterboards.ca.gov.

Low or Limited Threat General NPDES Permit

If the proposed project includes construction dewatering and it is necessary to discharge the groundwater to waters of the United States, the proposed project will require coverage under a National Pollutant Discharge Elimination System (NPDES) permit. Dewatering discharges are typically considered a low or limited threat to water quality and may be covered under the General Order for *Dewatering and Other Low Threat Discharges to Surface Waters* (Low Threat General Order) or the General Order for *Limited Threat Discharges of Treated/Untreated Groundwater from Cleanup Sites, Wastewater from Superchlorination Projects, and Other Limited Threat Wastewaters to Surface Water*

(Limited Threat General Order). A complete application must be submitted to the Central Valley Water Board to obtain coverage under these General NPDES permits.

For more information regarding the Low Threat General Order and the application process, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0074.pdf

For more information regarding the Limited Threat General Order and the application process, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0073.pdf

If you have questions regarding these comments, please contact me at (916) 464-4644 or Stephanie.Tadlock@waterboards.ca.gov.

Stephanie Tadlock

Stephanie Tadlock
Environmental Scientist

cc: State Clearinghouse unit, Governor's Office of Planning and Research, Sacramento

Wolf Creek Community Alliance
"Grass Valley – A Creek Runs Through It"

GRASS VALLEY
MAR 17 2016
Community Dev. Dept.

March 15, 2016

Thomas Last
Community Development Director
City of Grass Valley
125 E. Main Street
Grass Valley, CA 95945
toml@cityofgrassvalley.com

Re: Scoping Comments for proposed Dorsey Marketplace Project

Thank you for inviting us to provide scoping comments.

- Hydrology and Water Quality.

Reinforce the importance of analyzing the proposed onsite storm water retention and water quality measures. This project is just a few parcels from the Wolf Creek riparian corridor, and directly uphill. Please analyze baseline data for existing water quality conditions, and provide for an on-going water quality monitoring program to verify success of proposed measures. The goal should be to eliminate any negative impact from the project into the creek or riparian area. Do not allow storm drains from the project site to be extended to the creek.

Verify existence of natural springs (after all, this is "Spring Hill"!) and identify measures to protect and enhance them in the project.

Several storm drains and runoff channels from the freeway, especially around the new Dorsey interchange feed directly onto the property. They have already caused erosion and cutting into the soil. They also direct a large amount of "freeway trash" onto the property. Please identify the extent of these impacts and propose methods for correction. Ideally the water should be detained on Caltrans property before it is directed onto the adjacent property; if not, then a special detention basin and ongoing trash removal system will need to be developed.

- Greenhouse Gases/Climate Change.

Besides the subjects of concern mentioned in the NOP, please address the loss of carbon sequestration caused by the removal of any vegetation, and the effect this will have on climate change. As mentioned in the NOP, the proposed project will generate greenhouse gases and have measurable impacts on global climate change. Once these negative impacts are identified and quantified (including the life-cycle cost of the built environment), please propose mitigation measures that will at least

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www.WolfCreekAlliance.org

offset them. Mitigation measures can include on- or off-site solutions, such as tree planting, habitat restoration, and deed-restrictive development restrictions. Of course the City's best interests will be served if these mitigations are achieved on nearby properies in the City limits, and are designed to further the City's stated Goals and Objectives regarding open space, greenways, etc.

- Biological Resources.

The existing trees and other vegetation on this hilltop are an important visual community resource. Please identify how the project will improve and enhance this resource, and/or mitigate if any loss. In addition to the ponderosa and blue pine stands, there are several stands of McNab Cypress, a relatively rare and valuable species that exists in only a few spots within the City limits.

We understand the importance of cleaning up Brownfield sites caused by previous misuse; but the natural process of revegetation has already done significant reclamation of the site, adding soil and performing bioremediation of toxins. Please quantify how the proposed project will enhance the cleanup that has already occurred, and not set us back 60 years to "square one". Please identify how this project site, at the end of its 60 to 100 year expected life, will be healthier than it is today.

- Transportation.

Besides the subjects of concern mentioned in the NOP, please address the impacts that this project will have on the City's stated Goals and Objectives regarding walking and bicycle trails. Please specify how this project will tie into and enhance non-vehicular traffic planning, specifically the Wolf Creek Parkway and the county-wide system of trails being implemented by the Bear Yuba Land Trust and others.

Again, many thanks for the opportunity to comment on this project.

JB Keehn

Jonathan Keehn

For the Board of Directors
Wolf Creek Community Alliance

P.O.Box 477
Grass Valley, CA 95945
www.WolfCreekAlliance.org

Tom Last

From: calhounclan@yahoo.com
Sent: Thursday, March 17, 2016 12:41 PM
To: Tom Last
Subject: Scoping Comments Dorsey Interchange

Thomas Last
Community Development Director
City of Grass Valley
125 E. Main Street
Grass Valley, CA 95945
toml@cityofgrassvalley.com

Land Use Planning

New Urban Design favors infill in already established towns and villages. How does proposed development at Dorsey Drive fit into the expressed desire to promote thriving downtowns in Grass Valley and Nevada City. Many "for sale" signs are already appearing in our lovely historic downtowns. Throughout the US unfortunate planning decisions have turned unique towns into "anywhere USA". What will be the economic effect on our existing quaint and attractive community, including tourism as well as the effect on small independent family owned innovative businesses.
Will this development proposal provide space for innovation? Will it be yet another minimum wage punch the clock dulling down proposition. Traveling across the US there are many examples of box stores and fast food joints having killed the historic downtown. It is important that this phenomenon and its effects be studied and included in decision making on this proposal. Economic, environmental, social, and cultural effects.

Joy Waite.
Grass Valley

DEPARTMENT OF TRANSPORTATION
DISTRICT 3
703 B STREET
MARYSVILLE, CA 95901
PHONE (530) 741-4199
FAX (530) 741-4245
TTY 711
www.dot.ca.gov/dist3

Serious drought.
Help save water!

March 17, 2016

Mr. Thomas Last
Community Development Director
City of Grass Valley
125 E. Main Street
Grass Valley, CA 95945

Dorsey Marketplace Project

Dear Mr. Thomas Last:

Thank you for including California Department of Transportation (Caltrans) in the environmental review process for Dorsey Marketplace Project. Caltrans' new mission, vision, and goals signal a modernization of our approach to California's transportation system. We review this local development for impacts to the State Highway System in keeping with our mission, vision and goals for sustainability/livability/economy, and safety/heath. We provide these comments consistent with the state's mobility goals that support a vibrant economy, and build communities, not sprawl.

The proposed project is located on 26.9 acres at the southeast freeway interchange of Dorsey Drive and State Route (SR) 20/49. The commercial area is proposed to include nine buildings with multiple tenants ranging in size from 3,000 to 92,000 square feet (sq. ft.). There would be four major tenant spaces ranging from 20,000 to 48,000 sq. ft. in size. The residential area is proposed to include six residential structures that are two to three stories in height, a 3,200 sq. ft. clubhouse, and a pool. The following comments are based on the Notice of Preparation (NOP) received:

Transportation & Circulation

We note that the City of Grass Valley recognizes that the proposed project may result in impacts on area roadways, intersections, and transportation facilities. We also note that the Environmental Impact Report (EIR) will evaluate impacts to the transportation network resulting from construction and operational phases of the proposed project. However, this proposed project will generate more than 100 PM peak hour trips onto the State facilities, it will be necessary to adequately assess impacts on the State Highway System (SHS) through a Traffic Impact Study (TIS).

The analysis should include the following:

- Dorsey Drive/SR 20/SR 49 Interchange –
    - Evaluate the potential for queuing on the off ramps which could back up onto the mainline and create a potential for collisions
    - Analyze ramp intersection interactions
    - Consider impacts from the existing Springhill Garden Apartments driveway
    - Include evaluation of transit connections in the vicinity
    - Address bicycle and pedestrian needs along the project frontage
    - Evaluate all intersections, including ramp intersections for the most effective intersection control solutions, such as roundabouts, signalization, etc.

In addition to the Dorsey Drive Interchange, impacts to all nearby interchanges from Brunswick Road to the Empire Street/SR 20 interchange should also be analyzed.

Hydraulics/Hydrology

We note that the EIR will include a drainage study to address potential downstream storm drainage impacts on Caltrans and City facilities. Please provide a copy of the drainage study for our review to the address below:

Office of Transportation Planning
703 B Street
Marysville, CA 95901

Please provide our office with copies of any further actions regarding this project. We would appreciate the opportunity to review and comment on any changes related to this development.

We would be pleased to meet with the City of Grass Valley and the project proponent to further discuss our concerns.

If you have any question regarding these comments or require additional information, please contact Jennifer Jacobson, Intergovernmental Review Coordinator for Nevada County, by phone (530) 741-5435 or via email to jennifer.jacobson@dot.ca.gov.

Sincerely,

Susan Zanchi

SUSAN ZANCHI, Branch Chief
Transportation Planning—North

c: Scott Morgan, State Clearinghouse

FW: Dorsey Drive Development

TL Tom Last <toml@cityofgrassvalley.com> Reply all |
Fri 3/18/2016, 11:25 AM
Katherine Waugh

You forwarded this message on 3/18/2016 1:10 PM

Thomas Last | Community Development Director
City of Grass Valley | Community Development Department | 125 E. Main Street | Grass Valley, CA 95945
Phone: (530) 274-4711Email: toml@cityofgrassvalley.com | Web: www.cityofgrassvalley.com

-----Original Message-----
From: Shera Banbury [mailto:shera3@comcast.net]
Sent: Wednesday, March 16, 2016 3:41 PM
To: Tom Last
Cc: Larry Lund; Mike Murray; Yasemin Hellige; Joann Cartocelli
Subject: Dorsey Drive Development

Dear Tom,

I just found out how to send you a communication. I'm sure that I speak for many others who live near Dorsey Drive, East Main, and Sierra College Drive. I see that tomorrow, March 17th, is the last day for input.

Our homes have been inundated with traffic since the Dorsey Dr. exit off of Hwy 49 was completed. It is more than ten times worse than we thought it would be. Anyone who is around at noon or 5 p.m. can see the weekday daily congestion. There is a crazy 2-lanes that turns to one, competitive jams when people try to get into Golden Empire and turn onto 49, a foolish exit off of 49 coming from Nevada City that puts people in harms way trying to change lanes, a pile up in front of the shopping area and hospital streets, not enough lanes at the stoplight...and that's just on that side of Main Street.

Coming from BriarPatch, doctors offices, Sierra College, and CORR, there is almost always a line of cars that has to cross over the yellow line to turn. The traffic circle (that was there before the Dorsey exit) seems to be the only thing functioning well given the onslaught of traffic.

In front of our very nice housing area, The Highlands, on Main Street. We take our lives into our hands driving out into Main St. Other people pull out at the same time from the businesses on either side quite often, and none of us can see the fast traffic coming over the hill in time to react. Turning left is almost impossible and some are resorting to turning right (when we want to go left) even though it's hard to do that as well.

We see people walking from the College to Brunswick stores without proper sidewalks. When people cross Main St. and Hwy 49 there is no safe passage. I've seen several people almost hit, and I know of one pedestrian that was hit by a turning car.

Okay… so that's the impact of poor planning.

So now we are faced with the new plan for Development of yet another shopping mall on the other side of 49 off of Dorsey. Many of the people who live in the housing area there are in jeopardy. They are generally people of low income and many are disabled. Generally, I see people walking at almost any time of the day in this area as well as in my area. I have heard of no plans to accommodate them and make them safe as they go to the stores and appointments.

That is a major concern I have. What is the safest possible pedestrian plan?

Other than that, I have to say that big stores, especially franchises, will overload this area with traffic. Take a look at Roseville and what has happened near Sierra College Drive. They have a lot more land, and are further away from housing developments.

I don't see any news about beautification and supporting the local people in the papers. (By the way, drainage is a major issue for The Highlands development, so I'm sure it will be for the plan you are reviewing. That's also one of the issues that Wolf Creek Choosing ran into.

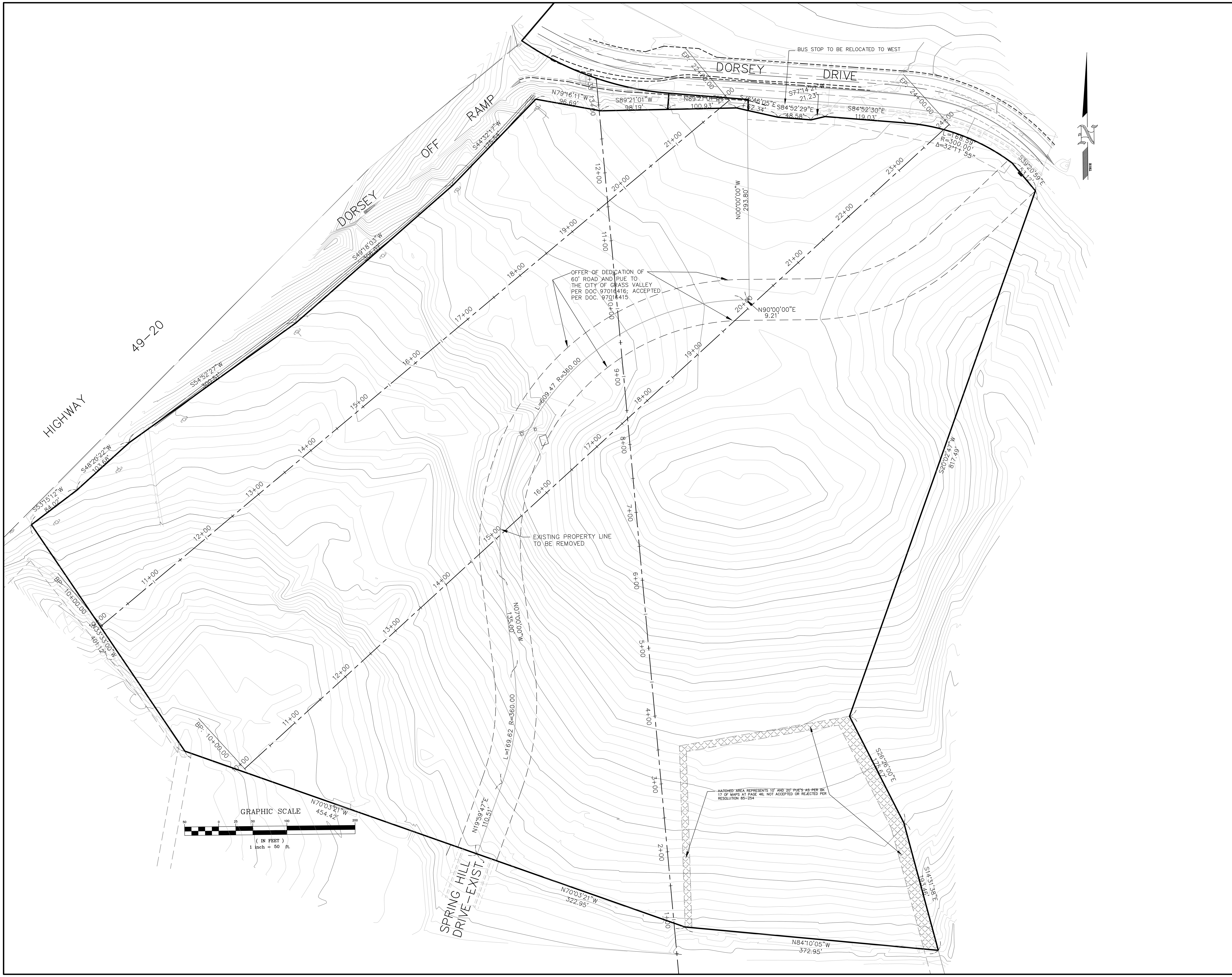
I can be reached at 530-277-9390 if you'd like to talk further.

Thank you for addressing my concerns,
Shera Banbury
The Highlands HOA
199 Highlands Court
Grass Valley, CA 95945

APPENDIX B

Project Plans

Alternative A Site Plans



CONSULTANT:

FOR DESIGN REVIEW ONLY 10-28-16

GENESIS ENGINEERING
1402 D Street · Marysville, CA 95901
office (530) 742-1300 · fax (530) 742-1331
email sean@genesisengineering.us

DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

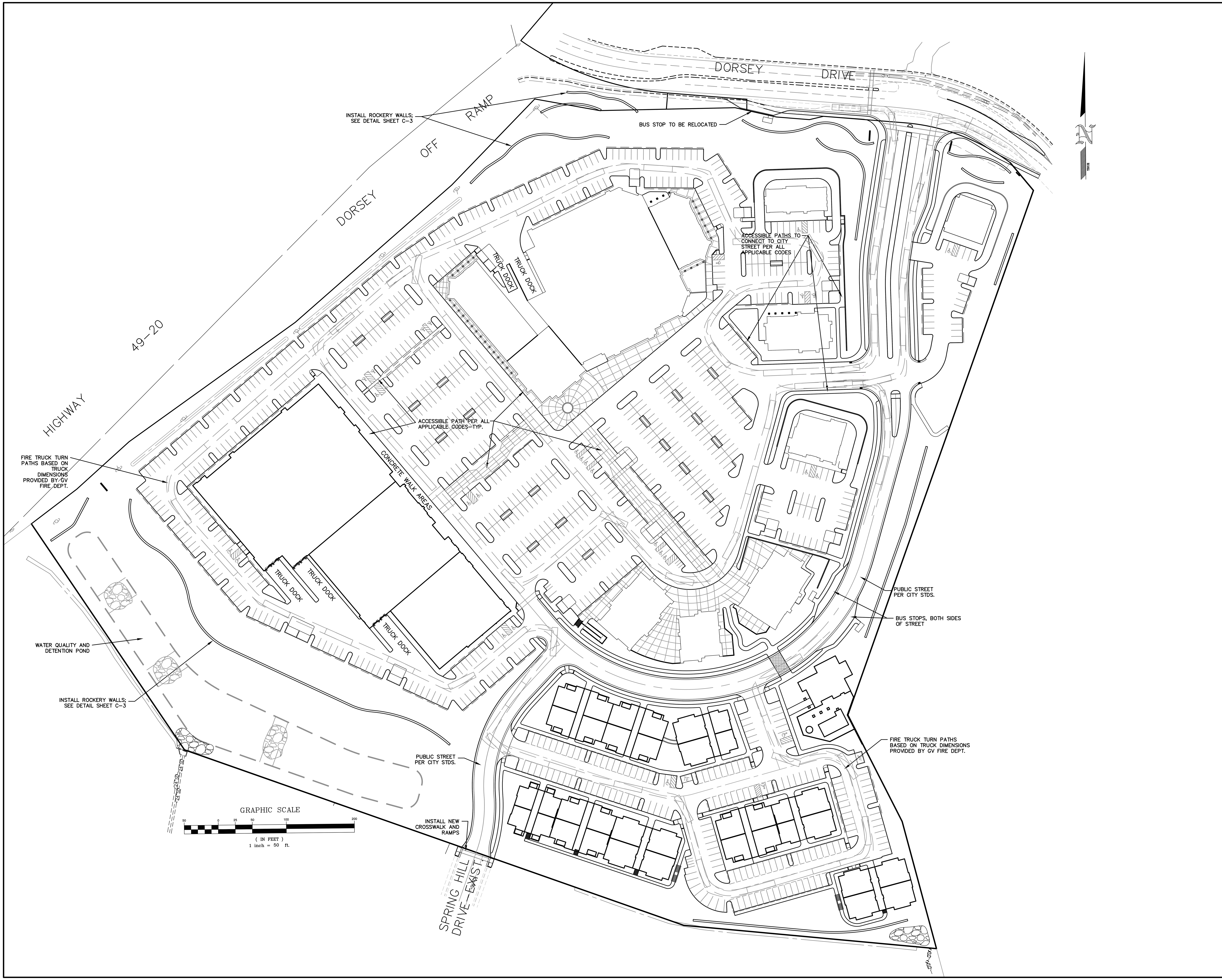
No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16

KEY PLAN:

SHEET TITLE:

TOPOGRAPHIC SURVEY

PROJECT NO: 13-135
DATE: 3-23-16
SHEET NO: Pre-C-1 OF 7



CONSULTANT:

FOR DESIGN REVIEW ONLY 10-28-16

REGISTERED PROFESSIONAL ENGINEER
SEAN MICHAEL O'NEILL
No. 49970
Exp. 03-31-17
CIVIL
STATE OF CALIFORNIA

GENESIS ENGINEERING
1402 D Street · Marysville, CA 95901
office (530) 742-1300 · fax (530) 742-1331
email sean@genesisengineering.us

DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16
2	Added WQ Pond	SMO	10-28-16

KEY PLAN:

SHEET TITLE:

PRELIMINARY SITE PLAN

PROJECT NO.
13-135

DATE:
3-23-16

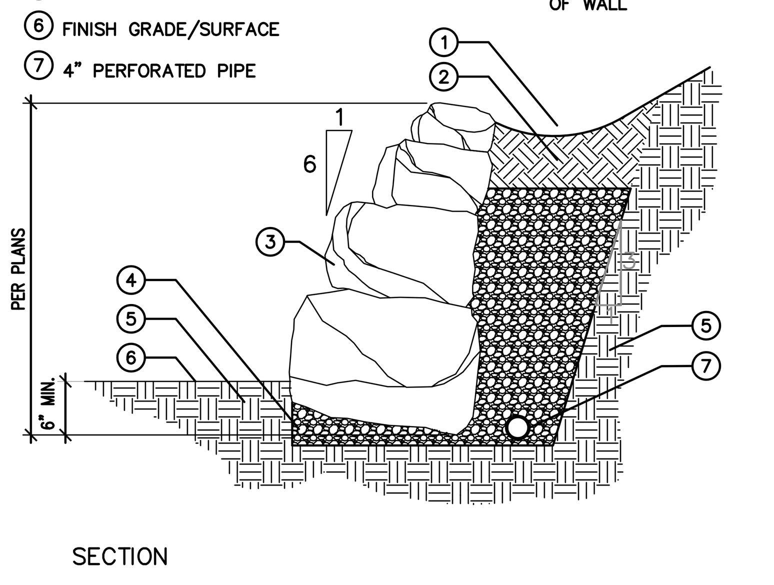
SHEET NO.
Pre-C-2
OF 7

LEGEND

1. DRAINAGE SWALE TO OUTLET OR AREA DRAIN. 1% FLOW LINE MINIMUM
2. 8" MIN. AMENDED SOIL FOR PLANTING
3. ANGULAR BOULDERS
4. ¾"-1 ½" COMPACTED GRANULAR FILL
5. NATIVE SOIL
6. FINISH GRADE/SURFACE
7. 4" PERFORATED PIPE

NOTES:

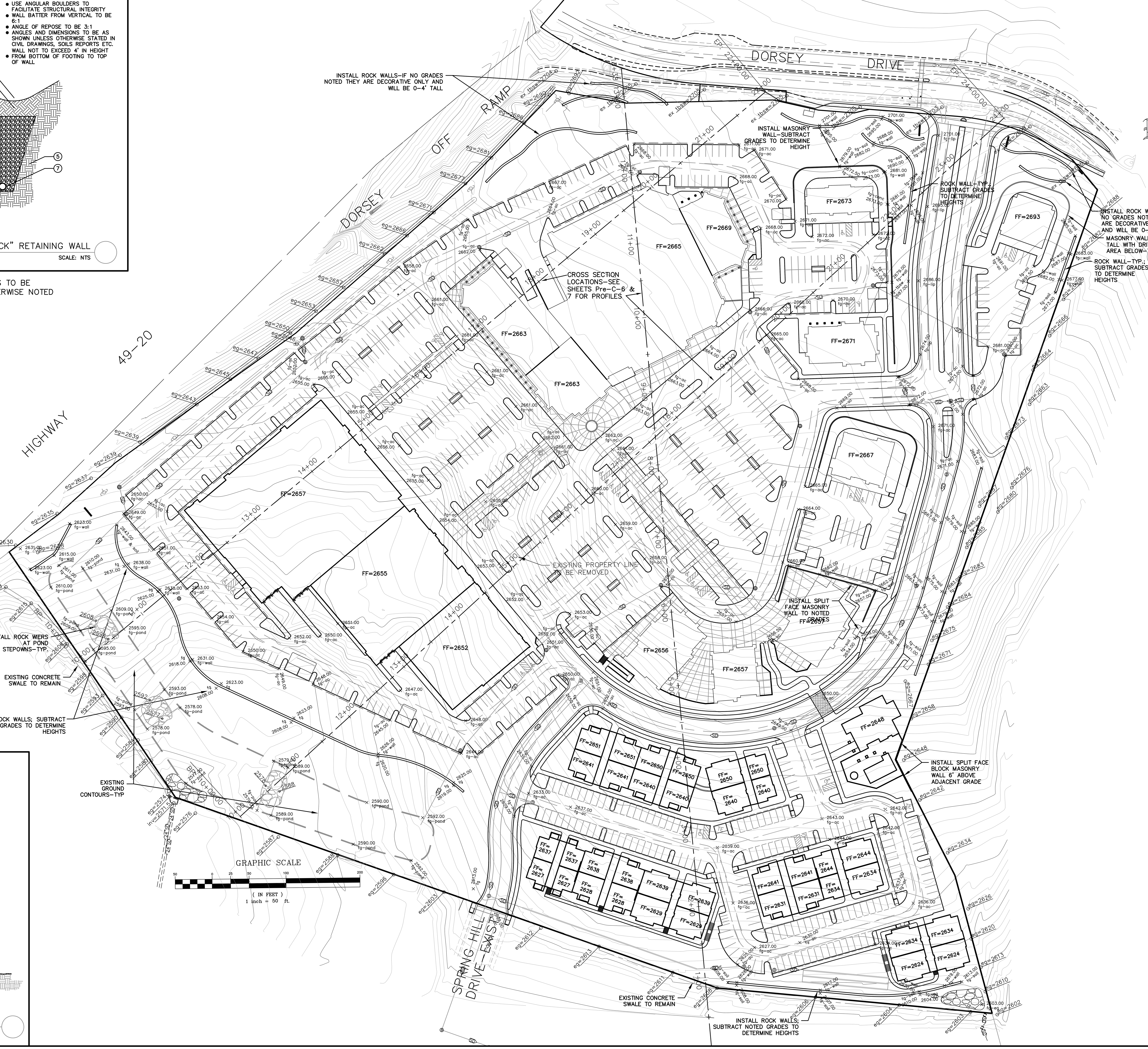
- USE ANGULAR BOULDERS TO FACILITATE STRUCTURAL INTEGRITY
- WALL BATTER FROM VERTICAL TO BE 6:1
- ANGLE OF REPOSE TO BE 3:1
- ANGLES AND DIMENSIONS TO BE AS SHOWN UNLESS OTHERWISE STATED IN CIVIL DRAWINGS, SOILS REPORTS ETC. WALL NOT TO EXCEED 4' IN HEIGHT
- FROM BOTTOM OF FOOTING TO TOP OF WALL

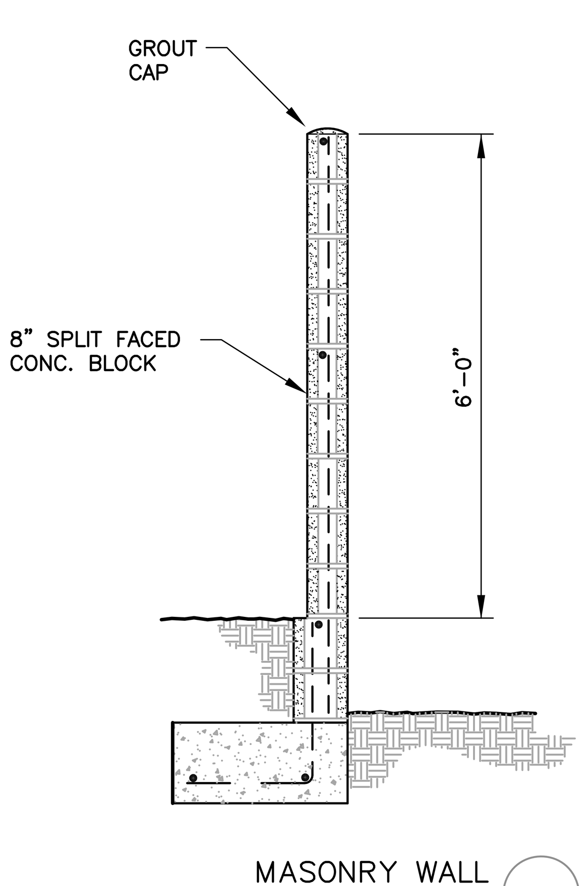


"ROCK" RETAINING WALL

BLDR-DRSTK SCALE: NTS

ALL RETAINING WALLS TO BE "ROCK" UNLESS OTHERWISE NOTED





MASONRY WALL

SCALE: NTS

CONSULTANT:

FOR DESIGN REVIEW ONLY 10-28-16

GENESIS ENGINEERING
1402 D Street - Marysville, CA 95901
office (530) 742-1300 - fax (530) 742-1331
email sean@genesisengineering.us

DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

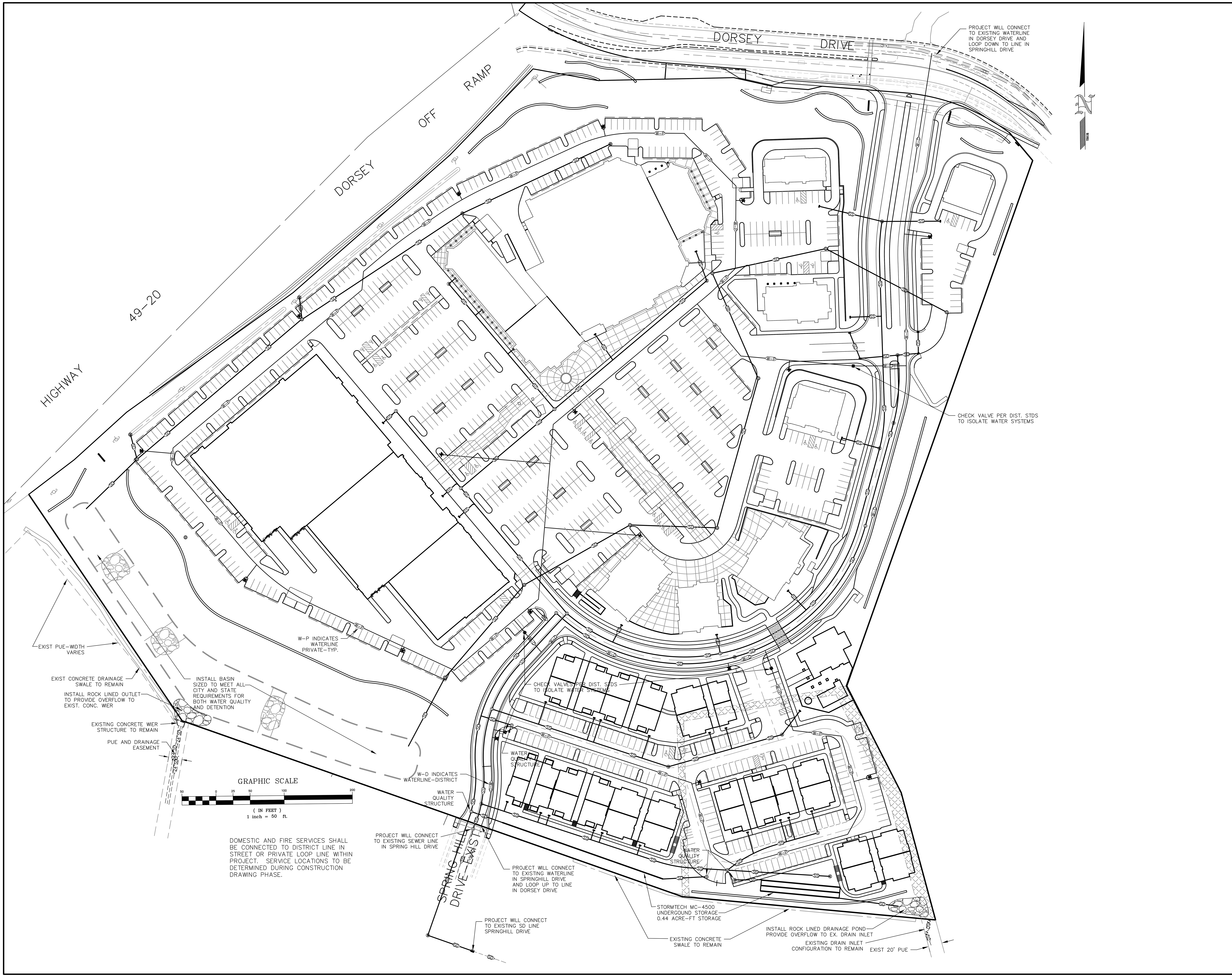
No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16
2	Added WQ Pond	SMO	10-28-16

KEY PLAN:

SHEET TITLE:

PRELIMINARY GRADING PLAN

PROJECT NO. 13-135
DATE: 3-23-16
SHEET NO. Pre-C-3 OF 7



CONSULTANT:

FOR DESIGN REVIEW ONLY
10-28-16

REGISTERED PROFESSIONAL ENGINEER
SEAN MICHAEL O'NEILL
No. 49970
Exp. 03-31-17
CIVIL
STATE OF CALIFORNIA

GENESIS ENGINEERING
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DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16
2	Added WQ Pond	SMO	10-28-16

KEY PLAN:

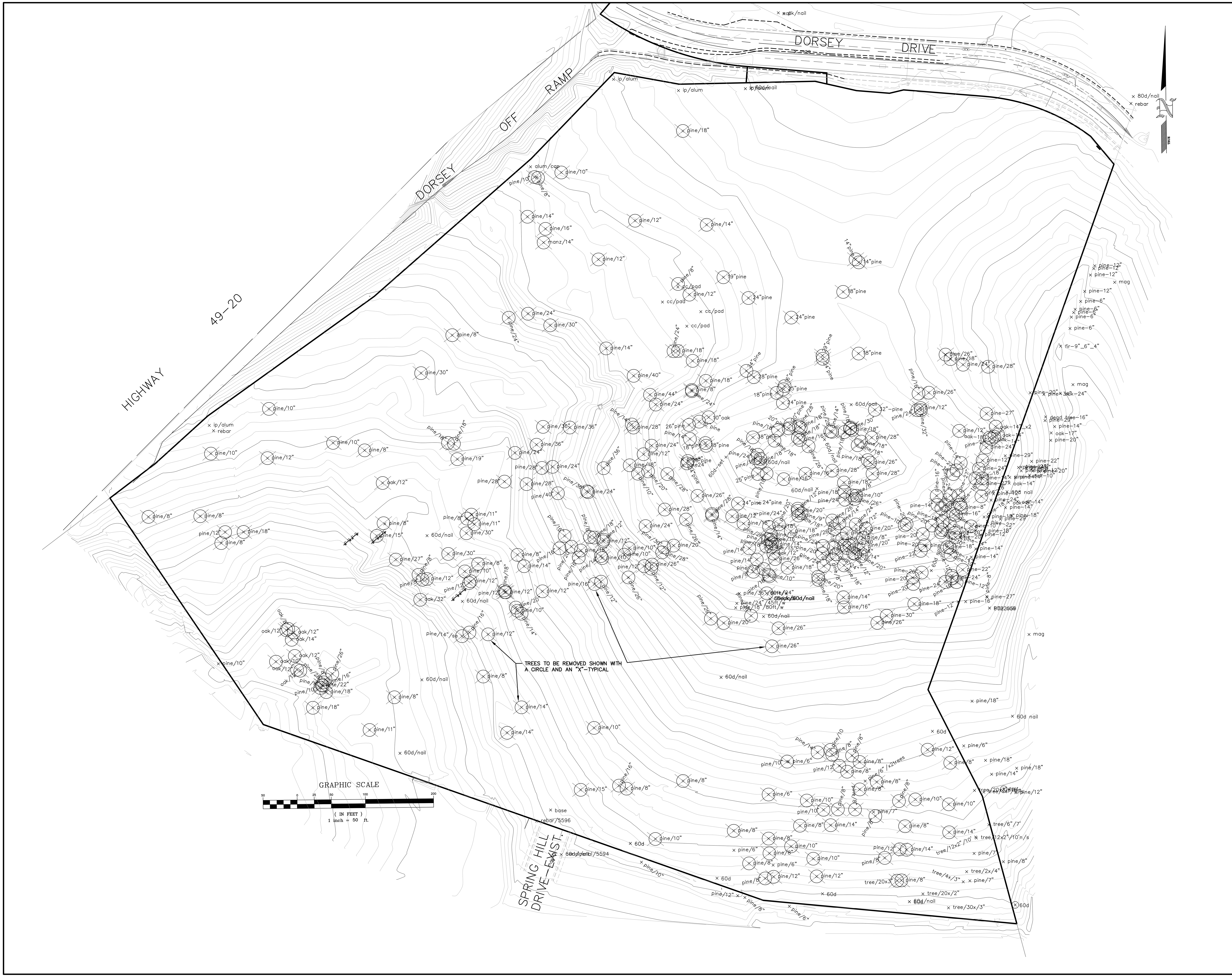
SHEET TITLE:

PRELIMINARY UTILITY PLAN

PROJECT NO. 13-135

DATE: 3-23-16

SHEET NO. Pre-C-4 OF 7



CONSULTANT:

FOR DESIGN REVIEW ONLY
10-28-16

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office (530) 742-1300 · fax (530) 742-1331
email sean@genesisengineering.us

DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16
2	Added WQ Pond	SMO	10-28-16

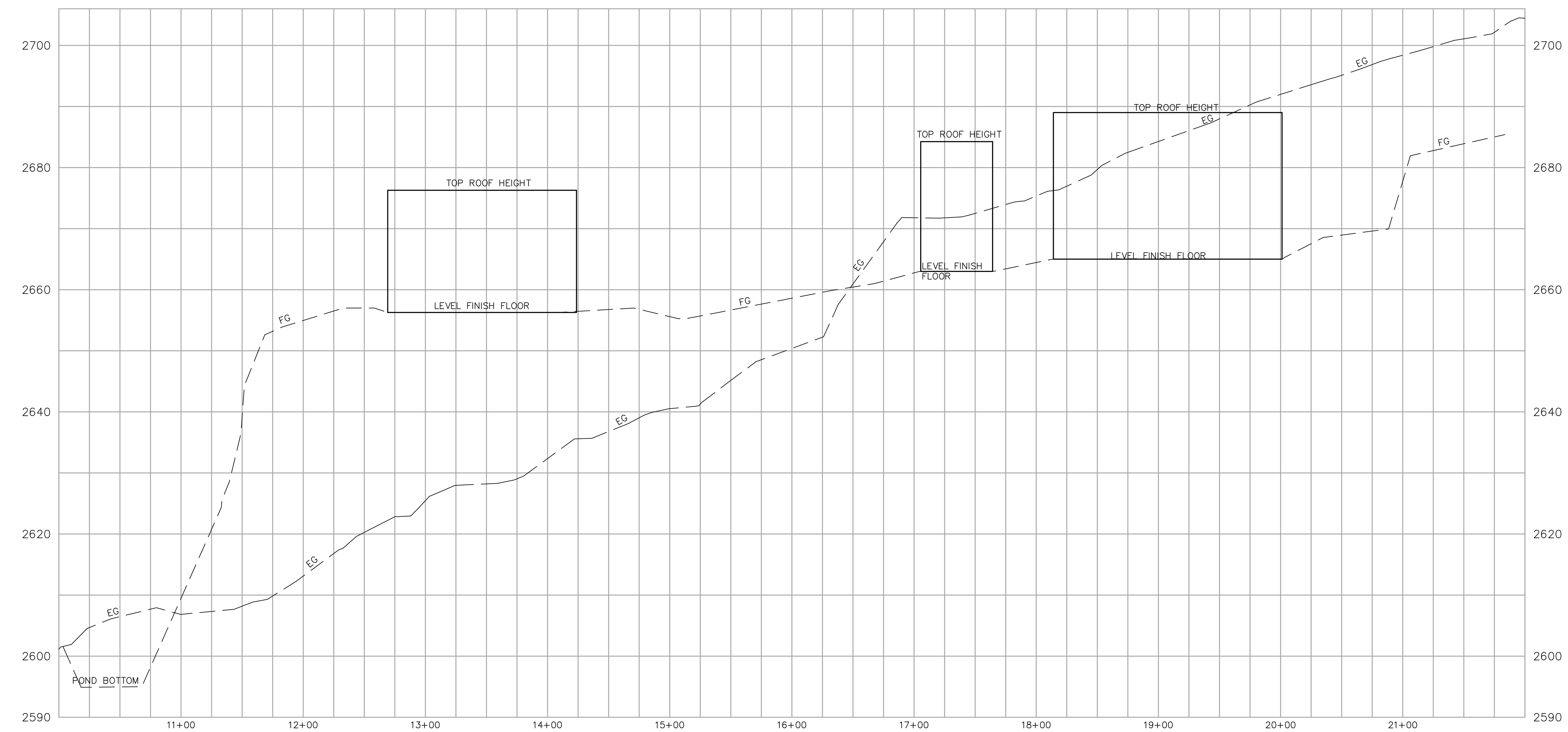
KEY PLAN:

SHEET TITLE:

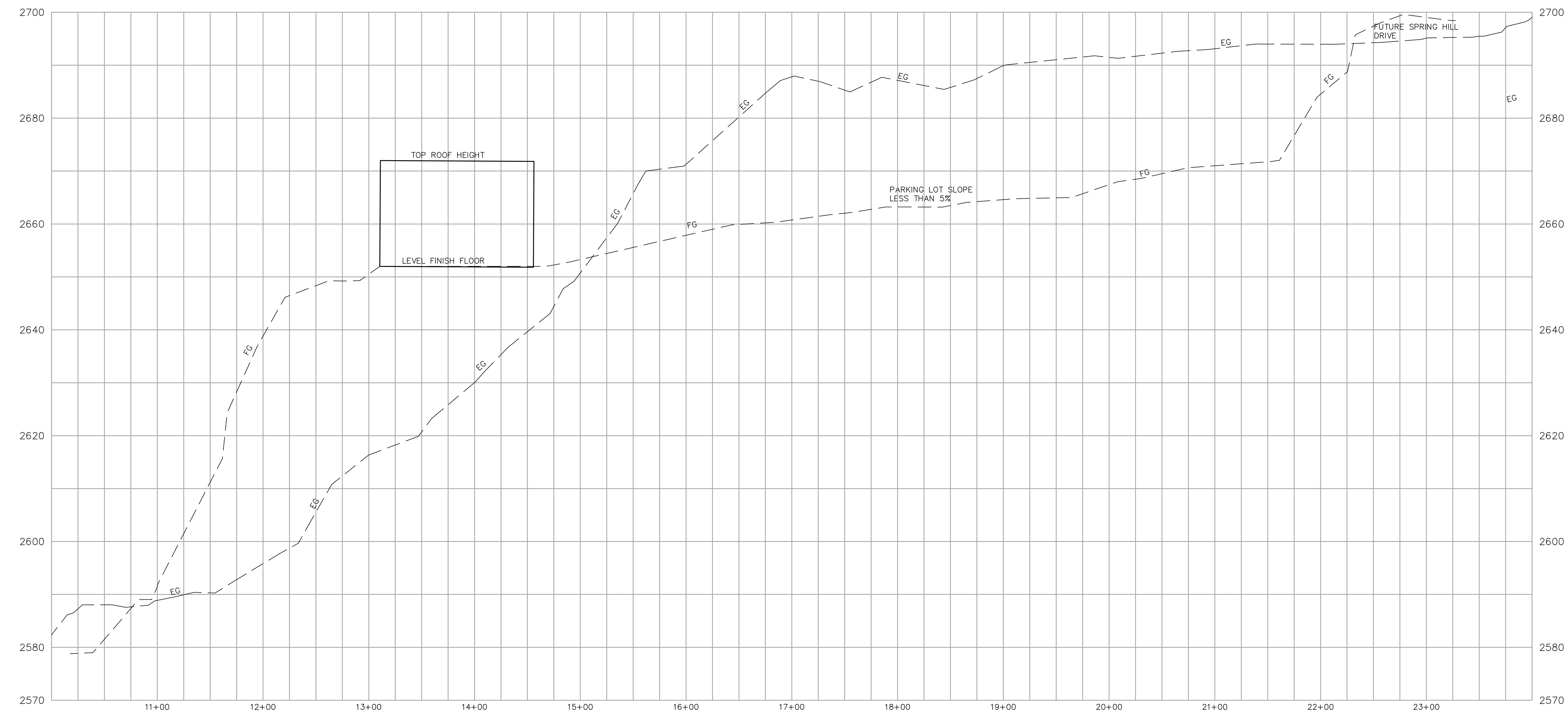
TREE REMOVAL PLAN

PROJECT NO. 13-135
DATE: 3-23-16
SHEET NO. Pre-C-5 OF 7

cross section west PROFILE



Cross Section East PROFILE



SEE SHEET C-1 FOR
LOCATIONS OF SECTIONS

CONSULTANT:

FOR DESIGN REVIEW ONLY 10-28-16

GENESIS ENGINEERING
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office (530) 742-1300 • fax (530) 742-1331
email sean@genesisengineering.us

DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16
2	Added WQ Pond	SMO	10-28-16

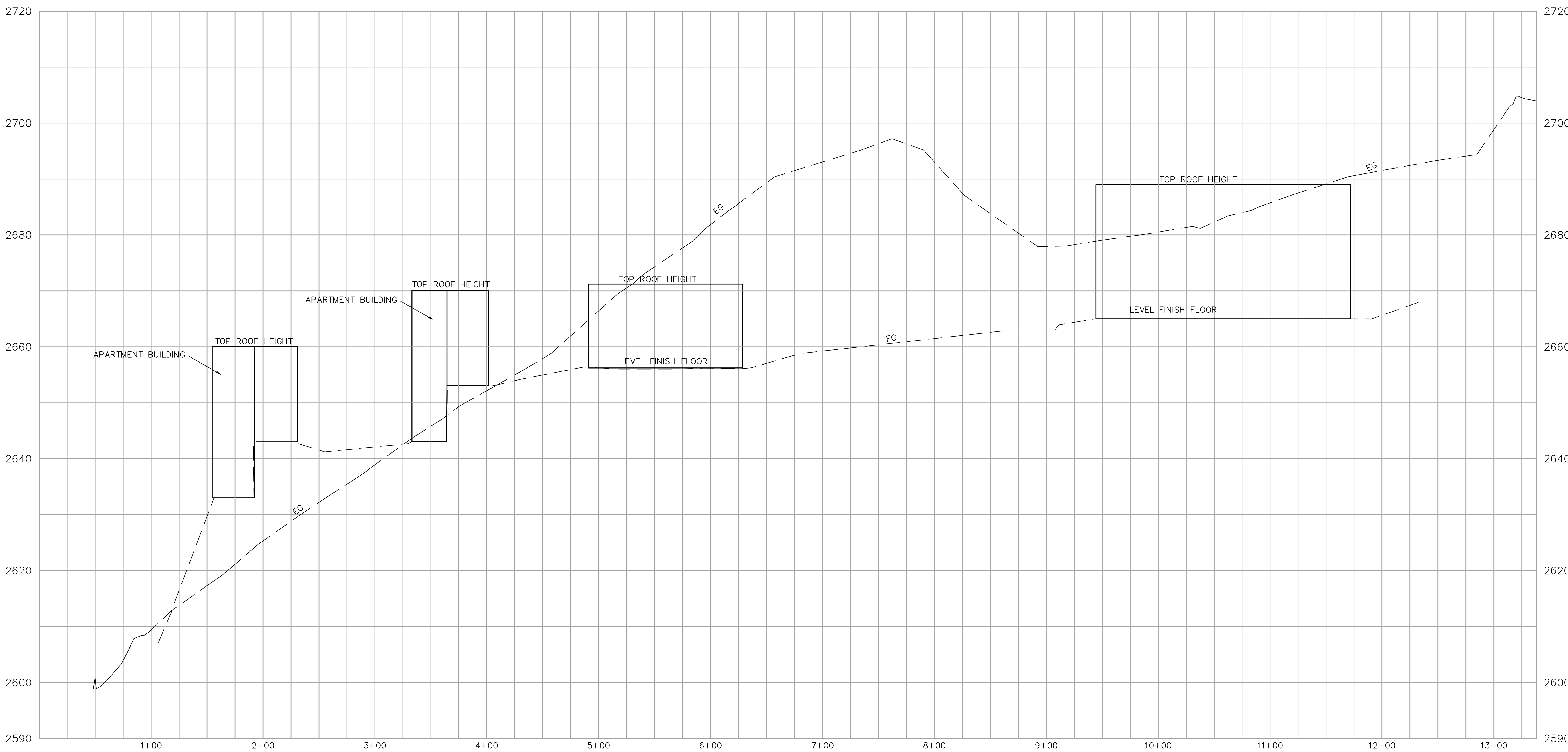
KEY PLAN:

SHEET TITLE:

PRELIMINARY CROSS SECTIONS #1

PROJECT NO: 13-135
DATE: 3-23-16
SHEET NO: Pre-C-6 OF 7

Cross Section NW PROFILE



SEE SHEET C-1 FOR CROSS
SECTION LOCATION

CONSULTANT:

FOR DESIGN REVIEW ONLY 10-28-16

GENESIS ENGINEERING
1402 D Street - Marysville, CA 95901
office (530) 742-1300 - fax (530) 742-1331
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DORSEY MARKETPLACE

DORSEY DRIVE @ HWY 20/49
CITY OF GRASS VALLEY
NEVADA COUNTY, CALIF

PLANNING SUBMITTAL

AGENCY APPROVAL:

Revisions

No.	Revisions	By	Date
1	Per City Comments	SMO	3-23-16
2	Added WQ Pond	SMO	10-28-16

KEY PLAN:

SHEET TITLE:

PRELIMINARY CROSS SECTIONS #2

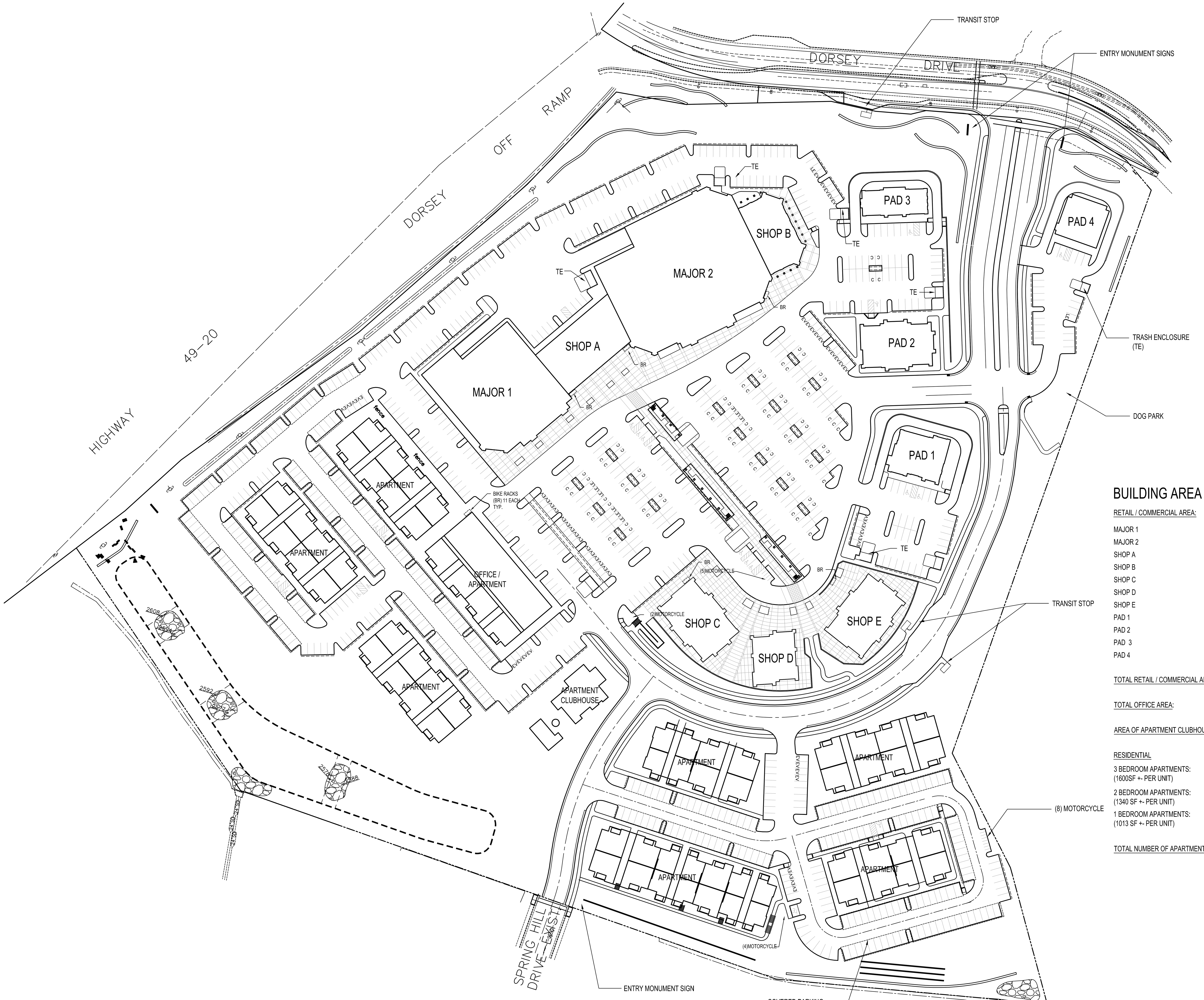
PROJECT NO.: 13-135

DATE: 3-23-16

SHEET NO.: **Pre-C-7**

OF 7

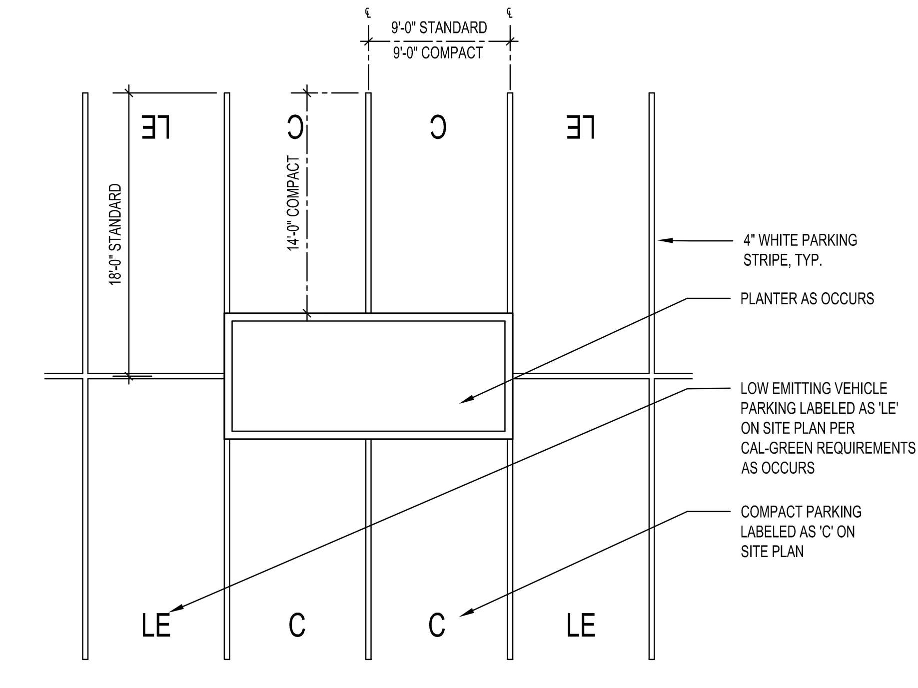
Alternative B Site Plans



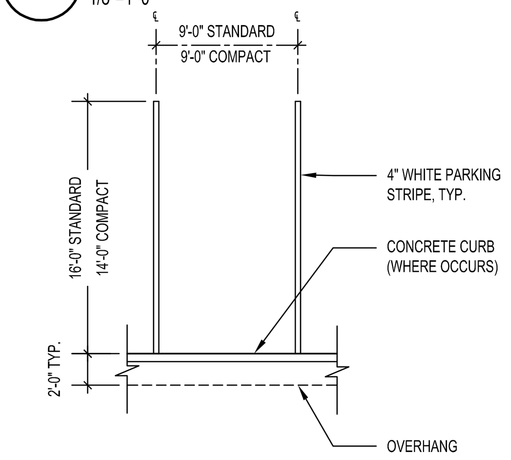
1 SITE PLAN - ALTERNATIVE

0 30' 60' 120'
(IN FEET) 1 inch = 60 ft.

N



3 TYPICAL PARKING STALL @ PLANTER
1/8"=1'-0"



2 TYPICAL PARKING STALL
1/8"=1'-0"

BUILDING AREA DATA:

RETAIL / COMMERCIAL AREA:

MAJOR 1	21,500 SF
MAJOR 2	35,000 SF
SHOP A	8,500 SF
SHOP B	5,650 SF
SHOP C	6,400 SF
SHOP D	4,000 SF
SHOP E	6,400 SF
PAD 1	4,200 SF
PAD 2	6,000 SF
PAD 3	3,200 SF
PAD 4	3,500 SF
TOTAL RETAIL / COMMERCIAL AREA:	104,350 SF
TOTAL OFFICE AREA:	8,500 SF
AREA OF APARTMENT CLUBHOUSE:	3,260 SF + -

RESIDENTIAL

3 BEDROOM APARTMENTS: (1600SF +- PER UNIT)	38 UNITS
2 BEDROOM APARTMENTS: (1340 SF +- PER UNIT)	95 UNITS
1 BEDROOM APARTMENTS: (1013 SF +- PER UNIT)	38 UNITS
TOTAL NUMBER OF APARTMENTS	171 UNITS

PARKING DATA:

PARKING REQUIRED :

REQUIRED PARKING COMMERCIAL BEFORE BICYCLE SUBSTITUTION (4/1000) :	417 STALLS
** REQUIRED PARKING COMMERCIAL AFTER BICYCLE SUBSTITUTION :	412 STALLS
***REQUIRED PARKING COMMERCIAL AFTER MOTORCYCLE SUBSTITUTION :	410 STALLS
REQUIRED ACCESSIBLE PARKING (2% OF TOTAL PARKING PROVIDED)	12 STALLS
REQUIRED BIKE PARKING (10% OF TOTAL PARKING PROVIDED)	0.1 * 568 = 57 BIKE RACKS
REQ. CLEAN AIR / VAN POOL / EV : (AS REQUIRED BY CAL GREEN)	0.08 * 568 = 46 STALLS
REQ. FUTURE ELECTRIC VEHICLE CHARGING STATION: (AS REQ. BY CAL GREEN)	0.06 * 568 = 35 STALLS
REQUIRED OFFICE PARKING (1:400)	22 STALLS

RETAIL / COMMERCIAL PARKING PROVIDED :

- STANDARD STALLS PROVIDED:	447 STALLS
- COMPACT STALLS PROVIDED:	77 STALLS (13% < 20% ALLOWED, THUS OK)
- ACCESSIBLE PARKING:	14 STALLS (12 > 15 STALLS, THUS OK)
- MOTORCYCLE ***	5 SPACES
- BIKE RACKS	57 BIKE RACKS
- CLEAN AIR / VAN POOL / EV : (STRIPED AND INDICATED ON SITE PLAN AS 'LE'. PART OF TOTAL STANDARD STALLS)	46 STALLS
- FUTURE ELECTRIC VEHICLE CHARGING: (INDICATED ON SITE PLAN AS 'EV' PART OF 'LE' STALL COUNT)	35 STALLS

RESIDENTIAL PARKING PROVIDED:

- STANDARD STALLS (COVERED) PROVIDED:	304 STALLS
- STANDARD STALLS (UNCOVERED) PROVIDED:	74 STALLS
- ACCESSIBLE PARKING PROVIDED:	10 STALLS (REQ. IS 2% OF TOTAL = 8 STALLS)
- MOTORCYCLE	7 SPACES
- FUTURE ELECTRIC VEHICLE CHARGING (INDICATED ON SITE PLAN AS 'EV' PART OF STANDARD STALL COUNT)	12 STALLS (3% OF PARKING PROVIDED)

OFFICE PARKING PROVIDED:

- STANDARD STALLS	28 STALLS
- ACCESSIBLE PARKING PROVIDED:	1 STALL

OTHER PARKING:

** SUBSTITUTION FOR AUTOMOBILE PARKING IS (1) STALL PER 8 BICYCLE RACKS, UP TO 10% MAXIMUM OF REQUIRED VEHICLE SPACES	** 417 X 10% = 41 / 8 = 5 STALL REDUCTION
MOTORCYCLE SPACES ALLOWED:	$\frac{1}{25}$, UP TO 10% MAX. OF REQUIRED VEHICLES
***SUBSTITUTION FOR AUTOMOBILE PARKING IS (1) SPACE PER 25 MOTORCYCLE SPACES, UP TO 10% MAXIMUM OF REQUIRED VEHICLE SPACE	***417 X 10% = 41 SPACES 41/ 25 = 2 SPACE REDUCTION (5 MOTORCYCLE SPACES PROVIDED , 41 ALLOWED, THUS "OK")

williams + paddon
ARCHITECTS + PLANNERS

DORSEY MARKETPLACE

GRASS VALLEY, CA.
AUGUST 11, 2017

REVISIONS

#	DATE	DESCRIPTION	BY
1	3/23/2016	CITY REVIEW COMMENTS	DP, DR
2	10/25/2016	DESIGN REVIEW COMMENTS	DP, DR, JC
3	2/9/2017	DESIGN REVIEW COMMENTS	DP, DR
4	8/11/2017	EIR ALTERNATIVE SITE PLAN	DP, DR

SHEET
A1.1

APPENDIX C
General Plan Consistency Analysis

Policy No.	Policy Text	Consistency	Analysis
2-LUP	Require adequate information when reviewing development proposals, including full environmental review and fiscal impact analyses, to assure minimization of environmental, public facilities and services impacts.	Consistent	The Dorsey Marketplace Draft EIR includes a full environmental review. Chapter 4, Population and Housing, evaluates impacts to jobs, housing, and growth. The other Draft EIR chapters evaluate and include mitigation measures when applicable to minimize environmental, public facilities and services impacts.
3-LUP	Maintain standards for population density and building intensity for each land use category identified in the General Plan.	Consistent	Under Alternative A or Alternative B, the project would require General Plan and Zoning Ordinance amendments to redesignate and rezone the land use categories proposed by the project as described in Draft EIR Chapters 2 and 3. With the approval of these amendments, the project would be consistent with the City's General Plan.
4-LUP	Identify areas appropriate for infill development and show them on the Land Use Diagram.	Consistent	The project site is undeveloped and within City limits, and is appropriate for infill development. The project site is zoned for development and the development potential of the site is discussed in several City planning documents.
5-LUP	Actively market infill and available parcels during contacts with developers and community members.	Consistent	
6-LUP	Develop a more specific development strategy for identified infill parcels following General Plan adoption.	Consistent	
8-LUP	Encourage and facilitate mixed-use developments on infill sites.	Consistent	The project site is undeveloped and within City limits, and is appropriate for infill development. Under Alternative A, the project would include a mix of commercial, retail, and multifamily residential uses. Under Alternative B, the project would include a mix of commercial, retail, office, and multifamily residential uses.
9-LUP	Provide for higher residential densities on infill sites and in the Downtown area.	Consistent	
11-LUP	Where feasible, treat newly developing areas as Planned Developments.	Generally Consistent	The project site is surrounded by development and previously supported the Spring Hill mine. The site is not strictly a newly developing area. The project does address similar goals as those under Planned Development, including a mix of housing types, integration of community design principles of the General Plan, evaluation of transportation/circulation impacts, and park needs (both Alternative A and Alternative B include a dog park).

APPENDIX C
General Plan Consistency Analysis

Policy No.	Policy Text	Consistency	Analysis
12-LUP	Permit increases in residential density (clustering) on portions of development sites while maintaining overall density.	Consistent	The project proposes clustering higher density residential development in the southern portion of the project site.
13-LUP	Encourage convenience goods and services opportunities to be incorporated into any significant development proposal.	Consistent	Under Alternative A, the project would construct 178,960 square feet of commercial and retail uses. Under Alternative B, the project would construct 104,350 square feet of commercial and retail uses and 8,500 square feet of office uses.
14-LUP	Encourage incorporation of multiple family development in new development areas while maintaining high design standards.	Consistent	The project proposes a mix of three-bedroom, two-bedroom, and one-bedroom apartments, incorporating appropriate use of colors, materials, accent features, and landscaping.
16-LUP	Maintain zoning that promotes protection of existing single family residential areas from inappropriate encroachments.	Consistent	Properties to the north and east of the project site support apartment complexes and a mobile home community; these areas are designated for residential land uses as Urban Medium Density under the General Plan. Properties to the south of the project site are designated Manufacturing/Industrial. The project's Commercial and Urban High Density Residential land uses would not encroach upon single family residential areas.
20-LUP	Avoid circulation improvements that bisect or adversely impact established neighborhoods.	Consistent	The project does not propose any circulation improvements outside of the project site. As discussed in Chapter 8, Transportation, the project would be required to contribute funding to planned intersection improvements in the vicinity. None of the required circulation improvements would bisect or adversely impact established neighborhoods.
22-LUP	Assure that a sufficient number of sites are zoned for multiple family use.	Consistent	The project would include 90 multiple family residential units under Alternative A and 171 multiple family residential units under Alternative B.
23-LUP	Encourage mixed use developments incorporating a variety of densities on infill sites and in areas proposed for annexation.	Consistent	The project proposes a range of three-bedroom, two-bedroom, and one-bedroom apartments, as well as commercial and retail land uses under Alternative A and commercial, retail and office land uses under Alternative B on undeveloped parcels within City limits.

APPENDIX C
General Plan Consistency Analysis

Policy No.	Policy Text	Consistency	Analysis
24-LUP	On large parcels, encourage clustering of residential units on the most developable portions of the site in order to reduce infrastructure and other housing-related construction costs.	Consistent	The project proposes clustering higher density residential development in the southern portion of the project site.
25-LUP	Utilize clustering and other land use techniques to protect environmentally sensitive resources, such as heritage trees and wetlands.	Generally Consistent	Heritage trees do not occur on the project site, and other special status species have not been found on the project site. The project would result in impacts to an intermittent drainage, 118 feet in length, and a seasonal wetland, 0.065 acres in size. Mitigation Measure 6f requires the project applicant to provide compensation for the loss of these features. The project could result in impacts to special status plants, Blainville's horned lizard, and nesting birds. Mitigation Measures 6a through 6d would be implemented to reduce potential impacts to these species, should they be found on the project site.
30-LUP	Encourage mixed use developments on larger parcels in newly developing areas incorporating jobs generating businesses and industry housing.	Consistent	The project proposes a range of three-bedroom, two-bedroom, and one-bedroom apartments, as well as commercial and retail land uses under Alternative A and commercial, retail and office land uses under Alternative B on undeveloped parcels within City limits.
31-LUP	Promote primary jobs and core employment opportunities; those that export goods while importing capital.	Consistent	Under Alternative A, the project would construct 178,960 square feet of commercial and retail uses. Under Alternative B, the project would construct 104,350 square feet of commercial and retail uses and 8,500 square feet of office uses. Either alternative would introduce new employment opportunities.
37-LUP	Assure that new development pays its fair share of the cost of municipal services.	Consistent	The project applicant would be responsible for the costs associated with extension of any necessary infrastructure to the project site.
39-LUP	Assure that acceptable inter-agency agreements regarding future service and facility provision are in place prior to approval of any major new development.	Consistent	The project applicant would be required to obtain necessary permits from the City prior to construction, as described in Section 2.5 of Draft EIR Chapter 2, Project Description.

APPENDIX C
General Plan Consistency Analysis

Policy No.	Policy Text	Consistency	Analysis
15-COSO	Protection of ground- and surface water quality.	Consistent	Chapter 13 of the project EIR provides information related to the project's potential to affect hydrology and water quality. In accordance with City and state requirements, the project would use Best Management Practices and would be required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) to reduce impacts to water quality.
16-COSO	Inclusion of air and water quality considerations in land use decisions rendered by the Planning Commission and City Council.	Consistent	Chapter 10 of the project EIR provides information regarding the project's potential air quality impacts; Chapter 13 of the project EIR provides information regarding the project's potential water quality impacts.
21-COSO	Continue to implement water quality improvement plans, including storm water separation and sewage treatment plant expansion.	Consistent	The proposed project would comply with the National Pollutant Discharge Elimination System permit by implementing a SWPPP. The project would not require expansion of the wastewater treatment plant. Chapter 13 of the project EIR provides analysis related to hydrology and water quality and Chapter 14 provides information regarding wastewater conveyance and treatment.
23-COSO	Respond appropriately to state and federal air and water quality policies and policy changes, understanding the implications of regulations and standards, and maintaining a continuing public education program.	Consistent	Please refer to Draft EIR Chapters 10 and 13 for air and water quality analyses and the project's consistency with state and federal requirements.
6-SP	Incorporate fire hazard reduction considerations into land use plans/patterns, both public and private.	Consistent	As discussed in Draft EIR Chapter 15, the project consists of infill development, which reduces potential wildland fire risks, and would conform to fire-related General Plan policies.
9-SP	Develop and implement fire-safe community design and landscaping standards, construction codes, and property maintenance regulations.	Consistent	
11-SP	Maintain appropriate standards for water supply, pressure and distribution for fire suppression purposes.	Consistent	As discussed in Draft EIR Chapter 14, there is sufficient water supply, pressure, and distribution capacity to serve the project.
24-CUP	Coordinate circulation and development plans with public safety agencies, fire departments/districts and emergency service providers.	Consistent	Please refer to the analyses in Draft EIR Chapters 8 and 15 regarding circulation and emergency access. Plans for the proposed project would be reviewed by emergency service providers.

APPENDIX C
General Plan Consistency Analysis

Policy No.	Policy Text	Consistency	Analysis
2-NP	Perform adequate acoustical analyses prior to approval of new development projects or transportation facilities, if warranted.	Consistent	Draft EIR Chapter 9 and Appendix H provide analysis of the project's impacts related to noise.
3-NP	Utilize noise contour data to determine land uses affected by transportation-related noise sources.	Consistent	
4-NP	Adopt appropriate noise level standards for existing and future residential areas.	Consistent	
5-NP	Utilize noise contour data to determine appropriate land use patterns in areas affected by stationary noise sources.	Consistent	
1-SP	Adopt current uniform codes for new construction.	Consistent	All buildings in the proposed project would conform to the California Building Code.
2-SP	Ensure seismic safety and structural integrity in housing and commercial/industrial facilities through code enforcement.	Consistent	All buildings in the proposed project would conform to the California Building Code. Draft EIR Chapter 12 includes analysis regarding the project's potential impacts associated with seismic risks.
4-SP	Based on location or probable need, require development plans in mined areas to include in-depth assessments of potential safety, including mining-related excavations, and health hazards and accompanying mitigation measures.	Consistent	The project site previously supported the Spring Hill mine. Draft EIR Chapter 15 evaluates the potential impacts related to hazardous materials present on the site. The project would implement the Removal Action Workplan for the site that has already been approved by the California Department of Toxic Substances Control.
7-SP	Identify, maintain, and mark evacuation routes for use in case of disasters or emergencies.	Consistent	The project would not interfere with emergency evacuation routes or plans, as described in Draft EIR Chapters 8 and 15.
8-SP	Assure public awareness of fire-safety measures, including those addressing property.	Generally Consistent	As discussed in Draft EIR Chapter 15, the project's fire hazard impacts are less than significant, and the project would comply with all fire-related policies and building codes.
9-SP	Develop and implement fire-safe community design and landscaping standards, construction codes, and property maintenance regulations.	Consistent	The project's fire hazard impacts are less than significant, and the project would comply with all fire-related policies and building codes.
10-SP	Adopt and implement appropriate standards for access roads, on-site driveway standards, fuel reduction and emergency water supply.	Consistent	Access roads and circulation are discussed in Draft EIR Chapter 8. The project would reduce potential fire fuel onsite by removing the ponderosa pine forest vegetation near the center of the site. Many of the trees onsite

<table>
<thead>
<tr><th>Policy No.</th><th>Policy Text</th><th>Consistency</th><th>Analysis</th></tr>
</thead>
<tbody>
<tr><td></td><td></td><td></td><td>appear diseased or dying. Such trees present a greater fire risk than healthy trees. Draft EIR Chapter 14 demonstrates that adequate water supply is available to serve the project.</td></tr>
<tr><td>11-SP</td><td>Maintain appropriate standards for water supply, pressure and distribution for fire suppression purposes.</td><td>Consistent</td><td>The proposed project would maintain appropriate standards for water supply, pressure, and distribution.</td></tr>
<tr><td>1-RP</td><td>Provide parks and open spaces of different sizes and types to respond to the needs of a diverse population, including trails for pedestrian and equestrian use, bicycle pathways, linear parkways and park-like natural areas.</td><td>Consistent</td><td>As discussed in Draft EIR Chapter 14, the project would be required to pay parkland dedication and park facilities fees at the time that building permits are issued to fully meet the City's park development standards.</td></tr>
<tr><td>5-RI</td><td>Reserve land or entitlements in advance of need. Accept dedications and donations if potentially useful for future facilities.</td><td>Consistent</td><td>The project site includes an easement that was established to define the alignment of the Spring Hill Drive extension between Idaho Maryland Road and Dorsey Drive. The project would alter that alignment but includes construction of the extension.</td></tr>
<tr><td>4-HP</td><td>Enhance the appearance of City entryways, commercial areas, and streetscapes, in part through the use of elements in the design standards that complement Grass Valley's historic heritage.</td><td>Consistent</td><td rowspan="2">The project site is visible from State Route 20/49, Dorsey Drive, the Sierra Nevada Hospital, and other vantage points in the surrounding area. Design of the proposed project would conform to the City's Design Standards. Draft EIR Chapter 5 evaluates the project's potential impacts related to aesthetics.</td></tr>
<tr><td>9-HP</td><td>Inform developers, builders and design professionals of Grass Valley's community design standards and preferences, using brochures, photographic displays and other illustrative techniques.</td><td>Consistent</td></tr>
<tr><td>10-HP</td><td>Where historic and prehistoric cultural resources have been identified, the City shall require that development be designed to protect such resources from damage, destruction, or defacement.</td><td>Consistent</td><td rowspan="2">Draft EIR Chapter 7 and Appendix D provide information regarding the prehistoric and historic context of the project site. Through research, field evaluation, and Native American consultation, no cultural resources were identified within the project site. Mitigation Measure 7a defines protocols to be followed in the event that cultural resources are uncovered during construction, consistent with Section 15064.5 of the CEQA Guidelines.</td></tr>
<tr><td>11-HP</td><td>If previously undiscovered cultural resources or human remains are encountered during construction or excavation, the procedures identified in Section 15064.5 of the CEQA Guidelines shall be followed.</td><td>Consistent</td></tr>
<tr><td>12-CDP</td><td>Provide a mixture of residential unit designs in all major new residential development.</td><td>Consistent</td><td>The project would include 90 multiple family residential units under Alternative A and 171 multiple family residential units under Alternative B.</td></tr>
</tbody>
</table>

APPENDIX C
General Plan Consistency Analysis

Policy No.	Policy Text	Consistency	Analysis
14-CDP	Integrate natural areas for runoff detention in all major new development.	Consistent	The proposed project would construct detention basins as described in Chapter 13.
16-CDP	Provide a mix of uses within walking distance in all major new development to promote pedestrian access and to provide definition of the area as a place.	Consistent	Under Alternative A, the project would include a mix of commercial, retail, and multifamily residential uses. Under Alternative B, the project would include a mix of commercial, retail, office, and multifamily residential uses. The project proposes pedestrian plazas at the front of all of the shop areas, connected by wide, landscaped walkways that cross through the parking area, which would increase walkability.
17-CDP	Assure adequate City design review of all new development.	Consistent	The proposed project would be reviewed by the City prior to issuance of permits.
20-CDP	Design all future major public and private development projects to include areas for public gathering and interaction.	Consistent	The project proposes pedestrian plazas at the front of all of the shop areas, connected by wide, landscaped walkways that cross through the parking area. Additionally, the residential development would include a 3,200-square-foot clubhouse.
22-CDP	Discourage gated communities and encourage open access through projects.	Consistent	The proposed project would not include gated communities. The project proposes pedestrian plazas at the front of all of the shop areas, connected by wide, landscaped walkways that cross through the parking area to encourage walkability.

APPENDIX D

Dorsey Marketplace Economic Analysis

HAUSRATH ECONOMICS GROUP

DRAFT MEMORANDUM

Date: July 26, 2016

To: Tom Last, Community Development Director City of Grass Valley

Katherine Waugh, DUDEK

From: Sally Nielsen

Subject: Dorsey Marketplace Economic Analysis

This memorandum provides economic analysis to determine the impact of the proposed Dorsey Marketplace on the Grass Valley retail market. This is one of two economic analyses of the proposed project. The second analysis describes fiscal impacts on the City of Grass Valley, construction period impacts, and longer-term on-going economic impacts associated with the proposed project and with the general plan land use change.

The analysis presented here evaluates the proposed supply of retail space (amount of space and types of retailers) in the context of existing retail market conditions and conditions in the relatively near term future based on increases in housing units and households in the market area (i.e., demand—including the demand represented by the proposed project's residential component) and any expected increases in competitive retail supply in the market area. The analysis addresses the related questions of 1) whether the project would fill gaps in local retail supply and therefore reduce the substantial leakage of retail spending out of Grass Valley and 2) whether the project retail development would have a negative impact on the economic health of the Downtown Business District.

The memorandum begins with an overview of approach, data sources, and definitions. This is followed by description and analysis of the existing retail market context for Grass Valley and the greater western Nevada County retail market area. That analysis includes presentation of household retail spending factors used to evaluate spending potential represented by the proposed project and by other increases in households and population in the market area. Detailed evaluation of retail sales drivers and trends in Grass Valley's Downtown Business District completes the context discussion. The Dorsey Marketplace project description then fleshes out the planning parameters for the project with estimates of types of retail tenancies and associated retail sales, employment estimates, household occupancy, apartment rents, household incomes, and retail spending estimates. Lastly, consideration of potential increases in retail spending potential due to other new development in the market area and other potential future retail supply completes the context for analysis of project implications.

APPROACH, SOURCES, AND DEFINITIONS

The approach to this analysis is to use detailed evaluation of retail spending and sales in Grass Valley, project assessment, and conservative projections of market area growth to develop conclusions about the implications of the proposed project. The approach evaluates the scale and characteristics of the proposed project against a backdrop of western Nevada County retail strengths and weaknesses and distinguishes the proposed project from Downtown Grass Valley's retail niche.

The analysis is not a market or feasibility analysis of the proposed project. The analysis assumes the project is feasible from the developer's perspective.

The analysis is based on assumptions and estimating factors derived from the best available current information. Furthermore, the analysis necessarily uses economic data that reflects recent trends in retailing. Such data may not fully account for significant changes in shopping behavior enabled by on-line retailing. Industry analysts and planners have numerous opinions about the future of retailing—the implications of omni-channel retail for the shopping experience and the role of the physical store as one of those channels. The longer term evolution of the retail landscape may have implications for developments such as Dorsey Marketplace, but that question is beyond the scope of this effort.

Assessing the city and regional retail market context is a key component of the quantitative analysis. Retail *capture* and *leakage* are the indicators used to identify retail strengths and weaknesses. Capture represents the ability of local businesses to attract spending from households living in the market area and, to a lesser extent, from local businesses and employees. Leakage refers to market area retail spending potential that is not captured by local establishments.

One approach to the capture and leakage evaluation is a per capita approach. Dividing aggregate sales data for a specific geographic area by the household population in that same geographic area provides one means of evaluating the relative strengths and weaknesses of that geographic area, compared to county or state norms (established by comparable per capita averages). Multi-county regional averages and statewide averages in particular can be said to represent a norm or baseline for a relatively self-sufficient retail market, i.e., one in which demand is adequately served by supply.

The other approach compares spending potential to local sales. The household spending analysis develops estimates of per-household retail spending based on estimates of household income and survey data describing the amount of money households spend every year on different types of retail and other goods and services. Comparing these estimates of potential to reported sales at local establishments generates a differential identified as either capture or leakage.

With the exception of convenience retail, there are reasons why retail market areas are not in perfect balance. Some market area household spending is expected to occur outside of the local market area where people work and where they travel, particularly eating and drinking out, specialty shopping, and sales at gasoline stations (auto and related category). Households are more likely to look outside a local market area for "big ticket" items such as auto sales and furniture and appliance sales. On the demand side, visitor spending can be a substantial component of reported sales in the eating and drinking out category and in specialty stores in some locations, so sales in those categories are expected to be greater than what would otherwise be the case based solely on local household demand.

The retail sales analysis conducted for the Dorsey Marketplace economic impact analysis assessment is based on data from the State of California Board of Equalization (SBOE), reporting taxable retail sales for Nevada County unincorporated areas and cities and reports compiled by Hinderliter de Lamas for the City of Grass Valley showing sales tax revenue (converted to taxable sales for the purposes of this analysis) for the City and separately for the Downtown Assessment District, also referred to as the Downtown Business District. In addition, information on total retail sales at the county and state levels from the 2012 Economic Census (Retail Trade and Accommodation and Food Services) is used to develop factors converting taxable sales to total sales. Estimates of household retail spending potential are based on U.S. Bureau of Labor Statistics Consumer Expenditure Survey data for the western region of the United States—data indicating the percentage in income devoted to retail spending and the distribution of that spending by retail category.

Some of the analysis is based on taxable sales data for which the SBOE prepares detailed annual reports for the state, counties and cities in the state. Comparison of spending potential to market area sales uses an estimate of *total* sales, accounting for the fact that many grocery store sales and drugstore sales are exempt from state sales tax. Reported taxable sales data are adjusted to account for the fact that only about 30 percent of food and beverage store sales are taxable and about 36 percent of health and personal care store sales are taxable (the primary exempted items in this large category are prescription medicines, candy, and snack food).

The economic assessment uses retailing categories to describe market orientation and the trends for different types of retail business activity. Similar categories and definitions are used routinely in retail analysis. This analysis focusses on retail and food services business activities—establishments for which sales data are a robust indicator of market strengths and weaknesses.[1]

- **Comparison retail** includes goods for which shoppers are willing to spend time comparing selection, price, and service. Items in the comparison category include clothing and accessories, appliances, furniture, electronic equipment, sporting goods, toys, office supplies, hardware, garden supplies, jewelry, and gifts. These items are found in department stores, home improvement stores, off-price superstores, variety stores, and in small and large format specialty stores.
- **Convenience retail** includes goods that consumers need immediately and frequently. These are generally the items that are found in supermarkets, drugstores, and neighborhood shopping centers.

[1] Taxable sales in California are also reported for businesses in the "all other outlets category" which includes a variety of types of retail and commercial activity such as beauty salons, repair shops, contractors, print shops, insurance and real estate companies, designers, travel agents, manufacturers, wholesalers, and lodging, as well as amusement and entertainment establishments such as movie theatres and bowling alleys. Business-to-business sales are a substantial component of the taxable sales in some of these types of establishments. These types of retail spending and sales are not included in the Dorsey Marketplace analysis. Although personal service businesses and small offices may likely locate in some of the Dorsey Marketplace commercial space, taxable sales are not relevant indicators for the economic analysis of this type of activity.

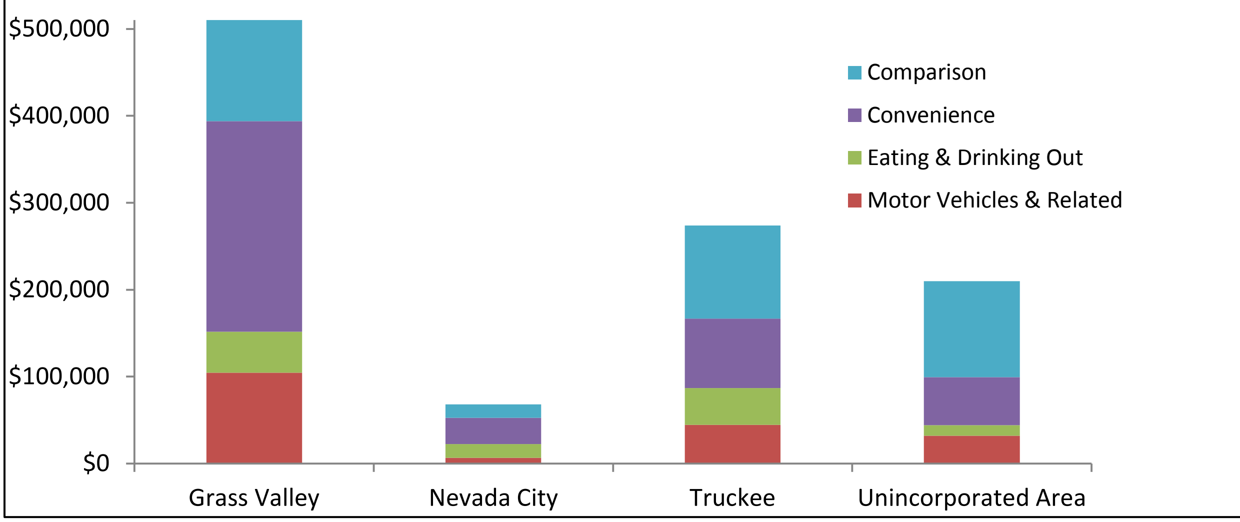
- **Eating and Drinking** covers sales of food away from home. This category includes sales at full-service restaurants, bars, take-out and drive-through establishments, coffee houses, and cafés.
- **Auto-related sales** includes sales of new and used vehicles, auto supplies, and service station sales.

In today's retailing environment, the distinction among categories is often blurred as large retail development formats have enabled the combination of comparison and convenience shopping under one roof or within one large typically highway-oriented center. Nevertheless, the categories remain a useful way to describe and classify trends in sales and in retail spending patterns.

Grass Valley Retail Context

County retail activity is concentrated in Grass Valley
Grass Valley captures more retail sales than any other part of Nevada County, but substantial local market area retail spending (demand) is lost to retail locations outside Nevada County. In 2013, although Grass Valley's 13,000 residents represent only 13 percent of the population in Nevada County, Grass Valley accounted for half of retail sales in the county—$543 million in retail and food services sales out of almost $1.1 billion countywide. (**Figure 1 and Table 1)** This pattern has persisted for a number of years, because Grass Valley is an employment center, a center for medical and education services, a retail location serving the greater western Nevada County market area, and a significant visitor destination. Grass Valley retail locations dominate across all retail sales categories: 39 percent of comparison retail sales in the county, 60 percent of convenience store sales, 40 percent of sales at food services establishments and drinking places, and 56 percent of sales at motor vehicle and parts dealers and gasoline stations.

Figure 1
Total Retail Sales in Nevada County, By Jurisdiction and Category: 2013



Sources: State of California Board of Equalization, U.S. Census Bureau, and Hausrath Economics Group

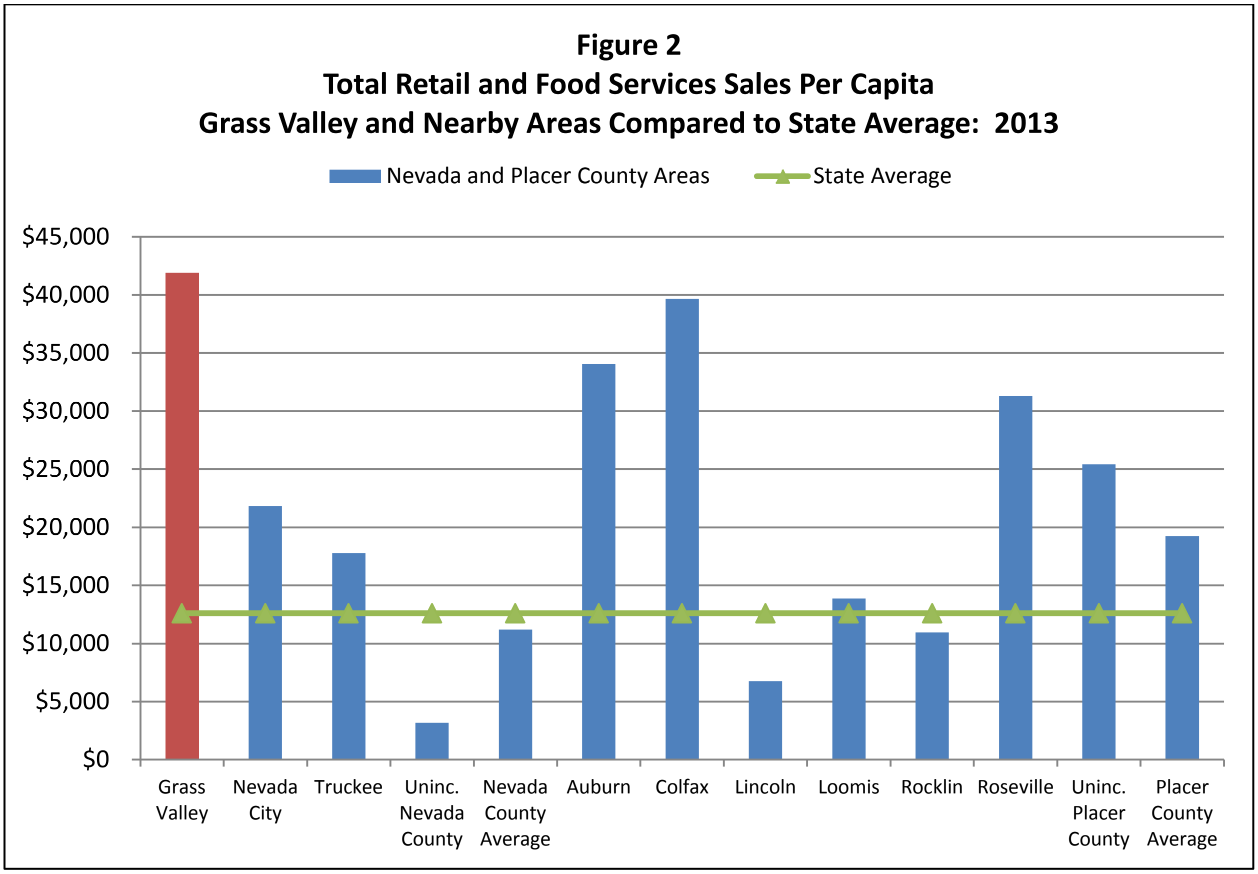
Table 1
Nevada County Total Retail and Food Services Sales by Jurisdiction, 2013
(dollars in thousands)

Retail Category	Grass Valley	Nevada City	Truckee	Subtotal Cities	Unincorporated area	Total
Comparison	$148,781	$15,469	$107,144	$271,393	$110,675	$382,069
Convenience [a]	242,352	30,047	79,555	351,954	55,180	407,135
Eating & drinking out	46,977	15,822	42,586	105,385	12,044	117,430
Motor vehicles and related	104,492	6,625	44,435	155,552	31,951	187,503
Total	**$542,602**	**$67,963**	**$273,720**	**$884,285**	**$209,851**	**$1,094,136**

Notes:
a. Total sales in grocery stores and drug stores estimated from reported taxable sales based on conversion factors derived from comparison of taxable sales (SBOE data) to total sales reported in the 2012 Economic Census, Census of Retail Trade. The comparison indicates 30 percent of sales in food and beverage stores are taxable and 36 percent of sales in drugstores are taxable.

Sources: California State Board of Equalization, *Taxable Sales in California During 2013, Fifty-Third Annual Report*; U.S. Census Bureau, *2012 Economic Census*; and Hausrath Economics Group.

Per capita analysis highlights retail strengths and weaknesses
At almost $42,000 per capita in 2013, per-capita sales in Grass Valley (total sales in retail and food services establishments divided by total population) are more than three times higher than the statewide average of $12,600 for sales for all retail and food services. **(Figure 2)** Among neighboring jurisdictions, none show higher per-capita sales. Per-capita retail sales in Grass Valley are higher than per-capita retail sales in Auburn ($34,000) and in Roseville ($31,000)—the latter city known as the retail location of choice for a large regional market area. Per-capita sales in Colfax are also high. The Colfax population base at about 2,000 residents is lowest of all nearby areas. In addition to substantial highway commercial development, large retail establishments in town (building materials and auto parts and supplies) serve a larger foothills market area.



Sources: State of California Board of Equalization, U.S. Census Bureau, and Hausrath Economics Group

Comparing actual Grass Valley sales by category to Grass Valley resident demand (estimated generally based on state per-capita averages by category) suggests where the strengths and weaknesses of the city's current retail market lie. **(Table 2)** The greatest amount of capture from outside the city falls in the food and beverage stores and building materials/garden supplies stores categories. Grass Valley establishments in these categories clearly draw on the spending from the greater western Nevada County market area. Health and personal care stores, food services and drinking places, home furnishings and appliances, and the "other retail" category (including sporting goods, music, book, office supply, gift and other specialty stores) also show substantial capture beyond the typical demand that might be expected from Grass Valley residents alone. The City's highway interchanges and gasoline stations also attract significant regional and visitor spending. By this analysis, only the clothing and accessories stores category is not meeting Grass Valley resident needs; *potential* taxable sales (based on statewide per capita averages) are more than double the reported sales at Grass Valley clothing and accessories establishments.

Table 2
Retail Sales Capture and Leakage Analysis for the City of Grass Valley, 2013

Retail Category	**Per capita taxable sales – California** [a]	**Potential taxable sales in Grass Valley** [b]	**Actual taxable sales in Grass Valley** [c]	**Capture / (Leakage)**	**Percent capture**
		(dollars in thousands)			
		A	*B*	*B - A*	*B / A*
Clothing and Accessories Stores	$915	$11,843	$5,820	($6,023)	49%
General Merchandise Stores	1,348	17,444	37,251	19,807	214%
Health and Personal Care Stores (estimate)	296	3,831	23,821	19,990	622%
Food and Beverage Stores	663	8,577	52,855	44,278	616%
Food Services and Drinking Places	1,645	21,292	46,977	25,685	221%
Home Furnishings and Appliance Stores	666	8,619	19,013	10,394	221%
Bldg. Matrl. and Garden Equip. and Supplies	778	10,067	53,399	43,332	530%
Motor Vehicles and Parts Dealers	1,781	23,059	45,099	22,040	196%
Gasoline Stations	1,490	19,285	59,393	40,108	308%
Other Retail	964	12,479	33,298	20,819	267%
Total Retail and Food Services	**$10,545**	**$136,495**	**$376,926**	**$240,431**	276%
All Other Outlets	4,832	62,542	150,248	87,706	240%
Total All Outlets	**$15,377**	**$199,037**	**$527,174**	**$328,137**	265%
	Grass Valley 2013 population [d]	12,944			

Notes:
a. California State Board of Equalization, *Taxable Sales in California During 2013, Fifty-Third Annual Report*, Table 1.
b. Statewide per capita sales by type of category multiplied by Grass Valley population.
c. California State Board of Equalization, *Taxable Sales in California During 2013, Fifty-Third Annual Report*, Table 5 with estimate for Health and Personal Care Stores using county total for that category allocated to jurisdictions based on detail from the 2012 Census of Retail Trade. "All Other Outlets" includes an estimate for the unallocated taxable sales not reported in SBOE Table 5.
d. State of California, Department of Finance, E-5. Population and Housing Estimates for Cities, Counties, and the State, January 1, 2011-2016, with 2010 Benchmark, May 2016

Sources: California State Board of Equalization, *Taxable Sales in California During 2013, Fifty-Third Annual Report*; U.S. Census Bureau, *2012 Economic Census*; and Hausrath Economics Group.

The analysis above substantiates Grass Valley as the retail center for a broader market area than just the households living in the city proper. The shopping centers in the Glenbrook Basin, as well as the Pine Creek Shopping Center, the K-Mart Shopping Center, and the Hills Flat district, offer a full range of convenience and general consumer shopping options for the western Nevada County market area: groceries, full service drugstore/pharmacies, hardware, building materials and garden supplies, office and electronics supplies, sporting goods, beauty supplies, apparel, pet food and supplies, and auto supply outlets. The shopping centers provide a typical mix of anchor stores and smaller spaces occupied by retail shops (both national chains and independents), personal service establishments, and small offices, along with pads for restaurants, coffee shops, or fast food operations, financial services, and telecommunications outlets, for example.

Furthermore, as discussed in more detail below, Downtown Grass Valley offers specialty retail and eating and drinking establishments that attract locals as well as Gold Country visitors.

Comparing market area spending potential to sales indicates where the gaps are
The appropriate market area lens takes in the greater western Nevada County area, including Nevada City and surrounding unincorporated areas with the exception of Lake of the Pines, where residents are more likely to use nearby Auburn and North Auburn in Placer County as their shopping destination of choice. There are about 78,000 people living in this larger western Nevada County market area; Grass Valley residents account for 16 percent of the total. Not only does this market area represent a larger pool of households (about 32,000 households, of which 6,000 live in Grass Valley), the households in the areas surrounding Grass Valley have higher incomes on average than do Grass Valley households, further increasing the retail spending potential. The average annual household income in Grass Valley is about $47,000, while the average annual household income in the greater western Nevada County market area (including Grass Valley) is $73,500.

Table 3 presents the retail spending potential in Grass Valley and the retail spending potential in the greater western Nevada County market area (including Grass Valley). Grass Valley households generate about $124 million per year in retail spending, and the western Nevada County market area generates about $853 million per year in retail spending. Grass Valley household spending potential is 15 percent of that total.

Table 4 compares this market area household retail spending potential to *total* retail and food services sales in Grass Valley and Nevada City (including estimates of non-taxable sales), to indicate how well local establishments are meeting market area demand and help identify options for increasing the retail supply in the city. Nevada City retail sales are counted in the market area supply estimates to present a more complete comparison of market area demand to market area supply. Because Nevada City sales account for only about 10 percent of market area sales, retail sales patterns in Grass Valley determine the conclusions of the market area analysis. After adjusting for non-taxable sales in some retail categories, total retail sales in Grass Valley and Nevada City retail store and food service establishments total about $611 million in 2013 (the most recent year for which annual sales data are available).

Table 3
Household Retail Spending: Grass Valley and the Western Nevada County Market Area, 2013

	Grass Valley	Western Nevada County market area [a]
Households [b]	5,994	32,239
Average Household Income [c]	$46,946	$73,500
Retail spending percent of income (rounded) [d]	44%	36%
Total annual retail spending	$20,656	$26,460

Distribution by category (rounded) [d]	**Grass Valley**	**Western Nevada County**	**Grass Valley**	**Western Nevada County market area**
Comparison	29%	31%	5,990	8,203
Convenience	26%	28%	5,371	7,409
Eating & drinking out	12%	13%	2,479	3,440
Motor vehicles, parts, service stations	33%	28%	6,817	7,409
Total	**100%**	**100%**	**$20,656**	**$26,460**

Estimated Household Spending by Category	**Grass Valley**	**Western Nevada County market area**
Comparison	$35,905,916	$264,445,262
Convenience	32,191,511	238,853,785
Eating & drinking out	14,857,620	110,896,400
Motor vehicles, parts, service stations	40,858,456	238,853,785
Total	**$123,813,503**	**$853,049,232**

Notes:
a. The western Nevada County market area is defined to include tabulations from two Census County Divisions (CCD) excluding counts for the Lake of the Pines Census Designated Place (CDP). The Grass Valley CCD includes the city of Grass Valley and the Nevada County CCD includes the city of Nevada City. Counts for the Lake of the Pines CDP are subtracted from the combined counts for the CCDs. Analysis of 2010 Census counts and American Community Survey 2014 5-year estimates indicates that 80 percent of county households live in western Nevada County, excluding Lake of the Pines.
b. Household count for Grass Valley and Nevada County are from the California Department of Finance Report E-5. Population and Housing Estimates for Cities, Counties, and the State, January 1, 2011-2016, with 2010 Benchmark, May 2016. The household count for the western Nevada County market area is estimated from the county total assuming 80 percent of county households live in the market area (as defined in note a. above).
c. U.S. Census Bureau, *American Community Survey 2010-2014 5-year estimates*.
d. U.S. Bureau of Labor Statistics, *Consumer Expenditure Survey 2013-2014*, September 2015. Table 3133, Western region by income before taxes: Average annual expenditures and characteristics.

Sources: State of California Department of Finance, U.S. Census Bureau, U.S. Bureau of Labor Statistics, and Hausrath Economics Group.

Table 4
Western Nevada County Market Area Household Retail Spending Compared to Grass Valley and Nevada City Retail Sales, 2013

Retail Category	Household retail spending - Western Nevada County market area [a]	Total retail sales in City of Grass Valley and Nevada City [b]	Capture or (Leakage)
Comparison	$264,445,000	$164,250,000	($100,195,000)
Convenience	$238,854,000	$272,399,000	$33,545,000
Eating & drinking out	$110,896,000	$62,799,000	($48,097,000)
Motor vehicles, parts, service stations	$238,854,000	$111,117,000	($127,737,000)
Total	**$853,049,000**	**$610,565,000**	**($242,484,000)**

Notes:
a. Excludes Lake of the Pines. See notes in Table 3.
b. California State Board of Equalization, *Taxable Sales in California During 2013, Fifty-Third Annual Report*, Table 5 with estimate for Health and Personal Care Stores using county total for that category allocated to jurisdictions based on detail from the 2012 Census of Retail Trade. Taxable sales converted to total sales assuming 30 percent of food and beverage store sales are taxable and about 36 percent of health and personal care store sales are taxable.

Sources: State of California, Board of Equalization, U.S. Census Bureau, 2012 Economic Census, and Hausrath Economics Group.

Overall, this comparison indicates substantial leakage of retail spending outside the market area. Key conclusions from the market area spending and sales analysis are as follows:

- Grass Valley is indeed the convenience retail center for the western Nevada County market area: household retail spending and local retail sales are most closely in balance for this category that includes grocery stores and drugstores.
- Motor vehicle and service station spending shows the most total leakage to establishments outside the market area. Although, as noted above, Grass Valley captures some visitor-related highway commercial spending, it is also the case that this is the category of household spending most likely to follow household place of work and travel patterns. Typically, for this retail category, there are locations where motor vehicle sales outlets traditionally cluster that attract shoppers from a large market area. Auburn and Roseville in Placer County are such locations in this case.
- A similar story applies to the spending potential in the eating and drinking out category. Work and travel mean a substantial portion of this type of household spending is naturally expected outside the market area. Nevertheless, leakage of about $50 million annually—about 40 percent of spending potential—indicates that the market could support additional local supply, especially considering that significant local sales are generated by visitors from outside the market area.
- The Table 4 analysis indicates roughly $100 million annually in net total leakage of market area spending on comparison goods. This large category represents spending/sales for clothing; furniture and appliances; home electronics, household

goods and supplies, building materials and garden supplies; sporting goods; books, toys, and music; and other consumer goods that are not everyday convenience items and for which shoppers are most likely to compare prices. Existing market area demand would support more stores offering these types of goods.

DOWNTOWN GRASS VALLEY SALES ANALYSIS

Grass Valley's downtown maintains a special function within the city's retail landscape. The Downtown Business District (Downtown) is marketed to visitors as Grass Valley's historic, walkable centerpiece. Downtown hosts events, markets, and street fairs year-round, and The Center for the Arts located on West Main Street presents more than 200 performances a year that bring both Nevada County residents and visitors downtown. Downtown is known for an eclectic mix of locally owned shops and restaurants, in a concentrated collection of buildings boasting the patina of age, enhancing the area's appeal to locals and visitors alike.

Data for the most recent fiscal year (2014/15) show $48 million in retail and food services sales in the Downtown Assessment District, representing about 11 percent of retail and food services sales in Grass Valley. The Downtown district has maintained this share of total city sales over the last few years. (**Table 5)** Downtown's restaurants, cafés, and bars capture a higher than average share of city sales—accounting for 25 percent of total city eating and drinking out sales. With a major grocery store located within the boundaries of the Downtown Assessment District, convenience sales are well represented in the downtown area and account for the largest total amount of sales. Comparison shopping represents the next highest amount of Downtown sales. Across all categories, the Downtown share of the city total has been remarkably consistent over time.

Table 5
Retail and Food Services Sales in the Downtown Assessment District (total sales in thousands) [a]

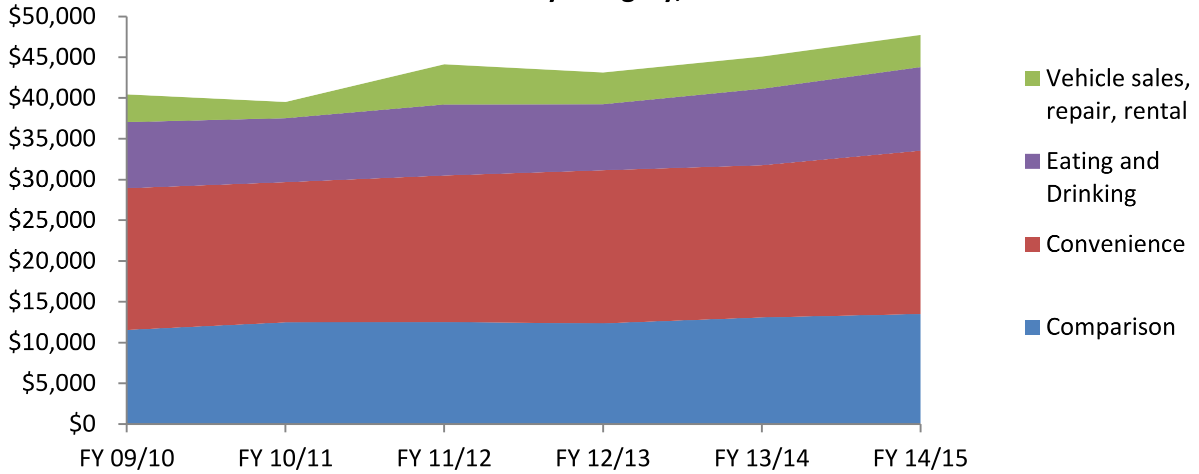
Retail Category	FY 09/10	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15
Comparison	$11,543	$12,468	$12,500	$12,351	$13,076	$13,495
Convenience	17,385	17,199	17,986	18,779	18,668	20,035
Eating and Drinking	8,105	7,850	8,716	8,102	9,384	10,258
Vehicle sales, repair, rental	3,403	1,986	4,925	3,888	3,944	3,940
Total	**$40,435**	**$39,504**	**$44,127**	**$43,120**	**$45,072**	**$47,729**
Downtown Assessment District percent of city total sales						
Comparison	10%	10%	11%	11%	10%	11%
Convenience	12%	11%	11%	12%	11%	12%
Eating and Drinking	26%	24%	25%	24%	26%	26%
Vehicle sales, repair, rental	4%	3%	6%	5%	5%	5%
Total	**10.8%**	**10.4%**	**11.3%**	**10.9%**	**11.0%**	**11.3%**

Notes:
a. Taxable sales converted to total sales assuming 30 percent of food and beverage store sales are taxable and about 36 percent of health and personal care store sales are taxable.

Sources: City of Grass Valley, HdL Companies, Allocations by Business Type, and Hausrath Economics Group.

Since a low point in sales citywide and Downtown during the Great Recession (2008 – 2009), retail and food services sales Downtown have increased relatively steadily across all retail categories (**Figure 3)** and at a somewhat faster pace than city retail and food services sales overall. Downtown sales increased 18 percent between 2009/10 and 2014/15 while citywide sales increased 12 percent over the same period. The net result has been a marginal increase in the contribution of Downtown to total city sales—from 10.4 percent in 2010/11 to 11.3 percent in 2014/15.

Figure 3
Retail and Food Services Sales by Category, Downtown Assessment District

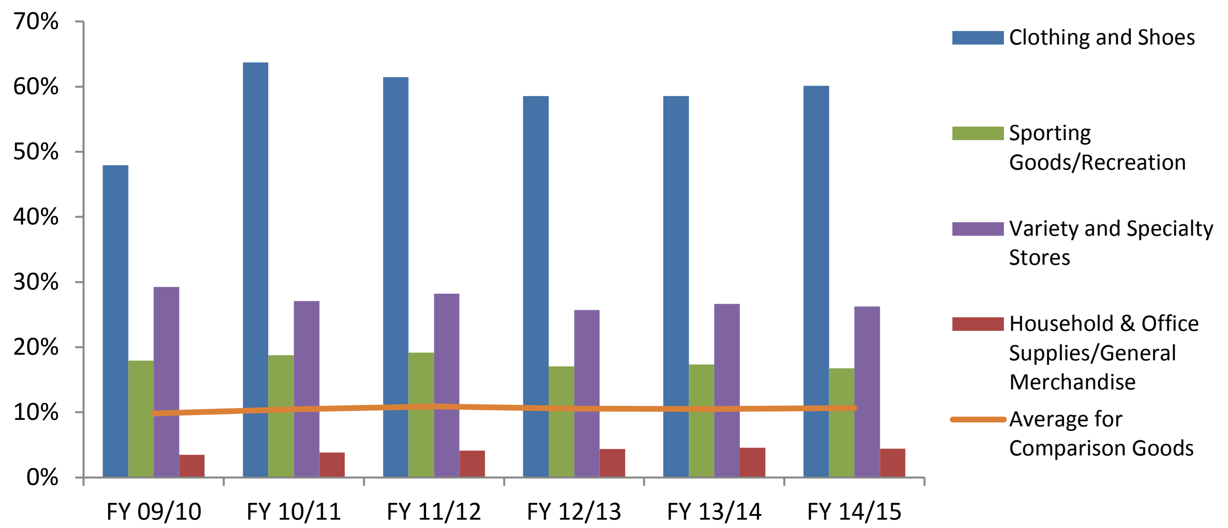


Sources: City of Grass Valley, HdL Companies, and Hausrath Economics Group.

Relative to sales trends citywide, Downtown has shown the strongest growth in comparison sales and sales at eating and drinking establishments. The $2 million per year increase in Downtown sales in each of these categories represents 20 percent of the increase in comparison sales and 30 percent of the increase in sales in eating and drinking establishments in Grass Valley since 2009/10.

Downtown has particular strengths in certain types of comparison goods sales. Sales at clothing and shoe stores, sporting goods/recreation stores, and specialty stores (establishments selling books, stationery, music, jewelry, flowers, gifts, and novelty items) are a disproportionate share of comparison sales Downtown **(Figure 4)**. By contrast, sales of household and office furnishings and supplies and general merchandise are more likely to occur in other locations in Grass Valley.

Figure 4
Downtown Share of City Sales: Detail for Comparison Goods



Sources: City of Grass Valley, HdL Companies, and Hausrath Economics Group.

DORSEY MARKETPLACE – PROJECT DESCRIPTION AND ECONOMIC ANALYSIS PARAMETERS

Retail space and retail sales

Proposed for a 26.9 acre site at the southeast corner of Highway 20/49 and Dorsey Drive, the Dorsey Marketplace project would be developed adjacent to the new off-ramp for the Dorsey Drive interchange. This is a prominent site, well-located to attract people driving between the highway and nearby educational, medical, residential and other business commercial activity in Grass Valley. The project proposes 181,900 square feet of commercial and retail development and 90 multi-family residential rental units, along with surface parking, plazas, pedestrian corridors, a community dog park, and residential common areas, including fitness center and pool. This is the largest amount of new retail space proposed to be added in Grass Valley in 10 years. The retail and commercial development is laid out to accommodate four major tenants ranging from 20,000 to 48,000 square feet in size, six smaller buildings ranging from 3,400 to 10,000 square feet each for shops and/or offices, and four restaurant and/or office pads for that could be oriented to drive-through uses. Entrances and exits are off Dorsey Drive and a new road extending into the site and connecting with Springhill Drive. The residential units would be developed in a series of six two- and three-story structures accessed off this new road.

The project sponsor has outlined the following mix of potential tenants for the commercial development:

- Four anchor tenants: including a neighborhood market, and stores offering general merchandise, apparel (men/women/children), home furnishings, health and beauty, sporting goods, or electronics, for example

- Six smaller shops: food services and drinking places, café's, smaller retail shops selling goods similar to those listed above
- Four drive-through pads: financial institutions, sandwich/coffee shops, quick-service food

Using sales per square foot estimating factors that reflect planning level estimates for establishments of these types based on industry data, the Dorsey Marketplace could potentially generate retail sales ranging from $53 million to $57.5 million per year at full occupancy. **(See Table 6)** The range illustrates two scenarios: higher sales with a neighborhood market/grocery store anchor and lower sales without such an anchor. Sales per square foot estimating factors are generally around $300 per square foot for the larger anchor stores and $350 per square foot for the smaller shops and eating and drinking places. Actual sales per square foot can be substantially higher or lower than these planning averages, depending on the characteristics of the operator. Industry standards indicate that a neighborhood market/grocery store would be expected to generate sales at a substantially higher rate of $500 per square foot.

The estimates assume two of the pads would be developed for office uses such as banks or real estate brokerages and would not generate retail sales. Based on review of the tenant mix at other Grass Valley shopping centers, it is likely that one or more of the small shop spaces might also be used for office or other commercial use not generating retail sales. That assumption is factored into the estimate above.

Table 6
Dorsey Marketplace Estimates of Annual Retail Sales and Employment

Retail/Commercial spaces	Square footage	Store types:	Annual sales per square foot [a]	Estimated Sales (annual) Grocery store [b]	Estimated Sales (annual) No grocery store [c]
Major 1	38,000	General merchandise, men's/women's/children's clothing, home furnishings, health and beauty, sporting goods, electronics, neighborhood market	$300	$11,400,000	
Major 2	48,000		$300	$14,400,000	
Major 3	24,000		$500 /$300	$12,000,000	$7,200,000
Major 4	20,000		$300	$6,000,000	
Shop A	10,400		$300	$3,120,000	
Shop B	7,200	Food service and drinking places, café	$350	$2,520,000	
Shop C	5,000		$350	$1,750,000	
Shop D	6,000		$350	$2,100,000	
Shop E	5,000		$350	$1,750,000	
Shop F - office	3,800				
Pad 2 - food service	3,000		$350	$1,050,000	
Pad 1 - food service	4,000	Drive-throughs: financial institution, sandwich/coffee, quick-service food	$350	$1,400,000	
Pad 3 - office	4,000				
Pad 4 - office	3,500				
Total Square Feet	**181,900**		**Total Annual Sales**	**$57,490,000**	**$52,690,000**

Employment Estimate	Grocery store [b]	No grocery store [c]
Sales per employee [d]	$235,000	
Estimated Retail Jobs	**245**	**224**
Office Space [e]	11,300	
Office space per employee [f]	350	
Estimated Office/ Commercial Jobs, full occupancy	**32**	
Estimated Property management/maintenance jobs	**3**	
Total Employment	**280**	**259**

Notes:

a. Sales per square foot factors developed based on Urban Land Institute and International Council of Shopping Centers, *Dollars and Cents of Shopping Centers / The SCORE 2008* (2008 sales per square foot factors inflated to 2015 dollars based on the Consumer Price Index) and review of data in selected corporate annual reports (Form 10-K).

b. This scenario assumes one of the major anchors is a grocery store/neighborhood market with annual sales estimated based on an average of $500 per square foot.

c. This scenario assumes there is no grocery store and annual sales at all of the major anchors are estimated at $300 per square foot. All other sales are assumed the same in this scenario.

d. Sales per employee factor from U.S. Census Bureau, 2012 Economic Census, *Retail Trade*.

e. Office space is assumed for the shop and pad spaces not occupied by retail tenants: Shop F, Pad 3 and Pad 4 totaling 11,300 square feet.

f. The Natelson Company, *Employment Density Study Summary Report*, prepared for Southern California Association of Governments, October 2001.

Sources: Dorsey Marketplace project description, Urban Land Institute, International Council of Shopping Centers, Corporate 10K reports, U.S. Census Bureau, The Natelson Company, and Hausrath Economics Group

Employment

Assuming sales per employee of about $235,000 per year, based on data for Grass Valley shopping-center-type retail establishments from the Census of Retail Trade, there would be about 225 - 245 people employed in retail activity at Dorsey Marketplace. Another ± 30 jobs would be expected at full occupancy of the office and other commercial space. Property management and maintenance staff at the residential units could add another three jobs, bringing total project employment to 260 - 280.

Households and population

The 90 residential rental units would provide housing for about 200 people. **(See Table 7)** Assuming a stabilized occupancy rate of 95 percent, typically 86 of the units would be occupied. Household size is estimated at an average of 2.25 persons per occupied unit (American Community Survey 2010-2014 5-year estimate for renter occupied units in Grass Valley), resulting in the estimate of 194 residents.

Table 7
Dorsey Marketplace Residential Units and Population Estimate

Unit types/sizes	Number of units
1 bedroom apartments (1,013 sf +- per unit)	20
2 bedroom apartments (1,340 sf +- per unit)	50
3 bedroom apartments (1,600 sf +- per unit)	20
Total number of apartments	90
Occupied units and population	
Average occupancy rate	95%
Average occupied units	86
Persons per occupied unit [a]	2.25
Total resident population	**194**

Notes:
a. U.S. Census Bureau, *American Community Survey 2010 - 2014 5-year estimates*, renter occupied units in Grass Valley.
Sources: Dorsey Marketplace project description, U.S. Census Bureau, and Hausrath Economics Group

Apartment rents and household income

The rents for the Dorsey Marketplace residential units will likely be established once the project is under construction. The units will not be age-restricted and rents will be at market rate, oriented towards professionals working in Grass Valley. There are no comparable market-rate rental projects in Grass Valley to provide indicators of likely market rents. HEG reviewed online rental listings in the Grass Valley and Nevada City areas and in the Auburn area and could find no directly comparable projects with current apartment listings. In the absence of relevant local comparable projects, apartment complexes in Roseville and Rocklin provide benchmarks to establish rough market-rate rental estimates for the proposed Dorsey Marketplace units. Current listings in Roseville and Rocklin indicate the following:

- One bedroom rentals ranging from $1,280 - $2,100 per bedroom
- Two bedrooms rentals ranging from $750 - $1,350 per bedroom
- Three bedroom rentals ranging from $530 - $1,030 per bedroom

All of the projects reviewed market themselves as adjacent to shopping; some are only a short walk to major shopping centers. All have pools and fitness centers; many have business centers, community gardens, sports courts and playgrounds, BBQ/picnic areas, and theatre/lounge/coffee bar spaces. The higher prices are for newer units, and the pricing range also reflects different levels finishes and amenities.

To establish rental rates for the Dorsey Marketplace units, HEG assumed rental rates per bedroom at the lower end of the range identified above, to account for differences in location and amenity factors. Furthermore, HEG adjusted the market rate rents for the income differential between Grass Valley and the Roseville/Rocklin area, in recognition of the differences in the labor market and in the ability to pay. Rents are estimated at 80 percent of the lower end of the market-rate rental range per bedroom.[2] **Table 8** presents the resultant rent assumptions for the Dorsey Marketplace units.

Table 8
Dorsey Marketplace Residential Units, Estimated Market Rents, and Household Income

Apartment types	Approximate square feet per unit	Rent per bedroom [a]	Rent per unit	Rent per square foot	Implied Household Income [b]
1 bedroom apartments	1,013	$1,000	$1,000	$0.99	$40,000
2 bedroom apartments	1,340	$700	$1,400	$1.04	$56,000
3 bedroom apartments	1,600	$500	$1,500	$0.94	$60,000

Notes:
a. Rent per bedroom based on Roseville rents for newer apartment complexes near shopping. Representative Roseville rents selected from the lower end of the range of rental listings to account for location factors and differences in amenities. Rent per bedroom for Dorsey Marketplace units estimated at 80 percent of the rent per bedroom for Roseville apartments, based on household income differentials between Grass Valley and Roseville.
b. Household income estimated from average rents assuming rent payments are 30 percent of annual household income.

Sources: Apartment listings for Roseville and Rocklin and Hausrath Economics Group.

Household incomes are projected from these rental rates using an assumption about the average share of household income devoted to rent. Typically, rent is considered affordable if it requires 30 percent of annual household income. Based on this assumption, the resulting estimated average household incomes range from $40,000 per year for one-bedroom units to $60,000 per year for 3 bedroom units. For comparison, the average household income for all households in

[2] According to the 2010-2014 5-year estimates from the American Community Survey, median rent in the city of Grass Valley is about 70 percent of the median rent in Rocklin and Roseville. Because so much of existing Grass Valley rental units are rented at below market rates through government subsidized rental programs (Grass Valley Housing Element 2014 – 2019, page II-10), this comparison overstates the difference between comparable market-rate rentals. Therefore, the 80 percent factor is used as a more appropriate gauge for estimating potential market rate rents in Grass Valley.

Grass Valley is about $47,000 per year and the median income for renter households is about $26,000 per year, according to the 2010-2014 American Community Survey 5-year estimates.

Retail spending from Dorsey Marketplace households

Applying the retail spending and household income relationships for western Nevada County households used in the market area spending and sales analysis, we can estimate retail spending by category for the households living in the Dorsey Marketplace project. **(See Table 9)** Assuming 36 percent of household income devoted to retail spending, these households would generate about $1.6 million per year in retail spending potential. Some of these dollars would be spent at Dorsey Marketplace, some elsewhere in Grass Valley, and some beyond the local market area. Spending in the categories represented by the types of tenants expected at the proposed project totals about $1.2 million per year—less than five percent of the project's total estimated retail sales. The housing units proposed as part of the project would add to total retail sales in Grass Valley—supporting tenancies in the Dorsey Marketplace and elsewhere in the city. The spending generated by Dorsey Marketplace residents does not represent a significant component of demand for the proposed retail at the site, however.

Table 9
Dorsey Marketplace Estimates of Household Retail Spending

Apartment types	Number of units	Occupied units	Monthly rent	Estimated average household income	Total annual household income
1 bedroom units	20	19	$1,000	$40,000	$760,000
2 bedroom units	50	48	$1,400	$56,000	$2,660,000
3 bedroom units	20	19	$1,500	$60,000	$1,140,000
Total	**90**	**86**		**$53,000**	**$4,560,000**
				Retail spending percent of income (rounded) [a]	36%
				Total annual retail spending	**$1,641,600**
		Distribution by category (rounded) [a]			
			Comparison	31%	$508,896
			Convenience	28%	$459,648
			Eating & drinking out	13%	$213,408
			Motor vehicles, parts, service stations	28%	$459,648
			Total	**100%**	**$1,641,600**
				Subtotal comparison, convenience, and eating and drinking out	**$1,181,952**

Notes:
a. U.S. Bureau of Labor Statistics, *Consumer Expenditure Survey 2013-2014*, September 2015. Table 3133, Western region by income before taxes: Average annual expenditures and characteristics.

Sources: U.S. Bureau of Labor Statistics, and Hausrath Economics Group.

PROJECTED INCREASE IN MARKET AREA DEMAND

There has been only modest housing and population growth in Grass Valley and the greater western Nevada County market area over the last couple of decades. The housing supply in Grass Valley increased by about 90 units per year between 1990 and 2000 and by about 133 units per year between 2000 and 2010. Since 2010, the pace has slowed to less than 10 units per year. This is well below the average annual rate through for the 2000 – 2020 period forecast in the *Grass Valley General Plan* (1999): 2,820 housing units translating to an average annual rate of 140 units per year over the 20-year planning period. An update prepared for the *Economic and Fiscal Conditions Study for the City of Grass Valley* (the SDA Study) in 2006 projected that Grass Valley could absorb 170 units per year between 2003 and 2020. (The latter projection was prepared during the economic boom times preceding the Great Recession and assumed expansion of housing supply potential within the city's sphere of influence areas as well as encouragement of infill development.)

More recent projections prepared by state agencies for infrastructure and service planning (California Department of Finance and Caltrans) and based on long-term demographic trends provide guidance for updated estimates of the amount and pace of growth in the market area. The California Department of Finance (DOF) projects Nevada County population will increase at the rate of 0.7 percent per year from 2015 through 2030; a somewhat faster pace of growth than the 0.4 percent per year rate evidenced from 2000 – 2015. **Table 10** presents estimates for population and household growth in Grass Valley and the Western Nevada County market area through 2030, based on the DOF projections for Nevada County.[3] The Grass Valley share of county households increased from 13.6 percent in 2000 to just under 15 percent in 2016. Assuming Grass Valley maintains this share of the county total through 2030, there would be 7,200 households in the city by 2030, an increase of about 1,240 over the 14 year period from 2016—an average annual pace of about 90 units per year. Assuming no change in average household size (2.1 persons per household is the current estimate) and no change in the percent of the population accommodated in group quarters, total population in the city would be about 15,700 by 2030. A similar analysis for the western Nevada County market area results in a 2030 projection of 38,600 households and 92,000 people living in this part of the Nevada County.[4]

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[3] Caltrans projections are somewhat lower than DOF projections for households and employment, but are within one percent (for population) and five percent (households) of the DOF projections used in this analysis. Caltrans does identify Nevada County as a "vulnerable county". These counties are forecast to have low rates of population growth and to be vulnerable to economic stagnation (constrained labor markets and relatively low growth rates for personal income and taxable sales), resulting in strained local government budgets.

[4] A more aggressive growth rate for Grass Valley was estimated for the 2011 Sphere of Influence Plan prepared by the Nevada County Local Agency Formation Commission (the SOI Plan). The projections in that report assumed Grass Valley population would grow at two percent per year on average—faster than the growth rate between 2000 and 2010 and more in line with the growth rate of the 1990s. In the SOI Plan, the city's population was projected to reach 19,000 people by 2030. The SOI Plan shows a 2015 population for Grass Valley (14,151) that is almost 10 percent higher than the current population. In the interests of a conservative analysis, HEG uses the slower rate of growth established in the DOF and Caltrans projections.

Table 10
Population and Household Projections for Grass Valley and Western Nevada County Market Area [a]

Grass Valley

	Census 2000 and 2010		DOF E-5 May 2016		Estimate based on County Total		
	2000	**2010**	**2015**	**2016**	**2020**	**2025**	**2030**
Total Population	10,922	12,860	12,967	12,955	14,400	15,200	15,700
Household Population	10,662	12,401	12,508	12,496	13,860	14,700	15,120
Households	5,016	6,077	5,970	5,961	6,600	7,000	7,200
Persons per Household	2.13	2.04	2.10	2.10	2.10	2.10	2.10
Household % of Total Population	98%	96%	96%	96%	96%	96%	96%

Grass Valley Share of County Total [b]

	Census 2000 and 2010		DOF E-5 May 2016		Factors for Projections Estimate		
	2000	**2010**	**2015**	**2016**	**2020**	**2025**	**2030**
Total Population	11.9%	13.0%	13.2%	13.2%	14.1%	14.4%	14.5%
Households	13.6%	14.6%	14.9%	14.8%	15%	15%	15%

Western Nevada County

	Census 2000 and 2010		ACS 2010 - 2014 5 year Estimate	Estimate based on County Total		
	2000	**2010**	**2014**	**2020**	**2025**	**2030**
Total Population	73,585	77,935	78,178	84,400	88,700	92,000
Household Population	72,765	76,819	77,065	83,180	87,410	90,700
Households	29,933	33,281	32,798	35,400	37,200	38,600
Persons per Household	2.43	2.31	2.35	2.35	2.35	2.35
Household % of Total Population	99%	99%	99%	99%	99%	99%

Western Nevada County Share of County Total [b]

	Census 2000 and 2010		ACS 2010 - 2014 5 year Estimate	Factors for Projections Estimate		
	2000	**2010**	**2014**	**2020**	**2025**	**2030**
Total Population	80.0%	78.9%	79.3%	83%	84%	85%
Households	81.1%	80.1%	80.3%	80%	80%	80%

Nevada County Total

	Census 2000 and 2010		ACS 2010 - 2014 5 year Estimate	DOF E-5 May 2016		DOF P-4 March 2015		
	2000	**2010**	**2014**	**2015**	**2016**	**2020**	**2025**	**2030**
Total Population	92,033	98,764	98,606	98,037	98,095	101,780	105,407	108,129
Household Population	91,167	97,589	97,481	96,801	96,881	100,629	104,196	106,857
Households	36,894	41,527	40,838	40,157	40,167	44,278	46,474	48,216
Persons per Household	2.47	2.35	2.39	2.41	2.41	2.27	2.24	2.22

Notes:

a. Excludes Lake of the Pines. See notes in Table 3.

b. Trend relationships (2000, 2010, 2014, 2015 and 2016) from various sources used to develop projections for Grass Valley and the western Nevada County market area from county total projections.

Sources: U. S. Census Bureau, State of California Department of Finance, and Hausrath Economics Group.

The 2014 – 2019 Housing Element (adopted August 2014) identifies the potential for 1,883 housing units within Grass Valley city limits, based on likely densities on vacant residential land, and vacant non-residentially zoned or mixed use properties. There are currently 1,145 residential units in projects approved but not yet built in Grass Valley. The 90 units in the proposed Dorsey Marketplace project bring the total pipeline (as of March 2016) to 1,235 residential units. More than half of these units (700 of the total) are approved in the Loma Rica Ranch Specific Plan. This pipeline of residential development fits within the rough growth parameters outlined above based on DOF projections for Nevada County. In addition, the pending annexation of the Southern Sphere of Influence Special Development Plan Area could accommodate up to 534 residential units. There are no current proposals for this development, however, although the potential supply is noted in the 2014-2019 Housing Element.

The projection of household growth in the western Nevada County market area provides the basis for a generalized estimate of growth in spending potential and market area retail demand. **Table 11** uses the household income and spending assumptions presented in Table 3 to generate an estimate of potential spending growth, assuming long-term trends in market area housing and population growth and no real income growth. The projections indicate an increase of about 6,500 households in the western Nevada County market area over the next 14 years through the 2030 projection horizon. Total annual household retail spending would increase from about $850 million per year in 2016 to just over $1 billion per year in the future sometime around the year 2030. There would be about $123 million more per year in spending on comparison and convenience goods and on eating and drinking out. Assuming average sales per square foot in the range of $300 - $350 for most types of retail space, this spending would support about 350,000 – 400,000 square feet of additional retail space.

Table 11
Increase in Retail Spending in the Western Nevada County Market Area [a]

		2016	Future (2030)
Households [b]		32,134	38,600
Average Household Income [c]		$73,500	$73,500
Retail spending percent of income (rounded) [d]		36%	36%
Total retail spending		$26,460	$26,460
Distribution by category (rounded) [d]		**2016**	**Future (2030)**
Comparison	31%	8,203	8,203
Convenience	28%	7,409	7,409
Eating & drinking out	13%	3,440	3,440
Motor vehicles, parts, service stations	28%	7,409	7,409
	100%	**$26,460**	**$26,460**
Estimated Household Spending by Category		**2016**	**Future (2030)**
Comparison		$263,579,067	$316,620,360
Convenience		238,071,416	285,979,680
Eating & drinking out		110,533,157	132,776,280
Motor vehicles, parts, service stations		238,071,416	285,979,680
		$850,255,056	**$1,021,356,000**
			Change from 2016
		Households	6,466
		Comparison, Convenience, Eating & drinking out Spending	$123,192,680
		Percent change	20%
		Space supported at $300 per square foot	411,000
		Space supported at $350 per square foot	352,000

Notes:
a. Excludes Lake of the Pines. See notes in Table 3.
b. Household count for 2016 from the California Department of Finance *Report E-5. Population and Housing Estimates for Cities, Counties, and the State, January 1, 2011-2016, with 2010 Benchmark*, May 2016, assuming 80 percent of county households live in the market area. Projections based on sources and analysis in Table 10.
c. U.S. Census Bureau, *American Community Survey 2010-2014 5-year estimates*. Assumes no real increase in household income over time.
d. U.S. Bureau of Labor Statistics, *Consumer Expenditure Survey 2013-2014*, September 2015. Table 3133, Western region by income before taxes: Average annual expenditures and characteristics.

Sources: State of California Department of Finance, U.S. Census Bureau, U.S. Bureau of Labor Statistics, and Hausrath Economics Group.

POTENTIAL NEW RETAIL SUPPLY IN THE MARKET AREA

The current pipeline of approved retail space in the City of Grass Valley includes 54,500 square feet in the Loma Rica Ranch Specific Plan.[5] The Dorsey Marketplace project would add another 181,900 square feet at most considering that some of that space would be tenanted by office or other service commercial establishments. The likely approved projects plus Dorsey Marketplace represent a total of about 236,000 square feet of retail space in Grass Valley.

In addition, in the near term, three Dollar General stores (a national chain small-box discount retailer) are proposed in unincorporated western Nevada County (Alta Sierra, Rough and Ready, and Penn Valley). A similar Dollar General store opened in the Glenbrook Basin area in Grass Valley at the end of 2014. The Dollar General format consists of a building of 9,100 square feet with about 7,200 square feet of sales floor area. Economic analysis conducted for the three proposed projects plus the existing Grass Valley store estimated that, combined, the four stores would have sales of $6.5 million per year. The stores are positioned to capture some of the well-documented spending leakage from the western Nevada County market area. The economic analysis concluded that the combined four stores would need to capture only a small portion of market area demand to achieve stabilized sales. The existing retail base and new market area household growth provide “more than sufficient support” to absorb the projected Dollar General sales with little or no impact on existing retailers.[6]

Longer-term, there is substantially more non-residential development potential in planning areas yet to be annexed to Grass Valley. The City approved pre-zoning for the Southern Sphere of Influence Area in 2014. Within the larger 416 acre planning area, 119 acres were originally proposed for annexation; another 60 acres are proposed for addition to the annexation area. Buildout would represent more than 800,000 square feet of non-residential development (primarily industrial use), based on the worst-case scenario analyzed in the October 2013 *Southern Sphere of Influence Planning and Annexation Report Draft EIR*. The intent of the updated annexation planning effort was to increase opportunities for commercial and industrial development within Grass Valley. While this area could be annexed to Grass Valley within the next five years, there are currently no specific development proposals for these properties. Proposals for other Special Development Areas within the Grass Valley Sphere of Influence are on hold or inactive at this time.

CONCLUSIONS FOR PROPOSED DORSEY MARKETPLACE RETAIL DEVELOPMENT

Retail development in the Dorsey Marketplace project would generate annual sales in the range of $52.7 million to about $57.5 million at full occupancy, depending primarily on whether or not a grocery store would be one of the anchor tenants. While this type of tenancy might be possible, the retail demand and supply analysis indicates that the gaps in existing retail capture lie in comparison goods (apparel, household goods, electronics and appliances, sporting goods, gifts and specialty items and the like) and food services and drinking places.

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[5] The Village at South Auburn (including about 15,000 square feet of retail development) is unlikely to be developed as approved due to changes in property ownership.

[6] ALH Urban and Regional Economics, Letter to Mr. Joshua Simon, “Dollar General Economic Analysis in Nevada County”, May 7, 2015. The economic analysis conducted for the Dollar General projects used methods and assumptions very directly comparable to those described in this analysis for the Dorsey Marketplace project.

With roughly $150 million in existing retail spending leakage from the western Nevada County market area (in the combined comparison and eating and drinking out categories) and only small amounts of similar retail supply proposed, the Dorsey Marketplace project provides a site that could accommodate a tenant mix well-positioned to enhance Grass Valley's already strong position in the regional retail market. Dorsey Marketplace sales of $53 million represent about 35 percent of existing retail leakage. Prior retail market assessment for Grass Valley (the *Glenbrook Basin Redevelopment Infill Study* (2010) and the Buxton Market Overview and Retail Site Assessment (2014) have indicated that a proposal of such a scale would be needed to recapture identified leakage. It is reasonable to expect that the right mix of Dorsey Marketplace tenants would result in existing market area households choosing to shift their shopping patterns—recapturing up to about one-third of market area household spending that is currently lost the market area and instead supporting stabilized operations at Dorsey Marketplace.

Furthermore, the moderate growth projected for the market area generates another $120 million in retail spending annually. Given the project's central location and accessibility, Dorsey Marketplace would benefit over time from some of this increase in market area spending.

The residential units proposed at Dorsey Marketplace would generate about $1.6 million per year in total retail spending. The spending that could support project retail ranges from about $700,000 per year up to $1.2 million per year, depending on the inclusion of a major grocery or drug store in the project. This amount of spending would not be a significant component of support for the Dorsey Marketplace retail, although it is part of the growth in broader market area support for retail throughout Grass Valley—growth that has been dormant in recent years due to the lack of new residential development.

Market area demand and supply analysis and projections, evaluation of retail spending leakage, detailed assessment of trends in Grass Valley retailing, and evaluation of project characteristics indicate that the Dorsey Marketplace project would not depend on cannibalizing from existing retail establishments in Grass Valley. A reasonable shift in market area retail spending patterns in the near term, combined with moderate growth in the market area over time, provide ample support for the proposed increase in the city's retail inventory. Specifically, with respect to Downtown Grass Valley, the analysis of retail sales trends highlights the strong and specialized character of that retail destination. Sales activity Downtown is more influenced by general economic conditions and factors affecting visitor travel and discretionary spending on entertainment and recreation. Development of Dorsey Marketplace would not change the reasons for shopping and dining Downtown.

HAUSRATH ECONOMICS GROUP

DRAFT MEMORANDUM

Date: August 2, 2018

To: Tom Last, Community Development Director City of Grass Valley
Katherine Waugh, DUDEK

From: Sally Nielsen

Subject: **Dorsey Marketplace Economic Analysis – Generalized Comparison of Alternatives**

OVERVIEW AND SUMMARY CONCLUSIONS

This memorandum is based on the July 26, 2016 "Dorsey Marketplace Economic Analysis" memorandum prepared by Hausrath Economics Group. That 2016 analysis was prepared to determine the impact of the proposed Dorsey Marketplace on the Grass Valley retail market. The project analyzed in 2016 is essentially the same as Alternative A in the July 2018 Draft environmental impact report (DEIR). Alternative B in the DEIR proposes less commercial/retail space, more housing units, and adds office space to the project. This 2018 memorandum compares Alternative A and Alternative B in terms of the key economic analysis parameters:

- commercial, retail, and office space;
- retail sales;
- employment;
- housing units;
- population and;
- household retail spending.

The memorandum then presents a generalized evaluation of the extent to which Alternative B would result in different conclusions about the effect of the project on the Grass Valley retail market, specifically whether the project would have a negative impact on the economic health of the Downtown Business District.

The local and regional retail market context analysis was not updated to prepare this memorandum. The existing market conditions are presumed to be mostly unchanged:

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- Grass Valley functions as the retail center for a broader market area, capturing more retail sales than any other part of Nevada County, while, at the same time, substantial local market area retail spending is lost to retail locations outside Nevada County.
- Downtown Grass Valley accounts for just over 10 percent of total sales in Grass Valley and has a special function in the Grass Valley retail landscape attracting both locals and visitors.
- Convenience sales are strong downtown (the largest in total dollar amount and about on par with Downtown's average share of total city sales), while sales at restaurants, cafés, and bars are concentrated in the Downtown (representing about one-quarter of total City sales in this category).

The projected increase in market area retail demand is presumed to be roughly the same as estimated in 2016, and there have been no significant changes in the potential for other new retail supply in the market area. [*Note to reviewers:* Please confirm. The 2016 memorandum mentions the 54,400 sf of retail space in the Loma Rica Ranch Specific Plan, the three Dollar General Stores in the approval process in unincorporated Nevada County—I see from some stories in *The Union* on February 27 and March 13 2018 that the Alta Sierra and Penn Valley stores were approved—and the longer term potential in the sphere of influence.]

Compared to Alternative A, Alternative B proposes about 40 percent less retail space. Total retail sales and local sales tax generated by Dorsey Marketplace businesses would be less under Alternative B. There would be about 100 fewer people working in commercial, retail, and office space within the project site under Alternative B. On the other hand, Alterative B proposes almost twice as many housing units as Alternative A. This would increase the resident population on-site and almost double the increase in household retail spending attributable to the project. That increase would support Dorsey Marketplace retail and more importantly other local businesses elsewhere in Grass Valley, including Downtown. The increase in household retail spending would somewhat offset the effects to the City of Grass Valley economy of the lower amount of project retail space and sales under Alternative B compared to Alternative A.

Support for Dorsey Marketplace retail businesses in either Alternative would depend on both shifts in local market area spending patterns **and** new residential development and associated household retail spending expected in the greater market area. The amount of spending to be captured in either case is reasonable, and neither Alternative would pose a competitive threat to Downtown Grass Valley retailers. The potential for any competitive impacts would be less under Alternative B than under Alternative A because Alternative B would add less retail supply and more retail demand from project households and associated local retail spending.

DORSEY MARKETPLACE ALTERNATIVES A AND B

Table 1 compares the physical characteristics of Alternatives A and B and the key economic analysis parameters that are derived from those characteristics. Under Alternative B, commercial/retail space is reduced by about 40 percent. There are sites for two major shops instead of four, and five smaller shops instead of six. Both Alternatives show four pads for food services and financial institutions; some of these pads would be drive-through establishments. Alternative B proposes almost two times the number of residential units for the site and adds office space in a mixed-use residential/office building near the center of the project site.

Table 1
Dorsey Marketplace Alternatives
Project Characteristics and Economic Parameters

		Alternative A Commercial/Residential	Alternative B Commercial/Office/Residential
Project Characteristics			
Commercial/Retail		4 major shops	2 major shops
		20,000 - 40,000 sf	21,000 - 35,000 sf
		6 smaller shops	5 smaller shops
		4,000 - 8,560 sf	4,000 - 8,500 sf
		4 pads	4 pads
		3,300 - 6,000 sf	3,200 - 6,000 sf
Office		-	8,500
Residential (dwelling units)			
	1 BR	20	38
	2 BR	50	95
	3 BR	20	38
Total square feet			
	Commercial/Retail	**178,960**	**104,350**
	Office	**-**	**8,500**
Total dwelling units		**90**	**171**
Economic Analysis Parameters [a]			
	Total annual retail sales	$52.7 million - $57.5 million	$33.3 million - $37.6 million
	Total employment	260 - 280 jobs	170 - 190 jobs
	Resident population	194 residents	365 residents
	Total annual retail spending	$1,600,000	$3,100,000

Notes:
a. Estimates are based on the same planning level factors used in the 2016 analysis. For retail sales, these are sales per square foot estimating factors for establishments of these types based on industry data. The range illustrates the difference in sales depending on whether or not one of the major anchors is a grocery store / neighborhood market that would have higher average sales per square foot. Retail employment is estimated based on retail sales per employee factors from the 2012 Economic Census, *Retail Trade*. Office employment assumes a density of 350 gross square feet per employee and estimates office employment for the pad spaces that might be occupied by financial institutions. Population is based on the household size for renter-occupied units in Grass Valley, according to the U.S. Census Bureau, *American Community Survey 2010 – 2014 5-year estimates.* Household retail spending estimates are based on estimates of market rate rent levels by unit size and incomes derived by assuming that rent payments are 30 percent of annual household income. Spending patterns are estimated from the U.S. Bureau of Labor Statistics, *Consumer Expenditure Survey 2013-14*, September 2015 for the Western Region.

Source: Dorsey Marketplace project description (2016 and 2018) and Hausrath Economics Group.

For either Alternative, the mix of potential tenants for the commercial/retail development is assumed to be roughly the same as described by the project sponsor in 2016:

- Anchor tenants: a neighborhood market and stores offering general merchandise, apparel (men/women/children), home furnishings, health and beauty, sporting goods, or electronics, for example
- Smaller shops: food services and drinking places, cafés, smaller retail shops selling goods similar to those listed above
- Four drive-through pads: financial institutions, sandwich/coffee shops, quick-service food

Alternative B would generate a lower amount of retail sales than Alternative A, proportional to the reduced commercial/retail building area—in the range of $32 million - $36 million per year at full occupancy.

There would be about 100 fewer people working in businesses located on the project site under Alternative B.

Alternative B proposes almost twice as much housing as Alternative A; there would be 365 people living in the Dorsey Marketplace housing units—about 170 more people living on the project site—90 percent more than under Alternative A.

Alternative B would generate about $3.1 million in annual household retail spending supporting Dorsey Marketplace businesses and other businesses in the market area—almost two times the amount estimated for Alternative A.

CONCLUSIONS – ALTERNATIVE B COMPARED TO ALTERNATIVE A

The 2016 analysis concluded that it is reasonable to expect that the right mix of Dorsey Marketplace tenants would result in existing market area households choosing to shift their shopping patterns—recapturing up to about one-third of market area household spending that is currently lost the market area and instead supporting stabilized operations at Dorsey Marketplace. Furthermore, retail development at the centrally located and accessible project site would benefit over time from the increase in market area spending attributable to expected moderate increases in residential development and population in the greater market area. With the reduced amount of commercial/retail development in Alternative B, it would be easier for project tenants to meet sales targets. A fully-occupied project would not have to capture as much leakage. On the other hand, the fiscal benefits to the City of Grass Valley from taxable retail sales generated by Dorsey Marketplace establishments would be less than under Alternative A.

The increase in the number of project households and the associated higher amount of household retail spending under Alternative B would to some extent offset this reduced fiscal benefit relative to Alternative A. The spending from project households would support more of the Dorsey Marketplace retail than under Alternative A, but that would still not be a significant component of support for project retail businesses. More importantly, the higher level of household retail spending would be part of the growth in broader market area support for retail throughout Grass Valley—growth that has been dormant in recent years due to the lack of new residential development. This benefit would be enhanced under Alternative B.

As in the 2016 analysis, neither Alterative A nor Alternative B for the Dorsey Marketplace project would depend on cannibalizing from existing retail establishments in Grass Valley. Any prospects for this outcome would be less likely under Alternative B than under Alternative A because there would be a fewer retail stores and shops to support and more household spending from project households that would increase sales activity in the City. A reasonable shift in market area retail spending patterns in the near term, combined with moderate growth in the market area over time, provide ample support for the proposed increase in the city's retail inventory under either Alternative.

With respect to Downtown Grass Valley, the 2016 analysis of retail sales trends highlighted the strong and specialized character of that retail destination. Sales activity Downtown is more influenced by general economic conditions and factors affecting visitor travel and discretionary spending on entertainment and recreation. Development of Dorsey Marketplace would not change the reasons for shopping and dining Downtown. Alternative B offers somewhat better prospects for Downtown businesses than Alternative A, because there would be less retail supply added to the market and more demand from household retail spending.

Dorsey Marketplace Development Project
Biological Technical Report
City of Grass Valley, California

Prepared for:

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JULY 2016

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1 INTRODUCTION

This assessment describes the existing conditions for the proposed Dorsey Marketplace Project site in the community of Grass Valley, Nevada County, California (Figure 1). This report provides a preliminary assessment of the biological resources observed or potentially present on the site, potential constraints associated with development of the site, and related regulatory requirements.

1.1 Project Location

The proposed project site is located in the City of Grass Valley, which is located along State Route (SR) 20/49 between Nevada City and Alta Sierra. The project site is bordered by SR 20/49 to the west, Dorsey Drive to the north, the Old Barn and Ernie's Storage to the south and the Grass Valley Terrace Apartments to the east. The project would be accessible from Dorsey Drive and from Spring Hill Drive, which accesses Idaho-Maryland Road. The project is located in Section 23, Township 16 North, and Range 8 East of the U.S. Geological Survey (USGS) Grass Valley 7.5' quadrangle. The approximate center of the site corresponds to 39°13'39.3" North latitude and 121°2'31.7" West longitude (Figure 2).

1.2 Project Description

The currently proposed project at Dorsey Marketplace involves developing an approximately 27-acre parcel of land. Proposed land uses include commercial, residential, and recreational facilities. Two project designs are being considered; the development footprint would be substantially the same under either design.

The proposed project is requesting a General Plan Amendment and rezone to change the land use designation on the site from Business Park to Commercial (21.2 acres) and Residential Urban High Density (5.7 acres). The project is also requesting a rezone from Corporate Business Park to Commercial (C-2) and Residential (R-3). This would facilitate the proposed development. One project design would construct 181,900 square feet of commercial building space and 90 multi-family dwelling units. The other project design would construct 171 apartments, approximately 105,000 square feet of commercial space, and approximately 8,500 square feet of office space. Within the commercial component of the project, each project design includes four pads for drive-through restaurants (with sizes ranging between 3,000 and 4,000 square feet) while the number and size of major shops and small shops varies between the two designs. The proposed dwelling units would be offered as market-rate rental units and are expected to include 1-, 2-, and 3-bedroom units. They would be constructed as two-story buildings in the southeast corner of the project site in the project design that includes 90 apartments. In the project design that includes 171 apartments, the dwelling units would be constructed in two-story buildings in both the southeast and southwest corners of the site; some of the buildings in the southwest corner would also include the 8,500 square feet of office space included in this design. In both designs, the residential area would include an apartment clubhouse and pool and a tot lot and small dog park would also be provided within the project site.

2 REGULATORY BACKGROUND

Federal

The following federal regulations pertaining to biological resources would apply to the proposed project.

Federal Endangered Species Act

The Federal Endangered Species Act (FESA) (16 USC 1533) gives joint authority to list a species as threatened or endangered to the Secretary of the Interior (represented by the U.S. Fish and Wildlife Service) and the Secretary of Commerce (represented by the National Marine Fisheries Service). Under FESA, the "take" of endangered or threatened fish, wildlife, or plants species or adverse modifications to critical habitat, in areas under federal jurisdiction is prohibited. Under the Act take is defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct". The USFWS and NMFS have interpreted the definition of "harm" to include significant habitat modification that could result in the take of a species.

Either an incidental take permit under Section 10(a) or an incidental take statement under Section 7 is required if an activity would result in the take of a federally listed species. Section 7 requires the reviewing agency to determine whether any federally listed species, or species proposed for listing, may be present on the project site and if the project is likely to affect the species. Additionally, the reviewing agency must determine if a proposed project is likely to jeopardize the existence of a listed species or a proposed listed species, or result in destruction or adverse modification of proposed or designated critical habitat for such species. FESA requires the federal government to designate "critical habitat" for any listed species, which is defined as specific areas within the geographical area occupied by the species at the time of listing if they contain physical or biological features essential to the species conservation, and those features that may require special management considerations or protection. Additionally, it includes specific areas outside the geographical area occupied by the species if the regulatory agency determines that the area itself is essential for conservation.

USFWS and/or NMFS must authorize projects where a federally listed species is present and likely to be affected by an existing or proposed project. Generally, terrestrial and freshwater fish species are under the jurisdiction of USFWS, while marine and anadromous fish species are under the jurisdiction of NMFS. Project authorization may involve a letter of concurrence that the project will not result in the take of a listed species, or a Biological Opinion that describes what measures must be undertaken to minimize the likelihood of an incidental take. Projects determined by USFWS and NMFS to jeopardize the continued existence of a species cannot be approved under a Biological Opinion. Take that is incidental to the lawful operation of a project is permitted under Section 10(a) through approval of a Habitat Conservation Plan (HCP), where a federal agency is not authorizing, funding, or carrying out the project.

Federal Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (MBTA) (16 USC Section 703, Supp. I, 1989) regulates and prohibits taking, killing, possessing, harming, or trading in migratory birds. The act addresses whole birds, parts of birds, and bird nests and eggs. This international treaty for the conservation and management of bird species that migrate through one or more countries is enforced in the United States by the U.S. Fish and Wildlife Service.

Clean Water Act

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical and biological integrity of waters of the United States (as defined in the Code of Federal Regulations 33 CFR 328.3[a]). Section 401 of the Act (33 USC 1341) prohibits the discharge of any pollutant into waters of the United States. Project applicants for a federal license or permit to conduct activities including, but not limited to, the creation or operation of facilities, which may result in discharge into waters of the United States, must obtain certification that the project would not violate applicable effluent limitations and water quality standards. Section 404 of the Act (33 USC 1344) requires a federal license or permit from the Army Corps of Engineers prior to the discharge of dredge or fill material into waters of the United States, unless activity is exempt from Section 404 permit requirements. Permit applicants must demonstrate that they have attempted to avoid or minimize impacts on the resource; however, if no further minimization of impacts is possible, the applicant is required to mitigate remaining impacts on all federally-regulated waters of the United States. In California the State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCBs) are responsible for the protection of water quality.

State

The following state regulations pertaining to biological resources would apply to the proposed project.

California Endangered Species Act

The California Endangered Species Act and Section 2081 of the California Department of Fish and Game Code identifies measures to ensure state-listed species and their habitats are conserved, protected, restored and enhanced. The Act requires permits from the CDFG for activities that could result in the take of a state-listed species threatened or endangered species.

"Take" is defined as to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture or kill (Fish and Game Code Section 86). Section 2080 of the Fish and Game Code prohibits the take of state-listed plants and animals unless otherwise permitted under Sections 2080.1, 2081, and 2835. Section 20814(b) affords CDFG the authority to issue permits for incidental take for otherwise lawful activities. To authorize an incidental take the impacts of the take must be minimized and fully mitigated. Issuance of incidental take permits for may not jeopardize the continued existence of a state-listed species. For species listed as threatened or endangered under FESA, CDFG may rely on a federal incidental take statement or permit to authorize an incidental take under CESA.

The California Fish and Game Commission maintains a list of threatened and endangered species (Fish and Game Code Section 2070). The California Fish and Game Commission maintains two additional lists; a Candidate species list, which identifies species under review for addition to either the endangered or threatened species list, and a species of special concern list which serves as a watch list based on limited distribution, declining populations, diminishing habitat, or unusual scientific, recreational, or educational value.

California Fully Protected Species and Species of Special Concern

The classification of "fully protected" was the CDFG's initial effort to identify and provide additional protection to those animals that were rare or faced possible extinction. California Fish and Game Code sections (fish at Section 5515, amphibians and reptiles at Section 5050, birds at Section 3511, and mammals at Section 4700) dealing with "fully protected" species states that these species may not be taken or possessed at any time and no provisions in this code or any other law shall be construed to authorize permits for the take of fully protected species. Species of special concern are broadly defined as animals not listed under the FESA or CESA, but which are nonetheless of concern to the CDFG because are declining at a rate that could result in listing or historically occurred in low numbers and known threats to their persistence currently exist. This designation is intended to elicit special consideration for these animals by the CDFG, land managers, consulting biology, and others. Additionally, this is intended to stimulate collection of additional information on the biology, distribution, and status of poorly known at-risk species, and focus research and management attention on them.

California Department of Fish and Game Code Section 3503

Birds of prey are protected in California under the Fish and Game Code (Section 3503.5, 1992). Under Section 3503.5 it is "unlawful to take, possess, or destroy any birds in the order Falconiformes (diurnal birds of prey) or Strigiformes (owls) or to take, possess, or destroy any nest or egg of any bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Disturbance during breeding season that results in the incidental loss of fertile eggs or nestlings or otherwise leads to nest abandonment is considered "taking" by the CDFG.

California Native Plant Protection Act

The California Native Plant Protection Act (California Fish and Game Code Sections 1900-1913) and the Natural Communities Conservation Planning Act provide guidance on the preservation of plant resources. Vascular plants which have no designated status or protection under state or federal endangered species legislation, but are listed as rare or endangered by the CNPS, are defined as follows:

1. List 1A: Plants presumed extinct
2. List 1B: Plants rare, threatened, or endangered in California and elsewhere
3. List 2: Plants rare, threatened, or endangered in California, but more numerous elsewhere
4. List 3: Plants about which more information is needed – a review list
5. List 4: Plants of limited distribution – a watch list

Generally, plants on CNPS List 1A, 1B, or 2 are considered to meet the criteria for endangered, threatened or rare species as outlined by Section 15380 of the CEQA Guidelines. Additionally, plants listed on CNPS List 1A, 1B, or 2 also meet the definition of Section 1901, Chapter 10 (Native Plant Protection Act) and Sections 2062 and 2067 (CESA) of the California Fish and Game Code.

California Department of Fish and Game Code Sections 1600-1616

Under Sections 1600-1616 of the California Fish and Game Code, CDFG regulates activities that would substantially alter the flow, bed, channel, or bank of streams and lakes. Such activities require a 1602 Lake and Streambed Alteration Agreement from the CDFG. California Code of Regulations (CCR) defines a stream as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). The term stream includes rivers, creeks, ephemeral streams, dry washes, canals, aqueducts, irrigation ditches and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife. Removal of riparian vegetation also requires a Section 1602 Lake and Stream Alteration Agreement from the CDFG.

State Water Resources Control Board

The State Water Resources Control Board (SWRCB) administers Section 401 of the CWA which requires that an applicant for a Section 404 permit first obtain a certification, or waiver thereof, that the project will not violate applicable state water quality standards. The authority to either grant certification or waive the requirement for certification has been delegated by the SWRCB to nine regional boards, including, in Sonoma County the North Coast Regional Water Quality Control Board (NCRWQCB). The SWRCB protects all waters of the State, but has special responsibility for isolated wetlands and headwaters. These waterbodies have high resources value but are vulnerable to filling and may lack regulation by other programs. Projects that require a USACE permit, or fall under other federal jurisdiction, and have the potential to impact waters of the State are required to comply with the terms of the Water Quality Certification Program. If a proposed project does not require a federal license or permit, but does involve activities that may result in a discharge of harmful substances to waters of the State, the Water Boards have the option to regulate such activities under its State authority in the form of Waste Discharge Requirements or Certification of Waste Discharge Requirements.

3 PROJECT SETTING

3.1 Land Uses

The project site is characterized as chaparral and coniferous woodland with several developed areas (Figure 3). It was the former location of the Spring Hill Mine, which operated at the site intermittently during the late 1800s and through the 1940s. Abandoned mine features located onsite include excavations, pits, remnants of building foundations, stockpiles of mine waste rock, and dry tailings ponds (Holdrege & Kull 2012). The project site is bounded on all sides by urban development.

3.2 Soils and Topography

In general, the native topsoil consists of clay, gravelly clay, and sandy clay; beneath the clay layer is the bedrock consisting of diabase and serpentine rock, which, in the trenches that appear on the site, are moderately to severely weathered. In these trenches, the clay layer over of the serpentine and diabase is approximately 2.5 feet thick. The Dubakella complex dominates the majority of the site's soil conditions (NRCS 2016). The site is a part of the ultramafic-mafic 'basement' of the Lake Combie complex. According to the Natural Resources Conservation Service (USDA 2016) the three soil types mapped within the site and include: Placer diggings; Rock outcrop-Dubakella complex, 5 to 50 percent slopes; and Sites loam, 9 to 15 percent slopes.

Placer diggings are generally found where historic mining practices have altered the land. Placer diggings consist of numerous minor components. Rock outcrops-Dubakella complex soils consist of ultrabasic rock outcrops in Dubakella soils on hills and mountains. These are rocky, well-drained soils that often contain serpentinite components. Sites loams consist of well-drained clay loams derived from metabasic residuum weathered from metasedimentary rock.

3.3 Watershed and Hydrology

The project site is located in the Upper Bear hydrological unit (HUC 18020126). Aquatic features within the site include numerous erosional channels and one depression at the southwestern end of the project site (Figure 4). Based on historic aerial photography and visual inspection during the site survey, these features are only periodically inundated and tend to remain inundated for short periods, depending on frequency and duration of rainfall events.

A formal wetland delineation has not been completed for the site. However, based on the site assessment, the numerous erosional features onsite appear to be the result of erosion of uplands from rainwater runoff and likely do not meet the three criteria for wetlands including hydrophytic vegetation, hydrology, and soils. Several flat areas at the top of the hill crest, in the center of the project site, were inundated with rainwater at the time of the site surveys; however, they did not contain any other indicators of hydrology, wetland vegetation, and were unlikely to remain inundated for extended periods of time. It is unlikely any of these features would be considered waters of the United States and the State of California, and would therefore not require permits from CDFW, ACOE and RWQCB if impacts to these features from development of the property are unavoidable. Although the depression at the southwestern end of the project site did not display any hydrophytic vegetation other than cottonwood trees on the margin, and was not inundated at the time of the site survey, this area appears to collect water that drains from the some of the linear drainage features and the sloped areas in the central portion of the site. The water exits this depression and enters travels through an intermittent drainage before entering a culvert and going underground at the southern property boundary. This depression and intermittent drainage may be considered jurisdictional by the ACOE or the RWQCB if the water moves through the storm drain system under the development to the south of the project site and eventually intersects with Wolf Creek to the south.

4 METHODOLOGY

4.1 Literature Review and Background Research

Prior to conducting fieldwork, the following available resources were reviewed to assess the potential for biological and wetland resources within the study area and vicinity:

- a 1:200-scale aerial photograph (Bing Maps 2014; Google Earth 2014),
- the USGS 7.5-minute topographic quadrangle (USGS 2014),
- a records search of the California Natural Diversity Database (Figure 3; CDFW 2016),
- a list of plants generated by a query of the California Native Plant Society's Inventory of Rare and Endangered Plants (CNPS 2016),
- A list of species generated from a review of the US Fish and Wildlife Service's (USFWS) list of federal endangered and threatened species (USFWS 2016),
- the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey (NRCS 2016), and
- the National Wetland Inventory (USFWS 2016).

4.2 Site Survey

Potential biological and wetland constraints were assessed in the field by Dudek biologist Laura Burris on March 4 and July 22, 2016. The site surveys consisted of walking the project area to identify habitat conditions, document all plant and animal species observed, and to determine if potential wetlands and waters of the U.S. were present within the project site. A follow-up evaluation of potential wetland resources was conducted by Dudek biologists Laura Burris and Tera Stoddard on July 27, 2016. The Dudek biologist collected georeferenced photographic records that represent the onsite habitats and wetlands (Appendix A).

4.2.1 Vegetation Community and Land Cover Types

The surveys were conducted on foot to visually cover the entire site. An aerial photograph (Google Earth 2015) with an overlay of the property boundary, and surrounding buffer was utilized to map the vegetation communities and record any special-status or sensitive biological resources while in the field. Nomenclature for vegetation communities follows A Manual of California Vegetation, Second Edition (Sawyer, et.al. 2009).

4.2.2 Flora

All plant species encountered during the field survey were identified to the lowest taxonomic group possible and recorded directly into a field notebook. Common and scientific names for plant species with a California Rare Plant Rank (CRPR, formerly CNPS List) follow the CNPS On-Line Inventory of Rare, Threatened, and Endangered Plants of California (CNPS 2015). Nomenclature for all other plant species observed on the site follows The Jepson Manual, Vascular Plants of California, Second Edition (Baldwin, ed 2012). A list of plant species observed on the site is presented in Appendix B.

4.2.3 Fauna

Wildlife species detected during the field survey by sight, calls, tracks, scat, or other signs were recorded directly into a field notebook. The site was scanned with and without binoculars to aid in the identification of wildlife. In addition to species actually detected during the surveys, expected wildlife use of the site was determined by known habitat preferences of local species and knowledge of their relative distributions in the area.

4.2.4 Jurisdictional Wetlands

Dudek conducted a constraints-level analysis for potentially jurisdictional waters and wetlands based on criteria provided by the following agencies:

- Waters of the U.S., including wetlands, under the jurisdiction of the U.S. Army Corps of Engineers (ACOE) pursuant to Section 404 of the federal Clean Water Act.
- Wetlands under the jurisdiction of the Regional Water Quality Control Board (RWQCB) pursuant to Section 401 of the Clean Water Act and the Porter-Cologne Act.
- Wetlands under the jurisdiction of CDFW, pursuant to Section 1602 of the California Fish and Game Code.

Pursuant to the federal Clean Water Act (CWA), ACOE- and RWQCB-jurisdictional areas include those supporting all three wetlands criteria described in the ACOE manual: hydric soils, hydrology, and hydrophytic vegetation. Areas regulated by the RWQCB are generally coincident with the ACOE, but may also include isolated features that have evidence of surface water inundation pursuant to the state Porter Cologne Act. These areas generally support at least one of the three ACOE wetlands indicators but are considered isolated through the lack of surface water hydrology/connectivity downstream. The extent of CDFW-regulated areas typically include areas supporting a predominance of hydrophytic vegetation (i.e., 50% cover or greater) where associated with a stream channel.

Specifically, Dudek performed a constraints-level wetland assessment on the property, reviewed current and historical aerial photography, and then identified potentially jurisdictional features based on aerial signatures and field observations.

5 RESULTS OF SURVEY

A total of 40 species of vascular plants were recorded during the site surveys (Appendix B). Of these 40 species, 27 are native to California. The rest of these species are non-native. The timing of the surveys was chosen to ensure identification of plants onsite to a taxonomic level sufficient to determine rarity.

Seven wildlife species or sign were observed during the field surveys: northern flicker (*Colaptes auratus*), several unidentified sparrows, dark-eyed junco (*Junco hyemalis*), bushtit (*Psaltriparus minimus*), and raccoon (*Procyon lotor*) scat.

5.1 Land Cover Types

Five land cover types exist on the project site. The majority of the site consists of whiteleaf manzanita (*Arctostaphylos viscida*) chaparral, McNab cypress (*Hesperocyparis macnabiana*) woodland (Figure 4). The remaining portion of the project site consists of, Ponderosa pine (*Pinus ponderosa*) forest, Fremont cottonwood (*Populus fremonti*) woodland, and ruderal/developed. These land cover types are described in Table 1 and in further detail below.

Table 1
Vegetation Communities and Vegetation Types

Alliance	Vegetation Type	Acres
Arctostaphylos viscida shrubland	California chaparral	11.76
(NA)	Developed	0.69
(NA)	Disturbed/Ruderal	5.22
Populous fremontii	Cottonwood forest	0.65
Pinus ponderosa forest	Mixed coniferous forest	6.62
Callitropsis macnabiana forest	McNabb Cypress Woodland	3.33
	Total	**28.28**

Whiteleaf Manzanita Chaparral. There are approximately 11.8 acres of whiteleaf manzanita chaparral onsite. The whiteleaf manzanita chaparral is dominated in most areas by whiteleaf manzanita. In other areas, whiteleaf manzanita is codominant in the canopy with scrub oaks (*Quercus berberidifolia* and *Q. durata*) and ceanothus (*Ceanothus cuneatus*). The shrub canopy in the chaparral is dense and little vegetation grows under the shrubs. The few herbaceous species noted in the chaparral included bedstraw (*Galium aparine*). Openings in the chaparral were either barren or dominated by annual grasses and forbs.

McNabb Cypress Woodland. There are approximately 3.3 acres of McNabb cypress woodland onsite. McNabb cypress woodland is dominated by McNab cypress in the overstory. This canopy in this habitat type was generally short (less than 20 feet in height) and was either densely clustered or scattered with whiteleaf manzanita chaparral between trees. McNab cypress forms a dense canopy and herbaceous vegetation was minimal in the understory. This vegetation community is a fire-adapted species and is known to occur primarily on soils derived from basalt, conglomerate, gabbro, greenstone, or serpentine substrates (Sawyer et al 2009).

McNab cypress woodland has a State rarity ranking of S3.2 and a global rarity rank of G3 (CDFW 2010).

Ponderosa Pine Forest. There is approximately 6.6 acres of coniferous forest onsite. Ponderosa pine trees are the dominant plant in this vegetation community. The trees onsite are tall and well-spaced, allowing for the growth of a sparse shrub layer in the understory. The shrub layer consists of ceanothus, whiteleaf manzanita, toyon (*Heteromeles arbutifolia*), and immature madrone trees (*Arbutus menzesii*). Herbaceous vegetation is sparse and primarily consists of an unidentifiable lily.

Cottonwood Forest. An approximately 0.6-acre stand of mature Fremont cottonwood (*Populus fremontii*) occurs in the southwestern corner of the project site. This area is the lowest point on the property and it appears that water runoff from the hillside collects there. Associated species include Himalayan blackberry (*Rubus armeniacus*) and coyote brush (*Baccharis pilularis*). No standing water was noted at the time of the site survey.

Cottonwood forest has a State rarity ranking of S3.2 and a global rarity rank of G4 (CDFW 2010).

Ruderal/Developed. Approximately 5.9 acres of ruderal/developed land cover occurs on the project site. Developed areas on the project site include a gravel parking lot at the northern end and several cleared dirt access roads. Additionally, historic mining facilities are present in the western portion of the project area, including cement foundations and mine tailing depressions. These areas have been altered through human disturbance and may support a variety of native and nonnative vegetation.

5.2 Special-Status Plant and Animal Species

For the purpose of this constraints evaluation, special-status plant and animal species are defined as those species that fall into one or more of the following categories:

1. Officially listed or proposed for listing under the State and/or Federal Endangered Species Acts.

2. State or Federal candidate for possible listing.

3. Species meeting the criteria for listing, even if not currently included on any list, as described in Section 15380 of the CEQA Guidelines.

4. Protected under the Federal Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act.

5. Species considered by the CDFW to be a "Species of Special Concern."

6. Species that are biological rare, very restricted in distribution, declining throughout their range, or have a critical, vulnerable stage in their life cycle that warrants monitoring.

7. Populations in California that may be on the periphery of a species' range, but are threatened with extirpation in California.

8. Species closely associated with habitat that is declining in California at an alarming rate (e.g., wetlands, riparian, old growth forests, desert aquatic systems, native grasslands, vernal pools, etc.).

9. Species designated as a special-status, sensitive, or declining species by other state, or federal agencies, or non-governmental organizations.

The potential occurrence of special-status plant and animal species on the Project site was initially evaluated by developing a list of special-status species that are known to or have the potential to occur in the Project vicinity. This list was primarily derived from a review of the California Natural Diversity Database (CDFG 2015), the CNPS Inventory of Rare and Endangered Plants (CNPS 2015), and the USFWS lists of federal endangered and threatened species (USFWS 2015) for all or some combination of the following USGS 7.5-minute quadrangles: Redwood Point, Newark, Niles, Milpitas, Mountain View, Palo Alto, Mindego Hill, Cupertino, and San Jose West.

5.2.1 Special-Status Plant Species

Results of the CNDDB and CNPS searches revealed 11 special-status plant species that have potential to occur on or in the vicinity of the project site. Of these, four were removed from consideration due to lack of suitable habitat within or adjacent to the project area, or the project site is outside of the species' known range (refer to Appendix C). Four special-status plant species have low potential to occur at the project site due to lack of appropriate soil substrates or habitat onsite. Three special-status plant species have moderate potential to occur at the project site. These include Stebbins' morning-glory (*Calystegia stebbinsii*), Follett's monardella (*Monardella follettii*), and Sierra blue grass (*Poa sierrae*). These species are discussed further in Table 2 and in the following section.

No special-status plants were observed during the field survey; however, the site survey was conducted at a time when special-status plants would not be evident and identifiable.

Table 2
Special-status Plant Species with Potential to Occur in the Project site

Common Name	Scientific Name	Status (Federal/State/CNPS)
Stebbins' morning-glory	*Calystegia stebbinsii*	FE/ CE/ 1B.1
Dubious pea	*Lathyrus sulphureus var. argillaceus*	None/ None/ 3
Sierra blue grass	*Poa sierrae*	None/ None/ 1B.3

Sources: CNPS 2016, CDFW 2016, USFWS 2016

Stebbins' Morning-glory

Stebbins' morning-glory (*Calystegia stebbinsii*) is a perennial rhizomatous herb found in serpentine or gabbroic soils in openings in chaparral and cismontane woodland (CNPS 2016). This species generally blooms from April through July. This species is known from El Dorado and Nevada Counties at elevations ranging from 600 to 3,600 feet above mean sea level (amsl).

The nearest previously documented occurrence of Stebbins' morning-glory is located approximately 3.8 miles southwest of the project site in similar habitat (CDFW 2016). Openings in the chaparral and serpentine soils within the project area provide potentially suitable habitat for this species. This species was not observed at the project site during the site surveys, which were conducted when it would be evident and identifiable. Thus, it is unlikely this species occurs within the Project site.

Dubious Pea

Dubious pea (*Lathyrus sulphureus* var. *argillaceus*) is a perennial herb found in cismontane woodland, lower montane coniferous forest, and upper montane coniferous forest (CNPS 2016). This species generally blooms from April through July (Jepson eFlora Project 2012). This species is known from Calaveras, El Dorado, Nevada, Placer, Shasta, and Tehama counties at elevations ranging from 192 to 3,051 feet amsl.

The nearest previously documented occurrence of dubious pea is located approximately 0.35 miles southwest of the project site in similar habitat (CDFW 2016). Montane coniferous forest onsite provides potentially suitable habitat for this species. The common sweet pea (*Lathyrus latifolius*) was observed within the Project site. No other species of pea (*Lathyrus* spp.) were noted during the site surveys, which were performed when this plant would be evident and identifiable. Thus, it is unlikely this species occurs within the Project site.

Sierra Blue Grass

Sierra blue grass (*Poa sierrae*) is a perennial rhizomatous herb found in openings of lower montane coniferous forest (CNPS 2016). This grass species generally blooms from April through July. This species is known from Butte, El Dorado, Madera, Nevada, Placer, Plumas, and Shasta counties at elevations ranging from 1,198 to 4,921 feet amsl.

The nearest previously documented occurrence of this species is located approximately 7.5 miles southeast of the project site (CDFW 2016). The montane woodland onsite provides potentially suitable habitat for this species. This species was not observed within the project site during the site survey, which were performed when the grass species onsite, including those in the genus *Poa*, were evident and identifiable by habit, inflorescence, and fruit. Thus, it is unlikely this species occurs within the project site.

5.2.2 Special-Status Animal Species

Results of the CNDDB and USFWS searches revealed nine listed or special-status wildlife species, or species proposed for listing as rare, threatened, or endangered by either the CDFW or the USFWS. Of these, seven were removed from consideration due to lack of suitable habitat within or adjacent to the project area, or the project site is outside of the species' known range. These were California red-legged frog (*Rana draytonii*), foothill yellow-legged frog (*Rana boylii*), western pond turtle (*Actinemys marmorata*), California black rail (*Laterallus jamaicensis coturniculus*), Sierra Nevada red fox (*Vulpes vulpes necator*), west coast distinct population of fisher (*Pekania pennant*), and valley elderberry longhorn beetle (*Desmocerus californicus dimpophus*). No suitable riparian or aquatic habitat exists for California red-legged frog, foothill yellow-legged frog, California black rail, or western pond turtle. There is an extremely low possibility of California black rail to utilize the depression in the southwest corner of the project site on the site due to its exposed nature and small size.

Blainville's horned lizard (*Phrynosoma blainvillii*) and northern goshawk (*Accipiter gentilis*) have low potential to be present within the site based on the available habitat. These species are discussed in Table 3 and in the following section.

Table 3
Special-status Animal Species with Potential to Occur in the Project Site

Common Name	Scientific Name	Status (Federal/State)
Birds		
Northern goshawk	*Accipiter gentilis* (nesting)	None/ SSC
Reptiles		
Blainville's horned lizard	*Phrynosoma blainvillii*	None/ SSC

Sources: CDFW 2016, USFWS 2016

All raptor species found in California are protected by California Fish and Game Code 3503.5 and may use the site for nesting or foraging. Although raptor species have the potential to nest on the site and forage adjacent to the site, the site does not provide substantially important habitat, due to its small size, that would affect raptor species from continuing to exist within the area.

Northern Goshawk

Northern goshawks are known to nest within ponderosa pine forest; however, the site is surrounded by development and highly degraded areas and it is unlikely that this species would utilize this isolated stand for nesting (Shuford ed. 2008). Additionally, this species was not observed during the site survey. It is unlikely this species is nesting within the site.

Blainville's Horned Lizard

Blainville's horned lizard prefers sandy soil substrates; thus, although the openings in the chaparral habitat may provide potentially suitable habitat, it is unlikely this species would occur on the project site due to the lack of appropriate soils (Zeiner, ed. 1988-1990). This species was not observed within the project site during the site assessment; however, the weather during the site visit was cold and rainy and this species may not have been very active under such conditions.

5.3 Sensitive Resources and Habitats

One sensitive natural community occurs within the project site: McNabb cypress woodland. The location and extent of these resources are depicted in Figure 4. This woodland is ranked S3.2 and G3 and is known in the Sierra Nevada only from a few isolated stands in Butte, Yuba, Nevada, and Amador counties (Sawyer et al 2009).

5.4 Wildlife Corridors and Habitat Linkages

Wildlife corridors are linear features that connect large patches of natural open space and provide avenues for the migration of animals. Habitat linkages are small patches that join larger blocks of habitat and help reduce the adverse effects of habitat fragmentation; they may be continuous habitat or discrete habitat islands that function as stepping stones for wildlife dispersal.

The project site is bounded on all sides by development and is not contiguous with any wildlife habitat or corridors. The site may provide important island habitat for birds and other wildlife adapted to urban environments.

5.5 Aquatic Resources

The site visit conducted on July 27, 2016 focused on potentially jurisdictional aquatic features that were noted during the previous two site visits. Table 4 presents the aquatic features that were identified within the Project site and their potential jurisdiction. These features are displayed graphically in Figure 4.

Table 4
Potentially Jurisdictional Wetlands and Waters of the U.S.

Feature ID	Cowardin Code	Potential Jurisdiction	Acres	Linear Feet
Drainages				
Cement-lined drainage	None	None	0.05	750.00
Ephemeral Drainage – 01		None	0.016	350.50
Intermittent Drainage – 01		ACOE/RWQCB	0.011	118.00
		Total	**0.077**	**1,218.50**
Wetlands				
Seasonal Wetland – 01		ACOE/RWQCB	0.065	N/A
		Total	**0.065**	**N/A**

Drainages

Three types of linear drainages were observed in the project site: Cement-lined drainage, ephemeral drainage (ED), and intermittent drainage (ID). One wetland feature was observed at the site: seasonal wetland (SW). The Cement-lined drainage appears to have been constructed as part of the drainage system for the SR 20/49 and associated off-ramps. The drainage conveys rainwater runoff during storm events north to south through the western edge of the Project site.

The water drains to ED-01, where it travels through a vegetated channel and appears to drain to SW-01.

Water from the surrounding hillsides appear to also collect at SW-01. Water exits SW-01 and travels through ID-01 before entering a culvert and going underground at the southern property boundary. Any connectivity to downstream waters of the U.S. is not apparent; however, if this water does move through the storm drain system under the development to the south of the Project site, and eventually intersects with Wolf Creek to the south, there is potential that ID-01 and SW-01 may be considered jurisdictional by the ACOE or the RWQCB.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Potential Impacts

6.1.1 Special-Status Plant Species

Three special-status plant species have moderate potential to occur within the project site: Stebbins' morning-glory, dubious pea, and Sierra blue grass. No special-status plant species were observed on the site during the survey; however, the site survey was conducted when the plants were not evident or identifiable. Because there is suitable habitat for special-status plant species at the project site, there is potential that these species may be present.

Direct impacts to special-status plant species could result from project implementation as a result of ground disturbance and vegetation clearing. To reduce potential for impacts, avoidance and minimization measures including preconstruction surveys during the appropriate time of year, are included in Section 6.2.

6.1.2 Special-Status Wildlife Species

Two special-status species have the potential to utilize the site for nesting, foraging, cover and/or local migration routes. All native birds in California are protected by the federal Migratory Bird Treaty Act (MBTA) of 1918 and Section 3503.5 of the California Fish and Game Code, which specifically protects raptors. The site has suitable nesting habitat for several common raptor and other nesting bird species found in California such as northern flicker.

6.1.3 Sensitive Natural Communities

Potential impacts from the proposed project would occur to all land covers types present on site as described in Section 5. Sensitive natural communities onsite include McNabb cypress woodland and a small stand of Fremont cottonwood forest in the southwestern corner of the site. Dudek recommends avoidance of sensitive habitats to the extent feasible through the establishment of avoidance buffers prior to construction. If avoidance is not feasible, further mitigation such as enhancement, restoration, or compensation would be necessary.

6.1.4 Aquatic Resources

The erosional features throughout the site, the cement-lined drainage, and the vegetated upland swale of ED-01 are not likely jurisdictional under regulation of the ACOE, RWQCB, and CDFW. However, SW-01 and ID-01 may be considered jurisdictional if there is some connectivity or adjacency to other waters of the U.S. or state. Dudek recommends a detailed jurisdictional delineation be verified by the appropriate regulatory agencies (e.g., ACOE and CDFW) prior to any permanent plans for development of this property.

If any features are considered jurisdictional, impacts would require authorization from the resource agencies listed above in the form of wetland permits (e.g., 404 Nationwide Permit, 401 Water Quality Certification, and 1602 Streambed Alteration Agreement respectively). Required compensatory mitigation would provide no net loss of jurisdictional habitats. Examples of potential mitigation may include mitigation credits to be purchased at a wetlands mitigation bank, or alternatively, in-lieu fee mitigation could be arranged with the resource agencies. Permit processing can take six to nine months for minor impacts less than one half-acre in size; and up to 2 years for impacts greater than one half-acre with special status species impacts (Individual Permit). If the jurisdictional impacts exceed 300 feet, the project would technically require an Individual Permit, unless a waiver is granted to allow for issuance of a Nationwide Permit authorization.

6.2 Recommended Avoidance and Minimization Measures

With implementation of the following avoidance and minimization measures, potential impacts to special-status and sensitive biological and wetland resources should be reduced or eliminated.

AMM-01: Avoid Sensitive Habitat

- For the protection of potential wetland resources, McNab cypress forest, and cottonwood forest, these areas shall be avoided by all construction activities to the maximum extent feasible.
- If avoidance of potential wetland resources is not feasible, a wetland delineation and habitat assessment shall be prepared by a qualified biologist and consultation with the US Fish and Wildlife Service and the US Army Corps of Engineers would be required.
- If avoidance and preservation of McNab cypress forest is not possible, consultation with the CDFW would be required to devise appropriate onsite enhancement, restoration, or offsite compensation of impacts to sensitive natural communities such as McNab cypress woodland and cottonwood forest. For example, a 1:1 mitigation ratio for habitat preserved to habitat impacted will be implemented through purchase of offsite habitat or mitigation credits.

AMM-02: Conduct Preconstruction Surveys

- If construction takes place during the nesting bird season (February 1 through September 30), a nesting bird survey shall be completed by a qualified biologist two weeks prior to construction to determine if any birds are nesting on or near the site (including a 500 foot buffer for raptors). If no active nests are observed during the preconstruction survey, no further measures are required for nesting birds.

- If any active nests are observed during surveys, a suitable avoidance buffer from the nests will be determined and flagged by the qualified biologist based on species, location and planned construction activity. Consultation with CDFW may be required to determine appropriate buffer distances. These nests shall be avoided until the young have fledged and the nests are no longer active, as determined by the qualified biologist. Dudek also recommends removing any habitat (i.e. trees and brush) outside of the breeding bird season.
- Prior to construction, surveys for Blainville's horned lizard shall be conducted by a qualified biologist familiar with this species' biology. If this species is not observed during the preconstruction survey, no further measures for Blainville's horned lizard are required.
- If Blainville's horned lizard is noted within the project area, consultation with CDFW will be required to determine whether additional avoidance or mitigation measures are warranted.

AMM-03: Implement Worker Environmental Awareness Program

- A qualified biologist will develop and implement a worker environmental awareness program (WEAP) detailing protections for potential special-status species that may be encountered in or adjacent to the project site. The WEAP will describe identification and avoidance measures to ensure no impacts to special status species such as Blainville's horned lizard, special-status plant communities and species, and nesting birds.

7 REFERENCES CITED

16 U.S.C. 703–712. Migratory Bird Treaty Act, as amended.

AOU. 2012. Check-List of North American Birds: List of the 2,078 Bird Species Known From the AOU Check-list Area. Accessed from http://www.aou.org/checklist/north/full.php

California Department of Fish and Wildlife (CDFW). 2016. Special Animals List. Periodic publication. Natural Diversity Database. January 2016. 51 pp. Website https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109406&inline=1 (accessed March 2016).

CDFW. 2016b. California Natural Diversity Database (CNDDB). Rarefind, Version 5 (Commercial Subscription). Sacramento, California: CDFW, http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp.

CDFW. 2016c. "State and Federally Listed Endangered, Threatened, and Rare Plants of California." California Natural Diversity Database. CDFW, Biogeographic Data Branch. July 2015, http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf.

CDFW. 2016. Special Vascular Plants, Bryophytes, and Lichens List. California Natural Diversity Database.http://www.dfg.ca.gov/biogeodata/cnddb/plants_and_animals.asp.

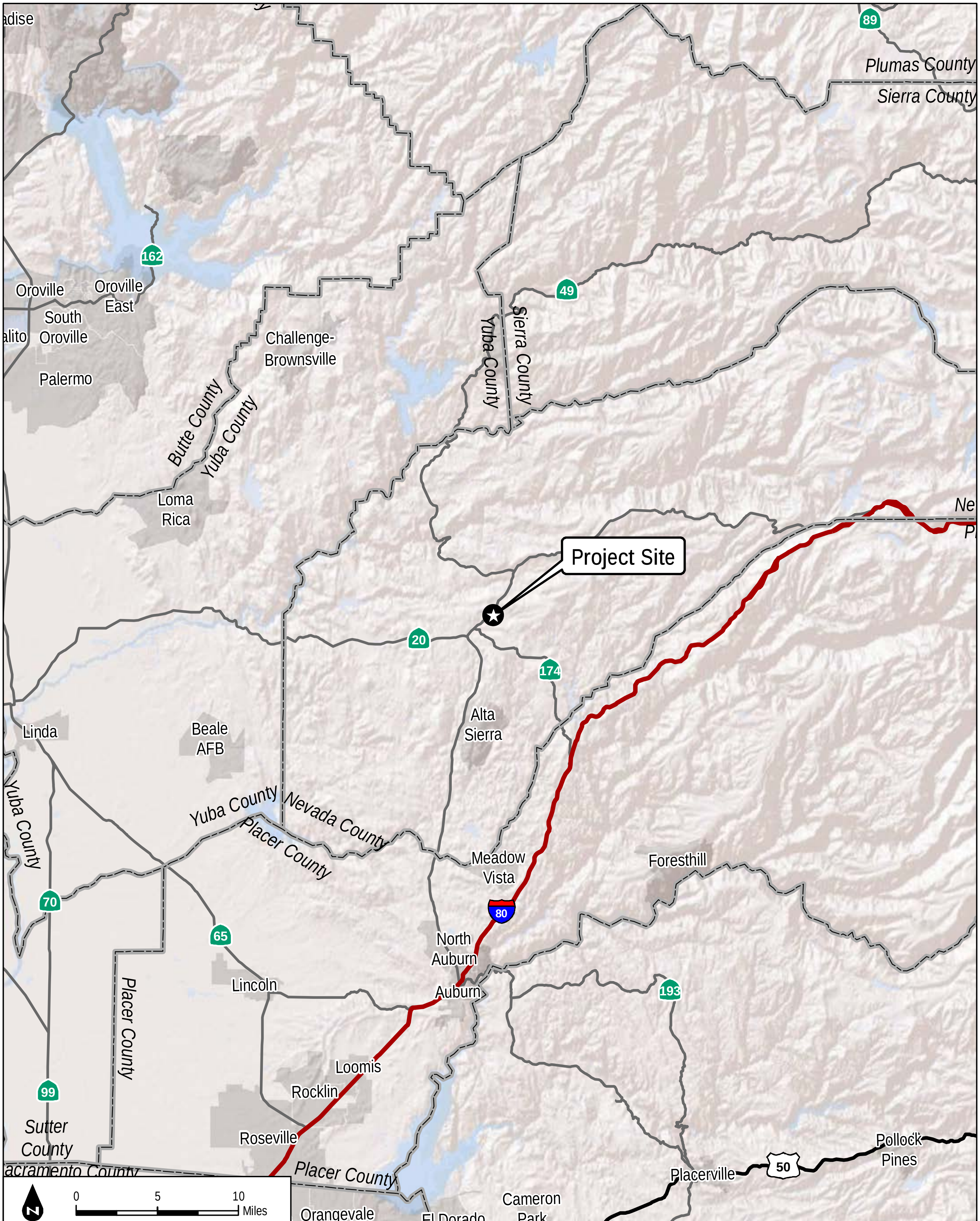
California Native Plant Society (CNPS), Rare Plant Program. 2016. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org (accessed February 2016).

Jepson eFlora Project. 2012. Jepson eFlora. Berkeley, California: University of California. Accessed March 2016. http://ucjeps.berkeley.edu/cgi-bin/get_JM_name_data.pl

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation, Second Edition. California Native Plant Society, Sacramento. 1300 pp.

Shuford, W. D., and Gardali, T., editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

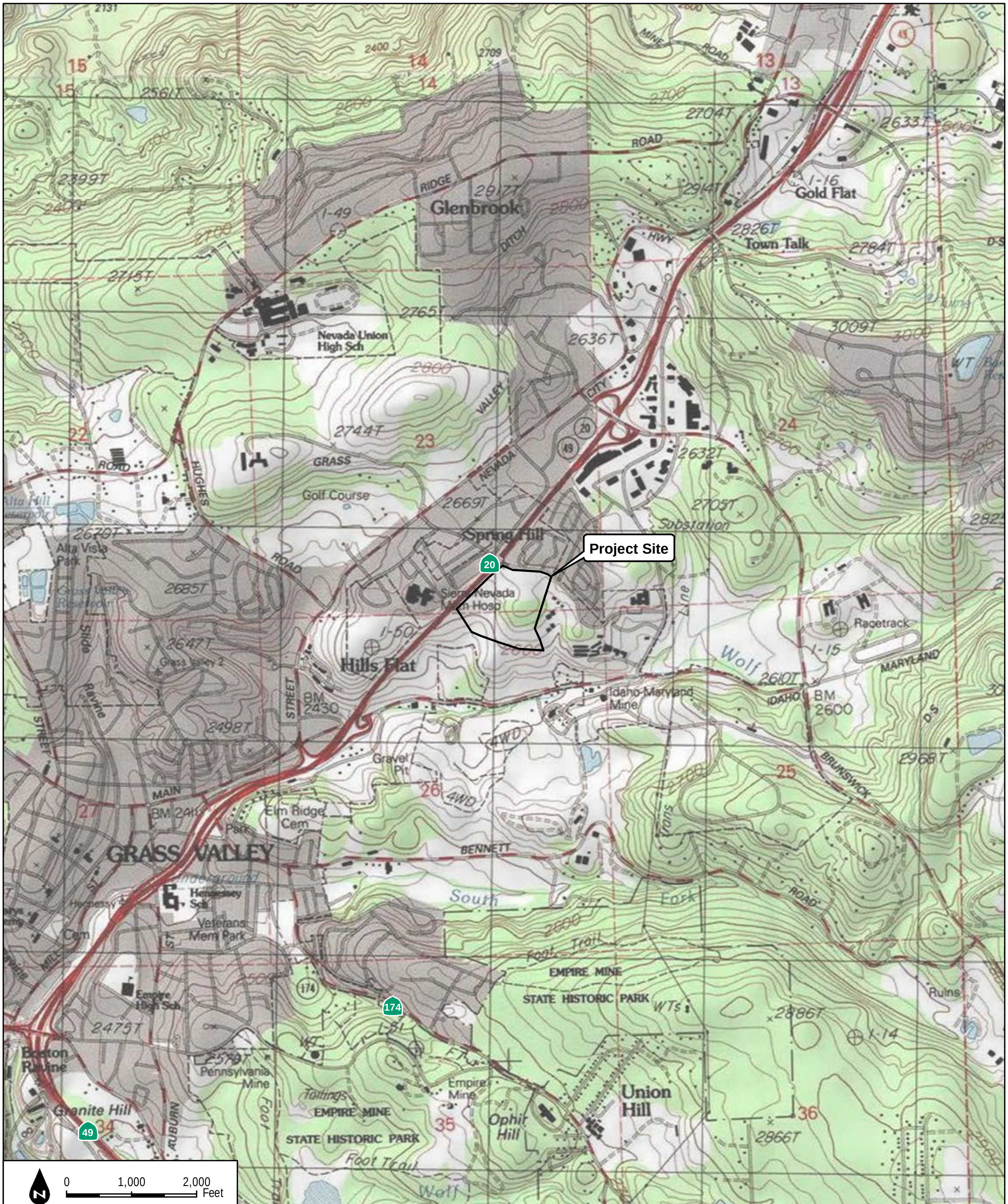
Zeiner, D.C., W.F.Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Depart. of Fish and Game, Sacramento, California.



DUDEK

FIGURE 1
Regional Map

Dorsey Marketplace Biological Technical Report



SOURCE: USGS Topo 7.5-Minute Grass Valley Quadrangle.

FIGURE 2

Site and Vicinity Map

DUDEK

Dorsey Marketplace Biological Technical Report

DUDEK

SOURCE: Google Maps 2016

FIGURE 3

Vegetation Comminities

Dorsey Marketplace Biological Technical Report

SOURCE: Google Maps 2016

DUDEK

FIGURE 4

Potentially Jurisdictional Aquatic Features

APPENDIX A

Representative Photos

APPENDIX A
Representative Photos

Photo 1: View of the California Annual Grassland, looking west. June 10, 2015

Photo 2: View of picklweed mats, facing north. October 28, 2015

Photo 3: View of drainage ditch, facing southeast. October 28, 2015

Photo 4: View of developed habitat, facing northwest. October 28, 2015.

APPENDIX B

Plant Species Observed

APPENDIX B
Plant Species Observed

VASCULAR SPECIES

GYMNOSPERMS AND GNETOPHYTES

PINACEAE—Pine Family

Abies amabilis—Pacific silver fir

MONOCOTS

POACEAE—Grass Family

*Avena barbata—slender oat
Bromus carinatus—California brome
Distichlis spicata—saltgrass
*Avena fatua—wild oat
*Bromus diandrus—ripgut brome
*Bromus hordeaceus—soft brome
*Cynodon dactylon—Bermudagrass
*Festuca myuros—rat-tail fescue
*Festuca perennis—Italian ryegrass
*Hordeum marinum ssp. gussoneanum—Mediterranean barley
*Hordeum murinum—mouse barley

EUDICOTS

AIZOACEAE—Fig-marigold Family

Sesuvium verrucosum—verrucose seapurslane
*Carpobrotus edulis—hottentot fig

AMARANTHACEAE—Amaranth Family

Amaranthus blitoides—mat amaranth

APIACEAE—Carrot Family

*Foeniculum vulgare—sweet fennel

ASTERACEAE—Sunflower Family

Baccharis pilularis—coyotebrush
Ericameria arborescens—goldenfleece
Grindelia hirsutula—hairy gumweed
*Carduus pycnocephalus—Italian plumeless thistle
*Centaurea calcitrapa—red star-thistle
*Cirsium vulgare—bull thistle
*Helminthotheca echioides—bristly oxtongue
*Pseudognaphalium luteoalbum—Jersey cudweed
*Sonchus asper—spiny sowthistle

BRASSICACEAE—Mustard Family

*Brassica nigra—black mustard

CARYOPHYLLACEAE—Pink Family

Spergularia macrotheca—sticky sandspurry

CHENOPODIACEAE—Goosefoot Family

Salicornia depressa—Virginia glasswort
Salicornia pacifica—Pacific swampfire
*Atriplex semibaccata—Australian saltbush
CONVOLVULACEAE—Morning-glory Family
*Convolvulus arvensis—field bindweed
FABACEAE—Legume Family
*Lotus corniculatus—bird's-foot trefoil
*Melilotus albus—yellow sweetclover
FAGACEAE—Oak Family
Quercus agrifolia—California live oak
GERANIACEAE—Geranium Family
*Erodium cicutarium—redstem stork's bill
LAMIACEAE—Mint Family
*Marrubium vulgare—horehound
MALVACEAE—Mallow Family
Malvella leprosa—alkali mallow
*Malva pseudolavatera—Cornish mallow
MYRTACEAE—Myrtle Family
*Eucalyptus globulus—Tasmanian bluegum
PLANTAGINACEAE—Plantain Family
*Plantago coronopus—buckhorn plantain
*Plantago lanceolata—narrowleaf plantain
*Plantago major—common plantain
POLYGONACEAE—Buckwheat Family
*Polygonum aviculare—prostrate knotweed
*Polygonum aviculare ssp. aviculare—prostrate knotweed
*Rumex conglomeratus—clustered dock
*Rumex crispus—curly dock
*Rumex pulcher—fiddle dock
VERBENACEAE—Vervain Family
Phyla nodiflora—turkey tangle fogfruit

*nonnative species

APPENDIX C

Special-status Species Potential to Occur

APPENDIX C
Special-Status Species Potential to Occur Tables

Table 1: Special-status Plant Species Potential to Occur in the Project Site

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Acanthomintha duttonii	San Mateo thorn-mint	FE/ CE/ 1B.1	Chaparral, Valley and foothill grassland/serpentinite/ annual herb/ Apr-Jun/ 164-984	**Not expected to occur.** The site is outside of the species' known elevation range.
Allium peninsulare var. *franciscanum*	Franciscan onion	None/ None/ 1B.2	Cismontane woodland, Valley and foothill grassland/clay, volcanic, often serpentinite/ perennial bulbiferous herb/ May-Jun/ 171-984	**Not expected to occur.** The site is outside of the species' known elevation range.
Androsace elongata ssp. *acuta*	California androsace	None/ None/ 4.2	Chaparral, Cismontane woodland, Coastal scrub, Meadows and seeps, Pinyon and juniper woodland, Valley and foothill grassland/ annual herb/ Mar-Jun/ 492-3,937	**Not expected to occur.** The site is outside of the species' known elevation range.
Arctostaphylos regismontana	Kings Mountain manzanita	None/ None/ 1B.2	Broadleafed upland forest, Chaparral, North Coast coniferous forest/granitic or sandstone/ perennial evergreen shrub/ Jan-Apr/ 1,001-2,395	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Astragalus tener var. *tener*	alkali milk-vetch	None/ None/ 1B.2	Playas, Valley and foothill grassland (adobe clay), Vernal pools/alkaline/ annual herb/ Mar-Jun/ 3-197	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.
Atriplex depressa	brittlescale	None/ None/ 1B.2	Chenopod scrub, Meadows and seeps, Playas, Valley and foothill grassland, Vernal pools/alkaline, clay/ annual herb/ Apr-Oct/ 3-1,050	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Atriplex minuscula	lesser saltscale	None/ None/ 1B.1	Chenopod scrub, Playas, Valley and foothill grassland/alkaline, sandy/ annual herb/ May-Oct/ 49-6,56	**Not expected to occur.** The site is outside of the species' known elevation range and the saline conditions do not provide suitable soils for this species.
Calandrinia breweri	Brewer's calandrinia	None/ None/ 4.2	Chaparral, Coastal scrub/sandy or loamy, disturbed sites and burns/ annual herb/ Mar-Jun/ 33-4,003	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Campanula exigua	chaparral harebell	None/ None/ 1B.2	Chaparral (rocky, usually serpentinite)/ annual herb/ May-Jun/ 902-4,101	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Centromadia parryi ssp. *congdonii*	Congdon's tarplant	None/ None/ 1B.1	Valley and foothill grassland (alkaline)/ annual herb/ May-Oct (Nov)/ 0-755	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.
Chloropyron maritimum ssp. *palustre*	Point Reyes bird's-beak	None/ None/ 1B.2	Marshes and swamps (coastal salt)/ annual herb (hemiparasitic)/ Jun-Oct/ 0-33	**Moderate potential to occur**. The wetlands and pickleweed mats onsite provide potentially suitable habitat for this species.
Chorizanthe robusta var. *robusta*	robust spineflower	FE/ None/ 1B.1	Chaparral (maritime), Cismontane woodland (openings), Coastal dunes, Coastal scrub/sandy or gravelly/ annual herb/ Apr-Sep/ 10-984	**Not expected to occur.** The soils onsite are not sandy or gravelly and do not provide suitable habitat for this species.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Cirsium fontinale var. *fontinale*	Crystal Springs fountain thistle	FE/ CE/ 1B.1	Chaparral (openings), Cismontane woodland, Valley and foothill grassland/serpentinite seeps/ perennial herb/ May-Oct/ 148-574	**Not expected to occur.** The site is outside of the species' known elevation range.
Cirsium praeteriens	lost thistle	None/ None/ 1A	unknown/ perennial herb/ Jun-Jul/ 0-328	**Low potential to occur**. Although this species may be found in marshlands in the bay area, it is believed to be extirpated from its historic range in California.
Clarkia concinna ssp. *automixa*	Santa Clara red ribbons	None/ None/ 4.3	Chaparral, Cismontane woodland/ annual herb/ (Apr),May-Jun (Jul)/ 295-4,921	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Clarkia lewisii	Lewis' clarkia	None/ None/ 4.3	Broadleafed upland forest, Closed-cone coniferous forest, Chaparral, Cismontane woodland, Coastal scrub/ annual herb/ May-Jul/ 98-2,001	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Collinsia multicolor	San Francisco collinsia	None/ None/ 1B.2	Closed-cone coniferous forest, Coastal scrub/sometimes serpentinite/ annual herb/ Mar-May/ 98-820	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Cypripedium fasciculatum	clustered lady's-slipper	None/ None/ 4.2	Lower montane coniferous forest, North Coast coniferous forest/usually serpentinite seeps and streambanks/ perennial rhizomatous herb/ Mar-Aug/ 328-7,989	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Dirca occidentalis	western leatherwood	None/ None/ 1B.2	Broadleafed upland forest, Closed-cone coniferous forest, Chaparral, Cismontane woodland, North Coast coniferous forest, Riparian forest, Riparian woodland/mesic/ perennial deciduous shrub/ Jan-Mar (Apr)/ 82-1,394	**Not expected to occur**. The site is outside of the species' known elevation range and there is no suitable habitat present.
Eriogonum nudum var. *decurrens*	Ben Lomond buckwheat	None/ None/ 1B.1	Chaparral, Cismontane woodland, Lower montane coniferous forest (maritime ponderosa pine sandhills)/sandy/ perennial herb/ Jun-Oct/ 164-2,625	**Not expected to occur. The** site is outside of the species' known elevation range and there is no suitable habitat present.
Eriophyllum latilobum	San Mateo woolly sunflower	FE/ CE/ 1B.1	Cismontane woodland (often serpentinite, on roadcuts)/ perennial herb/ May-Jun/ 148-492	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Eryngium aristulatum var. *hooveri*	Hoover's button-celery	None/ None/ 1B.1	Vernal pools/ annual / perennial herb/ Jul (Aug)/ 10-148	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Fissidens pauperculus	minute pocket moss	None/ None/ 1B.2	North Coast coniferous forest (damp coastal soil)/ moss/ N.A./ 33-3,360	**Not expected to occur.** There is no suitable habitat present.
Fritillaria liliacea	fragrant fritillary	None/ None/ 1B.2	Cismontane woodland, Coastal prairie, Coastal scrub, Valley and foothill grassland/Often serpentinite/ perennial bulbiferous herb/ Feb-Apr/ 10-1,345	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.
Hesperolinon congestum	Marin western flax	FT/ CT/ 1B.1	Chaparral, Valley and foothill grassland/serpentinite/ annual herb/ Apr-Jul/ 16-1,214	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Hoita strobilina	Loma Prieta hoita	None/ None/ 1B.1	Chaparral, Cismontane woodland, Riparian woodland/usually serpentinite, mesic/ perennial herb/ May-Jul (Aug), (Oct)/ 98-2,822	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Iris longipetala	coast iris	None/ None/ 4.2	Coastal prairie, Lower montane coniferous forest, Meadows and seeps/mesic/ perennial rhizomatous herb/ Mar-May/ 0-1,969	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.
Lasthenia conjugens	Contra Costa goldfields	FE/ None/ 1B.1	Cismontane woodland, Playas (alkaline), Valley and foothill grassland, Vernal pools/mesic/ annual herb/ Mar-Jun/ 0-1,542	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.
Legenere limosa	legenere	None/ None/ 1B.1	Vernal pools/ annual herb/ Apr-Jun/ 3-2,887	**Not expected to occur.** The saline soils in the wetlands onsite do not provide suitable habitat for this species.
Leptosiphon acicularis	bristly leptosiphon	None/ None/ 4.2	Chaparral, Cismontane woodland, Coastal prairie, Valley and foothill grassland/ annual herb/ Apr-Jul/ 180-4,921	**Not expected to occur.** The site is outside of the species' known elevation range.
Lessingia hololeuca	woolly-headed lessingia	None/ None/ 3	Broadleafed upland forest, Coastal scrub, Lower montane coniferous forest, Valley and foothill grassland/clay, serpentinite/ annual herb/ Jun-Oct/ 49-1,001	**Not expected to occur.** The site is outside of the species' known elevation range and the saline soils do not provide suitable habitat for this species.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Malacothamnus arcuatus	arcuate bush-mallow	None/ None/ 1B.2	Chaparral, Cismontane woodland/ perennial evergreen shrub/ Apr-Sep/ 49-1,165	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Malacothamnus davidsonii	Davidson's bush-mallow	None/ None/ 1B.2	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland/ perennial deciduous shrub/ Jun-Jan/ 607-2,805	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Malacothamnus hallii	Hall's bush-mallow	None/ None/ 1B.2	Chaparral, Coastal scrub/ perennial evergreen shrub/ May-Sep (Oct)/ 33-2,493	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Micropus amphibolus	Mt. Diablo cottonweed	None/ None/ 3.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Valley and foothill grassland/rocky/ annual herb/ Mar-May/ 148-2,707	**Not expected to occur.** The site is outside of the species' known elevation range.
Monardella antonina ssp. antonina	San Antonio Hills monardella	None/ None/ 3	Chaparral, Cismontane woodland/ perennial rhizomatous herb/ Jun-Aug/ 1,050-3,281	**Not expected to occur**. The site is outside of the species' known elevation range and there is no suitable habitat present.
Monolopia gracilens	woodland woolythreads	None/ None/ 1B.2	Broadleafed upland forest(openings), Chaparral (openings), Cismontane woodland, North Coast coniferous forest (openings), Valley and foothill grassland/Serpentine/ annual herb/ (Feb),Mar-Jul/ 328-3,937	**Not expected to occur.** The site is outside of the species' known elevation range.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Navarretia myersii ssp. *myersii*	pincushion navarretia	None/ None/ 1B.1	Vernal pools/often acidic/ annual herb/ Apr-May/ 66-1,083	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Navarretia prostrata	prostrate vernal pool navarretia	None/ None/ 1B.1	Coastal scrub, Meadows and seeps, Valley and foothill grassland (alkaline), Vernal pools/Mesic/ annual herb/ Apr-Jul/ 49-3,970	**Not expected to occur.** The site is outside of the species' known elevation range and the saline soils do not provide suitable habitat for this species.
Pedicularis dudleyi	Dudley's lousewort	None/ CR/ 1B.2	Chaparral (maritime), Cismontane woodland, North Coast coniferous forest, Valley and foothill grassland/ perennial herb/ Apr-Jun/ 197-2,953	**Not expected to occur.** The site is outside of the species' known elevation range.
Piperia candida	white-flowered rein orchid	None/ None/ 1B.2	Broadleafed upland forest, Lower montane coniferous forest, North Coast coniferous forest/sometimes serpentinite/ perennial herb/ (Mar), May-Sep/ 98-4,298	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Plagiobothrys chorisianus var. *chorisianus*	Choris' popcorn-flower	None/ None/ 1B.2	Chaparral, Coastal prairie, Coastal scrub/mesic/ annual herb/ Mar-Jun/ 49-525	**Not expected to occur.** The site is outside of the species' known elevation range and the saline soils do not provide suitable habitat for this species.
Plagiobothrys glaber	hairless popcorn-flower	None/ None/ 1A	Meadows and seeps (alkaline), Marshes and swamps (coastal salt)/ annual herb/ Mar-May/ 49-591	**Not expected to occur.** The site is outside of the species' known elevation range and the saline soils do not provide suitable habitat for this species.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Ranunculus lobbii	Lobb's aquatic buttercup	None/ None/ 4.2	Cismontane woodland, North Coast coniferous forest, Valley and foothill grassland, Vernal pools/mesic/ annual herb/ Feb-May/ 49-1,542	**Not expected to occur.** The site is outside of the species' known elevation range and the saline soils do not provide suitable habitat for this species.
Senecio aphanactis	chaparral ragwort	None/ None/ 2B.2	Chaparral, Cismontane woodland, Coastal scrub/sometimes alkaline/ annual herb/ Jan-Apr/ 49-2,625	**Not expected to occur.** The site is outside of the species' known elevation range and there is no suitable habitat present.
Streptanthus albidus ssp. *peramoenus*	most beautiful jewel-flower	None/ None/ 1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland/serpentinite/ annual herb/ (Mar), Apr-Sep (Oct)/ 312-3,281	**Not expected to occur.** The site is outside of the species' known elevation range.
Stuckenia filiformis ssp. *alpina*	slender-leaved pondweed	None/ None/ 2B.2	Marshes and swamps (assorted shallow freshwater)/ perennial rhizomatous herb/ May-Jul/ 984-7,054	**Not expected to occur.** The site is outside of the species' known elevation range.
Suaeda californica	California seablite	FE/ None/ 1B.1	Marshes and swamps (coastal salt)/ perennial evergreen shrub/ Jul-Oct/ 0-49	**High potential to occur.** The pickleweed mats and the wetland onsite provide suitable habitat for this species. This species was not observed during the site visit.
Trifolium amoenum	two-fork clover	FE/ None/ 1B.1	Coastal bluff scrub, Valley and foothill grassland (sometimes serpentinite)/ annual herb/ Apr-Jun/ 16-1362	**Not expected to occur.** The site is outside of the species' known elevation range and the saline soils do not provide suitable habitat for this species.

Scientific Name	Common Name	Status (Federal/State/CRPR)	Primary Habitat Associations/ Life Form/ Blooming Period/ Elevation Range (feet)	Potential to Occur
Trifolium hydrophilum	saline clover	None/ None/ 1B.2	Marshes and swamps, Valley and foothill grassland (mesic, alkaline), Vernal pools/ annual herb/ Apr-Jun/ 0-984	**Not expected to occur.** The saline soils associated with the wetlands onsite do not provide suitable habitat for this species.
Tropidocarpum capparideum	caper-fruited tropidocarpum	None/ None/ 1B.1	Valley and foothill grassland (alkaline hills)/ annual herb/ Mar-Apr/ 3-1,493	**Not expected to occur.** The saline soils associated with the wetlands onsite do not provide suitable habitat for this species.

Status Legend:
FE: Federally listed as endangered
FT: Federally listed as threatened
FC: Federal Candidate for listing
DL: Delisted
CE: State listed as endangered
CT: State listed as threatened
CR: State Rare
CRPR 1A: Plants Presumed Extirpated in California and Either Rare or Extinct Elsewhere
CRPR 1B: Plants Rare, Threatened, or Endangered in California and Elsewhere
CRPR 2A: Plants Presumed Extirpated in California, But More Common Elsewhere
CRPR 2B: Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere
CRPR 3: Plants About Which More Information is Needed - A Review List
CRPR 4: Plants of Limited Distribution - A Watch List
.1 Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
.2 Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
.3 Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

Table 2: Special-status Wildlife Species Potential to Occur in the Project Site

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
Amphibians				
California red-legged frog	*Rana draytonii*	FT/ SSC	Lowland streams, wetlands, riparian woodlands, livestock ponds; dense, shrubby or emergent vegetation associated with deep, still or slow-moving water; uses adjacent uplands.	**Not expected to occur.** There is no suitable freshwater aquatic breeding habitat for this species at the project site. Additionally, the project site does not provide suitable upland or migratory habitat for this species.
California tiger salamander	*Ambystoma californiense*	FT/ ST, SSC	Annual grassland, valley-foothill hardwood and valley-foothill riparian; vernal pools, other ephemeral pools, uncommonly along stream courses and man-made pools if predatory fishes are absent.	**Not expected to occur.** The site is outside of the species' known geographic range and there is no suitable freshwater aquatic breeding habitat for this species.
Reptiles				
Alameda whipsnake	*Masticophis lateralis euryxanthus*	FT/ ST	Open areas in chaparral and scrub habitat; also adjacent grassland, oak savanna, and woodland.	**Not expected to occur.** There is no suitable open grassland adjacent to tree cover required by this species.
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE/ SE, FP	Wide range of habitats including grasslands or wetlands adjacent to ponds, marshes and sloughs.	**Not expected to occur.** There is no suitable freshwater aquatic habitat required by this species.
Birds				
Burrowing owl	*Athene cunicularia* (burrow sites & some wintering sites)	BCC/ SSC	Nests and forages in grassland, open scrub, and agriculture, particularly with ground squirrel burrows.	**High potential to occur.** Suitable burrow habitat for this species is located along the levee of the marsh to the north and east of the project site. The nearest documented occurrence for this species is located directly adjacent to the project site, on the levee to the northeast of the fence.

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
California black rail	*Laterallus jamaicensis coturniculus*	BCC/ ST, FP	Tidal marshes, shallow freshwater margins, wet meadows and flooded grassy vegetation; suitable habitats are often supplied by canal leakage in Sierra foothill populations.	**Moderate potential to occur.** The project site is directly adjacent to tidal saltmarsh that provides suitable breeding habitat for this species. The nearest documented occurrence for this species is located directly southeast of the project area.
Northern harrier	*Circus cyaneus* (nesting)	None/ SSC	Nests in open wetlands including marshy meadows, wet lightly-grazed pastures, old fields, freshwater and brackish marshes, but also in drier habitats such as grassland and grain fields; forages in variety of habitats, including grassland, scrubs, rangelands, emergent wetlands, and other open habitats.	**Low potential to occur.** This species may utilize marsh habitat adjacent to the bay lands for nesting and foraging; however, it is unlikely to nest or forage within the project area.
Swainson's hawk	*Buteo swainsoni* (nesting)	BCC/ ST	Nests in open woodland and savanna, riparian and in isolated large trees; forages in nearby grasslands and agricultural areas such as wheat and alfalfa fields and pasture.	**Not expected to occur.** There is no suitable foraging habitat for this species; additionally, this species is primarily found in the Central Valley and is an uncommon visitor to the project area.
Tricolored blackbird	*Agelaius tricolor* (nesting colony)	BCC/ SE, SSC	Nests near fresh water, emergent wetland with cattails or tules, but also in Himalayan blackberrry; forages in grasslands, woodland, and agriculture.	**Not expected to occur.** There is no suitable nesting or foraging habitat for this species within the project area or vicinity.
American peregrine falcon	*Falco peregrinus anatum* (nesting)	FDL/ SDL, FP	Nests on cliffs, buildings, and bridges; forages in wetlands, riparian, meadows, croplands, especially where waterfowl are present.	**Not likely to occur.** No suitable nesting habitat for this species occurs within the project area.

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
Bank swallow	*Riparia riparia* (nesting)	None/ ST	Nests in riparian, lacustrine and coastal areas with vertical banks, bluffs and cliffs with sandy soils; open country and water during migration.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
Cooper's hawk	*Accipiter cooperii* (nesting)	None/ WL	Nests and forages in dense stands of live oak, riparian woodlands, or other woodland habitats often near water.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
Long-eared owl	*Asio otus* (nesting)	None/ SSC	Nests in riparian habitat, live oak thickets, other dense stands of trees, edges of coniferous forest; forages in nearby open habitats.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
White-tailed kite	*Elanus leucurus* (nesting)	None/ FP	Nests in woodland, riparian, and individual trees near open lands; forages opportunistically in grassland, meadows, scrubs, agriculture, emergent wetland, savanna, and disturbed lands.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
Golden eagle	*Aquila chrysaetos* (nesting & wintering)	BCC/ FP, WL	Nests and winters in hilly, open/semi-open areas, including shrublands, grasslands, pastures, riparian areas, mountainous canyon land, open desert rimrock terrain; nests in large trees and on cliffs in open areas and forages in open habitats.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
Alameda song sparrow	*Melospiza melodia pusillula*	BCC/ SSC	Nests and forages in tidal saltmarsh.	**High potential to occur.** The project site is directly adjacent to tidal saltmarsh that provides suitable breeding habitat for this species. The nearest documented occurrence for this species is located directly southeast of the project area.

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
Black-crowned night heron	*Nycticorax nycticorax* (nesting colony)	None/ None	Nests in dense-foliaged trees and dense fresh or brackish emergent wetlands associated with marshes, ponds, reservoirs, and estuaries.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
California least tern	*Sternula antillarum browni* (nesting colony)	FE/ SE, FP	Forages in shallow estuaries and lagoons; nests on sandy beaches or exposed tidal flat.	**Moderate potential to occur.** The tidal saltmarsh flats directly east and south of the project site provide suitable nesting and foraging habitat for this species.
Double-crested cormorant	*Phalacrocorax auritus* (nesting colony)	None/ WL	Nests in riparian trees near ponds, lakes, artificial impoundments, slow-moving rivers, lagoons, estuaries and open coastlines; winter habitat includes lakes, rivers, and coastal areas.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
Saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	BCC/ SSC	Nests and forages in emergent wetlands including woody swamp, brackish marsh, and freshwater marsh.	**High potential to occur.** The project site is directly adjacent to tidal saltmarsh that provides suitable breeding habitat for this species. The nearest documented occurrence for this species is located directly southeast of the project area.
Short-eared owl	*Asio flammeus* (nesting)	None/ SSC	Grassland, prairies, dunes, meadows, irrigated lands, saline and freshwater emergent wetlands.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis* (nesting)	FT, BCC/ SE	Nests dense, wide riparian woodlands and forest with well-developed understories.	**Not expected to occur.** No suitable nesting habitat occurs within the project area.

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
Fishes				
southern steelhead - southern California DPS	*Oncorhynchus mykiss irideus*	FE/ SSC	Clean, clear, cool well-oxygenated streams. Needs relatively deep pools in migration and gravelly substrate to spawn.	**Not expected to occur.** No suitable aquatic habitat is present within the project area.
steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	FT/ None	Coastal basins from Redwood Creek south to the Gualala River, inclusive. Does not include summer-run steelhead.	**Not expected to occur.** No suitable aquatic habitat is present within the project area.
Mammals				
Pallid bat	*Antrozous pallidus*	None/ SSC	Grasslands, shrublands, woodlands, forests; most common in open dry habitats with rocky outcrops for roosting, but also roosts in man-made structures and trees.	**Not expected to occur.** Suitable habitat for this species does not occur within the project area.
American badger	*Taxidea taxus*	None/ SSC	Dry, open, treeless areas; grasslands, coastal scrub, agriculture, pastures, especially with friable soils.	**Not expected to occur.** Suitable habitat for this species does not occur within the project area.
Salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE/ SE, FP	Saline emergent wetlands, preference for pickleweed saline emergent wetlands; also use adjacent grasslands.	**Moderate potential to occur.** The tidal saltmarsh to the south and east of the project site may provide suitable habitat for this species. Picklweed mats and adjacent grasslands within the project site provide marginal habitat for this species. The nearest documented occurrence for this species is located directly east of the project site in the adjacent saltmarsh habitat.

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
Salt-marsh wandering shrew	*Sorex vagrans halicoetes*	None/ SSC	Saltmarsh inundated daily by tidal waters.	**Moderate potential to occur.** The tidal saltmarsh to the south and east of the project site may provide suitable habitat for this species. Picklweed mats within the project site provide marginal habitat for this species. This species has not been previously documented within 5 miles of the project site.
San Francisco dusky-footed woodrat	*Neotoma fuscipes annectens*	None/ SSC	Forest habitats with a moderate canopy and moderate to dense understory.	**Not expected to occur.** Suitable habitat for this species does not occur within the project area.
Santa Cruz kangaroo rat	*Dipodomys venustus venustus*	None/ None	Chaparral in low foothills on sandy, loamy, and sandy loamy soils.	**Not expected to occur.** The site is outside of the species' known geographic range and there is no suitable habitat present.
Townsend's big-eared bat	*Corynorhinus townsendii*	None/ SC, SSC	Mesic habitats characterized by coniferous and deciduous forests and riparian habitat, but also xeric areas; roosts in limestone caves and lava tubes, also man-made structures and tunnels.	**Not expected to occur.** Suitable roosting and foraging habitat for this species does not occur within the project area.
Invertebrates				
vernal pool tadpole shrimp	*Lepidurus packardi*	FE/ None	Ephemeral freshwater habitats including alkaline pools, clay flats, vernal lakes, vernal pools, and vernal swales.	**Not expected to occur.** The site is outside of the species' known geographic range and there is no suitable habitat in the project area.

Common Name	Scientific Name	Status (Federal/ State)	Habitat	Potential to Occur
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT/ None	Serpentine or serpentine-like grasslands.	**Not expected to occur.** There is no suitable habitat or larval host plants for this species in the project area.

Status Abbreviations
FE: Federally Endangered
FT: Federally Threatened
PFE: Proposed Federally Endangered
PFT: Proposed Federally Threatened
FC: Federal Candidate
FDL: Federally Delisted
BCC: U.S. Fish and Wildlife Service Bird of Conservation Concern
BLM: Bureau of Land Management Sensitive Species
USFS: U.S. Forest Service Sensitive Species
SSC: California Species of Special Concern
FP: California Fully Protected Species
WL: California Watch List Species
SE: State Endangered
ST: State Threatened
SC: State Candidate
SDL: State Delisted
SS: List Special Animals List, but no other status
CDF: California Department of Forestry Sensitive Species
HCP: Habitat Conservation Plan
NCCP: Natural Community Conservation Plan

APPENDIX F

Cultural Resources Evaluation

CULTURAL RESOURCES INVENTORY REPORT
for the
DORSEY MARKETPLACE PROJECT, GRASS VALLEY, NEVADA COUNTY, CALIFORNIA

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NATIONAL ARCHAEOLOGICAL DATABASE (NADB) INFORMATION

Authors:	Angela Pham, MA, RPA and Adam Giacinto, MA, RPA
Firm:	Dudek
Project Proponent:	City of Grass Valley
Report Date:	May 2016
Report Title:	Cultural Resources Inventory Report for the Dorsey Marketplace Project, Grass Valley, Nevada County, California
Type of Study:	Archaeological Inventory
Resources:	P-29-2455-H
USGS Quads:	Grass Valley, California 1:24,000; T 16N, R 8E; Section 23
Acreage:	27
Permit Numbers:	
Keywords:	Grass Valley USGS 7.5-Minute Quadrangle; Cultural resources inventory, Intensive Pedestrian Survey; P-29-2455-H/CA-NEV-1538, Spring Hill Mine

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MANAGEMENT SUMMARY

The Dorsey Marketplace Project (project) is located in the community of Grass Valley, Nevada County, California (Figure 1). The project area is bordered by State Route 49 to the west, Dorsey Drive to the north, the Old Barn and Ernie's Storage to the south and the Grass Valley Terrace Apartments to the east. The project area is 27 acres in size. The project area occurs within Section 23 of Township 16 North, Range 8 East on the Rough and Ready 7.5-minute USGS topographic quadrangle (Figure 2).

The City of Grass Valley proposed project at Dorsey Marketplace involves developing the entire 27-acre parcel of land. Proposed developments include commercial, residential, and recreational facilities.

The City of Grass Valley is the Lead Agency for compliance with the California Environmental Quality Act (CEQA). The City contracted Dudek to perform a Phase I cultural resource inventory for the project, in compliance with CEQA.

A records search was completed for the current project for a one-mile radius around the project area by staff at the North Central Information Center (NCIC) at California State University Sacramento. The records search identified one previously recorded cultural resource, Spring Hill Mine (P-29-002455), in the project area. A 2001 Caltrans study determined this resource to be not eligible for listing in the California Register of Historical Resources (CRHR) or the National Register of Historic Places (NRHP). A Native American Heritage Commission (NAHC) Sacred Lands File (SLF) search did not indicate the presence of any Native American cultural resources in or near the project area. Subsequent Native American outreach letters were sent to the NAHC-listed Tribal representatives. No responses have been received to date.

Based on available information, and in consideration of the topography and the presence of recorded cultural resource located within the project area, Dudek recommends that a qualified archaeologist should be present at the Dorsey Marketplace Project preconstruction meeting to discuss archaeological sensitivity within the project area and to work with the construction project manager and/or foreman to determine the duration and extent of monitoring for historical archaeological deposits that may be uncovered during project implementation.

1 INTRODUCTION

1.1 Project Location and Description

The Dorsey Marketplace Project (project) is located in the City of Grass Valley, which is located along State Route (SR) 49 between Nevada City and Alta Sierra. The project site is bordered by SR 49 to the west, Dorsey Drive to the north, the Old Barn and Ernie's Storage to the south and the Grass Valley Terrace Apartments to the east. The project area is 27 acres in size. The project area occurs within Section 34 of Township 16 North, Range 7 East on the Rough and Ready 7.5-minute USGS topographic quadrangle.

The proposed project is requesting a General Plan Amendment and rezone to change the land use designation on the site from Business Park to Commercial (21.2 acres) and Residential Urban High Density (5.7 acres). This 26.9 acre direct impact footprint constitutes the area of potential effects (APE). The vertical APE is represented by the by the maximum depth of excavation, which is anticipated to be less than approximately 20 feet below the surface. The project is also requesting a rezone from Corporate Business Park to Commercial (C-2) and residential (R-3). This would facilitate the proposed development of 181,900 square feet of commercial building space and 90 multi-family dwelling units. Within the commercial component of the project, there are four major shops (with sizes ranging between 20,00 and 40,000 square feet), six smaller shops (with sizes ranging between 3,800 and 7,200 square feet), and four pads for drive-through restaurants (with sizes ranging between 3,000 and 4,000 square feet). The proposed dwelling units would be offered as market-rate rental units and are expected to include 50 2-bedroom units and 20 each of the 1- and 3-bedroom layouts. The units would range in size from 1,013 to 1,600 square feet. They would be constructed as two-story buildings in the southeast corner of the project site. This area would include an apartment clubhouse and pool. A small dog park is also proposed to be placed along the eastern site boundary, south of proposed Pad 4.

The City of Grass Valley is the Lead Agency for compliance with the California Environmental Quality Act (CEQA). The City contracted Dudek to perform a Phase I cultural resource inventory for the project, in compliance with CEQA.

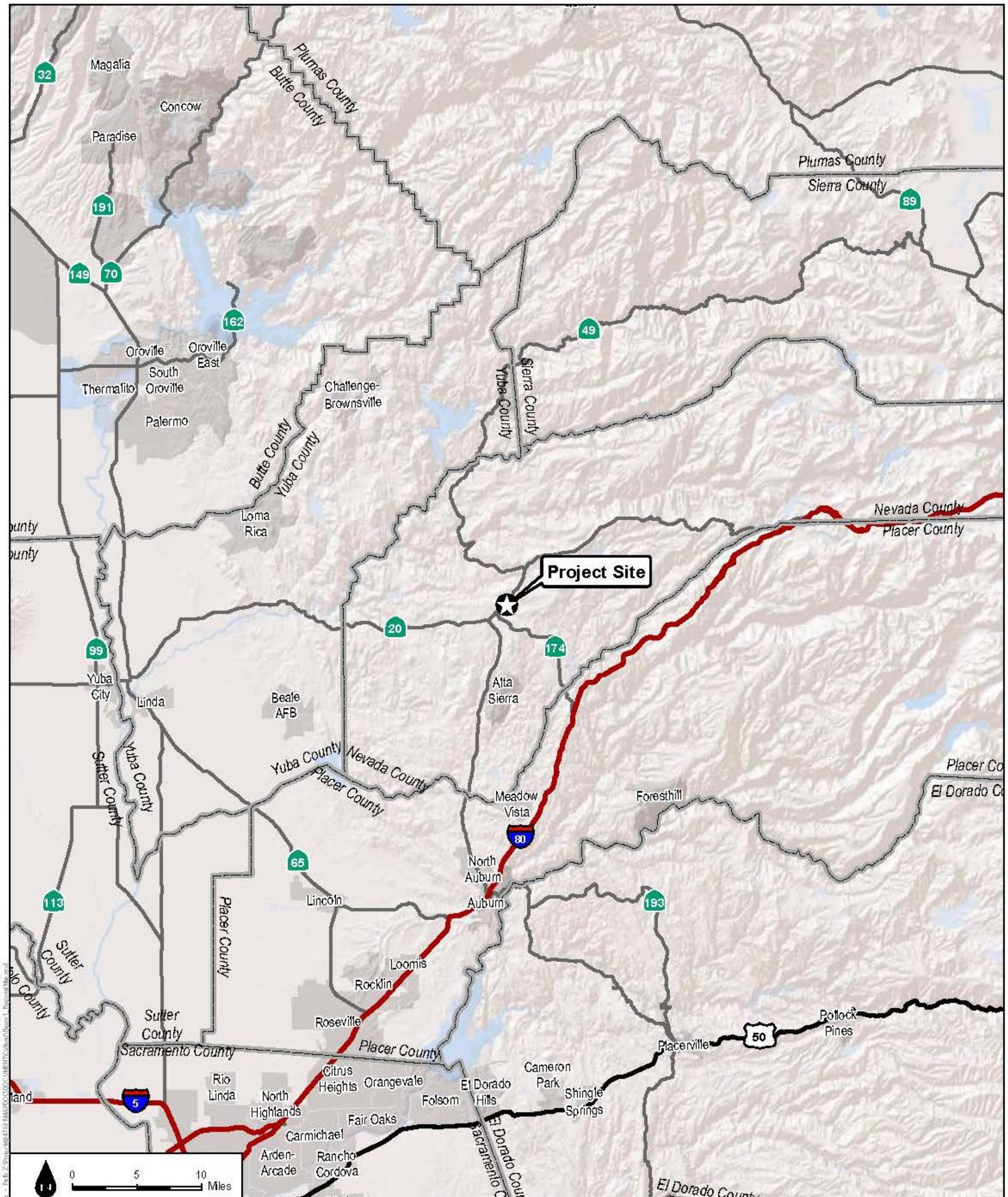
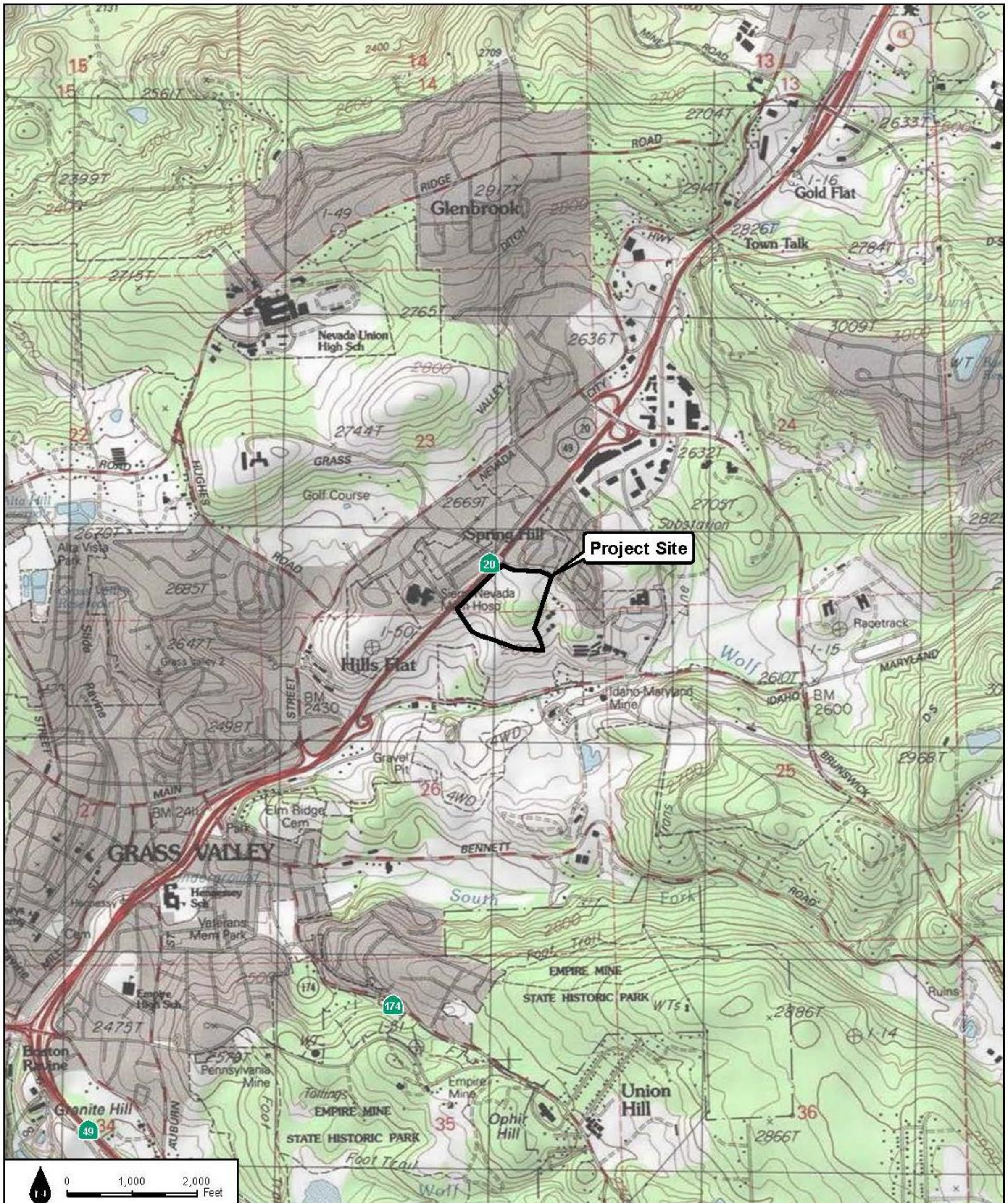


FIGURE 1
Regional Map

DUDEK

Dorsey Marketplace Project



SOURCE: USGS 7.5-Minute Series Grass Valley Quadrangle

FIGURE 2
Vicinity Map

DUDEK

Dorsey Marketplace Project

1.3 Regulatory Context

The current cultural resources investigation was completed to satisfy CEQA.

1.3.1 California Register of Historic Resources (CRHR) and CEQA

In California, the term "historical resource" includes but is not limited to "any object, building, structure, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California." (PRC section 5020.1(j).) In 1992, the California legislature established the CRHR "to be used by state and local agencies, private groups, and citizens to identify the state's historical resources and to indicate what properties are to be protected, to the extent prudent and feasible, from substantial adverse change." (PRC section 5024.1(a).) The criteria for listing resources on the CRHR were expressly developed to be in accordance with previously established criteria developed for listing in the National Register of Historic Places (NRHP), enumerated below. According to PRC Section 5024.1(c)(1–4), a resource is considered historically significant if it (i) retains "substantial integrity," and (ii) meets at least one of the following criteria:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
- Is associated with the lives of persons important in our past.
- Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
- Has yielded, or may be likely to yield, information important in prehistory or history.

In order to understand the historic importance of a resource, sufficient time must have passed to obtain a scholarly perspective on the events or individuals associated with the resource. A resource less than fifty years old may be considered for listing in the CRHR if it can be demonstrated that sufficient time has passed to understand its historical importance (see Cal. Code Regs., tit. 14, section 4852(d)(2)).

The CRHR protects cultural resources by requiring evaluations of the significance of prehistoric and historic resources. The criteria for the CRHR are nearly identical to those for the NRHP and properties listed or formally designated as eligible for listing in the NRHP are automatically listed in the CRHR, as are the state landmarks and points of interest. The CRHR also includes properties designated under local ordinances or identified through local historical resource surveys.

California Environmental Quality Act

As described further below, the following CEQA statutes and CEQA Guidelines are of relevance to the analysis of archaeological, historic, and tribal cultural resources:

- PRC section 21083.2(g) defines "unique archaeological resource."
- PRC section 21084.1 and CEQA Guidelines section 15064.5(a) defines "historical resources." In addition, CEQA Guidelines section 15064.5(b) defines the phrase "substantial adverse change in the significance of an historical resource;" it also defines the circumstances when a project would materially impair the significance of an historical resource.
- PRC section 21074(a) defines "tribal cultural resources."
- PRC section 5097.98 and CEQA Guidelines section 15064.5(e): Set forth standards and steps to be employed following the accidental discovery of human remains in any location other than a dedicated ceremony.

PRC sections 21083.2(b)-(c) and CEQA Guidelines section 15126.4: Provide information regarding the mitigation framework for archaeological and historic resources, including examples of preservation-in-place mitigation measures; preservation-in-place is the preferred manner of mitigating impacts to significant archaeological sites because it maintains the relationship between artifacts and the archaeological context, and may also help avoid conflict with religious or cultural values of groups associated with the archaeological site(s).

More specifically, under CEQA, a project may have a significant effect on the environment if it may cause "a substantial adverse change in the significance of an historical resource." (PRC section 21084.1; CEQA Guidelines section 15064.5(b).) If a site is either listed or eligible for listing in the CRHR, or if it is included in a local register of historic resources, or identified as significant in a historical resources survey (meeting the requirements of PRC section 5024.1(q)), it is a "historical resource" and is presumed to be historically or culturally significant for purposes of CEQA. (PRC section 21084.1; CEQA Guidelines section 15064.5(a).) The lead agency is not precluded from determining that a resource is a historical resource even if it does not fall within this presumption. (PRC section 21084.1; CEQA Guidelines section 15064.5(a).)

A "substantial adverse change in the significance of an historical resource" reflecting a significant effect under CEQA means "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired." (CEQA Guidelines section 15064.5(b)(1); PR Code section 5020.1(q).) In turn, the significance of an historical resource is materially impaired when a project:

- Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for, inclusion in the California Register; or
- Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical resources pursuant to section 5020.1(k) of the PRC or its identification in an historical resources survey meeting the requirements of section 5024.1(g) of the PRC, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or
- Demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its eligibility for inclusion in the California Register as determined by a lead agency for purposes of CEQA.

(CEQA Guidelines section 15064.5(b)(2).) Pursuant to these sections, the CEQA inquiry begins with evaluating whether a project site contains any "historical resources," then evaluates whether that project will cause a substantial adverse change in the significance of a historical resource such that the resource's historical significance is materially impaired.

If it can be demonstrated that a project will cause damage to a unique archaeological resource, the lead agency may require reasonable efforts be made to permit any or all of these resources to be preserved in place or left in an undisturbed state. To the extent that they cannot be left undisturbed, mitigation measures are required (Section 21083.2[a], [b], and [c]).

Section 21083.2(g) defines a unique archaeological resource as an archaeological artifact, object, or site about which it can be clearly demonstrated that without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.
- Has a special and particular quality such as being the oldest of its type or the best available example of its type.
- Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Impacts to non-unique archaeological resources are generally not considered a significant environmental impact (PRC section 21083.2(a); CEQA Guidelines section 15064.5(c)(4).) However, if a non-unique archaeological resource qualifies as tribal cultural resource (PRC 21074(c); 21083.2(h)), further consideration of significant impacts is required.

CEQA Guidelines section 15064.5 assigns special importance to human remains and specifies procedures to be used when Native American remains are discovered. As described below, these procedures are detailed in PRC section 5097.98.

California Health and Safety Code

California law protects Native American burials, skeletal remains, and associated grave goods, regardless of their antiquity, and provides for the sensitive treatment and disposition of those remains. Health and Safety Code section 7050.5 requires that if human remains are discovered in any place other than a dedicated cemetery, no further disturbance or excavation of the site or nearby area reasonably suspected to contain human remains shall occur until the County coroner has examined the remains (section 7050.5b). PRC Section 5097.98 also outlines the process to be followed in the event that remains are discovered. If the coroner determines or has reason to believe the remains are those of a Native American, the coroner must contact the California Native American Heritage Commission (NAHC) within 24 hours (section 7050.5c). The NAHC will notify the Most Likely Descendant. With the permission of the landowner, the Most Likely Descendant may inspect the site of discovery. The inspection must be completed within 48 hours of notification of the Most Likely Descendant by the NAHC. The Most Likely Descendant may recommend means of treating or disposing of, with appropriate dignity, the human remains and items associated with Native Americans.

2 PROJECT CONTEXT

2.1 Environmental Context

Average annual temperatures in the area range between 30 and 95 degrees Fahrenheit (Storer and Usinger 1963). Winter rains are substantial, with annual precipitation varying from 15 inches, in relatively dry years, to 40 inches in wet years.

Vegetation within this area is consistent with transitional Foothill and Yellow Pine communities. Tree varieties within this environment commonly include grey pine (*Pinus sabiniana*), interior live oak (*Quercus wislizenii*), blue oak (*Quercus douglasii*), California buckeye (*Aesculus californica*), yellow pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), Douglas fir (Pseudotsuga menziesii), white fir (Abies concolor), incense cedar (Libocedrus decurrens), black cottonwood (*Populus trichocarpa*), black oak (*Quercus kelloggii*), broadleaf maple (*Acer macrophyllum*), and California dogwood (*Cornus nuttallii*). Common shrubs include redbud (*Cercis occidentalis*), chamise (*Adenostoma fasciculatum*), ceanothus (*Ceonothus leucodermis*), mountain misery (*Chamaebatia foliolosa*), prostrate ceanothus (*Ceanothus prostratus*), and western azalea (*Rhododendron occidentale*; Selverston 2008; Storer and Usinger 1963). Common mammals include squirrel (*Sciurus sp*.), striped skunk (*Mephitis mephitis*), mule and whitetail deer (*Odocoileus sp*.), cottontail rabbit (*Sylvilagus sp*.), black-tailed jackrabbit (*Lepus californicus*), opossum, black bear (*Ursus americanus*), gray fox (*Urocyon cinereoargenteus*), mountain lion (*Puma concolor*), raccoon (*Procyon lotor*), among others. Birds include California quail (*Callipepla californica*), bushtit (*Psaltriparus minimus*), wild turkey (*Meleagris gallopavo*), woodpecker (*Melanerpes*), stellar jay (*Cyanocitta stelleri*), owl (*Megascops*), turkey vulture (*Cathartes aura*), warbler, and others. Additional animals include a variety of reptiles and amphibians, as well as insects.

2.2 Cultural Context

Various attempts to parse out information provided through recorded archaeological assemblages from throughout California for the past 12,000 years have led to the development of several cultural chronologies. Some of these are based on geologic time, most are interpreted through temporal trends derived from archaeological assemblages, and others are interpretive reconstructions. Each of these chronologies describe essentially similar trends in assemblage composition in more or less detail. California's archaeological assemblage composition is generally accepted as falling within the following overarching patterns: Paleoindian (pre-5500 BC), Archaic (8000 BC – AD 500), Late Prehistoric (AD 500–1750), and Ethnohistoric (post-AD 1769).

Occupation of the Sierra is likely to have occurred at least 9,000 years ago, however, only a handful of Paleoindian Period lithic bifacial points have been recorded. The nearest of these fluted points were found in Sierra Valley (west of Reno, Nevada; Foster and Betts 1995), Ebbett's Pass (south of Lake Tahoe; Dillon 2002), and at the Sailor Flat site (in the Tahoe National Forest; Wohlgemuth 1984). Fluted points from this area have generally been recorded as isolated finds, or recovered from contexts of mixed provenience. The primary examples of the PaleoIndian pattern, to which such fluted and stemmed points are generally assigned, have been recorded east of the Sierra Nevada. The typical assemblage includes large stemmed projectile points, high proportions of formal lithic tools, bifacial lithic reduction strategies, and relatively small proportions of groundstone tools. Some of the most pertinent of such sites were studied by Emma Lou Davis (1978) on China Lake Naval Air Weapons Station, near Ridgecrest, California. These sites contained fluted and unfluted stemmed points and large numbers of formal flake tools (e.g., shaped scrapers, blades). Other typical Paleoindian sites include the Komodo site (MNO-679)—a multicomponent fluted point site, and MNO-680—a single component Great Basined Stemmed point site (Basgall et al. 2002). At MNO-679 and MNO-680, groundstone tools were rare while finely made projectile points were common.

While the limited available data relating to the earliest occupation in the region has provided for a relatively broad and consistent interpretation of the Paleoindian Period, subsequent prehistoric temporal sequences are much more geographically defined and variable due to the greater amount of available data. The Tahoe Reach is currently the most commonly applied cultural temporal sequence within the region. This draws from regional syntheses primarily developed by both Heizer and Elsasser (1953) and Elston, Davis, and Townsend (1977). The sequence includes the Washoe Lake Phase, Tahoe Reach Phase, Spooner Phase, Martis Complex, and Kings Beach Complex (Hull 2007; Moratto 1984, 1999). Of these, the Martis Complex and the Kings Beach Complex are most applicable to the current project area.

2.2.1 Martis Complex (3000 B.C.–A.D. 500)

The Martis complex has been identified to extend from Lassen County to Alpine County (Elsasser 1960). The date range, 3000 B.C. to approximately 500 A.D. has been substantiated by obsidian hydration and radiocarbon dates provided by Elsasser and Gortner (1991). Subsistence during the Martis Complex was based on hunting and seed collecting economy, with highly mobile populations that exploited both upper and lower regions based on the relative seasonal abundance of resources. Projectile points are variable during this period, and were most commonly heavy with low formality, providing some resemblance to those identified in the Great Basin regions. Temporally representative tools include finger-held drills or punches, retouched volcanic flake scrapers, spokeshave-notched tools, and large biface blades and cores

(Hull 2007). During this period there is a more intensive exploitation of local materials, rather than non-local cherts and obsidian, for the manufacture of formed flaked tools.

2.2.2 Kings Beach Complex (A.D. 500–Historic Contact)

Similar to the Martis Complex, the Kings Beach Complex was characterized by populations that migrated between upper areas in the warmer months and lower elevations during the fall and winter. Subsistence during this period shifted toward a focus on fishing and gathering. A reduction in size and weight of projectile points corresponded with adoption of bow and arrow technology. Typical point forms within this region included Desert Side-notched, Cottonwood, and Rosegate series (CRM 2011). Obsidian and chert replaced volcanic materials such as basalt as the preferred materials for the manufacture of lithic tools. As both high quality cherts and obsidian are not local, the greater presence of such exotic materials suggests that there was an increase in trade with neighboring tribes during this period.

The Kings Beach Complex additional included a greater reliance on exploitation of acorns. This trend is exemplified by the increased presence of bedrock mortars and pestles formed from local cobbles. It should be noted that while bedrock mortars were predominantly used for crushing and grinding acorns, they were also employed for the processing of a variety of other foods, including deer meat, camas roots and seeds (CRM 2011). While the creation of mortars indicated a relatively high investment of time and energy, such bedrock milling features are just as frequently found at sites with limited-to-no subsurface cultural deposits as at intensive use occupation areas with well-developed midden soils.

2.2.3 Ethnohistoric (post-AD 1750)

The region surrounding the project area would have been in Hill Nisenan (also known as the southern Maidu) tribal territory during the ethnohistoric period (Wilson and Towne 1978). This group inhabited the Yuba, Bear, and American river watersheds, extending from the Sierra Nevada summit to the Sacramento River. Ethnographic work, most prominently conducted by Stephen Powers in the 1870s, writes of a relatively high population of indigenous inhabitance in this region (1877). Notably, Powers identified 18 named villages alone along the Bear River, further suggesting that there may have been a larger portion of villages that he had no knowledge of. This was substantiated by interviews conducted by Hugh Littlejohn in 1928, who recorded a number of additional named habitation areas (Carlson 1986).

Nisenan habitation areas were most commonly situated near primary drainages, along ridgelines with mild slopes and south-facing exposures (Wilson and Towne 1978). Traditional village features included bedrock milling stations, granaries, conical house structures, as well as sweat and ceremonial houses. The dead were typically cremated and buried within the boundaries of the habitation area. Tribal groups included extended and unmarried relatives. Groups of Hill Nisenan did have defined chiefs, however, these individuals were chosen based on wealth and popularity rather than hereditary decent (Kroeber 1925). Intra-tribal boundaries overlapped, with natural resources being shared relatively freely between triblets (Carlson 1986). Inter-tribal conflict did occur over resources, and the Hill Nisenan would attack small hunting parties of Washoe that encroached too far into their territory.

The Nisenan subsistence strategy was centered on fishing, hunting, and collecting vegetative resources. This group was highly mobile, with larger central habitation areas and surrounding satellite sites used during hunting excursions and for pre-processing of collected plant resources such as acorns. Common food items included deer, rabbits, birds, bear, rodents, other mammals of small and moderate size, as well as various insects. Deer were sometimes partially processed using mortar and pestle (Kroeber 1925). A ceremony among the Hill Nisenan involved the hunting of a bear during hibernation season. Common tools included the bows and arrow, traps, harpoons, hooks, nets, portable and stationary grinding implements, and pestles and handstones. A number of goods were made using fibrous plants, including canoes constructed tule balsa or logs. Imported items included shell ornaments and beads (particularly disk beads as a monetary unit), green pigment, tobacco, steatite items, and obsidian (Wilson and Towne 1978). Exported items included bows and arrows, animal skins, pine nuts, and other local resources (Kroeber 1925).

Central California indigenous populations derived their linguistic roots from a common Penution stock. The degree of internal variation among these three decedent language groups (Yokution, Maiduan, and Wintuan) is similar to Indo-European, suggesting a time depth of approximately 6,500 years (Golla 2007). The Nisenan spoke one of four closely related Maiduan languages, including Konkow, Chico Maidu, Mountain Maidu, and Nisenan. Shared Hokan phonological and morphological substratal components identified within all Miduan languages indicate past interactions between these two language populations (Hokan time depth is approximately 8,000 years). Miduan language structure suggests that all four Miduan languages were descended from the same proto-Maiduan speaking population to the north. The most likely scenario is that these populations spread southward in the last last1,200 years, with the Nisenan encroaching into area previously occupied by Miwok tribal groups sometime in the past few centuries (Golla 2007). This later population movement is further substantiated by the high frequency of Miwok loan words found within Nisenan vocabulary, a trait that is not shared with the other three Maiduan languages.

2.2.4 The Historic Period

Spanish Period (1769–1822)

Gaspar de Portolá entered the San Francisco bay in 1769. Additional explorations of the san Francisco bay and the plains to the east were conducted by father Pedro Fages in 1772 and Juan Bautista De Anza in 1776 (Grunsky 1989). In 1808, Lieutenant Gabriel Moragain led the first Spanish expedition into the Sacramento Valley. This group traveled explored areas along the American, Calaveras, Cosumnes, Feather, Merced, Mokelumne, Sacramento, and Stanislaus river watersheds. The most recent Spanish expedition into this region was conducted by Luis Arguello in 1817. This group traveled up the Sacramento River to the mouth of the Feather River (Grunsky 1989).

Spanish missionization of Alta California was initiated in San Diego (1769). A total of 21 missions were constructed by the Dominican and Franciscan orders between 1769 and 1823. Missions in the region included San Francisco de Asís (1776), Santa Clara de Asís (1776), San José de Guadalupe (1797 in Alameda County), San Rafael Arcángel (1817 in Marin County), and San Francisco Solano (1823 in Sonoma County; Grunsky 1989)). While missionization had a detrimental effect on tribes throughout the region, there is no record of forcible transport of Nisenan communities by the Spanish to the missions (Wilson and Towne 1978).

Mexican Period (1822–1848)

Mexico's separation from the Spanish empire in 1821 and the secularization of the California missions in the 1830s caused further disruptions to native populations. Following the establishment of the Mexican republic, the government seized many of the lands belonging to Native Americans, providing them as parts of larger Land Grants to affluent Mexican citizens and rancheros. Captain John Sutter was granted the two largest areas of land in the Sacramento Valley area. Sutter founded New Helvetia, a trading and agricultural empire, in 1839. The headquarters was located within Valley Nisenan territory at the confluence of the Sacramento and American rivers. The 1833 Secularization Act passed by the Mexican Congress ordered half of all mission lands to be transferred to the Indians, and the other half to remain in trust and managed by an appointed administrator. These orders were never implemented due to several factors that conspired to prevent the Indians from regaining their patrimony.

American fur trappers and traders conducted a number of exploratory intrusions into west Sierra Nevada Mexican territory. Notably, in 1826, Jedediah Smith led a small party of trappers in an expedition along the Sierra Nevada range, eventually entering the Sacramento Valley in 1827. This group covered the area along the American and Cosumnes rivers. From these travels, maps of this inhospitable terrain were created and disseminated, providing for the waves of European prospectors, ranchers and settlers that would come in the following decades (Grunsky 1989).

American Period (Post 1848)

The following section has been borrowed with permission from the BOR from *Cultural Resources Survey for the Closure of Eight Abandoned Mines in the Oregon Hill Area of Auburn State Recreation Area, Placer County, California* (2010):

California has been inexorably shaped by the mining of precious metals and other minerals. The discovery of gold in January of 1848 at Sutter's Mill in Coloma, on the South Fork of the American River, led to extensive and enduring changes to California's physical and cultural landscapes. A comprehensive discussion of the history and context of mining activities at the statewide level can be found in *A Historical Context and Archaeological Research Design for Mining Properties in California* (Caltrans 2008) and the references therein. The following historic context is restricted to the origins and effects of mining in the American River Basin, with a particular focus on the Auburn area where the current project is located.

The California gold rush prompted by news of the find at Sutter's Mill led to what has been characterized as "the greatest mass migration in American history" (Costello and Marvin 2002:16). Within months of the initial discovery, gold was being collected in the gravel bars of the North, Middle, and South Forks of the American River, and extensive placer mining was occurring in nearly every adjacent gulch and ravine. The effects of these activities are still evident in the form of tailings, ditches, and other mining features scattered throughout these areas. Mining can also be credited for the location and names of most of the towns and communities in the region, the placement of early transportation and communication corridors between the western Sierra Nevada, Sacramento, and San Francisco, and the subsequent development of agriculture and ranching throughout the foothills (Costello and Marvin 2002; Homer 1988).

Gold was first encountered in the Auburn area on May 16, 1848, when Claude Chana, en route to the mining camp at Sutter's Mill in Coloma with a company of three fellow Frenchmen and 25 Nisenan, made his initial discovery in Auburn Ravine. For the remainder of May, Chana and his group continued to pan for gold just south of what is today the city of Auburn (Davis 1975; Homer 1988). A lack of experience, and word of greater gold discoveries on the Yuba River, resulted in the abandonment of the Auburn area by Chana's group. Other miners, however, soon arrived to take their place. By the summer of 1949, what had been unblazed territory was transformed into a small community of wood and fabric buildings, originally known as North Fork Dry Diggings. Sometime between the summer and fall of 1849, the rapidly growing settlement was given the “more euphonious name” of Auburn (Davis 1975:6). In 1851, the California legislature carved Placer County from portions of Sutter and Yuba Counties, and named Auburn as the new county’s seat (Homer 1988).

Oxcart and stagecoach routes were soon established in the area, providing for the transport of people, supplies, and gold between Auburn, Sacramento and San Francisco. Situated at “the crossroads of the mother lode” (Homer 1988:28), Auburn came to serve as a financial center as well. In 1860, Auburn residents voted to provide a $50,000 subsidy to bring the Sacramento, Placer and Nevada Railroad to the town. The railroad was built to within five miles of Auburn when construction was suspended as the push to build Central Pacific’s segment of the transcontinental railroad through the Sierras took precedence. Despite the termination of the Sacramento, Placer and Nevada line, Auburn’s position as a supply and transportation center continued to grow (Davis 1975).

As the allure of gold mining declined, agriculture and ranching in the foothills, and the timber industry at higher elevations, became more prominent and productive economic pursuits in the region (Davis 1975). During the Great Depression, however, small scale placer mining, using Gold Rush era techniques and technologies, made a brief reappearance. Depression-era miners either reworked old diggings in formerly mined area or moved into previously unmined locations, often on public lands (Averill 1946; Caltrans 2008). According to Clark (1992), the second all-time high of gold production in California, totaling some $50.9 million, occurred during this period.

3 RESULTS

This section presents the results of the records search and the field survey of the current study.

3.1 Records Search Results

A records search was completed for the current project for a one-mile radius around the project area by staff at the North Central Information Center (NCIC) at California State University Sacramento on April 11, 2016. The records search identified 49 previous studies which have been performed with the records search area; of these, three studies (000557, 002907, 006706) have covered a least a portion of the project area; discussed below (Table 2). The records search also identified one cultural resource, 29-002455 (Spring Hill Mine), within the project area and an additional 26 cultural resources within the records search area (Table 2; Confidential Appendix A). Of the 27 previously recorded resources, one is a multi-component site consisting of a bedrock milling feature and the Olympia Creek spillway; a single bedrock milling isolate; a segment of the Nevada County Narrow gauge Railroad grade; six water conveyance systems; three mines; one single family residence; two highways; three historic refuse piles; one tailings pile; two fence structures; one utility power pole; and five historic isolates. Four (29-000839, 29-000840, 29-001447 and 29-002455) of the 27 cultural resources have been evaluated for NRHP and CRHP listing. Of the four evaluated resources, one, 29-000840, was determined to be possibility eligible for listing on the NRHP and CRHP; however, it further evaluation is required.

Table 1
Previous Cultural Resource Studies

Report Number	Year	Title	Author
Studies Covering Portions of the Record Search Area			
000198	1984	Archeological Reconnaissance of the Proposed Wolf Creek Plaza Project, Grass Valley, Nevada County, California.	Clark, Matthew R.
000358	1987	Cultural Resource Assessment of the Proposed Grass Valley Senior Citizens and Family Apartments, Nevada County, California.	Peak & Associates, Inc.
000365	1985	Negative Archeological Survey Report for Proposed Widening of Existing Brunswick Road Overcrossing (Br. No. 17-48) Nevada County, (3-NEV-20 PM R14.5/R15.1).	Bass, Henry O.
000375	1985	Archeological Reconnaissance of the Proposed Valley Terrace Subdivision, Nevada County, California.	Jensen, Peter M.
000548	2001	Archaeological Inventory Survey: Amaral Development Project Involving 13.68 acres at Lake Olympia, Grass Valley, Nevada County	Jensen, Peter
000863	1984	An Archeolgical Survey of the Litton Property, Grass Valley, Nevada County, California.	Ernest H.L. Decater
001148	1998	Archaeological Survey, 11.71-Acre Canon Ranch Property.	Jensen, Sean M.
001156	1998	Archaeological Survey, c. 5.43-Acre Wedgewood Project.	Jensen, Peter M.

Table 1
Previous Cultural Resource Studies

Report Number	Year	Title	Author
001684	1997	Archaeological Inventory Survey, c. 5.5-Acre Grass Valley Oak Ridge Apartments Development Project, Grass Valley, Nevada County, California.	Jensen, Peter
002245	1997	Archaeological Inventory Survey Of The Proposed Don Fultz Subdivision of 16.29 Acres, Penn Valley Drive, Nevada County, CaliforniaArchaeological Inventory Survey, 1.61-Acre Brunswick Inn Development Project, Grass Valley, Nevada County, California.	Jensen, Sean
002247	1993	Archaeological Inventory Survey, Proposed Smith's Development Project, Store #820 on c. 12 ac Site Adjacent to East Main Street and Dorsey Drive, Grass Valley, Nevada County, California.	Jensen and Associates
002249	1992	Archaeological Inventory Survey, North Star Rock Products, LTD., Proposed Expansion to Existing Facility, c. 11 AC, Near Idaho-Maryland Road, Grass Valley, Nevada County, California.	Jensen and Associates
002252	1992	Archaeological Inventory Survey, approx. 1.5-acres, Northeast Portion of Parcel 9-191-24 (Nevada County), Owned by Sierra Nevada Memorial Miners Hospitals, Inc., Proposed Project: Parking Area Expansion.	Jensen, Peter
002253	1992	Archaeological Inventory Survey, Proposed Developments on AP#s 35-411-81 and 82, Adjacent to Sutton Road, Grass Valley, Nevada County, California.	Jensen and Associates
002637	2000	Archaeological Inventory Survey for East Main Street Development Project , 14.6 Acres along East Main Street, Grass Valley, Nevada County, California	Jensen, Peter
002666	2001	Confidential Archaeological Addendum for Timber Operations on Non-Federal Lands for Ranchview Court THP Amendment	Whittlesey
002888	1995	Arch. Survey of the DeMartini Development	Markley, Richard
002892	1988	AN Arch. Survey of the Proposed Nevada Meadown Development, Grass Valley, Nevada Co., CA.	Werner, Roger H.
002895	1998	Confidnetial Arch. Addendum for Timber Operations on Non-Federal Lands in CA.	Funk, Andrew D.
002898	1990	Cultural Resources Survey of the Proposed Nevada Meadows Senior Apartments Project, Valley Springs, Nevada County, CA.	Werner, Roger H.
002922	1988	Cultural Resource Assessment of the Pine Ridge Apartments, Nevada County, CA.	Peak, Anne
004602	2001	Archaeological Survey, Chapa-De Indian Health Program Development Project	Jensen, Peter M.
004603	2003	Cultural Resources Analysis for Cingular Wireless' SN-051-02 Spring Hill Mine Site	Losee, Carolyn
004610	1995	Archaeological Inventory Survey Polcynmeyers Subdivision and Residential Development Project, C. 7.5 Acres South of Wolf Creek in Grass Valley, Nevada County, California	Jensen, Peter M.
004630	1994	Supplemental Archaeological Investigation at the Loma Rica Ranch, Grass Valley, Nevada County, California	Napton, Kyle
004632	1998	Environmental Impact Report Loma Rica Ranch	Roberts, William N.
004639	1981	An Archaeological Survey of the Wolf Creek Industrial Park, Grass Valley, California	Derr, Eleanor

Table 1
Previous Cultural Resource Studies

Report Number	Year	Title	Author
004641	2002	Archaeological Survey, 0.3-Acre Cooper Development Site, Grass Valley, Nevada County, California	Jensen, Peter M.
004646	1983	An Archaeological of the Proposed Whispering Pines Park Annexation to the City of Grass Valley, Nevada County, California	Decater, Ernest
004648	2000	Archaeological Addendum to the Ranchview Court Timber Harvest Plan	Whittlesey, Nicholas
004654	1993	Archaeological and Historical Resources Survey and Impact Assessment for the Ghidotti Property Timber Harvest Plan	Ferrier, Douglas C.
004666	2002	Addendum to Archaeological Inventory Survey, Amaral Valley, Nevada County, California	Jensen, Peter M.
005556	2004	Cultural Resources Assessment for the Spring Hill Mine Cell Tower.	St. Clair, Michelle C.
005557	2004	Archaeological Survey of c. 1-Acre Moule Property.	Jensen, Peter M.
006205	2004	Delineation of Clean Water Act Jurisdiction, Moule Paint & Glass Project Site, Northwest Corner of East Main Street and Berryhill Drive.	Bole, Marcus H.
006690	2005	Archaeological Survey, c. 14 acre Hills Flat Project, Nevada County, CA	Jensen, Peter
006718	2004	Archaeological Survey, c. 1 acre DeMartini Bridge Replacement Project, Idaho-Maryland Road, Nevada County, CA	Jensen, Peter
006719	2004	Archaeological Survey, 9.25 acre Brunswick One Development Project, Brunswick Road, Nevada County, CA	Jensen, Peter
007003	2006	Archaeological Survey, 3.12 acre Fisher Project, Nevada County, CA	Jensen, Sean
008033	2006	Archaeological Survey, c. 100-acre Sierra College Development Project, Nevada County, California	Jensen, Sean
008428	2007	Archaeological Survey, 32-acre Ranchview Development Project, Grass Valley, Nevada County, California	Jensen, Sean
008763	2007	Cultural Resources Study of APN 35:320:05, 35:320:67, 35:250:07, and 35:260:70, 11426 Nevada City Highway, Grass Valley, Nevada County, California 95945	Dana E. Supernowicz
009835	2008	Proposed MILCO Development Project	Jensen, Sean M.
010234	2006	Archaeological Survey report ffor Sierra College Grass Valley Campus Extension THP	Larry Rieger
010355	2009	CoRR Center for Hope, Cultural Resources Inventory and Evaluation, Grass Valley, Nevada County, California	Ric Windmiller
Studies Covering a Portion of the Project Area			
000557	2001	Archaeological Survey, DeSena 6.5 acre Development Project	Jensen, Peter
002907	1989	An Archaeological Survey of the Proposed Nevada Terraces Development, Grasss Valley, Nevada Co. CA	Werner, Roger H.
006706	2005	Historic Property Survey Report Dorsey Drive	Medin, Anmarie

Jensen 2001

This report documents the results of an archaeological inventory for the DeSena 6.5 acre Development Project. Jensen & Associates conducted an intensive pedestrian survey in 2001. The project site is located close to Highway 49/20; north Empire Mine Road. The project is located within Sections 26 and 23, Township 16 N, Range 8 E on the Grass Valley USGS 7.5 minute topographic quadrangle. Prior to the survey, a records search conducted at the NCIC indicated that the project area had not been previously surveyed and no cultural resources have been identified within or immediately adjacent to the project area. No prehistoric or historic cultural resources or materials were observed during the survey. Archaeologists observed that the project site has been impacted by various activities, especially from past mining operations associated with Spring Hill, located north on an adjacent parcel, and Idaho-Maryland. The negative results of the records search and field survey concluded that development of the property would not affect archaeological or built environment resources. No further mitigation was required.

Werner 1989

This report presents the results of an archaeological pedestrian survey conducted for the Nevada Terraces Development Project in 1989. This project area consists of approximately 5.6 acres located generally south of the currently proposed Dorsey Marketplace APE. Archaeologist John Pryor of Archaeological Services noted that no cultural resources had been recorded within the project boundaries, and no previous studies conducted. During the pedestrian survey, no archeological sites or material were identified. The negative results of the records search and field survey concluded that development of the property would not affect archaeological or built environment resources. No further mitigation was recommended (Werner 1989).

Medin 2005

The report documents the results of the archaeological pedestrian survey conducted for the Dorsey Drive Interchange Project by Caltrans in 2005. An initial archaeological survey was conducted in August 2001, and a follow-up survey was conducted November 2005. The survey identified two properties within the project area; the Spring Hill Mine and the Stone Ditch. Caltrans archaeologists noted that neither of these properties appears to be important under NRHP criteria. The Spring Hill Mine consists of five concrete foundation features that correspond to buildings documented in the county assessor's building records. All buildings and mine equipment have been removed from the area. Archaeologists noted modern sheet refuse scattered throughout the project area, indicating that the site is being used as an illicit recreation area. Stone Ditch has been destroyed by development and no remains of the site were present during the recent Dudek survey. No further study was recommended by the Caltrans study.

Table 2
Previously Recorded Cultural Resources

Primary # (P-)	Period	Type	NRHP/CRHP Status	Description
Resources within the Project Area				
29-002455	Historic	Mine	Not Eligible	Spring Hill Mine
Resources within the One- Mile Records Search Area				
29-000839	Historic	Railroad grade segment	Not Eligible	Nevada County Narrow gauge railroad grade
29-000840	Historic	Single Family Residence	Appears to be eligible/ NRHP status Code 3	Hill/Shaw House/Ranch
29-000859	Historic	Water Conveyance System segment	No Formal Recommendation	Ditch
29-000880	Multi-component	Bedrock milling; Dam	No Formal Recommendation	Bedrock milling; Olympia Creek concrete spillway
29-001447	Historic	Water Conveyance System	Not Eligible	Idaho-Maryland Water Conveyance Canal/Ditch
29-001462	Historic	Tailing pile	No Formal Recommendation	Tailing pile and possible mine shaft
29-001463	Historic	Mine	No Formal Recommendation	Mine shaft
29-001464	Historic	Water Conveyance System	No Formal Recommendation	Stone ditch
29-001465	Historic	Mine	No Formal Recommendation	Mine shaft with associated retaining walls and tailings
29-001514	Historic	Highway	No Formal Recommendation	Idaho-Maryland Road
29-001515	Historic	Highway	No Formal Recommendation	East Main Road
29-001520	Historic	Water Conveyance System	No Formal Recommendation	Nevada Irrigation District Earthen Canal/Ditch
29-003133	Prehistoric	Isolate	No Formal Recommendation	Bedrock milling
29-003134	Historic	Isolate	No Formal Recommendation	Glory hole; excavated pit with associated refuse
29-003836	Historic	Refuse	No Formal Recommendation	Refuse Pile
29-003837	Historic	Water Conveyance System	No Formal Recommendation	Earthen Canal/Ditch

Primary # (P-)	Period	Type	NRHP/CRHP Status	Description
29-003838	Historic	Refuse	No Formal Recommendation	Refuse Pile
29-003839	Historic	Water Conveyance System	No Formal Recommendation	Earthen Canal/Ditch
29-003840	Historic	Utility Infrastructure	No Formal Recommendation	Power pole
29-003841	Historic	Structure	No Formal Recommendation	Wooden fence line
29-003842	Historic	Refuse	No Formal Recommendation	Refuse pile
29-003843	Historic	Structure	No Formal Recommendation	Wooden fence line
29-003859	Historic	Isolate	No Formal Recommendation	Pipeline fragment
29-003860	Historic	Isolate	No Formal Recommendation	Milk glass jar fragment
29-003861	Historic	Isolate	No Formal Recommendation	Pipeline fragment
29-003862	Historic	Isolate	No Formal Recommendation	Pipeline fragment

29-002455

This historic Spring Hill Mine site was recorded by Caltrans archaeologists Medin and Schinke in 2001 as part of the Proposed Dorsey Drive Interchange Project. The site consists of five mine features comprising of concrete foundations (a concrete foundation, warehouse and shower, head frame foundation, hoist house, and the former mill location) that correspond to buildings documented in the county assessor's building records. The mine was claimed in 1871 and operated until approximately the 1970s. No exact date was determined as to when mining operations were ceased at Spring Hill. It was evident that the mine had undergone improvements in the 1930s. The 1930s improvements have most likely destroyed any archaeological deposits or features that remained from the 1870s era of operations. All equipment has since been removed from the site, leaving concrete foundations on site. Caltrans determined that Spring Hill Mine does not appear eligible for NRHP or CRHR listing in 2001.

Historical Map Review

Historic aerial photographs of the project area were available for the years 1947, 1998, 2005, 2009, 2010, and 2012 (Historicaerials 2016). Based on the 1947 photograph, Spring Hill Mine and associated structures are located in the central portion hill, with evidence of grading/clearing activities located to the west of the project area. The surrounding area is vegetated with pine, oak, and cotton tress. In 1998, the central portion of Spring Hill is surrounded by development (north, south, east and west). Spring Hill Mine and the associated structures are no longer visible; obscured by pine, oak, and cotton tress. A couple of dirt trails bisect the project area, running north-south. Photographs from 2005, 2009, 2010, and 2012 do not reveal any changes to the project area or surrounding area and represent what the current property looks like to date.

Geoarchaeological Information

Native soils within area has been substantially disturbed through an extended history of mining. For this reason there is a very low potential for intact prehistoric cultural resources to be present. However, in consideration of this history, there is a potential that this past mining activity resulted in the deposition of historical deposits and/or features. Holdrege & Kull (H&K) conducted survey and geotechnical investigation of the project area between July and August, 2007. This work consisted of a review of the geologic and soil survey literature of the project area and a surface reconnaissance of the site. Sediment within the Grass Valley is derived from continuous uplift and erosion of the Sierra Nevada. H&K noted that the western and central portions of the property contained abandoned mine features; the eastern portion was disturbed, but undeveloped. The topography of the property slopes toward the south and southwest from a flat lying area in the northern portion and a knoll in the northern central portion of the area. The Spring Hill shaft located within the central portion of the property, just as it is depicted on the historical Spring Hill Mine map. The shaft has been capped with concrete. H&K also observed the several concrete foundations that correspond with the locations of mining features recorded as CA-29-002455 and depicted on the 1942 Uren map. No structures remain on the foundations. Mine waste (waste rock composed of mineralized serpentine and diabase rock with quartz) was noted on approximately 6.5 acres of the 27 acre project area. The existing fill is comprised of waste rock, which is not considered suitable to support structural improvements. This type of soil will have to be removed from the site and replaced with compacted fill (Holdrege & Kull 2015). While the subsurface soils in the APE appear to be largely comprised of waste rock fill, it is possible that subsurface historical material or deposits could be present based on the extended history of use of this area.

3.2 NAHC Search

The Native American Heritage Commission (NAHC) was contacted by Dudek on March 14, 2016 to request a search of the Sacred Lands File (Appendix B). The NAHC responded on March 24, 2016 indicating that the search failed to identify any Native American resources in the vicinity of the project and provided a list of individuals and organizations to contact that may have additional information.

3.3 Tribal Correspondence

Following the NAHC response, letters were sent on April 5, 2016 to the listed tribal representatives with the intent of requesting information, opinions or concerns relating to the proposed project impacts (Appendix B). These letters contained a brief description of the planned Project, reference maps, and a summary of the NAHC SLF and NCIC search results. No response to these outreach attempts have been received to date. The lead agency will be provided with any responses should they be received from tribal representatives.

3.4 Methods

Dudek Archaeologist Kurt Lambert conducted an intensive pedestrian cultural survey of the of the project area on April 28, 2016. All field practices met the Secretary of Interior's standards and guidelines for a cultural resources inventory. The intensive-level survey methods consisted of a pedestrian survey conducted in parallel transects spaced no more than 10 meters apart over the entire project area. Within each transect, the ground surface was examined for prehistoric artifacts (e.g., flaked stone tools, tool-making debris, stone milling tools, ceramics, fire-affected rock), soil discoloration that might indicate the presence of a cultural midden, soil depressions, features indicative of the current or former presence of structures or buildings (e.g., standing exterior walls, post holes, foundations), and historic artifacts (e.g., metal, glass, ceramics, building materials). Ground disturbances such as burrows, cut banks, and drainages were also visually inspected for exposed subsurface materials. The previously recorded historic Spring Hill Mine Site, P-29-2455 (CA-NEV-1538), was relocated during the pedestrian survey.

Mr. Lambert took detailed notes and photographs of the Spring Hill Mine site and the surroundings. All fieldwork was documented using field notes, digital photography, a Global Positioning System (GPS) receiver with sub-meter accuracy, iPad technology with close-scale field maps, and aerial photographs. Location-specific photographs were taken using an Apple 3rd Generation IPAD equipped with 8 MP resolution and georeferenced PDF maps of the project site. Accuracy of this device ranged between 3 meters and 10 meters.

Documentation of the Spring Hill Mine complied with the Office of Historic Preservation (OHP) and Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740) and the California Office of Historic Preservation Planning Bulletin Number 4(a). Spring Hill Mine, P-29-2455 (CA-NEV-1538), was recorded on California Department of Parks and Recreation Form DPR 523L (Series 1/95) Continuation Sheet, using the *Instructions for Recording Historical Resources* (Office of Historic Preservation 1995). The DPR Form will be submitted to the NCIC and included in Confidential Appendix A.

3.5 Field Survey Results

Dudek Archaeologist Kurt Lamburt conducted the intensive-level pedestrian survey of the entire project area on April 28, 2016 using standard archaeological procedures and techniques. Mr. Lamburt relocated the Spring Hill Mine site (P-29-2455) during the field survey (Figure 3).

Figure 3 Feature 5 "basement" area current condition

The abandoned Spring Hill Mine concrete foundations, machinery anchors features, and shaft location were identified within the western portion of the project at their recorded location. As previously reported, the eastern portion is disturbed but no mining or other features are present. The distribution and number of features at P-29-2455 was noted to be consistent with the 2001 recordation, and the boundary as previously defined remains appropriate. The features have been subject to additional graffiti and illicit dumping of modern refuse. An updated DPR Continuation form for the Spring Hill Mine site was prepared for with the results of this survey, and is included in Confidential Appendix A. No historical debris or other cultural constituents were observed on the surface.

4 SUMMARY AND MANAGEMENT CONSIDERATIONS

The current cultural resources inventory was completed to satisfy the requirements of CEQA. A NAHC Sacred Lands File search did not identify cultural resources within the project area. Subsequent outreach to NAHC-listed Native American representatives has failed to receive any responses to date. The NCIC records search identified one previously recorded resource, the Spring Hill Mine site (P-29-002455), located within the project area. This resource was previously determined to be not significant (i.e., not eligible for CHRH or NRHP listing). The Spring Hill mine was relocated by Dudek during the current pedestrian survey. The distribution of mining features associated with this resource was observed to be as previously recorded; though this area has since been since subject to evident vandalism and illicit dumping of garbage. Dudek's Phase I cultural resources inventory of the project area suggests that there is some potential for the inadvertent discovery of intact historical mining deposits during earth moving activities.

The Spring Hill Mine was evaluated by Caltrans in 2001 and 2005 as not being eligible for on the NRHP or CRHR. As noted in the Caltrans studies, the integrity of this site was compromised through removal of the Spring Hill mining equipment and associated buildings. The remaining concrete features provide limited data potential beyond descriptive recordation previously completed. The findings of the Caltrans study appears to be appropriate. However, in consideration of the extended historical use in this location, there is some potential for yet-identified historical deposits in this area. Dudek recommends that a qualified archaeologist should be present at least one Dorsey Marketplace Project preconstruction meeting to discuss archaeological sensitivity within the project area, and to outline stop-work procedures should historical archaeological deposits be encountered by construction personnel.

In the event that archaeological resources are exposed during construction, ground-disturbing work in the immediate vicinity of the find should be halted until a qualified archaeologist meeting the Secretary of the Interior's Professional Qualification Standards can evaluate the significance of the find for CRHR/NRHP listing. Ground-disturbing activities may continue a elsewhere, but should be redirected a safe distance from the find. If the new discovery is evaluated and found to be significant under CEQA, and avoidance is not feasible, additional work such as data recovery may be warranted.

In the event of the discovery of human remains during ground disturbing activities, the State of California Health and Safety Code Section 7050.5 states that no further disturbance shall occur in areas which could contain human remains until the County coroner has made a determination of origin and disposition pursuant to PRC Section 5097.98. The County coroner must be notified of the find immediately. If the human remains are determined to be of Native American origin, the coroner will notify the NAHC within 24 hours. The NAHC will then determine and notify a MLD. The MLD shall complete the inspection of the site within 48 hours of notification and may recommend means of treating or disposing of, with appropriate dignity, the human remains and items associated with Native Americans.

6 REFERENCES

16 U.S.C. 470–470x-6. National Historic Preservation Act of 1966, as amended.

36 CFR 60. National Register of Historic Places.

36 CFR 800.1–800.16 and Appendix A. Protection of Historic Properties.

48 FR 44720–44726. "The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act." April 24, 1998.

1978. "Outline of History of California Vegetation." In *Terrestrial Vegetation of California*, edited by M.G. Barbour and J. Major, 139–194. New York, New York: Wiley and Sons.

BLM (Bureau of Land Management). 2004. "The Foundations for Managing Cultural Resources." Section 8100 in the *BLM Manual*. Release no. 8-72. December 3, 2004.

Bureau of Reclamation. 2010. Cultural Resources Survey for the Closure of Eight Abandoned Mines in the Oregon Hill Area of Auburn State Recreation Area, Placer County, California. Mid-Pacific Region. Prepared by Joanne E. Goodsell and Amy Dunay, Division of Environmental Affairs Cultural Resources Branch. Report on file at 2800 Cottage Way, MP-153 Sacramento, CA 95825. Carlson, Anne 1986.

Carlson, Anne 1986. T*ahoe National Forest Cultural Resources Overview, Part II: Ethnography. Tahoe National Forest*, Cultural Resources Report Number 19. Nevada City, California.

Chalmers, Claudine 2006. *Images of America: Grass Valley*. Arcadia, San Francisco.

Costello, J.G. and J. Marvin. 2002. *Results of Phase II Test Excavations at The Mountain Quarries Site: Historic Component of CA-ELD-616/H Near Cool, El Dorado County*. Prepared for California Department of Transportation. Report on file at Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

CSP (California State Parks). 2009. "Preservation Matters." *The Newsletter of the California Office of Historic Preservation* 2(3):3–21.

CRM (Cogstone Resource Management Inc.). 2011. *Cultural Resources Assessment Update Report for the Rincon Del Rio Project, Nevada County, California*.

Davis, E.L. 1978. *The Ancient Californians: Rancholabrean Hunters of the Mojave Lakes Country*. Los Angeles, California: Natural History Museum of Los Angeles County.

Davis, L.M. 1975. Dry Diggings on the North Fork: Personal Observations of Auburn, California in the Days of '49. Published by Placer County Museum Foundation.

Dillon, Brian D. 2002. "California PalaeoIndians: Lack of Evidence, or Evidence of a Lack?" In: *Essays in California Archaeology: A Memorial to Franklin Fenenga*, edited by William J. Wallace and Francis A. Riddell, 110–128. Contributions of the University of California Archaeological Research Facility, No. 60. Berkeley.

Elsasser, Albert B. 1960. *The Archaeology of the Sierra Nevada in California and Nevada*. University of California Archaeological Survey Reports 51. Berkeley.

Elston, Robert G., Jonathan O. Davis, and G. Townsend 1977. *The Archaeology of the Tahoe Reach of the Truckee River*. Submitted to the Tahoe-Truckee Sanitation Agency, Nevada.

Foster, D., and J. Betts 1996. The Pleistocene-Holocene Transition Along the Pacific Coast of North America. In: *Humans at the End of the Ice Age*, edited by L.G. Strause, B.V. Eriksen, J.M. Erlandson, and D.R. Yesner, pp. 277-301.

Golla, V. 2007. "Linguistic Prehistory." In *California Prehistory: Colonization, Culture, and Complexity,* edited by T.L. Jones and K.A. Klar, 71–82. New York, New York: Altamira Press.

Grunsky, F. R. 1989. *Pathfinders of the Sacramento Region: They Were There Before Sutter*. Sacramento County Historical Society.

Heizer, Robert F., and Albert B. Elsasser. 1953. *Some Archaeological Sites and Cultures of the Central Sierra Nevada.* University of California Archaeological Survey Reports 12. Berkeley.

Holdrege & Kull 2007. "Geotechnical Engineering Report for Former Spring Hill Mine Property, Grass Valley, California"

Homer, A.T. 1988. *Auburn and Placer County: Crossroads of a Golden Era*. Windsor Publications, Inc., Northridge, CA

Hull, Kathleen L. 2007. "The Sierra Nevada: Archaeology in the Range of Light." In California Prehistory: Colonization, Cultural and Complexity, edited by Terry L. Jones and Kathryn A. Klar. Lanham, MD: AltaMira Press.

Jensen, Peter 2001. "Archaeological Survey, DeSena 6.5 acre Development Project." On File at the North Central Information Center.

Kroeber, A. 1925. *Handbook of the Indians of California.* Washington D.C.: Smithsonian Institution.

Lardner, W.B. and M.J. Brock 1924. *History of Placer and Nevada Counties, California.* Historical Record Company, Los Angeles, California.

Medin, AnnMarie. 2005. "Historic Property Survey Report Dorsey Drive" On File at the North Central Information Center.

Moratto, Michael J. 1984. *California Archaeology*. San Diego: Academic Press.

1999. Cultural Chronology 2: The Yosemite Data. In Archaeological Synthesis and Research Design, Yosemite National Park, California, edited by Kathleen L. Hull and Michael J. Moratto, pp. 121-204. Yosemite Research Center Publications in Anthropology No. 21

NETR, 2016. http://www.historicaerials.com/ accessed May 4, 2016.

NPS (National Park Service). 2009. Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines [As Amended and Annotated]. Electronic document, http://www.nps.gov/ history/local-law/arch_stnds_0.htm, accessed on March 19, 2009.

NPS and ACHP (National Park Service and the Advisory Council on Historic Preservation). 1998. The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act. Published jointly by the National Park Service of the U.S. Department of the Interior and the Advisory Council on Historic Preservation.

Nevada Irrigation District 2005. "History." Nevada Irrigation District website: http://nidwater.com/about-nid/history/. Accessed 8/11/14.

Office of Historic Preservation. 1995. "Instructions for Recording Historical Resources." California State Parks, Office of Historic Preservation. March 1995. http://ohp.parks.ca.gov/ pages/1054/files/manual95.pdf.

Powers, Stephen 1877. *Tribes of California. Contributions to North American Ethnology, Volume III.* Department of the Interior, U.S. Geographical and Geological Survey of the

Rocky Mountain Region. Washington D.C.: Government Printing Office. Reprinted 1976 by University of California Press, Berkeley, California.

Riddell, F. A. 1978. Maidu and Konkow. In California, edited by Robert F. Heizer, pp. 370–386. *Handbook of North American Indians,* vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Selverston, Mark D. 2008. *A Cultural Resources Study for the Lake Combie Mercury Extraction Project, Nevada and Placer Counties, California.* Prepared by Anthropological Studies Center, Sonoma State University, for Nevada Irrigation District.

Squire, J.E. 1867. Sketch of Little York Township. In: *Bean's History and Directory of Nevada County, California*. Compiled by E.F. Bean. Daily Gazette Book and Job Office: Nevada. pp.367-372.

Storer, Tracy I., and Robert L. Usinger 1963. *Sierra Nevada Natural History*. University of California Press, Berkeley.

Werner, Roger 1989. "An Archaeological Survey of the Proposed Nevada Terraces Development, Grasss Valley, Nevada Co. CA." On File at the North Central Information Center.

Western Mining History. 2012. "The Mining Towns of California." Western Mining History. May 15, 2012. http://www.westernmininghistory.com/articles/37403/page1. Accessed July 24, 2014.

Wilson, Norman L., and Arlean H. Towne. 1978. "Nisenan." In California, edited by Robert F. Heizer, 387–397. Handbook of North American Indians, Vol. 8, William G. Sturtevant, general editor. Washington, D.C.: Smithsonian Institution.

Wohlgemuth, Eric. 1984. *Archaeological Investigations at CA-PLA-500, The Sailor Flat Site*. Tahoe National Forest Cultural Resources Report 16.

APPENDIX A (CONFIDENTIAL)

NCIC Results and DPR Forms

APPENDIX B (CONFIDENTIAL)

NAHC and Tribal Correspondence

APPENDIX C

Archaeological and Geotechnical Report

557

GRASS VALLEY
NEV-01-47

Peter M. Jensen

Archaeological • Historical • Cultural Resource Management Studies

9726 Lott Road • Durham, CA 95938-9742 • (530) 345-9515 • FAX (530) 345-0651 • p1m2j3@aol.com

545 Ocean View Drive • Hilo, HI 96720 • (808) 935-7551

Wednesday, June 6, 2001

Nevada City Engineering, Inc.
Attention: Andrew R. Cassano
505 Coyote Street, Suite B
Nevada City, California 95959

Subject: ***Archaeological Survey, DeSena 6.5-acre Development Project.***

Dear Mr. Cassano:

Per your request, Jensen & Associates conducted a high intensity, complete coverage archaeological inventory survey of the above referenced property, which consists of three separate parcels totaling approximately 6.5 acres and located close to Highway 49/20, north of Empire Mine Road, and accessed via Spring Hill Drive. The parcel will affect lands located within a portion of Sections 26 and 23 of Township 16 North, Range 8 East, as shown on the USGS Grass Valley, California, 7.5' series quad (see attached *Project Location and Archaeological Survey Area Map*).

According to agency definitions, proposed further development of this property constitutes an "undertaking" which could adversely affect various types of resources located within the Area of Potential Effect (APE), which consists of the 6.5 acre property itself. Evaluation of effects to such resources must be undertaken in conformity with Nevada County rules and regulations, in compliance with requirements of the California Environmental Quality Act of 1970, Public Resources Code, Section 21000, et seq. (CEQA), and The California Environmental Quality Act Guidelines, California Administrative Code, Section 15000 et seq. (Guidelines, as amended October 1998), prepared by the Office of Planning and Research.

As part of the CEQA requirements, an archaeological Records Search has been requested from the North Central Information Center at CSU-Sacramento (Preliminary results acquired from a previous search involving adjacent lands, written results pending). These records indicate the following existing conditions for the project area:

- None of the project area has been formally surveyed for cultural resources. Several surveys have been undertaken in the immediate vicinity, although there appears to have been only minimal overlap of these previous surveys into the present project area boundaries.

- No sites are currently formally recorded within or immediately adjacent to the project area, although both prehistoric and historic-period sites have been recorded within the vicinity.

- In view of at least moderate archaeological sensitivity of this area for cultural resources, combined with the lack of previous survey involving this property, the Information Center recommended a pedestrian survey prior to approval of ground disturbing impacts.

In addition to the official Nevada County archaeological records maintained by the North Central Information Center of the California Historical Resources Information System, the following documents were reviewed in an effort to recover additional cultural data:

- The National Register of Historic Places (1986, Supplements to 12/00).
- The California Inventory of Historic Resources (State of California 1976).
- The California Historical Landmarks (State of California 1990).

With this information in hand, the author proceeded to the project site on Monday, June 4, 2001, and completed a pedestrian field survey by walking non-systematic transects back and forth across the project area, with transect spacing maintained at c. 20- to 30-meter intervals. Property boundaries were easily determined on the basis of adjacent fully developed properties, fencing, and the Golden Center Freeway (Highway 20 and 49) located a short distance northwest.

The project area has been substantially impacted by a variety of activities, including especially past mining associated with both the Spring Hill and Idaho-Maryland operations. As well, portions of the property appear to have been the recipient of imported demolition and other debris, as well as limited grading, excavation, and other impacts.

Specific findings from the intensive-level pedestrian field survey are as follows:

Prehistoric Resources: No evidence of prehistoric activity or occupation was observed during the survey. These negative results may be at least partially explained by the lack of a permanent surface water source within or immediately adjacent to the property, combined with extensive prior disturbance to which all of the property has been subjected.

Historic Resources: No clear evidence of historic-period occupation, refuse disposal, or homesteading was observed. These negative results may be explained in part by disturbances to which the property has been subjected.

Impacts to the land surface and surface contours appear to have accompanied the intensive mining operations in the immediate vicinity. These impacts are evident in the form of boulders and rubble which have been pushed down onto the property from the Spring Hill Mine to the north, on an adjacent parcel. Several large excavated holes are also present within the project area, although it is not at all clear that these relate to historic mining operations – they may represent debris from clean-up following abandonment of the Spring Hill operation. No built environment exists within this property, which may itself be at least partially explained by the generally steep slopes which characterize most of the area.

In view of the negative results achieved during both the records search and pedestrian survey, it seems reasonable to conclude that further development of this property will not affect archaeological or historic sites deemed significant per CEQA.

Despite these negative findings, the following general provision remains appropriate:

> The present evaluation and recommendations are based on the findings of an inventory-level surface survey only. There is always the possibility that significant unidentified cultural materials could be encountered on or below the surface during the course of future development or construction activities. In such a situation, archaeological consultation should be sought immediately.

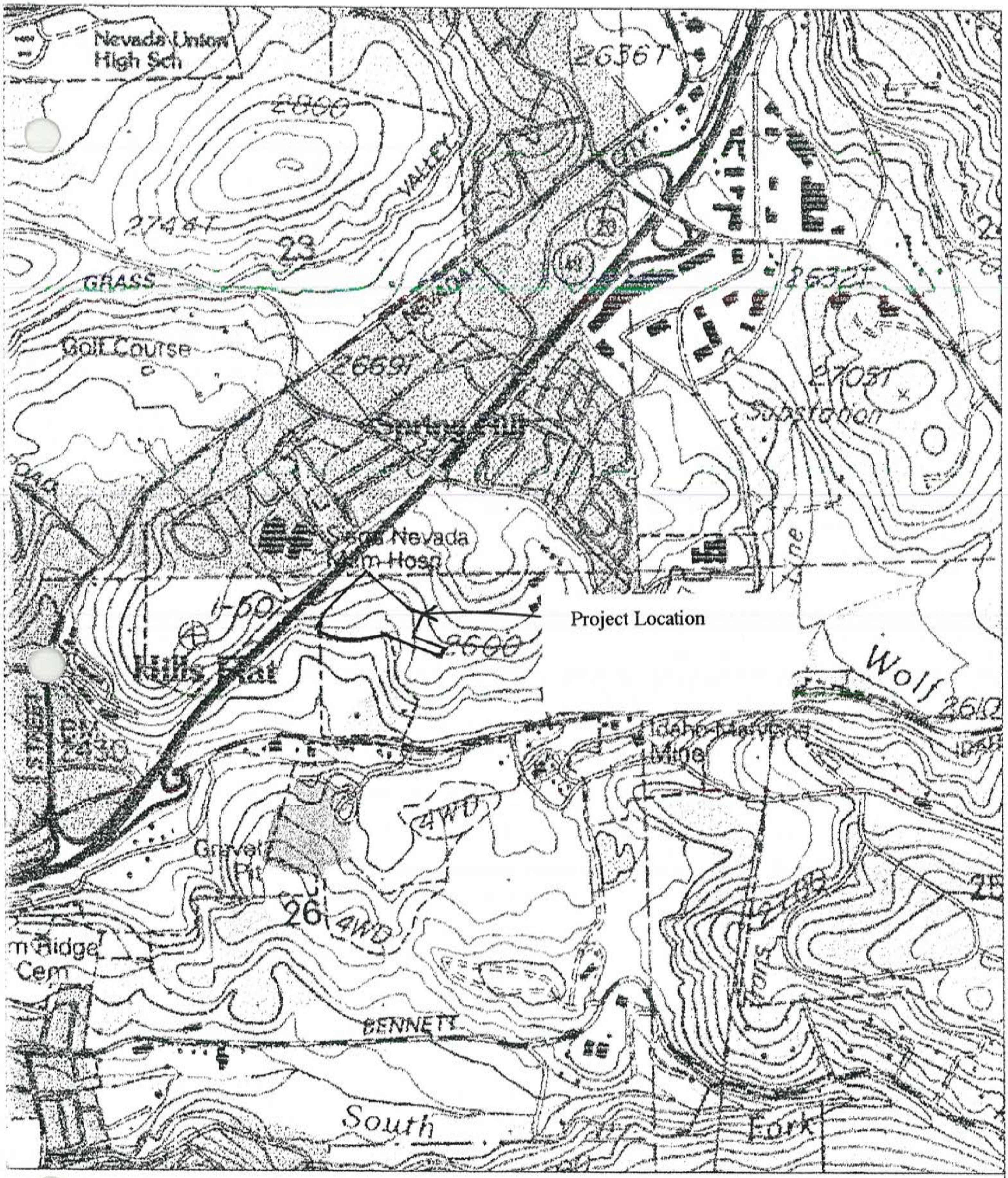
In view of the negative findings of the present project, the present letter is intended as a Final Report. If you or any of the review agencies have any questions concerning our survey findings or recommendations, please don't hesitate to contact me at your earliest convenience.

Sincerely Yours,

Peter M. Jensen, Ph.D.

***KEYWORDS** for Information Center Use:*

Inventory Survey, Nevada County, approx. 6.5-acres, USGS Grass Valley, California, 7.5' Series Quad., CEQA. No Prehistoric or Historic Resources Recorded.



e: GRASS VALLEY
ate: 5/23/101
Scale: 1 inch equals 1000 feet

Location: 039° 13' 36.9" N 121° 02' 24.4" W
Caption: Stephen DeSena

(2907) #2907

Archaeological

Services Inc.

(209) 474-7185 1117 Aberdeen Avenue • Stockton, California 95209

March 20, 1989

Anda O'Connell
Rooftree, Inc.
P.O. Box 406
Rockton, Il 61072

AN ARCHAEOLOGICAL SURVEY OF THE PROPOSED NEVADA TERRACES DEVELOPMENT, GRASS VALLEY, NEVADA COUNTY, CALIFORNIA

INTRODUCTION

This report presents the results of an archaeological survey conducted on 17 March 1989 by John H. Pryor, Research Archaeologist for Archaeological Services, Inc., Stockton, California. No archaeological resources were discovered within the project boundaries. The survey area consisted of approximately 5.6 acres located in Nevada County, California. The investigation was authorized by Anda O'Connel, representing Rooftree, Inc. The survey was required by the Farmers Home Administration (FmHA), pursuant to the National Historic Preservation Act and related federal regulations.

The purposes of the survey were: (1) to identify and record any archaeological resources, prehistoric or historic, that might be situated within the Area of Potential Effect (APE); (2) to make preliminary evaluations regarding the significance and National Register eligibility of identified archaeological resources; and (3) to propose recommendations for mitigation of potential impacts to identified archaeological resources.

PROJECT LOCATION AND DESCRIPTION

The APE was situated within the NE quarter of Section 26 and the SE quarter of Section 23, T16N, R8E, MDB&M, as depicted on the Grass Valley, California 7.5' USGS topographic quadrangle (1949, pr. 1973). Boundaries were determined by the use of a road map, USGS topographic map, and a parcel map. The southern and western boundaries of the APE were readily determined by the extent of adjacent property developments. The northern and western boundaries were unmarked but could be identified by nearby roads, prominent hills, and adjacent property lines. The project area is depicted on maps 1 and 2.

(209) 224-9077
Fresno, California

(707) 277-9533
9467 Chippewa Trail • Kelseyville, CA 95451

The survey area consisted of a roughly square parcel with a slight to moderate southerly slope. The entire parcel has been recently graded and lacks buildings or other related developments. The majority of the parcel consisted of open hillside that lacked vegetation except for sparse low grass.

Field work was carried out by John H. Pryor. Mr. Pryor has a Ph.D. in Anthropology and has 15 years of archaeological field experience in California. The report was prepared by Roger H. Werner. Mr. Werner has a Master of Arts Degree in Anthropology and 14 years of California archaeological field experience.

METHODS

The method employed in the archaeological investigation consisted of three steps. Initially, the ethnographic literature, archaeological base maps, site records, prior survey reports, and historical documents on file at the North Central Information Center of the California Archaeological Inventory (housed at California State University, Sacramento) were reviewed by Center staff (see Appendix 1) to determined whether recorded archaeological historical, or ethnographic sites were situated within the project area.

The second part of the investigation consisted of a intensive on-foot survey of the project (conducted in accordance with the specifications proposed in 36 CFR Part 64 Appendices A and B). Ground visibility was excellent throughout the parcel. Small outcrops of bedrock were carefully inspected for bedrock mortars.

RESULTS AND RECOMMENDATIONS

As a result of the record search, it was determined that no cultural resources had been recorded within the boundaries of the project. The archaeological data base revealed that several prehistoric archaeological sites have been recorded within a mile of the APE. Further, the APE is situated within the Nevada City Mining District, adjacent to the Spring Hill Mine. Other historic sites or features nearby include the Nevada Narrow Gauge Railway and Stone Ditch. While numerous mining related sites and features are known to exist in the vicinity of the project area, none of these are situated within the APE.

The records search indicated that the project area (1) had not been subjected to previous archaeological study, and (2) was located in an area of moderate to high archaeological sensitivity. Information Center staff recommended an archaeological survey because it appeared possible that the lack of cultural resources, particular historic-period sites and features, may have been a result of a lack of systematic survey.

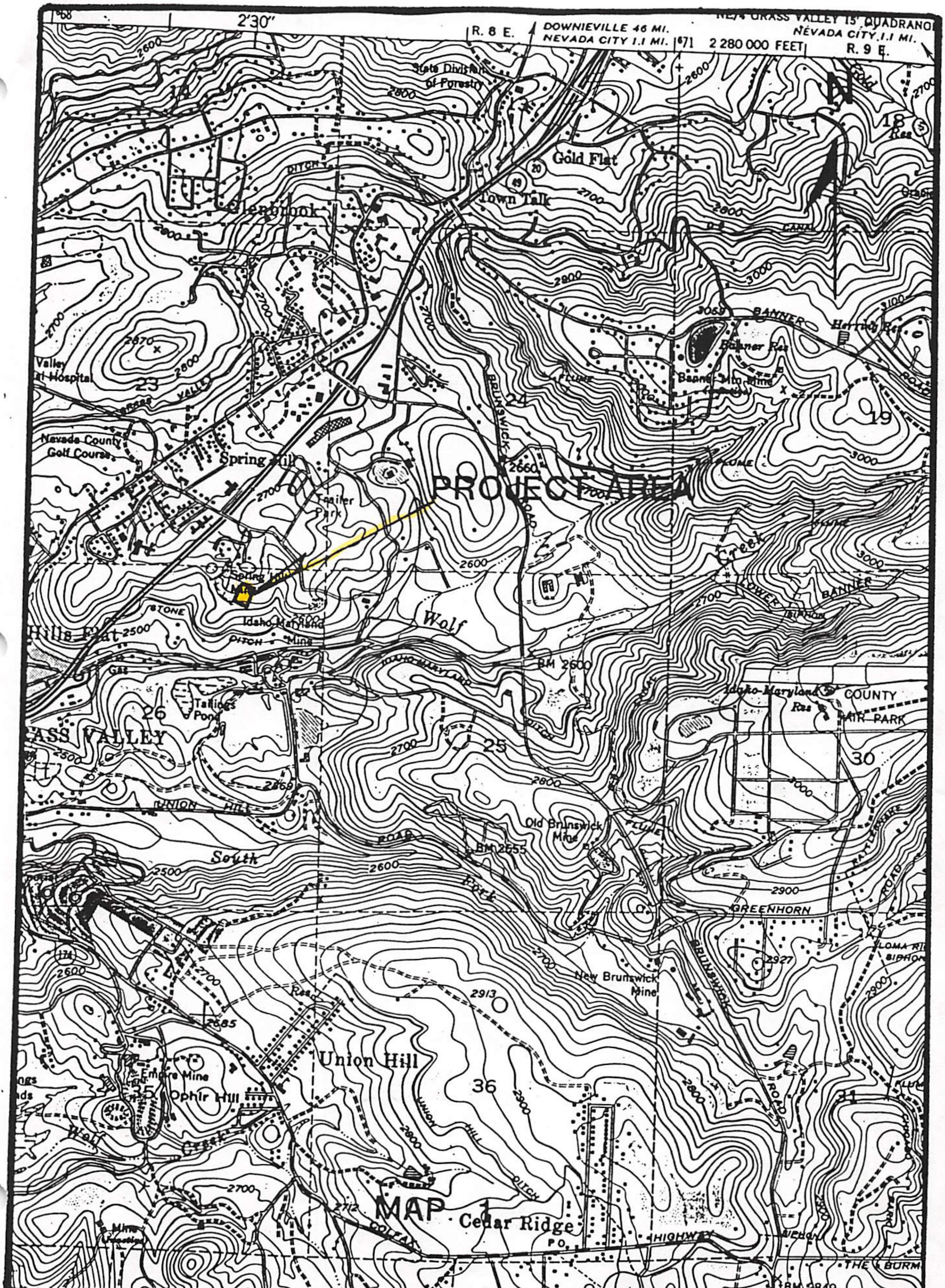
No archaeological sites were discovered as a result of the survey. Remains of the Spring Hill Mine were noted to the north of the APE and should not be effected by project development.

In that no cultural resources were noted within the project area, site-specific recommendations are unnecessary. It is unlikely that buried archaeological remains will be uncovered as the project area has been extensively graded and disturbed. However, should archaeological materials such as obsidian, bone, glass and ceramic fragments, or square nails be uncovered during project development, it is recommended that a qualified archaeologist be retained to evaluate the finds and propose recommendations as appropriate.

Roger H. Werner

President
Archaeological Services
1308 West Robinhood Drive, Suite 4B
Stockton, California 95209
(209) 474-3121

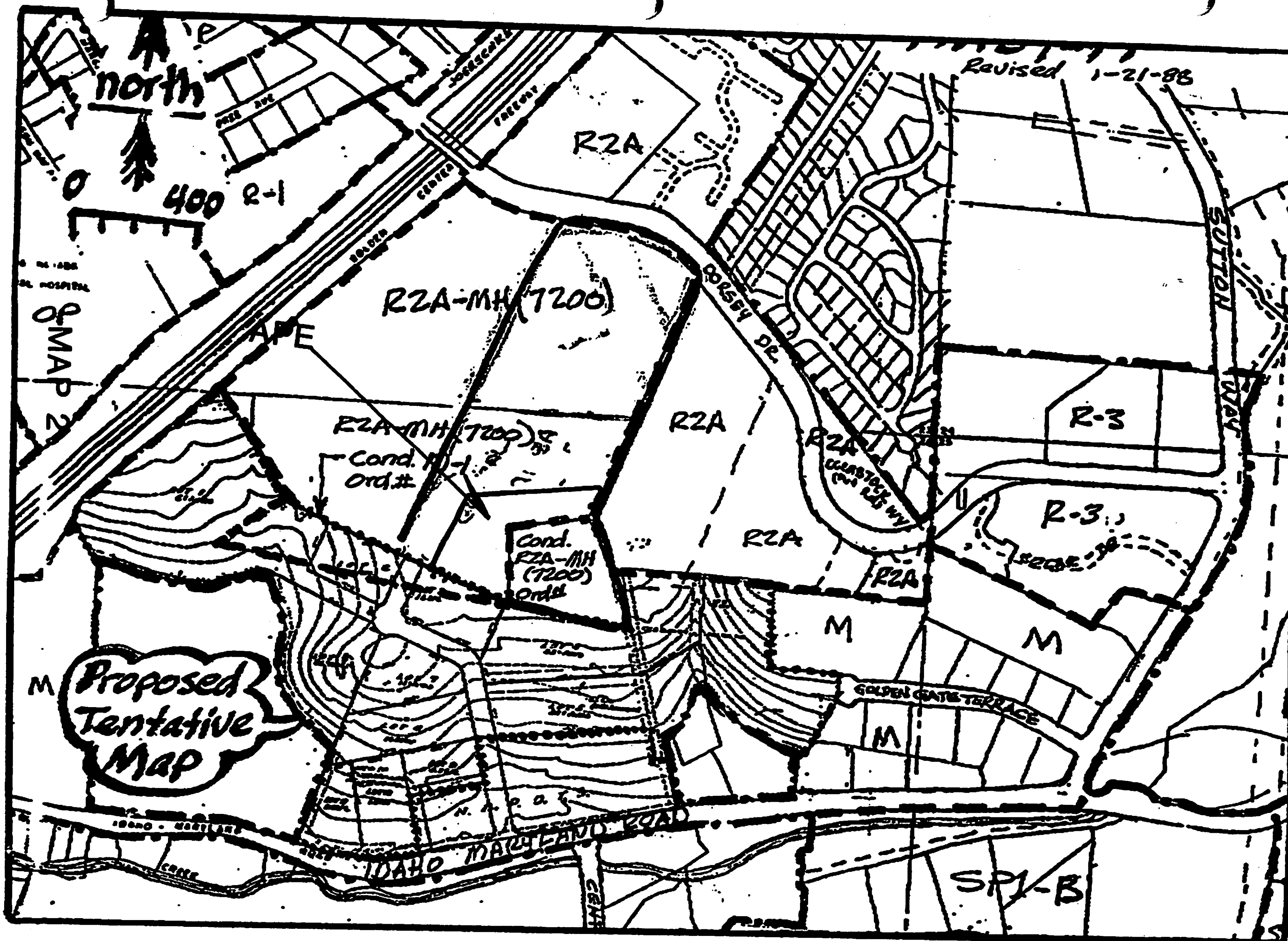
cc: Farmers Home Administration



1": 2000'

GRASS VALLEY 7.5 MINUTE

T16N/R8E/SEC 26



north
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400
R-1
Revised 1-21-88
SUTTON WAY
R2A
R2A-MH (7200)
DORSEY DR.
R2A
R2A
R2A
R2A
R-3
R-3
R2A-MH (7200)
Cond. R-1
Ord.#
Cond. R2A-MH (7200) Ord#
M
M
M
M
GOLDEN GATE TERRACE
IDAHO MARYLAND ROAD
SP1-B
Proposed Tentative Map
MAP 2

NEV-05-114
1-3-06

HISTORIC PROPERTY SURVEY REPORT

(6706)

California Department of Transportation

1. UNDERTAKING DESCRIPTION AND LOCATION

District	County	Route *(Local Agency)*	Kilo Posts *(Project prefix)*	Post Miles *(Project No.)*	Charge Unit *(Agreement)*	Expenditure Authorization *(Location)*
03	NEV	20	21.9/23.8	13.6/14.8		412400

(Both kilometer posts and post miles must be completed above. For Local Assistance projects off the highway system, use headers in italics)

Project Description: *(Insert project description below; refer reader to location and vicinity maps in HPSR)*

The California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA), in cooperation with the Nevada County Transportation Commission (NCTC) propose to convert Dorsey Drive Overcrossing to an interchange and connect with Route 20/49 to improve transportation and access for the region. The proposed project is situated at the interchange of Dorsey Drive and SR 20, Grass Valley, Nevada County, California (Figures 1 and 2). This project proposes to construct a tight-diamond interchange at the existing Dorsey Drive overcrossing on Route 20/49 in Nevada County. Improvements include replacing the existing 2-lane structure with a 5-lane structure, constructing on- and off-ramps, the construction of auxiliary lanes between existing ramps and proposed ramps, and the realignment of Joerschke Drive. Three soundwalls are proposed for the project. These improvements will:

- Provide direct access to specific high use sites (Sierra Nevada Memorial Hospital and Sierra College
- Relieve operational problems at the existing interchanges of Idaho-Maryland/East Main Street (to the south) and Brunswick Road (to the north).
- Provide additional capacity on Dorsey Drive for future development in accordance with adopted city and county general plans

The proposed project will require approximately 2.33 hectares (ha) (5.75 acres) of new right of way (R/W) consisting of purchase or easements, along the highway and Dorsey Drive from private landowners. Utilities will be affected.

2. AREA OF POTENTIAL EFFECTS

The Area of Potential Effects (APE) was approved by Caltrans staff archaeologist Anmarie Medin, architectural historian Gail St. John, and Project Manager Winder Bajwa on November 30, 2005. See Appendix A for project location, vicinity, and APE maps (Figures 1, 2, and 3, respectively).

The APE for the proposed project includes the existing state right-of-way and proposed right of way along Highway 20 between KP 21.9 (PM 13.6) and KP 23.8 (PM 14.8) in Nevada County. The maximum horizontal extent of the APE is 23 meters (75 feet) or less from the edge of the traveled way for the new structural section, shoulder, and slope work. The vertical extent of the APE varies from a maximum of 3 meters (9.8 feet) or less for the new structural section;

For the federal undertaking described in Part 1: To minimize redundancy and paperwork for the California Department of Transportation and the State Historic Preservation Officer, and in the spirit intended under the federal Paperwork Reduction Act (U.S.C. 44 Chapter 35), this document also satisfies consideration under California Environmental Quality Act Guidelines Section §15064.5(a) and, as appropriate, Public Resources Code §5024 (a)(b) and (d).

1.5meters (4.9 feet) for the light standard foundations; 7.6 meters (24.9 feet) for the overhead sign foundations; and 0.8 meters (2.6 feet) for the trench for electrical (see Map 3). New right of way will be required for this project.

The archaeological APE was established as including all area of potential direct impact (ground disturbance, construction easements, utility relocations, etc.) and includes the full extent of the horizontal and vertical limits of construction impacts in discussion with Design and Construction Engineers.

3. CONSULTING PARTIES / PUBLIC PARTICIPATION

(For the following, check the appropriate line, list names, dates, and locations and results of contacts, as appropriate. List organizations/persons contacted and attach correspondence and summarize verbal comments received as appropriate.)

_ Local Government *(Head of local government, Preservation Office / Planning Department)*

-

X Native American Tribes, Groups and Individuals

- Initial consultation was conducted in 2001. Second consultation was conducted in 2005. Caltrans archaeologist Erick Wulf sent letters on November 7,2005 and placed follow-up telephone calls on November 17, 2005. To date no replies have been received. Consultation letters are in Appendix B of the attached Archaeological Survey and Evaluation Report.

X Native American Heritage Commission

- Initial consultation in 2000 indicated there were no sacred sites within the project APE. The list of groups and individuals for direct contact was updated in 2005.

X Local Historical Society / Historic Preservation Group *(also if applicable, city archives, etc.)*

-

_ Public Information Meetings *(list locations, dates below and attach copies of notices)*

-

_ Other

-

4. SUMMARY OF IDENTIFICATION EFFORTS

X	National Register of Historic Places	Month & Year: 1979-2002 & supplements
X	California Register of Historical Resources	Year: 1992 & supplemental information to date
X	California Inventory of Historic Resources	Year: 1976
X	California Historical Landmarks	Year: 1995 & supplemental information to date
X	California Points of Historical Interest	Year: 1992 & supplemental information to date
_	State Historic Resources Commission	Year: 1980-present, minutes from quarterly meetings
X	Caltrans Historic Highway Bridge Inventory	Year: 2003 & supplemental information to date

X Archaeological Site Records [*List names of Institutions & date below*]

- North Central Information Center, March 17, 2000 with follow-up on November 15, 2005

x Other sources consulted *[e.g., historical societies, city archives, etc. List names and dates below]*

- See Historic Resources Evaluation Report (HRER) and Archaeological Survey and Evaluation report for specific repositories visited and research conducted to evaluate the historic-era properties.

_ **Results:** *(provide a brief summary of records search and research results, as well as inventory findings)*

- Small portions of the project APE had been previously surveyed and no cultural resources were previously identified within the project APE. One Point of Historic Interest (Nev-033, the Idaho-Maryland Mine) lies a short distance south of the project, but is well outside of the APE and the project will have no effect upon it.
- The present effort surveyed the entire APE, finding no properties that required evaluation.

5. PROPERTIES IDENTIFIED

(Check the appropriate category, list properties, or refer reader to appropriate technical study attached, according to their National Register status. Provide, as appropriate, complete address, period and level of significance, criteria, map reference, and any existing state or local designation. Do not include properties that are not within the APE. Attach previous SHPO determinations, as applicable.)

X **No cultural resources** in project APE.

X Anmarie Medin, who meets the Professionally Qualified Staff Standards in Section 106 Programmatic Agreement (Section 106 PA) Attachment 1 as a PI – Historical Archaeology, and Frank Lortie, Principal Architectural Historian, both determined that the only other properties present within the APE meet the criteria for Section 106 PA Attachment 4 (**Properties Exempt from Evaluation**).

_ **Bridges listed as Category 5** in the Caltrans Historic Highway Bridge Inventory. Appropriate pages from the Caltrans Historic Bridge Inventory are attached.

- The Dorsey Drive Overcrossing (Bridge # 17-081) was built in 1969, and consequently was rated a 5 (does not appear to be eligible) in the 1985-86 Caltrans historic highway bridge inventory. This structure has not attained an exceptional level of significance that is required for the evaluation of buildings and structures less than fifty years of age. Therefore, this structure was not formally evaluated and shall retain its rating of 5.
-

6. LIST OF ATTACHED DOCUMENTATION

(Provide the author/date and peer reviewer/date of the technical report)

X Project Vicinity, Location, and APE Maps (Appendix A of this HPSR)
X California Historic Bridge Inventory sheet
X Other *(Specify below)*

- Medin, Anmarie. Archaeological Survey Report. December 2005. Peer reviewed by Kendall Schinke and Erick Wulf, December 2005. (Attachment A to this HPSR)

7. FINDINGS – HPSR to File

(Check all that apply. Do not transmit to SHPO; file copy to CCSO)

X **No properties requiring evaluation** are present within the project's APE.

X Under the authority of FHWA, Caltrans has determined a Finding of **No Historic Properties Affected**, according to Section 106 PA Stipulation IX.A and 36 CFR 800.4(d)(1), is appropriate for this undertaking.

8. FINDINGS – HPSR to SHPO

(Check all that apply. Transmit to SHPO, copy to FHWA and CCSO)

-

9. HPSR PREPARATION AND DEPARTMENT APPROVAL

Prepared by *(sign on line)*:
District 3
Caltrans PQS discipline/level:

[signature]
Anmarie Medin
PI- Historical Archaeology
Co-PI – Prehistoric Archaeology

12-12-05
Date

Reviewed for approval by: *(sign on line)*

District 3
Caltrans PQS discipline/level:

[signature]
Erick Wulf
Co-PI – Prehistoric Archaeology

12/12/05
Date

Approved by: *(sign on line)*
District 3,
EBC:

[signature]
Japtej Gill
Chief, S4 Branch

12/13/05
Date

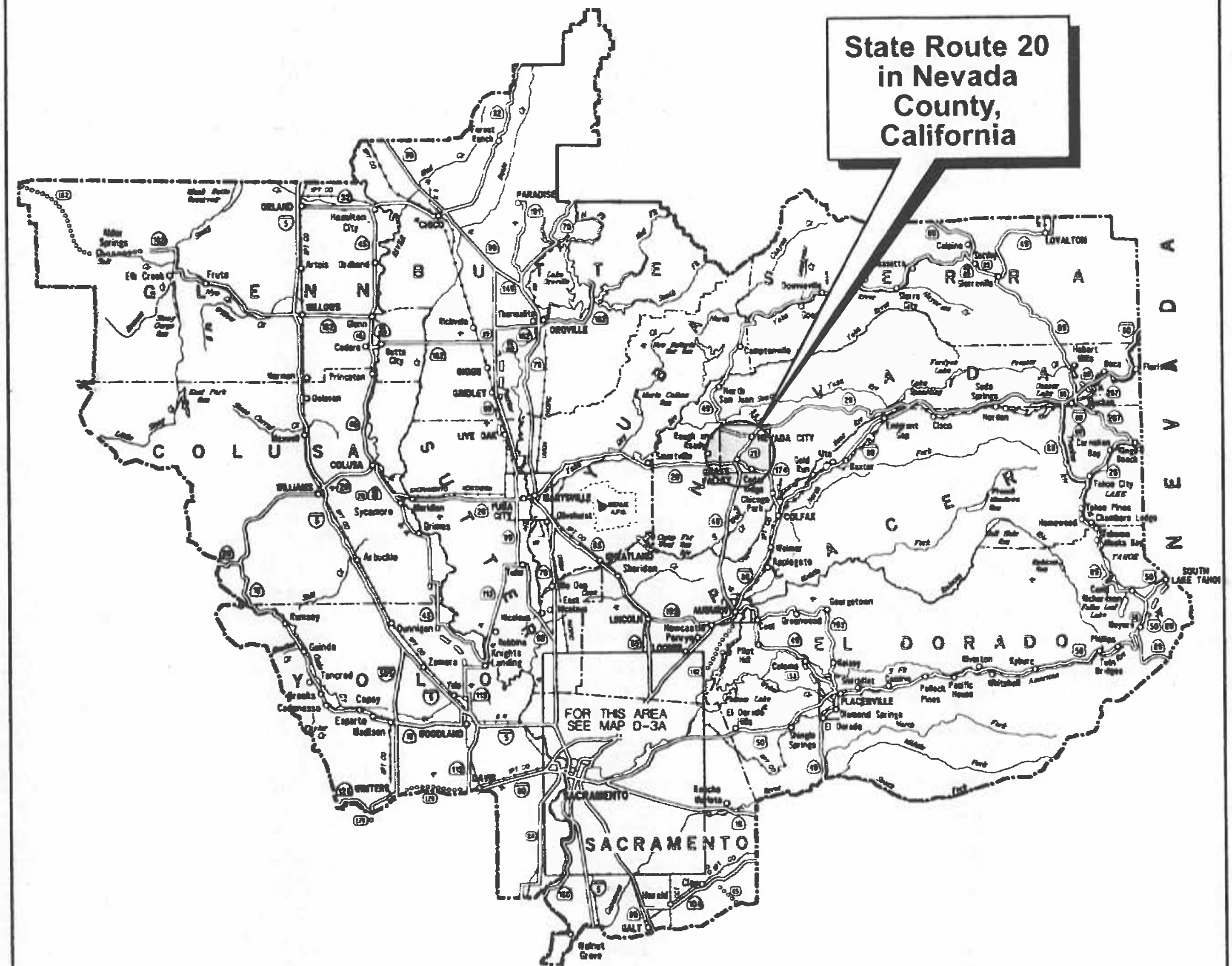
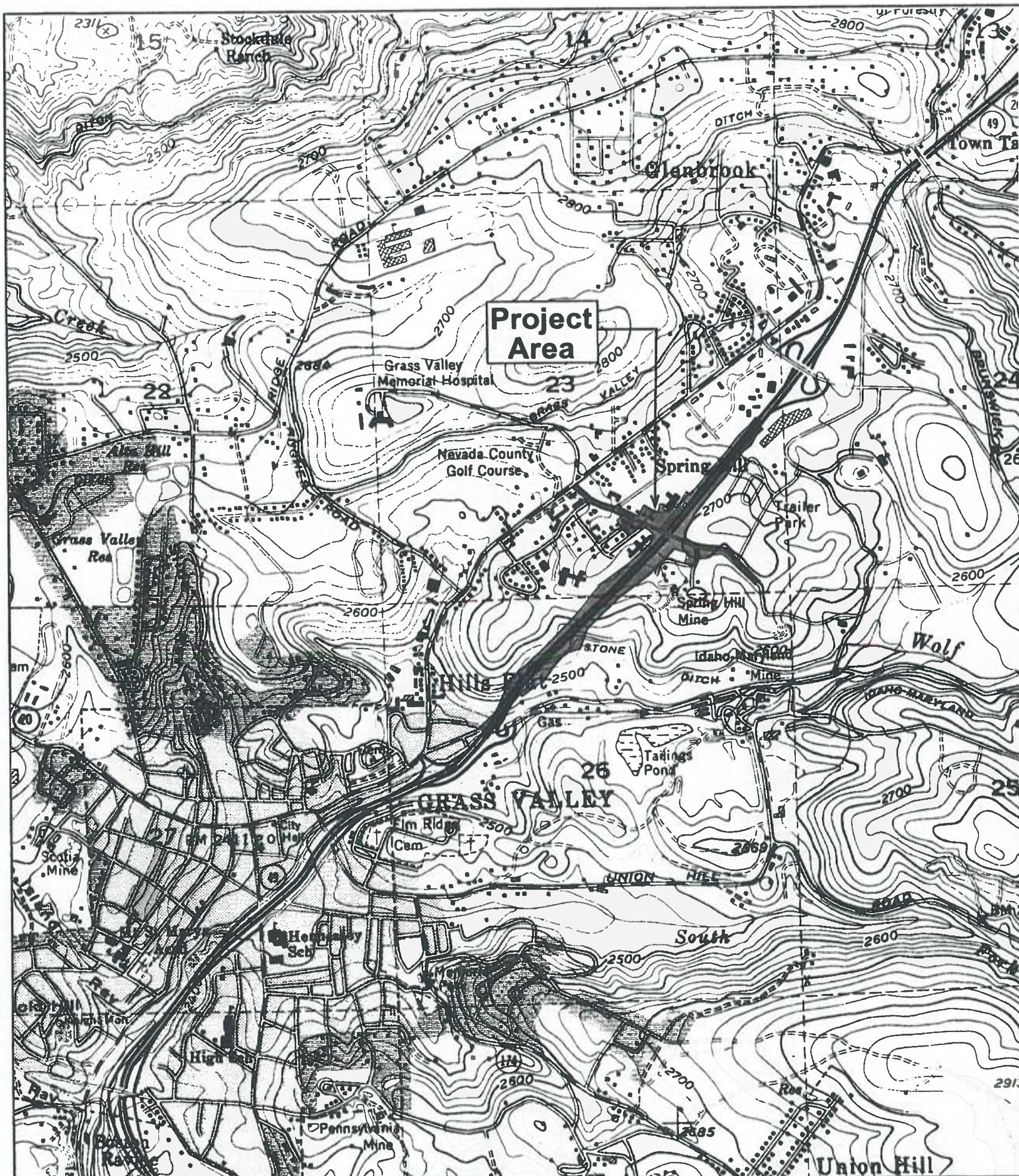


EXHIBIT 1
Project Vicinity Map

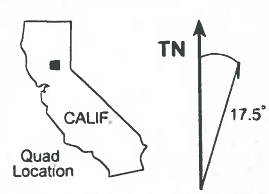
State of California
Department of Transportation

03-NEV-20
KP 21.8/23.6
(PM 13.6/14.7)
EA 03-412400

TN



Source: USGS 7.5' Quadrangle, Grassvalley, CA 1949 (rev.1973); T16N/R8E



State of California
Department of Transportation

Exhibit 2
PROJECT LOCATION

0 0.5 1 mile

0 0.5 1 kilometer

Scale: 1:24,000
Contour Interval 40 Feet

Dorsey Drive
03-NEV-20
KP 21.8/23.6
(PM 13.6/14.7)
EA 03-412400

Shrinkdot 4-6-01

ARCHAEOLOGICAL SURVEY REPORT
FOR THE PROPOSED DORSEY DRIVE INTERCHANGE PROJECT AT STATE ROUTE 20 IN NEVADA COUNTY, CALIFORNIA

03-NEV-20
K.P. 21.9/23.8 (P.M. 13.6/14.8)
EA 03-412400

Prepared by:

Anmarie Medin
Associate Environmental Planner (Archaeology)
Caltrans District 03

Prepared for:

Japtej Gill
Chief, Environmental Management, S4 Branch
Caltrans District 03
Sacramento, CA

Archaeological Survey and Evaluation Report, State Route 20

USGS Quadrangles: Grass Valley, Calif. 7.5 minute 1949 (pr 1995)

Keywords: Grass Valley, Stone Ditch, Spring Hill Mine. Nevada County.

December 2005

SUMMARY OF FINDINGS

The California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA), in cooperation with the Nevada County Transportation Commission (NCTC) propose to improve the Dorsey Drive Overcrossing of State Route (SR) 20 in Grass Valley, Nevada County. The project will convert Dorsey Drive Overcrossing to an interchange and connect with Route 20/49 to improve access to specific high-use sites, relieve operations at adjacent interchanges and provide additional capacity on Dorsey Drive for future development in accordance with adopted city and county general plans.

An initial archaeological survey was conducted in August 2001, and follow-up survey was conducted November 10, 2005. The final APE, which is approximately 59.33 hectares (146.60 acres) in size, encompasses all land that could potentially be included in the final project.

The survey identified two properties within the initial study area: the Spring Hill Mine and the Stone Ditch, neither of which appears to be particularly important when judged against National Register criteria. The final APE for this undertaking does not include the Spring Hill Mine. In the intervening time-period between the initial survey and completion of this documentation, the Stone Ditch segment was destroyed by industrial development. Thus, the final APE for the undertaking contains no known cultural properties.

It is Caltrans policy to avoid impacts to cultural resources whenever possible and it may be necessary to make special provisions to avoid impacts to sites that are adjacent to project limits. Further investigations may be needed for sites that cannot be avoided by the proposed project. It is possible that unidentified subsurface archaeological remains exist within the right-of-way and could be encountered during ground-disturbing activities. If buried cultural materials are encountered during construction, it is Caltrans policy that work in the immediate vicinity of the find halt until a qualified archaeologist can evaluate the nature and significance of the find. Additional survey will be required if the project changes to include unsurveyed areas.

For individuals with sensory disabilities, this document is available in alternate formats upon request. Please call or write Anmarie Medin, Caltrans Division of Environmental Analysis, P.O. Box 942874, MS-27, Sacramento, CA 94274-0001. (916) 653-6187 Voice, or use the CA Relay Service TTY number 1-800-735-2929.

TABLE OF CONTENTS

INTRODUCTION

The proposed project, involving alternative designs for improvement of the Dorsey Drive Interchange at SR 20 in Nevada County (Figures 1 and 2), represents a federal undertaking and is, therefore, subject to review under the January 2004 *Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California* (PA). The PA is the FHWA's approach for taking into account the affects of the Federal Aid Transportation Program on historic properties in California and for meeting compliance with Section 106 of the National Historic Preservation Act (36 CFR 800). The initial archaeological survey was conducted in August 2001, and follow-up survey was conducted November 10, 2005.

PROJECT PERSONNEL

The survey involved the following Caltrans archaeologists:

Caltrans Staff	PQS Status	Project Position
Anmarie Medin	PI- Historical Archaeology, Co-PI, Prehistoric Archaeology	Principal Investigator, Report Author
Kendall Schinke	Lead Archaeological Surveyor	Lead Surveyor, Peer Reviewer
Erick Wulf	Co-PI – Prehistoric Archaeology	Surveyor, Native American consultation, Peer Reviewer
Jeff Haney	PI – Prehistoric Archaeology	Co-Author (context)

HIGHWAY PROJECT LOCATION AND DESCRIPTION

The proposed project is situated at the interchange of Dorsey Drive and SR 20, Grass Valley, Nevada County, California (Figures 1 and 2). This project proposes to construct a tight-diamond interchange at the existing Dorsey Drive overcrossing on Route 20/49 in Nevada County. The project will improve access to specific high-use sites, relieve operations at adjacent interchanges and provide additional capacity on Dorsey Drive for future development in accordance with adopted city and county general plans.

Specific improvements include replacing the existing 2-lane structure with a 5-lane structure, constructing on- and off-ramps, the construction of northbound and southbound auxiliary lanes between existing ramps and proposed ramps, constructing sound walls and retaining walls, and the realignment of Joerschke Drive at approximately KP R21.9 (PM R13.6) State Route (SR) 20 within the City of Grass Valley.

The project's potential to affect historic properties derives primarily from the construction of the new interchange, auxiliary lanes, ramp lighting, signals, and the new overhead road signs, as well as the excavation for these and the electrical connections.

The initial Study Area, as depicted on the Grass Valley, Calif. 7.5-minute U.S.G.S. quadrangles (Figure 2), was delineated to encompass all land that could potentially be included in the final project. The initial Study Area included the existing and maximum proposed right-of-way, as well as identified possible construction easements or staging areas. The project is located in a rural setting on the Grass Valley USGS Topographic Quad, T16N R8E Section 23, Mount Diablo Base Meridian (MDBM).

The Area of Potential Effects (APE) for the proposed project includes the existing and state right-of-way and proposed right of way along Highway 20 between KP 21.9 (PM 13.6) and KP 23.8 (PM 14.8) in Nevada County (please see Map 3, APE, in the Historic Properties Survey Report to which this report is attached). The archaeological APE was established as including all area of potential direct impact (ground disturbance, construction easements, utility relocations, etc.) and includes the full extent of the horizontal and vertical limits of construction impacts in discussion with Design and Construction Engineers.

The Spring Hill Mine was included in the initial Study Area because there was a possibility the area would be needed for equipment staging and storage. After design development and finalization, Caltrans project engineers and archaeologists determined that the project has no potential to affect Spring Hill Mine, thus the APE does not include that property.

SOURCES CONSULTED

A records search and literature review were conducted before the field study to identify prior archaeological investigations and previously recorded sites within and adjacent to the survey area. No properties listed within the National Register of Historic Places (United States Government 1979 and supplements to date), California Historical Landmarks (State of California 1990 and supplemental information to date), California Points of Historical Interest (State of California 1992 and supplemental information to date), California Register of Historical Resources (State of California 1997), or California Inventory of Historic Resources (State of California 1976 and supplemental information to date) occur within record search area. One Point of Historic Interest (Nev-033, the Idaho-Maryland Mine) lies a short distance south of the project, but is well outside of the APE and the project will have no effect upon it.

A records search was conducted at the North Central Information Center of the California Historical Resources Information System at the California State University, Sacramento on March 17, 2000. An updated records search was conducted on November 15, 2005. The records search area (1/4 mile) was delineated to identify all recorded archaeological sites and previous studies conducted in the vicinity. This area is representative of the APE in terms of vegetation, elevation, and landforms, and provides an indication of the sensitivity for cultural resources in the project vicinity. Previous cultural resources studies within the project area are discussed below.

In addition to the standard archaeological record search, archival research was conducted at the Nevada County Assessor's Office in Nevada City, the California State Library in Sacramento, the California Division of Mines and Geology in Sacramento, and Caltrans records in District 3 and at Headquarters.

NATIVE AMERICAN AND INTERESTED PARTIES CONSULTATION

A review of the sacred lands file of the Native American Heritage Commission did not identify any Native American cultural resources in the vicinity. Representatives of local Native American groups were contacted in 2001 regarding any heritage values associated with the project location. Initially, one tribe requested to be kept informed when construction commenced. Given the time lapse between initial consultation and preparation of this report, follow up consultation was deemed necessary. These contacts were based on an updated list of Native American contacts provided by the Native American Heritage Commission in 2005. Caltrans archaeologist Erick Wulf sent new letters with the latest project information on November 7, 2005(Appendix A). Wulf placed follow-up telephone calls to contacts on November 17, 2005 leaving messages to verify receipt of the information and requesting any interested parties contact him for further information. Similarly, local historical societies were contacted regarding any information or concerns related to potential historic resources within the project area (Appendix A). No replies were received in response to these inquiries.

PREVIOUS CULTURAL RESOURCES STUDIES

Some small portions of the project APE have been previously surveyed for cultural resources. None of the previous studies identified cultural properties within the current project's APE. Henry Bass surveyed the northern extent of SR 20 portion of the APE in 1985 (Bass 1985). Pete Jensen surveyed a small portion of Dorsey Drive for a subdivision development in 1985 (Jensen 1985) and Peak and Associates surveyed an adjacent area off of Dorsey drive in 1987 (Peak & Associates 1987). Given that a considerable amount of time has passed since these initial surveys and it was unclear whether the studies considered historic-era properties, it was deemed necessary to survey the entire APE for this particular undertaking.

The follow-up records search determined that, while surveys had occurred in the immediate vicinity in the intervening years, no additional portions of the project APE had been surveyed. The follow-up records search also determined that a segment of the Stone Ditch had been recorded by Eleanor Derr in 1981 (Derr 1981). It has been assigned primary number P-29-1464-H (see archaeological site survey record in Appendix B).

BACKGROUND

The following background sections are taken largely from "Archaeological Survey Report for a Proposed Safety Improvement Project Along State Route 20 in Nevada County, California (03-NEV-20, K.P. 0.00-6.60 (P.M. 0.00-4.10), EA 03-1A5300)" prepared by Jeff Haney, Associate Environmental Planner, Archaeologist, District 3, Marysville. August 2003.

ENVIRONMENT

The Project is within lower foothills between the Central Valley and the Sierra Nevada in western Nevada County, California (Figures 1 and 2). This upland area is characterized by rolling hills with gentle to steep slopes above numerous ephemeral streams. Elevations within the APE range from 792.5 to 823 m (2600-2700ft) above mean sea level (amsl). Soils within this area are part of the Auburn, Argonaut, Boomer, and Sobrante Series (Brittan 1975). Most of these soils are shallow loams, which occur on undulating to steep uplands and contain areas of exposed rock outcrops. The underlying geology consists of folded and faulted meta-sedimentary rock, which contains intrusions of granitic rock and some areas of overlying volcanic conglomerate rock.

Nevada County is characterized by warm, dry summers and mild, wet winters. The annual average temperature ranges between 12.78° and 15.56° C (55.00°-60.00° F). Average annual precipitation in the western half of the county ranges from 66.04 to 152.40 cm (26.00-60.00 inches). The natural environment within the APE is altered as a result of historic and modern uses of the land, such as grazing, mining, and development associated with the town of Grass Valley. Lower elevations are mostly covered with scattered oak-grasslands, while the higher elevations contain conifer and hardwood forests. The grassland is dominated by mostly annual grasses and includes wild oats (*Avena fatua*), slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), perennial ryegrass (*Lolium multiflorum*), and Medusa-head (*Taeniatherum caput-medusae*). Tree species present within the area consist of black oak (*Quercus kelloggii*), blue oak (*Quercus douglasii*), interior live oak (*Quercus wislizenii)*, Ponderosa pine (*Pinus ponderosa*), and gray pine (*Pinus sabiniana*).

Based on an examination of the above information (including old topographic maps, soils maps, geology maps, etc, as well as examining the area during the field review), there is a low potential for buried archaeological deposits in the project area.

ETHNOGRAPHIC BACKGROUND

The project is within land inhabited by the Nisenan at the time of European contact (Wilson and Towne 1978). The Nisenan spoke a number of dialects belonging to the Maiduan language family, which is part of the larger Penutian linguistic phylum. The latter consists of four families of languages spoken by various populations throughout California. Ethnographic sources for the Nisenan include: Kroeber (1925, 1929, 1932), Faye (1923), Beals (1933), Littlejohn (1928), Gifford (1927), Loeb (1933), and Ritter and Schulz (1972).

The area inhabited by the Nisenan stretched between the American and Yuba Rivers from the Sierra Crest to the Feather and Sacramento Rivers in the Central Valley. The ethnographic village documented to be nearest to the project, *Hi'et*, was at the headwaters of Bear River (Wilson and Towne 1978:388). Each local group or tribelet occupied a main village or a cluster of small settlements surrounding a main village within a territory that was habitually used for hunting, fishing, and gathering. Main villages were permanently occupied, while seasonal camps were established to exploit particular resources, such for acorn harvesting in oak groves during the fall. Within the commonly held land of a village community, families could lay claim to specific fishing sites, oak groves, and trees. Each tribelet had a chief or headman who provided guidance and organized communal activities, such as deer drives, the fall acorn harvest, and ceremonies. Each extended family had a leader who assisted the headman.

Subsistence resources were available year-round within the habitat occupied by the Nisenan, although the types of ripening or otherwise available resources varied throughout the year. Groups were most active during the late summer and early fall. Subsistence tasks conducted by tribelet members consisted of hunting and gathering wild plants, fish, and game. The mainstay of their diet was the acorn, which was supplemented with a variety of fresh meat from large and small mammals, fish, and waterfowl. Exploited plants resources included roots, bulbs, berries, and fruits.

ARCHAEOLOGICAL BACKGROUND

As described above, the project lies within the lower foothills between the Central Valley and higher elevations of the Sierra. Archaeological research in this zone within Nevada County consists of a number of small surveys and few excavations. Additional archaeological excavations in proximity to the project area were conducted within the Tahoe National Forest to the east and in valley floor near Marysville to the west. More extensive archaeological investigations were conducted in conjunction with the Oroville Dam in Butte County. These studies and others provided information that permitted refinement of the region's prehistoric cultural sequence, as found in Kowta (1988) and outlined below.

Mesilla Complex (+1000 B.C. to A.D. 1): The Mesilla Complex is possibly related to the widespread Milling Stone Horizon in northern California and may represent Hokan-speaking groups, which are among the earliest populations in California. Meager information exists regarding settlement and subsistence patterns, although it is suggested that populations engaged in generalized hunting and gathering with an emphasis on deer hunting and collecting small seeds. Settlement systems probably involved some variation of seasonal camps and special use locations tied to a winter village.

Bidwell Complex (A.D. 1 to A.D. 800): The Bidwell Complex represents a continuation of Mesilla Complex, but with intensified subsistence practices and the addition of Central Valley traits in artifact inventory. This period possibly coincides with a warming trend when oak woodland spread into the foothill zone. Subsistence practices show both intensification and diversification. Settlement systems involved relatively permanent villages, although small groups made short-term movements away from main settlements to exploit specific resources during different seasons.

Sweetwater Complex (A.D. 800 to A.D. 1600): This period may mark the emergence of the acorn as a staple resource as reflected by milling assemblages that contain bedrock, hopper, and bowl mortars. This complex possibly marks the intrusion of Penutian-speaking populations (Maidu) from the south. The use of acorns, which requires intensive processing, marks a shift in of subsistence activities that is possibly in response to a growing population.

Oroville Complex (A.D. 1600 to A.D. 1850): This complex, which represents the protohistoric Maidu, is marked by complex forms of social organization, including variation in social status, and more formal exchange relationships. Subsistence practices of this complex were dominated by intensive processing of acorns.

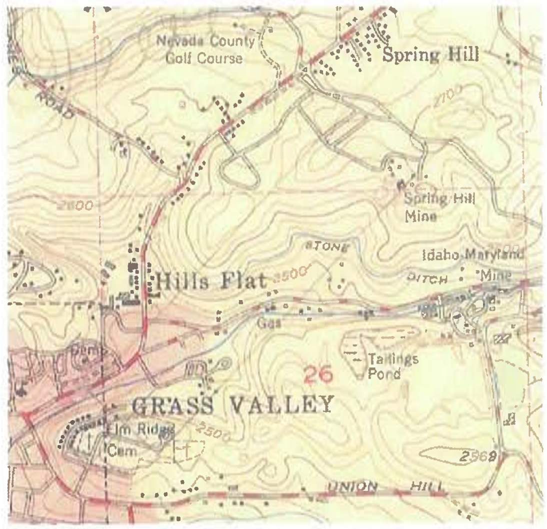
HISTORY

Nevada County became one of the most populous counties in northern California when an influx of prospectors poured into the region following the discovery of gold in 1848. Grass Valley became one of the world's richest mining districts during this period and dozens of mining camps were established along Yuba River. Nevada County was created in 1851 with Nevada City as its county seat. Ranching activities, including livestock and orchards, became increasingly important in western part of county in the late 1800s. The Nevada Irrigation District was established in 1921 to provide water to this area. Widespread unemployment the 1930s resulted in a second gold boom in the region that was followed by a real estate boom in the late 1950s when the area attracted retirees and recreationalists.

Spring Hill Mine

The Spring Hill Mine was first mentioned in the journal Mining and Scientific Press in 1865 as "in the course of being thoroughly opened" [Mining and Scientific Press II(19):290]. It was mapped on the 1867 GLO plat, but the mine was not formally claimed until 1871 (Mineral Survey 1557). Additional mines were claimed nearby and by 1887 a new plat was filed that corrected some locational information that conflicted with these other claims (Mineral Survey 2629). The 1887 plat indicates the mine comprised three shafts and a mill site. The mine remained idle for some time until the 1930s when new owners acquired an option on the property. In 1936, the Engineering and Mining Journal included a two-page article describing improvements, including a 100-ton flotation mill, shafts and veins excavated, various structures, and gold recovery equipment. The article mentions that "the mill is run in three shifts, with one man employed on each shift, and is now treating about 110 tons of ore a day" [Engineering and Mining Journal 137(3):146]. The State Mineralogists report of 1941 mentions that Spring Hill Mine shaft had reached a depth of 1,900 ft., but noted that results were not satisfactory.

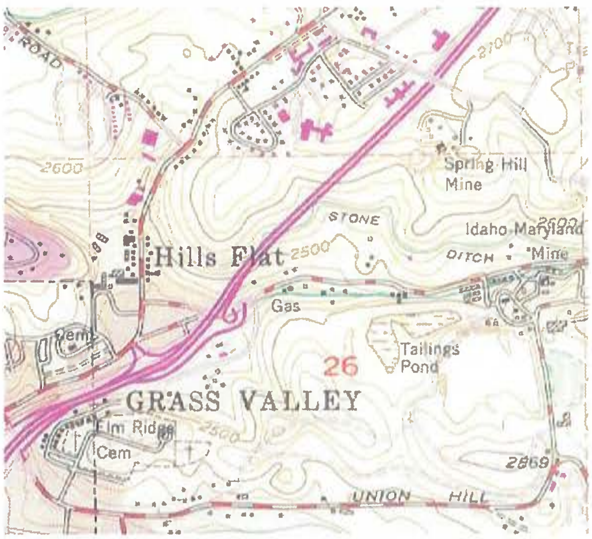
It is unclear at this time when mining operations ceased at the Spring Hill Mine. County assessment records indicate the buildings were in good condition in 1954. Subsequent notes indicate the buildings were reduced to abandoned shells, but there is no date on those notes. When the appraiser revisited the site in 1975, all the buildings had been removed. The 1973 photorevised topographic quadrangle depicts several structures and the mine shaft.



1949 Grass Valley topographic quadrangle depicting Spring Hill Mine and Stone Ditch.

Stone Ditch

"Stone's Ditch" is depicted on the survey plat for the Roannaise Quartz Mine (Mineral Survey 2083) filed in 1883, however the Smartville topographic quadrangle, surveyed in 1885 but published in 1895, does not depict the ditch. It appears on the



1973 Grass Valley quadrangle depicting new freeway alignment and Spring Hill Mine and Stone Ditch.

1949 Grass Valley quadrangle, as well as the 1973 update, as "Stone Ditch." The 1967 SR 20 as-built depicts "Stone Ditch" (see continuation sheet on DPR forms in Appendix A). The 1995 photorevised topographic quadrangle, based on 1985 aerial photographs, does not depict the ditch.

FIELD METHODS

An intensive pedestrian survey of the APE was conducted on August 9, 2001. As described above, this APE was designed to encompass all land that could potentially be included in the final project alternatives.

Field methods consisted of an intensive pedestrian survey whereby the ground surface was inspected while walking a series of linear transects over the entire APE. Kendall Schinke and Anmarie Medin conducted the initial survey. The interval between transects varied from 5 to 15 meters, depending on terrain and project area width. Ground surface visibility varied from poor to fair (10-50%), since most of the area is paved over or is covered by grasslands or brush. To compensate for poor visibility, survey crew members deviated from transects to locate and focus on areas with improved ground surface visibility, such as rodent burrows, and systematically used trowels to periodically clear small areas of vegetation every to observe mineral soils. All bedrock exposures were also examined for milling features. California Department of Parks and Recreation Primary Record, Archaeological Site Record, and Linear Feature forms were used to record the newly discovered properties. Sites were mapped using a Trimble GPS datalogger.

Given the time that elapsed between the initial survey and writing this report, Anmarie Medin and Erick Wulf conducted a second phase of fieldwork on November 10, 2005. Their field effort involved spot checking of selected locations to assess the relationship of cultural properties to the project's final APE. During this survey Medin and Wulf noticed that recent industrial development had destroyed the short segment of Stone Ditch that had been identified within the initial study area in 2001. No remains of Stone Ditch are present within the current project's APE. During the second field reconnaissance, Medin and Wulf were also able to compare aerial photographs, engineering drawings, and actual ground conditions. With this information they were able to determine with certainty that the Spring Hill Mine will not be affected by the undertaking.

SURVEY RESULTS AND PROPERTY DESCRIPTIONS

The initial survey identified two properties within the initial Study Area: the Spring Hill Mine and Stone Ditch. As noted above, both properties are not within the final APE for the federal undertaking. Appendix B contains copies of the site record forms.

SPRING HILL MINE

The Spring Hill Mine archaeological site consists of five concrete foundation features that correspond to buildings documented in the county assessor's building records. All buildings and mine equipment have been removed from the site. Modern sheet refuse is strewn about the site indicating it is used as an illicit recreation area.

Feature 1 is a concrete foundation near the crest of the hill. It measures 45 ft. long by 26 ft. wide. It is unclear what this foundation supported since the residence described in assessment information is indicated as having a wood foundation. Feature 2 was the warehouse and shower. The warehouse portion measures 50 ft. long by 30 ft. wide while the shower portion (on the south side of the building) measures 12 ft. by 36 ft. This corresponds to the assessors building record. Feature 3 is the head frame foundation. This irregularly shaped concrete foundation is built into the hillside with concrete piers adjacent. It measures 8 ½ ft. tall in front and 5 ft. tall in back. Overall length is 12 ½ ft. while overall width is 10 ½ ft. Feature 4 was likely the hoist house. The "E" shaped foundation measures 13 ½ ft. on the long side with 8 ft. long top and bottom extensions and a 10 ft. long middle segment. Metal bolts stick up from the foundation. Feature 5 is the former mill location. The foundation is in two levels: a basement measuring 42 by 15 ft with a 10 foot square additional area, and the main mill platform measuring 42 ft by 30 ft with a 22 ft. wide addition in the rear. These dimensions match the assessor's building record that also mentions "all machinery removed, nothing but a shell remains" however there is no date. Inside the foundation are several concrete platforms that must have served to anchor machinery.

STONE DITCH

Stone Ditch appears on maps as early as 1883. The 1973 Grass Valley topographic quadrangle depicts it contouring generally east west along the 2550-ft. elevation. The segment identified in 2001 was an approximately 300 ft. long segment on the southeast side of SR 20. Eleanor Derr recorded a segment of the Stone Ditch in 1981 (Derr 1981). It has since been assigned Primary Number 29-1464H. Appendix B contains a copy of Derr's site record form.

The following description documents this segment as it appeared in 2001. As mentioned above, recent construction has obliterated this segment. The ditch was excavated into the slightly sloping hillside with earth mounded on the southern side to create a berm. The earthen berm is approximately 1 foot higher than the uphill side of the ditch. Stones are piled on both sides of the ditch suggesting it was named for the terrain rather than a person. The ditch ran east to west, carrying water diverted from Wolf Creek. The western terminus is unclear as the line depicted on the topographic quad simply ends in the middle of a gradually sloping hillside where there are no other features. It is unclear if the ditch continued to the west at some time in the past.

A concrete box is present on the southern or downslope side of the ditch. It measures 8 ft. long by 6 ft. wide and is 4 ft. deep. A concrete and wood gate has been constructed into the ditch, allowing control of water flow. The box is currently partially filled with rocks and wood planks. The historical function of this box is unclear. A fence runs along the southern or downslope edge of the ditch. It consists of wood posts connected with barbed wire. The posts are rotten and falling over. Stone Ditch retains very poor integrity. It is breached in several locations where cattle have eroded the ditch walls. Construction of SR 20 severely impacted its integrity by burying the alignment. Modern development has further damaged the alignment.

CONCLUSION

While the initial field survey identified two cultural properties, the final project APE includes no cultural properties. The Stone Ditch has been destroyed and the Spring Hill Mine is outside the refined, final APE. Given the absence of cultural resources, no further study is recommended. However, additional survey will be required if the project changes to include unsurveyed areas.

It is Caltrans policy to avoid impacts to cultural resources whenever possible. It is possible that unidentified subsurface archaeological remains exist within the project limits and could be encountered during ground-disturbing activities. If the site cannot be avoided by the proposed project, testing to determine its potential National Register eligibility will be necessary. If buried cultural materials are encountered during construction, it is Caltrans policy that work in the immediate vicinity of the find halt until a qualified archaeologist can evaluate the nature and significance of the find.

BIBLIOGRAPHY

Bass, Henry O.

1985 Negative Archaeological Survey Report for Proposed Widening of Existing Brunswick Road Overcrossing (Br. No. 17-48) Nevada County, (3-NEV-20 PM R14.5/R15.1). Report on file at the North Central Information Center, California State University, Sacramento.

Beals, R. L.

1933 Ethnology of the Nisenan. *University of California Publications in American Archaeology and Ethnology* 31(6): 335-441. Berkeley.

Brittan, L. A.

1975 *Soil Survey of Nevada County Area, California*. U.S. Department of Agriculture, Soil Conservation Service, and Forest Service in Cooperation with the University of California Agricultural Experiment Station. Government Printing Office, Washington, D.C.

Derr, Eleanor

1981 Archaeological Site Survey Record for the Stone Ditch (Field No. W.C. –6). Form on file at the North Central Information Center, California State University, Sacramento (P# 29-1464-H).

Faye, P. L.

1923 Notes of the Southern Maidu. *University of California Publications in American Archaeology and Ethnology* 20(3): 35-53. Berkeley.

Gifford, E. W.

1927 Southern Maidu Religious Ceremonies. *American Anthropologist* 29(2): 214-257.

Jensen, Peter M.

1985 Archaeological Reconnaissance of the Proposed Valley Terrace Subdivision, Nevada County, California. Report on file at the North Central Information Center, California State University, Sacramento (#375).

Jewell, D. P.

1964 Archaeology of the Oroville Dam Spillway. *Archaeological Papers* No. 10, Part I. State Division of Beaches and Parks, Sacramento.

Johnson, J. J., and D. J. Theodoratus, eds.

1978 Cultural Resources of the Marysville Lake, California Project (Parks Bar Site), Yuba and Nevada Counties, California. Report on file at the North Central Information Center, California State University, Sacramento.

Kowta, M.
1988 *The Archaeology and Prehistory of Plumas and Butte Counties, California: An Introduction and Interpretive Model*. California Archaeological Site Inventory, Northeast Information Center, California State University, Chico.

Kroeber, A. L.
1925 *Handbook of the Indians of California*. Bureau of American Ethnology Bulletin 78. Washington.

1929 The Valley Nisenan. *University of California Publications in American Archaeology and Ethnology* 24(4): 253-290. Berkeley.

1932 The Patwin and Their Neighbors. *University of California Publications in American Archaeology and Ethnology* 29(4):253-423. Berkeley.

Littlejohn, H. W.
1928 Nisenan Geography. Unpublished manuscript on file in Bancroft Library, University of California, Berkeley.

Loeb, E. M.
1933 The Eastern Kuksu Cult. *University of California Publications in American Archaeology and Ethnology* 33(2): 139-232. Berkeley.

Moratto, M. J.
1984 *California Archaeology*. Academic Press, New York.

Peak & Associates, Inc.
1987 Cultural Resources Assessment of the Proposed Grass Valley Senior Citizens and Family Apartments, Nevada County, California. Report on file at the North Central Information Center, California State University, Sacramento.

Ritter, E. W., and P. Schultz, eds.
1972 Papers on Nisenan Environment and Subsistence. *University of California Center for Archaeological Research Publications* 3. Davis.

State of California
1976 *California Inventory of Historic Resources.* Department of Parks and Recreation, Sacramento.

1990 *California Historical Landmarks*. Department of Parks and Recreation, Sacramento.

1992 *California Points of Historical Interest.* Department of Parks and Recreation, Sacramento.

1997 California Register of Historical Resources, and updates to date. Department of Parks and Recreation, Sacramento.

United States Government
1979-2003
National Register of Historic Places, Annual Listing of Historic Properties in the *Federal Register*; and supplements to date. Heritage Conservation and Recreation Service (1979-1981), Department of the Interior/National Park Service (1982-2003), Washington, D.C.

Wilson, N.L. and A. H. Towne
1978 Nisenan. In *California*, edited by Robert F. Heizer, pp. 387-397. Handbook of North American Indians, vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
for
FORMER SPRING HILL MINE PROPERTY
APNs 35-260-62, 63 and 64
Grass Valley, California

Prepared for:
Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3292-03
September 7, 2007

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 3292-03
September 7, 2007

Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677

Attention: Warren Hughes

Reference: ***Former Spring Hill Mine Property***
APNs 35-260-62, 63, and 64
Grass Valley, California

Subject: ***Preliminary Geotechnical Engineering Report***

Dear Mr. Hughes:

This report presents the results of our preliminary geotechnical engineering investigation for the former Spring Hill Mine property located southeast of Dorsey Drive and east of Highway 20/49 in Grass Valley, California. The site includes three parcels with a total area of approximately 26.7 acres. The Nevada County Assessor's Parcel Numbers (APNs) are 35-260-62, 63, and 64. As proposed, the project will include significant cut and fill grading to create building pads for commercial development and associated roads, parking areas, and underground utilities.

The preliminary findings presented in this report are based on a cursory surface reconnaissance at the site, review of selected geologic references and reports previously prepared for the site by Holdrege and Kull, and our experience with subsurface conditions in the area. Based on our preliminary findings, our opinion is the project as currently proposed appears to be feasible from a geotechnical engineering standpoint. We should be retained to perform a design-level investigation prior to construction to confirm the preliminary recommendations presented in this report and provide alternate recommendations, if appropriate, based on the subsurface conditions encountered. Furthermore, we should be allowed to perform testing and observation services during grading to confirm our design-level recommendations.

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Please contact us if you have any questions regarding our observations or the preliminary recommendations presented in this report.

Sincerely,

HOLDREGE & KULL

Prepared by:

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1 INTRODUCTION

At the request of Warren Hughes of Gallelli & Sons, LLC, Holdrege & Kull (H&K) performed a preliminary geotechnical engineering investigation of the former Spring Hill Mine Property in Grass Valley, California. The preliminary geotechnical investigation was performed in general accordance with the scope of services presented in our July 17, 2007 proposal for the project, a copy of which is included as Appendix A of this report. For your review, Appendix B contains a document prepared by ASFE entitled *Important Information About Your Geotechnical Engineering Report*, which summarizes the general limitations, responsibilities, and use of geotechnical reports.

1.1 SITE DESCRIPTION

The site is comprised of three contiguous parcels, an eastern parcel (Assessor's Parcel Number (APN) 35-260-64, 11.37 acres), a northern parcel (APN 35-260-62, 1.7 acres), and a western parcel (APN 35-260-63, 13.67 acres). Figure 2 shows the approximate site boundary.

Surface topography at the site generally slopes toward the south and southwest from a relatively flat-lying area in the northern portion of the site and a knoll in the north central portion of the site. The site elevation ranges from approximately 2550 feet above mean sea level (MSL) in the southwestern portion of the site to approximately 2690 feet above MSL in the northern portion of the site. The site is generally vegetated by pine, manzanita, oak, and cottonwood trees in the southwestern portion of the site. Rock outcrop is present at several locations in the western, northern and eastern portions of the property.

1.2 PROPOSED IMPROVEMENTS

Our understanding of the project is based on our recent conversations with Warren Hughes and review of an August 2007 preliminary site plan prepared by Genesis Engineering. The preliminary site plan shows that up to 40 feet of cut is proposed in the central portion of the property and up to 60 feet of fill in the southwestern portion of the property. The plan also shows 6 smaller buildings proposed in the northern and eastern portions of the site, a large parking lot in the central and western portions of the site, and a large structure in the southwestern portion of the site.

1.3 SCOPE OF SERVICES

To prepare this report, we performed the following scope of services:

- We reviewed selected geologic and soil survey literature, as well as previous reports prepared for the site by H&K.
- We performed a cursory surface reconnaissance of the site.
- Based on observations made during our site reconnaissance, the results of our literature review, and our experience with soil conditions in the area, we prepared this report to provide preliminary geotechnical engineering recommendations for the proposed improvements.

2 SITE INVESTIGATION

The following sections summarize our literature review and field reconnaissance.

2.1 LITERATURE REVIEW

We performed a limited review of geologic literature pertaining to the project site. The following sections summarize our findings.

2.1.1 Soil Survey

The Soil Survey of Nevada County, California, Western Part (United States Department of Agriculture, Soil Conservation Service, August 1993) indicates that soil conditions across the majority of the site are mapped as Dubakella-rock outcrop complex, 5 to 50 percent slopes. Runoff is medium to rapid, based on degree of slope, and the erosion hazard is low to moderate. The central portion of the site is mapped as "Placer Diggings", although this classification appears to be incorrect based on the identification of past hard rock gold mining in this area. A limited area in the eastern portion of the site is mapped as Sites loam, 9 to 15 percent slopes. Runoff is medium on this soil and erosion hazard is moderate.

A typical profile of the Dubakella soil consists of an approximate 10-inch-thick surface layer of brown, gravelly heavy loam to gravelly clay loam. The surface layer is underlain by dark yellowish brown and brown, very cobbly clay to a depth of approximately 21 inches below the ground surface (bgs). Weathered ultrabasic rock is encountered below the cobbly clay loam.

A representative profile of the Sites Loam consists of brown and yellowish red heavy loam from the ground surface to an approximate depth of 12 inches bgs. The heavy loam is underlain by yellowish red loam and red clay, and light clay to an approximate depth of 78 inches bgs. The loam, clay, and light clay are underlain by weathered metasedimentary and basic rock.

2.1.2 Geology

The property is located in the Sierra Nevada Foothills, on the western side of the Sierra Nevada geomorphic province. The Sierra Nevada province is an elongate, north-west trending structural block that is tilted upward to form a steep scarp above the adjacent Basin and Range province to the east. The western slope of the Sierra Nevada dips gently westward, and extends beneath sediment of the Great Valley province. Sediment within the Great Valley is derived from continual uplift and erosion of the Sierra Nevada.

The Geologic Map of the Grass Valley - Colfax Area (A. Tuminas, 1983), shows that the site is underlain by serpentine rocks of the Early Mesozoic aged Ultramafic-Mafic "Basement" Unit of the Lake Combie Complex. According to the Mineral Land Classification of Nevada County (Special Report 164, California Department of Conservation Division of Mines and Geology, 1990), the site geology is mapped as the ultramafic unit of the Jurassic-aged Lake Combie Complex. The Mesozoic era occurred from approximately 245 to 65 million years ago. The Jurassic period occurred from approximately 206 to 144 million years ago.

The Map of the Spring Hill Mine (Uren, 1942) depicts buildings, mine shafts, tailing piles, and waste dumps comprising the western and central portion of the property.

The Nevada City Special Folio, California (United States Geologic Survey; 1896), depicts an east-west trending quartz vein passing through the central portion of the site. The vein apparently dips to the north.

We reviewed California Geological Survey Open File Report 96-08, Probabilistic Seismic Hazard Assessment for the State of California, and the 2002 update entitled California Fault Parameters. The documents indicate the property is located within the Foothills Fault System. The Foothills Fault System is designated as a Type C fault zone, with low seismicity and a low rate of recurrence. The 1997 edition of California Geological Survey Special Publication 43, Fault Rupture Hazard Zones in California, describes active faults and fault zones (activity within 11,000 years), as part of the Alquist-Priolo Earthquake Fault Zoning Act. The map and documents indicate the site is not located within an Alquist-Priolo active fault zone.

2.1.3 Previous Site Investigations

H&K performed a Preliminary Endangerment Assessment (PEA) for the site dated July 6, 2007. The draft PEA has been reviewed by the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) and we are currently addressing their review comments. Additional information pertaining to mining features and associated waste rock is presented in the draft PEA.

2.2 FIELD INVESTIGATION

We performed our site reconnaissance on August 28, 2007 to observe existing surface conditions at the project site.

2.2.1 Surface Conditions

At the time of our site visit, the western and central portions of the property contained significant abandoned mine features, while the eastern portion appeared to be generally undeveloped. However, dense manzanita generally obscured the surface conditions in the south-central and eastern portions of the site. The topography of the property generally slopes toward the south and southwest from a relatively flat lying area in the northern portion of the site and a knoll in the northern central portion of the site.

We observed the location of the Spring Hill shaft in the central portion of the property as depicted in the Map of the Spring Hill Mine (Uren, 1942). The Spring Hill shaft appeared to have been capped with concrete. Approximately 500 feet northeast of the Spring Hill shaft, we observed mounded soil, rock, and wood debris that appeared to be a shaft that was backfilled or capped. An apparent shaft, approximately 10 to 15 feet wide and open to a depth of 15 feet or greater, was observed approximately 400 feet southwest of the Spring Hill shaft. Our investigation did not include assessing the method or adequacy of physical shaft closure.

Several relic concrete foundations and concrete slabs were identified at the approximate locations of historic mining features depicted on the 1942 Uren map (bin, hoist, compressor, mill, machine shop, carpenter shop, dry, furnace, superintendent residence). No structures remain in these locations. The "bin" foundation (assumed to be for an ore bin), approximately 10 feet by 15 feet by 8 feet high, apparently served as an ore storage area between the Spring Hill shaft and the mill located to the southeast of the shaft. The mill foundation, located approximately 100 feet to the east of the bin foundation, was approximately 50 feet by 75 feet with concrete wall remnants up to 6 feet high.

Extensive surface exposures of mine waste rock were identified in the central and western portions of the site. Mine waste rock generally consisted of slightly to moderately weathered, mineralized serpentine and diabase rock with abundant quartz. The waste rock was coarse material with variable amounts of sand and gravel. The waste rock was present in several benches extending down slope to the south and southwest of the knoll-top, the location of the former mill and superintendent's residence. There was some evidence of disturbance or removal of waste rock in the area of the bin foundation. Smaller mine waste rock stockpiles of similar consistency were observed in the area between the bin and compressor foundations. Scattered waste rock was observed at the perimeter of the larger, main stockpiles of mine waste rock in the central and western portion of the site.

Mill tailings, consisting of light grey, grayish green and olive-brown silt with fine sand, were observed in the central and western portions of the site. The areas of observed tailings are down slope of the mill foundation. Two former "tailing ponds" were identified in this area.

Apparent glory holes with associated small volumes of apparent excavation spoils were observed in the eastern portion of the site.

H&K observed mine waste on approximately 6.5 acres of the 26.7-acre site, during their investigation for the PEA for the site.

2.2.2 Surface Water and Ground Water Conditions

Although we did not observe areas of saturated ground or seeps, our experience has shown that seepage will likely be encountered in excavations that reveal the contact between relatively permeable surface soil and resistant volcanic rock.

3 LABORATORY TESTING

Laboratory testing was not included in the scope of our preliminary geotechnical engineering investigation. Laboratory testing would be required as part of a design-level geotechnical engineering investigation for the project.

4 CONCLUSIONS

The following conclusions are based on our field observations and our experience in the area.

- Based on the results of our preliminary geotechnical investigation, our opinion is that the project is feasible from a geotechnical standpoint.

- Our primary concerns, from a geotechnical standpoint, are the presence of relic mine features and existing fill consisting of waste rock. In general, existing fill is not suitable to support structural improvements and we anticipate that areas of relatively shallow fill would be removed and replaced as compacted fill during site preparation and grading. Deeper areas of existing fill, particularly in the southern portion of the property will need to be evaluated as part of a design-level geotechnical investigation to determine what mitigation approaches, such as fill replacement or the use of deep foundation systems, are appropriate.

- The most notable historic mining features documented on the site were the Spring Hill shaft and the other two shafts located east and southwest of the Spring Hill shaft. If improvements are planned in the immediate vicinity of these mining features, the features should be closed per the recommendations of H&K or another qualified engineer. We would be able to provide closure recommendations as part of a design-level geotechnical engineering report.

- The July 6, 2007 draft PEA prepared by H&K recommended that the estimated 2,300 tons of waste and affected soil at the Former Mill Area should be excavated, transported offsite, and disposed at an appropriate solid waste facility. Additional characterization of the waste may be required by the landfill during the remedial action to meet their acceptance criteria.

- Based on the ultramafic and serpentine rock observed onsite and our past experience with serpentine rock in the area, we anticipate naturally-occurring asbestiform minerals may be encountered during grading. California Geological Survey Special Publication 124 (2002) states that an asbestos dust mitigation plan (ADMP) is required for grading in areas where naturally occurring asbestos (NOA) or asbestiform minerals are expected (areas where ultramafic, schistose, or serpentine rock is encountered), unless a comprehensive program of sampling and testing indicates the absence of asbestiform minerals. The ADMP is to be developed in accordance with

Section 93105 of the CalEPA's Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying and Surface Mining Operations.

- Based on the site geology and the presence of rock outcrop we anticipate that relatively shallow, resistant rock may be encountered, particularly in the northern and eastern portions of the site, during grading or excavation for utilities. Preliminary recommendations for resistant rock are presented in the following sections. Fill material resulting from excavation onsite may contain significant gravel and oversized rock that may require specific recommendations for use as fill. General recommendations for placement of rock fill and oversized material are presented in the following sections.

- Although we did not observe saturated surface soil and daylighting seepage during our field reconnaissance, areas of seepage will likely be encountered during grading onsite, particularly during the rainy season and/or in excavations which reveal the surface soil/weathered rock contact. Preliminary recommendations regarding subsurface drainage are presented in this report.

5 PRELIMINARY RECOMMENDATIONS

The following preliminary geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our literature review, our field observations during surface reconnaissance, and our experience in the area. The recommendations are preliminary, and are provided for planning purposes. The preliminary conclusions and recommendations in this report should be verified by a design-level geotechnical engineering investigation and/or observation during grading.

5.1 GRADING

The following preliminary grading recommendations address clearing and grubbing, soil preparation, fill placement, cut and fill slope grading, erosion control, subsurface drainage, surface drainage, and construction monitoring.

5.1.1 Clearing and Grubbing

Areas proposed for fill placement, paved areas, and building pads should be cleared and grubbed of vegetation and other deleterious materials as described below.

1. Strip and remove organic surface soil containing shallow vegetation and any other deleterious materials. This organic soil can be stockpiled onsite and used in landscape areas, but is not suitable for use as fill. The actual depth of stripping may vary across the site. Areas of deeper organic surface soil may be encountered in drainage swales and low lying areas.

2. Overexcavate any existing fill, waste rock piles less than 10 feet in depth, debris and/or other onsite excavations to underlying, competent material. Possible excavations include exploratory trenches excavated by others, mantles or soil test pits, and tree stump holes. The waste rock piles consisting of coarse-grained material in the southwestern portion of the site will need to be evaluated to determine appropriate mitigation of the fill to support structures.

3. Remove all rocks greater than 8 inches in greatest dimension (oversized rock) by scarifying to a depth of 12 inches in proposed building pads and areas to support pavement, slabs-on-grade, and other flatwork. Oversized rock should be placed in deep fill per the recommendations of the project geotechnical engineer, stockpiled for later use in landscape areas or stacked rock walls, or removed from the site.

4. Vegetation, tree stumps and exposed root systems, and any other deleterious materials and oversized rocks not used in landscape areas should be removed from the site.

5.1.2 Preparation for Fill Placement

Upon completion of site clearing, grubbing and overexcavation, the exposed native soil should be observed by a representative of our firm prior to placement of fill at the project site. Fill placed on slopes steeper than 5:1, horizontal:vertical (H:V), should be benched into the existing slope to allow placement of fill in horizontal lifts.

5.1.3 Fill Placement

Fill should be placed according to the following guidelines:

1. Material used for fill construction should consist of uncontaminated, predominantly granular, non-expansive native soil or approved import soil. Rock used in fill should be no larger than 8 inches in diameter. Rocks larger than 8 inches are considered oversized material and should be placed in deep

fill per the recommendations of the project geotechnical engineer, stockpiled for use in landscape areas or rock walls, or removed from the site.

2. Oversized material may be windrowed in deeper fill under the observation of the project geotechnical engineer. The windrows should be separated by at least one equipment width. Compacted fill should be worked into the sides of each windrow, and remaining voids should be filled with smaller rock. If the oversized material is to be incorporated into a rock fill that does not permit density testing by nuclear methods, the contractor should prepare a test fill during initial fill placement to facilitate establishing a procedural specification for fill placement. The means and methods of subsequent fill placement will be evaluated for conformance with the approved test fill.

3. Imported fill material should be predominantly granular, non-expansive and free of deleterious or organic material. If imported material is required to grade the site, it should be submitted to H&K for approval and laboratory analysis at least 72 hours prior to import to the site.

4. Clay soil, if encountered, may be used as fill if mixed with granular soil at a ratio determined by the project geotechnical engineer.

5. Fill should be uniformly moisture conditioned and placed in maximum 8-inch thick loose lifts (layers) prior to compacting.

6. The moisture content, density and relative compaction of all fill should be evaluated by our firm during construction.

7. Our observation of rock outcrop in western, northern, and eastern portions of the property and our experience in the area has shown that areas of moderately or slightly weathered rock that is difficult to trench with conventional trenching equipment may be encountered during grading or trenching. Pre-ripping, blasting, or splitting may be required in these areas. The scope of a future design-level investigation should include excavation of exploratory trenches along proposed road and utility trench alignments to allow observation of subsurface soil and rock conditions.

5.1.4 Differential Fill Depth

To reduce the magnitude of differential settlement associated with variable fill depth beneath structures, we recommend that differential fill depths beneath structures should not exceed 5 feet. For example, if the maximum fill depth is 8 feet across a building pad, the minimum fill depth beneath that pad should not be less than 3 feet. If a cut-fill building pad is used in this example, the cut portion would need to be overexcavated 3 feet and replaced with compacted fill.

5.1.5 Cut/Fill Slope Grading

1. Cut and fill slopes should generally be no steeper than 2:1, H:V. Based on our experience in the area, steeper cut slope gradients may be feasible in areas that have significant rock structure. Steeper slope gradients must be verified based on the results of laboratory testing and observation of slope conditions.

2. Fill slopes should be constructed by overbuilding the slope face and then cutting it back to the design slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking.

3. Benching during placement of fill on an existing slope must extend through loose surface soil into firm material, and be performed at intervals such that no loose soil is left beneath the fill.

5.1.6 Erosion Control

Graded portions of the site should be seeded following grading to allow vegetation to become established prior to and during the rainy season. In addition, grading that results in greater than one acre of soil disturbance or in sensitive areas may require the preparation of a storm water pollution prevention plan. As a minimum, the following controls should be installed prior to and during grading to reduce erosion.

1. Prior to commencement of site work, fiber rolls should be installed down slope of the proposed area of disturbance to reduce migration of sediment and small rocks from the site.

2. Soil exposed in permanent slope faces should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District.

3. Following seeding, jute netting or erosion control blankets should be placed and secured over graded slopes steeper than 2:1, H:V, to keep seeds and

straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.

4. Surface water drainage ditches should be established as necessary to intercept and redirect concentrated surface water away from cut and fill slope faces. Under no circumstances should surface water be directed over slope faces. The intercepted water should be discharged into natural drainage courses or into other collection and disposal structures.

5.1.7 Subsurface Drainage

If grading is performed during or immediately following the rainy season, seepage will likely be encountered. If groundwater or saturated soil conditions are encountered during grading, we anticipate that dewatering may be possible by gravity or by installation of sump pumps in excavations.

Control of subsurface seepage at the base of fill areas can typically be accomplished by placement of an area drain. Underlying, saturated soil is typically removed and replaced with free draining, granular drain rock enveloped in geotextile fabric. Fill soil can be placed over the granular rock. H&K should review proposed drainage improvements with regard to the site conditions prior to construction.

5.1.8 Surface Water Drainage

Proper surface water drainage is important to the successful development of the project. We recommend the following measures to help mitigate surface water drainage problems:

1. Slope final grade adjacent to structural areas so that surface water drains away from building pad finish subgrades at a minimum 2 percent slope for a minimum distance of 10 feet.

2. Compact and slope all soil placed adjacent to building foundations such that water is not retained to pond or infiltrate. Backfill should be free of deleterious material.

3. Direct downspouts to a solid collector pipe which discharges flow to positive drainage.

5.1.9 Construction Monitoring

Construction monitoring includes review of plans and specifications and observation of onsite activities during construction as described below.

1. We should be retained to review the final grading plans prior to construction to determine whether our recommendations have been implemented, and if necessary, to provide additional and/or modified recommendations.

2. We should be retained to perform construction monitoring during grading performed by the contractor to determine whether our recommendations have been implemented, and if necessary, provide additional and/or modified recommendations.

5.2 FOUNDATION SYSTEMS

Our preliminary opinion is that conventional shallow spread footings will be suitable for support of structures across much of the property. Footings should be founded on native, undisturbed soil, weathered rock or compacted and tested fill. Foundation design criteria and construction recommendations are typically provided as part of a design-level geotechnical engineering report.

Footings should be deepened through expansive clay soil, if encountered at the base of the footing excavations. Expansive clay soil is typically encountered in relatively thin layers near the soil/weathered rock interface.

Shallow, resistant rock which limits footing excavation may be encountered during construction in the northern and eastern portions of the property. The presence of shallow rock within building footprints may require the use of rock anchors or dowels to provide uplift and sliding resistance. H&K can provide site specific anchor recommendations during construction, if requested.

Existing deep fill is probably not suitable to support structures without mitigation. The mitigation options should be determined during the course of a design-level investigation.

6 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in northern California. This warranty is in lieu of all other warranties, either expressed or implied.

2. These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client. Any reliance on this report by a third party is at the risk of that party.

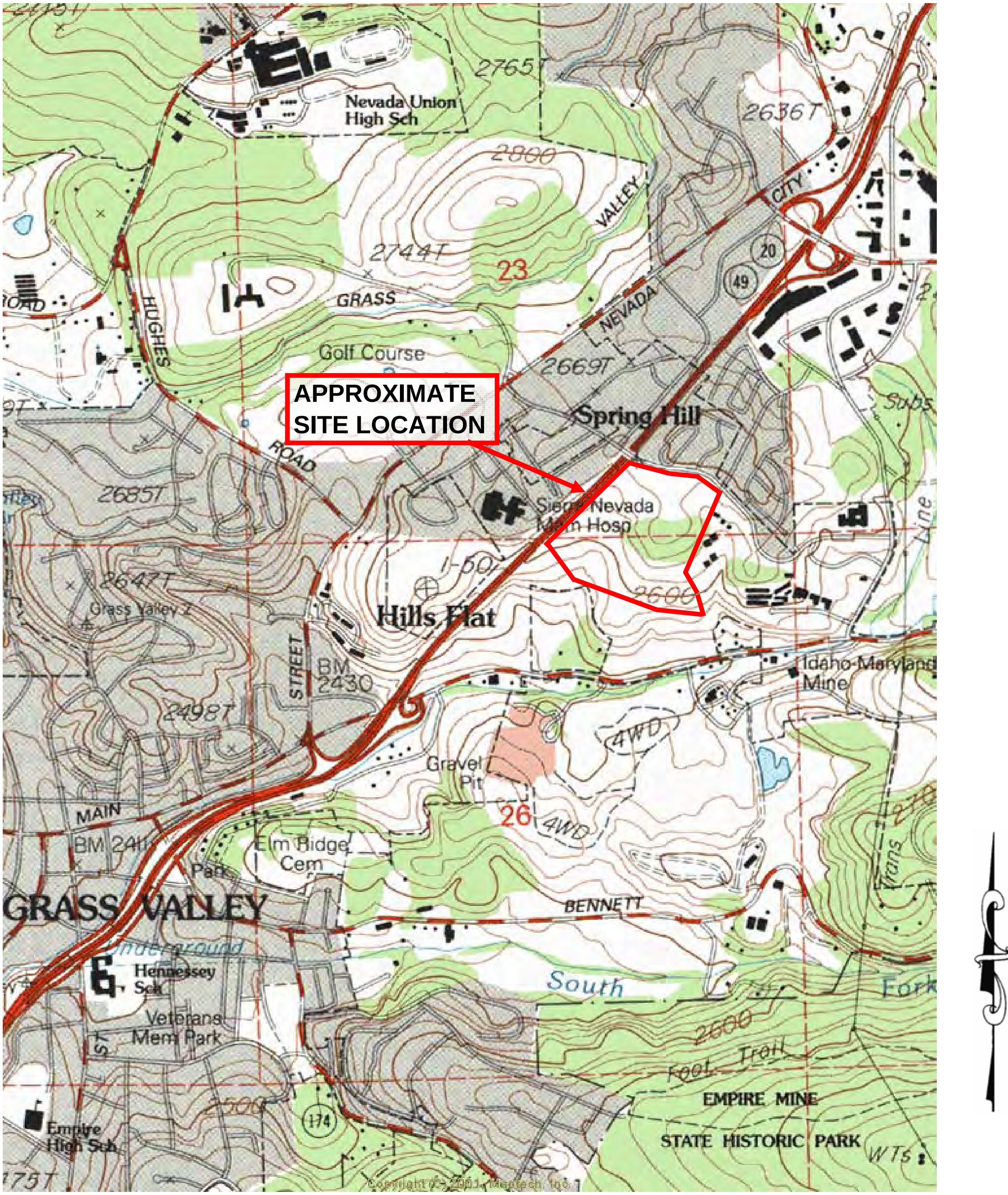
3. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid by all parties. Only our firm can determine the validity of the conclusions and recommendations presented in this report. Therefore, we should be retained to review all project changes and prepare written responses with regards to their impacts on our conclusions and recommendations. Subsurface investigation and laboratory testing will be required to develop design-level recommendations.

4. The analyses, conclusions and recommendations presented in this report are preliminary, based on site conditions as they existed at the time we performed our surface observations. The subsurface conditions should be confirmed by a design-level geotechnical investigation prior to construction.

5. Our scope of services for the preliminary geotechnical investigation did not include evaluating the project site for the presence of hazardous materials. Please review the July 6, 2007 draft PEA for information regarding hazardous materials. Project personnel should be careful and take the necessary precautions when working with hazardous materials during construction.

6. The findings of this report are valid as of the present date. Changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

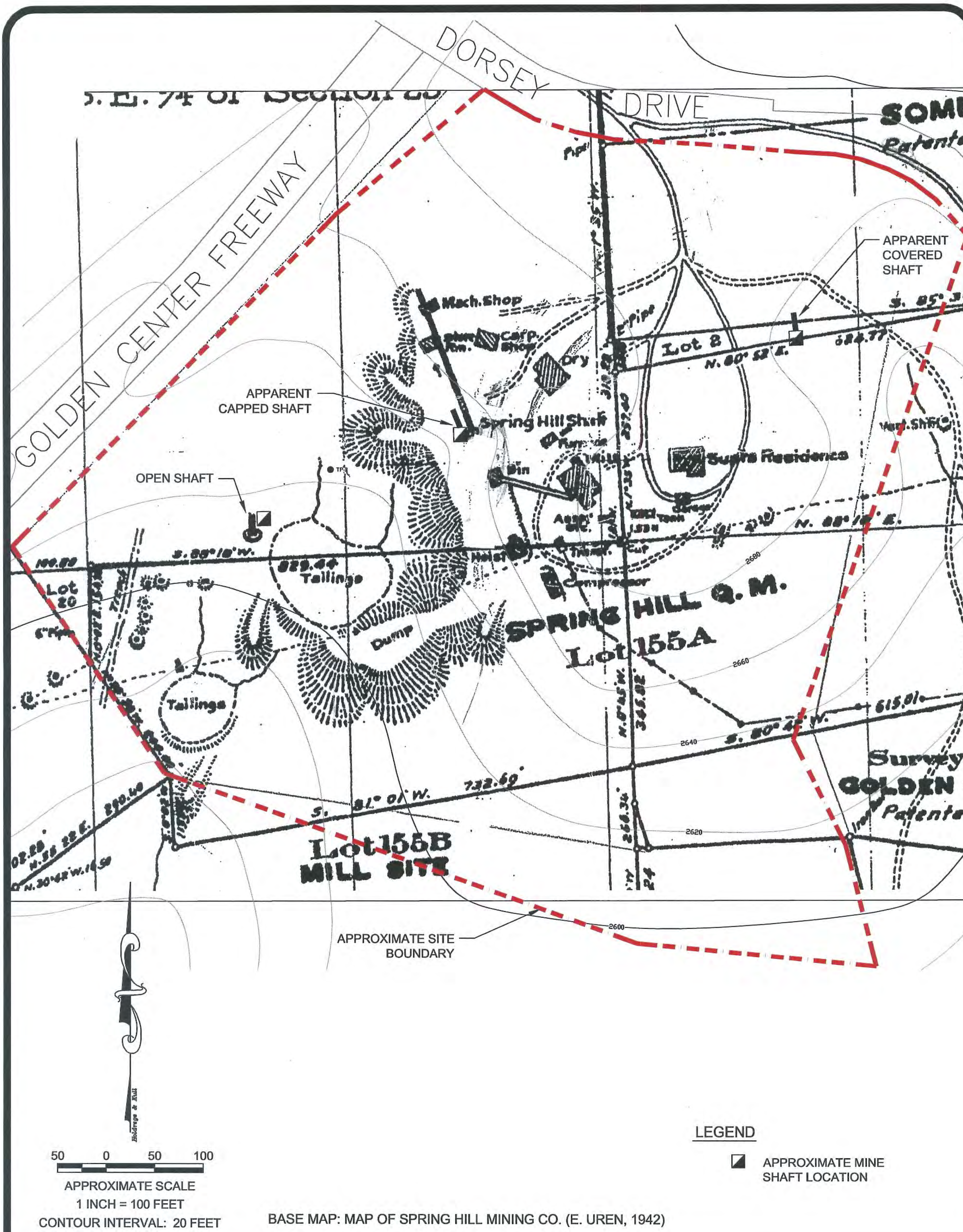
FIGURES



NO SCALE

SOURCE: GRASS VALLEY QUADRANGLE MAP (USGS, PROVISIONAL EDITION 1995)

HOLDREGE & KULL CONSULTING ENGINEERS • GEOLOGISTS 792 Searls Avenue • Nevada City, CA 95959 (530) 478-1305 • FAX (530) 478-1019	SITE LOCATION MAP SPRING HILL MINE PROPERTY GRASS VALLEY, CALIFORNIA	PROJECT NO. 3292-03 SEPTEMBER 2007 FIGURE 1



SITE MAP

FORMER SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

3292–03–FIG2

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959
(530) 478-1305 FAX 478-1019

DRAWN BY: DFD	CHECKED BY: ZW
PROJECT NO.: 3292-03	
DATE: SEPTEMBER 2007	
FIGURE NO.: 2	

APPENDIX A PROPOSAL

Proposal No. PN07219
July 17, 2007

Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677
fax: 916 415 0360

Attention: Mr. Warren Hughes

Reference: ***Former Spring Hill Mine Property***
APNs 35-260-62, 63, and 64
Nevada County, California

Subject: ***Contract Extension for Preliminary Geotechnical investigation***

Dear Mr. Hughes:

At your request, we are providing this proposal for preliminary geotechnical engineering services at the former Spring Hill Mine property located immediately southeast of Dorsey Drive and east of Highway 20/49 in Grass Valley, California. The site includes three parcels with a total area of approximately 26.7 acres. The Nevada County Assessor's Parcel Numbers (APNs) are 35-260-62, 63, and 64. The purpose of our services will be to evaluate the feasibility of the proposed development from a geotechnical/geological standpoint.

As currently proposed, the project will include commercial development of the property, with associated grading for access roads, building pads, and subsurface utilities.

SCOPE OF SERVICES

Based on our current understanding of the project, we propose to perform the following scope of services:

Field Investigation

We will perform a literature review of pertinent geologic and soil survey documents and previous reports prepared by H&K. Our field investigation will also involve a cursory site
visit to observe the existing condition of the subject property, noting existing fill, standing water and drainage, past mining features and other geotechnical or geologic features that may impact the development, as well as rock/soil types observed at the ground surface.

Preliminary Geotechnical Report

Following completion of the above tasks, we will compile a report which will include:

- Site plan showing approximate locations of geologic features;
- Description of soil and rock conditions;
- Preliminary grading and drainage recommendations;
- General conclusions regarding feasibility of the proposed improvements from a geotechnical engineering standpoint;
- Recommended foundation systems; and
- Preliminary recommendations to mitigate the presence of expansive soil, if encountered.

FEES

Our fee to provide the outlined services will be $2,400. Progress billing will be monthly on a percent complete basis. If this proposal meets your approval, please sign the enclosed terms and conditions and return one copy as our authorization to proceed.

TIMING

We will be able to start our field investigation for the project within one weeks of receiving authorization to proceed. Our report will be submitted within three weeks of completing our field investigation.

If you have any questions, please do not hesitate to contact us. Thank you for considering our firm to provide services for your project.

Sincerely,

HOLDREGE & KULL

Zack Washburn, P.G.
Staff Geologist

Authorization of Contract Extension

I hereby authorize Holdrege & Kull to implement the above scope of services for the fee outlined in this proposal. This authorization extends the existing signed contract between Gallelli & Sons, LLC and Holdrege & Kull dated March 5, 2007 to apply to the services and fees outlined in this proposal.

____
Name

____
Signature

____
Date

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APPENDIX B IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT (Included with permission of ASFE, Copyright 2004)

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
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e-mail: info@asfe.org www.asfe.org

APPENDIX G

Traffic Impacts Analysis Report

Dorsey Marketplace Transportation Impact Analysis Report

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DORSEY MARKETPLACE
TRANSPORTATION IMPACT ANALYSIS REPORT

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Introduction

This report has been prepared for Dudek to present the results of the Transportation Impact Analysis Report (TIAR) performed by GHD for the proposed Market Place in the City of Grass Valley. The project is located in the southeast quadrant of the intersection of State Route 49/20 Northbound Ramps and Dorsey Drive in Grass Valley, California.

The proposed project includes two alternatives. Alternative A proposes commercial development and multi-family units. Alterative B proposes commercial development, multi-family units and office space. The project location and study area are presented in **Figure 1**.

The following analysis scenarios are included as a part of the TIAR:

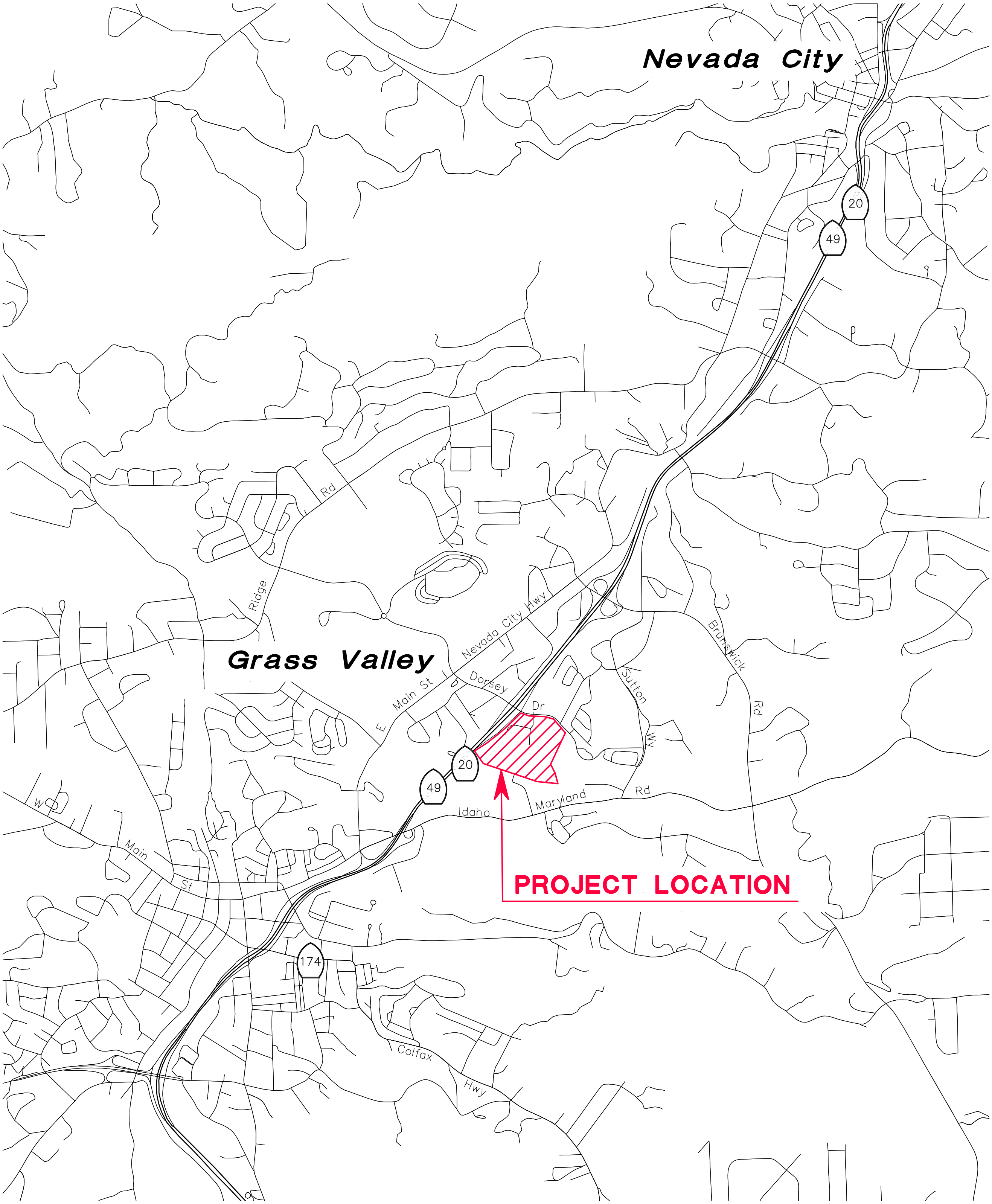
- *Existing No Project* Conditions
- *Existing Plus Project* Conditions
- *Year 2035 No Project* Conditions
- *Year 2035 Plus Project* Conditions

Existing No Project conditions represent the analysis scenario in which the current traffic operations at the study locations are investigated using current traffic counts and intersection configurations.

Existing Plus Project conditions represent the analysis scenario in which traffic impacts associated with the proposed project for Alternatives A and B are investigated in comparison to the *Existing No Project* conditions. Project trips generated by the project are added to existing traffic counts and intersection configurations remain the same. To reduce the proposed project impact to acceptable levels, mitigations were recommended for locations where the project's impacts were found to be significant.

Year 2035 No Project conditions represent the analysis scenario which would exist following approximately twenty years of development in the City of Grass Valley. *Year 2035 No Project* conditions evaluate traffic operations in the Year 2035 excluding the proposed development of the Dorsey Marketplace.

Year 2035 Plus Project conditions represent the analysis scenario in which traffic impacts associated with the proposed project for Alternative A and B are investigated in comparison to the *Year 2035 No Project* conditions. To reduce the proposed project impact to acceptable levels, mitigations were recommended for locations where the project's impacts were found to be significant.



Dorsey Marketplace TIAR

Figure 1

Study Area Map

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Project Setting

The City of Grass Valley is the largest city in the western region of Nevada County, California, covering approximately 4.74 square miles. The US Census Bureau reports that in 2010 the population in Grass Valley was approximately 12,900 people.

Transportation System

The following roadways provide primary circulation within the City of Grass Valley in the vicinity of the proposed project:

> ***State Route 49 (SR 49)*** is an inter-regional highway that begins in Madera County where it diverges from State Route 41. SR 49 traverses in the north-south direction through Tuolumne, Calaveras, Amador, El Dorado, Placer, Nevada, Yuba, Sierra, and Plumas counties. SR 49 terminates at its northern terminus at SR 70. SR 49 has a four-lane divided freeway through the project study area. SR 49 has double designation through the project study area as SR 20. Throughout this report, the segment of highway will be recognized as SR 49/20.
>
> ***Brunswick Road*** is primarily a two-lane with portions widening to four-lanes, east-west arterial that runs between Nevada City Highway and CA 174. Brunswick Road runs north-south from Old Tunnel Road to CA 174.
>
> ***Dorsey Drive*** is a two-lane, east-west collector that runs between East Main Street and Sutton Way.
>
> ***Idaho Maryland Road*** is a two-lane, east-west arterial/collector that runs between East Main Street and Banner Lava Cap Road.
>
> ***East Main Street*** is a two-lane, north-south arterial that runs between Nevada City Highway and West Main Street. East Main Street transitions into West Main Street and continues to Squirrel Creek Road.
>
> ***Nevada City Highway*** is a two-lane, north-south arterial that runs between East Main Street and Gold Flat Road.

Study Intersections and Freeway Segments

Intersections

The following list of critical study intersections were selected in coordination with City of Grass Valley and Caltrans staff for analysis within this study for weekday AM and PM peak hour conditions:

1. Brunswick Road/Olympia Drive and Nevada City Highway
2. Brunswick Road and State Route 49/20 SB/WB Off Ramp/Maltman Drive
3. Brunswick Road and State Route 49/20 NB/EB Ramps
4. Brunswick Road and Sutton Way
5. Dorsey Drive and Main Street
6. Dorsey Drive and Catherine Lane
7. Dorsey Drive and State Route 49/20 SB/EB On Ramp/Joerschke Drive

8. Dorsey Drive and State Route 49/20 NB/WB Ramps
9. Dorsey Drive and Apartment Driveway
10. Dorsey Drive and Sutton Way
11. Idaho Maryland Road and Sutton Way
12. Idaho Maryland Road and Brunswick Road
13. Idaho Maryland Road and Spring Hill Drive
14. Idaho Maryland Road and Centennial Drive
15. Idaho Maryland Road/Main Street and State Route 49/20 SB/EB Ramps/Main Street
16. Idaho Maryland Road and State Route 49/20 NB Ramps
17. Bennett Street and State Route 49/20 SB Off Ramp/Tinloy Street
18. Bennett Street and State Route 49/20 On Ramp/Hansen Way

Roadway Segments

Roadway segments were not analyzed as part of this study. Intersection operations typically dictate whether widening would need to occur for roadway segments. Wider roadways would require tapering toward intersections not requiring widening.

Mainline and Ramp Segments

The following mainline and ramp segments were selected for State Route 49/20 in coordination with the City of Grass Valley and Caltrans staff for analysis within this study for Existing and Year 2035 conditions with and without the proposed project:

1. North of Brunswick Road NB - Mainline
2. Brunswick Road On Ramp NB - Merge
3. Brunswick Road Loop On Ramp NB - Merge
4. Dorsey Drive to Brunswick Road NB - Weave
5. Idaho Maryland Road to Dorsey Drive NB - Weave
6. Bennett Street to Idaho Maryland Road NB - Weave
7. South of Bennett Street NB - Mainline
8. North of Brunswick Road B - Mainline
9. Brunswick Road Off Ramp SB - Diverge
10. Brunswick Road Loop On Ramp SB - Merge
11. Brunswick Road to Dorsey Drive SB - Weave
12. Dorsey Drive to Idaho Maryland Road SB - Weave
13. Idaho Maryland Road to Bennett Street SB - Weave
14. South of Bennett Street SB - Mainline

Ramp traffic volumes were obtained from the existing intersection counts at the following intersections:

- State Route 49/20 SB Off Ramp and Brunswick Road
- State Route 49/20 NB Ramps and Brunswick Road
- State Route 49/20 SB On Ramp/Joerschke Drive and Dorsey Drive
- State Route 49/20 NB Ramps and Dorsey Drive
- State Route 49/20 SB Ramps/Idaho Maryland Road and Main Street
- State Route 49/20 NB Ramps and Idaho Maryland Road
- State Route 49/20 SB Off Ramp/Tinloy Street and Bennett Street
- State Route 49/20 NB On Ramp/Hansen Way and Bennett Street

Freeway mainline traffic volumes were obtained from the 2014 published Caltrans data for the SR 49/20 mainline segment.

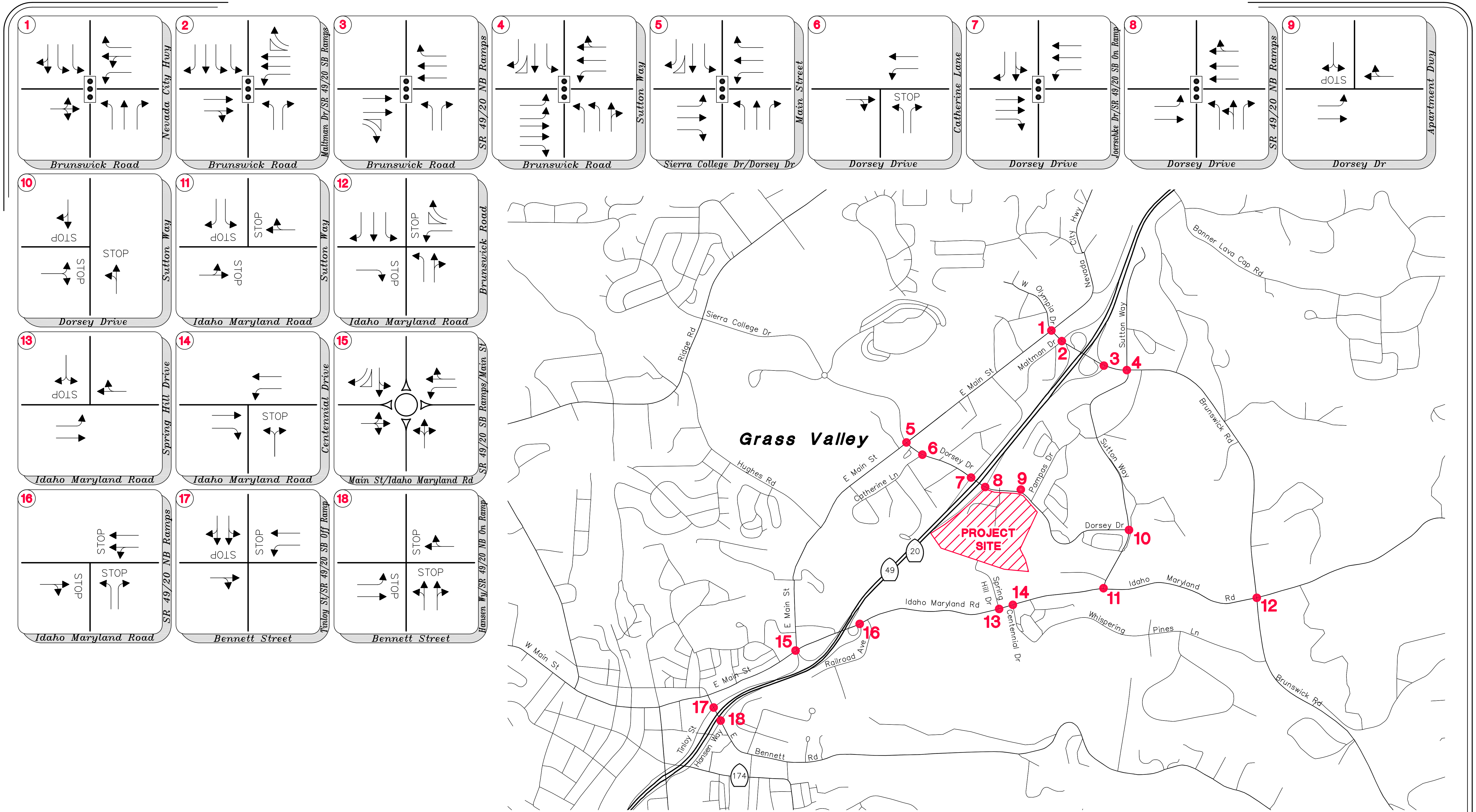
Data Collection and Analysis Time Periods

Weekday AM and PM peak hour traffic counts were collected on March 8th and 17th, 2016. Schools in the area were in session and no known special events were occurring in the area at the time of the traffic counts. No precipitation or inclement weather was recorded on the collection dates.

To ensure the counts conducted in 2016 were still valid, counts collected between January to March 2018 at study locations located along Dorsey Road, Idaho Maryland Road, and Brunswick were compared. The comparison showed traffic volumes to be within 10 percent. Thus, the counts collected in 2016 still closely and accurately represent existing conditions.

Figure 2 presents the *Existing No Project* lane geometrics and intersection control types. **Figure 3** presents the *Existing No Project* traffic volumes at all study locations.

All intersections were analyzed during the weekday AM and PM peak hour periods. The AM peak hour period is defined as the one-hour of peak traffic flow (which is the highest total volume count over four consecutive 15-minute count periods) counted between 7:00 am and 9:00 am on a typical weekday. The PM peak hour is defined as one-hour of peak traffic flow counted between 4:00 pm and 6:00 pm on a typical weekday.



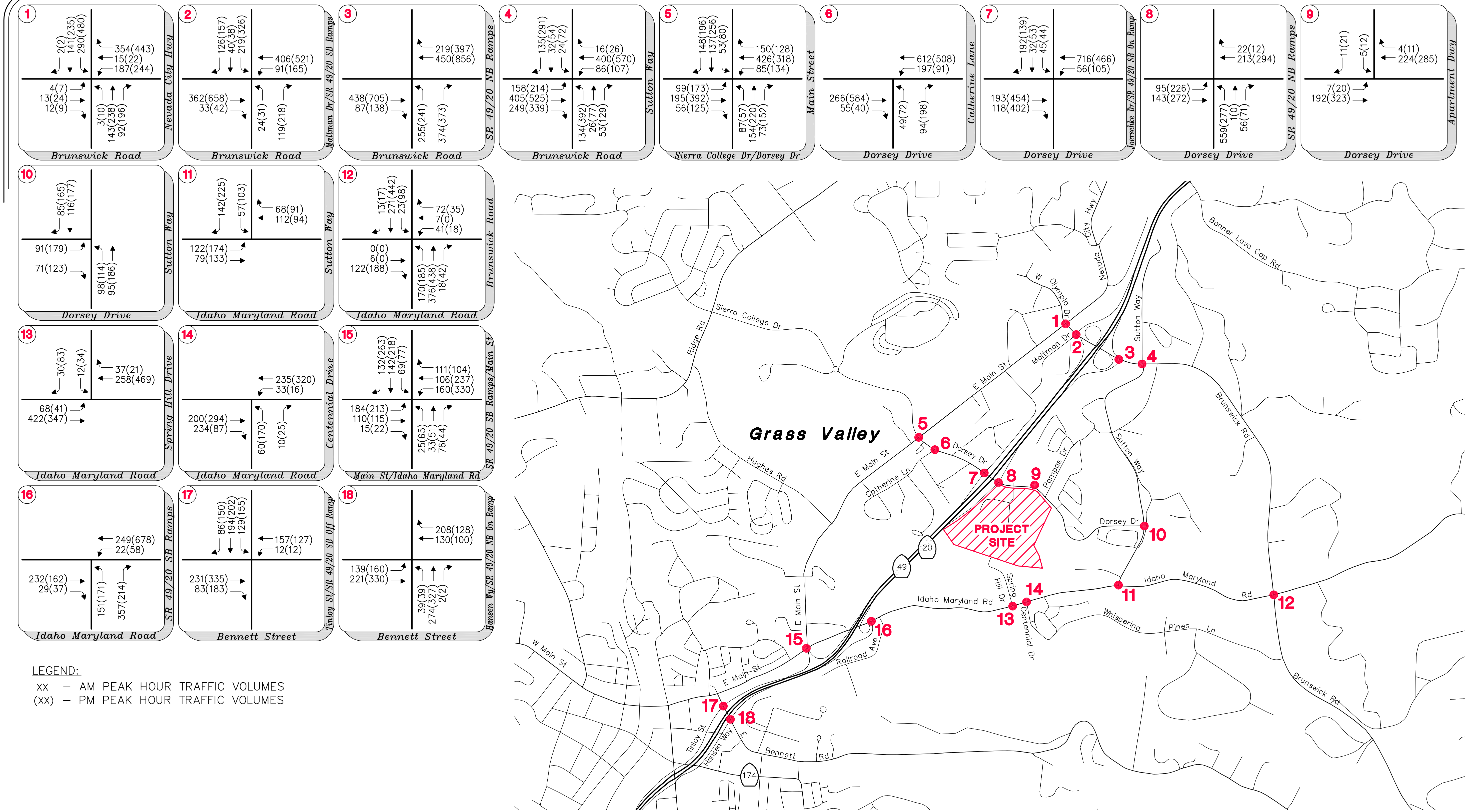
Dorsey Marketplace TIAR

Figure 2

Existing Lane Geometrics and Control

Dorsey Marketplace TIAR

Figure 3



LEGEND:
XX – AM PEAK HOUR TRAFFIC VOLUMES
(XX) – PM PEAK HOUR TRAFFIC VOLUMES

Existing Peak Hour Traffic Volumes

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Job No:

Level of Service Methodologies and Guidelines

The following sections outlines the methodology and analysis parameters used to quantify traffic operations at study locations.

General LOS Methodologies

Intersection and ramp LOS have been calculated for all control types using the methods documented in the Transportation Research Board publication *Highway Capacity Manual 2010*. LOS determinations are presented on a letter grade scale from "A" to "F", whereby LOS "A" represents "free flow" conditions and LOS "F" represents over capacity conditions.

Mainline and Ramp LOS Methodologies

Mainline and ramp LOS is calculated using *HCS 2010* software by McTrans. LOS has been calculated on a density basis as passenger cars per mile per lane (pc/mi/ln). **Table 1** presents the LOS thresholds for freeway mainline segments and ramps within the study area.

TABLE 1
LEVEL OF SERVICE (LOS) CRITERIA FOR MAINLINE AND RAMP SEGMENTS

BASIC FREEWAY SEGMENTS		RAMP MERGE AND DIVERGE AREAS	
LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
A	0 - 11	A	≤ 10
B	> 11 - 18	B	> 10 - 20
C	> 18 - 26	C	> 20 - 28
D	> 26 - 35	D	> 28 - 35
E	35 - 45	E	> 35
F	> 45	F	Demand exceeds capacity

References: 2010 Highway Capacity Manual

Intersection LOS Methodologies

Levels of Service (LOS) have been calculated for all intersection control types using the methods documented in the Transportation Research Board's *Highway Capacity Manual, Fourth Edition 2010*. Traffic operations have been quantified through the determination of "Level of Service" (LOS). Level of service is a qualitative measure of traffic operating conditions, whereby a letter grade A through F is assigned to an intersection or roadway segment representing progressively worsening traffic conditions.

For signalized intersections and all-way stop-controlled (AWSC) intersections, intersection delays and LOS are average values for all intersection movements. For two-way stop-controlled (TWSC) intersections, the intersection delays and LOS are represented by the worst approach. The delay-based LOS criteria for different types of intersection control are outlined in **Table 2**.

TABLE 2
LEVEL OF SERVICE CRITERIA FOR INTERSECTIONS

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay/Vehicle (sec) Signalized/ Roundabouts	Stopped Delay/Vehicle (sec) Unsignalized/ All-Way Stop
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	< 10.0	< 10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10.0 and < 20.0	>10.0 and < 15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted.	>20.0 and < 35.0	>15.0 and < 25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35.0 and < 55.0	>25.0 and < 35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55.0 and < 80.0	>35.0 and < 50.0
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	> 80.0	> 50.0

References: 2010 Highway Capacity Manual

In addition, the City of Grass Valley has the following methodologies for analysis in traffic studies:

1. **Traffic Impact Analysis** - Unless otherwise noted in the Scoping Agreement, includes evaluation of intersection operation as well as midblock roadway segment operation.
   a. **Analysis Methodologies** -
      i. Highway Capacity Manual (HCM) methodology must be used. Default HCM values must be used unless noted otherwise below.
      ii. Current signal timing schedules for signalized intersections must be used in the analysis.
      iii. Found roundabouts, micro simulation (SimTraffic for single lane roundabouts and Vissim for multi-lane roundabouts) or SIDRA software must be used.
      iv. For the Brunswick Road Corridor (including Brunswick/E. Main, Brunswick. SR 20/49 on and off ramps, and Brunswick/Sutton intersections) and the McKnight Way corridor (McKnight and SR 49 on and off ramp intersections), Synchro/SimTraffic Version 7 software (or approved equal) micro-simulation software using HCM 2000 methodology must be used to evaluate the corridor as a whole due to the coordinated operation of the closely spaced signalized intersections.
      v. Intersections with non-standard traffic control (i.e. McKnight and South Auburn) should be analyzed using the engineer's best judgment (such as micro-simulation) and are subject to the review and approval of methodology by the Engineering Division.
      vi. Standard lane utilization may not occur at all intersections. This operational aspect is particularly true at SR 20/49 interchanges. The assumed lane utilizations should reflect actual conditions, which may require counts for each lane.

City of Grass Valley LOS Guidelines

The City of Grass Valley Traffic Studies' guidelines state the following:

> *"Study Intersections and Roadway Segments – LOS A, B, C, and D are considered acceptable LOS's for City intersections and roadway segments except where LOS E is considered acceptable for the following downtown intersections: Mill/Neal, W. Main/Mill, W. Main/Church, W. Main/School, Bank/S. Auburn, SR 20/49 SB Ramp/Bennett. Where project traffic is distributed, the following intersections and roadway segments must be analyzed if they: 1) are currently operating at LOS A, B and C (D for downtown intersections identified above) where project traffic contributes 10 or more peak hour trips; 2) are currently operating LOS D (E for downtown intersections identified above) or worse; and/or 3)are high accident locations (defined as intersections or roadway segments having five or more reported accidents within the most recent 3 year period)*

Caltrans LOS Guidelines

The following section outlines the LOS guidelines as mandated by Caltrans.

Intersection Analysis

The Caltrans published Guide for the Preparation of Traffic Impact Studies (dated December 2002) states the following:

"Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities, however, Caltrans acknowledges that this may not be always feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS."

Mainline and Ramp Analysis

Due to the close proximity of the interchanges along State Route 49/20, weave analysis will be performed on all interchanges. Caltrans standards identify the usage of the Leisch and Level D methods *(Source: Highway Design Manual Section 504.7)*. HCM weave analysis methods were used due to less difficulty in implementation and similar results to the Leisch and Level D methods. This methodology was reviewed and approved by Caltrans District 3 staff.

Target LOS Threshold

Consistent with all of the above noted service level policies, an LOS D threshold will be used at all study intersections, roadways, mainlines and ramps as standard acceptable threshold. This LOS threshold was reviewed and approved by City of Grass Valley and Caltrans District 3 staff.

Intersection Operations Analysis Software

The Synchro 9 (Trafficware) software suite will be used to implement the HCM 2010 analysis methodologies, except at the unsignalized intersection of State Route 49/20 SB Off Ramp/Tinloy Street and Bennett Street and the roundabout intersection of State Route 49/20 SB Ramps/Idaho Maryland and Main Street. These locations are either non-standard side street, stop-controlled or roundabout intersections which cannot be analyzed by implementing HCM analysis through Synchro. The study intersection of State Route 49/20 SB Off ramp/Tinloy Street and Bennett Street will be analyzed in SimTraffic 9 (Trafficware). The study intersection of State Route 49/20 SB Ramps/Idaho Maryland and Main Street will be analyzed with Sidra 6.

Significance and Mitigation Thresholds

The following thresholds of significance were used to determine if the impact is significant and requires mitigation. These thresholds are consistent with the City policy on study intersections and roadway segments:

"If the project traffic causes an intersection or roadway segment to worsen from an acceptable LOS to LOS E or worse or is distributed to an intersection or roadway segment currently operating at an unacceptable LOS, the project is determined to cause a significant impact which must be mitigated. It is acceptable to mitigate an intersection or roadway segment from an unacceptable LOS to an acceptable LOS. In the event of a significant impact, cumulative year analyses are required"

Technical Analysis Parameters

This TIAR provides evaluation of traffic operating conditions by incorporating appropriate heavy vehicle adjustment factors, peak hour factors, and signal lost-time factors and reports the resulting intersection delays and LOS as estimated using HCM 2010 based analysis methodologies. The following section describes all technical parameters incorporated into intersection analysis.

Table 3 presents parameters which were applied to study intersections during the analysis:

TABLE 3
INTERSECTION LOS - TECH NICAL ANALYSIS PARAMETERS

Technical Parameters[1, 2, 6]	Caltrans Intersections	City Intersections
Grade	Level at all Intersections	Level at all Intersections
% Trucks	From Counts	From Counts
PHF for Existing & Short Term	From Counts	From Counts
PHF for Future Conditions	0.88 or higher	0.88 or higher
Minimum Signal Cycle Length[3]	From Signal Timing Plans	80 seconds
Lost Time per Critical Signal Phase	From Signal Timing Plans	7 seconds
Left Turn Critical Volume[4]	1900 vph	1900 vph
Pedestrian calls per hour[5]	From Counts	From Counts

Notes:

1) Parameters apply to all study intersection unless specifically indicated otherwise

2) All parameters are same for existing as well as 2030 conditions

3) Will be optimized as appropriate for all relevant study intersections

4) a.k.a saturated flow rate

5) Applied to all approaches at signalized intersections

6) Computer software defaults will be used for all parameters not listed

Peak Hour Factors

Peak hour factors (PHF) were used in the HCM capacity and LOS analysis to account for the variation in traffic volumes during the peak hour. The adjustment increases the observed hourly volume to account for the peak 15 minutes of traffic. For *Existing* conditions analyses, observed peak hour factors will be used (for both the Caltrans and City intersections). For all scenarios in the *Year 2035*, a PHF of 0.88 will be used at the intersections with observed PHFs less than 0.92 in *Existing* conditions.

State Facility Parameters

Intersections within Caltrans jurisdiction will follow detailed technical parameters as provided by Caltrans District 3. District 3 provided very specific technical parameters to be applied to study intersections in the HCM capacity analysis. These factors largely affect signal timing to allow for specific pedestrian crossing times and also affect roadway capacity values by adjusting the assumed "saturation flow rate". The full District 3 parameters are attached in the Appendix of this report. These technical parameters were provided by Caltrans for inclusion in the study and are consistent with Caltrans District 3 traffic study requirements.

- Pedestrian Walk time: 7 seconds
- Pedestrian Don't Walk time: 3.5 feet/sec (or slower) pedestrian walk speed
- All-Red time: 1.0 seconds
- Yellow times: Use values per CA MUTCD
- Lead/Lag option: Protected left-turns shall be leading phasing
- Minimum green time: 8 seconds

Warrant Analysis

A supplemental traffic signal warrant analysis will be completed on unsignalized intersections operating at unacceptable LOS. The term "signal warrants" refers to the list of established criteria used by Caltrans and other public agencies to quantitatively justify or ascertain the need for installation of a traffic signal at an unsignalized intersection. This study has employed the signal warrant criteria presented in the latest edition of the California Manual on Uniform Traffic Control Devices (MUTCD) for all study intersections. The signal warrant criteria are based upon several factors, including the volume of vehicular and pedestrian traffic, frequency of accidents, and location of school areas. The California MUTCD indicates that the installation of a traffic signal should be considered if one or more of the signal warrants are met. Specifically, the study will utilize the peak hour volume-based Warrant 3.

Existing Conditions

The *Existing* conditions present the analysis scenario in which current operations at study locations are analyzed. This scenario establishes the baseline traffic conditions. **Figure 3** presents the *Existing No Project* traffic volumes at all study locations.

Intersection Operations

Existing No Project weekday AM and PM peak hour intersection traffic operations were quantified utilizing the existing traffic volumes and lane geometrics and controls. **Table 4** presents a summary of the *Existing No Project* study intersection LOS conditions.

TABLE 4
EXISTING CONDITIONS LEVEL OF SERVICE

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Brunswick Rd/Olympia Dr & Nevada City Hwy	Signal	D	35.6	D	-	39.1	D	-
2	Brunswick Rd & SR 49/20 SB/WB Off Ramp/Maltman Dr	Signal	D	33.1	C	-	36.3	D	-
3	Brunswick Rd & SR 49/20 NB/EB Ramps	Signal	D	14.4	B	-	12.5	B	-
4	Brunswick Rd & Sutton Way	Signal	D	29.4	C	-	40.6	D	-
5	Dorsey Dr & Main St	Signal	D	18.2	B	-	22.5	C	-
6	Dorsey Dr & Catherine Lane	TWSC	D	16.6	C		19.7	C	
7	Dorsey Dr & SR 49/20 SB/EB On Ramp/ Joerschke Dr	Signal	D	8.3	A	-	11.5	B	-
8	Dorsey Dr & SR 49/20 NB/WB Ramps	Signal	D	16.5	B	-	15.0	B	-
9	Dorsey Dr & Apartment Driveway	TWSC	D	10.6	B	-	11.8	B	-
10	Dorsey Dr & Sutton Way	AWSC	D	10.0	A	-	13.1	B	-
11	Idaho Maryland Rd & Sutton Way	AWSC	D	9.3	A	-	11.1	B	-
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	16.4	C	-	**122.1**	**F**	**No**
13	Idaho Maryland Rd & Spring Hill Dr	TWSC	D	11.8	B	-	15.2	C	-
14	Idaho Maryland Rd & Centennial Dr	TWSC	D	12.2	B	-	16.8	C	-
15	Idaho Maryland Rd/Main St & SR 49/20 SB/EB Ramps/Main St	RNDBT	D	7.8	A	-	9.9	A	-
16	Idaho Maryland Rd & SR 49/20 NB Ramps	AWSC	D	14.5	B	-	29.4	D	
17	Bennett St & SR 49/20 SB Off Ramp/Tinloy St	TWSC	D	14.5	B	-	17.8	C	-
18	Bennett St & SR 49/20 On Ramp/Hansen Way	AWSC	D	14.9	B	-	14.0	B	-

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3

As presented in **Table 4**, all study intersections, except the following, are currently found to operate at or above acceptable LOS.

- Intersection 12 – Idaho Maryland Road and Brunswick Road

Freeway and Ramp Operations

Table 5 presents a summary of the *Existing No Project* ramp merge, diverge and freeway mainline operations.

TABLE 5
EXISTING RAMP AND FREEWAY LEVEL OF SERVICE

#	Interchange Location	Target LOS	Segment Type	No. of Lanes	AM Peak Hour			PM Peak Hour		
					Volume	Density (pc/mi/ln)	LOS	Volume	Density (pc/mi/ln)	LOS
	SR 49/SR 20									
1	North of Brunswick NB	D	Freeway	2	991	9.3	A	1,762	16.4	B
2	Brunswick On Ramp NB	D	Merge	1	219	11.9	B	397	18.9	B
3	Brunswick Loop On Ramp NB	D	Merge	1	87	9.7	A	138	16.4	B
4	Dorsey to Brunswick NB	D	Weave	1		10.1	B		12.3	B
5	Idaho Maryland to Dorsey NB	D	Weave	1		14.2	B		14.8	B
6	Bennett to Idaho Marlyand NB	D	Weave	1		24.1	C		18.0	B
7	South of Bennett NB	D	Freeway	2	1,648	16.3	B	1,626	16.0	B
8	North of Brunswick SB	D	Freeway	2	1,625	16.0	B	1,242	12.3	B
9	Brunswick Off Ramp SB	D	Diverge	1	385	14.1	B	521	4.8	A
10	Brunswick Loop On Ramp SB	D	Merge	1	208	15.9	B	411	16.5	B
11	Brunswick to Dorsey SB	D	Weave	1		10.2	B		9.9	A
12	Dorsey to Idaho Maryland SB	D	Weave	1		11.8	B		14.4	B
13	Idaho Maryland to Bennett SB	D	Weave	1		14.4	B		18.4	B
14	South of Bennett SB	D	Freeway	2	1,379	13.6	B	1,811	17.9	B

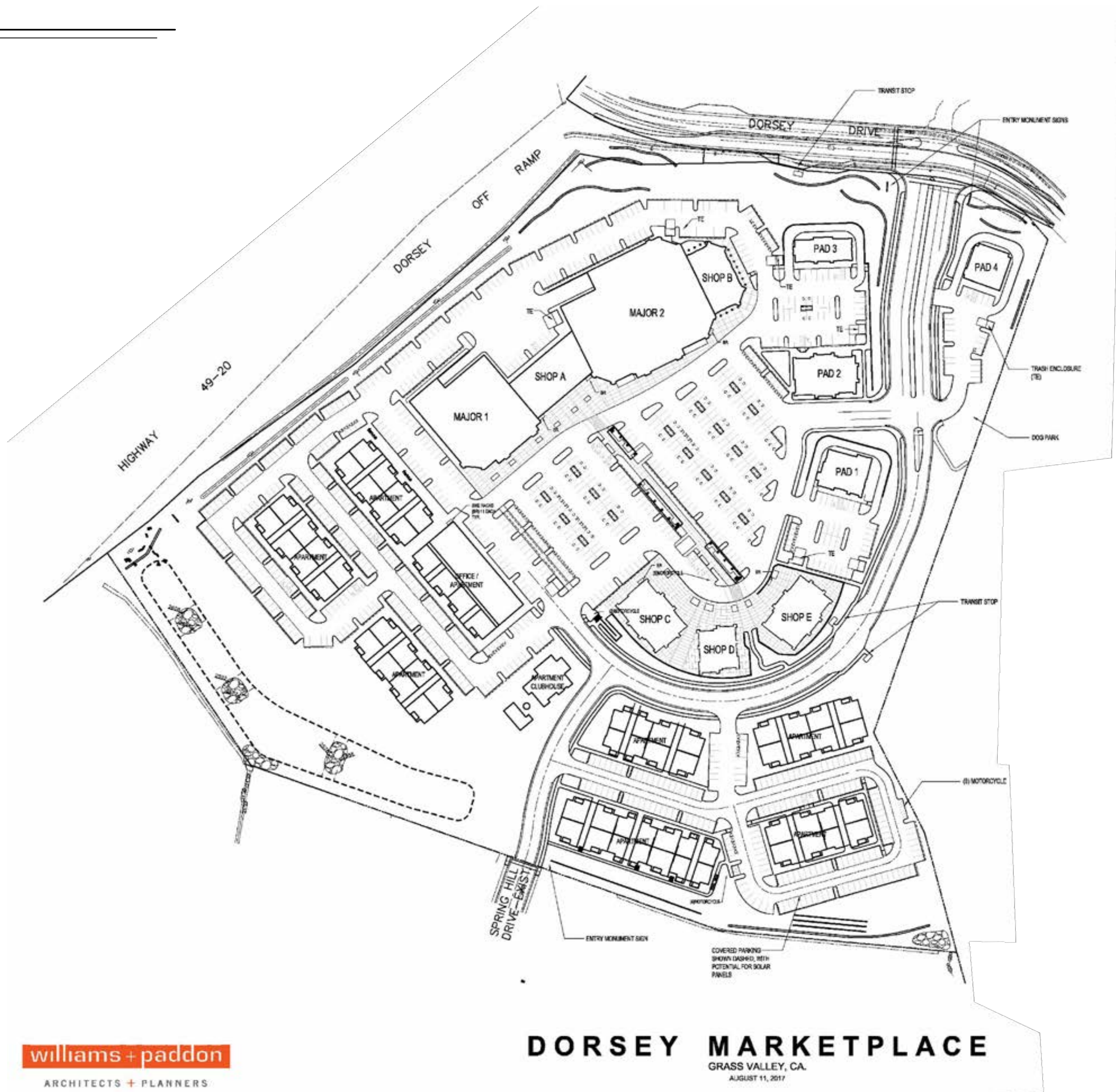
As presented in **Table 5**, all study ramps and freeway segments are currently found to operate at acceptable LOS.

Project Description

The following two variations of site plan have been considered for the project:

Alternative A: Under this alternative, the proposed project includes approximately 104,350 square feet of retail and commercial development, a 171-unit multi-family development, and approximately 8,500 square feet of office space. The proposed project site is located on a vacant 27-acre parcel southeast of the intersection of State Route 49/20 NB Ramps and Dorsey Drive. **Figure 4A** presents the detailed project site plan.

Alternative B: Under this alternative, the proposed project includes approximately 181,900 square feet of retail and commercial development and a 90-unit multi-family development. The proposed project site is located on a vacant 27-acre parcel southeast of the intersection of State Route 49/20 NB Ramps and Dorsey Drive. **Figure 4B** presents the detailed project site plan.



Dorsey Marketplace TIAR

Figure 4A

Project Site Plan (Alternative A)

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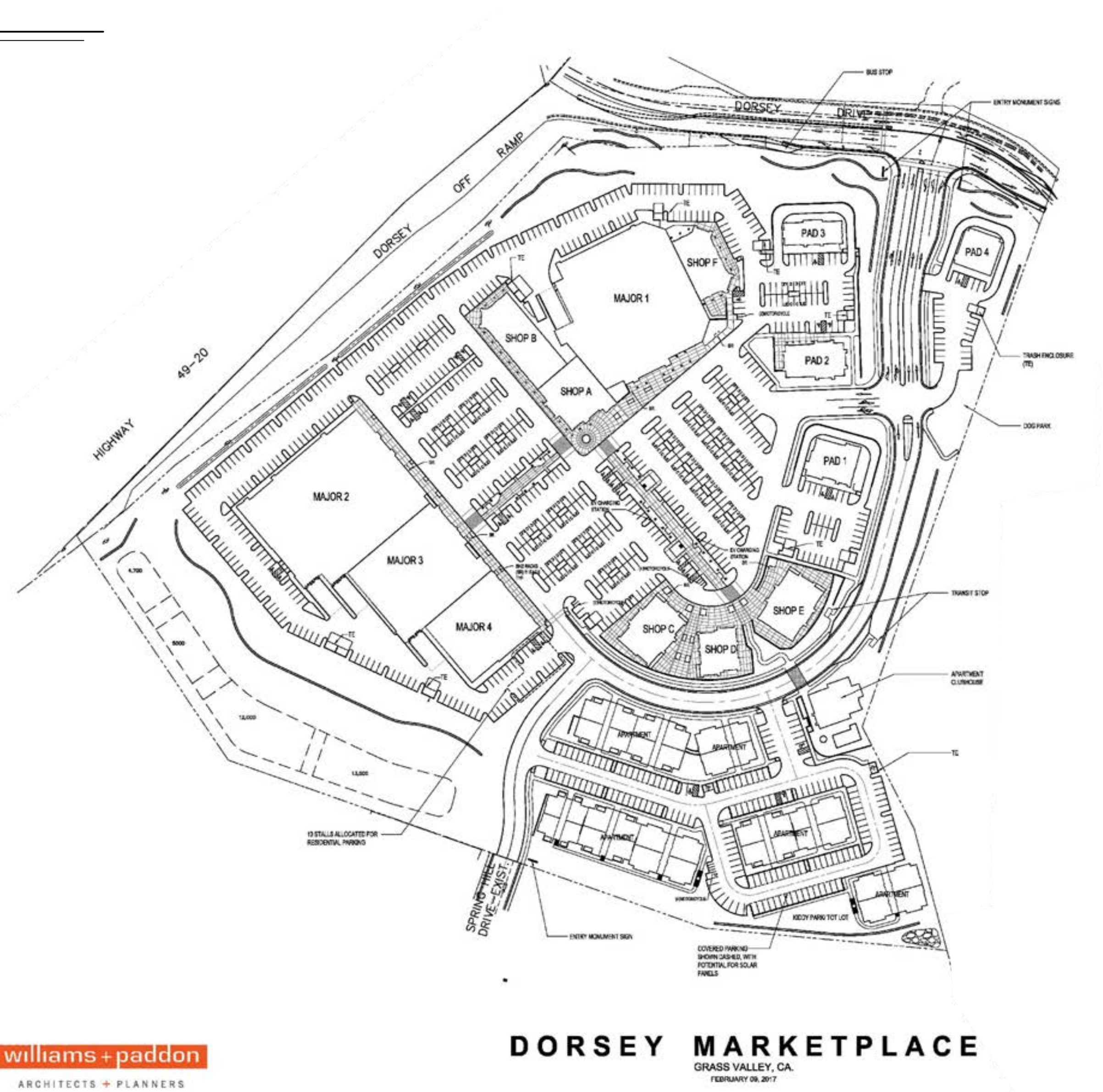

Dorsey Marketplace TIAR

Figure 4B

Project Site Plan (Alternative B)

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Project Site Access

Access to the project site will be provided via a newly constructed driveway located across from the Springhill Gardens Apartments Driveway along Dorsey Drive approximately 550 feet east of the intersection of State Route 49/20 NB Ramps and Dorsey Drive to the north and an extension of Spring Hill Drive northerly to the south limits of the proposed project.

This TIAR will quantify the weekday AM and PM peak hour impacts of the proposed project at the study intersections under *Existing* and *Year 2035* conditions, following build-out of the proposed project.

Trip Generation (Alternative A)

In order to calculate trip generation for the proposed project's retail and commercial component, peak hour counts were performed on March 2, 2016 at three local shopping centers with similar uses to the proposed project. The three local shopping centers' peak hour traffic was averaged to derive peak hour trip rates. When compared, the three local shopping centers were shown to generate more traffic compared to the published average rates and equations in the Institute of Transportation Engineers' (ITE) *Trip Generation Manual 9th Edition*. Internal trip capture and pass-by rates were used based on the *Trip Generation Handbook 3rd Edition* by the Institute of Transportation Engineers.

The proposed project's apartment component will use ITE average rates. **Table 6** presents the trip generation, calculated using the described methodology.

TABLE 6
PROPOSED PROJECT TRIP GENERATION (ALTERNATIVE A)

Land Use Category (ITE Code)	Unit[1]	AM Peak Hour Trip Rate/Unit Total	AM In %	AM Out %	PM Peak Hour Trip Rate/Unit Total	PM In %	PM Out %
Apartment (220)	DU	0.46	23%	77%	0.56	63%	37%
Shopping Center (820)	ksf	2.80	62%	38%	6.63	48%	52%
Office (710)	ksf	4.06	86%	14%	1.29	16%	84%
Project Name	**Quantity (Units)**	**AM Peak Hour Trips Total**	**In**	**Out**	**PM Peak Hour Trips Total**	**In**	**Out**
Multi-Family Residential	171	79	18	61	95	60	35
To Shopping Center		*0*	*0*	*0*	*-36*	*-18*	*-18*
To Office		*0*	*0*	*0*	*0*	*0*	*0*
Market Place	104.4	293	181	111	692	332	360
To Residential		*0*	*0*	*0*	*-36*	*-18*	*-18*
To Office		*-2*	*-1*	*-1*	*-1*	*-1*	*0*
General Office	8.5	34	30	5	11	2	9
To Shopping Center		*-2*	*-1*	*-1*	*-1*	*0*	*-1*
To Residential		*0*	*0*	*0*	*0*	*0*	*0*
Project Trips		402	227	175	724	357	367
Shopping Center Pass-by (15% for AM, 30% for PM reduction)		*-44*	*-27*	*-17*	*-197*	*-94*	*-103*
Net New Project Trips		**358**	**200**	**158**	**527**	**263**	**264**

Notes:
1. 1 ksf = 1,000 square feet DU = dwelling unit
2. Trip rates based on ITE Trip Generation Manual 10th edition fitted curve equations and local data

As presented within **Table 6**, the proposed project is projected to generate 358 trips and 527 trips in the AM and PM peak hours, respectively.

Project Trip Distribution

The *Existing Plus Project* directional trip distribution and specific assignment of project-generated trips were established based on an understanding of existing and projected future traffic flows and travel patterns within the vicinity of the project site and the Nevada County Travel Demand Model.

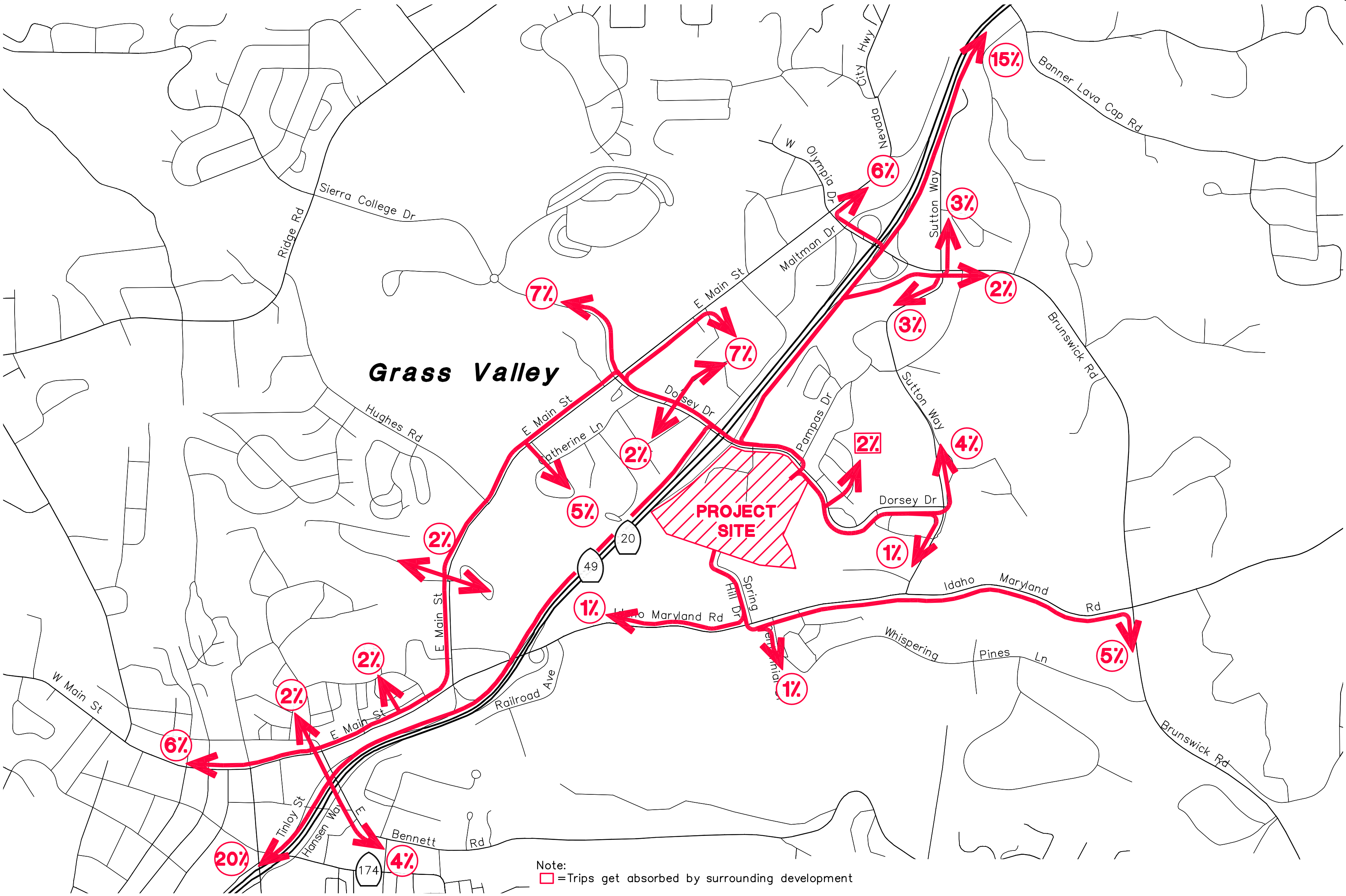
The *Year 2035 Plus Project* directional trip distribution and specific assignment of project-generated trips were established based on an understanding of existing and projected future traffic flows and travel patterns within the vicinity of the project site and the Nevada County Travel Demand Model.

Currently, the following movements are restricted at the intersection of Brunswick Road and Idaho Maryland Road:

- Eastbound approach is restricted to right turns only
- Westbound approach is restricted to left and right turns only

Based on information from City of Grass Valley staff and consistent with the Loma Rica EIR, the intersection of Brunswick Road and Idaho Maryland Road is assumed to be improved to allow full access in Cumulative conditions.

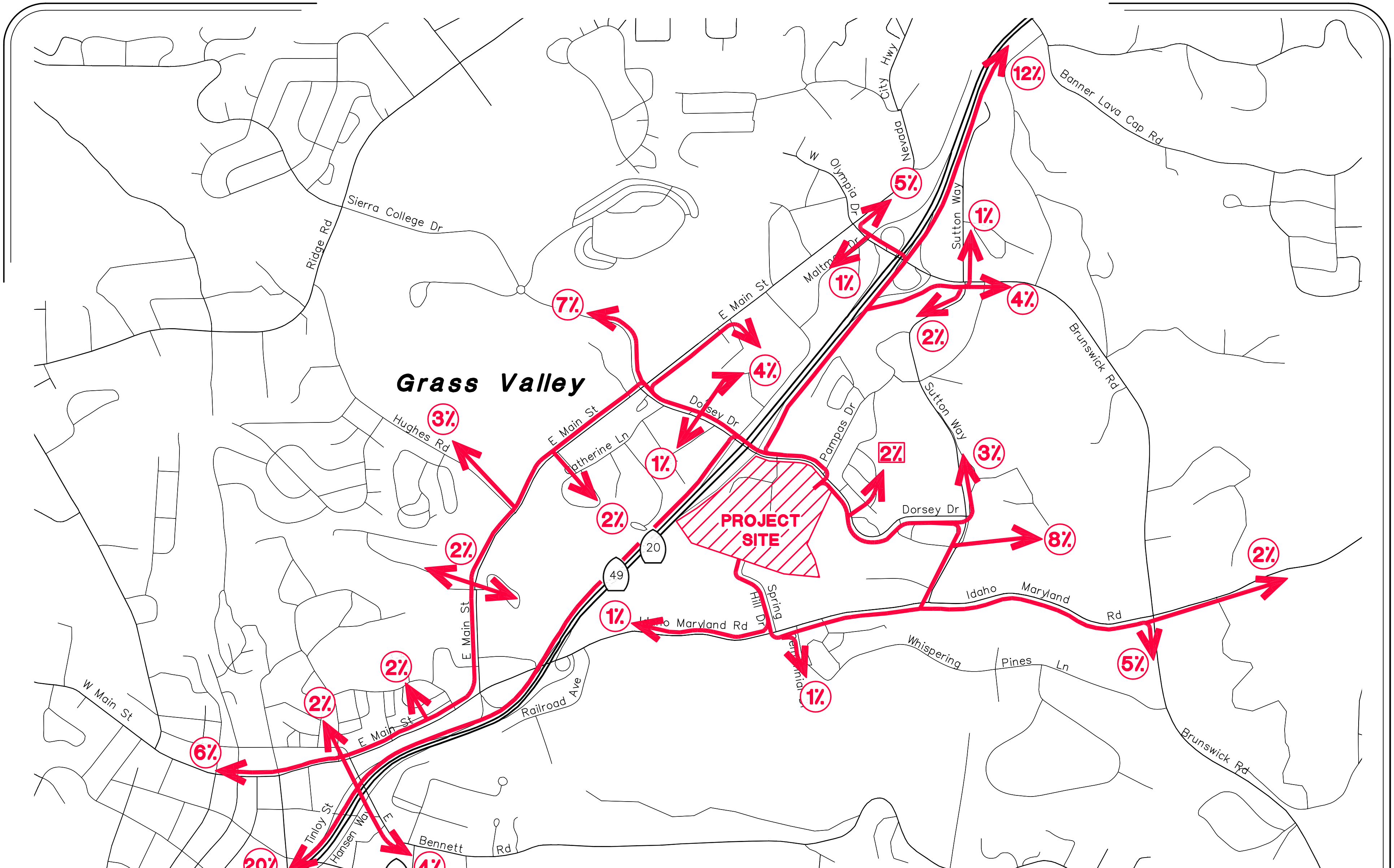
Figures 5A and **5B** present the *Existing Plus Project* and *Year 2035 Plus Project* directional trip distribution graphics.



Dorsey Marketplace TIAR

Figure 5A

Existing Plus Project Trip Distribution



Note: Under Cumulative conditions, Brunswick Road and Idaho Maryland Road assumed intersection operations to full access configurations

☐ =Trips get absorbed by surrounding development

Dorsey Marketplace TIAR

Figure 5B

Cumulative Trip Distribution

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JOB NO: 25-2460-02

Alternative Transportation Methods

The following sections outline the alternative transportation methods present for the existing conditions.

Pedestrian Facilities

The following discussion presents the existing pedestrian facilities and examines the impact of project conditions on the existing infrastructure.

Existing Pedestrian Facilities

Dorsey Drive, from the SR 49/20 NB Ramps to Sutton Way, does not have continuous sidewalks on the northerly side of the roadway. An existing sidewalk on the northerly Dorsey Drive spans 780 feet and extends from the SR 49/20 NB Ramps to an unnamed residential street to the east of Springhill Gardens Apartments. Sidewalks exist on the southerly side of Dorsey Drive and connect to a sidewalk along the westerly side of Sutton Way. A marked crosswalk is present only at the intersection of SR 49/20 NB Ramps and Dorsey Drive.

Spring Hill Drive, from Idaho Maryland Road to proposed project limits, contains continuous sidewalks on both sides of the existing roadway. Existing sidewalks on Spring Hill Drive spans a distance of 1100 feet in each direction. Idaho Maryland Road, from Spring Hill Drive to Sutton Way, contains sidewalks on the southerly side of the roadway. Sidewalks on the southerly side of Idaho Maryland Road are not continuous and are present only within close proximity to Spring Hill Drive and Sutton Way.

Project Impact to Pedestrian Facilities

Due to the lack of any heavy commercial or employment centers in the immediate project vicinity, the weekday AM and PM peak hour pedestrian counts for *Existing No Project* conditions indicate the presence of minimal pedestrian traffic at the stated roadways. With the development of the proposed project, the pedestrian traffic is expected to increase slightly due to its commercial and retail components located within close proximity to surrounding residential developments. The following off-site and on-site additions to existing pedestrian facilities are to be implemented by the proposed project and should accommodate the expected increase in pedestrian traffic.

In the Notice of Preparation (NOP) dated March 17, 2016, Caltrans identifies the need to "address bicycle and pedestrian needs along the project frontage" at the intersection of Dorsey Drive and State Route 49/20 Interchange. With the following proposed improvements, the increase in alternative modes of transportation are expected to be met.

Off-Site

The project will maintain the pedestrian facilities along the project frontage.

On-Site

Pedestrian sidewalks, crosswalks, and accessible paths of travel should be provided within the project area as follows:

- Provide continuous sidewalks to enable easy access to each building, plaza and crosswalk

- Where feasible, configure sidewalks to channel pedestrians to crosswalks
- Extend existing sidewalks on southerly side of Dorsey Drive into Project Driveway
- Extend existing easterly sidewalks on Spring Hill Drive into southerly entrance to marketplace

Bicycle Facilities

The following discussion presents the existing bicycle facilities and examines the impact of project conditions on the existing infrastructure.

Existing Bicycle Facilities

In the vicinity of the project, the existing conditions identify the following bicycle facilities

- Class II: bike lane currently exists on both sides along Dorsey Drive. This facility extends from the driveway of Springhill Gardens Apartments to East Main Street.
- No bike facilities are present along Idaho Maryland Drive, Spring Hill Drive, or Sutton Way.

The Nevada County Transportation Commission provides safe and efficient regional systems of bicycle routes for commuter, school, and recreational use. Within the City of Grass Valley, this study identifies the existing bike facilities with classifications from the California Streets and Highways code as follows:

> *(a) Bike paths or shared use paths, also referred to as "Class I bikeways," which provide a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with cross-flows by motorists minimized.*
>
> *(b) Bike lanes, also referred to as "Class II bikeways", which provide a restricted right-of-way designated for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross-flows by pedestrians and motorists permitted.*
>
> *(c) Bike routes, also referred to as "Class III bikeways," which provide a right-of-way on street or off-street, designated by signs or permanent markings and shared with pedestrians and motorists.*
>
> *(d) Cycle tracks or separated bikeways, also referred to as "Class IV bikeways," which promote active transportation and provide a right-of-way designated exclusively for bicycle travel adjacent to a roadway and which are separated from vehicular traffic. Types of separation include, but are not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.*

Project Impact on Bicycle Facilities

Under existing conditions, the study roadways have very light bicycle use. With the development of the proposed project, the bicycle traffic is expected to increase slightly due to its commercial and retail components located within close proximity to surrounding residential developments.

In the Notice of Preparation (NOP) dated March 17, 2016, Caltrans identifies the need to "address bicycle and pedestrian needs along the project frontage" at the intersection of Dorsey Drive and

State Route 49/20 Interchange. With the following proposed improvements, the increase in alternative modes of transportation are expected to be met.

Off-Site

All off-site roadway improvements on Spring Hill Drive and Dorsey Drive will be designed to accommodate bicycle traffic consistent with the City and County adopted plans. Only minimal improvements are anticipated for the existing Class II bike facility on southerly Dorsey Drive.

The project will need to maintain the pedestrian facilities along the project frontage.

On-Site

- Implement the City's development standards to satisfy on-site transportation needs of cyclists
- Install bike racks at store fronts

Transit Services

The following discussion presents the existing transit services and examines the impact of project conditions on these existing facilities.

Existing Transit Services

City of Grass Valley is currently served by the following two public transportation services:

- Gold Country Stage: A fixed route system serving populated centers in western Nevada County plus Colfax (https://mynevadacounty.com/2257/Transit-Services)
- Gold Country Lift: Private, non-profit system for handicapped and elderly patrons, using cars and similar vehicles to transport passengers to shopping and medical appointments (http://goldcountrylift.com/)

The following route serves intersections within the immediate vicinity of the proposed project:

Brunswick Basin Route: This bus service operates between Grass Valley and Nevada City, with service commencing at the Tinloy Street Transit Center in Grass Valley and the Fowler Center in Nevada City. The service operates hourly for six days a week. The bus stop near the project is located along Dorsey Drive, across from Springhill Gardens Apartments.

A detailed bus schedule may be obtained from the Gold Country Stage website.

Project Impact on Transit Services

The proposed project is expected generate moderate demand on existing transit services. As this increase in ridership is expected to be satisfied by the current services, no additional transit routes or stops are anticipated to be installed. Currently, there is approximately 85% usage along the primary route that services the proposed project development site. The expected increase in ridership with the proposed project should be accommodate.

Off-Site

Existing bus bays on both sides of Dorsey Drive would serve as transit stops for bus riders traveling to and from the project on public transit.

Existing Plus Project Conditions (Alternative A)

The *Existing Plus Project* conditions is the analysis scenario in which traffic impacts associated with the proposed project are investigated in comparison to the *Existing* conditions.

Intersection Operations

Existing Plus Project weekday AM and PM peak hour intersection traffic operations were quantified by superimposing traffic generated by the proposed project onto *Existing No Project* conditions. **Figure 6** presents the *Existing Plus Project* intersection traffic volumes.

Table 7 presents a summary of the *Existing Plus Project* study intersection LOS conditions.

TABLE 7
EXISTING PLUS PROJECT INTERSECTION LEVEL OF SERVICE (ALTERNATIVE A)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Brunswick Rd/Olympia Dr & Nevada City Hwy	Signal	D	36.2	D	-	39.6	D	-
2	Brunswick Rd & SR 49/20 SB/WB Off Ramp/Maltman Dr	Signal	D	33.3	C	-	36.8	D	-
3	Brunswick Rd & SR 49/20 NB/EB Ramps	Signal	D	14.7	B	-	13.1	B	-
4	Brunswick Rd & Sutton Way	Signal	D	29.7	C	-	40.8	D	-
5	Dorsey Dr & Main St	Signal	D	18.4	B	-	23.7	C	-
6	Dorsey Dr & Catherine Lane	TWSC	D	19.1	C	-	21.3	C	-
7	Dorsey Dr & SR 49/20 SB/EB On Ramp/ Joerschke Dr	Signal	D	14.9	B	-	21.2	C	-
8	Dorsey Dr & SR 49/20 NB/WB Ramps	Signal	D	30.8	C	-	25.4	C	-
9	Dorsey Dr & Apartment Driveway	Signal	D	11.5	B	-	15.8	B	
10	Dorsey Dr & Sutton Way	AWSC	D	10.2	B	-	13.6	B	-
11	Idaho Maryland Rd & Sutton Way	AWSC	D	9.4	A	-	11.4	B	-
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	16.9	C	-	**157.6**	**F**	**Yes**
13	Idaho Maryland Rd & Spring Hill Dr	TWSC	D	13.0	B	-	19.7	C	-
14	Idaho Maryland Rd & Centennial Dr	TWSC	D	12.4	B	-	17.4	C	-
15	Idaho Maryland Rd/Main St & SR 49/20 SB/EB Ramps/Main St	RNDBT	D	7.9	A	-	10.1	B	-
16	Idaho Maryland Rd & SR 49/20 NB Ramps	AWSC	D	15.6	C	-	35.0	D	-
17	Bennett St & SR 49/20 SB Off Ramp/Tinloy St	TWSC	D	14.6	B	-	18.2	C	-
18	Bennett St & SR 49/20 On Ramp/Hansen Way	AWSC	D	15.3	C	-	14.4	B	-

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3

As presented in **Table 7**, all study intersections, except the following, are projected to operate at or above the threshold LOS:

- Intersection 12 – Idaho Maryland Road and Brunswick Road (increase of 35.5 seconds of delay during the PM peak hour)

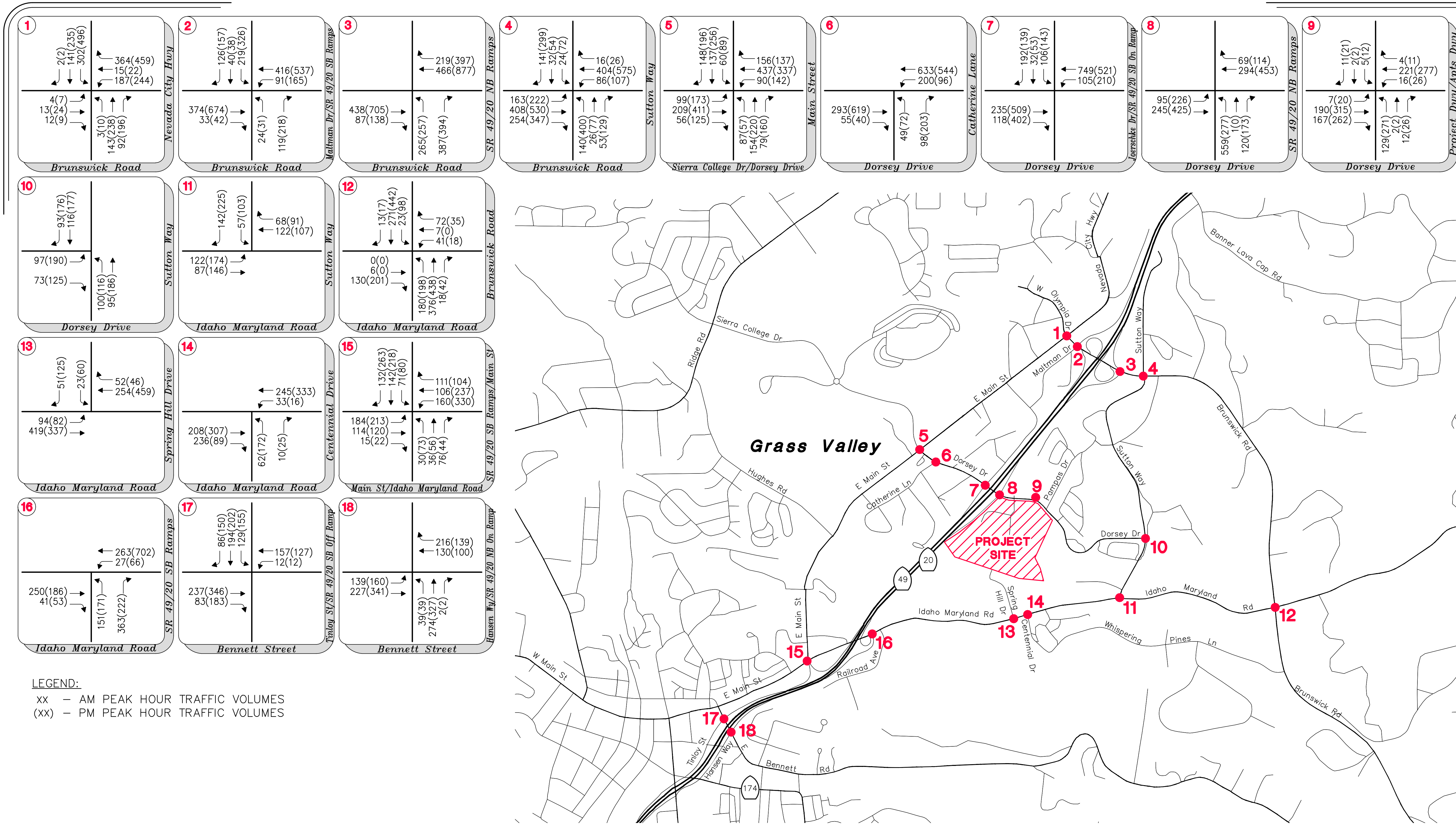
Freeway and Ramp Operations

Table 8 presents a summary of the *Existing Plus Project* ramp merge, diverge and freeway mainline operations.

TABLE 8
EXISTING PLUS PROJECT FREEWAY AND RAMP LEVEL OF SERVICE (ALTERNATIVE A)

#	Interchange Location	Target LOS	Segment Type	No. of Lanes	AM Peak Hour Volume	AM Peak Hour Density (pc/mi/ln)	AM Peak Hour LOS	PM Peak Hour Volume	PM Peak Hour Density (pc/mi/ln)	PM Peak Hour LOS
	SR 49/SR 20									
1	North of Brunswick NB	D	Freeway	2	991	9.3	A	1,762	16.4	B
2	Brunswick On Ramp NB	D	Merge	1	219	11.9	B	397	18.9	B
3	Brunswick Loop On Ramp NB	D	Merge	1	87	9.7	A	138	15.1	B
4	Dorsey to Brunswick NB	D	Weave	1		10.4	B		15.2	B
5	Idaho Maryland to Dorsey NB	D	Weave	1		15.3	B		15.9	B
6	Bennett to Idaho Marlyand NB	D	Weave	1		19.4	B		18.7	B
7	South of Bennett NB	D	Freeway	2	1,723	17.0	B	1,701	16.8	B
8	North of Brunswick SB	D	Freeway	2	1,625	16.0	B	1,242	12.3	B
9	Brunswick Off Ramp SB	D	Diverge	1	385	14.1	B	521	10.2	B
10	Brunswick Loop On Ramp SB	D	Merge	1	230	16.1	B	445	12.9	B
11	Brunswick to Dorsey SB	D	Weave	1		11.0	B		10.2	B
12	Dorsey to Idaho Maryland SB	D	Weave	1		12.4	B		16.2	B
13	Idaho Maryland to Bennett SB	D	Weave	1		14.9	B		20.0	C
14	South of Bennett SB	D	Freeway	2	1,411	13.9	B	1,925	19.0	C

As presented in **Table 8**, all ramps and freeway segments are projected to operate at acceptable LOS under *Existing Plus Project* conditions.



Dorsey Marketplace TIAR

Figure 6

Existing Plus Project Peak Hour Traffic Volumes (Alternative A)

Cumulative (Year 2035) Conditions

The long term future year traffic forecasts for this study have been developed using the Year 2035 Nevada County Travel Demand Model. **Figure 7** presents the Year 2035 No Project weekday AM and PM traffic volumes.

Year 2035 No Project conditions is alternatively referred to as the Cumulative "No Project" conditions where the proposed development remains undeveloped through Year 2035.

Year 2035 No Project Conditions

The Year 2035 No Project conditions is the analysis scenario in which future operations at study locations, assuming no project development, are analyzed.

Year 2035 No Project Intersection Operations

Table 9 presents a summary of the Year 2035 No Project study intersection LOS conditions.

TABLE 9
YEAR 2035 NO PROJECT INTERSECTION LEVEL OF SERVICE

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Brunswick Rd/Olympia Dr & Nevada City Hwy	Signal	D	36.1	D	-	39.5	D	-
2	Brunswick Rd & SR 49/20 SB/WB Off Ramp/Maltman Dr	Signal	D	34.2	C	-	36.8	D	-
3	Brunswick Rd & SR 49/20 NB/EB Ramps	Signal	D	15.4	B	-	13.1	B	-
4	Brunswick Rd & Sutton Way	Signal	D	31.4	C	-	45.4	D	-
5	Dorsey Dr & Main St	Signal	D	19.7	B	-	28.2	C	-
6	Dorsey Dr & Catherine Lane	TWSC	D	18.8	C	-	29.4	D	-
7	Dorsey Dr & SR 49/20 SB/EB On Ramp/ Joerschke Dr	Signal	D	12.5	B	-	19.8	B	-
8	Dorsey Dr & SR 49/20 NB/WB Ramps	Signal	D	17.3	B	-	17.6	B	-
9	Dorsey Dr & Apartment Driveway	TWSC	D	13.1	B	-	23.2	C	-
10	**Dorsey Dr & Sutton Way**	**AWSC**	**D**	**45.1**	**E**	**No**	**291.3**	**F**	**Yes**
11	Idaho Maryland Rd & Sutton Way	AWSC	D	10.2	B	-	13.0	B	-
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	**209.8**	**F**	**Yes**	**OVR**	**F**	**Yes**
13	Idaho Maryland Rd & Spring Hill Dr	TWSC	D	13.5	B	-	18.4	C	-
14	Idaho Maryland Rd & Centennial Dr	TWSC	D	13.6	B	-	29.4	D	-
15	Idaho Maryland Rd/Main St & SR 49/20 SB/EB Ramps/Main St	RNDBT	D	9.1	A	-	13.6	B	-
16	**Idaho Maryland Rd & SR 49/20 NB Ramps**	**AWSC**	**D**	22.6	C	-	**49.3**	**E**	**Yes**
17	Bennett St & SR 49/20 SB Off Ramp/Tinloy St	TWSC	D	15.1	C	-	26.2	D	-
18	Bennett St & SR 49/20 On Ramp/Hansen Way	AWSC	D	23.6	C	-	18.1	C	-

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3
4. OVR = Delay over 300 seconds

As presented in **Table 9**, all study intersections, except the following, are projected to operate at or above the threshold LOS:

- Intersection 10 – Dorsey Drive and Sutton Way
- Intersection 12 – Idaho Maryland Road and Brunswick Road
- Intersection 16 – Idaho Maryland Road and SR 49/20 NB Ramps

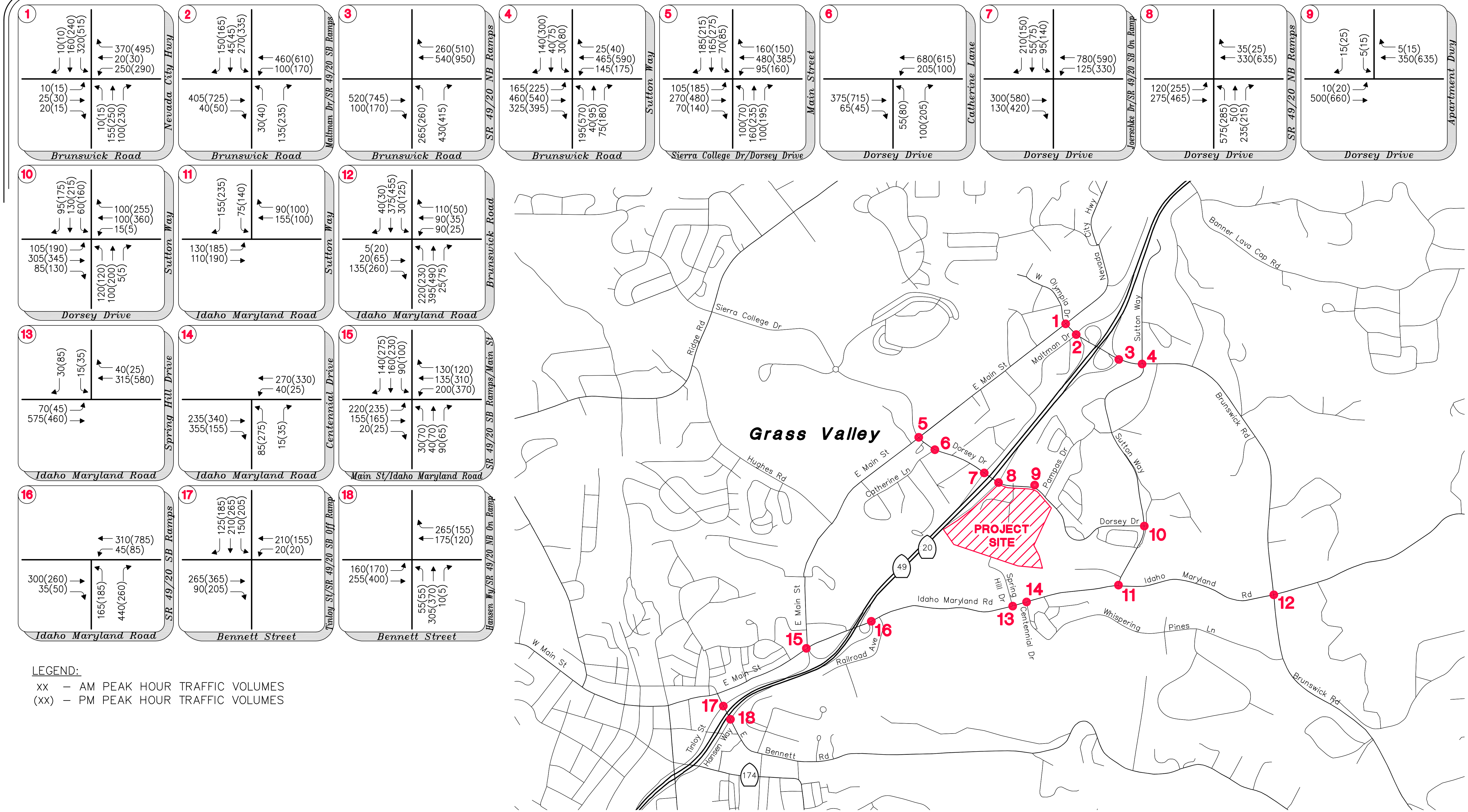
Freeway and Ramp Operations

Table 10 presents a summary of the Year 2035 No Project ramp merge, diverge and freeway mainline operations.

TABLE 10
YEAR 2035 NO PROJECT FREEWAY AND RAMP LEVEL OF SERVICE

#	Interchange Location	Target LOS	Segment Type	No. of Lanes	AM Peak Hour Volume	AM Peak Hour Density (pc/mi/ln)	AM Peak Hour LOS	PM Peak Hour Volume	PM Peak Hour Density (pc/mi/ln)	PM Peak Hour LOS
	SR 49/SR 20									
1	North of Brunswick NB	D	Freeway	2	1,083	10.1	A	1,924	18.0	B
2	Brunswick On Ramp NB	D	Merge	1	260	12.7	B	510	20.3	C
3	Brunswick Loop On Ramp NB	D	Merge	1	100	10.2	B	170	15.6	B
4	Dorsey to Brunswick NB	D	Weave	1		11.0	B		15.1	B
5	Idaho Maryland to Dorsey NB	D	Weave	1		16.9	B		17.0	B
6	Bennett to Idaho Marlyand NB	D	Weave	1		21.8	C		20.1	C
7	South of Bennett NB	D	Freeway	2	1,868	18.5	C	1,754	17.3	B
8	North of Brunswick SB	D	Freeway	2	1,775	17.5	B	1,356	13.4	B
9	Brunswick Off Ramp SB	D	Diverge	1	465	15.6	B	545	11.3	B
10	Brunswick Loop On Ramp SB	D	Merge	1	245	16.8	B	430	13.7	B
11	Brunswick to Dorsey SB	D	Weave	1		11.1	B		10.7	B
12	Dorsey to Idaho Maryland SB	D	Weave	1		13.3	B		17.5	B
13	Idaho Maryland to Bennett SB	D	Weave	1		16.5	B		22.0	C
14	South of Bennett SB	D	Freeway	2	1,500	14.8	B	1,999	19.7	C

As presented in **Table 10**, all ramps and freeway segments are projected to operate at acceptable LOS under Year 2035 No Project conditions.



LEGEND:
XX – AM PEAK HOUR TRAFFIC VOLUMES
(XX) – PM PEAK HOUR TRAFFIC VOLUMES

Dorsey Marketplace TIAR

Figure 7

Year 2035 No Project Peak Hour Traffic Volumes

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Year 2035 Plus Project Conditions (Alternative A)

Year 2035 Plus Project conditions were simulated by superimposing traffic generated by full build-out of the proposed project onto Year 2035 No Project traffic volumes. **Figure 8** presents the Year 2035 Plus Project peak hour traffic volumes.

Year 2035 Plus Project Intersection Operations

Table 11 presents a summary of the Year 2035 Plus Project study intersection LOS conditions.

TABLE 11
YEAR 2035 PLUS PROJECT INTERSECTION LEVEL OF SERVICE (ALTERNATIVE A)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Brunswick Rd/Olympia Dr & Nevada City Hwy	Signal	D	36.9	D	-	39.9	D	-
2	Brunswick Rd & SR 49/20 SB/WB Off Ramp/Maltman Dr	Signal	D	35.2	D	-	38.7	D	-
3	Brunswick Rd & SR 49/20 NB/EB Ramps	Signal	D	15.8	B	-	13.7	B	-
4	Brunswick Rd & Sutton Way	Signal	D	31.5	C	-	46.0	D	-
5	Dorsey Dr & Main St	Signal	D	20.0	B	-	29.7	C	-
6	Dorsey Dr & Catherine Lane	TWSC	D	22.5	C	-	33.8	D	-
7	Dorsey Dr & SR 49/20 SB/EB On Ramp/ Joerschke Dr	Signal	D	18.2	B	-	40.0	D	-
8	Dorsey Dr & SR 49/20 NB/WB Ramps	Signal	D	33.2	C	-	41.4	D	-
9	Dorsey Dr & Apartment Driveway	Signal	D	12.6	B	-	18.4	B	
10	**Dorsey Dr & Sutton Way**	**AWSC**	**D**	**55.7**	**F**	**No**	**OVR**	**F**	**Yes**
11	Idaho Maryland Rd & Sutton Way	AWSC	D	10.5	B	-	13.7	B	-
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	**259.7**	**F**	**Yes**	**OVR**	**F**	**Yes**
13	Idaho Maryland Rd & Spring Hill Dr	TWSC	D	15.7	C	-	24.3	C	-
14	Idaho Maryland Rd & Centennial Dr	TWSC	D	13.9	B	-	32.6	D	-
15	Idaho Maryland Rd/Main St & SR 49/20 SB/EB Ramps/Main St	RNDBT	D	9.2	A	-	14.1	B	-
16	**Idaho Maryland Rd & SR 49/20 NB Ramps**	**AWSC**	**D**	25.4	D	-	**58.6**	**F**	**Yes**
17	Bennett St & SR 49/20 SB Off Ramp/Tinloy St	TWSC	D	15.3	C	-	27.5	D	-
18	Bennett St & SR 49/20 On Ramp/Hansen Way	AWSC	D	24.7	C	-	19.1	C	-

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3
4. OVR = Delay over 300 seconds

As presented in **Table 11**, all study intersections, except the following, are projected to operate at or above the threshold LOS:

- Intersection 10 – Dorsey Drive and Sutton Way (increase of more than 10 seconds during AM and PM peak hours)
- Intersection 12 – Idaho Maryland Road and Brunswick Road (increase of 49.9 seconds during AM peak hour and more than 10 seconds during PM peak hour)
- Intersection 16 – Idaho Maryland Road and SR 49/20 NB Ramps (increase of 9.3 seconds in the PM peak hour)

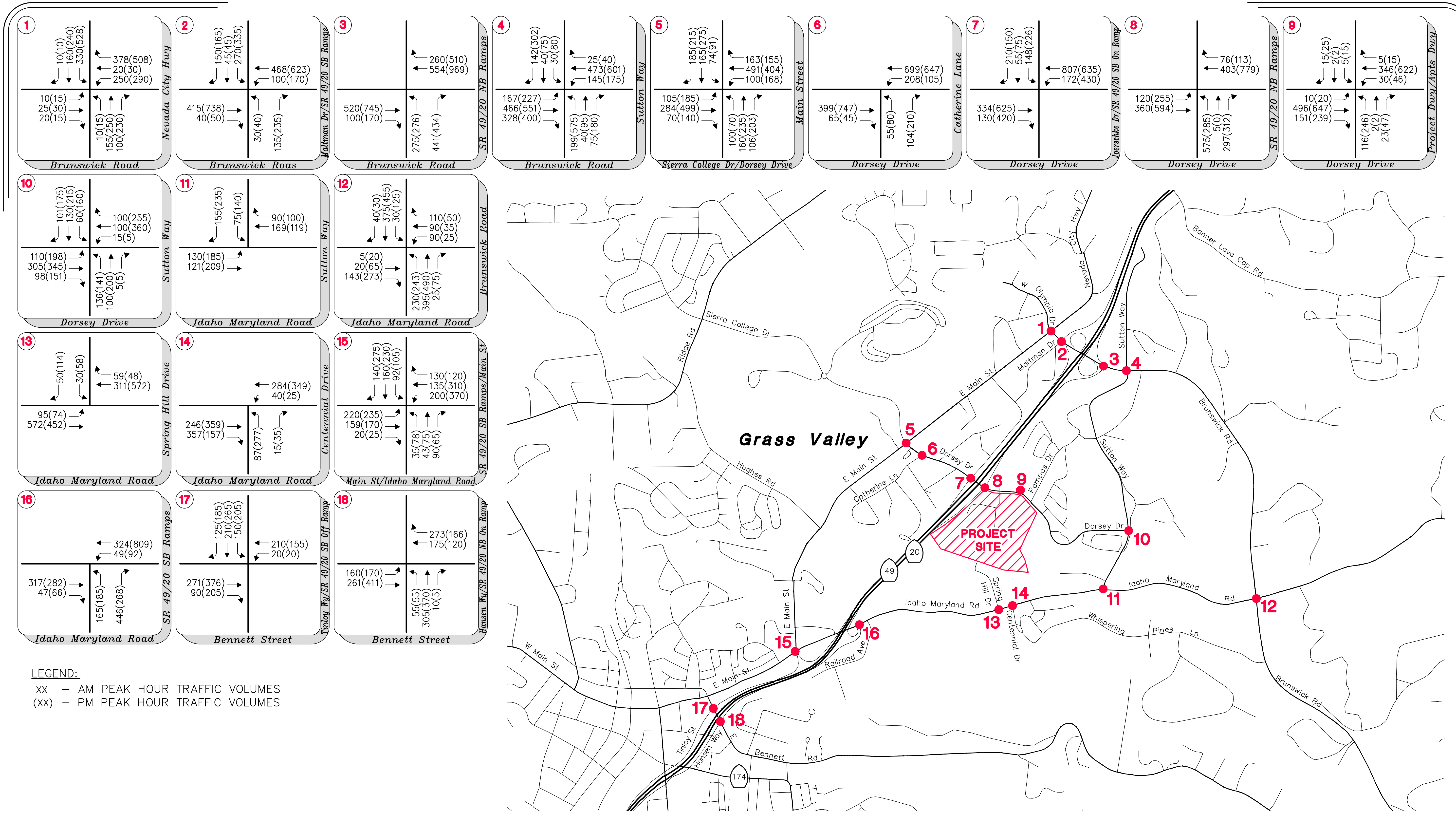
Year 2035 Plus Project Ramp and Freeway Operations

Table 12 presents a summary of the Year 2035 Plus Project ramp merge, diverge and freeway mainline LOS.

TABLE 12
YEAR 2035 PLUS PROJECT FREEWAY AND RAMP LEVEL OF SERVICE (ALTERNATIVE A)

#	Interchange Location	Target LOS	Segment Type	No. of Lanes	AM Peak Hour			PM Peak Hour		
					Volume	Density (pc/mi/ln)	LOS	Volume	Density (pc/mi/ln)	LOS
	SR 49/SR 20									
1	North of Brunswick NB	D	Freeway	2	1,083	10.1	A	1,924	18.0	B
2	Brunswick On Ramp NB	D	Merge	1	260	12.7	B	510	20.3	C
3	Brunswick Loop On Ramp NB	D	Merge	1	100	10.2	B	170	15.6	B
4	Dorsey to Brunswick NB	D	Weave	1		11.1	B		16.0	B
5	Idaho Maryland to Dorsey NB	D	Weave	1		17.6	B		18.0	B
6	Bennett to Idaho Marlyand NB	D	Weave	1		22.3	C		21.0	C
7	South of Bennett NB	D	Freeway	2	1,901	18.8	C	1,794	17.7	B
8	North of Brunswick SB	D	Freeway	2	1,775	17.5	B	1,356	13.4	B
9	Brunswick Off Ramp SB	D	Diverge	1	465	15.6	B	545	11.3	B
10	Brunswick Loop On Ramp SB	D	Merge	1	245	16.8	B	449	13.9	B
11	Brunswick to Dorsey SB	D	Weave	1		10.9	B		11.0	B
12	Dorsey to Idaho Maryland SB	D	Weave	1		13.7	B		19.4	B
13	Idaho Maryland to Bennett SB	D	Weave	1		16.8	B		23.8	C
14	South of Bennett SB	D	Freeway	2	1,529	15.1	B	2,130	21.0	C

As presented in **Table 12**, all ramps and freeway segments are projected to operate at acceptable LOS under Year 2035 Plus Project conditions.



Dorsey Marketplace TIAR

Figure 8

Year 2035 Plus Project Peak Hour Traffic Volumes (Alternative A)

2/15/2019 10:29 AM \\GHDNET\GHD\US\ROSEVILLE\PROJECTS\LEGACY\PRJ\2147\T2147\T2147TG001.DWG

Job No:

Queues

Based on comments received during the NOP period, 95th percentile queues were analyzed under Existing and Cumulative Plus Project conditions. The following timing plan was used in the SimTraffic analysis for determining the queue lengths. This timing plan shows the allocated green, yellow, and red times for the respective phases during a full cycle.

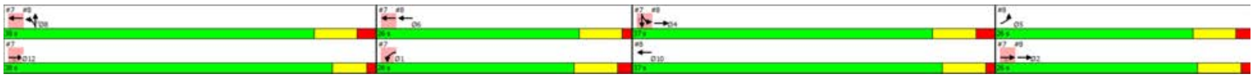


Table 13 presents the projected 95th percentile queues during AM and PM peak hours with the proposed project.

TABLE 13
PLUS PROJECT 95TH PERCENTILE QUEUES (ALTERNATIVE A)

Int. #	Intersection/Approach	Control Type	Available Storage	Existing Plus Project AM Peak Hour 95th Percentile Queue (ft)	Existing Plus Project PM Peak Hour 95th Percentile Queue (ft)	Cumulative Plus Project AM Peak Hour 95th Percentile Queue (ft)	Cumulative Plus Project PM Peak Hour 95th Percentile Queue (ft)
7	***Dorsey Drive/SR 49/20 SB Ramp/Joerschke Dr***			--		--	
	Eastbound Thru	Signal	800	95	272	172	**1081**
	Eastbound Right	Signal	155	57	***190***	73	**266**
	Westbound Left	Signal	170	102	166	148	**281**
	Westbound Thru	Signal	180	111	168	166	**323**
	Southbound Left/Thru	Signal	430	142	207	204	**1342**
	Southbound Right	Signal	300	73	66	105	**1443**
8	***Dorsey Drive/SR 49/20 NB Ramps***			--	--	--	--
	Eastbound Left	Signal	170	94	***192***	138	**285**
	Eastbound Thru	Signal	180	144	***231***	**211**	**246**
	Westbound Thru	Signal	540	141	156	141	**619**
	Westbound Thru/Right	Signal	540	101	119	110	**603**
	Northbound Left/Thru	Signal	1000	530	354	530	**1622**
	Northbound Right	Signal	190	108	83	183	**378**

Note: Queues clear out each cycle

Under *Existing Plus Project* PM peak hour conditions, the queue for the eastbound right for intersection 7 in the PM peak hour is expected to spillback two vehicles or less (based on an approximate vehicle length of 25 feet) into the thru lane. It is not expected these queues will result in spillback that will affect adjacent intersections. Implementing a “keep clear” marking is expected to minimize any affects due to the spillback for ingress and egress at the western driveway to the Springhill Apartment complex. Intersection 8 in the PM peak hour eastbound left and through movements are expected to spillback approximately two vehicles. Field observations and simulation analysis projects the queues to dissipate every cycle. Additionally for both directions at both intersection, the sight distance is projected to remain acceptable for vehicles to react to the expected queues as the posted speed limit is 30 mph.

Cumulative Plus Project PM peak hour 95th percentile queues are projected to exceed available storage in most movements.

Improvement Options

To improve the cumulative queuing impacts impact on intersection 7 and 8, alternate timings have been used to analyze the intersections of Dorsey Drive/SR 49 SB Ramp/Joerschke Drive and Dorsey Drive/SR 49 NB Ramps. Signal timings similar to the current timing plan used at the McKnight interchange were used. This timing plan shows the allocated green, yellow, and red times for the respective phases during a full cycle.

Table 14 presents the projected 95th percentile queues during the PM peak hour with the proposed project and modified timings under Cumulative Plus Project conditions.

TABLE 14
CUMULATIVE PLUS PROJECT 95TH PERCENTILE IMPROVED QUEUES (ALTERNATIVE A)

Int. #	Intersection/Approach	Control Type	Available Storage	Cumulative Plus Project
				PM Peak Hour
				95th Percentile Queue (ft)
7	***Dorsey Drive/SR 49/20 SB Ramp/Joerschke Dr***			
	Eastbound Thru	Signal	800	427
	Eastbound Right		155	**241**
	Westbound Left		170	**281**
	Westbound Thru		180	150
	Southbound Left/Thru		430	269
	Southbound Right		300	76
8	***Dorsey Drive/SR 49/20 NB Ramps***			--
	Eastbound Left	Signal	170	**211**
	Eastbound Thru		180	**197**
	Westbound Thru		540	331
	Westbound Thru/Right		540	228
	Northbound Left/Thru		1000	276
	Northbound Right		190	162

Note: Queues clear out each cycle

As presented in **Table 14**, all 95th percentile queues, except for the following, are projected to be acceptable during the PM peak hour conditions under Cumulative Plus Project conditions with the alternate timing plan:

- Intersection 7 Dorsey Drive & SR 49/20 SB Ramps/Joerschke Drive
  - Eastbound Right: The queue for the eastbound right for intersection 7 in the PM peak hour is expected to spillback four vehicles or less (based on an approximate vehicle length of 25 feet) into the thru lane. It is not expected these queues will result in spillback that will affect adjacent intersections. Implementing a “keep clear” marking is expected to minimize any affects due to the spillback.

    - Westbound Left: The queue for the westbound left for intersection 7 in the PM peak hour is expected to spillback four vehicles or less (based on an approximate vehicle length of 25 feet) into the thru lane. It is not expected these queues will result in spillback that will affect adjacent intersections.
- Intersection 8 Dorsey Drive & SR 49/20 NB Ramps
    - Eastbound Left: The queue for the eastbound left for intersection 8 in the PM peak hour is expected to spillback two vehicles or less (based on an approximate vehicle length of 25 feet) into the thru lane. It is not expected these queues will result in spillback that will affect adjacent intersections.
    - Eastbound Thru: The queue for the eastbound right for intersection 8 in the PM peak hour is expected to spillback one vehicle or less (based on an approximate vehicle length of 25 feet) into the thru lane. It is not expected these queues will result in spillback that will affect adjacent intersections.

Where more than one lane exists, the lane with the worse expected queuing is reported only.

Alternatively, constructing a hybrid roundabout interchange would also mitigate the queues to an acceptable level under cumulative conditions.

Project Impacts and Proposed Improvements (Alternative A)

This section presents recommended project-related mitigation measures at the study intersections, developed based on the findings from the analyses presented in the prior sections of this report. The mitigations are provided for both *Existing* conditions and *Year 2035* conditions separately, so it may be possible that the same mitigations at one location are applicable to both conditions.

Impact Significance Criteria

In accordance with the February 2012 City of Grass Valley Traffic Study Guidelines, the following thresholds of significance are used to determine if the proposed project causes a significant impact and requires mitigation:

Intersections

- An intersection or roadway segment deteriorates from an acceptable LOS to LOS E or worse, or
- Distributes a project trip to an intersection or roadway segment currently operating at an unacceptable LOS

In the event of a significant impact, cumulative year analysis is required. Proposed mitigations to intersections and/or roadway segments should improve traffic operations from an unacceptable LOS to an acceptable LOS.

Existing Plus Project Impacts

Table 15 presents the intersections projected to operate at unacceptable levels of service under *Existing Plus Project* conditions.

TABLE 15
EXISTING PLUS PROJECT SIGNIFICANT IMPACTS (ALTERNATIVE A)

AM Peak Hour										
#	Intersection	Control Type[1]	Target LOS	Existing LOS[2]	Existing Plus Project LOS[2]	Existing Delay (D1)	Existing Plus Project Delay (D2)	Delay Increase (D2-D1)	Signal Warrant Met?	Significant Impact?
12	Idaho Maryland Rd & Brunswick Rd	TWSC	D	C	C	16.4	16.9	0.5	No	No

PM Peak Hour										
#	Intersection	Control Type[1]	Target LOS	Existing LOS[2]	Existing Plus Project LOS[2]	Existing Delay (D1)	Existing Plus Project Delay (D2)	Delay Increase (D2-D1)	Signal Warrant Met?	Significant Impact?
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	**F**	**F**	**122.1**	**157.6**	**35.5**	**Yes**	**Yes**

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3

Existing Plus Project Mitigations

The following improvements are proposed to provide acceptable operations at intersections where a project's significant impact is identified:

Intersection 12 - Idaho Maryland Road and Brunswick Road

The proposed project creates a significant impact in the weekday PM peak hour by adding a project trip to an intersection operating unacceptably between the *Existing No Project* and *Existing Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS for the weekday PM peak hour:

- Construct a traffic signal OR
- Closure of Idaho Maryland Road and Brunswick Road intersection

This intersection has been identified by the City's General Plan for closure by Year 2020. Alternatively, the Loma Rica EIR has identified improvements for this intersection as potential for signalization. If the signal option is chosen, a payment of fair-share would mitigate the project's impact at this location.

Significance After Mitigation

Table 16 presents the mitigated LOS operations assuming the stated improvements are implemented.

TABLE 16
EXISTING PLUS PROJECT MITIGATED INTERSECTION LEVEL OF SERVICE (ALTERNATIVE A)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
12	Idaho Maryland Rd & Brunswick Rd	Signal	D			10.5	B

Notes:
1. LOS = Delay based on average of all approaches for Signal

As presented in **Table 16**, the proposed improvement for Intersection 12 is projected to elevate the LOS from F to B for the PM peak hour of the *Existing Plus Project* conditions. AM peak hour was not evaluated as the improvement is expected to decrease the delay which is already acceptable.

Year 2035 Plus Project Impacts

Table 17 presents the intersections projected to operate at unacceptable levels of service under the *Year 2035 Plus Project* conditions.

TABLE 17
YEAR 2035 PLUS PROJECT SIGNIFICANT IMPACTS (ALTERNATIVE A)

AM Peak Hour										
#	Intersection	Control Type[1]	Target LOS	Year 2035 LOS[2]	Year 2035 Plus Project LOS[2]	Year 2035 Delay (D1)	Year 2035 Plus Project Delay (D2)	Delay Increase (D2-D1)	Signal Warrant Met?	Significant Impact?
10	**Dorsey Dr & Sutton Way**	**AWSC**	**D**	**E**	**F**	**45.1**	**55.7**	**10.6**	**No**	**Yes**
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	**F**	**F**	**209.8**	**259.7**	**49.9**	**Yes**	**Yes**
16	Idaho Maryland Rd & SR 49/20 NB Ramps	AWSC	D	C	D	22.6	25.4	2.8	-	No

PM Peak Hour										
#	Intersection	Control Type[1]	Target LOS	Year 2035 LOS[2]	Year 2035 Plus Project LOS[2]	Year 2035 Delay (D1)	Year 2035 Plus Project Delay (D2)	Delay Increase (D2-D1)	Signal Warrant Met?	Significant Impact?
10	**Dorsey Dr & Sutton Way**	**AWSC**	**D**	**F**	**F**	**291.3**	**OVR**	**>10**	**Yes**	**Yes**
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	**F**	**F**	**OVR**	**OVR**	**>10**	**Yes**	**Yes**
16	**Idaho Maryland Rd & SR 49/20 NB Ramps**	**AWSC**	**D**	**E**	**F**	**49.3**	**58.6**	**9.3**	**Yes**	**Yes**

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3
4. OVR = Delay over 300 seconds

Year 2035 Plus Project Mitigations

The following improvements are proposed to provide acceptable operations at intersections where a project's significant impact is identified:

Intersection 10 - Dorsey Drive and Sutton Way

The proposed project creates a significant impact in the weekday AM and PM peak hour by adding a project trip to an intersection operating unacceptably between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS for both the weekday AM and PM conditions:

- Construct a traffic signal OR
- Construct a single/multi-lane roundabout

Payment of fair-share would mitigate the project’s impact at this intersection.

Intersection 12 - Idaho Maryland Road and Brunswick Road

The proposed project creates a significant impact in the weekday AM and PM peak hour by adding a project trip to an intersection operating unacceptably between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS for both the weekday AM and PM conditions:

- Construct a traffic signal OR
- Closure of Idaho Maryland Road and Brunswick Road intersection

This intersection has been identified by the City’s General Plan for closure by Year 2020. Alternatively, the Loma Rica EIR has identified improvements for this intersection as potential for signalization. If the signal option is chosen, a payment of fair-share would mitigate the project’s impact at this location.

Intersection 16 - Idaho Maryland Road and State Route 49/20 NB Ramps

The proposed project creates a significant impact in the weekday PM peak hour by adding a project trip to an intersection operating unacceptably between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS for both the weekday AM and PM conditions:

- Construct a traffic signal

Due to the close proximity of the intersection of Idaho Maryland Road/State Route 49/20 NB Ramps to the adjacent intersection of Idaho Maryland Rd/Railroad Avenue, clustering these two intersections under one controller would be required to ensure traffic progression and to minimize queue build-up between the two intersections.

Payment of fee towards the City's CIP for signalization shall mitigate the project's impact at this intersection.

Significance After Mitigation

Table 18 presents the mitigated LOS operations assuming the stated improvements are implemented.

TABLE 18
YEAR 2035 PLUS PROJECT MITIGATED INTERSECTION LEVEL OF SERVICE (ALTERNATIVE A)

#	Intersection	Control Type[1]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
10	Dorsey Dr & Sutton Way	Signal	D	17.2	B	23.1	C
12	Idaho Maryland Rd & Brunswick Rd	Signal	D	25.6	C	43.9	D
16	Idaho Maryland Rd & SR 49/20 NB Ramps	Signal	D			34.2	C

Notes:
1. LOS = Delay based on average of all approaches for Signal

As presented in **Table 18**, all intersections are projected to operate at acceptable LOS under the proposed mitigations for the weekday AM and PM peak hours of the *Year 2035 Plus Project* conditions. The AM peak hour for the intersection of Idaho Maryland Road and SR 49/20 NB Ramps is projected to operate before any identified improvement and is, therefore, expected to remain acceptable with the proposed improvement.

Existing Plus Project Conditions (Alternative B)

The *Existing Plus Project* conditions is the analysis scenario in which traffic impacts associated with the proposed project are investigated in comparison to the *Existing* conditions.

Land Uses (Alternative B)

The proposed project includes approximately 181,900 square feet of retail and commercial development and a 90 unit multi-family development.

Trip Generation (Alternative B)

The proposed project's apartment component will use ITE average rates. **Table 19** shows the trip generation, calculated using the described methodology.

TABLE 19
PROPOSED PROJECT TRIP GENERATION (ALTERNATIVE B)

Land Use Category (ITE Code)	Unit[1]	AM Peak Hour Trip Rate/Unit			PM Peak Hour Trip Rate/Unit		
		Total	In %	Out %	Total	In %	Out %
Apartment (220)	DU	0.51	20%	80%	0.62	65%	35%
Shopping Center (820)	ksf	2.80	62%	38%	6.63	48%	52%
Project Name	**Quantity (Units)**	**AM Peak Hour Trips**			**PM Peak Hour Trips**		
		Total	**In**	**Out**	**Total**	**In**	**Out**
Multi-Family Residential	90	46	9	37	56	36	20
To Shopping Center		*-1*	*0*	*-1*	*-21*	*-11*	*-10*
Market Place	181.9	510	316	194	1,207	579	627
To Residential		*-1*	*-1*	*0*	*-21*	*-10*	*-11*
Project Trips		554	324	230	1,220	594	626
Shopping Center Pass-by (15% for AM, 30% for PM reduction)		*-76*	*-47*	*-29*	*-356*	*-171*	*-185*
Net New Project Trips		**478**	**277**	**200**	**865**	**424**	**441**

Notes:
1. 1 ksf = 1,000 square feet DU = dwelling unit
2. Trip rates based on ITE Trip Generation Manual 9th edition average rates and local data

As presented within **Table 19**, the proposed project is projected to generate 478 trips and 865 trips in the AM and PM peak hours, respectively.

Intersection Operations

Existing Plus Project weekday AM and PM peak hour intersection traffic operations were quantified by superimposing traffic generated by the proposed project onto *Existing No Project* conditions. Appendix G contains the *Existing Plus Project* intersection traffic volumes.

Table 20 presents a summary of the *Existing Plus Project* study intersection LOS conditions.

As shown in **Table 20**, all study intersections, except the following, are projected to operate at or above the threshold LOS:

- Idaho Maryland Road and Brunswick Road (increase of 62 seconds during the PM peak hour)
- Idaho Maryland Rd & SR 49/20 NB Ramps (increase of 9.5 seconds during the PM peak hour)

TABLE20
EXISTING PLUS PROJECT INTERSECTION LEVEL OF SERVICE (ALTERNATIVE B)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Brunswick Rd/Olympia Dr & Nevada City Hwy	Signal	D	36.2	D	-	39.2	D	-
2	Brunswick Rd & SR 49/20 SB/WB Off Ramp/Maltman Dr	Signal	D	33.2	C	-	37.7	D	-
3	Brunswick Rd & SR 49/20 NB/EB Ramps	Signal	D	14.7	B	-	13.5	B	-
4	Brunswick Rd & Sutton Way	Signal	D	29.8	C	-	40.8	D	-
5	Dorsey Dr & Main St	Signal	D	18.7	B	-	27.0	C	-
6	Dorsey Dr & Catherine Lane	TWSC	D	19.5	C	-	22.9	C	-
7	Dorsey Dr & SR 49/20 SB/EB On Ramp/ Joerschke Dr	Signal	D	16.1	B	-	27.7	C	-
8	Dorsey Dr & SR 49/20 NB/WB Ramps	Signal	D	32.3	C	-	28.1	C	-
9	Dorsey Dr & Apartment Driveway	Signal	D	13.4	B	-	18.1	B	
10	Dorsey Dr & Sutton Way	AWSC	D	10.2	B	-	14.0	B	-
11	Idaho Maryland Rd & Sutton Way	AWSC	D	9.4	A	-	11.7	B	-
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	17.2	C	-	**184.1**	**F**	**Yes**
13	Idaho Maryland Rd & Spring Hill Dr	TWSC	D	13.0	B	-	27.9	D	-
14	Idaho Maryland Rd & Centennial Dr	TWSC	D	12.9	B	-	17.7	C	-
15	Idaho Maryland Rd/Main St & SR 49/20 SB/EB Ramps/Main St	RNDBT	D	8.7	A	-	11.9	B	-
16	**Idaho Maryland Rd & SR 49/20 NB Ramps**	**AWSC**	**D**	16.0	C	-	**38.9**	**E**	**Yes**
17	Bennett St & SR 49/20 SB Off Ramp/Tinloy St	TWSC	D	17.0	C	-	23.8	C	-
18	Bennett St & SR 49/20 On Ramp/Hansen Way	AWSC	D	15.4	C	-	14.6	B	-

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3

Freeway and Ramp Operations

Table 21 presents a summary of the *Existing Plus Project* ramp merge, diverge and freeway mainline operations.

TABLE 21
EXISTING PLUS PROJECT FREEWAY AND RAMP LEVEL OF SERVICE (ALTERNATIVE B)

#	Interchange Location	Target LOS	Segment Type	No. of Lanes	AM Peak Hour			PM Peak Hour		
					Volume	Density (pc/mi/ln)	LOS	Volume	Density (pc/mi/ln)	LOS
	SR 49/SR 20									
1	North of Brunswick NB	D	Freeway	2	991	9.3	A	1,762	16.4	B
2	Brunswick On Ramp NB	D	Merge	1	219	11.9	B	397	18.9	B
3	Brunswick Loop On Ramp NB	D	Merge	1	87	9.7	A	138	15.1	B
4	Dorsey to Brunswick NB	D	Weave	1		10.3	B		14.8	B
5	Idaho Maryland to Dorsey NB	D	Weave	1		14.9	B		15.4	B
6	Bennett to Idaho Marlyand NB	D	Weave	1		18.9	B		18.2	B
7	South of Bennett NB	D	Freeway	2	1,699	16.8	B	1,687	16.6	B
8	North of Brunswick SB	D	Freeway	2	1,625	16.0	B	1,242	12.3	B
9	Brunswick Off Ramp SB	D	Diverge	1	385	14.1	B	521	10.2	B
10	Brunswick Loop On Ramp SB	D	Merge	1	224	16.0	B	432	12.8	B
11	Brunswick to Dorsey SB	D	Weave	1		11.0	B		10.1	B
12	Dorsey to Idaho Maryland SB	D	Weave	1		12.6	B		15.2	B
13	Idaho Maryland to Bennett SB	D	Weave	1		14.9	B		19.0	B
14	South of Bennett SB	D	Freeway	2	1,447	14.3	B	1,878	18.5	C

As presented in **Table 21**, all ramps and freeway segments are projected to operate at acceptable LOS under *Existing Plus Project* Conditions.

Year 2035 Plus Project Conditions (Alternative B)

Year 2035 Plus Project conditions were simulated by superimposing traffic generated by full build-out of the proposed project onto Year 2035 No Project traffic volumes. Figure 8 presents the Year 2035 Plus Project peak hour traffic volumes.

Year 2035 Plus Project Intersection Operations

Table 22 presents a summary of the Year 2035 Plus Project study intersection LOS conditions.

TABLE 22
YEAR 2035 PLUS PROJECT INTERSECTION LEVEL OF SERVICE (ALTERNATIVE B)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	Brunswick Rd/Olympia Dr & Nevada City Hwy	Signal	D	36.9	D	-	39.1	D	-
2	Brunswick Rd & SR 49/20 SB/WB Off Ramp/Maltman Dr	Signal	D	35.2	D	-	38.7	D	-
3	Brunswick Rd & SR 49/20 NB/EB Ramps	Signal	D	15.9	B	-	14.0	B	-
4	Brunswick Rd & Sutton Way	Signal	D	31.5	C	-	46.0	D	-
5	Dorsey Dr & Main St	Signal	D	21.3	C	-	33.1	C	-
6	**Dorsey Dr & Catherine Lane**	**TWSC**	**D**	23.0	C	-	**35.9**	**E**	**Yes**
7	**Dorsey Dr & SR 49/20 SB/EB On Ramp/ Joerschke Dr**	**Signal**	**D**	19.3	B	-	**105.2**	**F**	**-**
8	Dorsey Dr & SR 49/20 NB/WB Ramps	Signal	D	34.4	C	-	35.6	D	-
9	Dorsey Dr & Apartment Driveway	Signal	D	13.4	B	-	23.0	C	
10	**Dorsey Dr & Sutton Way**	**AWSC**	**D**	**59.0**	**F**	**No**	**OVR**	**F**	**Yes**
11	Idaho Maryland Rd & Sutton Way	AWSC	D	10.6	B	-	14.2	B	-
12	**Idaho Maryland Rd & Brunswick Rd**	**TWSC**	**D**	**OVR**	**F**	**Yes**	**OVR**	**F**	**Yes**
13	**Idaho Maryland Rd & Spring Hill Dr**	**TWSC**	**D**	15.3	C	-	**39.0**	**E**	**Yes**
14	Idaho Maryland Rd & Centennial Dr	TWSC	D	13.7	B	-	33.6	D	-
15	Idaho Maryland Rd/Main St & SR 49/20 SB/EB Ramps/Main St	RNDBT	D	12.2	B	-	17.8	B	-
16	**Idaho Maryland Rd & SR 49/20 NB Ramps**	**AWSC**	**D**	27.2	D	-	**65.0**	**F**	**Yes**
17	**Bennett St & SR 49/20 SB Off Ramp/Tinloy St**	**TWSC**	**D**	17.9	C	-	**45.6**	**E**	**Yes**
18	Bennett St & SR 49/20 On Ramp/Hansen Way	AWSC	D	25.1	D	-	19.6	C	-

Notes:
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control; RNDBT = Roundabout
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC, Signal, RNDBT
3. Warrant = Based on California MUTCD Warrant 3
4. OVR = Delay over 300 seconds

As shown in **Table 22**, all study intersections, except the following, are projected to operate at or above the threshold LOS:

- Dorsey Drive and Catherine Lane (increase of 6.5 seconds during the PM peak hour)
- Dorsey Drive and SR 49/20 SB/EB Ramp/Joerschke Drive (increase of 52.7 seconds during the PM peak hour)
- Dorsey Drive and Sutton Way (increase of 13.9 for the AM peak hour and more than 10 seconds for the PM peak hour)
- Idaho Maryland Road and Brunswick Road (increase of more than 10 seconds for the AM and PM peak hours)
- Idaho Maryland Road and Spring Hill Drive (increase of 20.9 seconds during the PM peak hour)
- Idaho Maryland Road and SR 49/20 NB Ramps (increase of 15.7 seconds during the PM peak hour)
- Bennett Street and SR 49/20 SB Off Ramp/Tinloy Street (increase of 4.2 seconds during the PM peak hour)

Year 2035 Plus Project Ramp and Freeway Operations

Table 23 presents a summary of the Year 2035 Plus Project ramp merge, diverge and freeway mainline LOS.

TABLE 23
YEAR 2035 PLUS PROJECT FREEWAY AND RAMP LEVEL OF SERVICE (ALTERNATIVE B)

#	Interchange Location	Target LOS	Segment Type	No. of Lanes	AM Peak Hour			PM Peak Hour		
					Volume	Density (pc/mi/ln)	LOS	Volume	Density (pc/mi/ln)	LOS
	SR 49/SR 20									
1	North of Brunswick NB	D	Freeway	2	1,083	10.1	A	1,924	18.0	B
2	Brunswick On Ramp NB	D	Merge	1	260	12.7	B	510	20.3	C
3	Brunswick Loop On Ramp NB	D	Merge	1	100	10.2	B	170	15.6	B
4	Dorsey to Brunswick NB	D	Weave	1		11.2	B		15.6	B
5	Idaho Maryland to Dorsey NB	D	Weave	1		17.6	B		17.4	B
6	Bennett to Idaho Marlyand NB	D	Weave	1		22.4	C		20.4	C
7	South of Bennett NB	D	Freeway	2	1,922	19.0	C	1,772	17.5	B
8	North of Brunswick SB	D	Freeway	2	1,775	17.5	B	1,356	13.4	B
9	Brunswick Off Ramp SB	D	Diverge	1	465	15.6	B	545	11.3	B
10	Brunswick Loop On Ramp SB	D	Merge	1	259	17.0	B	449	13.8	B
11	Brunswick to Dorsey SB	D	Weave	1		11.1	B		10.9	B
12	Dorsey to Idaho Maryland SB	D	Weave	1		14.3	B		18.3	B
13	Idaho Maryland to Bennett SB	D	Weave	1		17.3	B		22.6	C
14	South of Bennett SB	D	Freeway	2	1,591	15.7	B	2,067	20.4	C

As presented in **Table 23**, all ramps and freeway segments are projected to operate at acceptable LOS under Year 2035 Plus Project Conditions.

Queues (Alternative B)

Based on comments received during the NOP period, 95th percentile queues were analyzed under Existing and *Cumulative Plus Project* conditions. The following timing plan was used in the SimTraffic analysis for determining the queue lengths. This timing plan shows the allocated green, yellow, and red times for the respective phases during a full cycle.

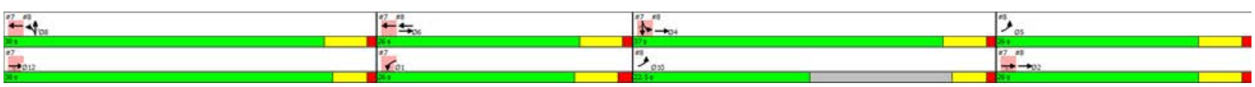


Table 24 presents the projected 95th percentile queues during AM and PM peak hours with the proposed project.

TABLE 24
PLUS PROJECT 95TH PERCENTILE QUEUES (ALTERNATIVE B)

				Existing Plus Project		Cumulative Plus Project	
				AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Int. #	Intersection/Approach	Control Type	Available Storage	95th Percentile Queue (ft)	95th Percentile Queue (ft)	95th Percentile Queue (ft)	95th Percentile Queue (ft)
7	***Dorsey Drive/SR 49 SB Ramp/Joerschke Dr***			--		--	
	Eastbound Thru	Signal	800	170	288	193	772
	Eastbound Right		155	90	***235***	114	**256**
	Westbound Left		285	106	0	106	175
	Westbound Thru		285	118	99	118	99
	Southbound Left/Thru		430	169	289	224	**965**
	Southbound Right		300	95	85	125	**673**
8	***Dorsey Drive/SR 49 NB Ramps***			--	--	--	--
	Eastbound Left	Signal	285	90	79	126	236
	Eastbound Thru		285	100	122	225	**300**
	Westbound Thru		540	118	316	158	491
	Westbound Thru/Right		540	124	250	146	352
	Northbound Left/Thru		1000	617	432	619	436
	Northbound Right		190	***201***	186	**227**	**199**

The queue for the eastbound right for intersection 7 in the *Existing Plus Project* PM peak hour is expected to spill back four vehicles into the thru lane and intersection 8 the northbound right turn lane will spill back by a vehicle. It is not expected these queues will result in spillback that will affect adjacent intersections. Implementing a “keep clear” marking is expected to minimize any affects due to the spillback for ingress and egress at the western driveway to the Springhill Apartment complex. Additionally, the sight distance is projected to remain acceptable for vehicles to react to the expected queues as the posted speed limit is 30 mph.

In the *Cumulative Plus Project* PM peak hour 95th percentile queues are projected to exceed in half the movements.

Improvement Options

To improve the *Cumulative Plus Project* queuing with a traditional signal alternative will require reconstruction of the interchange to add additional lanes on the overcrossing and off-ramp approaches or a multi-lane roundabout interchange that will require significant modifications to the over-crossing.

Project Impacts and Proposed Improvements (Alternative B)

This section presents recommended project-related mitigation measures at the study intersections, developed based on the findings from the analyses presented in the prior sections of this report. The mitigations are provided for both *Existing* conditions and *Year 2035* conditions separately, so it may be possible that the same mitigations at one location are applicable to both conditions.

Impact Significance Criteria

In accordance with the February 2012 City of Grass Valley Traffic Study Guidelines, the following thresholds of significance are used to determine if the proposed project causes a significant impact and requires mitigation:

Intersections

- An intersection or roadway segment deteriorates from an acceptable LOS to LOS E or worse, or
- Distributes a project trip to an intersection or roadway segment currently operating at an unacceptable LOS

Existing Plus Project Impacts and Mitigations

The following improvements are proposed to provide acceptable operations at intersections where a project's significant impact is identified:

Intersection 12 - Idaho Maryland Road and Brunswick Road

The proposed project creates a significant impact in the weekday PM peak hour by reducing the level of service to unacceptable operations between the *Existing No Project* and *Existing Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS C or better) for the weekday PM peak hour:

- Construct a traffic signal OR
- Closure of Idaho Maryland Road and Brunswick Road intersection

This intersection has been identified by the City's General Plan for closure by Year 2020. Alternatively, the Loma Rica EIR has identified improvements for this intersection as potential for signalization. If the signal option is chosen, a payment of fair-share would mitigate the project's impact at this location.

Intersection 16 - Idaho Maryland Rd & SR 49/20 NB Ramps

The proposed project creates a significant impact in the weekday PM peak hour by reducing the level of service to unacceptable operations between the *Existing No Project* and *Existing Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS:

- Construct a traffic signal OR

Due to the close proximity of the intersection of Idaho Maryland Road/State Route 49/20 NB Ramps to the adjacent intersection of Idaho Maryland Rd/Railroad Avenue, signal coordination would be required to ensure traffic progression and to minimize queue build-up between the two intersections.

Year 2035 Plus Project Impacts and Mitigations

The following improvements are proposed to provide acceptable operations at intersections where a project's significant impact is identified:

Intersection 6 - Dorsey Drive and Catherine Lane

The proposed project creates a significant impact in the weekday PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Construct a traffic signal

Due to the close proximity of the intersection of Dorsey Drive/Catherine Lane to the adjacent intersection of East Main Street/Dorsey Drive, signal coordination would be required to ensure traffic progression and to minimize queue build-up between the two intersections.

Intersection 7 - Dorsey Drive and State Route 49/20 SB/EB On Ramp/Joerschke Drive

The proposed project creates a significant impact in the weekday PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Revised traffic signal timings (this will not improve the queueing at the SB off ramp)

Intersection 10 - Dorsey Drive and Sutton Way

The proposed project creates a significant impact in the weekday AM and PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Construct a traffic signal OR
- Construct a single/multi-lane roundabout

Intersection 12 - Idaho Maryland Road and Brunswick Road

The proposed project creates a significant impact in the weekday AM and PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Construct a traffic signal OR
- Closure of Idaho Maryland Road and Brunswick Road intersection

This intersection has been identified by the City's General Plan for closure by Year 2020. Alternatively, the Loma Rica EIR has identified improvements for this intersection as potential for signalization. If the signal option is chosen, a payment of fair-share would mitigate the project's impact at this location.

Intersection 13 - Idaho Maryland Road and Spring Hill Drive

The proposed project creates a significant impact in the weekday AM and PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Construct a southbound right turn pocket (It appears that the roadway width is approximately 38 feet. Restriping the approach to provide a right turn pocket should not require any addition right-of-way.)

Intersection 16 - Idaho Maryland Road and State Route 49/20 NB Ramps

The proposed project creates a significant impact in the weekday PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Construct a traffic signal OR
- Construct a single/multi-lane roundabout

Due to the close proximity of the intersection of Idaho Maryland Road/State Route 49/20 NB Ramps to the adjacent intersection of Idaho Maryland Rd/Railroad Avenue, signal coordination would be required to ensure traffic progression and to minimize queue build-up between the two intersections.

Intersection 17 - Bennett Street and State Route 49/20 SB Off Ramps/Tinloy Street

The proposed project creates a significant impact in the weekday PM peak hour by reducing the level of service to unacceptable operations between the *Year 2035 No Project* and *Year 2035 Plus Project* conditions. The following improvements are proposed to restore the intersection to acceptable LOS (LOS D or better):

- Construct a traffic signal OR
- Construct a single/multi-lane roundabout

Due to the close proximity of the intersection of Bennett Street and State Route 49/20 SB Off Ramps/Tinloy Street to the adjacent intersection of East Main Street/Richardson Street, signal coordination would be required to ensure traffic progression and to minimize queue build-up between the two intersections.

Appendices

Appendix A: Synchro/SimTraffic Outputs (Alternative A)

Appendix B: Sidra Outputs (Alternative A)

Appendix C: HCS Outputs (Alternative A)

Appendix D: Signal Warrant Analysis Worksheets (Alternative A)

Appendix E: Caltrans NOP Comments

Appendix F: Grass Valley Traffic Impact Fee 2016 Nexus Fee Update Exhibit 23

Appendix G: Exhibits for Alternative B

Appendix H: LOS Worksheets for Alternative B

Appendix A: Synchro/SimTraffic Outputs

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	13	12	187	15	354	3	143	92	290	141	2
Future Volume (vph)	4	13	12	187	15	354	3	143	92	290	141	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1729		1665	1681	1568	1752	1845	1568	3400	1840	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1729		1665	1681	1568	1752	1845	1568	3400	1840	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	5	16	15	234	19	442	4	179	115	362	176	2
RTOR Reduction (vph)	0	15	0	0	0	131	0	0	101	0	1	0
Lane Group Flow (vph)	0	21	0	126	127	312	4	179	14	363	178	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		4.0		68.6	68.6	85.7	15.3	15.3	15.3	17.1	17.1	
Effective Green, g (s)		4.0		68.6	68.6	85.7	15.3	15.3	15.3	17.1	17.1	
Actuated g/C Ratio		0.03		0.56	0.56	0.71	0.13	0.13	0.13	0.14	0.14	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		56		940	949	1105	220	232	197	478	258	
v/s Ratio Prot		c0.01		0.08	0.08	c0.04	0.00	c0.10		c0.11	0.10	
v/s Ratio Perm						0.16			0.01			
v/c Ratio		0.38		0.13	0.13	0.28	0.02	0.77	0.07	0.76	0.69	
Uniform Delay, d1		57.5		12.5	12.5	6.6	46.5	51.4	46.8	50.2	49.7	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.6		0.3	0.3	0.1	0.0	13.4	0.1	6.1	6.3	
Delay (s)		59.1		12.8	12.8	6.6	46.5	64.8	46.9	56.3	56.0	
Level of Service		E		B	B	A	D	E	D	E	E	
Approach Delay (s)		59.1			8.9			57.7			56.2	
Approach LOS		E			A			E			E	

Intersection Summary			
HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	121.5	Sum of lost time (s)	16.5
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	362	33	91	406	0	24	0	119	219	40	126
Future Volume (vph)	0	362	33	91	406	0	24	0	119	219	40	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3461		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3461		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	381	35	96	427	0	25	0	125	231	42	133
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	111	0	0	121
Lane Group Flow (vph)	0	414	0	96	427	0	25	0	14	231	42	12
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		100.2		11.6	115.3		4.8		16.4	13.4	13.4	13.4
Effective Green, g (s)		100.2		11.6	115.3		4.8		16.4	13.4	13.4	13.4
Actuated g/C Ratio		0.68		0.08	0.79		0.03		0.11	0.09	0.09	0.09
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		2363		138	2754		57		175	310	168	143
v/s Ratio Prot		c0.12		c0.05	0.12		c0.01		0.01	c0.07	0.02	
v/s Ratio Perm									0.00			0.01
v/c Ratio		0.18		0.70	0.16		0.44		0.08	0.75	0.25	0.08
Uniform Delay, d1		8.4		65.8	3.8		69.6		58.4	65.0	62.0	61.0
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2		11.6	0.1		2.0		0.1	8.2	0.3	0.1
Delay (s)		8.5		77.4	3.9		71.6		58.5	73.2	62.3	61.1
Level of Service		A		E	A		E		E	E	E	E
Approach Delay (s)		8.5			17.4			60.6			68.1	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	146.7	Sum of lost time (s)	16.7
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	438	87	0	450	219	255	0	374	0	0	0
Future Volume (vph)	0	438	87	0	450	219	255	0	374	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	498	99	0	511	249	290	0	425	0	0	0
RTOR Reduction (vph)	0	0	33	0	0	0	0	0	267	0	0	0
Lane Group Flow (vph)	0	498	66	0	511	249	290	0	158	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		59.5	59.5		59.5	80.5	20.5		20.5			
Effective Green, g (s)		59.5	59.5		59.5	80.5	20.5		20.5			
Actuated g/C Ratio		0.67	0.67		0.67	0.91	0.23		0.23			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2353	1053		2353	1486	405		362			
v/s Ratio Prot		0.14			c0.15	0.04	c0.17		0.10			
v/s Ratio Perm			0.04			0.12						
v/c Ratio		0.21	0.06		0.22	0.17	0.72		0.44			
Uniform Delay, d1		5.6	5.0		5.6	0.4	31.4		29.1			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.2	0.1		0.0	0.1	5.9		0.8			
Delay (s)		5.8	5.1		5.6	0.5	37.3		29.9			
Level of Service		A	A		A	A	D		C			
Approach Delay (s)		5.7			4.0			32.9			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	158	405	249	86	400	16	134	26	53	24	32	135
Future Volume (vph)	158	405	249	86	400	16	134	26	53	24	32	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3484		3400	1660		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3484		3400	1660		1752	1845	1568
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	174	445	274	95	440	18	147	29	58	26	35	148
RTOR Reduction (vph)	0	0	110	0	1	0	0	53	0	0	0	130
Lane Group Flow (vph)	174	445	164	95	457	0	147	34	0	26	35	18
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	10.5	82.6	82.6	22.9	95.0		10.4	12.6		4.4	6.6	17.1
Effective Green, g (s)	10.5	82.6	82.6	22.9	95.0		10.4	12.6		4.4	6.6	17.1
Actuated g/C Ratio	0.08	0.60	0.60	0.17	0.69		0.08	0.09		0.03	0.05	0.12
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	259	2104	941	291	2405		256	152		56	88	194
v/s Ratio Prot	c0.05	c0.13		c0.05	0.13		c0.04	0.02		0.01	c0.02	0.01
v/s Ratio Perm			0.10									0.00
v/c Ratio	0.67	0.21	0.17	0.33	0.19		0.57	0.23		0.46	0.40	0.09
Uniform Delay, d1	61.9	12.6	12.3	50.6	7.6		61.5	58.0		65.4	63.6	53.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.3	0.2	0.4	0.2	0.2		1.9	0.3		2.2	1.1	0.1
Delay (s)	67.2	12.8	12.7	50.8	7.8		63.4	58.3		67.7	64.6	53.5
Level of Service	E	B	B	D	A		E	E		E	E	D
Approach Delay (s)		23.4			15.2			61.5			57.1	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	99	195	56	85	426	150	87	154	73	53	137	148
Future Volume (veh/h)	99	195	56	85	426	150	87	154	73	53	137	148
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	109	214	62	93	468	165	96	169	80	58	151	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	142	628	534	131	616	524	133	346	294	99	310	264
Arrive On Green	0.08	0.34	0.34	0.07	0.33	0.33	0.08	0.19	0.19	0.06	0.17	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	109	214	62	93	468	165	96	169	80	58	151	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	2.9	4.1	1.3	2.5	10.7	3.7	2.5	3.9	2.1	1.5	3.5	0.0
Cycle Q Clear(g_c), s	2.9	4.1	1.3	2.5	10.7	3.7	2.5	3.9	2.1	1.5	3.5	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	142	628	534	131	616	524	133	346	294	99	310	264
V/C Ratio(X)	0.77	0.34	0.12	0.71	0.76	0.31	0.72	0.49	0.27	0.59	0.49	0.00
Avail Cap(c_a), veh/h	463	1026	872	352	1065	905	241	1182	1004	241	1221	1038
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	21.4	11.7	10.7	21.5	14.1	11.8	21.4	17.2	16.5	21.9	17.9	0.0
Incr Delay (d2), s/veh	8.5	0.3	0.1	6.9	2.0	0.3	7.2	1.1	0.5	5.4	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	2.1	0.6	1.4	5.8	1.6	1.5	2.1	0.9	0.9	1.9	0.0
LnGrp Delay(d),s/veh	29.9	12.0	10.8	28.4	16.0	12.1	28.6	18.3	17.0	27.3	19.1	0.0
LnGrp LOS	C	B	B	C	B	B	C	B	B	C	B	
Approach Vol, veh/h		385			726			345			209	
Approach Delay, s/veh		16.9			16.7			20.9			21.3	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.2	13.5	7.0	20.8	7.1	12.6	7.3	20.5
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	3.5	5.9	4.5	6.1	4.5	5.5	4.9	12.7
Green Ext Time (p_c), s	0.0	1.2	0.1	1.3	0.0	0.8	0.1	3.1

Intersection Summary	
HCM 2010 Ctrl Delay	18.2
HCM 2010 LOS	B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	266	55	197	612	49	94
Future Volume (Veh/h)	266	55	197	612	49	94
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	317	65	235	729	58	112
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351					
pX, platoon unblocked			0.92		0.92	0.92
vC, conflicting volume			382		1548	350
vC1, stage 1 conf vol					350	
vC2, stage 2 conf vol					1199	
vCu, unblocked vol			290		1553	254
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			80		73	84
cM capacity (veh/h)			1170		217	722

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	382	235	729	58	112
Volume Left	0	235	0	58	0
Volume Right	65	0	0	0	112
cSH	1700	1170	1700	217	722
Volume to Capacity	0.22	0.20	0.43	0.27	0.16
Queue Length 95th (ft)	0	19	0	26	14
Control Delay (s)	0.0	8.8	0.0	27.5	10.9
Lane LOS		A		D	B
Approach Delay (s)	0.0	2.2		16.6	
Approach LOS				C	

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	193	118	56	716	0	0	0	0	45	32	192
Future Volume (vph)	0	193	118	56	716	0	0	0	0	45	32	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.9						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1793	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1793	1568
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	233	142	67	863	0	0	0	0	54	39	231
RTOR Reduction (vph)	0	0	115	0	0	0	0	0	0	0	0	158
Lane Group Flow (vph)	0	233	27	67	863	0	0	0	0	0	93	73
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	5 6 8!					4!	4!	
Permitted Phases			2									4
Actuated Green, G (s)		10.0	10.0	7.6	51.7						16.4	16.4
Effective Green, g (s)		10.0	10.0	7.6	39.9						16.4	16.4
Actuated g/C Ratio		0.19	0.19	0.15	0.77						0.32	0.32
Clearance Time (s)		5.4	5.4	5.9							6.4	6.4
Vehicle Extension (s)		0.5	0.5	1.0							0.5	0.5
Lane Grp Cap (vph)		677	303	257	2705						568	497
v/s Ratio Prot		0.07		0.04	c0.25						0.05	
v/s Ratio Perm			0.02									0.05
v/c Ratio		0.34	0.09	0.26	0.32						0.16	0.15
Uniform Delay, d1		18.0	17.1	19.6	1.8						12.7	12.6
Progression Factor		1.00	1.00	0.87	1.00						1.00	1.00
Incremental Delay, d2		0.1	0.0	0.2	0.0						0.0	0.1
Delay (s)		18.1	17.2	17.2	1.8						12.8	12.7
Level of Service		B	B	B	A						B	B
Approach Delay (s)		17.8			2.9			0.0			12.7	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	51.7	Sum of lost time (s)	17.7
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	143	0	0	213	22	559	1	56	0	0	0
Future Volume (vph)	95	143	0	0	213	22	559	1	56	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.9			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.99		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4965		1665	1669	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4965		1665	1669	1568			
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	116	174	0	0	260	27	682	1	68	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	46	0	0	0
Lane Group Flow (vph)	116	174	0	0	272	0	341	342	22	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	1 2 4!			6		8!	8!				
Permitted Phases									8			
Actuated Green, G (s)	9.3	51.7			8.3		16.4	16.4	16.4			
Effective Green, g (s)	9.3	39.9			8.3		16.4	16.4	16.4			
Actuated g/C Ratio	0.18	0.77			0.16		0.32	0.32	0.32			
Clearance Time (s)	5.9				5.4		6.4	6.4	6.4			
Vehicle Extension (s)	1.0				0.5		0.5	0.5	0.5			
Lane Grp Cap (vph)	315	1423			797		528	529	497			
v/s Ratio Prot	c0.07	c0.09			c0.05		0.20	c0.20				
v/s Ratio Perm									0.01			
v/c Ratio	0.37	0.12			0.34		0.65	0.65	0.04			
Uniform Delay, d1	18.6	1.5			19.3		15.2	15.2	12.2			
Progression Factor	1.63	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	0.3	0.0			0.1		2.0	2.0	0.0			
Delay (s)	30.7	1.5			19.4		17.2	17.2	12.2			
Level of Service	C	A			B		B	B	B			
Approach Delay (s)		13.2			19.4			16.7			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	51.7	Sum of lost time (s)	17.7
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		
! Phase conflict between lane groups.			
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	192	224	4	5	11
Future Volume (Veh/h)	7	192	224	4	5	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	9	237	277	5	6	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		539				
pX, platoon unblocked					0.97	
vC, conflicting volume	282				534	280
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	282				507	280
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	98
cM capacity (veh/h)	1275				506	757

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	9	237	282	20
Volume Left	9	0	0	6
Volume Right	0	0	5	14
cSH	1275	1700	1700	659
Volume to Capacity	0.01	0.14	0.17	0.03
Queue Length 95th (ft)	1	0	0	2
Control Delay (s)	7.8	0.0	0.0	10.6
Lane LOS	A			B
Approach Delay (s)	0.3		0.0	10.6
Approach LOS				B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	22.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	91	71	98	95	116	85
Future Vol, veh/h	91	71	98	95	116	85
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	115	90	124	120	147	108
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	9.9	10.3	9.7
HCM LOS	A	B	A

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	51%	56%	0%
Vol Thru, %	49%	0%	58%
Vol Right, %	0%	44%	42%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	193	162	201
LT Vol	98	91	0
Through Vol	95	0	116
RT Vol	0	71	85
Lane Flow Rate	244	205	254
Geometry Grp	1	1	1
Degree of Util (X)	0.33	0.281	0.319
Departure Headway (Hd)	4.859	4.934	4.512
Convergence, Y/N	Yes	Yes	Yes
Cap	735	724	794
Service Time	2.912	2.995	2.564
HCM Lane V/C Ratio	0.332	0.283	0.32
HCM Control Delay	10.3	9.9	9.7
HCM Lane LOS	B	A	A
HCM 95th-tile Q	1.4	1.2	1.4

Intersection	
Intersection Delay, s/veh	9.3
Intersection LOS	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	122	79	112	68	57	142
Future Vol, veh/h	122	79	112	68	57	142
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	131	85	120	73	61	153
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	9.8	9	9
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	61%	0%	100%	0%
Vol Thru, %	39%	62%	0%	0%
Vol Right, %	0%	38%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	201	180	57	142
LT Vol	122	0	57	0
Through Vol	79	112	0	0
RT Vol	0	68	0	142
Lane Flow Rate	216	194	61	153
Geometry Grp	2	2	7	7
Degree of Util (X)	0.289	0.243	0.102	0.203
Departure Headway (Hd)	4.822	4.516	6.001	4.792
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	743	794	596	745
Service Time	2.861	2.555	3.752	2.542
HCM Lane V/C Ratio	0.291	0.244	0.102	0.205
HCM Control Delay	9.8	9	9.4	8.8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.2	1	0.3	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	6	122	41	7	72	170	376	18	23	271	13
Future Volume (Veh/h)	0	6	122	41	7	72	170	376	18	23	271	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	6	130	44	7	77	181	400	19	24	288	14
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1102	1117	288	1240	1122	410	302			419		
vC1, stage 1 conf vol	336	336		772	772							
vC2, stage 2 conf vol	766	781		469	350							
vCu, unblocked vol	1102	1117	288	1240	1122	410	302			419		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	83	81	98	88	86			98		
cM capacity (veh/h)	255	303	749	231	304	640	1253			1135		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	136	128	181	419	24	288	14
Volume Left	0	44	181	0	24	0	0
Volume Right	130	77	0	19	0	0	14
cSH	703	605	1253	1700	1135	1700	1700
Volume to Capacity	0.19	0.21	0.14	0.25	0.02	0.17	0.01
Queue Length 95th (ft)	18	20	13	0	2	0	0
Control Delay (s)	11.3	16.4	8.4	0.0	8.2	0.0	0.0
Lane LOS	B	C	A		A		
Approach Delay (s)	11.3	16.4	2.5		0.6		
Approach LOS	B	C					

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	68	422	258	37	12	30
Future Vol, veh/h	68	422	258	37	12	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	75	464	284	41	13	33

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	325	0	-	0	919	305
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	614	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1229	-	-	-	300	732
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	538	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1229	-	-	-	282	732
Mov Cap-2 Maneuver	-	-	-	-	373	-
Stage 1	-	-	-	-	700	-
Stage 2	-	-	-	-	538	-

Approach	EB	WB	SB
HCM Control Delay, s	1.1	0	11.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1229	-	-	-	574
HCM Lane V/C Ratio	0.061	-	-	-	0.08
HCM Control Delay (s)	8.1	-	-	-	11.8
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	200	234	33	235	60	10
Future Vol, veh/h	200	234	33	235	60	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	220	257	36	258	66	11

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	477	0	550	220
Stage 1	-	-	-	-	220	-
Stage 2	-	-	-	-	330	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1080	-	494	817
Stage 1	-	-	-	-	814	-
Stage 2	-	-	-	-	726	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1080	-	478	817
Mov Cap-2 Maneuver	-	-	-	-	551	-
Stage 1	-	-	-	-	787	-
Stage 2	-	-	-	-	726	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	12.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	578	-	-	1080	-
HCM Lane V/C Ratio	0.133	-	-	0.034	-
HCM Control Delay (s)	12.2	-	-	8.4	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	14.5
Intersection LOS	B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	232	29	22	249	151	357
Future Vol, veh/h	232	29	22	249	151	357
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	255	32	24	274	166	392
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	15.3	12.1	15.4
HCM LOS	C	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	21%	0%
Vol Thru, %	0%	0%	89%	79%	100%
Vol Right, %	0%	100%	11%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	151	357	261	105	166
LT Vol	151	0	0	22	0
Through Vol	0	0	232	83	166
RT Vol	0	357	29	0	0
Lane Flow Rate	166	392	287	115	182
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.312	0.606	0.496	0.214	0.332
Departure Headway (Hd)	6.779	5.564	6.225	6.668	6.561
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	529	647	579	538	547
Service Time	4.525	3.309	4.271	4.421	4.314
HCM Lane V/C Ratio	0.314	0.606	0.496	0.214	0.333
HCM Control Delay	12.6	16.6	15.3	11.2	12.6
HCM Lane LOS	B	C	C	B	B
HCM 95th-tile Q	1.3	4.1	2.7	0.8	1.4

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	231	83	12	157	0	0	0	0	129	194	86
Future Vol, veh/h	0	231	83	12	157	0	0	0	0	129	194	86
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	285	102	15	194	0	0	0	0	159	240	106

Major/Minor	Major1									Minor2		
Conflicting Flow All	-	0	0							336	388	0
Stage 1	-	-	-							0	0	-
Stage 2	-	-	-							336	388	-
Critical Hdwy	-	-	-							6.43	6.53	-
Critical Hdwy Stg 1	-	-	-							-	-	-
Critical Hdwy Stg 2	-	-	-							5.43	5.53	-
Follow-up Hdwy	-	-	-							3.527	4.027	-
Pot Cap-1 Maneuver	0	-	-							657	545	-
Stage 1	0	-	-							-	-	-
Stage 2	0	-	-							722	607	-
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-							657	0	-
Mov Cap-2 Maneuver	-	-	-							657	0	-
Stage 1	-	-	-							-	0	-
Stage 2	-	-	-							722	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	657	-
HCM Lane V/C Ratio	-	-	0.425	-
HCM Control Delay (s)	-	-	14.5	-
HCM Lane LOS	-	-	B	-
HCM 95th %tile Q(veh)	-	-	2.1	-

Intersection	
Intersection Delay, s/veh	14.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	139	221	0	0	130	208	39	274	2	0	0	0
Future Vol, veh/h	139	221	0	0	130	208	39	274	2	0	0	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	158	251	0	0	148	236	44	311	2	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	13.3	18.5	13
HCM LOS	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	22%	0%	100%	0%	0%
Vol Thru, %	78%	99%	0%	100%	38%
Vol Right, %	0%	1%	0%	0%	62%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	176	139	139	221	338
LT Vol	39	0	139	0	0
Through Vol	137	137	0	221	130
RT Vol	0	2	0	0	208
Lane Flow Rate	200	158	158	251	384
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.379	0.294	0.297	0.436	0.629
Departure Headway (Hd)	6.814	6.691	6.761	6.252	5.894
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	528	537	531	575	611
Service Time	4.566	4.443	4.513	4.004	3.94
HCM Lane V/C Ratio	0.379	0.294	0.298	0.437	0.628
HCM Control Delay	13.7	12.2	12.4	13.8	18.5
HCM Lane LOS	B	B	B	B	C
HCM 95th-tile Q	1.8	1.2	1.2	2.2	4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	24	9	244	22	443	10	238	196	480	235	2
Future Volume (vph)	7	24	9	244	22	443	10	238	196	480	235	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frpb, ped/bikes		1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1789		1681	1699	1558	1770	1863	1553	3433	1860	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1789		1681	1699	1558	1770	1863	1553	3433	1860	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	8	26	10	268	24	487	11	262	215	527	258	2
RTOR Reduction (vph)	0	9	0	0	0	150	0	0	135	0	0	0
Lane Group Flow (vph)	0	35	0	145	147	337	11	262	80	527	260	0
Confl. Peds. (#/hr)						1			4			4
Confl. Bikes (#/hr)									2			
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		5.6		55.5	55.5	78.8	20.6	20.6	20.6	23.3	23.3	
Effective Green, g (s)		5.6		55.5	55.5	78.8	20.6	20.6	20.6	23.3	23.3	
Actuated g/C Ratio		0.05		0.46	0.46	0.65	0.17	0.17	0.17	0.19	0.19	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		82		767	776	1010	300	315	263	658	356	
v/s Ratio Prot		c0.02		0.09	0.09	c0.06	0.01	c0.14		c0.15	0.14	
v/s Ratio Perm						0.15			0.05			
v/c Ratio		0.43		0.19	0.19	0.33	0.04	0.83	0.30	0.80	0.73	
Uniform Delay, d1		56.4		19.6	19.6	9.6	42.2	48.8	44.2	46.9	46.1	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.3		0.5	0.5	0.1	0.0	16.2	0.2	6.6	6.5	
Delay (s)		57.7		20.2	20.2	9.6	42.2	64.9	44.4	53.4	52.6	
Level of Service		E		C	C	A	D	E	D	D	D	
Approach Delay (s)		57.7			13.6			55.4			53.2	
Approach LOS		E			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	121.5	Sum of lost time (s)	16.5
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	658	42	165	521	0	31	0	218	326	38	157
Future Volume (vph)	0	658	42	165	521	0	31	0	218	326	38	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3499		1770	3539		1770		1583	3433	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3499		1770	3539		1770		1583	3433	1863	1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	774	49	194	613	0	36	0	256	384	45	185
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	46	0	0	159
Lane Group Flow (vph)	0	821	0	194	613	0	36	0	210	384	45	26
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)						1						
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		80.1		19.0	102.6		6.7		25.7	19.6	19.6	19.6
Effective Green, g (s)		80.1		19.0	102.6		6.7		25.7	19.6	19.6	19.6
Actuated g/C Ratio		0.56		0.13	0.72		0.05		0.18	0.14	0.14	0.14
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		1972		236	2555		83		286	473	256	218
v/s Ratio Prot		c0.23		c0.11	0.17		0.02		c0.10	c0.11	0.02	
v/s Ratio Perm									0.03			0.02
v/c Ratio		0.42		0.82	0.24		0.43		0.73	0.81	0.18	0.12
Uniform Delay, d1		17.7		59.9	6.6		65.9		55.0	59.5	54.1	53.7
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.6		19.2	0.2		1.3		8.2	9.7	0.1	0.1
Delay (s)		18.3		79.1	6.9		67.2		63.1	69.2	54.2	53.8
Level of Service		B		E	A		E		E	E	D	D
Approach Delay (s)		18.3			24.2			63.6			63.4	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	142.1	Sum of lost time (s)	16.7
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	705	138	0	856	397	241	0	373	0	0	0
Future Volume (vph)	0	705	138	0	856	397	241	0	373	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frpb, ped/bikes		1.00	0.97		1.00	0.98	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1537		3539	1559	1770		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1537		3539	1559	1770		1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	766	150	0	930	432	262	0	405	0	0	0
RTOR Reduction (vph)	0	0	49	0	0	0	0	0	139	0	0	0
Lane Group Flow (vph)	0	766	101	0	930	432	262	0	266	0	0	0
Confl. Peds. (#/hr)			5									
Confl. Bikes (#/hr)						1						
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		59.7	59.7		59.7	80.5	20.3		20.3			
Effective Green, g (s)		59.7	59.7		59.7	80.5	20.3		20.3			
Actuated g/C Ratio		0.67	0.67		0.67	0.91	0.23		0.23			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2384	1035		2384	1478	405		362			
v/s Ratio Prot		0.22			c0.26	0.07	0.15		c0.17			
v/s Ratio Perm			0.07			0.21						
v/c Ratio		0.32	0.10		0.39	0.29	0.65		0.74			
Uniform Delay, d1		6.0	5.0		6.4	0.5	30.9		31.7			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.4	0.2		0.1	0.1	3.5		7.6			
Delay (s)		6.4	5.2		6.5	0.6	34.4		39.2			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		6.2			4.6			37.3			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	214	525	339	107	570	26	392	77	129	72	54	291
Future Volume (vph)	214	525	339	107	570	26	392	77	129	72	54	291
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1522	1770	3514		3433	1661		1770	1863	1577
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1522	1770	3514		3433	1661		1770	1863	1577
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	243	597	385	122	648	30	445	88	147	82	61	331
RTOR Reduction (vph)	0	0	188	0	2	0	0	49	0	0	0	61
Lane Group Flow (vph)	243	597	197	122	676	0	445	186	0	82	61	270
Confl. Peds. (#/hr)			8			1			10			
Confl. Bikes (#/hr)												2
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	20.6	69.7	69.7	22.2	71.3		23.2	20.4		10.2	7.4	28.0
Effective Green, g (s)	20.6	69.7	69.7	22.2	71.3		23.2	20.4		10.2	7.4	28.0
Actuated g/C Ratio	0.15	0.51	0.51	0.16	0.52		0.17	0.15		0.07	0.05	0.20
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	513	1792	770	285	1820		578	246		131	100	320
v/s Ratio Prot	0.07	0.17		c0.07	c0.19		c0.13	0.11		0.05	0.03	c0.13
v/s Ratio Perm			0.13									0.05
v/c Ratio	0.47	0.33	0.26	0.43	0.37		0.77	0.76		0.63	0.61	0.84
Uniform Delay, d1	53.5	20.2	19.2	52.0	19.8		54.6	56.2		61.8	63.7	52.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.5	0.8	0.4	0.6		5.5	11.2		6.6	7.0	17.3
Delay (s)	53.8	20.7	20.0	52.4	20.4		60.2	67.4		68.4	70.7	69.9
Level of Service	D	C	C	D	C		E	E		E	E	E
Approach Delay (s)		27.0			25.2			62.7			69.8	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	40.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	392	125	134	318	128	57	220	152	80	256	196
Future Volume (veh/h)	173	392	125	134	318	128	57	220	152	80	256	196
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	201	456	145	156	370	149	66	256	177	93	298	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	253	577	490	199	521	440	122	389	330	145	413	351
Arrive On Green	0.14	0.31	0.31	0.11	0.28	0.28	0.07	0.21	0.21	0.08	0.22	0.00
Sat Flow, veh/h	1774	1863	1581	1774	1863	1575	1774	1863	1580	1774	1863	1583
Grp Volume(v), veh/h	201	456	145	156	370	149	66	256	177	93	298	0
Grp Sat Flow(s),veh/h/ln	1774	1863	1581	1774	1863	1575	1774	1863	1580	1774	1863	1583
Q Serve(g_s), s	6.2	12.6	3.9	4.8	10.1	4.2	2.0	7.1	5.6	2.9	8.3	0.0
Cycle Q Clear(g_c), s	6.2	12.6	3.9	4.8	10.1	4.2	2.0	7.1	5.6	2.9	8.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	253	577	490	199	521	440	122	389	330	145	413	351
V/C Ratio(X)	0.80	0.79	0.30	0.78	0.71	0.34	0.54	0.66	0.54	0.64	0.72	0.00
Avail Cap(c_a), veh/h	394	873	741	299	906	766	205	1005	853	205	1039	883
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	23.4	17.8	14.8	24.3	18.2	16.1	25.4	20.4	19.9	25.1	20.3	0.0
Incr Delay (d2), s/veh	6.1	2.9	0.3	7.6	1.8	0.5	3.7	1.9	1.4	4.7	2.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.4	6.9	1.7	2.8	5.4	1.9	1.1	3.8	2.6	1.6	4.6	0.0
LnGrp Delay(d),s/veh	29.4	20.6	15.1	31.9	20.0	16.6	29.1	22.3	21.2	29.7	22.7	0.0
LnGrp LOS	C	C	B	C	C	B	C	C	C	C	C	
Approach Vol, veh/h		802			675			499			391	
Approach Delay, s/veh		21.8			22.0			22.8			24.4	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	16.4	9.8	22.1	7.4	17.1	11.5	20.3
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	4.9	9.1	6.8	14.6	4.0	10.3	8.2	12.1
Green Ext Time (p_c), s	0.0	2.1	0.1	2.6	0.0	1.7	0.2	2.5

Intersection Summary	
HCM 2010 Ctrl Delay	22.5
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	584	40	91	508	72	198
Future Volume (Veh/h)	584	40	91	508	72	198
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	664	45	103	577	82	225
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351					
pX, platoon unblocked			0.78		0.78	0.78
vC, conflicting volume			709		1474	686
vC1, stage 1 conf vol					686	
vC2, stage 2 conf vol					788	
vCu, unblocked vol			479		1467	450
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			88		74	52
cM capacity (veh/h)			839		313	472

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	709	103	577	82	225
Volume Left	0	103	0	82	0
Volume Right	45	0	0	0	225
cSH	1700	839	1700	313	472
Volume to Capacity	0.42	0.12	0.34	0.26	0.48
Queue Length 95th (ft)	0	10	0	26	63
Control Delay (s)	0.0	9.9	0.0	20.5	19.4
Lane LOS		A		C	C
Approach Delay (s)	0.0	1.5		19.7	
Approach LOS				C	

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	454	402	105	466	0	0	0	0	44	53	139
Future Volume (vph)	0	454	402	105	466	0	0	0	0	44	53	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.9						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.98	1.00
Satd. Flow (prot)		3539	1583	1770	3539						1822	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.98	1.00
Satd. Flow (perm)		3539	1583	1770	3539						1822	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	510	452	118	524	0	0	0	0	49	60	156
RTOR Reduction (vph)	0	0	342	0	0	0	0	0	0	0	0	125
Lane Group Flow (vph)	0	510	110	118	524	0	0	0	0	0	109	31
Confl. Peds. (#/hr)						5						
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	5 6 8!					4!	4!	
Permitted Phases			2									4
Actuated Green, G (s)		11.2	11.2	8.0	46.0						9.1	9.1
Effective Green, g (s)		11.2	11.2	8.0	34.2						9.1	9.1
Actuated g/C Ratio		0.24	0.24	0.17	0.74						0.20	0.20
Clearance Time (s)		5.4	5.4	5.9							6.4	6.4
Vehicle Extension (s)		0.5	0.5	1.0							0.5	0.5
Lane Grp Cap (vph)		861	385	307	2631						360	313
v/s Ratio Prot		c0.14		c0.07	c0.15						c0.06	
v/s Ratio Perm			0.07									0.02
v/c Ratio		0.59	0.29	0.38	0.20						0.30	0.10
Uniform Delay, d1		15.4	14.1	16.8	1.8						15.7	15.1
Progression Factor		1.00	1.00	0.92	1.00						1.00	1.00
Incremental Delay, d2		0.7	0.1	0.3	0.0						0.2	0.1
Delay (s)		16.1	14.3	15.8	1.8						15.9	15.1
Level of Service		B	B	B	A						B	B
Approach Delay (s)		15.3			4.4			0.0			15.5	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	17.7
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	226	272	0	0	294	12	277	0	71	0	0	0
Future Volume (vph)	226	272	0	0	294	12	277	0	71	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.9			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.99		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1770	1863			5049		1681	1681	1583			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1770	1863			5049		1681	1681	1583			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	238	286	0	0	309	13	292	0	75	0	0	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	60	0	0	0
Lane Group Flow (vph)	238	286	0	0	317	0	146	146	15	0	0	0
Confl. Peds. (#/hr)						5						
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	1 2 4!			6		8!	8!				
Permitted Phases									8			
Actuated Green, G (s)	10.9	46.0			8.3		9.1	9.1	9.1			
Effective Green, g (s)	10.9	34.2			8.3		9.1	9.1	9.1			
Actuated g/C Ratio	0.24	0.74			0.18		0.20	0.20	0.20			
Clearance Time (s)	5.9				5.4		6.4	6.4	6.4			
Vehicle Extension (s)	1.0				0.5		0.5	0.5	0.5			
Lane Grp Cap (vph)	419	1385			911		332	332	313			
v/s Ratio Prot	c0.13	c0.15			c0.06		c0.09	0.09				
v/s Ratio Perm									0.01			
v/c Ratio	0.57	0.21			0.35		0.44	0.44	0.05			
Uniform Delay, d1	15.5	1.8			16.5		16.2	16.2	14.9			
Progression Factor	1.67	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	1.0	0.0			0.1		0.3	0.3	0.0			
Delay (s)	26.8	1.8			16.6		16.6	16.6	15.0			
Level of Service	C	A			B		B	B	B			
Approach Delay (s)		13.2			16.6			16.2			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	17.7
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	323	285	11	12	21
Future Volume (Veh/h)	20	323	285	11	12	21
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	21	336	297	11	13	22
Pedestrians					3	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		539				
pX, platoon unblocked					0.95	
vC, conflicting volume	311				684	306
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	311				645	306
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				97	97
cM capacity (veh/h)	1246				409	732

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	21	336	308	35
Volume Left	21	0	0	13
Volume Right	0	0	11	22
cSH	1246	1700	1700	566
Volume to Capacity	0.02	0.20	0.18	0.06
Queue Length 95th (ft)	1	0	0	5
Control Delay (s)	7.9	0.0	0.0	11.8
Lane LOS	A			B
Approach Delay (s)	0.5		0.0	11.8
Approach LOS				B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	13.1
Intersection LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	179	123	114	186	177	165
Future Vol, veh/h	179	123	114	186	177	165
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	185	127	118	192	182	170
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	13.4	13.1	12.9
HCM LOS	B	B	B

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	38%	59%	0%
Vol Thru, %	62%	0%	52%
Vol Right, %	0%	41%	48%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	300	302	342
LT Vol	114	179	0
Through Vol	186	0	177
RT Vol	0	123	165
Lane Flow Rate	309	311	353
Geometry Grp	1	1	1
Degree of Util (X)	0.466	0.474	0.492
Departure Headway (Hd)	5.419	5.482	5.022
Convergence, Y/N	Yes	Yes	Yes
Cap	665	657	716
Service Time	3.456	3.521	3.058
HCM Lane V/C Ratio	0.465	0.473	0.493
HCM Control Delay	13.1	13.4	12.9
HCM Lane LOS	B	B	B
HCM 95th-tile Q	2.5	2.6	2.7

Intersection	
Intersection Delay, s/veh	11.1
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	174	133	94	91	103	225
Future Vol, veh/h	174	133	94	91	103	225
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	181	139	98	95	107	234
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	12.5	9.8	10.4
HCM LOS	B	A	B

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	57%	0%	100%	0%
Vol Thru, %	43%	51%	0%	0%
Vol Right, %	0%	49%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	307	185	103	225
LT Vol	174	0	103	0
Through Vol	133	94	0	0
RT Vol	0	91	0	225
Lane Flow Rate	320	193	107	234
Geometry Grp	2	2	7	7
Degree of Util (X)	0.455	0.262	0.187	0.329
Departure Headway (Hd)	5.126	4.902	6.27	5.057
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	697	725	568	703
Service Time	3.206	2.993	4.066	2.852
HCM Lane V/C Ratio	0.459	0.266	0.188	0.333
HCM Control Delay	12.5	9.8	10.5	10.4
HCM Lane LOS	B	A	B	B
HCM 95th-tile Q	2.4	1	0.7	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	188	18	0	35	185	438	42	98	442	17
Future Volume (Veh/h)	0	0	188	18	0	35	185	438	42	98	442	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	209	20	0	39	206	487	47	109	491	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1608	1655	491	1840	1650	510	510			534		
vC1, stage 1 conf vol	709	709		922	922							
vC2, stage 2 conf vol	899	946		918	728							
vCu, unblocked vol	1608	1655	491	1840	1650	510	510			534		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	64	31	100	93	80			89		
cM capacity (veh/h)	134	155	578	29	158	563	1055			1034		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	209	59	206	534	109	491	19
Volume Left	0	20	206	0	109	0	0
Volume Right	209	39	0	47	0	0	19
cSH	578	81	1055	1700	1034	1700	1700
Volume to Capacity	0.36	0.72	0.20	0.31	0.11	0.29	0.01
Queue Length 95th (ft)	41	88	18	0	9	0	0
Control Delay (s)	14.7	122.1	9.2	0.0	8.9	0.0	0.0
Lane LOS	B	F	A		A		
Approach Delay (s)	14.7	122.1	2.6		1.6		
Approach LOS	B	F					

Intersection Summary			
Average Delay	8.1		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection						
Int Delay, s/veh	2.1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	41	347	469	21	34	83
Future Vol, veh/h	41	347	469	21	34	83
Conflicting Peds, #/hr	0	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	46	386	521	23	38	92

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	546	0	-	0	1013	535
Stage 1	-	-	-	-	535	-
Stage 2	-	-	-	-	478	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1023	-	-	-	265	545
Stage 1	-	-	-	-	587	-
Stage 2	-	-	-	-	624	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1021	-	-	-	252	544
Mov Cap-2 Maneuver	-	-	-	-	374	-
Stage 1	-	-	-	-	559	-
Stage 2	-	-	-	-	623	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	15.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1021	-	-	-	481
HCM Lane V/C Ratio	0.045	-	-	-	0.27
HCM Control Delay (s)	8.7	-	-	-	15.2
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	1.1

Intersection	
Int Delay, s/veh	3.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	Y	
Traffic Vol, veh/h	294	87	16	320	170	25
Future Vol, veh/h	294	87	16	320	170	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	323	96	18	352	187	27

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	419	0	711	323
Stage 1	-	-	-	-	323	-
Stage 2	-	-	-	-	388	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1140	-	400	718
Stage 1	-	-	-	-	734	-
Stage 2	-	-	-	-	686	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1140	-	394	718
Mov Cap-2 Maneuver	-	-	-	-	496	-
Stage 1	-	-	-	-	722	-
Stage 2	-	-	-	-	686	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	16.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	516	-	-	1140	-
HCM Lane V/C Ratio	0.415	-	-	0.015	-
HCM Control Delay (s)	16.8	-	-	8.2	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	2	-	-	0	-

Intersection	
Intersection Delay, s/veh	29.4
Intersection LOS	D

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	162	37	58	678	171	214
Future Vol, veh/h	162	37	58	678	171	214
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	193	44	69	807	204	255
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	14.9	40.5	15.7
HCM LOS	B	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	20%	0%
Vol Thru, %	0%	0%	81%	80%	100%
Vol Right, %	0%	100%	19%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	171	214	199	284	452
LT Vol	171	0	0	58	0
Through Vol	0	0	162	226	452
RT Vol	0	214	37	0	0
Lane Flow Rate	204	255	237	338	538
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.44	0.464	0.439	0.613	0.96
Departure Headway (Hd)	7.784	6.561	6.674	6.529	6.425
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	462	548	538	551	565
Service Time	5.544	4.32	4.73	4.286	4.182
HCM Lane V/C Ratio	0.442	0.465	0.441	0.613	0.952
HCM Control Delay	16.6	14.9	14.9	19.2	53.9
HCM Lane LOS	C	B	B	C	F
HCM 95th-tile Q	2.2	2.4	2.2	4.1	12.8

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	335	183	12	127	0	0	0	0	155	202	150
Future Vol, veh/h	0	335	183	12	127	0	0	0	0	155	202	150
Conflicting Peds, #/hr	0	0	2	0	0	7	0	0	1	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	364	199	13	138	0	0	0	0	168	220	163

Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0	0	464	563	2
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	464	563	-
Critical Hdwy	-	-	-	6.42	6.52	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	5.42	5.52	-
Follow-up Hdwy	-	-	-	3.518	4.018	-
Pot Cap-1 Maneuver	0	-	-	556	435	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	633	509	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	556	0	-
Mov Cap-2 Maneuver	-	-	-	556	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	633	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	556	-
HCM Lane V/C Ratio	-	-	0.5	-
HCM Control Delay (s)	-	-	17.8	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	2.8	-

Intersection	
Intersection Delay, s/veh	14
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	160	330	0	0	100	128	39	327	2	0	0	0
Future Vol, veh/h	160	330	0	0	100	128	39	327	2	0	0	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	165	340	0	0	103	132	40	337	2	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	15.2	13	12.9
HCM LOS	C	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	19%	0%	100%	0%	0%
Vol Thru, %	81%	99%	0%	100%	44%
Vol Right, %	0%	1%	0%	0%	56%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	203	166	160	330	228
LT Vol	39	0	160	0	0
Through Vol	164	164	0	330	100
RT Vol	0	2	0	0	128
Lane Flow Rate	209	171	165	340	235
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.385	0.309	0.301	0.574	0.395
Departure Headway (Hd)	6.635	6.529	6.578	6.071	6.051
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	543	551	546	595	595
Service Time	4.378	4.272	4.318	3.811	4.093
HCM Lane V/C Ratio	0.385	0.31	0.302	0.571	0.395
HCM Control Delay	13.5	12.2	12.1	16.7	13
HCM Lane LOS	B	B	B	C	B
HCM 95th-tile Q	1.8	1.3	1.3	3.6	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	13	12	187	15	364	3	143	92	302	141	2
Future Volume (vph)	4	13	12	187	15	364	3	143	92	302	141	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1729		1665	1681	1568	1752	1845	1568	3400	1840	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1729		1665	1681	1568	1752	1845	1568	3400	1840	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	5	16	15	234	19	455	4	179	115	378	176	2
RTOR Reduction (vph)	0	15	0	0	0	132	0	0	101	0	1	0
Lane Group Flow (vph)	0	21	0	126	127	323	4	179	14	378	178	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		4.0		70.6	70.6	88.8	15.6	15.6	15.6	18.2	18.2	
Effective Green, g (s)		4.0		70.6	70.6	88.8	15.6	15.6	15.6	18.2	18.2	
Actuated g/C Ratio		0.03		0.57	0.57	0.71	0.12	0.12	0.12	0.15	0.15	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		55		941	950	1114	218	230	195	495	268	
v/s Ratio Prot		c0.01		0.08	0.08	c0.04	0.00	c0.10		c0.11	0.10	
v/s Ratio Perm						0.16			0.01			
v/c Ratio		0.39		0.13	0.13	0.29	0.02	0.78	0.07	0.76	0.66	
Uniform Delay, d1		59.3		12.8	12.8	6.6	47.9	53.0	48.3	51.3	50.5	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.7		0.3	0.3	0.1	0.0	14.0	0.1	6.2	4.8	
Delay (s)		60.9		13.1	13.1	6.6	47.9	66.9	48.3	57.5	55.2	
Level of Service		E		B	B	A	D	E	D	E	E	
Approach Delay (s)		60.9			8.9			59.5			56.8	
Approach LOS		E			A			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	124.9	Sum of lost time (s)	16.5
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	374	33	91	416	0	24	0	119	219	40	126
Future Volume (vph)	0	374	33	91	416	0	24	0	119	219	40	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3462		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3462		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	394	35	96	438	0	25	0	125	231	42	133
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	111	0	0	121
Lane Group Flow (vph)	0	427	0	96	438	0	25	0	14	231	42	12
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		103.1		11.8	118.4		4.8		16.6	13.7	13.7	13.7
Effective Green, g (s)		103.1		11.8	118.4		4.8		16.6	13.7	13.7	13.7
Actuated g/C Ratio		0.69		0.08	0.79		0.03		0.11	0.09	0.09	0.09
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		2377		137	2764		56		173	310	168	143
v/s Ratio Prot		c0.12		c0.05	0.12		c0.01		0.01	c0.07	0.02	
v/s Ratio Perm									0.00			0.01
v/c Ratio		0.18		0.70	0.16		0.45		0.08	0.75	0.25	0.08
Uniform Delay, d1		8.4		67.4	3.8		71.3		59.9	66.5	63.4	62.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2		12.4	0.1		2.1		0.1	8.2	0.3	0.1
Delay (s)		8.6		79.8	3.9		73.4		60.0	74.7	63.7	62.6
Level of Service		A		E	A		E		E	E	E	E
Approach Delay (s)		8.6			17.6			62.2			69.6	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	150.1	Sum of lost time (s)	16.7
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	438	87	0	466	219	265	0	387	0	0	0
Future Volume (vph)	0	438	87	0	466	219	265	0	387	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	498	99	0	530	249	301	0	440	0	0	0
RTOR Reduction (vph)	0	0	33	0	0	0	0	0	265	0	0	0
Lane Group Flow (vph)	0	498	66	0	530	249	301	0	175	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		58.9	58.9		58.9	80.5	21.1		21.1			
Effective Green, g (s)		58.9	58.9		58.9	80.5	21.1		21.1			
Actuated g/C Ratio		0.66	0.66		0.66	0.91	0.24		0.24			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2330	1042		2330	1486	417		373			
v/s Ratio Prot		0.14			c0.15	0.04	c0.17		0.11			
v/s Ratio Perm			0.04			0.12						
v/c Ratio		0.21	0.06		0.23	0.17	0.72		0.47			
Uniform Delay, d1		5.8	5.2		5.9	0.4	31.1		28.9			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.2	0.1		0.1	0.1	6.1		0.9			
Delay (s)		6.0	5.3		5.9	0.5	37.1		29.9			
Level of Service		A	A		A	A	D		C			
Approach Delay (s)		5.9			4.2			32.8			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	163	408	254	86	404	16	140	26	53	24	32	141
Future Volume (vph)	163	408	254	86	404	16	140	26	53	24	32	141
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3484		3400	1660		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3484		3400	1660		1752	1845	1568
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	179	448	279	95	444	18	154	29	58	26	35	155
RTOR Reduction (vph)	0	0	112	0	1	0	0	53	0	0	0	136
Lane Group Flow (vph)	179	448	167	95	461	0	154	34	0	26	35	19
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	10.7	82.2	82.2	23.0	94.5		10.7	12.9		4.4	6.6	17.3
Effective Green, g (s)	10.7	82.2	82.2	23.0	94.5		10.7	12.9		4.4	6.6	17.3
Actuated g/C Ratio	0.08	0.60	0.60	0.17	0.69		0.08	0.09		0.03	0.05	0.13
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	264	2093	936	292	2392		264	155		56	88	197
v/s Ratio Prot	c0.05	c0.13		c0.05	0.13		c0.05	0.02		0.01	c0.02	0.01
v/s Ratio Perm			0.11									0.00
v/c Ratio	0.68	0.21	0.18	0.33	0.19		0.58	0.22		0.46	0.40	0.10
Uniform Delay, d1	61.8	12.8	12.5	50.5	7.8		61.3	57.7		65.4	63.6	53.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.3	0.2	0.4	0.2	0.2		2.1	0.3		2.2	1.1	0.1
Delay (s)	67.1	13.0	12.9	50.7	8.0		63.4	58.0		67.7	64.6	53.3
Level of Service	E	B	B	D	A		E	E		E	E	D
Approach Delay (s)		23.7			15.2			61.4			56.9	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	29.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	99	209	56	90	437	156	87	154	79	60	137	148
Future Volume (veh/h)	99	209	56	90	437	156	87	154	79	60	137	148
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	109	230	62	99	480	171	96	169	87	66	151	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	142	635	540	134	627	533	132	333	283	107	307	261
Arrive On Green	0.08	0.34	0.34	0.08	0.34	0.34	0.08	0.18	0.18	0.06	0.17	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	109	230	62	99	480	171	96	169	87	66	151	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	2.9	4.5	1.3	2.6	11.1	3.9	2.6	4.0	2.3	1.8	3.6	0.0
Cycle Q Clear(g_c), s	2.9	4.5	1.3	2.6	11.1	3.9	2.6	4.0	2.3	1.8	3.6	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	142	635	540	134	627	533	132	333	283	107	307	261
V/C Ratio(X)	0.77	0.36	0.11	0.74	0.77	0.32	0.73	0.51	0.31	0.62	0.49	0.00
Avail Cap(c_a), veh/h	458	1015	863	348	1053	895	238	1169	993	238	1207	1026
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	21.6	11.8	10.7	21.7	14.1	11.7	21.7	17.7	17.1	22.0	18.2	0.0
Incr Delay (d2), s/veh	8.5	0.3	0.1	7.7	2.0	0.3	7.4	1.2	0.6	5.6	1.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	2.3	0.6	1.6	5.9	1.7	1.5	2.1	1.0	1.0	1.9	0.0
LnGrp Delay(d),s/veh	30.1	12.1	10.8	29.4	16.1	12.1	29.1	18.9	17.7	27.6	19.4	0.0
LnGrp LOS	C	B	B	C	B	B	C	B	B	C	B	
Approach Vol, veh/h		401			750			352			217	
Approach Delay, s/veh		16.8			16.9			21.4			21.9	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	13.3	7.2	21.1	7.1	12.6	7.4	20.9
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	3.8	6.0	4.6	6.5	4.6	5.6	4.9	13.1
Green Ext Time (p_c), s	0.0	1.2	0.1	1.4	0.0	0.8	0.1	3.2

Intersection Summary	
HCM 2010 Ctrl Delay	18.4
HCM 2010 LOS	B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	293	55	200	633	49	98
Future Volume (Veh/h)	293	55	200	633	49	98
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	349	65	238	754	58	117
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			910		
pX, platoon unblocked			0.92		0.81	0.92
vC, conflicting volume			414		1612	382
vC1, stage 1 conf vol					382	
vC2, stage 2 conf vol					1230	
vCu, unblocked vol			315		1405	279
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			79		67	83
cM capacity (veh/h)			1136		176	694

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	414	238	754	58	117
Volume Left	0	238	0	58	0
Volume Right	65	0	0	0	117
cSH	1700	1136	1700	176	694
Volume to Capacity	0.24	0.21	0.44	0.33	0.17
Queue Length 95th (ft)	0	20	0	34	15
Control Delay (s)	0.0	9.0	0.0	35.1	11.2
Lane LOS		A		E	B
Approach Delay (s)	0.0	2.2		19.1	
Approach LOS				C	

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	235	118	105	749	0	0	0	0	106	32	192
Future Volume (vph)	0	235	118	105	749	0	0	0	0	106	32	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1777	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1777	1568
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	283	142	127	902	0	0	0	0	128	39	231
RTOR Reduction (vph)	0	0	78	0	0	0	0	0	0	0	0	194
Lane Group Flow (vph)	0	283	64	127	902	0	0	0	0	0	167	37
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		42.8	42.8	20.6	52.2						15.5	15.5
Effective Green, g (s)		42.8	42.8	20.6	45.8						15.5	15.5
Actuated g/C Ratio		0.45	0.45	0.22	0.48						0.16	0.16
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1567	701	377	1677						287	253
v/s Ratio Prot		c0.08		0.07	c0.26						c0.09	
v/s Ratio Perm			0.04									0.02
v/c Ratio		0.18	0.09	0.34	0.54						0.58	0.15
Uniform Delay, d1		15.9	15.2	31.8	17.5						37.1	34.4
Progression Factor		1.00	1.00	0.57	0.24						1.00	1.00
Incremental Delay, d2		0.0	0.0	2.2	0.2						1.9	0.1
Delay (s)		15.9	15.3	20.4	4.3						39.0	34.5
Level of Service		B	B	C	A						D	C
Approach Delay (s)		15.7			6.3			0.0			36.4	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	95.7	Sum of lost time (s)	24.6
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	245	0	0	294	69	559	1	120	0	0	0
Future Volume (vph)	95	245	0	0	294	69	559	1	120	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.97		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4893		1665	1669	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4893		1665	1669	1568			
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	116	299	0	0	359	84	682	1	146	0	0	0
RTOR Reduction (vph)	0	0	0	0	31	0	0	0	103	0	0	0
Lane Group Flow (vph)	116	299	0	0	412	0	341	342	43	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	10.3	32.7			43.0		24.7	24.7	24.7			
Effective Green, g (s)	10.3	26.3			43.0		24.7	24.7	24.7			
Actuated g/C Ratio	0.11	0.27			0.45		0.26	0.26	0.26			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	188	507			2198		429	430	404			
v/s Ratio Prot	0.07	c0.16			c0.08		0.20	c0.20				
v/s Ratio Perm									0.03			
v/c Ratio	0.62	0.59			0.19		0.79	0.80	0.11			
Uniform Delay, d1	40.8	30.0			15.8		33.1	33.1	27.1			
Progression Factor	0.69	0.88			1.00		1.00	1.00	1.00			
Incremental Delay, d2	4.1	1.1			0.0		9.2	9.2	0.0			
Delay (s)	32.3	27.7			15.9		42.3	42.3	27.1			
Level of Service	C	C			B		D	D	C			
Approach Delay (s)		29.0			15.9			39.6			0.0	
Approach LOS		C			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	95.7	Sum of lost time (s)	24.6
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	190	167	16	221	4	129	2	12	5	2	11
Future Volume (vph)	7	190	167	16	221	4	129	2	12	5	2	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.2	4.6	4.6	4.2	4.6		4.6	4.6	4.6		4.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)	1752	1845	1568	1752	1840		1665	1671	1568		1664	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)	1752	1845	1568	1752	1840		1665	1671	1568		1664	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	9	235	206	20	273	5	159	2	15	6	2	14
RTOR Reduction (vph)	0	0	147	0	1	0	0	0	13	0	14	0
Lane Group Flow (vph)	9	235	59	20	277	0	81	80	2	0	8	0
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.5	9.3	9.3	0.7	9.5		3.6	3.6	3.6		0.7	
Effective Green, g (s)	0.5	9.3	9.3	0.7	9.5		3.6	3.6	3.6		0.7	
Actuated g/C Ratio	0.02	0.29	0.29	0.02	0.29		0.11	0.11	0.11		0.02	
Clearance Time (s)	4.2	4.6	4.6	4.2	4.6		4.6	4.6	4.6		4.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	27	531	451	37	541		185	186	174		36	
v/s Ratio Prot	0.01	0.13		c0.01	c0.15		c0.05	0.05			c0.00	
v/s Ratio Perm			0.04						0.00			
v/c Ratio	0.33	0.44	0.13	0.54	0.51		0.44	0.43	0.01		0.23	
Uniform Delay, d1	15.7	9.4	8.5	15.6	9.5		13.4	13.4	12.8		15.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	7.2	0.6	0.1	15.1	0.8		1.7	1.6	0.0		3.3	
Delay (s)	22.9	10.0	8.6	30.8	10.3		15.1	15.0	12.8		18.8	
Level of Service	C	A	A	C	B		B	B	B		B	
Approach Delay (s)		9.6			11.7			14.8			18.8	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	32.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	31.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	10.2
Intersection LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	97	73	100	95	116	93
Future Vol, veh/h	97	73	100	95	116	93
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	123	92	127	120	147	118
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	10.2	10.4	9.9
HCM LOS	B	B	A

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	51%	57%	0%
Vol Thru, %	49%	0%	56%
Vol Right, %	0%	43%	44%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	195	170	209
LT Vol	100	97	0
Through Vol	95	0	116
RT Vol	0	73	93
Lane Flow Rate	247	215	265
Geometry Grp	1	1	1
Degree of Util (X)	0.336	0.297	0.333
Departure Headway (Hd)	4.901	4.973	4.534
Convergence, Y/N	Yes	Yes	Yes
Cap	731	719	788
Service Time	2.96	3.037	2.59
HCM Lane V/C Ratio	0.338	0.299	0.336
HCM Control Delay	10.4	10.2	9.9
HCM Lane LOS	B	B	A
HCM 95th-tile Q	1.5	1.2	1.5

Intersection	
Intersection Delay, s/veh	9.4
Intersection LOS	A

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	122	87	122	68	57	142
Future Vol, veh/h	122	87	122	68	57	142
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	131	94	131	73	61	153
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	10	9.2	9
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	58%	0%	100%	0%
Vol Thru, %	42%	64%	0%	0%
Vol Right, %	0%	36%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	209	190	57	142
LT Vol	122	0	57	0
Through Vol	87	122	0	0
RT Vol	0	68	0	142
Lane Flow Rate	225	204	61	153
Geometry Grp	2	2	7	7
Degree of Util (X)	0.302	0.258	0.103	0.205
Departure Headway (Hd)	4.833	4.541	6.048	4.838
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	742	789	591	739
Service Time	2.876	2.584	3.802	2.591
HCM Lane V/C Ratio	0.303	0.259	0.103	0.207
HCM Control Delay	10	9.2	9.5	8.8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.3	1	0.3	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	6	130	41	7	72	180	376	18	23	271	13
Future Volume (Veh/h)	0	6	130	41	7	72	180	376	18	23	271	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	6	138	44	7	77	191	400	19	24	288	14
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1122	1137	288	1268	1142	410	302			419		
vC1, stage 1 conf vol	336	336		792	792							
vC2, stage 2 conf vol	786	801		477	350							
vCu, unblocked vol	1122	1137	288	1268	1142	410	302			419		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	82	80	98	88	85			98		
cM capacity (veh/h)	246	294	749	217	295	640	1253			1135		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	144	128	191	419	24	288	14
Volume Left	0	44	191	0	24	0	0
Volume Right	138	77	0	19	0	0	14
cSH	703	571	1253	1700	1135	1700	1700
Volume to Capacity	0.20	0.22	0.15	0.25	0.02	0.17	0.01
Queue Length 95th (ft)	19	21	13	0	2	0	0
Control Delay (s)	11.4	16.9	8.4	0.0	8.2	0.0	0.0
Lane LOS	B	C	A		A		
Approach Delay (s)	11.4	16.9	2.6		0.6		
Approach LOS	B	C					

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	94	419	254	52	23	51
Future Vol, veh/h	94	419	254	52	23	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	103	460	279	57	25	56

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	336	0	-	0	974	308
Stage 1	-	-	-	-	308	-
Stage 2	-	-	-	-	666	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1218	-	-	-	278	730
Stage 1	-	-	-	-	743	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1218	-	-	-	254	730
Mov Cap-2 Maneuver	-	-	-	-	334	-
Stage 1	-	-	-	-	680	-
Stage 2	-	-	-	-	509	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	13
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1218	-	-	-	533
HCM Lane V/C Ratio	0.085	-	-	-	0.153
HCM Control Delay (s)	8.2	-	-	-	13
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.5

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	Y	
Traffic Vol, veh/h	208	236	33	245	62	10
Future Vol, veh/h	208	236	33	245	62	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	229	259	36	269	68	11

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	488	0	570	229
Stage 1	-	-	-	-	229	-
Stage 2	-	-	-	-	341	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1070	-	481	808
Stage 1	-	-	-	-	807	-
Stage 2	-	-	-	-	718	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1070	-	465	808
Mov Cap-2 Maneuver	-	-	-	-	542	-
Stage 1	-	-	-	-	780	-
Stage 2	-	-	-	-	718	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	12.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	568	-	-	1070	-
HCM Lane V/C Ratio	0.139	-	-	0.034	-
HCM Control Delay (s)	12.4	-	-	8.5	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	15.6
Intersection LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰↑	↰	↱
Traffic Vol, veh/h	250	41	27	263	151	363
Future Vol, veh/h	250	41	27	263	151	363
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	275	45	30	289	166	399
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	17.1	12.5	16.4
HCM LOS	C	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	24%	0%
Vol Thru, %	0%	0%	86%	76%	100%
Vol Right, %	0%	100%	14%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	151	363	291	115	175
LT Vol	151	0	0	27	0
Through Vol	0	0	250	88	175
RT Vol	0	363	41	0	0
Lane Flow Rate	166	399	320	126	193
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.32	0.633	0.559	0.238	0.357
Departure Headway (Hd)	6.934	5.717	6.288	6.791	6.671
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	518	630	572	527	538
Service Time	4.688	3.47	4.341	4.553	4.433
HCM Lane V/C Ratio	0.32	0.633	0.559	0.239	0.359
HCM Control Delay	12.9	17.9	17.1	11.7	13.1
HCM Lane LOS	B	C	C	B	B
HCM 95th-tile Q	1.4	4.5	3.4	0.9	1.6

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	237	83	12	157	0	0	0	0	129	194	86
Future Vol, veh/h	0	237	83	12	157	0	0	0	0	129	194	86
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	293	102	15	194	0	0	0	0	159	240	106

Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0	0	344	395	0
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	344	395	-
Critical Hdwy	-	-	-	6.43	6.53	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	5.43	5.53	-
Follow-up Hdwy	-	-	-	3.527	4.027	-
Pot Cap-1 Maneuver	0	-	-	650	540	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	716	603	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	650	0	-
Mov Cap-2 Maneuver	-	-	-	650	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	716	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	650	-
HCM Lane V/C Ratio	-	-	0.429	-
HCM Control Delay (s)	-	-	14.6	-
HCM Lane LOS	-	-	B	-
HCM 95th %tile Q(veh)	-	-	2.2	-

Intersection	
Intersection Delay, s/veh	15.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	139	227	0	0	130	216	39	274	2	0	0	0
Future Vol, veh/h	139	227	0	0	130	216	39	274	2	0	0	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	158	258	0	0	148	245	44	311	2	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	13.5	19.1	13.1
HCM LOS	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	22%	0%	100%	0%	0%
Vol Thru, %	78%	99%	0%	100%	38%
Vol Right, %	0%	1%	0%	0%	62%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	176	139	139	227	346
LT Vol	39	0	139	0	0
Through Vol	137	137	0	227	130
RT Vol	0	2	0	0	216
Lane Flow Rate	200	158	158	258	393
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.381	0.295	0.297	0.449	0.645
Departure Headway (Hd)	6.855	6.732	6.779	6.27	5.902
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	524	534	529	573	609
Service Time	4.605	4.482	4.533	4.024	3.949
HCM Lane V/C Ratio	0.382	0.296	0.299	0.45	0.645
HCM Control Delay	13.8	12.3	12.4	14.1	19.1
HCM Lane LOS	B	B	B	B	C
HCM 95th-tile Q	1.8	1.2	1.2	2.3	4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	24	9	244	22	459	10	238	196	496	235	2
Future Volume (vph)	7	24	9	244	22	459	10	238	196	496	235	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frpb, ped/bikes		1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1789		1681	1699	1558	1770	1863	1553	3433	1860	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1789		1681	1699	1558	1770	1863	1553	3433	1860	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	8	26	10	268	24	504	11	262	215	545	258	2
RTOR Reduction (vph)	0	8	0	0	0	155	0	0	133	0	0	0
Lane Group Flow (vph)	0	36	0	145	147	349	11	262	82	545	260	0
Confl. Peds. (#/hr)						1			4			4
Confl. Bikes (#/hr)									2			
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		6.9		55.1	55.1	79.6	21.0	21.0	21.0	24.5	24.5	
Effective Green, g (s)		6.9		55.1	55.1	79.6	21.0	21.0	21.0	24.5	24.5	
Actuated g/C Ratio		0.06		0.44	0.44	0.64	0.17	0.17	0.17	0.20	0.20	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		3.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		99		746	754	1000	299	315	263	678	367	
v/s Ratio Prot		c0.02		0.09	0.09	c0.07	0.01	c0.14		c0.16	0.14	
v/s Ratio Perm						0.16			0.05			
v/c Ratio		0.36		0.19	0.19	0.35	0.04	0.83	0.31	0.80	0.71	
Uniform Delay, d1		56.4		21.0	21.0	10.2	43.0	49.8	45.2	47.5	46.4	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.2		0.6	0.6	0.1	0.0	16.2	0.2	6.5	5.0	
Delay (s)		58.6		21.5	21.5	10.3	43.1	65.9	45.4	53.9	51.5	
Level of Service		E		C	C	B	D	E	D	D	D	
Approach Delay (s)		58.6			14.4			56.4			53.1	
Approach LOS		E			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	39.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	674	42	165	537	0	31	0	218	326	38	157
Future Volume (vph)	0	674	42	165	537	0	31	0	218	326	38	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3500		1770	3539		1770		1583	3433	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3500		1770	3539		1770		1583	3433	1863	1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	793	49	194	632	0	36	0	256	384	45	185
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	45	0	0	160
Lane Group Flow (vph)	0	840	0	194	632	0	36	0	211	384	45	25
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)						1						
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		76.9		19.1	100.6		6.7		25.8	19.5	19.5	19.5
Effective Green, g (s)		76.9		19.1	100.6		6.7		25.8	19.5	19.5	19.5
Actuated g/C Ratio		0.54		0.13	0.71		0.05		0.18	0.14	0.14	0.14
Clearance Time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		1894		237	2505		83		287	471	255	217
v/s Ratio Prot		c0.24		c0.11	0.18		0.02		c0.10	c0.11	0.02	
v/s Ratio Perm									0.03			0.02
v/c Ratio		0.44		0.82	0.25		0.43		0.74	0.82	0.18	0.12
Uniform Delay, d1		19.7		59.8	7.4		65.9		54.9	59.6	54.2	53.8
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.8		18.4	0.2		1.3		8.1	9.9	0.1	0.1
Delay (s)		20.4		78.2	7.6		67.2		63.1	69.5	54.3	53.8
Level of Service		C		E	A		E		E	E	D	D
Approach Delay (s)		20.4			24.2			63.6			63.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	142.1	Sum of lost time (s)	19.9
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	705	138	0	877	397	257	0	394	0	0	0
Future Volume (vph)	0	705	138	0	877	397	257	0	394	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frpb, ped/bikes		1.00	0.97		1.00	0.99	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1537		3539	1560	1770		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1537		3539	1560	1770		1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	766	150	0	953	432	279	0	428	0	0	0
RTOR Reduction (vph)	0	0	51	0	0	0	0	0	136	0	0	0
Lane Group Flow (vph)	0	766	99	0	953	432	279	0	292	0	0	0
Confl. Peds. (#/hr)			5									
Confl. Bikes (#/hr)						1						
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		58.4	58.4		58.4	80.5	21.6		21.6			
Effective Green, g (s)		58.4	58.4		58.4	80.5	21.6		21.6			
Actuated g/C Ratio		0.66	0.66		0.66	0.91	0.24		0.24			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2332	1013		2332	1479	431		385			
v/s Ratio Prot		0.22			c0.27	0.07	0.16		c0.18			
v/s Ratio Perm			0.06			0.20						
v/c Ratio		0.33	0.10		0.41	0.29	0.65		0.76			
Uniform Delay, d1		6.6	5.5		7.0	0.5	30.1		31.1			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.4	0.2		0.1	0.1	3.3		8.3			
Delay (s)		6.9	5.7		7.2	0.6	33.4		39.4			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		6.7			5.1			37.0			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	222	530	347	107	575	26	400	77	129	72	54	299
Future Volume (vph)	222	530	347	107	575	26	400	77	129	72	54	299
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1522	1770	3514		3433	1661		1770	1863	1578
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1522	1770	3514		3433	1661		1770	1863	1578
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	252	602	394	122	653	30	455	88	147	82	61	340
RTOR Reduction (vph)	0	0	192	0	2	0	0	49	0	0	0	61
Lane Group Flow (vph)	252	602	202	122	681	0	455	186	0	82	61	279
Confl. Peds. (#/hr)			8			1			10			
Confl. Bikes (#/hr)												2
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	21.5	69.5	69.5	22.3	70.3		23.3	20.5		10.2	7.4	28.9
Effective Green, g (s)	21.5	69.5	69.5	22.3	70.3		23.3	20.5		10.2	7.4	28.9
Actuated g/C Ratio	0.16	0.51	0.51	0.16	0.51		0.17	0.15		0.07	0.05	0.21
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	536	1787	768	286	1795		581	247		131	100	331
v/s Ratio Prot	0.07	0.17		c0.07	c0.19		c0.13	0.11		0.05	0.03	c0.13
v/s Ratio Perm			0.13									0.05
v/c Ratio	0.47	0.34	0.26	0.43	0.38		0.78	0.76		0.63	0.61	0.84
Uniform Delay, d1	52.9	20.3	19.4	51.9	20.4		54.7	56.1		61.8	63.7	52.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.5	0.8	0.4	0.6		6.3	11.0		6.6	7.0	16.8
Delay (s)	53.1	20.8	20.3	52.3	21.0		61.0	67.2		68.4	70.7	69.0
Level of Service	D	C	C	D	C		E	E		E	E	E
Approach Delay (s)		27.2			25.8			63.1			69.1	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	411	125	142	337	137	57	220	160	89	256	196
Future Volume (veh/h)	173	411	125	142	337	137	57	220	160	89	256	196
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	201	478	145	165	392	159	66	256	186	103	298	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	251	592	502	209	547	463	120	381	323	148	410	349
Arrive On Green	0.14	0.32	0.32	0.12	0.29	0.29	0.07	0.20	0.20	0.08	0.22	0.00
Sat Flow, veh/h	1774	1863	1581	1774	1863	1575	1774	1863	1579	1774	1863	1583
Grp Volume(v), veh/h	201	478	145	165	392	159	66	256	186	103	298	0
Grp Sat Flow(s),veh/h/ln	1774	1863	1581	1774	1863	1575	1774	1863	1579	1774	1863	1583
Q Serve(g_s), s	6.4	13.8	4.0	5.3	11.0	4.6	2.1	7.4	6.2	3.3	8.7	0.0
Cycle Q Clear(g_c), s	6.4	13.8	4.0	5.3	11.0	4.6	2.1	7.4	6.2	3.3	8.7	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	251	592	502	209	547	463	120	381	323	148	410	349
V/C Ratio(X)	0.80	0.81	0.29	0.79	0.72	0.34	0.55	0.67	0.58	0.70	0.73	0.00
Avail Cap(c_a), veh/h	379	841	714	288	873	738	197	968	821	197	1000	850
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	24.3	18.3	15.0	25.1	18.5	16.2	26.4	21.5	21.0	26.1	21.2	0.0
Incr Delay (d2), s/veh	7.0	3.9	0.3	9.8	1.8	0.4	3.9	2.1	1.6	6.7	2.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	7.7	1.8	3.1	5.9	2.0	1.2	4.0	2.8	1.9	4.8	0.0
LnGrp Delay(d),s/veh	31.3	22.3	15.3	34.9	20.2	16.7	30.3	23.5	22.6	32.8	23.6	0.0
LnGrp LOS	C	C	B	C	C	B	C	C	C	C	C	
Approach Vol, veh/h		824			716			508			401	
Approach Delay, s/veh		23.2			22.8			24.1			26.0	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.4	16.5	10.4	23.2	7.4	17.5	11.8	21.8
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	5.3	9.4	7.3	15.8	4.1	10.7	8.4	13.0
Green Ext Time (p_c), s	0.0	2.1	0.1	2.6	0.0	1.7	0.2	2.6

Intersection Summary	
HCM 2010 Ctrl Delay	23.7
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	619	40	96	544	72	203
Future Volume (Veh/h)	619	40	96	544	72	203
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	703	45	109	618	82	231
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			908		
pX, platoon unblocked			0.76		0.85	0.76
vC, conflicting volume			748		1566	726
vC1, stage 1 conf vol					726	
vC2, stage 2 conf vol					841	
vCu, unblocked vol			511		1086	481
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			86		74	48
cM capacity (veh/h)			802		310	445

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	748	109	618	82	231
Volume Left	0	109	0	82	0
Volume Right	45	0	0	0	231
cSH	1700	802	1700	310	445
Volume to Capacity	0.44	0.14	0.36	0.26	0.52
Queue Length 95th (ft)	0	12	0	26	73
Control Delay (s)	0.0	10.2	0.0	20.7	21.5
Lane LOS		B		C	C
Approach Delay (s)	0.0	1.5		21.3	
Approach LOS				C	

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	509	402	210	521	0	0	0	0	143	53	139
Future Volume (vph)	0	509	402	210	521	0	0	0	0	143	53	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3539	1583	1770	3539						1797	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3539	1583	1770	3539						1797	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	572	452	236	585	0	0	0	0	161	60	156
RTOR Reduction (vph)	0	0	266	0	0	0	0	0	0	0	0	124
Lane Group Flow (vph)	0	572	186	236	585	0	0	0	0	0	221	32
Confl. Peds. (#/hr)						5						
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		40.1	40.1	20.6	43.0						20.2	20.2
Effective Green, g (s)		40.1	40.1	20.6	36.6						20.2	20.2
Actuated g/C Ratio		0.41	0.41	0.21	0.37						0.21	0.21
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1452	649	373	1325						371	327
v/s Ratio Prot		c0.16		c0.13	0.17						c0.12	
v/s Ratio Perm			0.12									0.02
v/c Ratio		0.39	0.29	0.63	0.44						0.60	0.10
Uniform Delay, d1		20.3	19.2	35.1	22.9						35.1	31.4
Progression Factor		1.00	1.00	0.62	0.50						1.00	1.00
Incremental Delay, d2		0.1	0.1	7.8	0.1						1.7	0.0
Delay (s)		20.3	19.3	29.5	11.4						36.8	31.4
Level of Service		C	B	C	B						D	C
Approach Delay (s)		19.9			16.6			0.0			34.6	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	21.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	97.7	Sum of lost time (s)	24.6
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	226	425	0	0	453	114	277	0	173	0	0	0
Future Volume (vph)	226	425	0	0	453	114	277	0	173	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00	1.00			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.97		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1770	1863			4900		1681	1681	1583			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1770	1863			4900		1681	1681	1583			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	238	447	0	0	477	120	292	0	182	0	0	0
RTOR Reduction (vph)	0	0	0	0	32	0	0	0	153	0	0	0
Lane Group Flow (vph)	238	447	0	0	565	0	146	146	29	0	0	0
Confl. Peds. (#/hr)						5						
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	16.8	43.9			47.7		15.5	15.5	15.5			
Effective Green, g (s)	16.8	37.5			47.7		15.5	15.5	15.5			
Actuated g/C Ratio	0.17	0.38			0.49		0.16	0.16	0.16			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	304	715			2392		266	266	251			
v/s Ratio Prot	c0.13	c0.24			c0.12		c0.09	0.09				
v/s Ratio Perm									0.02			
v/c Ratio	0.78	0.63			0.24		0.55	0.55	0.12			
Uniform Delay, d1	38.7	24.4			14.5		37.9	37.9	35.2			
Progression Factor	0.63	0.83			1.00		1.00	1.00	1.00			
Incremental Delay, d2	11.1	1.2			0.0		1.2	1.2	0.1			
Delay (s)	35.5	21.4			14.5		39.1	39.1	35.3			
Level of Service	D	C			B		D	D	D			
Approach Delay (s)		26.3			14.5			37.7			0.0	
Approach LOS		C			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	97.7	Sum of lost time (s)	24.6
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	315	262	26	277	11	271	2	26	12	2	21
Future Volume (vph)	20	315	262	26	277	11	271	2	26	12	2	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)	1770	1863	1583	1770	1851		1681	1686	1583		1684	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)	1770	1863	1583	1770	1851		1681	1686	1583		1684	
Peak-hour factor, PHF	0.96	0.96	0.92	0.92	0.96	0.96	0.92	0.92	0.92	0.96	0.92	0.96
Adj. Flow (vph)	21	328	285	28	289	11	295	2	28	12	2	22
RTOR Reduction (vph)	0	0	186	0	1	0	0	0	21	0	21	0
Lane Group Flow (vph)	21	328	99	28	299	0	147	150	7	0	16	0
Confl. Peds. (#/hr)						3						
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.8	18.0	18.0	1.9	19.1		13.4	13.4	13.4		1.8	
Effective Green, g (s)	0.8	18.0	18.0	1.9	19.1		13.4	13.4	13.4		1.8	
Actuated g/C Ratio	0.02	0.35	0.35	0.04	0.37		0.26	0.26	0.26		0.03	
Clearance Time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0		2.0	
Lane Grp Cap (vph)	27	646	549	64	681		434	435	408		58	
v/s Ratio Prot	0.01	c0.18		c0.02	0.16		0.09	c0.09			c0.01	
v/s Ratio Perm			0.06						0.00			
v/c Ratio	0.78	0.51	0.18	0.44	0.44		0.34	0.34	0.02		0.27	
Uniform Delay, d1	25.5	13.4	11.8	24.5	12.4		15.6	15.7	14.3		24.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	76.6	0.6	0.2	1.7	0.5		0.5	0.5	0.0		0.9	
Delay (s)	102.1	14.1	12.0	26.2	12.8		16.1	16.2	14.4		25.3	
Level of Service	F	B	B	C	B		B	B	B		C	
Approach Delay (s)		16.0			14.0			16.0			25.3	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	51.9	Sum of lost time (s)	16.8
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Intersection Delay, s/veh	13.6
Intersection LOS	B

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	190	125	116	186	177	176
Future Vol, veh/h	190	125	116	186	177	176
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	196	129	120	192	182	181
Number of Lanes	1	0	0	1	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	14	13.4	13.4
HCM LOS	B	B	B

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	38%	60%	0%
Vol Thru, %	62%	0%	50%
Vol Right, %	0%	40%	50%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	302	315	353
LT Vol	116	190	0
Through Vol	186	0	177
RT Vol	0	125	176
Lane Flow Rate	311	325	364
Geometry Grp	1	1	1
Degree of Util (X)	0.475	0.499	0.513
Departure Headway (Hd)	5.492	5.536	5.073
Convergence, Y/N	Yes	Yes	Yes
Cap	654	649	710
Service Time	3.533	3.578	3.112
HCM Lane V/C Ratio	0.476	0.501	0.513
HCM Control Delay	13.4	14	13.4
HCM Lane LOS	B	B	B
HCM 95th-tile Q	2.6	2.8	3

Intersection	
Intersection Delay, s/veh	11.4
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	174	146	107	91	103	225
Future Vol, veh/h	174	146	107	91	103	225
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	181	152	111	95	107	234
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	13.1	10.1	10.6
HCM LOS	B	B	B

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	54%	0%	100%	0%
Vol Thru, %	46%	54%	0%	0%
Vol Right, %	0%	46%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	320	198	103	225
LT Vol	174	0	103	0
Through Vol	146	107	0	0
RT Vol	0	91	0	225
Lane Flow Rate	333	206	107	234
Geometry Grp	2	2	7	7
Degree of Util (X)	0.486	0.29	0.192	0.34
Departure Headway (Hd)	5.249	5.062	6.44	5.225
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	690	714	558	689
Service Time	3.256	3.071	4.167	2.952
HCM Lane V/C Ratio	0.483	0.289	0.192	0.34
HCM Control Delay	13.1	10.1	10.7	10.6
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.7	1.2	0.7	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	201	18	0	35	198	438	42	98	442	17
Future Volume (Veh/h)	0	0	201	18	0	35	198	438	42	98	442	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	223	20	0	39	220	487	47	109	491	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1636	1683	491	1882	1678	510	510			534		
vC1, stage 1 conf vol	709	709		950	950							
vC2, stage 2 conf vol	927	974		932	728							
vCu, unblocked vol	1636	1683	491	1882	1678	510	510			534		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	61	22	100	93	79			89		
cM capacity (veh/h)	122	144	578	26	147	563	1055			1034		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	223	59	220	534	109	491	19
Volume Left	0	20	220	0	109	0	0
Volume Right	223	39	0	47	0	0	19
cSH	578	72	1055	1700	1034	1700	1700
Volume to Capacity	0.39	0.82	0.21	0.31	0.11	0.29	0.01
Queue Length 95th (ft)	45	99	20	0	9	0	0
Control Delay (s)	15.1	157.6	9.3	0.0	8.9	0.0	0.0
Lane LOS	C	F	A		A		
Approach Delay (s)	15.1	157.6	2.7		1.6		
Approach LOS	C	F					

Intersection Summary			
Average Delay	9.5		
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	82	337	459	46	60	125
Future Vol, veh/h	82	337	459	46	60	125
Conflicting Peds, #/hr	0	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	91	374	510	51	67	139

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	563	0	-	0	1094	538
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	556	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1008	-	-	-	237	543
Stage 1	-	-	-	-	585	-
Stage 2	-	-	-	-	574	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1006	-	-	-	215	542
Mov Cap-2 Maneuver	-	-	-	-	328	-
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	573	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	19.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1006	-	-	-	447
HCM Lane V/C Ratio	0.091	-	-	-	0.46
HCM Control Delay (s)	8.9	-	-	-	19.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	2.4

Intersection	
Int Delay, s/veh	3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	307	89	16	333	172	25
Future Vol, veh/h	307	89	16	333	172	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	337	98	18	366	189	27

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	435	0	739	337
Stage 1	-	-	-	-	337	-
Stage 2	-	-	-	-	402	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1125	-	385	705
Stage 1	-	-	-	-	723	-
Stage 2	-	-	-	-	676	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1125	-	379	705
Mov Cap-2 Maneuver	-	-	-	-	484	-
Stage 1	-	-	-	-	711	-
Stage 2	-	-	-	-	676	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	17.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	504	-	-	1125	-
HCM Lane V/C Ratio	0.43	-	-	0.016	-
HCM Control Delay (s)	17.4	-	-	8.3	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	2.1	-	-	0	-

Intersection	
Intersection Delay, s/veh	35
Intersection LOS	D

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	186	53	66	702	171	222
Future Vol, veh/h	186	53	66	702	171	222
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	221	63	79	836	204	264
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	17.2	50	16.4
HCM LOS	C	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	22%	0%
Vol Thru, %	0%	0%	78%	78%	100%
Vol Right, %	0%	100%	22%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	171	222	239	300	468
LT Vol	171	0	0	66	0
Through Vol	0	0	186	234	468
RT Vol	0	222	53	0	0
Lane Flow Rate	204	264	285	357	557
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.449	0.493	0.532	0.662	1.016
Departure Headway (Hd)	7.945	6.719	6.726	6.675	6.563
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	452	534	535	539	552
Service Time	5.709	4.482	4.782	4.44	4.328
HCM Lane V/C Ratio	0.451	0.494	0.533	0.662	1.009
HCM Control Delay	17.1	15.9	17.2	21.7	68.1
HCM Lane LOS	C	C	C	C	F
HCM 95th-tile Q	2.3	2.7	3.1	4.8	14.9

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	346	183	12	127	0	0	0	0	155	202	150
Future Vol, veh/h	0	346	183	12	127	0	0	0	0	155	202	150
Conflicting Peds, #/hr	0	0	2	0	0	7	0	0	1	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	376	199	13	138	0	0	0	0	168	220	163

Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0	0	476	575	2
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	476	575	-
Critical Hdwy	-	-	-	6.42	6.52	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	5.42	5.52	-
Follow-up Hdwy	-	-	-	3.518	4.018	-
Pot Cap-1 Maneuver	0	-	-	548	429	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	625	503	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	548	0	-
Mov Cap-2 Maneuver	-	-	-	548	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	625	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	548	-
HCM Lane V/C Ratio	-	-	0.508	-
HCM Control Delay (s)	-	-	18.2	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	2.9	-

Intersection	
Intersection Delay, s/veh	14.4
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	160	341	0	0	100	139	39	327	2	0	0	0
Future Vol, veh/h	160	341	0	0	100	139	39	327	2	0	0	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	165	352	0	0	103	143	40	337	2	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	15.8	13.4	13
HCM LOS	C	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	19%	0%	100%	0%	0%
Vol Thru, %	81%	99%	0%	100%	42%
Vol Right, %	0%	1%	0%	0%	58%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	203	166	160	341	239
LT Vol	39	0	160	0	0
Through Vol	164	164	0	341	100
RT Vol	0	2	0	0	139
Lane Flow Rate	209	171	165	352	246
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.388	0.312	0.303	0.595	0.415
Departure Headway (Hd)	6.69	6.584	6.605	6.098	6.064
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	539	546	544	591	594
Service Time	4.436	4.33	4.346	3.839	4.107
HCM Lane V/C Ratio	0.388	0.313	0.303	0.596	0.414
HCM Control Delay	13.6	12.3	12.2	17.5	13.4
HCM Lane LOS	B	B	B	C	B
HCM 95th-tile Q	1.8	1.3	1.3	3.9	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	25	20	250	20	370	10	155	100	320	160	10
Future Volume (vph)	10	25	20	250	20	370	10	155	100	320	160	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1737		1665	1681	1568	1752	1845	1568	3400	1829	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1737		1665	1681	1568	1752	1845	1568	3400	1829	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	28	23	284	23	420	11	176	114	364	182	11
RTOR Reduction (vph)	0	18	0	0	0	131	0	0	100	0	2	0
Lane Group Flow (vph)	0	44	0	153	154	289	11	176	14	364	191	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		6.2		66.2	66.2	83.7	15.1	15.1	15.1	17.5	17.5	
Effective Green, g (s)		6.2		66.2	66.2	83.7	15.1	15.1	15.1	17.5	17.5	
Actuated g/C Ratio		0.05		0.54	0.54	0.69	0.12	0.12	0.12	0.14	0.14	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		88		907	915	1080	217	229	194	489	263	
v/s Ratio Prot		c0.03		0.09	0.09	c0.04	0.01	c0.10		c0.11	0.10	
v/s Ratio Perm						0.15			0.01			
v/c Ratio		0.50		0.17	0.17	0.27	0.05	0.77	0.07	0.74	0.73	
Uniform Delay, d1		56.1		13.9	13.9	7.2	46.9	51.5	47.0	49.9	49.7	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.6		0.4	0.4	0.0	0.0	13.0	0.1	5.3	8.2	
Delay (s)		57.8		14.3	14.3	7.3	46.9	64.5	47.1	55.2	57.9	
Level of Service		E		B	B	A	D	E	D	E	E	
Approach Delay (s)		57.8			10.2			57.3			56.1	
Approach LOS		E			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	121.5	Sum of lost time (s)	16.5
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	405	40	100	460	0	30	0	135	270	45	150
Future Volume (vph)	0	405	40	100	460	0	30	0	135	270	45	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3458		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3458		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	426	42	105	484	0	32	0	142	284	47	158
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	125	0	0	141
Lane Group Flow (vph)	0	466	0	105	484	0	32	0	17	284	47	17
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		97.0		12.3	112.8		5.0		17.3	15.7	15.7	15.7
Effective Green, g (s)		97.0		12.3	112.8		5.0		17.3	15.7	15.7	15.7
Actuated g/C Ratio		0.66		0.08	0.77		0.03		0.12	0.11	0.11	0.11
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		2286		146	2695		59		184	363	197	167
v/s Ratio Prot		c0.13		c0.06	0.14		c0.02		0.01	c0.08	0.03	
v/s Ratio Perm									0.00			0.01
v/c Ratio		0.20		0.72	0.18		0.54		0.09	0.78	0.24	0.10
Uniform Delay, d1		9.7		65.5	4.5		69.7		57.7	63.8	60.0	59.1
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2		13.2	0.1		5.4		0.1	9.7	0.2	0.1
Delay (s)		9.9		78.7	4.7		75.1		57.8	73.6	60.3	59.2
Level of Service		A		E	A		E		E	E	E	E
Approach Delay (s)		9.9			17.9			61.0			67.7	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	34.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	146.7	Sum of lost time (s)	16.7
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	520	100	0	540	260	265	0	430	0	0	0
Future Volume (vph)	0	520	100	0	540	260	265	0	430	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	591	114	0	614	295	301	0	489	0	0	0
RTOR Reduction (vph)	0	0	40	0	0	0	0	0	209	0	0	0
Lane Group Flow (vph)	0	591	74	0	614	295	301	0	280	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		57.9	57.9		57.9	80.5	22.1		22.1			
Effective Green, g (s)		57.9	57.9		57.9	80.5	22.1		22.1			
Actuated g/C Ratio		0.65	0.65		0.65	0.91	0.25		0.25			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2290	1024		2290	1486	437		391			
v/s Ratio Prot		0.17			c0.18	0.05	0.17		c0.18			
v/s Ratio Perm			0.05			0.14						
v/c Ratio		0.26	0.07		0.27	0.20	0.69		0.72			
Uniform Delay, d1		6.4	5.6		6.4	0.5	30.1		30.4			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.3	0.1		0.1	0.1	4.5		6.1			
Delay (s)		6.7	5.7		6.5	0.5	34.6		36.5			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		6.5			4.6			35.8			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	165	460	325	145	465	25	195	40	75	30	40	140
Future Volume (vph)	165	460	325	145	465	25	195	40	75	30	40	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3478		3400	1665		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3478		3400	1665		1752	1845	1568
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	181	505	357	159	511	27	214	44	82	33	44	154
RTOR Reduction (vph)	0	0	148	0	1	0	0	57	0	0	0	134
Lane Group Flow (vph)	181	505	209	159	537	0	214	69	0	33	44	20
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	10.8	80.4	80.4	22.5	92.1		12.8	15.0		4.6	6.8	17.6
Effective Green, g (s)	10.8	80.4	80.4	22.5	92.1		12.8	15.0		4.6	6.8	17.6
Actuated g/C Ratio	0.08	0.58	0.58	0.16	0.67		0.09	0.11		0.03	0.05	0.13
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	266	2047	916	286	2327		316	181		58	91	200
v/s Ratio Prot	c0.05	c0.14		c0.09	0.15		c0.06	0.04		0.02	c0.02	0.01
v/s Ratio Perm			0.13									0.00
v/c Ratio	0.68	0.25	0.23	0.56	0.23		0.68	0.38		0.57	0.48	0.10
Uniform Delay, d1	61.7	13.9	13.7	53.0	8.9		60.4	57.0		65.5	63.7	53.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.6	0.3	0.6	1.3	0.2		4.5	0.5		7.4	1.5	0.1
Delay (s)	67.3	14.2	14.3	54.3	9.1		64.9	57.5		72.9	65.2	53.1
Level of Service	E	B	B	D	A		E	E		E	E	D
Approach Delay (s)		23.4			19.4			62.1			58.2	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	31.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	105	270	70	95	480	160	100	160	100	70	165	185
Future Volume (veh/h)	105	270	70	95	480	160	100	160	100	70	165	185
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	115	297	77	104	527	176	110	176	110	77	181	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	150	680	578	134	664	564	140	317	269	114	290	246
Arrive On Green	0.09	0.37	0.37	0.08	0.36	0.36	0.08	0.17	0.17	0.07	0.16	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	115	297	77	104	527	176	110	176	110	77	181	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	3.3	6.2	1.7	3.0	13.0	4.1	3.1	4.4	3.2	2.2	4.7	0.0
Cycle Q Clear(g_c), s	3.3	6.2	1.7	3.0	13.0	4.1	3.1	4.4	3.2	2.2	4.7	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	150	680	578	134	664	564	140	317	269	114	290	246
V/C Ratio(X)	0.77	0.44	0.13	0.78	0.79	0.31	0.78	0.56	0.41	0.67	0.63	0.00
Avail Cap(c_a), veh/h	431	956	813	328	992	843	224	1101	936	224	1137	967
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	22.8	12.1	10.7	23.1	14.6	11.8	23.0	19.3	18.8	23.3	20.1	0.0
Incr Delay (d2), s/veh	8.0	0.4	0.1	9.2	2.7	0.3	9.1	1.5	1.0	6.7	2.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	3.2	0.7	1.8	7.1	1.8	1.9	2.4	1.5	1.3	2.5	0.0
LnGrp Delay(d),s/veh	30.8	12.5	10.8	32.3	17.3	12.1	32.1	20.8	19.8	30.0	22.3	0.0
LnGrp LOS	C	B	B	C	B	B	C	C	B	C	C	
Approach Vol, veh/h		489			807			396			258	
Approach Delay, s/veh		16.6			18.1			23.7			24.6	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.8	13.4	7.4	23.4	7.6	12.6	7.8	22.9
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	4.2	6.4	5.0	8.2	5.1	6.7	5.3	15.0
Green Ext Time (p_c), s	0.0	1.3	0.1	1.8	0.0	1.0	0.1	3.3

Intersection Summary	
HCM 2010 Ctrl Delay	19.7
HCM 2010 LOS	B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	375	65	205	680	55	100
Future Volume (Veh/h)	375	65	205	680	55	100
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	426	74	233	773	63	114
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351					
pX, platoon unblocked			0.88		0.88	0.88
vC, conflicting volume			500		1702	463
vC1, stage 1 conf vol					463	
vC2, stage 2 conf vol					1239	
vCu, unblocked vol			370		1728	328
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			78		68	82
cM capacity (veh/h)			1047		200	629

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	500	233	773	63	114
Volume Left	0	233	0	63	0
Volume Right	74	0	0	0	114
cSH	1700	1047	1700	200	629
Volume to Capacity	0.29	0.22	0.45	0.32	0.18
Queue Length 95th (ft)	0	21	0	32	16
Control Delay (s)	0.0	9.4	0.0	31.1	12.0
Lane LOS		A		D	B
Approach Delay (s)	0.0	2.2		18.8	
Approach LOS				C	

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	300	130	125	780	0	0	0	0	95	55	210
Future Volume (vph)	0	300	130	125	780	0	0	0	0	95	55	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.9						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1788	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1788	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	341	148	142	886	0	0	0	0	108	62	239
RTOR Reduction (vph)	0	0	124	0	0	0	0	0	0	0	0	132
Lane Group Flow (vph)	0	341	24	142	886	0	0	0	0	0	171	107
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	5 6 8!					4!	4!	
Permitted Phases			2									4
Actuated Green, G (s)		11.2	11.2	9.5	69.6						31.2	31.2
Effective Green, g (s)		11.2	11.2	9.5	57.8						31.2	31.2
Actuated g/C Ratio		0.16	0.16	0.14	0.83						0.45	0.45
Clearance Time (s)		5.4	5.4	5.9							6.4	6.4
Vehicle Extension (s)		0.5	0.5	1.0							0.5	0.5
Lane Grp Cap (vph)		564	252	239	2910						801	702
v/s Ratio Prot		c0.10		c0.08	c0.25						0.10	
v/s Ratio Perm			0.02									0.07
v/c Ratio		0.60	0.09	0.59	0.30						0.21	0.15
Uniform Delay, d1		27.1	24.9	28.2	1.3						11.7	11.4
Progression Factor		1.00	1.00	1.12	1.00						1.00	1.00
Incremental Delay, d2		1.3	0.1	2.5	0.0						0.0	0.0
Delay (s)		28.4	24.9	34.1	1.4						11.8	11.4
Level of Service		C	C	C	A						B	B
Approach Delay (s)		27.4			5.9			0.0			11.6	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	69.6	Sum of lost time (s)	17.7
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
! Phase conflict between lane groups.			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	275	0	0	330	35	575	5	235	0	0	0
Future Volume (vph)	120	275	0	0	330	35	575	5	235	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.9			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.99		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4963		1665	1670	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4963		1665	1670	1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	136	312	0	0	375	40	653	6	267	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	147	0	0	0
Lane Group Flow (vph)	136	313	0	0	400	0	326	333	120	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	1 2 4!			6		8!	8!				
Permitted Phases									8			
Actuated Green, G (s)	10.5	69.6			10.2		31.2	31.2	31.2			
Effective Green, g (s)	10.5	57.8			10.2		31.2	31.2	31.2			
Actuated g/C Ratio	0.15	0.83			0.15		0.45	0.45	0.45			
Clearance Time (s)	5.9				5.4		6.4	6.4	6.4			
Vehicle Extension (s)	1.0				0.5		0.5	0.5	0.5			
Lane Grp Cap (vph)	264	1532			727		746	748	702			
v/s Ratio Prot	c0.08	c0.17			c0.08		0.20	c0.20				
v/s Ratio Perm									0.08			
v/c Ratio	0.52	0.20			0.55		0.44	0.45	0.17			
Uniform Delay, d1	27.2	1.2			27.6		13.2	13.2	11.5			
Progression Factor	1.56	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	0.7	0.0			0.5		1.9	1.9	0.5			
Delay (s)	43.1	1.2			28.0		15.0	15.2	12.0			
Level of Service	D	A			C		B	B	B			
Approach Delay (s)		13.9			28.0			14.2			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	69.6	Sum of lost time (s)	17.7
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	500	350	5	5	15
Future Volume (Veh/h)	10	500	350	5	5	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	11	568	398	6	6	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		539				
pX, platoon unblocked					0.92	
vC, conflicting volume	404				991	401
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	404				945	401
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	97
cM capacity (veh/h)	1149				263	647

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	11	568	404	23
Volume Left	11	0	0	6
Volume Right	0	0	6	17
cSH	1149	1700	1700	468
Volume to Capacity	0.01	0.33	0.24	0.05
Queue Length 95th (ft)	1	0	0	4
Control Delay (s)	8.2	0.0	0.0	13.1
Lane LOS	A			B
Approach Delay (s)	0.2		0.0	13.1
Approach LOS				B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	45.1
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	105	305	85	15	100	100	120	100	5	60	130	95
Future Vol, veh/h	105	305	85	15	100	100	120	100	5	60	130	95
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	119	347	97	17	114	114	136	114	6	68	148	108
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	80.5	17.8	20.4	23.8
HCM LOS	F	C	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	53%	21%	7%	21%
Vol Thru, %	44%	62%	47%	46%
Vol Right, %	2%	17%	47%	33%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	225	495	215	285
LT Vol	120	105	15	60
Through Vol	100	305	100	130
RT Vol	5	85	100	95
Lane Flow Rate	256	562	244	324
Geometry Grp	1	1	1	1
Degree of Util (X)	0.548	1.055	0.495	0.654
Departure Headway (Hd)	8.041	6.754	7.581	7.568
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	453	534	479	479
Service Time	6.041	4.84	5.581	5.568
HCM Lane V/C Ratio	0.565	1.052	0.509	0.676
HCM Control Delay	20.4	80.5	17.8	23.8
HCM Lane LOS	C	F	C	C
HCM 95th-tile Q	3.2	16.4	2.7	4.6

Intersection	
Intersection Delay, s/veh	10.2
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	130	110	155	90	75	155
Future Vol, veh/h	130	110	155	90	75	155
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	140	118	167	97	81	167
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	10.9	10.2	9.6
HCM LOS	B	B	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	54%	0%	100%	0%
Vol Thru, %	46%	63%	0%	0%
Vol Right, %	0%	37%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	240	245	75	155
LT Vol	130	0	75	0
Through Vol	110	155	0	0
RT Vol	0	90	0	155
Lane Flow Rate	258	263	81	167
Geometry Grp	2	2	7	7
Degree of Util (X)	0.358	0.343	0.14	0.234
Departure Headway (Hd)	4.999	4.685	6.267	5.055
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	715	761	569	703
Service Time	3.064	2.747	4.049	2.836
HCM Lane V/C Ratio	0.361	0.346	0.142	0.238
HCM Control Delay	10.9	10.2	10.1	9.4
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	1.6	1.5	0.5	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	20	135	90	90	110	220	395	25	30	375	40
Future Volume (Veh/h)	5	20	135	90	90	110	220	395	25	30	375	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	5	21	144	96	96	117	234	420	27	32	399	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6			1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1399	1378	399	1447	1408	434	442			447		
vC1, stage 1 conf vol	463	463		902	902							
vC2, stage 2 conf vol	936	915		546	506							
vCu, unblocked vol	1399	1378	399	1447	1408	434	442			447		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	91	78	28	56	81	79			97		
cM capacity (veh/h)	99	230	649	133	220	620	1113			1108		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	170	309	234	447	32	399	43
Volume Left	5	96	234	0	32	0	0
Volume Right	144	117	0	27	0	0	43
cSH	766	235	1113	1700	1108	1700	1700
Volume to Capacity	0.22	1.31	0.21	0.26	0.03	0.23	0.03
Queue Length 95th (ft)	21	408	20	0	2	0	0
Control Delay (s)	14.1	209.8	9.1	0.0	8.3	0.0	0.0
Lane LOS	B	F	A		A		
Approach Delay (s)	14.1	209.8	3.1		0.6		
Approach LOS	B	F					

Intersection Summary			
Average Delay	42.6		
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection						
Int Delay, s/veh	1.1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	70	575	315	40	15	30
Future Vol, veh/h	70	575	315	40	15	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	77	632	346	44	16	33

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	390	0	-	0	1154	368
Stage 1	-	-	-	-	368	-
Stage 2	-	-	-	-	786	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1163	-	-	-	217	675
Stage 1	-	-	-	-	698	-
Stage 2	-	-	-	-	447	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1163	-	-	-	203	675
Mov Cap-2 Maneuver	-	-	-	-	296	-
Stage 1	-	-	-	-	652	-
Stage 2	-	-	-	-	447	-

Approach	EB	WB	SB
HCM Control Delay, s	0.9	0	13.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1163	-	-	-	473
HCM Lane V/C Ratio	0.066	-	-	-	0.105
HCM Control Delay (s)	8.3	-	-	-	13.5
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.3

Intersection	
Int Delay, s/veh	1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	235	355	40	270	85	15
Future Vol, veh/h	235	355	40	270	85	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	258	390	44	297	93	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	648	0	643	258
Stage 1	-	-	-	-	258	-
Stage 2	-	-	-	-	385	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	933	-	436	778
Stage 1	-	-	-	-	783	-
Stage 2	-	-	-	-	686	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	933	-	416	778
Mov Cap-2 Maneuver	-	-	-	-	502	-
Stage 1	-	-	-	-	746	-
Stage 2	-	-	-	-	686	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	13.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	530	-	-	933	-
HCM Lane V/C Ratio	0.207	-	-	0.047	-
HCM Control Delay (s)	13.6	-	-	9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	22.6
Intersection LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	300	35	45	310	165	440
Future Vol, veh/h	300	35	45	310	165	440
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	330	38	49	341	181	484
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	23.6	14.9	26.5
HCM LOS	C	B	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	30%	0%
Vol Thru, %	0%	0%	90%	70%	100%
Vol Right, %	0%	100%	10%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	165	440	335	148	207
LT Vol	165	0	0	45	0
Through Vol	0	0	300	103	207
RT Vol	0	440	35	0	0
Lane Flow Rate	181	484	368	163	227
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.369	0.82	0.689	0.33	0.451
Departure Headway (Hd)	7.325	6.103	6.736	7.299	7.143
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	490	590	534	489	502
Service Time	5.102	3.88	4.815	5.093	4.938
HCM Lane V/C Ratio	0.369	0.82	0.689	0.333	0.452
HCM Control Delay	14.4	31	23.6	13.7	15.7
HCM Lane LOS	B	D	C	B	C
HCM 95th-tile Q	1.7	8.3	5.3	1.4	2.3

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	265	90	20	210	0	0	0	0	150	210	125
Future Vol, veh/h	0	265	90	20	210	0	0	0	0	150	210	125
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	301	102	23	239	0	0	0	0	170	239	142

Major/Minor	Major1									Minor2		
Conflicting Flow All	-	0	0							352	403	0
Stage 1	-	-	-							0	0	-
Stage 2	-	-	-							352	403	-
Critical Hdwy	-	-	-							6.43	6.53	-
Critical Hdwy Stg 1	-	-	-							-	-	-
Critical Hdwy Stg 2	-	-	-							5.43	5.53	-
Follow-up Hdwy	-	-	-							3.527	4.027	-
Pot Cap-1 Maneuver	0	-	-							644	535	-
Stage 1	0	-	-							-	-	-
Stage 2	0	-	-							710	598	-
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-							644	0	-
Mov Cap-2 Maneuver	-	-	-							644	0	-
Stage 1	-	-	-							-	0	-
Stage 2	-	-	-							710	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	644	-
HCM Lane V/C Ratio	-	-	0.45	-
HCM Control Delay (s)	-	-	15.1	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	2.3	-

Intersection	
Intersection Delay, s/veh	23.6
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	160	255	0	0	175	265	55	305	10	0	0	0
Future Vol, veh/h	160	255	0	0	175	265	55	305	10	0	0	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	182	290	0	0	199	301	63	347	11	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	16.1	37.5	15.6
HCM LOS	C	E	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	27%	0%	100%	0%	0%
Vol Thru, %	73%	94%	0%	100%	40%
Vol Right, %	0%	6%	0%	0%	60%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	208	163	160	255	440
LT Vol	55	0	160	0	0
Through Vol	153	153	0	255	175
RT Vol	0	10	0	0	265
Lane Flow Rate	236	185	182	290	500
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.48	0.367	0.366	0.543	0.868
Departure Headway (Hd)	7.334	7.154	7.252	6.741	6.247
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	490	500	493	533	580
Service Time	5.111	4.931	5.035	4.523	4.314
HCM Lane V/C Ratio	0.482	0.37	0.369	0.544	0.862
HCM Control Delay	16.8	14.1	14.2	17.3	37.5
HCM Lane LOS	C	B	B	C	E
HCM 95th-tile Q	2.6	1.7	1.7	3.2	9.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	30	15	290	30	495	15	250	230	515	240	10
Future Volume (vph)	15	30	15	290	30	495	15	250	230	515	240	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frpb, ped/bikes		1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1779		1681	1700	1559	1770	1863	1553	3433	1849	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1779		1681	1700	1559	1770	1863	1553	3433	1849	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	33	16	319	33	544	16	275	253	566	264	11
RTOR Reduction (vph)	0	9	0	0	0	156	0	0	147	0	2	0
Lane Group Flow (vph)	0	56	0	175	177	388	16	275	106	566	273	0
Confl. Peds. (#/hr)						1			4			4
Confl. Bikes (#/hr)									2			
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		7.9		52.1	52.1	77.8	21.8	21.8	21.8	25.7	25.7	
Effective Green, g (s)		7.9		52.1	52.1	77.8	21.8	21.8	21.8	25.7	25.7	
Actuated g/C Ratio		0.06		0.42	0.42	0.63	0.18	0.18	0.18	0.21	0.21	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		113		706	714	978	311	327	273	711	383	
v/s Ratio Prot		c0.03		0.10	0.10	c0.08	0.01	c0.15		c0.16	0.15	
v/s Ratio Perm						0.17			0.07			
v/c Ratio		0.49		0.25	0.25	0.40	0.05	0.84	0.39	0.80	0.71	
Uniform Delay, d1		56.1		23.3	23.3	11.5	42.5	49.4	45.2	46.7	45.7	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.2		0.8	0.8	0.1	0.0	16.8	0.3	5.8	5.2	
Delay (s)		57.3		24.1	24.1	11.6	42.5	66.2	45.5	52.4	50.9	
Level of Service		E		C	C	B	D	E	D	D	D	
Approach Delay (s)		57.3			16.5			55.9			51.9	
Approach LOS		E			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	39.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	725	50	170	610	0	40	0	235	335	45	165
Future Volume (vph)	0	725	50	170	610	0	40	0	235	335	45	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3495		1770	3539		1770		1583	3433	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3495		1770	3539		1770		1583	3433	1863	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	824	57	193	693	0	45	0	267	381	51	188
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	43	0	0	162
Lane Group Flow (vph)	0	879	0	193	693	0	45	0	224	381	51	26
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)						1						
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		83.3		19.6	106.4		7.1		26.7	20.0	20.0	20.0
Effective Green, g (s)		83.3		19.6	106.4		7.1		26.7	20.0	20.0	20.0
Actuated g/C Ratio		0.57		0.13	0.73		0.05		0.18	0.14	0.14	0.14
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		1984		236	2566		85		288	468	253	215
v/s Ratio Prot		c0.25		c0.11	0.20		0.03		c0.10	c0.11	0.03	
v/s Ratio Perm									0.04			0.02
v/c Ratio		0.44		0.82	0.27		0.53		0.78	0.81	0.20	0.12
Uniform Delay, d1		18.3		61.8	6.9		68.2		57.2	61.5	56.3	55.6
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.7		18.4	0.3		2.7		11.3	9.9	0.1	0.1
Delay (s)		19.0		80.2	7.1		70.9		68.5	71.5	56.4	55.7
Level of Service		B		F	A		E		E	E	E	E
Approach Delay (s)		19.0			23.1			68.8			65.4	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	146.7	Sum of lost time (s)	16.7
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	745	170	0	950	510	260	0	415	0	0	0
Future Volume (vph)	0	745	170	0	950	510	260	0	415	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frpb, ped/bikes		1.00	0.97		1.00	0.99	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1537		3539	1561	1770		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1537		3539	1561	1770		1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	810	185	0	1033	554	283	0	451	0	0	0
RTOR Reduction (vph)	0	0	67	0	0	0	0	0	119	0	0	0
Lane Group Flow (vph)	0	810	118	0	1033	554	283	0	332	0	0	0
Confl. Peds. (#/hr)			5									
Confl. Bikes (#/hr)						1						
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		56.5	56.5		56.5	80.5	23.5		23.5			
Effective Green, g (s)		56.5	56.5		56.5	80.5	23.5		23.5			
Actuated g/C Ratio		0.64	0.64		0.64	0.91	0.27		0.27			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2256	980		2256	1479	469		419			
v/s Ratio Prot		0.23			c0.29	0.10	0.16		c0.21			
v/s Ratio Perm			0.08			0.25						
v/c Ratio		0.36	0.12		0.46	0.37	0.60		0.79			
Uniform Delay, d1		7.5	6.3		8.2	0.6	28.5		30.3			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.4	0.3		0.1	0.2	2.2		9.9			
Delay (s)		8.0	6.5		8.4	0.7	30.7		40.2			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		7.7			5.7			36.5			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	540	395	175	590	40	570	95	180	80	75	300
Future Volume (vph)	225	540	395	175	590	40	570	95	180	80	75	300
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	0.98		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1522	1770	3503		3433	1651		1770	1863	1575
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1522	1770	3503		3433	1651		1770	1863	1575
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	256	614	449	199	670	45	648	108	205	91	85	341
RTOR Reduction (vph)	0	0	245	0	3	0	0	51	0	0	0	61
Lane Group Flow (vph)	256	614	204	199	712	0	648	262	0	91	85	280
Confl. Peds. (#/hr)			8			1			10			
Confl. Bikes (#/hr)												2
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	18.6	59.5	59.5	23.0	63.9		29.7	29.2		10.8	10.3	28.9
Effective Green, g (s)	18.6	59.5	59.5	23.0	63.9		29.7	29.2		10.8	10.3	28.9
Actuated g/C Ratio	0.14	0.43	0.43	0.17	0.46		0.22	0.21		0.08	0.07	0.21
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	464	1530	658	295	1626		740	350		138	139	330
v/s Ratio Prot	0.07	0.17		c0.11	c0.20		c0.19	0.16		0.05	0.05	c0.11
v/s Ratio Perm			0.13									0.06
v/c Ratio	0.55	0.40	0.31	0.67	0.44		0.88	0.75		0.66	0.61	0.85
Uniform Delay, d1	55.6	26.8	25.6	53.8	24.8		52.2	50.8		61.6	61.7	52.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.8	1.2	4.7	0.9		11.0	7.4		8.4	5.5	17.4
Delay (s)	56.4	27.6	26.8	58.5	25.6		63.1	58.2		70.0	67.2	69.6
Level of Service	E	C	C	E	C		E	E		E	E	E
Approach Delay (s)		32.9			32.8			61.5			69.3	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	45.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (veh/h)	185	480	140	160	385	150	70	235	195	85	275	215
Future Volume (veh/h)	185	480	140	160	385	150	70	235	195	85	275	215
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	210	545	159	182	438	170	80	267	222	97	312	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	256	630	535	224	596	504	124	400	339	134	411	349
Arrive On Green	0.14	0.34	0.34	0.13	0.32	0.32	0.07	0.21	0.21	0.08	0.22	0.00
Sat Flow, veh/h	1774	1863	1581	1774	1863	1576	1774	1863	1580	1774	1863	1583
Grp Volume(v), veh/h	210	545	159	182	438	170	80	267	222	97	312	0
Grp Sat Flow(s),veh/h/ln	1774	1863	1581	1774	1863	1576	1774	1863	1580	1774	1863	1583
Q Serve(g_s), s	7.6	18.1	4.9	6.6	13.8	5.4	2.9	8.7	8.5	3.5	10.4	0.0
Cycle Q Clear(g_c), s	7.6	18.1	4.9	6.6	13.8	5.4	2.9	8.7	8.5	3.5	10.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	256	630	535	224	596	504	124	400	339	134	411	349
V/C Ratio(X)	0.82	0.86	0.30	0.81	0.73	0.34	0.65	0.67	0.65	0.72	0.76	0.00
Avail Cap(c_a), veh/h	336	744	632	255	773	654	175	857	727	175	885	753
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.4	20.4	16.1	28.1	20.0	17.1	29.9	23.8	23.7	29.9	24.1	0.0
Incr Delay (d2), s/veh	11.5	9.2	0.3	16.1	2.6	0.4	5.5	1.9	2.1	9.9	2.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	10.8	2.2	4.2	7.5	2.4	1.6	4.7	3.9	2.1	5.6	0.0
LnGrp Delay(d),s/veh	39.0	29.7	16.4	44.2	22.6	17.5	35.4	25.7	25.8	39.8	27.0	0.0
LnGrp LOS	D	C	B	D	C	B	D	C	C	D	C	
Approach Vol, veh/h		914			790			569			409	
Approach Delay, s/veh		29.5			26.5			27.1			30.1	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.5	18.8	11.8	26.9	8.1	19.2	13.0	25.7
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	5.5	10.7	8.6	20.1	4.9	12.4	9.6	15.8
Green Ext Time (p_c), s	0.0	2.3	0.0	2.1	0.0	1.7	0.2	2.6

Intersection Summary	
HCM 2010 Ctrl Delay	28.2
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	715	45	100	615	80	205
Future Volume (Veh/h)	715	45	100	615	80	205
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	813	51	114	699	91	233
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351					
pX, platoon unblocked			0.72		0.72	0.72
vC, conflicting volume			864		1770	838
vC1, stage 1 conf vol					838	
vC2, stage 2 conf vol					932	
vCu, unblocked vol			612		1878	577
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			84		63	37
cM capacity (veh/h)			693		245	370

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	864	114	699	91	233
Volume Left	0	114	0	91	0
Volume Right	51	0	0	0	233
cSH	1700	693	1700	245	370
Volume to Capacity	0.51	0.16	0.41	0.37	0.63
Queue Length 95th (ft)	0	15	0	41	103
Control Delay (s)	0.0	11.2	0.0	28.1	29.9
Lane LOS		B		D	D
Approach Delay (s)	0.0	1.6		29.4	
Approach LOS				D	

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	580	420	330	590	0	0	0	0	140	75	150
Future Volume (vph)	0	580	420	330	590	0	0	0	0	140	75	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.9						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (prot)		3539	1583	1770	3539						1804	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.97	1.00
Satd. Flow (perm)		3539	1583	1770	3539						1804	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	652	472	371	663	0	0	0	0	157	84	169
RTOR Reduction (vph)	0	0	351	0	0	0	0	0	0	0	0	136
Lane Group Flow (vph)	0	652	121	371	663	0	0	0	0	0	241	33
Confl. Peds. (#/hr)						5						
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2		1	5 6 8!					4!	4!	
Permitted Phases			2									4
Actuated Green, G (s)		16.9	16.9	18.6	66.1						12.9	12.9
Effective Green, g (s)		16.9	16.9	18.6	54.3						12.9	12.9
Actuated g/C Ratio		0.26	0.26	0.28	0.82						0.20	0.20
Clearance Time (s)		5.4	5.4	5.9							6.4	6.4
Vehicle Extension (s)		0.5	0.5	1.0							0.5	0.5
Lane Grp Cap (vph)		904	404	498	2907						352	308
v/s Ratio Prot		c0.18		c0.21	c0.19						c0.13	
v/s Ratio Perm			0.08									0.02
v/c Ratio		0.72	0.30	0.74	0.23						0.68	0.11
Uniform Delay, d1		22.5	19.8	21.6	1.3						24.7	21.9
Progression Factor		1.00	1.00	1.45	1.00						1.00	1.00
Incremental Delay, d2		2.4	0.2	5.1	0.0						4.4	0.1
Delay (s)		24.9	20.0	36.4	1.3						29.1	21.9
Level of Service		C	B	D	A						C	C
Approach Delay (s)		22.8			13.9			0.0			26.1	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	19.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	66.1	Sum of lost time (s)	17.7
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	465	0	0	635	25	285	0	215	0	0	0
Future Volume (vph)	255	465	0	0	635	25	285	0	215	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.9			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.99		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1770	1863			5051		1681	1681	1583			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1770	1863			5051		1681	1681	1583			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	268	489	0	0	668	26	300	0	226	0	0	0
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	182	0	0	0
Lane Group Flow (vph)	268	489	0	0	690	0	150	150	44	0	0	0
Confl. Peds. (#/hr)						5						
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	1 2 4!			6		8!	8!				
Permitted Phases									8			
Actuated Green, G (s)	14.1	66.1			21.4		12.9	12.9	12.9			
Effective Green, g (s)	14.1	54.3			21.4		12.9	12.9	12.9			
Actuated g/C Ratio	0.21	0.82			0.32		0.20	0.20	0.20			
Clearance Time (s)	5.9				5.4		6.4	6.4	6.4			
Vehicle Extension (s)	1.0				0.5		0.5	0.5	0.5			
Lane Grp Cap (vph)	377	1530			1635		328	328	308			
v/s Ratio Prot	c0.15	c0.26			c0.14		c0.09	0.09				
v/s Ratio Perm									0.03			
v/c Ratio	0.71	0.32			0.42		0.46	0.46	0.14			
Uniform Delay, d1	24.1	1.4			17.5		23.5	23.5	22.0			
Progression Factor	1.32	1.00			1.00		1.00	1.00	1.00			
Incremental Delay, d2	4.5	0.0			0.1		0.4	0.4	0.1			
Delay (s)	36.2	1.5			17.6		23.9	23.9	22.1			
Level of Service	D	A			B		C	C	C			
Approach Delay (s)		13.8			17.6			23.1			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	66.1	Sum of lost time (s)	17.7
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	20	660	635	15	15	25
Future Volume (Veh/h)	20	660	635	15	15	25
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	21	688	661	16	16	26
Pedestrians					3	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					3.5	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		539				
pX, platoon unblocked					0.89	
vC, conflicting volume	680				1402	672
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	680				1389	672
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				88	94
cM capacity (veh/h)	910				135	454

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	21	688	677	42
Volume Left	21	0	0	16
Volume Right	0	0	16	26
cSH	910	1700	1700	239
Volume to Capacity	0.02	0.40	0.40	0.18
Queue Length 95th (ft)	2	0	0	16
Control Delay (s)	9.1	0.0	0.0	23.2
Lane LOS	A			C
Approach Delay (s)	0.3		0.0	23.2
Approach LOS				C

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	291.3
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✢			✢			✢			✢	
Traffic Vol, veh/h	190	345	130	5	360	255	120	200	5	160	215	175
Future Vol, veh/h	190	345	130	5	360	255	120	200	5	160	215	175
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	196	356	134	5	371	263	124	206	5	165	222	180
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	390.8	325.8	80.6	256.7
HCM LOS	F	F	F	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	37%	29%	1%	29%
Vol Thru, %	62%	52%	58%	39%
Vol Right, %	2%	20%	41%	32%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	325	665	620	550
LT Vol	120	190	5	160
Through Vol	200	345	360	215
RT Vol	5	130	255	175
Lane Flow Rate	335	686	639	567
Geometry Grp	1	1	1	1
Degree of Util (X)	0.902	1.774	1.621	1.456
Departure Headway (Hd)	16.042	12.64	12.92	13.03
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	228	295	288	284
Service Time	14.042	10.64	10.92	11.03
HCM Lane V/C Ratio	1.469	2.325	2.219	1.996
HCM Control Delay	80.6	390.8	325.8	256.7
HCM Lane LOS	F	F	F	F
HCM 95th-tile Q	7.4	33.3	27.7	22.5

Intersection	
Intersection Delay, s/veh	13
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	185	190	100	100	140	235
Future Vol, veh/h	185	190	100	100	140	235
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	193	198	104	104	146	245
Number of Lanes	0	1	1	0	1	1
Approach	EB		WB		SB	
Opposing Approach	WB		EB			
Opposing Lanes	1		1		0	
Conflicting Approach Left	SB				WB	
Conflicting Lanes Left	2		0		1	
Conflicting Approach Right			SB		EB	
Conflicting Lanes Right	0		2		1	
HCM Control Delay	15.7		10.6		11.5	
HCM LOS	C		B		B	

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	49%	0%	100%	0%
Vol Thru, %	51%	50%	0%	0%
Vol Right, %	0%	50%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	375	200	140	235
LT Vol	185	0	140	0
Through Vol	190	100	0	0
RT Vol	0	100	0	235
Lane Flow Rate	391	208	146	245
Geometry Grp	2	2	7	7
Degree of Util (X)	0.584	0.305	0.269	0.368
Departure Headway (Hd)	5.381	5.27	6.632	5.416
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	672	681	543	663
Service Time	3.41	3.306	4.364	3.148
HCM Lane V/C Ratio	0.582	0.305	0.269	0.37
HCM Control Delay	15.7	10.6	11.8	11.3
HCM Lane LOS	C	B	B	B
HCM 95th-tile Q	3.8	1.3	1.1	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	65	260	25	35	50	230	490	75	125	455	30
Future Volume (Veh/h)	20	65	260	25	35	50	230	490	75	125	455	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	72	289	28	39	56	256	544	83	139	506	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6			1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1860	1923	506	2062	1914	586	539			627		
vC1, stage 1 conf vol	784	784		1098	1098							
vC2, stage 2 conf vol	1076	1139		964	817							
vCu, unblocked vol	1860	1923	506	2062	1914	586	539			627		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	49	0	48	89	75			85		
cM capacity (veh/h)	22	67	566	0	75	511	1029			955		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	383	123	256	627	139	506	33
Volume Left	22	28	256	0	139	0	0
Volume Right	289	56	0	83	0	0	33
cSH	182	8	1029	1700	955	1700	1700
Volume to Capacity	2.10	15.44	0.25	0.37	0.15	0.30	0.02
Queue Length 95th (ft)	747	Err	25	0	13	0	0
Control Delay (s)	555.0	Err	9.7	0.0	9.4	0.0	0.0
Lane LOS	F	F	A		A		
Approach Delay (s)	555.0	Err	2.8		1.9		
Approach LOS	F	F					

Intersection Summary			
Average Delay	699.7		
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection						
Int Delay, s/veh	2.1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	45	460	580	25	35	85
Future Vol, veh/h	45	460	580	25	35	85
Conflicting Peds, #/hr	0	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	511	644	28	39	94

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	674	0	-	0	1271	660
Stage 1	-	-	-	-	660	-
Stage 2	-	-	-	-	611	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	917	-	-	-	185	463
Stage 1	-	-	-	-	514	-
Stage 2	-	-	-	-	542	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	915	-	-	-	174	462
Mov Cap-2 Maneuver	-	-	-	-	302	-
Stage 1	-	-	-	-	485	-
Stage 2	-	-	-	-	541	-

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	18.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	915	-	-	-	400
HCM Lane V/C Ratio	0.055	-	-	-	0.333
HCM Control Delay (s)	9.2	-	-	-	18.4
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	1.4

Intersection	
Int Delay, s/veh	8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	340	155	25	330	275	35
Future Vol, veh/h	340	155	25	330	275	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	374	170	27	363	302	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	544	0	791	374
Stage 1	-	-	-	-	374	-
Stage 2	-	-	-	-	417	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1025	-	358	672
Stage 1	-	-	-	-	696	-
Stage 2	-	-	-	-	665	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1025	-	349	672
Mov Cap-2 Maneuver	-	-	-	-	459	-
Stage 1	-	-	-	-	678	-
Stage 2	-	-	-	-	665	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	29.4
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	476	-	-	1025	-
HCM Lane V/C Ratio	0.716	-	-	0.027	-
HCM Control Delay (s)	29.4	-	-	8.6	-
HCM Lane LOS	D	-	-	A	-
HCM 95th %tile Q(veh)	5.7	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	49.3
Intersection LOS	E

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	260	50	85	785	185	260
Future Vol, veh/h	260	50	85	785	185	260
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	295	57	97	892	210	295
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	22.2	75	18.1
HCM LOS	C	F	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	25%	0%
Vol Thru, %	0%	0%	84%	75%	100%
Vol Right, %	0%	100%	16%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	185	260	310	347	523
LT Vol	185	0	0	85	0
Through Vol	0	0	260	262	523
RT Vol	0	260	50	0	0
Lane Flow Rate	210	295	352	394	595
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.464	0.56	0.656	0.764	1.132
Departure Headway (Hd)	8.24	7.01	6.956	6.98	6.855
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	439	517	521	520	535
Service Time	5.94	4.71	4.956	4.694	4.569
HCM Lane V/C Ratio	0.478	0.571	0.676	0.758	1.112
HCM Control Delay	17.9	18.3	22.2	28.9	105.5
HCM Lane LOS	C	C	C	D	F
HCM 95th-tile Q	2.4	3.4	4.7	6.7	19.9

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	365	205	20	155	0	0	0	0	205	265	185
Future Vol, veh/h	0	365	205	20	155	0	0	0	0	205	265	185
Conflicting Peds, #/hr	0	0	2	0	0	7	0	0	1	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	397	223	22	168	0	0	0	0	223	288	201

Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0	0	508	620	2
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	508	620	-
Critical Hdwy	-	-	-	6.42	6.52	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	5.42	5.52	-
Follow-up Hdwy	-	-	-	3.518	4.018	-
Pot Cap-1 Maneuver	0	-	-	525	404	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	604	480	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	525	0	-
Mov Cap-2 Maneuver	-	-	-	525	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	604	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	525	-
HCM Lane V/C Ratio	-	-	0.699	-
HCM Control Delay (s)	-	-	26.2	-
HCM Lane LOS	-	-	D	-
HCM 95th %tile Q(veh)	-	-	5.5	-

Intersection	
Intersection Delay, s/veh	18.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	170	400	0	0	120	155	55	370	5	0	0	0
Future Vol, veh/h	170	400	0	0	120	155	55	370	5	0	0	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	175	412	0	0	124	160	57	381	5	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	21.5	15.8	15.1
HCM LOS	C	C	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	23%	0%	100%	0%	0%
Vol Thru, %	77%	97%	0%	100%	44%
Vol Right, %	0%	3%	0%	0%	56%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	240	190	170	400	275
LT Vol	55	0	170	0	0
Through Vol	185	185	0	400	120
RT Vol	0	5	0	0	155
Lane Flow Rate	247	196	175	412	284
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.483	0.375	0.337	0.735	0.504
Departure Headway (Hd)	7.023	6.887	6.926	6.417	6.402
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	512	521	517	561	561
Service Time	4.784	4.649	4.688	4.179	4.464
HCM Lane V/C Ratio	0.482	0.376	0.338	0.734	0.506
HCM Control Delay	16.2	13.8	13.2	25	15.8
HCM Lane LOS	C	B	B	C	C
HCM 95th-tile Q	2.6	1.7	1.5	6.2	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	25	20	250	20	378	10	155	100	330	160	10
Future Volume (vph)	10	25	20	250	20	378	10	155	100	330	160	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1737		1665	1681	1568	1752	1845	1568	3400	1829	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1737		1665	1681	1568	1752	1845	1568	3400	1829	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	28	23	284	23	430	11	176	114	375	182	11
RTOR Reduction (vph)	0	18	0	0	0	132	0	0	100	0	2	0
Lane Group Flow (vph)	0	44	0	153	154	298	11	176	14	375	191	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		6.2		67.9	67.9	85.9	15.4	15.4	15.4	18.0	18.0	
Effective Green, g (s)		6.2		67.9	67.9	85.9	15.4	15.4	15.4	18.0	18.0	
Actuated g/C Ratio		0.05		0.55	0.55	0.69	0.12	0.12	0.12	0.15	0.15	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		86		911	920	1086	217	229	194	493	265	
v/s Ratio Prot		c0.03		0.09	0.09	c0.04	0.01	c0.10		c0.11	0.10	
v/s Ratio Perm						0.15			0.01			
v/c Ratio		0.51		0.17	0.17	0.27	0.05	0.77	0.07	0.76	0.72	
Uniform Delay, d1		57.4		14.0	14.0	7.2	47.9	52.6	48.0	50.9	50.6	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.1		0.4	0.4	0.1	0.0	13.0	0.1	6.1	8.0	
Delay (s)		59.5		14.4	14.4	7.3	47.9	65.6	48.0	57.1	58.6	
Level of Service		E		B	B	A	D	E	D	E	E	
Approach Delay (s)		59.5			10.2			58.3			57.6	
Approach LOS		E			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	415	40	100	468	0	30	0	135	270	45	150
Future Volume (vph)	0	415	40	100	468	0	30	0	135	270	45	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3459		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3459		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	437	42	105	493	0	32	0	142	284	47	158
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	124	0	0	141
Lane Group Flow (vph)	0	477	0	105	493	0	32	0	18	284	47	17
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		100.2		12.6	116.3		6.7		19.3	16.3	16.3	16.3
Effective Green, g (s)		100.2		12.6	116.3		6.7		19.3	16.3	16.3	16.3
Actuated g/C Ratio		0.66		0.08	0.76		0.04		0.13	0.11	0.11	0.11
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		2272		144	2672		76		198	363	197	167
v/s Ratio Prot		c0.14		c0.06	0.14		c0.02		0.01	c0.08	0.03	
v/s Ratio Perm									0.00			0.01
v/c Ratio		0.21		0.73	0.18		0.42		0.09	0.78	0.24	0.10
Uniform Delay, d1		10.4		68.3	5.0		71.0		58.8	66.4	62.4	61.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2		14.4	0.2		1.4		0.1	9.7	0.2	0.1
Delay (s)		10.6		82.7	5.2		72.4		58.9	76.1	62.6	61.6
Level of Service		B		F	A		E		E	E	E	E
Approach Delay (s)		10.6			18.8			61.4			70.1	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	152.5	Sum of lost time (s)	16.7
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	520	100	0	554	260	275	0	441	0	0	0
Future Volume (vph)	0	520	100	0	554	260	275	0	441	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	591	114	0	630	295	312	0	501	0	0	0
RTOR Reduction (vph)	0	0	40	0	0	0	0	0	208	0	0	0
Lane Group Flow (vph)	0	591	74	0	630	295	313	0	293	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		57.3	57.3		57.3	80.5	22.7		22.7			
Effective Green, g (s)		57.3	57.3		57.3	80.5	22.7		22.7			
Actuated g/C Ratio		0.65	0.65		0.65	0.91	0.26		0.26			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2266	1014		2266	1486	448		401			
v/s Ratio Prot		0.17			c0.18	0.05	0.18		c0.19			
v/s Ratio Perm			0.05			0.14						
v/c Ratio		0.26	0.07		0.28	0.20	0.70		0.73			
Uniform Delay, d1		6.7	5.8		6.7	0.5	29.9		30.2			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.3	0.1		0.1	0.1	4.7		6.8			
Delay (s)		6.9	5.9		6.8	0.5	34.6		36.9			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		6.8			4.8			36.0			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	466	328	145	473	25	199	40	75	30	40	142
Future Volume (vph)	167	466	328	145	473	25	199	40	75	30	40	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3479		3400	1665		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3479		3400	1665		1752	1845	1568
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	184	512	360	159	520	27	219	44	82	33	44	156
RTOR Reduction (vph)	0	0	150	0	1	0	0	57	0	0	0	136
Lane Group Flow (vph)	184	512	210	159	546	0	219	69	0	33	44	20
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	10.9	80.1	80.1	22.6	91.8		13.0	15.2		4.6	6.8	17.7
Effective Green, g (s)	10.9	80.1	80.1	22.6	91.8		13.0	15.2		4.6	6.8	17.7
Actuated g/C Ratio	0.08	0.58	0.58	0.16	0.67		0.09	0.11		0.03	0.05	0.13
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	269	2040	912	287	2321		321	183		58	91	201
v/s Ratio Prot	c0.05	c0.15		c0.09	0.16		c0.06	0.04		0.02	c0.02	0.01
v/s Ratio Perm			0.13									0.00
v/c Ratio	0.68	0.25	0.23	0.55	0.24		0.68	0.38		0.57	0.48	0.10
Uniform Delay, d1	61.7	14.1	13.9	52.9	9.0		60.3	56.8		65.5	63.7	52.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.6	0.3	0.6	1.3	0.2		4.7	0.5		7.4	1.5	0.1
Delay (s)	67.3	14.4	14.5	54.2	9.3		65.0	57.3		72.9	65.2	53.0
Level of Service	E	B	B	D	A		E	E		E	E	D
Approach Delay (s)		23.6			19.4			62.2			58.1	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (veh/h)	105	284	70	100	491	163	100	160	106	74	165	185
Future Volume (veh/h)	105	284	70	100	491	163	100	160	106	74	165	185
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	115	312	77	110	540	179	110	176	116	81	181	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	150	682	580	142	674	573	140	311	264	117	286	243
Arrive On Green	0.09	0.37	0.37	0.08	0.37	0.37	0.08	0.17	0.17	0.07	0.16	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	115	312	77	110	540	179	110	176	116	81	181	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	3.3	6.6	1.7	3.2	13.5	4.2	3.2	4.5	3.4	2.3	4.7	0.0
Cycle Q Clear(g_c), s	3.3	6.6	1.7	3.2	13.5	4.2	3.2	4.5	3.4	2.3	4.7	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	150	682	580	142	674	573	140	311	264	117	286	243
V/C Ratio(X)	0.77	0.46	0.13	0.77	0.80	0.31	0.78	0.57	0.44	0.69	0.63	0.00
Avail Cap(c_a), veh/h	426	944	803	324	980	833	221	1088	924	221	1123	955
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	23.1	12.3	10.8	23.2	14.7	11.7	23.3	19.7	19.2	23.5	20.4	0.0
Incr Delay (d2), s/veh	8.0	0.5	0.1	8.7	3.1	0.3	9.1	1.6	1.1	7.1	2.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	3.4	0.7	1.9	7.3	1.9	1.9	2.4	1.6	1.4	2.6	0.0
LnGrp Delay(d),s/veh	31.1	12.8	10.9	31.9	17.7	12.0	32.4	21.3	20.4	30.7	22.7	0.0
LnGrp LOS	C	B	B	C	B	B	C	C	C	C	C	
Approach Vol, veh/h		504			829			402			262	
Approach Delay, s/veh		16.7			18.4			24.1			25.2	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.9	13.3	7.7	23.7	7.6	12.6	7.9	23.4
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	4.3	6.5	5.2	8.6	5.2	6.7	5.3	15.5
Green Ext Time (p_c), s	0.0	1.4	0.1	1.9	0.0	1.0	0.1	3.3

Intersection Summary		
HCM 2010 Ctrl Delay		20.0
HCM 2010 LOS		B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	399	65	208	699	55	104
Future Volume (Veh/h)	399	65	208	699	55	104
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	453	74	236	794	63	118
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			910		
pX, platoon unblocked			0.88		0.81	0.88
vC, conflicting volume			527		1756	490
vC1, stage 1 conf vol					490	
vC2, stage 2 conf vol					1266	
vCu, unblocked vol			392		1477	350
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			77		61	81
cM capacity (veh/h)			1020		160	607

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	527	236	794	63	118
Volume Left	0	236	0	63	0
Volume Right	74	0	0	0	118
cSH	1700	1020	1700	160	607
Volume to Capacity	0.31	0.23	0.47	0.39	0.19
Queue Length 95th (ft)	0	22	0	43	18
Control Delay (s)	0.0	9.6	0.0	41.5	12.4
Lane LOS		A		E	B
Approach Delay (s)	0.0	2.2		22.5	
Approach LOS				C	

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	334	130	172	807	0	0	0	0	148	55	210
Future Volume (vph)	0	334	130	172	807	0	0	0	0	148	55	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1780	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1780	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	380	148	195	917	0	0	0	0	168	62	239
RTOR Reduction (vph)	0	0	84	0	0	0	0	0	0	0	0	190
Lane Group Flow (vph)	0	380	64	195	917	0	0	0	0	0	231	49
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		45.4	45.4	20.7	53.2						21.3	21.3
Effective Green, g (s)		45.4	45.4	20.7	46.8						21.3	21.3
Actuated g/C Ratio		0.44	0.44	0.20	0.45						0.20	0.20
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1527	683	348	1574						363	320
v/s Ratio Prot		c0.11		0.11	c0.26						c0.13	
v/s Ratio Perm			0.04									0.03
v/c Ratio		0.25	0.09	0.56	0.58						0.64	0.15
Uniform Delay, d1		18.6	17.3	37.6	21.4						37.9	34.0
Progression Factor		1.00	1.00	0.57	0.28						1.00	1.00
Incremental Delay, d2		0.0	0.0	5.8	0.3						2.7	0.1
Delay (s)		18.6	17.3	27.3	6.4						40.6	34.1
Level of Service		B	B	C	A						D	C
Approach Delay (s)		18.3			10.1			0.0			37.3	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	104.2	Sum of lost time (s)	24.6
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	360	0	0	403	76	575	5	297	0	0	0
Future Volume (vph)	120	360	0	0	403	76	575	5	297	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.98		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4917		1665	1670	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4917		1665	1670	1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	136	409	0	0	458	86	653	6	338	0	0	0
RTOR Reduction (vph)	0	0	0	0	21	0	0	0	248	0	0	0
Lane Group Flow (vph)	136	409	0	0	523	0	326	333	90	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	12.0	40.2			48.9		25.6	25.6	25.6			
Effective Green, g (s)	12.0	33.8			48.9		25.6	25.6	25.6			
Actuated g/C Ratio	0.12	0.32			0.47		0.25	0.25	0.25			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	201	598			2307		409	410	385			
v/s Ratio Prot	0.08	c0.22			c0.11		0.20	c0.20				
v/s Ratio Perm									0.06			
v/c Ratio	0.68	0.68			0.23		0.80	0.81	0.23			
Uniform Delay, d1	44.2	30.6			16.4		36.9	37.0	31.4			
Progression Factor	0.70	0.99			1.00		1.00	1.00	1.00			
Incremental Delay, d2	6.7	2.5			0.0		9.7	11.0	0.1			
Delay (s)	37.6	32.7			16.4		46.6	48.1	31.6			
Level of Service	D	C			B		D	D	C			
Approach Delay (s)		33.9			16.4			42.0			0.0	
Approach LOS		C			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	104.2	Sum of lost time (s)	24.6
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	496	151	30	346	5	116	2	23	5	2	15
Future Volume (vph)	10	496	151	30	346	5	116	2	23	5	2	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)	1752	1845	1568	1752	1840		1665	1671	1568		1655	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)	1752	1845	1568	1752	1840		1665	1671	1568		1655	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	564	172	34	393	6	132	2	26	6	2	17
RTOR Reduction (vph)	0	0	58	0	0	0	0	0	22	0	17	0
Lane Group Flow (vph)	11	564	114	34	399	0	67	67	4	0	8	0
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.7	26.6	26.6	1.9	27.8		8.0	8.0	8.0		1.6	
Effective Green, g (s)	0.7	26.6	26.6	1.9	27.8		8.0	8.0	8.0		1.6	
Actuated g/C Ratio	0.01	0.48	0.48	0.03	0.51		0.15	0.15	0.15		0.03	
Clearance Time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0		2.0	
Lane Grp Cap (vph)	22	893	759	60	931		242	243	228		48	
v/s Ratio Prot	0.01	c0.31		c0.02	0.22		c0.04	0.04			c0.01	
v/s Ratio Perm			0.07						0.00			
v/c Ratio	0.50	0.63	0.15	0.57	0.43		0.28	0.28	0.02		0.18	
Uniform Delay, d1	26.9	10.5	7.9	26.1	8.5		20.9	20.9	20.1		26.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	6.4	1.5	0.1	7.1	0.3		0.6	0.6	0.0		0.6	
Delay (s)	33.3	12.0	8.0	33.2	8.9		21.5	21.5	20.1		26.7	
Level of Service	C	B	A	C	A		C	C	C		C	
Approach Delay (s)		11.4			10.8			21.3			26.7	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	54.9	Sum of lost time (s)	16.8
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	55.7
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	110	305	98	15	100	100	136	100	5	60	130	101
Future Vol, veh/h	110	305	98	15	100	100	136	100	5	60	130	101
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	125	347	111	17	114	114	155	114	6	68	148	115
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	103.6	18.8	22.7	25.8
HCM LOS	F	C	C	D

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	56%	21%	7%	21%
Vol Thru, %	41%	59%	47%	45%
Vol Right, %	2%	19%	47%	35%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	241	513	215	291
LT Vol	136	110	15	60
Through Vol	100	305	100	130
RT Vol	5	98	100	101
Lane Flow Rate	274	583	244	331
Geometry Grp	1	1	1	1
Degree of Util (X)	0.594	1.124	0.509	0.679
Departure Headway (Hd)	8.284	6.939	7.889	7.829
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	438	525	459	466
Service Time	6.284	4.999	5.889	5.829
HCM Lane V/C Ratio	0.626	1.11	0.532	0.71
HCM Control Delay	22.7	103.6	18.8	25.8
HCM Lane LOS	C	F	C	D
HCM 95th-tile Q	3.8	19.2	2.8	5

Intersection	
Intersection Delay, s/veh	10.5
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	130	121	169	90	75	155
Future Vol, veh/h	130	121	169	90	75	155
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	140	130	182	97	81	167
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	11.1	10.5	9.7
HCM LOS	B	B	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	52%	0%	100%	0%
Vol Thru, %	48%	65%	0%	0%
Vol Right, %	0%	35%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	251	259	75	155
LT Vol	130	0	75	0
Through Vol	121	169	0	0
RT Vol	0	90	0	155
Lane Flow Rate	270	278	81	167
Geometry Grp	2	2	7	7
Degree of Util (X)	0.376	0.365	0.142	0.237
Departure Headway (Hd)	5.021	4.72	6.33	5.117
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	713	758	562	695
Service Time	3.09	2.785	4.118	2.904
HCM Lane V/C Ratio	0.379	0.367	0.144	0.24
HCM Control Delay	11.1	10.5	10.2	9.5
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	1.8	1.7	0.5	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	20	143	90	90	110	230	395	25	30	375	40
Future Volume (Veh/h)	5	20	143	90	90	110	230	395	25	30	375	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	5	21	152	96	96	117	245	420	27	32	399	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6			1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1421	1400	399	1473	1430	434	442			447		
vC1, stage 1 conf vol	463	463		924	924							
vC2, stage 2 conf vol	958	937		550	506							
vCu, unblocked vol	1421	1400	399	1473	1430	434	442			447		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	91	77	18	55	81	78			97		
cM capacity (veh/h)	91	221	649	117	211	620	1113			1108		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	178	309	245	447	32	399	43
Volume Left	5	96	245	0	32	0	0
Volume Right	152	117	0	27	0	0	43
cSH	760	216	1113	1700	1108	1700	1700
Volume to Capacity	0.23	1.43	0.22	0.26	0.03	0.23	0.03
Queue Length 95th (ft)	23	451	21	0	2	0	0
Control Delay (s)	14.3	259.7	9.1	0.0	8.3	0.0	0.0
Lane LOS	B	F	A		A		
Approach Delay (s)	14.3	259.7	3.2		0.6		
Approach LOS	B	F					

Intersection Summary			
Average Delay	51.6		
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	95	572	311	59	30	50
Future Vol, veh/h	95	572	311	59	30	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	104	629	342	65	33	55

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	407	0	-	0	1212	375
Stage 1	-	-	-	-	375	-
Stage 2	-	-	-	-	837	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1146	-	-	-	200	669
Stage 1	-	-	-	-	693	-
Stage 2	-	-	-	-	423	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1146	-	-	-	182	669
Mov Cap-2 Maneuver	-	-	-	-	262	-
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	423	-

Approach	EB	WB	SB
HCM Control Delay, s	1.2	0	15.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1146	-	-	-	423
HCM Lane V/C Ratio	0.091	-	-	-	0.208
HCM Control Delay (s)	8.5	-	-	-	15.7
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	0.8

Intersection						
Int Delay, s/veh	1.7					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	Y	
Traffic Vol, veh/h	246	357	40	284	87	15
Future Vol, veh/h	246	357	40	284	87	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	270	392	44	312	96	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	662	0	670	270
Stage 1	-	-	-	-	270	-
Stage 2	-	-	-	-	400	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	922	-	421	766
Stage 1	-	-	-	-	773	-
Stage 2	-	-	-	-	675	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	922	-	401	766
Mov Cap-2 Maneuver	-	-	-	-	491	-
Stage 1	-	-	-	-	736	-
Stage 2	-	-	-	-	675	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	13.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	518	-	-	922	-
HCM Lane V/C Ratio	0.216	-	-	0.048	-
HCM Control Delay (s)	13.9	-	-	9.1	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	25.4
Intersection LOS	D

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	317	47	49	324	165	446
Future Vol, veh/h	317	47	49	324	165	446
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	348	52	54	356	181	490
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	28.2	15.8	29.5
HCM LOS	D	C	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	31%	0%
Vol Thru, %	0%	0%	87%	69%	100%
Vol Right, %	0%	100%	13%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	165	446	364	157	216
LT Vol	165	0	0	49	0
Through Vol	0	0	317	108	216
RT Vol	0	446	47	0	0
Lane Flow Rate	181	490	400	173	237
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.376	0.85	0.756	0.361	0.485
Departure Headway (Hd)	7.468	6.244	6.8	7.524	7.363
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	479	573	528	481	491
Service Time	5.266	4.041	4.893	5.224	5.063
HCM Lane V/C Ratio	0.378	0.855	0.758	0.36	0.483
HCM Control Delay	14.8	35	28.2	14.4	16.8
HCM Lane LOS	B	D	D	B	C
HCM 95th-tile Q	1.7	9.1	6.6	1.6	2.6

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	271	90	20	210	0	0	0	0	150	210	125
Future Vol, veh/h	0	271	90	20	210	0	0	0	0	150	210	125
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	308	102	23	239	0	0	0	0	170	239	142

Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0	0	359	410	0
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	359	410	-
Critical Hdwy	-	-	-	6.43	6.53	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	5.43	5.53	-
Follow-up Hdwy	-	-	-	3.527	4.027	-
Pot Cap-1 Maneuver	0	-	-	638	530	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	704	594	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	638	0	-
Mov Cap-2 Maneuver	-	-	-	638	0	-
Stage 1	-	-	-	-	0	-
Stage 2	-	-	-	704	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	638	-
HCM Lane V/C Ratio	-	-	0.454	-
HCM Control Delay (s)	-	-	15.3	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	2.4	-

Intersection	
Intersection Delay, s/veh	24.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	160	261	0	0	175	273	55	305	10	0	0	0
Future Vol, veh/h	160	261	0	0	175	273	55	305	10	0	0	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	182	297	0	0	199	310	63	347	11	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	16.5	39.9	15.7
HCM LOS	C	E	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	27%	0%	100%	0%	0%
Vol Thru, %	73%	94%	0%	100%	39%
Vol Right, %	0%	6%	0%	0%	61%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	208	163	160	261	448
LT Vol	55	0	160	0	0
Through Vol	153	153	0	261	175
RT Vol	0	10	0	0	273
Lane Flow Rate	236	185	182	297	509
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.483	0.369	0.367	0.557	0.885
Departure Headway (Hd)	7.371	7.191	7.272	6.761	6.257
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	486	499	493	531	575
Service Time	5.149	4.969	5.059	4.547	4.327
HCM Lane V/C Ratio	0.486	0.371	0.369	0.559	0.885
HCM Control Delay	16.9	14.2	14.3	17.8	39.9
HCM Lane LOS	C	B	B	C	E
HCM 95th-tile Q	2.6	1.7	1.7	3.4	10.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	30	15	290	30	508	15	250	230	528	240	10
Future Volume (vph)	15	30	15	290	30	508	15	250	230	528	240	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1762		1665	1684	1568	1752	1845	1568	3400	1834	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1762		1665	1684	1568	1752	1845	1568	3400	1834	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	33	16	319	33	558	16	275	253	580	264	11
RTOR Reduction (vph)	0	9	0	0	0	158	0	0	145	0	2	0
Lane Group Flow (vph)	0	56	0	175	177	400	16	275	108	580	273	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		7.9		52.5	52.5	79.3	22.3	22.3	22.3	26.8	26.8	
Effective Green, g (s)		7.9		52.5	52.5	79.3	22.3	22.3	22.3	26.8	26.8	
Actuated g/C Ratio		0.06		0.42	0.42	0.63	0.18	0.18	0.18	0.21	0.21	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		110		693	701	986	310	326	277	723	390	
v/s Ratio Prot		c0.03		0.11	0.11	c0.09	0.01	c0.15		c0.17	0.15	
v/s Ratio Perm						0.17			0.07			
v/c Ratio		0.51		0.25	0.25	0.41	0.05	0.84	0.39	0.80	0.70	
Uniform Delay, d1		57.2		24.0	24.0	11.6	43.1	50.2	45.8	47.1	45.9	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.3		0.9	0.9	0.1	0.0	17.1	0.3	6.1	4.6	
Delay (s)		58.5		24.8	24.8	11.7	43.1	67.2	46.2	53.1	50.5	
Level of Service		E		C	C	B	D	E	D	D	D	
Approach Delay (s)		58.5			16.8			56.7			52.3	
Approach LOS		E			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	126.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	738	50	170	623	0	40	0	235	335	45	165
Future Volume (vph)	0	738	50	170	623	0	40	0	235	335	45	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3471		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3471		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	839	57	193	708	0	45	0	267	381	51	188
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	47	0	0	162
Lane Group Flow (vph)	0	894	0	193	708	0	45	0	220	381	51	26
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		84.0		20.4	109.0		7.2		27.6	20.7	20.7	20.7
Effective Green, g (s)		84.0		20.4	109.0		7.2		27.6	20.7	20.7	20.7
Actuated g/C Ratio		0.55		0.13	0.72		0.05		0.18	0.14	0.14	0.14
Clearance Time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		1915		234	2510		82		284	462	250	213
v/s Ratio Prot		c0.26		c0.11	0.20		0.03		c0.10	c0.11	0.03	
v/s Ratio Perm									0.04			0.02
v/c Ratio		0.47		0.82	0.28		0.55		0.77	0.82	0.20	0.12
Uniform Delay, d1		20.6		64.2	7.7		70.9		59.3	64.0	58.4	57.8
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.8		19.6	0.3		4.0		11.3	10.9	0.1	0.1
Delay (s)		21.4		83.8	8.0		74.9		70.6	74.9	58.6	57.8
Level of Service		C		F	A		E		E	E	E	E
Approach Delay (s)		21.4			24.2			71.2			68.4	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	38.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	152.2	Sum of lost time (s)	19.9
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	745	170	0	969	510	276	0	434	0	0	0
Future Volume (vph)	0	745	170	0	969	510	276	0	434	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	810	185	0	1053	554	300	0	472	0	0	0
RTOR Reduction (vph)	0	0	70	0	0	0	0	0	119	0	0	0
Lane Group Flow (vph)	0	810	115	0	1053	554	300	0	353	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		55.3	55.3		55.3	80.5	24.7		24.7			
Effective Green, g (s)		55.3	55.3		55.3	80.5	24.7		24.7			
Actuated g/C Ratio		0.62	0.62		0.62	0.91	0.28		0.28			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2187	978		2187	1486	488		437			
v/s Ratio Prot		0.23			c0.30	0.11	0.17		c0.23			
v/s Ratio Perm			0.07			0.25						
v/c Ratio		0.37	0.12		0.48	0.37	0.61		0.81			
Uniform Delay, d1		8.1	6.8		8.9	0.6	27.8		29.7			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.5	0.2		0.2	0.2	2.3		10.5			
Delay (s)		8.6	7.0		9.1	0.7	30.1		40.2			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		8.3			6.2			36.3			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	227	551	400	175	601	40	575	95	180	80	75	302
Future Volume (vph)	227	551	400	175	601	40	575	95	180	80	75	302
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3472		3400	1663		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3472		3400	1663		1752	1845	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	258	626	455	199	683	45	653	108	205	91	85	343
RTOR Reduction (vph)	0	0	243	0	3	0	0	50	0	0	0	60
Lane Group Flow (vph)	258	626	212	199	725	0	653	263	0	91	85	283
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	19.3	60.3	60.3	23.3	64.3		30.9	30.4		10.9	10.4	29.7
Effective Green, g (s)	19.3	60.3	60.3	23.3	64.3		30.9	30.4		10.9	10.4	29.7
Actuated g/C Ratio	0.14	0.43	0.43	0.17	0.46		0.22	0.22		0.08	0.07	0.21
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	468	1509	675	291	1594		750	361		136	137	332
v/s Ratio Prot	0.08	0.18		c0.11	c0.21		c0.19	0.16		0.05	0.05	c0.12
v/s Ratio Perm			0.14									0.06
v/c Ratio	0.55	0.41	0.31	0.68	0.46		0.87	0.73		0.67	0.62	0.85
Uniform Delay, d1	56.3	27.6	26.2	54.9	25.9		52.6	51.0		62.8	62.9	53.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.8	1.2	5.2	0.9		10.5	6.1		9.3	6.1	18.0
Delay (s)	57.1	28.5	27.5	60.1	26.8		63.1	57.1		72.1	69.0	71.1
Level of Service	E	C	C	E	C		E	E		E	E	E
Approach Delay (s)		33.6			34.0			61.2			70.9	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	46.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.1
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	499	140	168	404	155	70	235	203	91	275	215
Future Volume (veh/h)	185	499	140	168	404	155	70	235	203	91	275	215
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	210	567	159	191	459	176	80	267	231	103	312	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	255	642	545	232	618	525	102	373	317	131	403	343
Arrive On Green	0.15	0.35	0.35	0.13	0.33	0.33	0.06	0.20	0.20	0.07	0.22	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	210	567	159	191	459	176	80	267	231	103	312	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	7.7	19.3	4.9	7.1	14.7	5.6	3.0	9.0	9.2	3.8	10.6	0.0
Cycle Q Clear(g_c), s	7.7	19.3	4.9	7.1	14.7	5.6	3.0	9.0	9.2	3.8	10.6	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	255	642	545	232	618	525	102	373	317	131	403	343
V/C Ratio(X)	0.82	0.88	0.29	0.82	0.74	0.34	0.78	0.72	0.73	0.78	0.77	0.00
Avail Cap(c_a), veh/h	330	731	621	250	758	645	171	842	715	171	869	739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.6	20.5	15.8	28.1	19.6	16.6	31.0	24.8	24.9	30.3	24.5	0.0
Incr Delay (d2), s/veh	12.2	11.4	0.3	18.3	3.1	0.4	12.2	2.6	3.2	16.0	3.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	11.8	2.1	4.6	7.9	2.5	1.8	4.9	4.3	2.4	5.7	0.0
LnGrp Delay(d),s/veh	39.9	31.8	16.1	46.4	22.8	17.0	43.2	27.4	28.1	46.3	27.7	0.0
LnGrp LOS	D	C	B	D	C	B	D	C	C	D	C	
Approach Vol, veh/h		936			826			578			415	
Approach Delay, s/veh		30.9			27.0			29.9			32.3	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.5	18.1	12.3	27.8	7.4	19.2	13.2	26.9
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	5.8	11.2	9.1	21.3	5.0	12.6	9.7	16.7
Green Ext Time (p_c), s	0.0	2.3	0.0	1.9	0.0	1.7	0.2	2.7

Intersection Summary	
HCM 2010 Ctrl Delay	29.7
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	747	45	105	647	80	210
Future Volume (Veh/h)	747	45	105	647	80	210
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	849	51	119	735	91	239
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			912		
pX, platoon unblocked			0.70		0.82	0.70
vC, conflicting volume			900		1848	874
vC1, stage 1 conf vol					874	
vC2, stage 2 conf vol					973	
vCu, unblocked vol			644		1290	608
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			82		62	31
cM capacity (veh/h)			656		240	346

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	900	119	735	91	239
Volume Left	0	119	0	91	0
Volume Right	51	0	0	0	239
cSH	1700	656	1700	240	346
Volume to Capacity	0.53	0.18	0.43	0.38	0.69
Queue Length 95th (ft)	0	16	0	42	122
Control Delay (s)	0.0	11.7	0.0	28.9	35.6
Lane LOS		B		D	E
Approach Delay (s)	0.0	1.6		33.8	
Approach LOS				D	

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	625	420	430	635	0	0	0	0	226	75	150
Future Volume (vph)	0	625	420	430	635	0	0	0	0	226	75	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1778	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1778	1568
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	702	472	483	713	0	0	0	0	254	84	169
RTOR Reduction (vph)	0	0	219	0	0	0	0	0	0	0	0	130
Lane Group Flow (vph)	0	702	253	483	713	0	0	0	0	0	338	39
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		50.0	50.0	34.2	63.2						29.8	29.8
Effective Green, g (s)		50.0	50.0	34.2	56.8						29.8	29.8
Actuated g/C Ratio		0.38	0.38	0.26	0.43						0.23	0.23
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1339	599	458	1522						405	357
v/s Ratio Prot		c0.20		c0.28	0.20						c0.19	
v/s Ratio Perm			0.16									0.02
v/c Ratio		0.52	0.42	1.05	0.47						0.83	0.11
Uniform Delay, d1		31.2	29.8	48.3	26.3						48.1	40.0
Progression Factor		1.00	1.00	0.68	0.44						1.00	1.00
Incremental Delay, d2		0.2	0.2	56.6	0.1						13.2	0.0
Delay (s)		31.4	29.9	89.3	11.5						61.4	40.0
Level of Service		C	C	F	B						E	D
Approach Delay (s)		30.8			42.9			0.0			54.3	
Approach LOS		C			D			A			D	

Intersection Summary			
HCM 2000 Control Delay	40.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.8	Sum of lost time (s)	24.6
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	594	0	0	779	113	285	0	312	0	0	0
Future Volume (vph)	255	594	0	0	779	113	285	0	312	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.98		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4940		1665	1665	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4940		1665	1665	1568			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	268	625	0	0	820	119	300	0	328	0	0	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	273	0	0	0
Lane Group Flow (vph)	268	625	0	0	927	0	150	150	55	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	20.1	56.8			70.9		22.1	22.1	22.1			
Effective Green, g (s)	20.1	50.4			70.9		22.1	22.1	22.1			
Actuated g/C Ratio	0.15	0.39			0.54		0.17	0.17	0.17			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	269	710			2677		281	281	264			
v/s Ratio Prot	c0.15	c0.34			c0.19		c0.09	0.09				
v/s Ratio Perm									0.04			
v/c Ratio	1.00	0.88			0.35		0.53	0.53	0.21			
Uniform Delay, d1	55.3	37.4			16.9		49.6	49.6	46.8			
Progression Factor	0.81	1.02			1.00		1.00	1.00	1.00			
Incremental Delay, d2	49.1	10.4			0.0		1.0	1.0	0.1			
Delay (s)	93.8	48.6			16.9		50.6	50.6	47.0			
Level of Service	F	D			B		D	D	D			
Approach Delay (s)		62.1			16.9			48.7			0.0	
Approach LOS		E			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	41.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	130.8	Sum of lost time (s)	24.6
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	647	239	46	622	15	246	2	47	15	2	25
Future Volume (vph)	20	647	239	46	622	15	246	2	47	15	2	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)	1752	1845	1568	1752	1838		1665	1670	1568		1667	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)	1752	1845	1568	1752	1838		1665	1670	1568		1667	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	21	674	249	48	648	16	256	2	49	16	2	26
RTOR Reduction (vph)	0	0	61	0	0	0	0	0	41	0	25	0
Lane Group Flow (vph)	21	674	188	48	664	0	128	130	8	0	19	0
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	2.2	37.1	37.1	4.0	38.9		12.5	12.5	12.5		3.5	
Effective Green, g (s)	2.2	37.1	37.1	4.0	38.9		12.5	12.5	12.5		3.5	
Actuated g/C Ratio	0.03	0.50	0.50	0.05	0.53		0.17	0.17	0.17		0.05	
Clearance Time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0		2.0	
Lane Grp Cap (vph)	52	926	787	94	967		281	282	265		78	
v/s Ratio Prot	0.01	c0.37		c0.03	0.36		0.08	c0.08			c0.01	
v/s Ratio Perm			0.12						0.01			
v/c Ratio	0.40	0.73	0.24	0.51	0.69		0.46	0.46	0.03		0.25	
Uniform Delay, d1	35.2	14.4	10.4	34.0	13.0		27.6	27.7	25.6		33.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.9	2.9	0.2	1.9	2.0		1.2	1.2	0.0		0.6	
Delay (s)	37.1	17.3	10.6	35.9	15.0		28.8	28.9	25.7		34.5	
Level of Service	D	B	B	D	B		C	C	C		C	
Approach Delay (s)		16.0			16.4			28.3			34.5	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	73.9	Sum of lost time (s)	16.8
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	316.5
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	198	345	151	5	360	255	141	200	5	160	215	175
Future Vol, veh/h	198	345	151	5	360	255	141	200	5	160	215	175
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	204	356	156	5	371	263	145	206	5	165	222	180
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	440	341.3	97	270.7
HCM LOS	F	F	F	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	41%	29%	1%	29%
Vol Thru, %	58%	50%	58%	39%
Vol Right, %	1%	22%	41%	32%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	346	694	620	550
LT Vol	141	198	5	160
Through Vol	200	345	360	215
RT Vol	5	151	255	175
Lane Flow Rate	357	715	639	567
Geometry Grp	1	1	1	1
Degree of Util (X)	0.963	1.884	1.652	1.484
Departure Headway (Hd)	16.751	13.082	13.656	13.746
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	221	286	275	272
Service Time	14.751	11.082	11.656	11.746
HCM Lane V/C Ratio	1.615	2.5	2.324	2.085
HCM Control Delay	97	440	341.3	270.7
HCM Lane LOS	F	F	F	F
HCM 95th-tile Q	8.3	35.8	27.4	22.4

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	185	209	119	100	140	235
Future Vol, veh/h	185	209	119	100	140	235
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	193	218	124	104	146	245
Number of Lanes	0	1	1	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	17	11.2	11.7
HCM LOS	C	B	B

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	47%	0%	100%	0%
Vol Thru, %	53%	54%	0%	0%
Vol Right, %	0%	46%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	394	219	140	235
LT Vol	185	0	140	0
Through Vol	209	119	0	0
RT Vol	0	100	0	235
Lane Flow Rate	410	228	146	245
Geometry Grp	2	2	7	7
Degree of Util (X)	0.621	0.34	0.274	0.377
Departure Headway (Hd)	5.449	5.373	6.766	5.548
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	665	668	531	649
Service Time	3.481	3.411	4.501	3.283
HCM Lane V/C Ratio	0.617	0.341	0.275	0.378
HCM Control Delay	17	11.2	12	11.6
HCM Lane LOS	C	B	B	B
HCM 95th-tile Q	4.3	1.5	1.1	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	65	273	25	35	50	243	490	75	125	455	30
Future Volume (Veh/h)	20	65	273	25	35	50	243	490	75	125	455	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	72	303	28	39	56	270	544	83	139	506	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6			1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1888	1951	506	2097	1942	586	539			627		
vC1, stage 1 conf vol	784	784		1126	1126							
vC2, stage 2 conf vol	1104	1167		972	817							
vCu, unblocked vol	1888	1951	506	2097	1942	586	539			627		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	46	0	35	89	74			85		
cM capacity (veh/h)	17	56	564	0	60	509	1024			950		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	397	123	270	627	139	506	33
Volume Left	22	28	270	0	139	0	0
Volume Right	303	56	0	83	0	0	33
cSH	151	5	1024	1700	950	1700	1700
Volume to Capacity	2.64	26.80	0.26	0.37	0.15	0.30	0.02
Queue Length 95th (ft)	876	Err	27	0	13	0	0
Control Delay (s)	802.0	Err	9.8	0.0	9.4	0.0	0.0
Lane LOS	F	F	A		A		
Approach Delay (s)	802.0	Err	2.9		1.9		
Approach LOS	F	F					

Intersection Summary			
Average Delay	740.9		
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection						
Int Delay, s/veh	3.7					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↱		Y	
Traffic Vol, veh/h	74	452	572	48	58	114
Future Vol, veh/h	74	452	572	48	58	114
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	82	502	636	53	64	127

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	689	0	-	0	1329	663
Stage 1	-	-	-	-	663	-
Stage 2	-	-	-	-	666	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	901	-	-	-	170	459
Stage 1	-	-	-	-	511	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	901	-	-	-	155	459
Mov Cap-2 Maneuver	-	-	-	-	274	-
Stage 1	-	-	-	-	464	-
Stage 2	-	-	-	-	509	-

Approach	EB	WB	SB
HCM Control Delay, s	1.3	0	24.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	901	-	-	-	374
HCM Lane V/C Ratio	0.091	-	-	-	0.511
HCM Control Delay (s)	9.4	-	-	-	24.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	2.8

Intersection						
Int Delay, s/veh	8.6					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱	↰	↑	Y	
Traffic Vol, veh/h	359	157	25	349	277	35
Future Vol, veh/h	359	157	25	349	277	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	395	173	27	384	304	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	568	0	833	395
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	438	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	999	-	337	652
Stage 1	-	-	-	-	678	-
Stage 2	-	-	-	-	648	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	999	-	328	652
Mov Cap-2 Maneuver	-	-	-	-	442	-
Stage 1	-	-	-	-	660	-
Stage 2	-	-	-	-	648	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	32.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	459	-	-	999	-
HCM Lane V/C Ratio	0.747	-	-	0.028	-
HCM Control Delay (s)	32.6	-	-	8.7	-
HCM Lane LOS	D	-	-	A	-
HCM 95th %tile Q(veh)	6.2	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	58.6
Intersection LOS	F

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	282	66	92	809	185	268
Future Vol, veh/h	282	66	92	809	185	268
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	320	75	105	919	210	305
Number of Lanes	1	0	0	2	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	27.6	90.5	18.8
HCM LOS	D	F	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	25%	0%
Vol Thru, %	0%	0%	81%	75%	100%
Vol Right, %	0%	100%	19%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	185	268	348	362	539
LT Vol	185	0	0	92	0
Through Vol	0	0	282	270	539
RT Vol	0	268	66	0	0
Lane Flow Rate	210	305	395	411	613
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.472	0.579	0.743	0.815	1.193
Departure Headway (Hd)	8.37	7.138	6.995	7.139	7.009
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	433	509	522	510	521
Service Time	6.07	4.838	4.995	4.839	4.709
HCM Lane V/C Ratio	0.485	0.599	0.757	0.806	1.177
HCM Control Delay	18.3	19.2	27.6	34.2	128.3
HCM Lane LOS	C	C	D	D	F
HCM 95th-tile Q	2.5	3.6	6.3	7.9	22.6

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	376	205	20	155	0	0	0	0	205	265	185
Future Vol, veh/h	0	376	205	20	155	0	0	0	0	205	265	185
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	409	223	22	168	0	0	0	0	223	288	201

Major/Minor	Major1									Minor2		
Conflicting Flow All	-	0	0							520	632	0
Stage 1	-	-	-							0	0	-
Stage 2	-	-	-							520	632	-
Critical Hdwy	-	-	-							6.43	6.53	-
Critical Hdwy Stg 1	-	-	-							-	-	-
Critical Hdwy Stg 2	-	-	-							5.43	5.53	-
Follow-up Hdwy	-	-	-							3.527	4.027	-
Pot Cap-1 Maneuver	0	-	-							515	396	-
Stage 1	0	-	-							-	-	-
Stage 2	0	-	-							595	472	-
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-							515	0	-
Mov Cap-2 Maneuver	-	-	-							515	0	-
Stage 1	-	-	-							-	0	-
Stage 2	-	-	-							595	0	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	515	-
HCM Lane V/C Ratio	-	-	0.712	-
HCM Control Delay (s)	-	-	27.5	-
HCM Lane LOS	-	-	D	-
HCM 95th %tile Q(veh)	-	-	5.7	-

Intersection	
Intersection Delay, s/veh	19.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	170	411	0	0	120	166	55	370	5	0	0	0
Future Vol, veh/h	170	411	0	0	120	166	55	370	5	0	0	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	175	424	0	0	124	171	57	381	5	0	0	0
Number of Lanes	1	1	0	0	1	0	0	2	0	0	0	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	23.1	16.5	15.4
HCM LOS	C	C	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	23%	0%	100%	0%	0%
Vol Thru, %	77%	97%	0%	100%	42%
Vol Right, %	0%	3%	0%	0%	58%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	240	190	170	411	286
LT Vol	55	0	170	0	0
Through Vol	185	185	0	411	120
RT Vol	0	5	0	0	166
Lane Flow Rate	247	196	175	424	295
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.488	0.379	0.34	0.761	0.528
Departure Headway (Hd)	7.102	6.966	6.978	6.469	6.442
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	507	515	514	559	557
Service Time	4.866	4.731	4.742	4.233	4.504
HCM Lane V/C Ratio	0.487	0.381	0.34	0.758	0.53
HCM Control Delay	16.5	14	13.3	27.1	16.5
HCM Lane LOS	C	B	B	D	C
HCM 95th-tile Q	2.6	1.8	1.5	6.8	3.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	201	18	0	35	198	438	42	98	442	17
Future Volume (veh/h)	0	0	201	18	0	35	198	438	42	98	442	17
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	0	1863	1863	0	1863	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	0	0	223	20	0	39	220	487	47	109	491	19
Adj No. of Lanes	0	0	1	1	0	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	0	0	2	2	0	2	2	2	2	2	2	2
Cap, veh/h	0	0	0	45	0	0	292	856	83	163	817	695
Arrive On Green	0.00	0.00	0.00	0.03	0.00	0.00	0.16	0.51	0.51	0.09	0.44	0.44
Sat Flow, veh/h		0		1774	20		1774	1673	161	1774	1863	1583
Grp Volume(v), veh/h		0.0		20	24.4		220	0	534	109	491	19
Grp Sat Flow(s),veh/h/ln				1774	C		1774	0	1834	1774	1863	1583
Q Serve(g_s), s				0.4			4.3	0.0	7.3	2.2	7.3	0.2
Cycle Q Clear(g_c), s				0.4			4.3	0.0	7.3	2.2	7.3	0.2
Prop In Lane				1.00			1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h				45			292	0	939	163	817	695
V/C Ratio(X)				0.45			0.75	0.00	0.57	0.67	0.60	0.03
Avail Cap(c_a), veh/h				244			805	0	1912	512	1634	1389
HCM Platoon Ratio				1.00			1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00			1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh				17.5			14.5	0.0	6.1	16.0	7.8	5.8
Incr Delay (d2), s/veh				6.9			3.9	0.0	0.5	4.7	0.7	0.0
Initial Q Delay(d3),s/veh				0.0			0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.3			2.4	0.0	3.7	1.3	3.8	0.1
LnGrp Delay(d),s/veh				24.4			18.4	0.0	6.7	20.7	8.5	5.8
LnGrp LOS				C			B		A	C	A	A
Approach Vol, veh/h								754			619	
Approach Delay, s/veh								10.1			10.6	
Approach LOS								B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3		5	6		
Phs Duration (G+Y+Rc), s	7.8	23.1	5.4		10.5	20.5		
Change Period (Y+Rc), s	4.5	4.5	4.5		4.5	4.5		
Max Green Setting (Gmax), s	10.5	37.9	5.0		16.5	31.9		
Max Q Clear Time (g_c+I1), s	4.2	9.3	2.4		6.3	9.3		
Green Ext Time (p_c), s	0.1	7.1	0.0		0.4	6.7		

Intersection Summary		
HCM 2010 Ctrl Delay		10.5
HCM 2010 LOS		B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	305	98	15	100	100	136	100	5	60	130	101
Future Volume (veh/h)	110	305	98	15	100	100	136	100	5	60	130	101
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	125	347	111	17	114	114	155	114	6	68	148	115
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	216	511	435	38	324	276	199	336	18	116	269	229
Arrive On Green	0.12	0.28	0.28	0.02	0.18	0.18	0.11	0.19	0.19	0.07	0.15	0.15
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1737	91	1757	1845	1568
Grp Volume(v), veh/h	125	347	111	17	114	114	155	0	120	68	148	115
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	0	1829	1757	1845	1568
Q Serve(g_s), s	2.7	6.8	2.2	0.4	2.2	2.6	3.5	0.0	2.3	1.5	3.0	2.8
Cycle Q Clear(g_c), s	2.7	6.8	2.2	0.4	2.2	2.6	3.5	0.0	2.3	1.5	3.0	2.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.05	1.00		1.00
Lane Grp Cap(c), veh/h	216	511	435	38	324	276	199	0	353	116	269	229
V/C Ratio(X)	0.58	0.68	0.26	0.45	0.35	0.41	0.78	0.00	0.34	0.59	0.55	0.50
Avail Cap(c_a), veh/h	777	1405	1194	216	816	693	337	0	908	250	825	701
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.9	13.1	11.4	19.7	14.7	14.9	17.5	0.0	14.2	18.5	16.1	16.0
Incr Delay (d2), s/veh	2.5	1.6	0.3	8.2	0.6	1.0	6.5	0.0	0.6	4.7	1.8	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	3.7	1.0	0.3	1.2	1.2	2.0	0.0	1.2	0.9	1.7	1.3
LnGrp Delay(d),s/veh	19.3	14.7	11.8	27.9	15.4	15.9	24.0	0.0	14.7	23.1	17.9	17.7
LnGrp LOS	B	B	B	C	B	B	C		B	C	B	B
Approach Vol, veh/h		583			245			275			331	
Approach Delay, s/veh		15.1			16.5			20.0			18.9	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.2	12.4	5.4	15.8	9.1	10.4	9.5	11.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.8	20.2	5.0	31.0	7.8	18.2	18.0	18.0
Max Q Clear Time (g_c+I1), s	3.5	4.3	2.4	8.8	5.5	5.0	4.7	4.6
Green Ext Time (p_c), s	0.0	0.5	0.0	2.5	0.1	0.9	0.2	0.8

Intersection Summary	
HCM 2010 Ctrl Delay	17.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	20	143	90	90	110	230	395	25	30	375	40
Future Volume (veh/h)	5	20	143	90	90	110	230	395	25	30	375	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	5	21	152	96	96	117	245	420	27	32	399	43
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	44	187	198	135	135	235	296	677	44	60	481	409
Arrive On Green	0.13	0.13	0.13	0.15	0.15	0.15	0.17	0.39	0.39	0.03	0.26	0.26
Sat Flow, veh/h	351	1476	1568	900	900	1568	1757	1715	110	1757	1845	1568
Grp Volume(v), veh/h	26	0	152	192	0	117	245	0	447	32	399	43
Grp Sat Flow(s),veh/h/ln	1827	0	1568	1800	0	1568	1757	0	1825	1757	1845	1568
Q Serve(g_s), s	0.8	0.0	5.7	6.2	0.0	4.2	8.2	0.0	12.0	1.1	12.5	1.3
Cycle Q Clear(g_c), s	0.8	0.0	5.7	6.2	0.0	4.2	8.2	0.0	12.0	1.1	12.5	1.3
Prop In Lane	0.19		1.00	0.50		1.00	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	231	0	198	270	0	235	296	0	721	60	481	409
V/C Ratio(X)	0.11	0.00	0.77	0.71	0.00	0.50	0.83	0.00	0.62	0.53	0.83	0.11
Avail Cap(c_a), veh/h	537	0	461	529	0	461	390	0	922	146	675	574
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.7	0.0	25.8	24.7	0.0	23.9	24.6	0.0	14.8	29.1	21.3	17.2
Incr Delay (d2), s/veh	0.2	0.0	6.1	3.5	0.0	1.6	10.7	0.0	0.9	7.1	6.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	2.8	3.4	0.0	1.9	4.8	0.0	6.1	0.7	7.1	0.6
LnGrp Delay(d),s/veh	23.9	0.0	31.9	28.2	0.0	25.5	35.3	0.0	15.7	36.2	27.4	17.3
LnGrp LOS	C		C	C		C	D		B	D	C	B
Approach Vol, veh/h		178			309			692			474	
Approach Delay, s/veh		30.7			27.2			22.6			27.1	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.6	28.7		12.2	14.8	20.5		13.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.1	30.9		18.0	13.6	22.4		18.0
Max Q Clear Time (g_c+I1), s	3.1	14.0		7.7	10.2	14.5		8.2
Green Ext Time (p_c), s	0.0	2.4		0.4	0.2	1.5		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	25.6
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	198	345	151	1	360	255	141	200	5	160	215	175
Future Volume (veh/h)	198	345	151	1	360	255	141	200	5	160	215	175
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	204	356	156	1	371	263	145	206	5	165	222	180
Adj No. of Lanes	1	1	1	1	1	1	1	1	0	1	1	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	265	777	660	3	501	426	185	285	7	211	321	272
Arrive On Green	0.15	0.42	0.42	0.00	0.27	0.27	0.11	0.16	0.16	0.12	0.17	0.17
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1793	44	1757	1845	1568
Grp Volume(v), veh/h	204	356	156	1	371	263	145	0	211	165	222	180
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	0	1837	1757	1845	1568
Q Serve(g_s), s	6.7	8.3	3.9	0.0	11.1	8.9	4.9	0.0	6.6	5.5	6.8	6.5
Cycle Q Clear(g_c), s	6.7	8.3	3.9	0.0	11.1	8.9	4.9	0.0	6.6	5.5	6.8	6.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	265	777	660	3	501	426	185	0	292	211	321	272
V/C Ratio(X)	0.77	0.46	0.24	0.34	0.74	0.62	0.78	0.00	0.72	0.78	0.69	0.66
Avail Cap(c_a), veh/h	533	1561	1327	146	1154	981	294	0	658	420	793	674
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.6	12.5	11.2	30.1	20.0	19.2	26.3	0.0	24.1	25.8	23.4	23.2
Incr Delay (d2), s/veh	4.7	0.4	0.2	58.2	2.2	1.5	7.1	0.0	3.4	6.2	2.7	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.6	4.3	1.7	0.1	5.9	4.0	2.7	0.0	3.6	3.0	3.7	3.0
LnGrp Delay(d),s/veh	29.2	12.9	11.4	88.3	22.2	20.7	33.4	0.0	27.5	32.0	26.1	26.0
LnGrp LOS	C	B	B	F	C	C	C		C	C	C	C
Approach Vol, veh/h		716			635			356			567	
Approach Delay, s/veh		17.2			21.7			29.9			27.8	
Approach LOS		B			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.7	14.1	4.6	29.9	10.8	15.0	13.6	20.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	14.4	21.6	5.0	51.0	10.1	25.9	18.3	37.7
Max Q Clear Time (g_c+I1), s	7.5	8.6	2.0	10.3	6.9	8.8	8.7	13.1
Green Ext Time (p_c), s	0.2	0.9	0.0	2.9	0.1	1.7	0.4	3.3

Intersection Summary	
HCM 2010 Ctrl Delay	23.1
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	65	273	25	35	50	243	490	75	125	455	30
Future Volume (veh/h)	20	65	273	25	35	50	243	490	75	125	455	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1845	1845	1900	1845	1845	1845	1845	1900	1845	1845	1845
Adj Flow Rate, veh/h	22	72	303	28	39	56	270	544	83	139	506	33
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	94	307	344	47	66	98	300	599	91	156	555	472
Arrive On Green	0.22	0.22	0.22	0.06	0.06	0.06	0.17	0.38	0.38	0.09	0.30	0.30
Sat Flow, veh/h	427	1397	1568	755	1052	1568	1757	1564	239	1757	1845	1568
Grp Volume(v), veh/h	94	0	303	67	0	56	270	0	627	139	506	33
Grp Sat Flow(s),veh/h/ln	1823	0	1568	1807	0	1568	1757	0	1803	1757	1845	1568
Q Serve(g_s), s	3.1	0.0	13.7	2.6	0.0	2.5	11.0	0.0	24.1	5.7	19.3	1.1
Cycle Q Clear(g_c), s	3.1	0.0	13.7	2.6	0.0	2.5	11.0	0.0	24.1	5.7	19.3	1.1
Prop In Lane	0.23		1.00	0.42		1.00	1.00		0.13	1.00		1.00
Lane Grp Cap(c), veh/h	400	0	344	113	0	98	300	0	690	156	555	472
V/C Ratio(X)	0.23	0.00	0.88	0.59	0.00	0.57	0.90	0.00	0.91	0.89	0.91	0.07
Avail Cap(c_a), veh/h	448	0	386	444	0	386	300	0	727	156	592	503
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.5	0.0	27.6	33.4	0.0	33.3	29.7	0.0	21.4	33.0	24.6	18.3
Incr Delay (d2), s/veh	0.3	0.0	18.9	4.8	0.0	5.1	28.0	0.0	14.9	42.1	17.8	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	7.7	1.5	0.0	1.2	7.7	0.0	14.7	4.6	12.6	0.5
LnGrp Delay(d),s/veh	23.8	0.0	46.5	38.2	0.0	38.4	57.8	0.0	36.3	75.1	42.4	18.3
LnGrp LOS	C		D	D		D	E		D	E	D	B
Approach Vol, veh/h		397			123			897			678	
Approach Delay, s/veh		41.1			38.3			42.7			48.0	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.0	32.5		20.6	17.0	26.5		9.1
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	6.5	29.5		18.0	12.5	23.5		18.0
Max Q Clear Time (g_c+I1), s	7.7	26.1		15.7	13.0	21.3		4.6
Green Ext Time (p_c), s	0.0	1.3		0.4	0.0	0.7		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	43.9
HCM 2010 LOS	D

Intersection: 7: SR 49/20 SB On Ramp/Joerschke Dr & Dorsey Dr

Movement	EB	EB	EB	B26	B26	WB	WB	WB	SB	SB
Directions Served	T	T	R	T	T	L	T	T	LT	R
Maximum Queue (ft)	198	332	200	17	192	254	168	172	307	90
Average Queue (ft)	98	199	164	1	19	172	93	79	162	45
95th Queue (ft)	174	323	241	13	104	281	150	144	269	76
Link Distance (ft)	237	237		556	556	226	226	226	1014	1014
Upstream Blk Time (%)	0	8				5				
Queuing Penalty (veh)	0	37				17				
Storage Bay Dist (ft)			155							
Storage Blk Time (%)		18	7							
Queuing Penalty (veh)		77	22							

Intersection: 8: SR 49/20 NB Ramps & Dorsey Dr

Movement	EB	EB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	TR	L	LT	R
Maximum Queue (ft)	225	220	194	386	323	145	184	199
Average Queue (ft)	140	102	150	141	109	46	104	96
95th Queue (ft)	211	197	225	331	228	116	160	162
Link Distance (ft)	226	226		502	502		883	
Upstream Blk Time (%)	1	0		0	0			
Queuing Penalty (veh)	3	1		0	0			
Storage Bay Dist (ft)			140			205		190
Storage Blk Time (%)			22	1			0	0
Queuing Penalty (veh)			58	1			0	1

Zone Summary

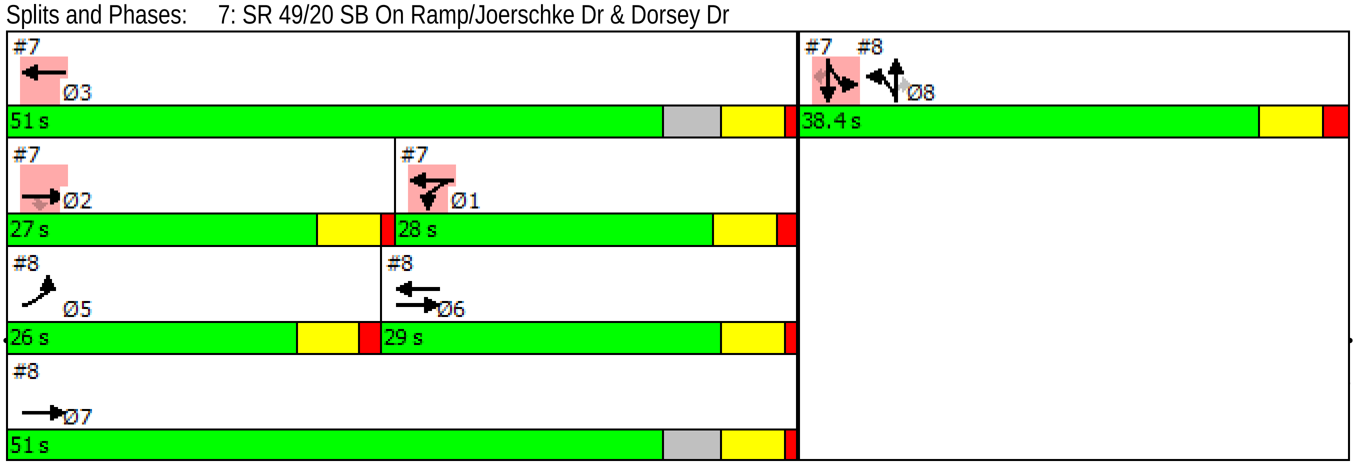
Zone wide Queuing Penalty: 219

Lane Group	EBT	EBR	WBL	WBT	SBT	SBR	Ø3	Ø5	Ø6	Ø7
Lane Configurations										
Traffic Volume (vph)	625	420	430	635	75	150				
Future Volume (vph)	625	420	430	635	75	150				
Turn Type	NA	Perm	Prot	NA	NA	Perm				
Protected Phases	2		1	3 1	8		3	5	6	7
Permitted Phases		2				8				
Detector Phase	2	2	1	3 1	8	8				
Switch Phase										
Minimum Initial (s)	7.0	7.0	7.0		7.0	7.0	1.0	7.0	1.0	7.0
Minimum Split (s)	12.4	12.4	12.9		13.4	13.4	6.4	12.9	6.4	12.4
Total Split (s)	27.0	27.0	28.0		38.4	38.4	51.0	26.0	29.0	51.0
Total Split (%)	28.9%	28.9%	30.0%		41.1%	41.1%	55%	28%	31%	55%
Yellow Time (s)	4.4	4.4	4.4		4.4	4.4	4.4	4.4	4.4	4.4
All-Red Time (s)	1.0	1.0	1.5		2.0	2.0	1.0	1.5	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0				
Total Lost Time (s)	5.4	5.4	5.9		6.4	6.4				
Lead/Lag	Lead	Lead	Lag					Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes					Yes	Yes	
Recall Mode	None	None	None		None	None	None	None	None	None
Act Effct Green (s)	20.6	20.6	22.4	48.9	19.2	19.2				
Actuated g/C Ratio	0.26	0.26	0.28	0.61	0.24	0.24				
v/c Ratio	0.78	0.63	0.99	0.33	0.79	0.33				
Control Delay	35.9	7.6	52.5	11.6	42.4	5.8				
Queue Delay	1.0	0.0	0.0	0.5	0.0	0.0				
Total Delay	36.8	7.6	52.5	12.1	42.5	5.8				
LOS	D	A	D	B	D	A				
Approach Delay	25.1			28.4	30.3					
Approach LOS	C			C	C					

Intersection Summary

Cycle Length: 93.4
Actuated Cycle Length: 80.1
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 27.4 Intersection LOS: C
Intersection Capacity Utilization 88.5% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 7: SR 49/20 SB On Ramp/Joerschke Dr & Dorsey Dr

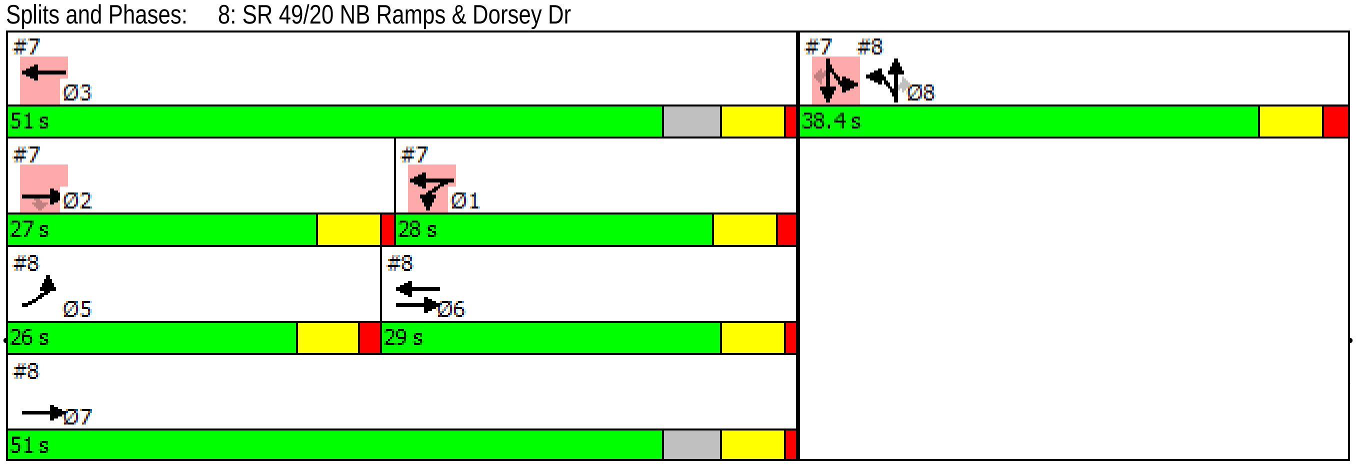


Lane Group	EBL	EBT	WBT	NBL	NBT	NBR	Ø1	Ø2	Ø3	Ø7
Lane Configurations										
Traffic Volume (vph)	255	594	779	285	0	312				
Future Volume (vph)	255	594	779	285	0	312				
Turn Type	Prot	NA	NA	Split	NA	Perm				
Protected Phases	5	7 6	6	8	8		1	2	3	7
Permitted Phases						8				
Detector Phase	5	7 6	6	8	8	8				
Switch Phase										
Minimum Initial (s)	7.0		1.0	7.0	7.0	7.0	7.0	7.0	1.0	7.0
Minimum Split (s)	12.9		6.4	13.4	13.4	13.4	12.9	12.4	6.4	12.4
Total Split (s)	26.0		29.0	38.4	38.4	38.4	28.0	27.0	51.0	51.0
Total Split (%)	27.8%		31.0%	41.1%	41.1%	41.1%	30%	29%	55%	55%
Yellow Time (s)	4.4		4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
All-Red Time (s)	1.5		1.0	2.0	2.0	2.0	1.5	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0				
Total Lost Time (s)	5.9		5.4	6.4	6.4	6.4				
Lead/Lag	Lead		Lag				Lag	Lead		
Lead-Lag Optimize?	Yes		Yes				Yes	Yes		
Recall Mode	None		None	None	None	None	None	None	None	None
Act Effct Green (s)	15.1	48.9	27.9	19.2	19.2	19.2				
Actuated g/C Ratio	0.19	0.61	0.35	0.24	0.24	0.24				
v/c Ratio	0.81	0.55	0.54	0.38	0.38	0.59				
Control Delay	40.6	10.4	23.8	27.7	27.7	12.6				
Queue Delay	0.2	7.3	0.1	0.0	0.0	0.0				
Total Delay	40.8	17.7	23.9	27.7	27.7	12.6				
LOS	D	B	C	C	C	B				
Approach Delay		24.6	23.9		19.8					
Approach LOS		C	C		B					

Intersection Summary

Cycle Length: 93.4
Actuated Cycle Length: 80.1
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 23.1 — Intersection LOS: C
Intersection Capacity Utilization 88.5% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 8: SR 49/20 NB Ramps & Dorsey Dr



Appendix B: Sidra Outputs

LANE SUMMARY

Site: 101 [Existing AM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB													
Lane 1[d]	165	3.0	756	0.219	100	7.2	LOS A	1.3	32.9	Full	1035	0.0	0.0
Approach	165	3.0		0.219		7.2	LOS A	1.3	32.9				
East: Idaho Maryland Road													
Lane 1	204	3.0	950	0.214	100	5.9	LOS A	1.3	32.4	Short	65	0.0	NA
Lane 2[d]	268	3.0	1072	0.250	100	5.7	LOS A	1.6	40.0	Full	600	0.0	0.0
Approach	472	3.0		0.250		5.8	LOS A	1.6	40.0				
North: E Main St													
Lane 1[d]	260	3.0	953	0.273	100	6.6	LOS A	1.3	32.6	Full	225	0.0	0.0
Lane 2	163	3.0	1094	0.149	100	4.6	LOS A	0.7	17.9	Short	60	0.0	NA
Approach	423	3.0		0.273		5.8	LOS A	1.3	32.6				
West: E Main St													
Lane 1[d]	383	3.0	734	0.522	100	12.7	LOS B	3.6	91.8	Full	290	0.0	0.0
Approach	383	3.0		0.522		12.7	LOS B	3.6	91.8				
Intersection	1443	3.0		0.522		7.8	LOS A	3.6	91.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [Existing PM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	170	3.0	760	0.224	100	7.2	LOS A	1.3	34.4	Full	1035	0.0	0.0
Approach	170	3.0		0.224		7.2	LOS A	1.3	34.4				
East: Idaho Maryland Road													
Lane 1	353	3.0	946	0.373	100	7.9	LOS A	2.5	64.4	Short	65	0.0	NA
Lane 2[d]	363	3.0	1024	0.354	100	7.2	LOS A	2.4	61.5	Full	600	0.0	0.0
Approach	716	3.0		0.373		7.6	LOS A	2.5	64.4				
North: E Main St													
Lane 1[d]	316	3.0	788	0.401	100	9.6	LOS A	2.0	52.2	Full	225	0.0	0.0
Lane 2	280	3.0	962	0.291	100	6.7	LOS A	1.6	40.4	Short	60	0.0	NA
Approach	596	3.0		0.401		8.2	LOS A	2.0	52.2				
West: E Main St													
Lane 1[d]	372	3.0	602	0.619	100	18.3	LOS B	5.1	131.2	Full	290	0.0	0.0
Approach	372	3.0		0.619		18.3	LOS B	5.1	131.2				
Intersection	1854	3.0		0.619		9.9	LOS A	5.1	131.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [E+P AM]

New Site
Roundabout

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB													
Lane 1[d]	175	3.0	750	0.234	100	7.4	LOS A	1.4	35.6	Full	1035	0.0	0.0
Approach	175	3.0		0.234		7.4	LOS A	1.4	35.6				
East: Idaho Maryland Road													
Lane 1	204	3.0	942	0.216	100	6.0	LOS A	1.3	32.6	Short	65	0.0	NA
Lane 2[d]	268	3.0	1064	0.252	100	5.8	LOS A	1.6	40.2	Full	600	0.0	0.0
Approach	472	3.0		0.252		5.9	LOS A	1.6	40.2				
North: E Main St													
Lane 1[d]	263	3.0	949	0.277	100	6.6	LOS A	1.3	33.0	Full	225	0.0	0.0
Lane 2	163	3.0	1090	0.150	100	4.6	LOS A	0.7	18.0	Short	60	0.0	NA
Approach	426	3.0		0.277		5.9	LOS A	1.3	33.0				
West: E Main St													
Lane 1[d]	388	3.0	732	0.530	100	13.0	LOS B	4.3	109.7	Full	290	0.0	0.0
Approach	388	3.0		0.530		13.0	LOS B	4.3	109.7				
Intersection	1460	3.0		0.530		7.9	LOS A	4.3	109.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [E+P PM]

New Site
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	184	3.0	753	0.244	100	7.5	LOS A	1.5	38.0	Full	1035	0.0	0.0
Approach	184	3.0		0.244		7.5	LOS A	1.5	38.0				
East: Idaho Maryland Road													
Lane 1	353	3.0	934	0.378	100	8.1	LOS A	2.5	65.1	Short	65	0.0	NA
Lane 2[d]	363	3.0	1014	0.358	100	7.3	LOS A	2.4	62.1	Full	600	0.0	0.0
Approach	716	3.0		0.378		7.7	LOS A	2.5	65.1				
North: E Main St													
Lane 1[d]	319	3.0	784	0.407	100	9.7	LOS A	2.2	57.3	Full	225	0.0	0.0
Lane 2	280	3.0	956	0.293	100	6.8	LOS A	1.6	40.7	Short	60	0.0	NA
Approach	599	3.0		0.407		8.4	LOS A	2.2	57.3				
West: E Main St													
Lane 1[d]	378	3.0	600	0.630	100	18.8	LOS B	6.1	156.9	Full	290	0.0	0.0
Approach	378	3.0		0.630		18.8	LOS B	6.1	156.9				
Intersection	1877	3.0		0.630		10.1	LOS B	6.1	156.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Organisation: GHD | Processed: Tuesday, March 13, 2018 11:53:38 AM
Project: K:\PRJ\2147\T2147\Revised Site Plan\Sidra\Intersection 15 Reduced.sip7.sip7

LANE SUMMARY

Site: 101 [Cumulative AM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB													
Lane 1[d]	182	3.0	716	0.254	100	8.0	LOS A	1.6	40.4	Full	1035	0.0	0.0
Approach	182	3.0		0.254		8.0	LOS A	1.6	40.4				
East: Idaho Maryland Road													
Lane 1	233	3.0	938	0.248	100	6.3	LOS A	1.5	39.2	Short	65	0.0	NA
Lane 2[d]	301	3.0	1075	0.280	100	6.0	LOS A	1.8	47.0	Full	600	0.0	0.0
Approach	534	3.0		0.280		6.2	LOS A	1.8	47.0				
North: E Main St													
Lane 1[d]	284	3.0	953	0.298	100	6.9	LOS A	1.4	36.2	Full	225	0.0	0.0
Lane 2	159	3.0	1104	0.144	100	4.5	LOS A	0.7	17.5	Short	60	0.0	NA
Approach	443	3.0		0.298		6.0	LOS A	1.4	36.2				
West: E Main St													
Lane 1[d]	455	3.0	730	0.623	100	15.8	LOS B	5.2	134.4	Full	290	0.0	0.0
Approach	455	3.0		0.623		15.8	LOS B	5.2	134.4				
Intersection	1614	3.0		0.623		9.1	LOS A	5.2	134.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [Cumulative PM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	218	3.0	696	0.313	100	9.1	LOS A	2.1	52.5	Full	1035	0.0	0.0
Approach	218	3.0		0.313		9.1	LOS A	2.1	52.5				
East: Idaho Maryland Road													
Lane 1	399	3.0	893	0.447	100	9.5	LOS A	3.2	81.8	Short	65	0.0	NA
Lane 2[d]	457	3.0	1013	0.452	100	8.7	LOS A	3.4	86.5	Full	600	0.0	0.0
Approach	856	3.0		0.452		9.1	LOS A	3.4	86.5				
North: E Main St													
Lane 1[d]	356	3.0	756	0.471	100	11.3	LOS B	2.7	68.0	Full	225	0.0	0.0
Lane 2	293	3.0	926	0.316	100	7.3	LOS A	1.8	46.6	Short	60	0.0	NA
Approach	649	3.0		0.471		9.5	LOS A	2.7	68.0				
West: E Main St													
Lane 1[d]	452	3.0	570	0.793	100	30.2	LOS C	9.4	241.2	Full	290	0.0	0.0
Approach	452	3.0		0.793		30.2	LOS C	9.4	241.2				
Intersection	2176	3.0		0.793		13.6	LOS B	9.4	241.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [C+P AM]

New Site
Roundabout

Lane Use and Performance	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB													
Lane 1[d]	191	3.0	710	0.269	100	8.3	LOS A	1.7	43.2	Full	1035	0.0	0.0
Approach	191	3.0		0.269		8.3	LOS A	1.7	43.2				
East: Idaho Maryland Road													
Lane 1	233	3.0	930	0.250	100	6.4	LOS A	1.5	39.5	Short	65	0.0	NA
Lane 2[d]	301	3.0	1068	0.282	100	6.1	LOS A	1.8	47.3	Full	600	0.0	0.0
Approach	534	3.0		0.282		6.2	LOS A	1.8	47.3				
North: E Main St													
Lane 1[d]	286	3.0	950	0.301	100	6.9	LOS A	1.4	36.6	Full	225	0.0	0.0
Lane 2	159	3.0	1100	0.145	100	4.6	LOS A	0.7	17.6	Short	60	0.0	NA
Approach	445	3.0		0.301		6.1	LOS A	1.4	36.6				
West: E Main St													
Lane 1[d]	459	3.0	728	0.630	100	16.1	LOS B	6.6	169.4	Full	290	0.0	0.0
Approach	459	3.0		0.630		16.1	LOS B	6.6	169.4				
Intersection	1630	3.0		0.630		9.2	LOS A	6.6	169.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [C+P PM]

New Site
Roundabout

Lane Use and Performance													
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	232	3.0	687	0.337	100	9.6	LOS A	2.2	57.4	Full	1035	0.0	0.0
Approach	232	3.0		0.337		9.6	LOS A	2.2	57.4				
East: Idaho Maryland Road													
Lane 1	399	3.0	882	0.452	100	9.7	LOS A	3.2	82.8	Short	65	0.0	NA
Lane 2[d]	457	3.0	1002	0.457	100	8.9	LOS A	3.4	87.4	Full	600	0.0	0.0
Approach	856	3.0		0.457		9.2	LOS A	3.4	87.4				
North: E Main St													
Lane 1[d]	362	3.0	752	0.481	100	11.6	LOS B	3.1	80.3	Full	225	0.0	0.0
Lane 2	293	3.0	920	0.318	100	7.3	LOS A	1.8	47.0	Short	60	0.0	NA
Approach	654	3.0		0.481		9.7	LOS A	3.1	80.3				
West: E Main St													
Lane 1[d]	457	3.0	566	0.808	100	31.8	LOS C	11.7	300.0	Full	290	0.0	6.0
Approach	457	3.0		0.808		31.8	LOS C	11.7	300.0				
Intersection	2200	3.0		0.808		14.1	LOS B	11.7	300.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [Int 7 Only Dorsey Drive & Joerschke Dr/SR 49/20 SB On Ramp]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
East: Dorsey Drive													
Lane 1[d]	1158	3.0	1700	0.681	100	9.9	LOS A	0.0	0.0	Full	165	0.0	0.0
Approach	1158	3.0		0.681		9.9	LOS A	0.0	0.0				
North: Joerschke Dr													
Lane 1[d]	327	3.0	680	0.481	100	12.5	LOS B	4.6	118.7	Full	425	0.0	0.0
Lane 2	163	3.0	491	0.332	100	12.6	LOS B	2.2	55.8	Full	425	0.0	0.0
Approach	490	3.0		0.481		12.5	LOS B	4.6	118.7				
West: Dorsey Drive													
Lane 1[d]	679	3.0	862	0.788	100	21.7	LOS C	12.7	324.3	Full	850	0.0	0.0
Lane 2	457	3.0	660	0.692	100	20.3	LOS C	7.8	200.1	Full	850	0.0	0.0
Approach	1136	3.0		0.788		21.1	LOS C	12.7	324.3				
Intersection	2784	3.0		0.788		14.9	LOS B	12.7	324.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

Organisation: GHD SERVICES PTY LTD | Processed: Thursday, May 24, 2018 11:21:14 AM
Project: K:\PRJ\2147\T2147\Synchro - Revised Site Plan\Sidra\Intersection 7 & 17 concepts.sip7

Appendix C: HCS Outputs

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	991	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	269	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	555	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	555	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	9.3	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	772	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	219	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	87	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	772	219	87	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	210	62	25	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV           0.917       1.000       1.000
Driver population factor, fP            1.00        1.00        1.00
Flow rate, vp                           915         249         99         pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  915    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1164          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 915                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual       Max Desirable        Violation?
     v                1164         4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   11.9    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.305
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	685	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	87	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	219	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	685	87	219	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	186	25	62	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV           0.917       1.000       1.000
Driver population factor, fP            1.00        1.00        1.00
Flow rate, vp                           812         99          249       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  812    pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     911           4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 812                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                911           4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   9.7     pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  A

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.299
                                              S
Space mean speed in ramp influence area,     S  = 54.6    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	567	118	629	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.88	0.82	
Peak 15-min volume, v15	154	36	179	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	672	144	715	0	pc/h

Volume ratio, VR 0.561

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	859	lc/h
Weaving lane changes, LCW	1160	lc/h
Non-weaving vehicle index, INW	222	
Non-weaving lane change, LCNW	157	lc/h
Total lane changes, LCALL	1317	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.260

Average weaving speed, SW	50.7	mi/h
Average non-weaving speed, SNW	51.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	51.0	mi/h
Weaving segment density, D	10.0+	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.358	
Weaving segment flow rate, v	1405	veh/h
Weaving segment capacity, cW	3924	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	8549	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1730	c
		Maximum	Analyzed	
v/c ratio		1.00	0.358	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1145	51	616	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	311	14	188	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1357	56	751	0	pc/h

Volume ratio, VR 0.373

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	807	lc/h
Weaving lane changes, LCW	1160	lc/h
Non-weaving vehicle index, INW	570	
Non-weaving lane change, LCNW	461	lc/h
Total lane changes, LCALL	1621	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.254

Average weaving speed, SW	50.9	mi/h
Average non-weaving speed, SNW	50.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.8	mi/h
Weaving segment density, D	14.2	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.376	
Weaving segment flow rate, v	1986	veh/h
Weaving segment capacity, cW	5282	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6379	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1919	c
		Maximum	Analyzed	
v/c ratio		1.00	0.376	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1140	621	508	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	310	176	140	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1351	706	558	0	pc/h

Volume ratio, VR 0.483

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1264	lc/h
Weaving lane changes, LCW	1546	lc/h
Non-weaving vehicle index, INW	405	
Non-weaving lane change, LCNW	243	lc/h
Total lane changes, LCALL	1789	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.358

Average weaving speed, SW	48.1	mi/h
Average non-weaving speed, SNW	46.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.4	mi/h
Weaving segment density, D	18.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.527	
Weaving segment flow rate, v	2400	veh/h
Weaving segment capacity, cW	4555	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7633	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1793	c
		Maximum	Analyzed	
v/c ratio		1.00	0.527	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1648	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	448	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	976	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	976	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1625	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	442	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	963	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	963	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1625	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1625		385			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	442		101			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1925	405	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1925 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1925	4600	No
$v_{FO} = v_F - v_R$	1520	4600	No
v_R	405	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1925 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1925	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 14.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.464

Space mean speed in ramp influence area, S_R = 51.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 51.6 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

```
Phone:                                       Fax:
E-mail:

_________________________________Merge Analysis________________________________

Analyst:                 ZS
Agency/Co.:              Omni Means, a GHD Company
Date performed:          4/24/2018
Analysis time period:    AM Peak Hour
Freeway/Dir of Travel:   SR 49/20 SB-WB
Junction:                Brunswick Loop On Ramp
Jurisdiction:            Caltrans
Analysis Year:           Existing
Description:  Grass Valley Marketplace EIR

__________________________________Freeway Data_________________________________

Type of analysis                              Merge
Number of lanes in freeway                    2
Free-flow speed on freeway                    60.0           mph
Volume on freeway                             1240           vph

__________________________________On Ramp Data_________________________________

Side of freeway                               Right
Number of lanes in ramp                       1
Free-flow speed on ramp                       35.0           mph
Volume on ramp                                208            vph
Length of first accel/decel lane              420            ft
Length of second accel/decel lane                            ft

_________________________Adjacent Ramp Data (if one exists)____________________

Does adjacent ramp exist?                     No
Volume on adjacent Ramp                                      vph
Position of adjacent Ramp
Type of adjacent Ramp
Distance to adjacent Ramp                                    ft

____________________Conversion to pc/h Under Base Conditions___________________

Junction Components                      Freeway     Ramp        Adjacent
                                                                 Ramp
Volume, V (vph)                          1240        208                  vph
Peak-hour factor, PHF                    0.92        0.95
Peak 15-min volume, v15                  337         55                   v
Trucks and buses                         6           0                    %
Recreational vehicles                    0           0                    %
Terrain type:                            Rolling     Level
     Grade                                      %           %           %
     Length                                    mi          mi          mi
Trucks and buses PCE, ET                 2.5         1.5
Recreational vehicle PCE, ER             2.0         1.2
```

```
Heavy vehicle adjustment, fHV           0.917       1.000
Driver population factor, fP            1.00        1.00
Flow rate, vp                           1469        219                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1469   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1688          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1469                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1688          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.9    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.313
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1256	175	192	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	334	47	51	0	
Trucks and buses	0	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	1.000	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1336	186	204	0	pc/h

Volume ratio, VR 0.226

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	334	lc/h
Total lane changes, LCALL	438	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.104

Average weaving speed, SW	55.8	mi/h
Average non-weaving speed, SNW	57.2	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.9	mi/h
Weaving segment density, D	10.1	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.285	
Weaving segment flow rate, v	1726	veh/h
Weaving segment capacity, cW	6066	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4803	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2022	c
		Maximum	Analyzed	
v/c ratio		1.00	0.285	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1297	206	134	0	veh/h
Peak hour factor, PHF	0.92	0.83	0.81	0.94	
Peak 15-min volume, v15	352	62	41	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1537	248	165	0	pc/h
Volume ratio, VR		0.212			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	413	lc/h
Weaving lane changes, LCW	853	lc/h
Non-weaving vehicle index, INW	927	
Non-weaving lane change, LCNW	828	lc/h
Total lane changes, LCALL	1681	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.196

Average weaving speed, SW	52.6	mi/h
Average non-weaving speed, SNW	53.9	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	53.6	mi/h
Weaving segment density, D	12.1	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.310	
Weaving segment flow rate, v	1789	veh/h
Weaving segment capacity, cW	5772	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4657	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2097	c
		Maximum	Analyzed	
v/c ratio		1.00	0.310	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1094	317	409	0	veh/h
Peak hour factor, PHF	0.92	0.81	0.81	0.94	
Peak 15-min volume, v15	297	98	126	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1225	391	505	0	pc/h

Volume ratio, VR 0.422

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	896	lc/h
Weaving lane changes, LCW	987	lc/h
Non-weaving vehicle index, INW	102	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	987	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.448

Average weaving speed, SW	46.1	mi/h
Average non-weaving speed, SNW	50.2	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.4	mi/h
Weaving segment density, D	14.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.393	
Weaving segment flow rate, v	2060	veh/h
Weaving segment capacity, cW	5246	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6934	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1801	c
		Maximum	Analyzed	
v/c ratio		1.00	0.393	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1411	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	383	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	836	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	836	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1762	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	479	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	986	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	986	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1365	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	397	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	138	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1365	397	138	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	371	113	39	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          1617        451         157       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1617   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     2068          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1617                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2068          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   18.9    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation_________________________________

Intermediate speed variable,                 M  = 0.324
                                              S
Space mean speed in ramp influence area,     S  = 54.2    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.2    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1227	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	138	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	397	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1227	138	397	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	333	39	113	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV           0.917       1.000       1.000
Driver population factor, fP            1.00        1.00        1.00
Flow rate, vp                           1454        157         451       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1454   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1611          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1454                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1611          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.1    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.309
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	989	238	614	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.92	0.82	
Peak 15-min volume, v15	269	73	167	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1172	290	667	0	pc/h

Volume ratio, VR 0.450

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	957	lc/h
Weaving lane changes, LCW	1258	lc/h
Non-weaving vehicle index, INW	387	
Non-weaving lane change, LCNW	260	lc/h
Total lane changes, LCALL	1518	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.291

Average weaving speed, SW	49.8	mi/h
Average non-weaving speed, SNW	49.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.8	mi/h
Weaving segment density, D	14.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.399	
Weaving segment flow rate, v	1954	veh/h
Weaving segment capacity, cW	4898	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7242	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1830	c
		Maximum	Analyzed	
v/c ratio		1.00	0.399	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1508	95	348	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	410	26	106	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1787	104	424	0	pc/h

Volume ratio, VR 0.228

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	528	lc/h
Weaving lane changes, LCW	881	lc/h
Non-weaving vehicle index, INW	751	
Non-weaving lane change, LCNW	549	lc/h
Total lane changes, LCALL	1430	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.230

Average weaving speed, SW	51.6	mi/h
Average non-weaving speed, SNW	52.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	52.3	mi/h
Weaving segment density, D	14.8	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.379	
Weaving segment flow rate, v	2124	veh/h
Weaving segment capacity, cW	5609	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4825	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2038	c
		Maximum	Analyzed	
v/c ratio		1.00	0.379	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1241	615	385	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	337	175	106	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1470	699	423	0	pc/h

Volume ratio, VR 0.433

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1122	lc/h
Weaving lane changes, LCW	1404	lc/h
Non-weaving vehicle index, INW	441	
Non-weaving lane change, LCNW	267	lc/h
Total lane changes, LCALL	1671	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.339

Average weaving speed, SW	48.6	mi/h
Average non-weaving speed, SNW	47.8	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.1	mi/h
Weaving segment density, D	18.0	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.470	
Weaving segment flow rate, v	2378	veh/h
Weaving segment capacity, cW	5056	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7052	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1837	c
		Maximum	Analyzed	
v/c ratio		1.00	0.470	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1626	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	442	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	963	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	963	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHd Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1242	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	337	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	736	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	736	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	12.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1242	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	521	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1242		521			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	337		137			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1472	548	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1472 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1472	4600	No
$v_{FO} = v_F - v_R$	924	4600	No
v_R	548	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1472 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1472	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 10.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.477	
Space mean speed in ramp influence area,	S_R = 51.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 51.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB-WB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	721	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	411	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	721	411		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	196	108		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          854         433                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  854    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1287          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 854                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1287          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   12.7    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.306
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	989	359	143	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	263	95	38	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1147	382	152	0	pc/h

Volume ratio, VR 0.318

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	295	lc/h
Total lane changes, LCALL	399	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.096

Average weaving speed, SW	56.0	mi/h
Average non-weaving speed, SNW	57.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.9	mi/h
Weaving segment density, D	9.8	pc/mi/ln
Level of service, LOS	A	
Weaving segment v/c ratio	0.288	
Weaving segment flow rate, v	1543	veh/h
Weaving segment capacity, cW	5361	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5774	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1948	c
		Maximum	Analyzed	
v/c ratio		1.00	0.288	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1188	560	160	0	veh/h
Peak hour factor, PHF	0.92	0.89	0.94	0.94	
Peak 15-min volume, v15	323	157	43	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1408	629	170	0	pc/h

Volume ratio, VR 0.362

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	799	lc/h
Weaving lane changes, LCW	1239	lc/h
Non-weaving vehicle index, INW	849	
Non-weaving lane change, LCNW	802	lc/h
Total lane changes, LCALL	2041	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.229

Average weaving speed, SW	51.6	mi/h
Average non-weaving speed, SNW	50.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	51.0	mi/h
Weaving segment density, D	14.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.372	
Weaving segment flow rate, v	2025	veh/h
Weaving segment capacity, cW	5436	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6259	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1975	c
		Maximum	Analyzed	
v/c ratio		1.00	0.372	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1241	570	507	0	veh/h
Peak hour factor, PHF	0.92	0.94	0.92	0.94	
Peak 15-min volume, v15	337	152	138	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1389	606	551	0	pc/h
Volume ratio, VR		0.454			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1157	lc/h
Weaving lane changes, LCW	1248	lc/h
Non-weaving vehicle index, INW	115	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1248	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.539

Average weaving speed, SW	44.2	mi/h
Average non-weaving speed, SNW	47.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.0	mi/h
Weaving segment density, D	18.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.482	
Weaving segment flow rate, v	2472	veh/h
Weaving segment capacity, cW	5127	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7299	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1773	c
		Maximum	Analyzed	
v/c ratio		1.00	0.482	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1811	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	492	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1073	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1073	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	991	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	269	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	555	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	555	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	9.3	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing + Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	772	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	219	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	87	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	772	219	87	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	210	62	25	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV           0.917       1.000       1.000
Driver population factor, fP            1.00        1.00        1.00
Flow rate, vp                           915         249         99         pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  915    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1164          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 915                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1164          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   11.9    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.305
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	685	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	87	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	219	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	685	87	219	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	186	25	62	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV            0.917       1.000       1.000
Driver population factor, fP             1.00        1.00        1.00
Flow rate, vp                            812         99          249       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  812    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     911           4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 812                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area______________________
                      Actual        Max Desirable        Violation?
     v                911           4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   9.7     pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  A

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.299
                                              S
Space mean speed in ramp influence area,     S  = 54.6    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	520	165	652	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.88	0.82	
Peak 15-min volume, v15	141	50	185	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	616	201	741	0	pc/h

Volume ratio, VR 0.605

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	942	lc/h
Weaving lane changes, LCW	1243	lc/h
Non-weaving vehicle index, INW	203	
Non-weaving lane change, LCNW	145	lc/h
Total lane changes, LCALL	1388	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.272

Average weaving speed, SW	50.4	mi/h
Average non-weaving speed, SNW	50.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.5	mi/h
Weaving segment density, D	10.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.392	
Weaving segment flow rate, v	1430	veh/h
Weaving segment capacity, cW	3642	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	9075	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1690	c
		Maximum	Analyzed	
v/c ratio		1.00	0.392	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1134	68	680	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	308	19	207	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1344	75	829	0	pc/h

Volume ratio, VR	0.402

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	904	lc/h
Weaving lane changes, LCW	1257	lc/h
Non-weaving vehicle index, INW	564	
Non-weaving lane change, LCNW	458	lc/h
Total lane changes, LCALL	1715	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.265

Average weaving speed, SW	50.6	mi/h
Average non-weaving speed, SNW	49.9	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.2	mi/h
Weaving segment density, D	14.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.396	
Weaving segment flow rate, v	2063	veh/h
Weaving segment capacity, cW	5213	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6705	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1894	c
		Maximum	Analyzed	
v/c ratio		1.00	0.396	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1185	629	514	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	322	179	141	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1404	715	565	0	pc/h
Volume ratio, VR		0.477			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1280	lc/h
Weaving lane changes, LCW	1562	lc/h
Non-weaving vehicle index, INW	421	
Non-weaving lane change, LCNW	253	lc/h
Total lane changes, LCALL	1815	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.362

Average weaving speed, SW	48.0	mi/h
Average non-weaving speed, SNW	46.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.2	mi/h
Weaving segment density, D	18.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.533	
Weaving segment flow rate, v	2463	veh/h
Weaving segment capacity, cW	4617	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7558	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1798	c
		Maximum	Analyzed	
v/c ratio		1.00	0.533	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1699	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	462	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1006	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1006	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.8	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1625	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	442	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	963	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	963	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1625	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1625		385			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	442		101			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1925	405	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1925 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1925	4600	No
$v_{FO} = v_F - v_R$	1520	4600	No
v_R	405	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1925 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1925	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 14.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.464	
Space mean speed in ramp influence area,	S_R = 51.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 51.6	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1240	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	224	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1240		224			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	337		59			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1469        236                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1469   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1705          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1469                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1705          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   16.0    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.313
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1239	187	225	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	330	50	60	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1437	199	239	0	pc/h

Volume ratio, VR 0.234

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	355	lc/h
Total lane changes, LCALL	459	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.108

Average weaving speed, SW	55.6	mi/h
Average non-weaving speed, SNW	57.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.7	mi/h
Weaving segment density, D	11.0	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.310	
Weaving segment flow rate, v	1721	veh/h
Weaving segment capacity, cW	5549	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4883	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2016	c
		Maximum	Analyzed	
v/c ratio		1.00	0.310	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1284	255	142	0	veh/h
Peak hour factor, PHF	0.92	0.83	0.81	0.94	
Peak 15-min volume, v15	349	77	44	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1521	307	175	0	pc/h

Volume ratio, VR 0.241

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	482	lc/h
Weaving lane changes, LCW	922	lc/h
Non-weaving vehicle index, INW	917	
Non-weaving lane change, LCNW	825	lc/h
Total lane changes, LCALL	1747	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.202

Average weaving speed, SW	52.4	mi/h
Average non-weaving speed, SNW	53.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	53.1	mi/h
Weaving segment density, D	12.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.322	
Weaving segment flow rate, v	1838	veh/h
Weaving segment capacity, cW	5711	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4956	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2075	c
		Maximum	Analyzed	
v/c ratio		1.00	0.322	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1130	317	409	0	veh/h
Peak hour factor, PHF	0.92	0.81	0.81	0.94	
Peak 15-min volume, v15	307	98	126	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1265	391	505	0	pc/h
Volume ratio, VR		0.415			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	896	lc/h
Weaving lane changes, LCW	987	lc/h
Non-weaving vehicle index, INW	105	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	987	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.448

Average weaving speed, SW	46.1	mi/h
Average non-weaving speed, SNW	50.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.3	mi/h
Weaving segment density, D	14.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.398	
Weaving segment flow rate, v	2099	veh/h
Weaving segment capacity, cW	5266	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6846	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1808	c
		Maximum	Analyzed	
v/c ratio		1.00	0.398	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1447	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	393	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	857	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	857	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	14.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1762	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	479	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	986	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	986	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1365	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	397	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	138	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1365	397	138	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	371	113	39	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          1617        451         157       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1617   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     2068          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1617                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2068          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   18.9    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.324
                                              S
Space mean speed in ramp influence area,     S  = 54.2    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.2    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing + Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1227	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	138	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	397	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1227	138	397	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	333	39	113	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          1454        157         451       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1454   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     1611          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1454                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1611          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.1    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation________________________________

Intermediate speed variable,                 M  = 0.309
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	887	340	651	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.92	0.82	
Peak 15-min volume, v15	241	104	177	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1051	415	708	0	pc/h

Volume ratio, VR 0.517

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1123	lc/h
Weaving lane changes, LCW	1424	lc/h
Non-weaving vehicle index, INW	347	
Non-weaving lane change, LCNW	235	lc/h
Total lane changes, LCALL	1659	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.313

Average weaving speed, SW	49.3	mi/h
Average non-weaving speed, SNW	48.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.9	mi/h
Weaving segment density, D	14.8	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.468	
Weaving segment flow rate, v	1995	veh/h
Weaving segment capacity, cW	4263	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	8021	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1771	c
		Maximum	Analyzed	
v/c ratio		1.00	0.468	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1419	119	450	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	386	33	137	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1681	131	549	0	pc/h

Volume ratio, VR 0.288

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	680	lc/h
Weaving lane changes, LCW	1033	lc/h
Non-weaving vehicle index, INW	706	
Non-weaving lane change, LCNW	527	lc/h
Total lane changes, LCALL	1560	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.246

Average weaving speed, SW	51.1	mi/h
Average non-weaving speed, SNW	51.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	51.3	mi/h
Weaving segment density, D	15.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.395	
Weaving segment flow rate, v	2167	veh/h
Weaving segment capacity, cW	5477	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5456	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1990	c
		Maximum	Analyzed	
v/c ratio		1.00	0.395	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1243	626	393	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	338	178	108	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1473	711	432	0	pc/h

Volume ratio, VR 0.437

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1143	lc/h
Weaving lane changes, LCW	1425	lc/h
Non-weaving vehicle index, INW	442	
Non-weaving lane change, LCNW	268	lc/h
Total lane changes, LCALL	1693	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.342

Average weaving speed, SW	48.5	mi/h
Average non-weaving speed, SNW	47.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.0	mi/h
Weaving segment density, D	18.2	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.476	
Weaving segment flow rate, v	2400	veh/h
Weaving segment capacity, cW	5039	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7099	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1833	c
		Maximum	Analyzed	
v/c ratio		1.00	0.476	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1687	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	458	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	999	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	999	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.6	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1242	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	337	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	736	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	736	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	12.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1242	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	521	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1242		521			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	337		137			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1472	548	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1472 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1472	4600	No
$v_{FO} = v_F - v_R$	924	4600	No
v_R	548	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1472 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1472	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 10.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.477	
Space mean speed in ramp influence area,	S_R = 51.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 51.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	721	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	432	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	721	432		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	196	114		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          854         455                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  854    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1309          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 854                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1309          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   12.8    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.306
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	948	375	205	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	252	100	55	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1099	399	218	0	pc/h
Volume ratio, VR		0.360			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	285	lc/h
Total lane changes, LCALL	389	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.094

Average weaving speed, SW	56.1	mi/h
Average non-weaving speed, SNW	57.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.8	mi/h
Weaving segment density, D	10.1+	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.299	
Weaving segment flow rate, v	1575	veh/h
Weaving segment capacity, cW	5265	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6232	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1913	c
		Maximum	Analyzed	
v/c ratio		1.00	0.299	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1150	665	173	0	veh/h
Peak hour factor, PHF	0.92	0.89	0.94	0.94	
Peak 15-min volume, v15	313	187	46	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1363	747	184	0	pc/h

Volume ratio, VR 0.406

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	931	lc/h
Weaving lane changes, LCW	1371	lc/h
Non-weaving vehicle index, INW	822	
Non-weaving lane change, LCNW	792	lc/h
Total lane changes, LCALL	2163	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.239

Average weaving speed, SW	51.3	mi/h
Average non-weaving speed, SNW	49.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.3	mi/h
Weaving segment density, D	15.2	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.395	
Weaving segment flow rate, v	2105	veh/h
Weaving segment capacity, cW	5334	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6747	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1938	c
		Maximum	Analyzed	
v/c ratio		1.00	0.395	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1308	570	507	0	veh/h
Peak hour factor, PHF	0.92	0.94	0.92	0.94	
Peak 15-min volume, v15	355	152	138	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1464	606	551	0	pc/h
Volume ratio, VR		0.441			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1157	lc/h
Weaving lane changes, LCW	1248	lc/h
Non-weaving vehicle index, INW	122	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1248	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.539

Average weaving speed, SW	44.2	mi/h
Average non-weaving speed, SNW	47.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.0	mi/h
Weaving segment density, D	19.0	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.489	
Weaving segment flow rate, v	2545	veh/h
Weaving segment capacity, cW	5199	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7150	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1785	c
		Maximum	Analyzed	
v/c ratio		1.00	0.489	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1878	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	510	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1113	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1113	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1083	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	294	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	606	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	606	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	10.1	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick On Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 No Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	823	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	260	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	100	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	823	260	100	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	224	74	28	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	975	295	114	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 975 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1270	4600	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 975 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1270	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 12.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.307	
Space mean speed in ramp influence area,	S_R = 54.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.5	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	723	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	260	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	723		100		260	vph
Peak-hour factor, PHF	0.92		0.88		0.88	
Peak 15-min volume, v15	196		28		74	v
Trucks and buses	6		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

```
Heavy vehicle adjustment, fHV          0.917        1.000        1.000
Driver population factor, fP           1.00         1.00         1.00
Flow rate, vp                          857          114          295       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =             (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  857    pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     971           4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 857                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                971           4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   10.2    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation________________________________

Intermediate speed variable,                 M  = 0.300
                                              S
Space mean speed in ramp influence area,     S  = 54.6    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	563	160	695	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.88	0.82	
Peak 15-min volume, v15	153	49	197	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	667	195	790	0	pc/h
Volume ratio, VR		0.596			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	985	lc/h
Weaving lane changes, LCW	1286	lc/h
Non-weaving vehicle index, INW	220	
Non-weaving lane change, LCNW	156	lc/h
Total lane changes, LCALL	1442	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.280

Average weaving speed, SW	50.2	mi/h
Average non-weaving speed, SNW	50.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.2	mi/h
Weaving segment density, D	11.0	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.410	
Weaving segment flow rate, v	1516	veh/h
Weaving segment capacity, cW	3693	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	8973	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1698	c
		Maximum	Analyzed	
v/c ratio		1.00	0.410	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1178	80	815	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	320	22	248	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1396	88	994	0	pc/h

Volume ratio, VR 0.437

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1082	lc/h
Weaving lane changes, LCW	1435	lc/h
Non-weaving vehicle index, INW	586	
Non-weaving lane change, LCNW	469	lc/h
Total lane changes, LCALL	1904	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.288

Average weaving speed, SW	49.9	mi/h
Average non-weaving speed, SNW	48.2	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.0	mi/h
Weaving segment density, D	16.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.451	
Weaving segment flow rate, v	2274	veh/h
Weaving segment capacity, cW	5043	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7095	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1864	c
		Maximum	Analyzed	
v/c ratio		1.00	0.451	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1263	730	605	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	343	207	166	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1496	830	665	0	pc/h
Volume ratio, VR		0.500			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1495	lc/h
Weaving lane changes, LCW	1777	lc/h
Non-weaving vehicle index, INW	449	
Non-weaving lane change, LCNW	272	lc/h
Total lane changes, LCALL	2049	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.398

Average weaving speed, SW	47.2	mi/h
Average non-weaving speed, SNW	44.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	45.8	mi/h
Weaving segment density, D	21.8	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.623	
Weaving segment flow rate, v	2745	veh/h
Weaving segment capacity, cW	4405	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7824	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1778	c
		Maximum	Analyzed	
v/c ratio		1.00	0.623	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1868	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	508	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1107	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1107	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.5	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1775	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	482	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1051	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1051	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.5	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: ZS
Agency/Co.: Omni Means,a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB/WB
Junction: Brunswick Off Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 No Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1775	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	465	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1775		465			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	482		122			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2103	489	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2103 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2103	4600	No
$v_{FO} = v_F - v_R$	1614	4600	No
v_R	489	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 2103 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2103	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 15.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D_S = 0.472	
Space mean speed in ramp influence area,	S_R = 51.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 51.5	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB-WB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 No Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1310	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	245	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1310	245		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	356	64		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1552        258                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1552   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1810          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1552                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1810          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   16.8    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.315
                                              S
Space mean speed in ramp influence area,     S  = 54.3    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.3    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1320	190	235	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	351	51	63	0	
Trucks and buses	0	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	1.000	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1404	202	250	0	pc/h
Volume ratio, VR		0.244			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	348	lc/h
Total lane changes, LCALL	452	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.106

Average weaving speed, SW	55.7	mi/h
Average non-weaving speed, SNW	57.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.7	mi/h
Weaving segment density, D	10.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.308	
Weaving segment flow rate, v	1856	veh/h
Weaving segment capacity, cW	6024	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4986	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2008	c
		Maximum	Analyzed	
v/c ratio		1.00	0.308	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1350	310	160	0	veh/h
Peak hour factor, PHF	0.92	0.83	0.81	0.94	
Peak 15-min volume, v15	367	93	49	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1599	373	198	0	pc/h
Volume ratio, VR		0.263			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	571	lc/h
Weaving lane changes, LCW	1011	lc/h
Non-weaving vehicle index, INW	964	
Non-weaving lane change, LCNW	841	lc/h
Total lane changes, LCALL	1852	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.212

Average weaving speed, SW	52.1	mi/h
Average non-weaving speed, SNW	52.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	52.3	mi/h
Weaving segment density, D	13.8	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.352	
Weaving segment flow rate, v	1991	veh/h
Weaving segment capacity, cW	5661	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5192	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2057	c
		Maximum	Analyzed	
v/c ratio		1.00	0.352	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1175	380	485	0	veh/h
Peak hour factor, PHF	0.92	0.81	0.81	0.94	
Peak 15-min volume, v15	319	117	150	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1315	469	599	0	pc/h
Volume ratio, VR		0.448			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1068	lc/h
Weaving lane changes, LCW	1159	lc/h
Non-weaving vehicle index, INW	109	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1159	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.508

Average weaving speed, SW	44.8	mi/h
Average non-weaving speed, SNW	48.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.8	mi/h
Weaving segment density, D	17.0	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.446	
Weaving segment flow rate, v	2314	veh/h
Weaving segment capacity, cW	5182	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7227	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1779	c
		Maximum	Analyzed	
v/c ratio		1.00	0.446	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1555	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	423	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	921	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	921	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	15.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1924	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	523	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1077	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1077	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.0-	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1414	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	170	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1414	510	170	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	384	145	48	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          1675        580         193       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1675   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     2255          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1675                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2255          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   20.3    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.330
                                              S
Space mean speed in ramp influence area,     S  = 54.1    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.1    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 No Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1244	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	170	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	510	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1244	170	510	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	338	48	145	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV           0.917       1.000       1.000
Driver population factor, fP            1.00        1.00        1.00
Flow rate, vp                           1474        193         580       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    1.000   Using Equation  0
                   FM
                  v   = v  (P   ) =  1474   pc/h
                   12   F    FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1667          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1474                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1667          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.6    pc/mi/ln
          R                    R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.310
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	964	280	675	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.92	0.82	
Peak 15-min volume, v15	262	85	183	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1142	341	734	0	pc/h

Volume ratio, VR 0.485

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1075	lc/h
Weaving lane changes, LCW	1376	lc/h
Non-weaving vehicle index, INW	377	
Non-weaving lane change, LCNW	254	lc/h
Total lane changes, LCALL	1630	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.308

Average weaving speed, SW	49.4	mi/h
Average non-weaving speed, SNW	48.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.0	mi/h
Weaving segment density, D	15.1	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.448	
Weaving segment flow rate, v	2034	veh/h
Weaving segment capacity, cW	4541	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7650	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1799	c
		Maximum	Analyzed	
v/c ratio		1.00	0.448	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1504	135	500	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	409	37	152	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1782	148	610	0	pc/h
Volume ratio, VR		0.298			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	758	lc/h
Weaving lane changes, LCW	1111	lc/h
Non-weaving vehicle index, INW	748	
Non-weaving lane change, LCNW	548	lc/h
Total lane changes, LCALL	1659	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.258

Average weaving speed, SW	50.8	mi/h
Average non-weaving speed, SNW	50.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.6	mi/h
Weaving segment density, D	16.7	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.427	
Weaving segment flow rate, v	2331	veh/h
Weaving segment capacity, cW	5452	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5567	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1981	c
		Maximum	Analyzed	
v/c ratio		1.00	0.427	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1309	695	445	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	356	197	122	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1551	790	489	0	pc/h

Volume ratio, VR 0.452

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1279	lc/h
Weaving lane changes, LCW	1561	lc/h
Non-weaving vehicle index, INW	465	
Non-weaving lane change, LCNW	284	lc/h
Total lane changes, LCALL	1845	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.366

Average weaving speed, SW	47.9	mi/h
Average non-weaving speed, SNW	46.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.0	mi/h
Weaving segment density, D	20.1+	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.533	
Weaving segment flow rate, v	2597	veh/h
Weaving segment capacity, cW	4872	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7270	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1820	c
		Maximum	Analyzed	
v/c ratio		1.00	0.533	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD ompany
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1754	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	477	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1039	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1039	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1356	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	368	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	803	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	803	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1356	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	545	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1356		545			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	368		143			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%	%	
Length	0.00	mi	0.00	mi	mi	
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1607        574                   pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    1.000   Using Equation  0
                   FD
                  v  = v  + (v - v ) P  =  1607   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v  = v                1607          4600            No
      Fi   F
     v  = v - v            1033          4600            No
      FO   F   R
     v                     574           2000            No
      R
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1607                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area_____________________
                        Actual        Max Desirable        Violation?
     v                  1607          4400                 No
      12
_________________Level of Service Determination (if not F)_____________________

Density,                 D = 4.252 + 0.0086 v  - 0.009  L   =   11.3    pc/mi/ln
                          R                  12          D
Level of service for ramp-freeway junction areas of influence B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                D  = 0.480
                                             S
Space mean speed in ramp influence area,    S  = 51.4    mph
                                             R
Space mean speed in outer lanes,            S  =  N/A    mph
                                             0
Space mean speed for all vehicles,          S  = 51.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	811	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	430	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	811	430		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	220	113		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          961         453                  pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  961    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1414          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 961                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1414          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   13.7    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.308
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1029	380	212	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	274	101	56	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1193	404	226	0	pc/h
Volume ratio, VR		0.346			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	305	lc/h
Total lane changes, LCALL	409	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.098

Average weaving speed, SW	56.0	mi/h
Average non-weaving speed, SNW	57.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.7	mi/h
Weaving segment density, D	10.7	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.316	
Weaving segment flow rate, v	1673	veh/h
Weaving segment capacity, cW	5298	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6078	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1925	c
		Maximum	Analyzed	
v/c ratio		1.00	0.316	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1204	825	205	0	veh/h
Peak hour factor, PHF	0.92	0.89	0.94	0.94	
Peak 15-min volume, v15	327	232	55	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1426	927	218	0	pc/h
Volume ratio, VR		0.445			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	440	lc/h
Non-weaving vehicle index, INW	860	
Non-weaving lane change, LCNW	805	lc/h
Total lane changes, LCALL	1245	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.155

Average weaving speed, SW	54.0	mi/h
Average non-weaving speed, SNW	55.9	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	55.0	mi/h
Weaving segment density, D	15.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.477	
Weaving segment flow rate, v	2359	veh/h
Weaving segment capacity, cW	4944	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7195	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1903	c
		Maximum	Analyzed	
v/c ratio		1.00	0.477	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	2035 No Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1374	625	655	0	veh/h
Peak hour factor, PHF	0.92	0.94	0.92	0.94	
Peak 15-min volume, v15	373	166	178	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1538	665	712	0	pc/h

Volume ratio, VR 0.472

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1377	lc/h
Weaving lane changes, LCW	1468	lc/h
Non-weaving vehicle index, INW	128	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1468	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.612

Average weaving speed, SW	42.9	mi/h
Average non-weaving speed, SNW	45.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	44.2	mi/h
Weaving segment density, D	22.0	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.574	
Weaving segment flow rate, v	2831	veh/h
Weaving segment capacity, cW	4933	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7505	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1758	c
		Maximum	Analyzed	
v/c ratio		1.00	0.574	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	2035 No Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1999	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	543	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1184	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1184	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	19.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1083	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	294	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	606	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	606	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	10.1	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	823	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	260	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	100	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	823	260	100	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	224	74	28	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          975         295         114       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  975    pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     1270          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 975                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1270          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   12.7    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.307
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Compan y
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 NB/EB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 Plus Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	723	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	260	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	723	100	260	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	196	28	74	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV            0.917        1.000        1.000
Driver population factor, fP             1.00         1.00         1.00
Flow rate, vp                            857          114          295        pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  857    pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     971           4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 857                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                971           4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   10.2    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.300
                                              S
Space mean speed in ramp influence area,     S  = 54.6    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	522	201	716	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.88	0.82	
Peak 15-min volume, v15	142	61	203	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	618	245	814	0	pc/h

Volume ratio, VR 0.631

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1059	lc/h
Weaving lane changes, LCW	1360	lc/h
Non-weaving vehicle index, INW	204	
Non-weaving lane change, LCNW	146	lc/h
Total lane changes, LCALL	1506	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.290

Average weaving speed, SW	49.9	mi/h
Average non-weaving speed, SNW	49.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.8	mi/h
Weaving segment density, D	11.2	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.441	
Weaving segment flow rate, v	1539	veh/h
Weaving segment capacity, cW	3487	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	9403	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1665	c
		Maximum	Analyzed	
v/c ratio		1.00	0.441	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1172	96	877	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	318	26	267	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1389	105	1070	0	pc/h

Volume ratio, VR 0.458

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1175	lc/h
Weaving lane changes, LCW	1528	lc/h
Non-weaving vehicle index, INW	583	
Non-weaving lane change, LCNW	467	lc/h
Total lane changes, LCALL	1995	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.299

Average weaving speed, SW	49.6	mi/h
Average non-weaving speed, SNW	47.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.4	mi/h
Weaving segment density, D	17.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.490	
Weaving segment flow rate, v	2353	veh/h
Weaving segment capacity, cW	4805	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7343	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1845	c
		Maximum	Analyzed	
v/c ratio		1.00	0.490	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1311	738	611	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	356	210	168	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1553	839	671	0	pc/h
Volume ratio, VR		0.493			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1510	lc/h
Weaving lane changes, LCW	1792	lc/h
Non-weaving vehicle index, INW	466	
Non-weaving lane change, LCNW	284	lc/h
Total lane changes, LCALL	2076	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.402

Average weaving speed, SW	47.1	mi/h
Average non-weaving speed, SNW	44.2	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	45.6	mi/h
Weaving segment density, D	22.4	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.629	
Weaving segment flow rate, v	2811	veh/h
Weaving segment capacity, cW	4466	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7745	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1784	c
		Maximum	Analyzed	
v/c ratio		1.00	0.629	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1922	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	522	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1139	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1139	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	19.0	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1775	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	482	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1051	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1051	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.5	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: ZS
Agency/Co.: Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB/WB
Junction: Brunswick Off Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 Plus Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1775	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	465	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1775		465			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	482		122			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          2103        489                    pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    1.000   Using Equation  0
                   FD
                  v  = v  + (v - v ) P  =  2103   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                             Actual        Maximum         LOS F?
     v  = v                  2103          4600            No
      Fi   F
     v  = v - v              1614          4600            No
      FO   F   R
     v                       489           2000            No
      R
     v  or v                 0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?             No
      3     av34
Is   v  or v      > 1.5 v  /2              No
      3     av34         12
If yes, v    = 2103                     (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2103          4400                  No
      12
_________________Level of Service Determination (if not F)_____________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   15.6    pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 D  = 0.472
                                              S
Space mean speed in ramp influence area,     S  = 51.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 51.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst: ZS
Agency/Co.:   Omni Means, a GHD Company
Date performed: 4/24/2018
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB-WB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: 2035 Plus Project
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1310	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	259	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1310	259		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	356	68		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1552        273                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1552   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1825          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1552                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1825          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   17.0    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.316
                                              S
Space mean speed in ramp influence area,     S  = 54.3    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.3    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1305	202	264	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	347	54	70	0	
Trucks and buses	0	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	1.000	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1388	215	281	0	pc/h
Volume ratio, VR		0.263			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	345	lc/h
Total lane changes, LCALL	449	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.106

Average weaving speed, SW	55.7	mi/h
Average non-weaving speed, SNW	57.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.6	mi/h
Weaving segment density, D	11.1	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.315	
Weaving segment flow rate, v	1884	veh/h
Weaving segment capacity, cW	5979	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5193	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1993	c
		Maximum	Analyzed	
v/c ratio		1.00	0.315	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1339	357	168	0	veh/h
Peak hour factor, PHF	0.92	0.83	0.81	0.94	
Peak 15-min volume, v15	364	108	52	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1586	430	207	0	pc/h
Volume ratio, VR		0.287			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	637	lc/h
Weaving lane changes, LCW	1077	lc/h
Non-weaving vehicle index, INW	956	
Non-weaving lane change, LCNW	838	lc/h
Total lane changes, LCALL	1915	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.218

Average weaving speed, SW	52.0	mi/h
Average non-weaving speed, SNW	51.9	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	51.9	mi/h
Weaving segment density, D	14.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.364	
Weaving segment flow rate, v	2040	veh/h
Weaving segment capacity, cW	5609	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5440	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	2038	c
		Maximum	Analyzed	
v/c ratio		1.00	0.364	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1211	380	485	0	veh/h
Peak hour factor, PHF	0.92	0.81	0.81	0.94	
Peak 15-min volume, v15	329	117	150	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1356	469	599	0	pc/h
Volume ratio, VR		0.441			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1068	lc/h
Weaving lane changes, LCW	1159	lc/h
Non-weaving vehicle index, INW	113	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1159	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.508

Average weaving speed, SW	44.8	mi/h
Average non-weaving speed, SNW	48.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.8	mi/h
Weaving segment density, D	17.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.453	
Weaving segment flow rate, v	2354	veh/h
Weaving segment capacity, cW	5199	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7140	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1785	c
		Maximum	Analyzed	
v/c ratio		1.00	0.453	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1591	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	432	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	942	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	942	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	15.7	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHDCompany
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1924	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	523	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1077	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1077	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.0-	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1414	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	170	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1414	510	170	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	384	145	48	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          1675        580         193       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1675   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     2255          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1675                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2255          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   20.3    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.330
                                              S
Space mean speed in ramp influence area,     S  = 54.1    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.1    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1244	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	170	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	510	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1244	170	510	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	338	48	145	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	1474	193	580	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1474 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1667	4600	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1474 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1667	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 15.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.310

Space mean speed in ramp influence area, S_R = 54.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.4 mph

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	876	368	710	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.92	0.82	
Peak 15-min volume, v15	238	112	193	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1038	449	772	0	pc/h
Volume ratio, VR		0.541			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1221	lc/h
Weaving lane changes, LCW	1522	lc/h
Non-weaving vehicle index, INW	343	
Non-weaving lane change, LCNW	232	lc/h
Total lane changes, LCALL	1754	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.327

Average weaving speed, SW	48.9	mi/h
Average non-weaving speed, SNW	47.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.3	mi/h
Weaving segment density, D	15.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.509	
Weaving segment flow rate, v	2073	veh/h
Weaving segment capacity, cW	4074	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	8304	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1749	c
		Maximum	Analyzed	
v/c ratio		1.00	0.509	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1428	158	597	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	388	43	182	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1692	174	728	0	pc/h

Volume ratio, VR 0.348

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	902	lc/h
Weaving lane changes, LCW	1255	lc/h
Non-weaving vehicle index, INW	711	
Non-weaving lane change, LCNW	530	lc/h
Total lane changes, LCALL	1785	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.274

Average weaving speed, SW	50.3	mi/h
Average non-weaving speed, SNW	49.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.7	mi/h
Weaving segment density, D	17.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.446	
Weaving segment flow rate, v	2380	veh/h
Weaving segment capacity, cW	5339	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6101	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1940	c
		Maximum	Analyzed	
v/c ratio		1.00	0.446	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1319	706	453	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	358	201	124	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1563	802	498	0	pc/h
Volume ratio, VR		0.454			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1300	lc/h
Weaving lane changes, LCW	1582	lc/h
Non-weaving vehicle index, INW	469	
Non-weaving lane change, LCNW	286	lc/h
Total lane changes, LCALL	1868	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.370

Average weaving speed, SW	47.8	mi/h
Average non-weaving speed, SNW	46.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.9	mi/h
Weaving segment density, D	20.4	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.542	
Weaving segment flow rate, v	2627	veh/h
Weaving segment capacity, cW	4849	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7295	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1818	c
		Maximum	Analyzed	
v/c ratio		1.00	0.542	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1772	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	482	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1050	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1050	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.5	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1356	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	368	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	803	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	803	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.4	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1356	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	545	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1356		545			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	368		143			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1607        574                   pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    1.000   Using Equation  0
                   FD
                  v  = v  + (v - v ) P  =  1607   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v  = v                1607          4600            No
      Fi   F
     v  = v - v            1033          4600            No
      FO   F   R
     v                     574           2000            No
      R
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1607                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1607          4400                 No
      12
_________________Level of Service Determination (if not F)_____________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   11.3    pc/mi/ln
                        R                   12          D
Level of service for ramp-freeway junction areas of influence B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                D  = 0.480
                                             S
Space mean speed in ramp influence area,    S  = 51.4    mph
                                             R
Space mean speed in outer lanes,            S  =  N/A    mph
                                             0
Space mean speed for all vehicles,          S  = 51.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.50

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date performed:	4/24/2018
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	811	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	449	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	811	449		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	220	118		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	961	473	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 961 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1434	4600	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 961 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1434	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 13.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.308	
Space mean speed in ramp influence area,	S_R = 54.5	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.5	mph

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	994	396	266	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	264	105	71	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1153	421	283	0	pc/h

Volume ratio, VR 0.379

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	297	lc/h
Total lane changes, LCALL	401	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.097

Average weaving speed, SW	56.0	mi/h
Average non-weaving speed, SNW	57.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.6	mi/h
Weaving segment density, D	10.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.326	
Weaving segment flow rate, v	1704	veh/h
Weaving segment capacity, cW	5221	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6448	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1897	c
		Maximum	Analyzed	
v/c ratio		1.00	0.326	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1172	925	218	0	veh/h
Peak hour factor, PHF	0.92	0.89	0.94	0.94	
Peak 15-min volume, v15	318	260	58	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1389	1039	232	0	pc/h
Volume ratio, VR		0.478			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1271	lc/h
Weaving lane changes, LCW	1711	lc/h
Non-weaving vehicle index, INW	838	
Non-weaving lane change, LCNW	798	lc/h
Total lane changes, LCALL	2509	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.269

Average weaving speed, SW	50.5	mi/h
Average non-weaving speed, SNW	46.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.4	mi/h
Weaving segment density, D	18.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.530	
Weaving segment flow rate, v	2441	veh/h
Weaving segment capacity, cW	4608	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7568	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1875	c
		Maximum	Analyzed	
v/c ratio		1.00	0.530	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency/Co.:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	2035 Plus Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1442	625	655	0	veh/h
Peak hour factor, PHF	0.92	0.94	0.92	0.94	
Peak 15-min volume, v15	392	166	178	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1614	665	712	0	pc/h

Volume ratio, VR 0.460

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1377	lc/h
Weaving lane changes, LCW	1468	lc/h
Non-weaving vehicle index, INW	134	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1468	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.612

Average weaving speed, SW	42.9	mi/h
Average non-weaving speed, SNW	45.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	44.2	mi/h
Weaving segment density, D	22.6	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.574	
Weaving segment flow rate, v	2904	veh/h
Weaving segment capacity, cW	5061	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7367	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1768	c
		Maximum	Analyzed	
v/c ratio		1.00	0.574	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.50

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	ZS
Agency or Company:	Omni Means, a GHD Company
Date Performed:	4/24/2018
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	2035 Plus Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	2067	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	562	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1224	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

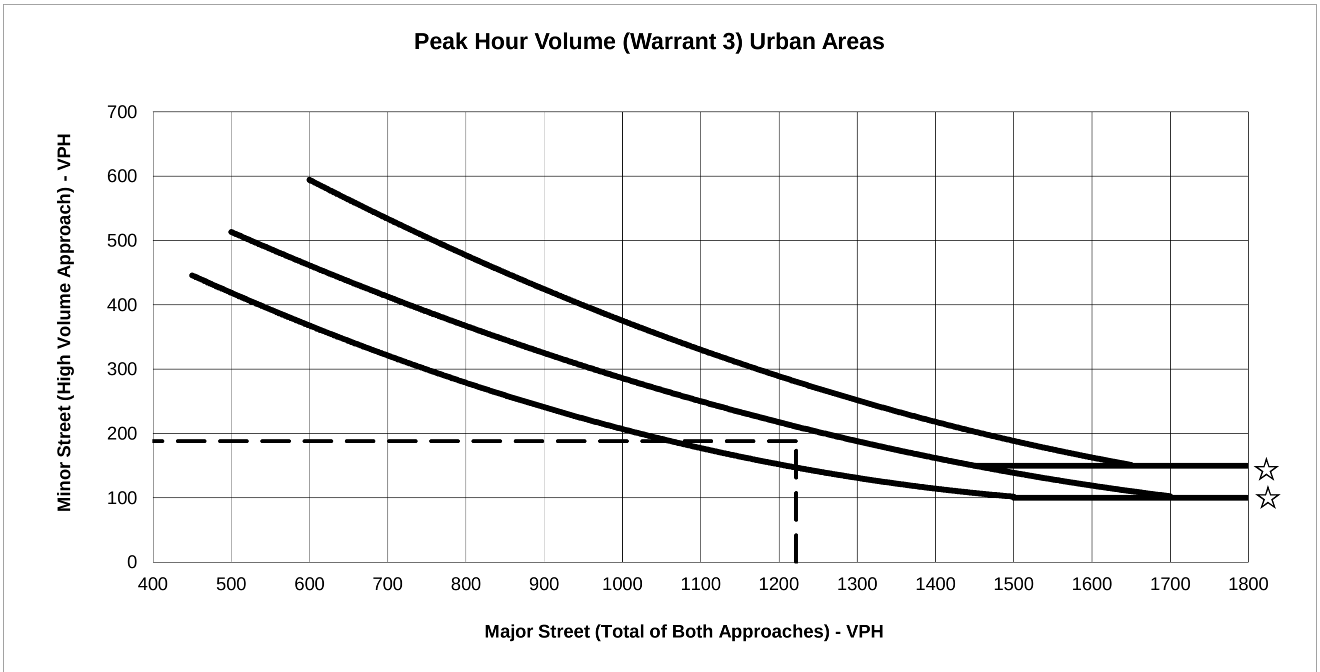
LOS and Performance Measures

Flow rate, vp	1224	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	20.4	pc/mi/ln
Level of service, LOS	C	

Appendix D: Signal Warrant Analysis Worksheets

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

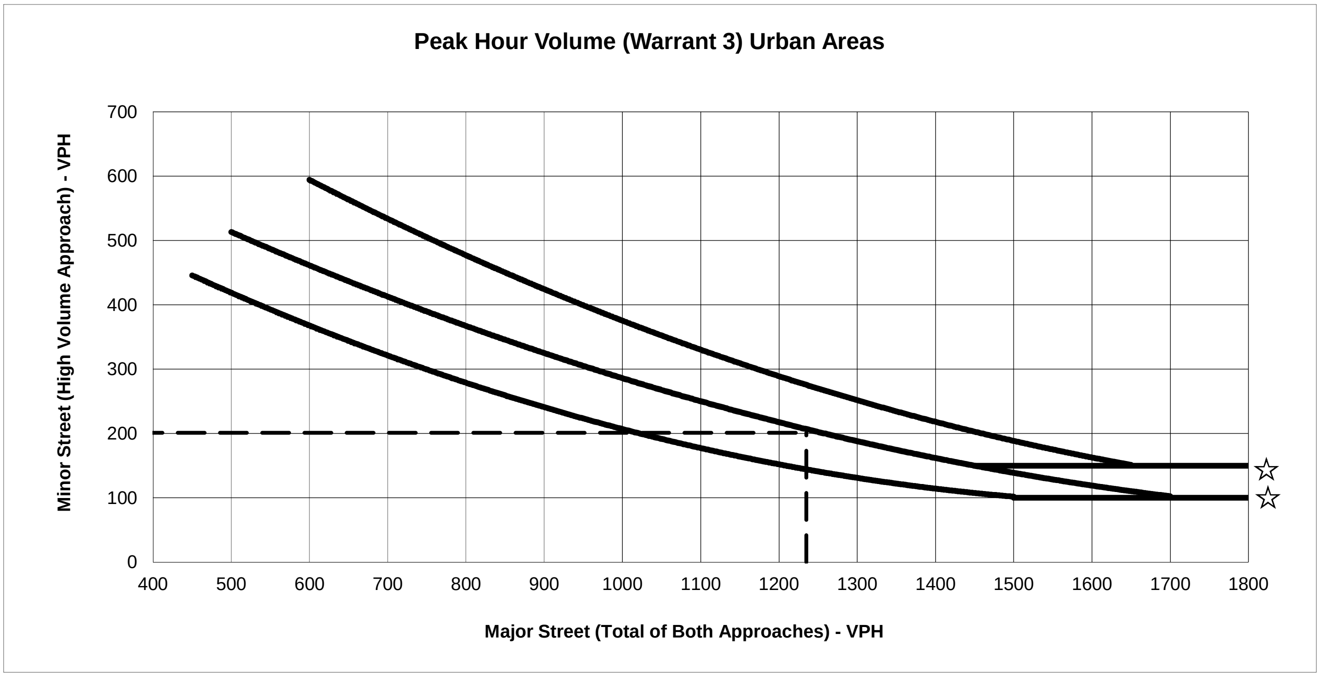
Existing No Project PM - Alternative A

		Number of Lanes
Major Approach	Brunswick Road	1
Minor Approach	Idaho Maryland Road	1

Major St. Volume:	1222
Minor St. Volume:	188
Warrant Met?:	Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

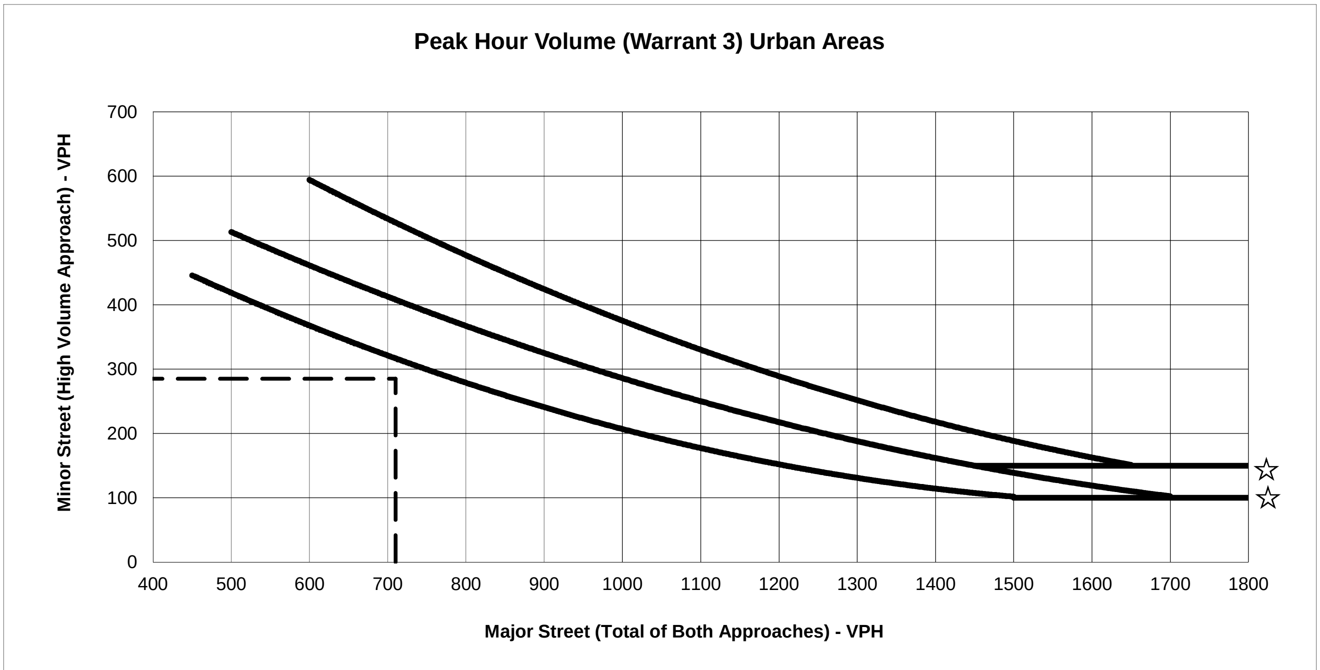
Existing Plus Project PM - Alternative A

		Number of Lanes
Major Approach	Brunswick Road	1
Minor Approach	Idaho Maryland Road	1

Major St. Volume: 1235
Minor St. Volume: 201
Warrant Met?: Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

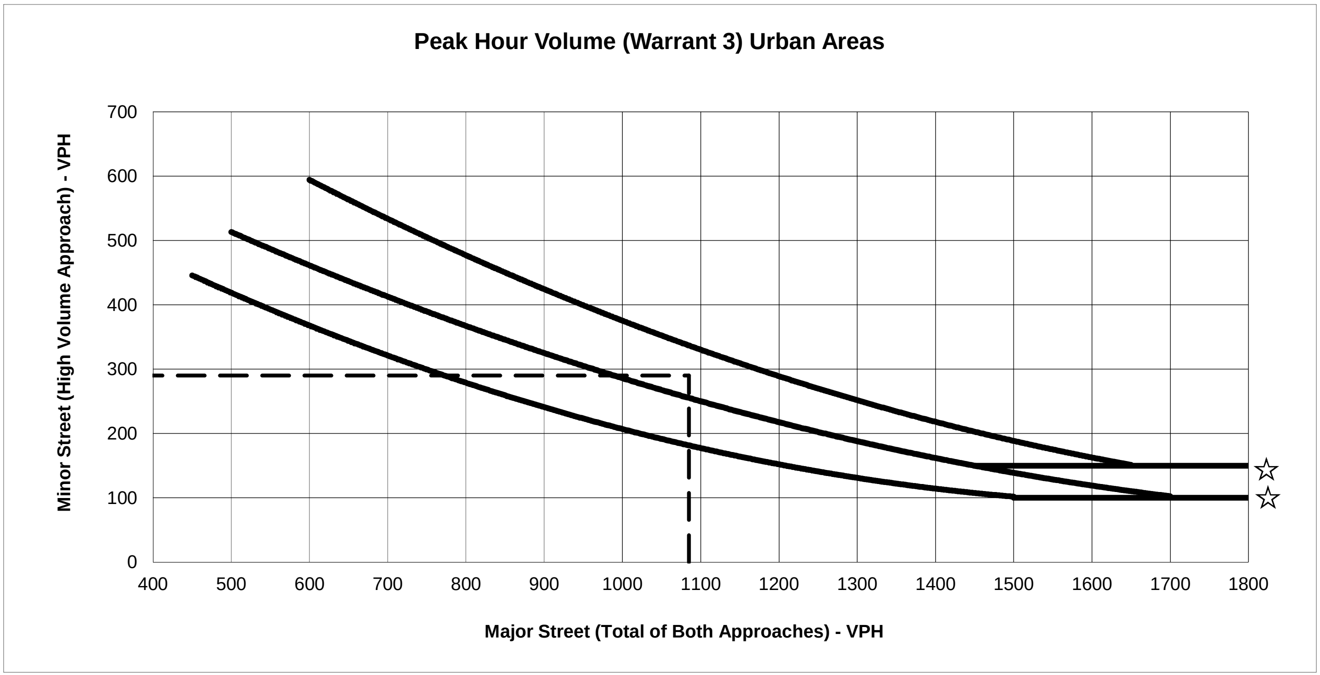
Year 2035 No Project AM - Alternative A

		Number of Lanes
Major Approach	Dorsey Drive	1
Minor Approach	Sutton Way	1

Major St. Volume: 710
Minor St. Volume: 285
Warrant Met?: No

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

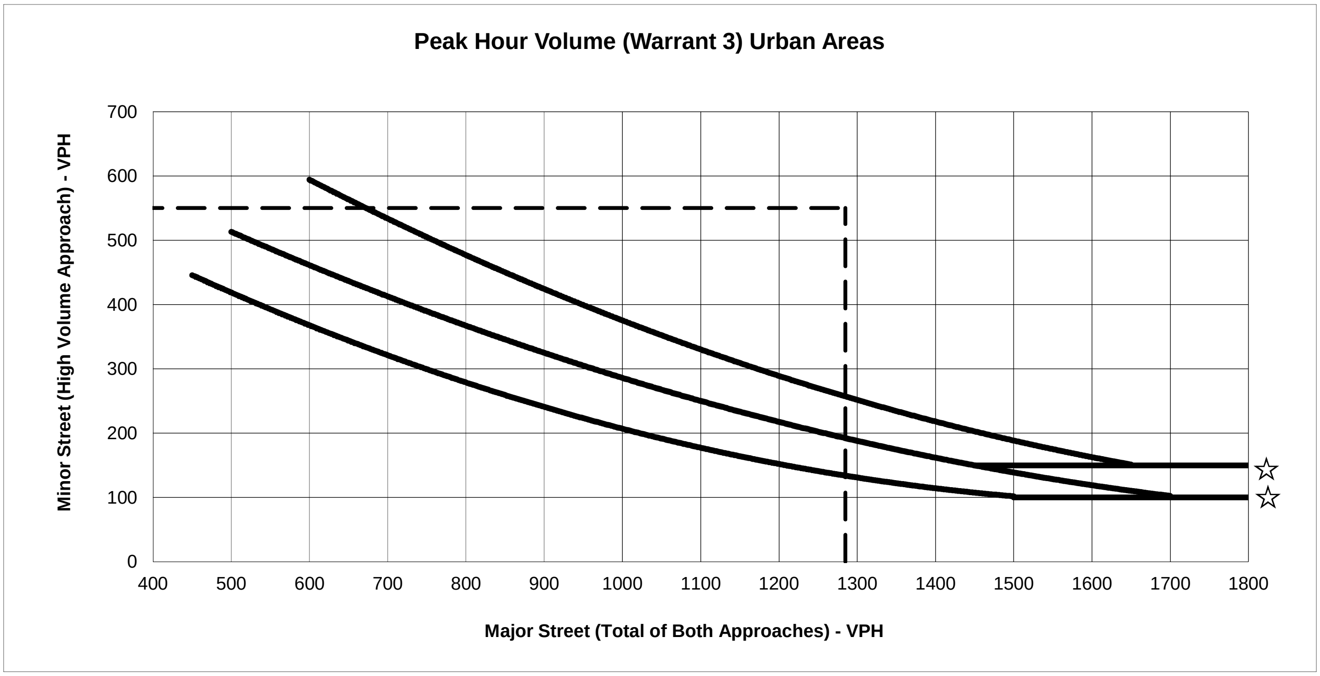
Year 2035 No Project AM - Alternative A

		Number of Lanes
Major Approach	Brunswick Road	1
Minor Approach	Idaho Maryland Road	1

Major St. Volume:	1085
Minor St. Volume:	290
Warrant Met?:	Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

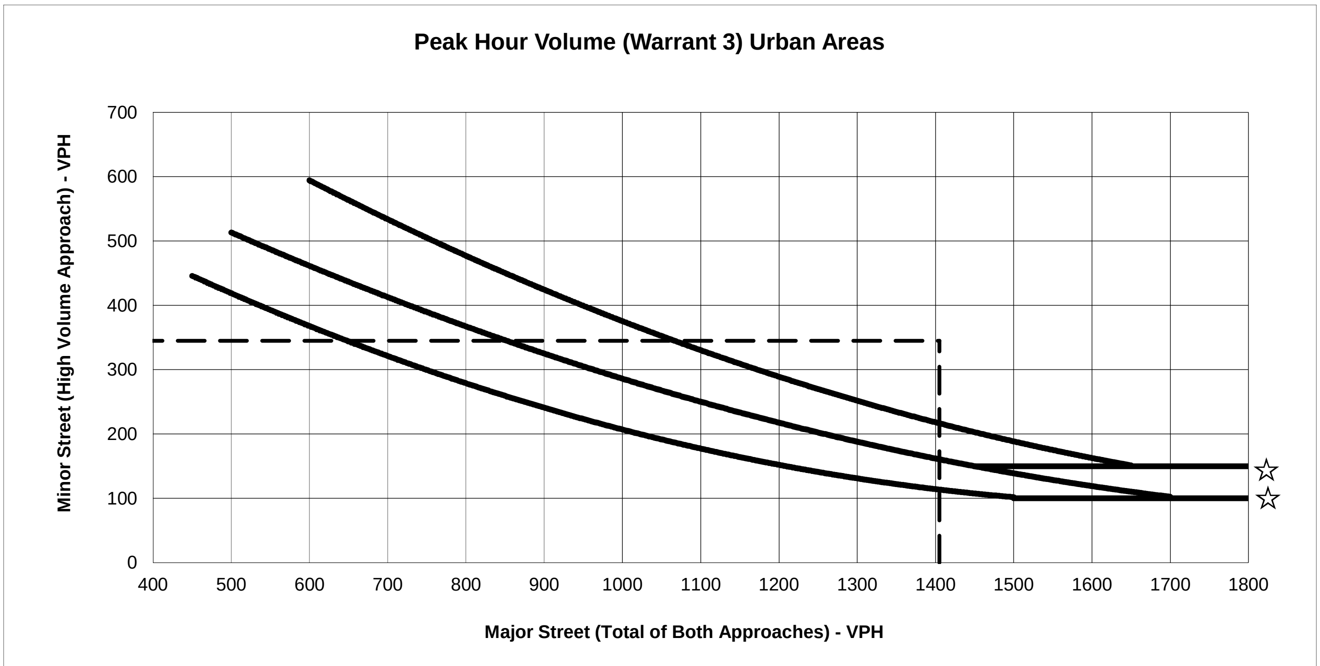
Year 2035 No Project PM - Alternative A

		Number of Lanes
Major Approach	Dorsey Drive	1
Minor Approach	Sutton Way	1

Major St. Volume:	1285
Minor St. Volume:	550
Warrant Met?:	Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

***** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

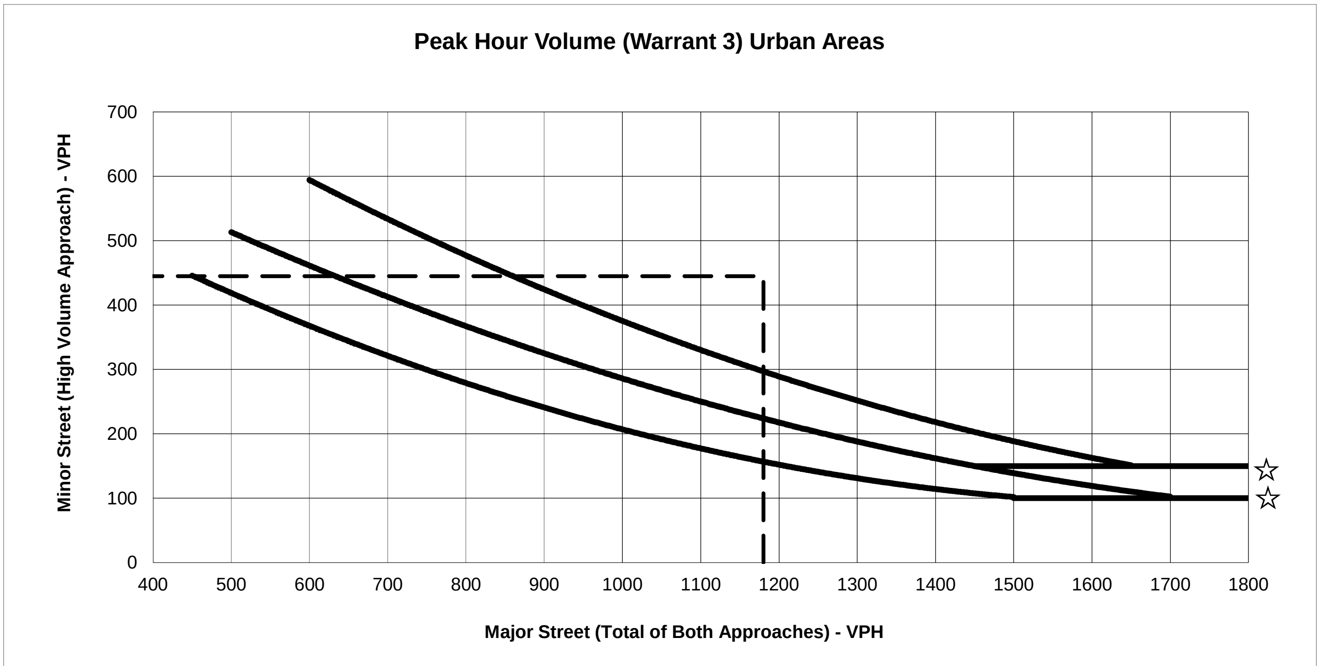
Year 2035 No Project PM - Alternative A

		Number of Lanes
Major Approach	Brunswick Road	1
Minor Approach	Idaho Maryland Road	1

Major St. Volume:	1405
Minor St. Volume:	345
Warrant Met?:	Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

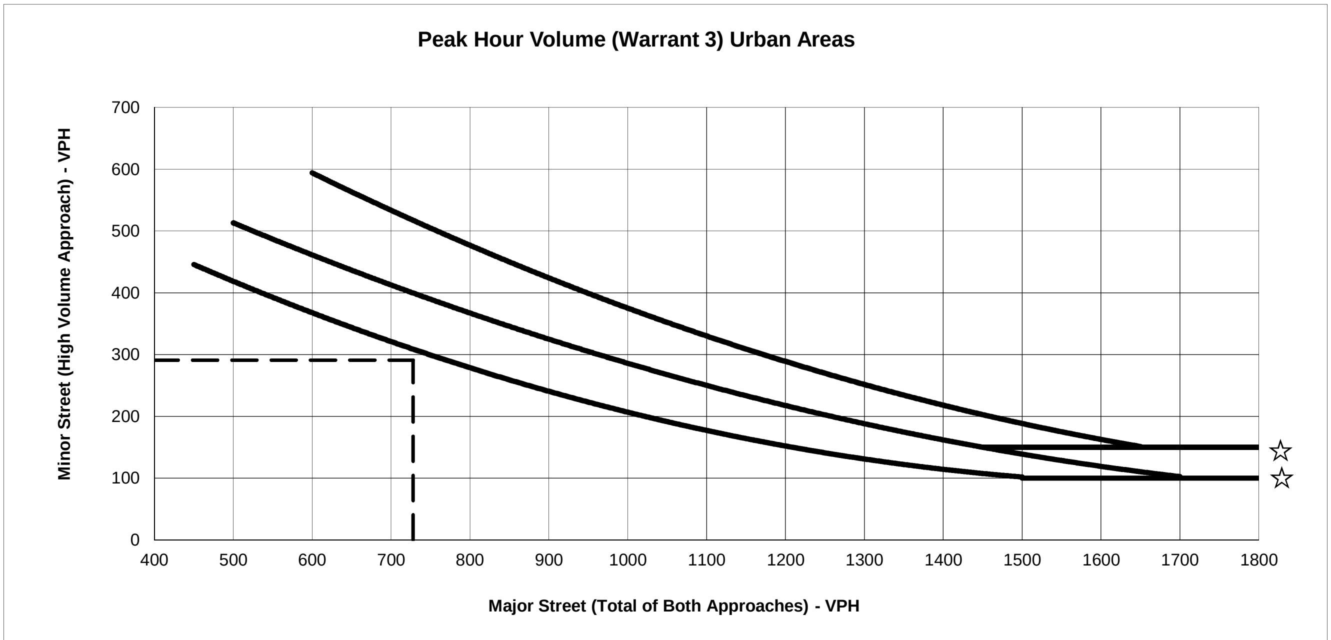
Year 2035 No Project PM - Alternative A

		Number of Lanes
Major Approach	Idaho Maryland Road	1
Minor Approach	SR 49/20 NB Ramps	1

Major St. Volume:	1180
Minor St. Volume:	445
Warrant Met?:	Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

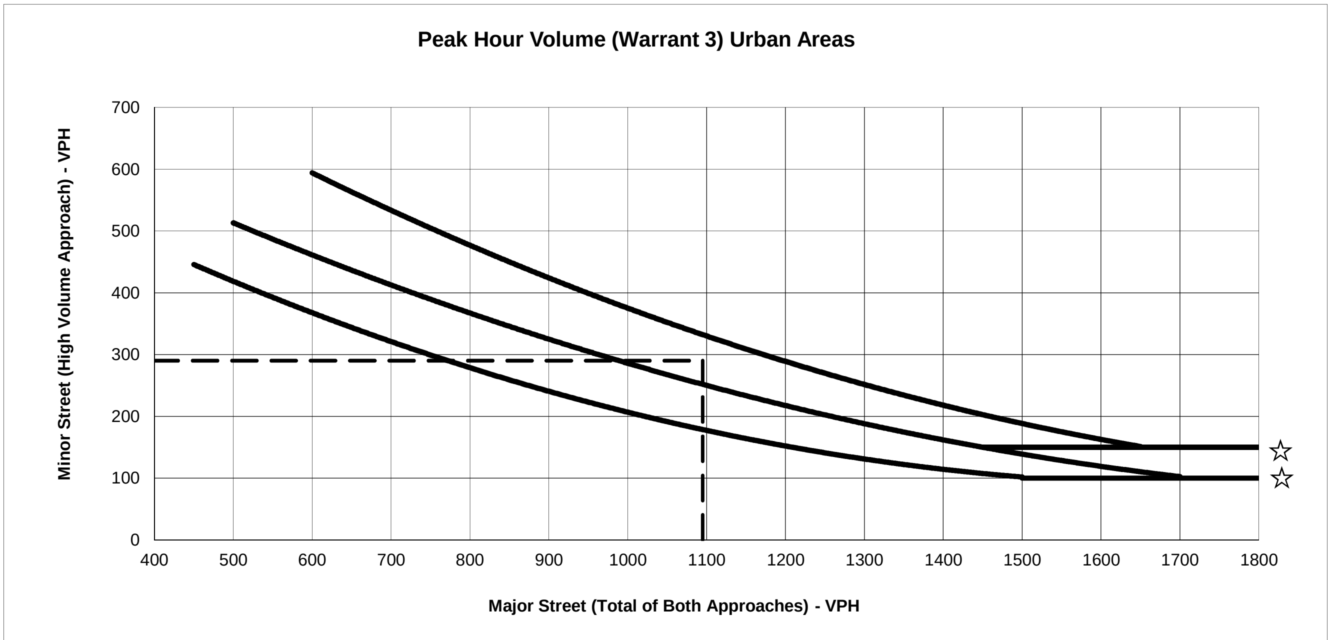
Year 2035 Plus Project AM - Alternative A

		Number of Lanes
Major Approach	Dorsey Drive	1
Minor Approach	Sutton Way	1

Major St. Volume: 728
Minor St. Volume: 291
Warrant Met?: No

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

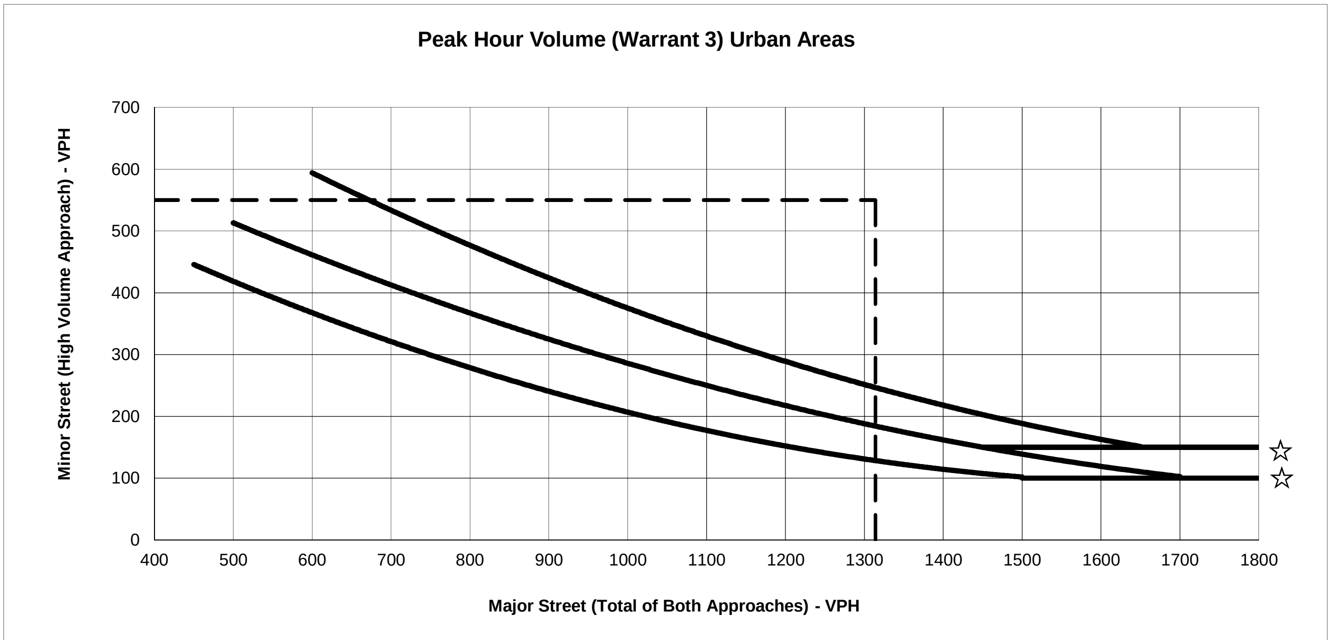
Year 2035 Plus Project AM - Alternative A

		Number of Lanes
Major Approach	Brunswick Road	1
Minor Approach	Idaho Maryland Road	1

Major St. Volume: 1095
Minor St. Volume: 290
Warrant Met?: Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

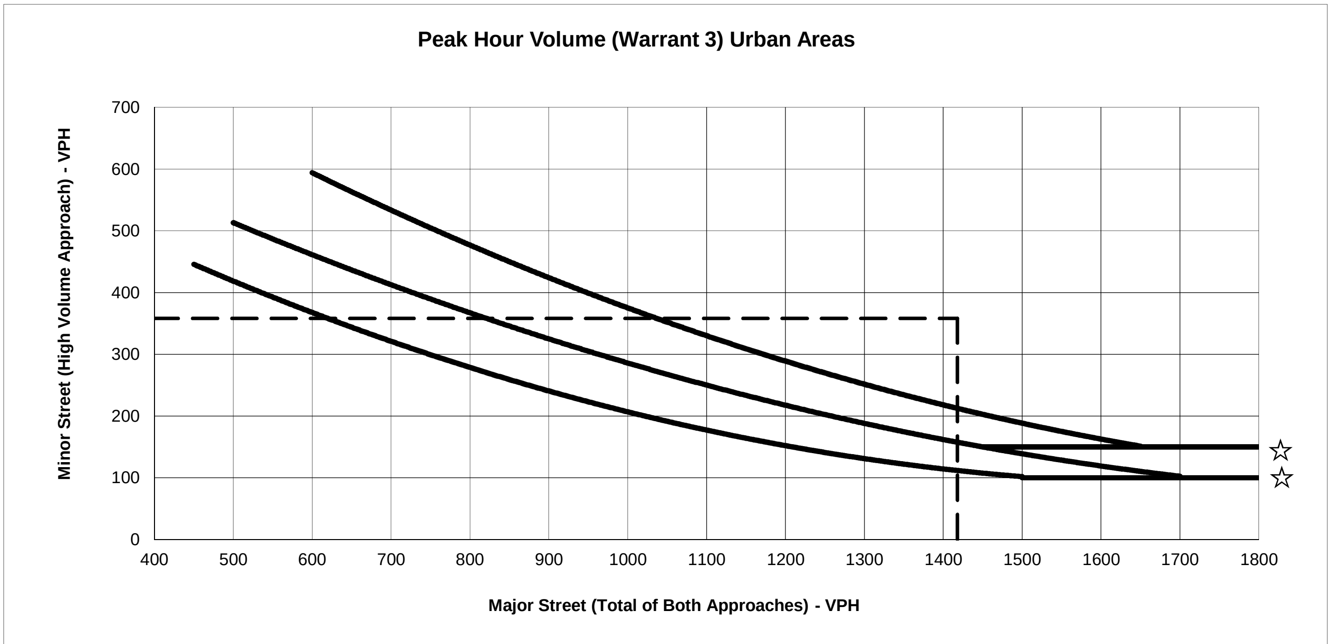
Year 2035 Plus Project PM - Alternative A

		Number of Lanes
Major Approach	Dorsey Drive	1
Minor Approach	Sutton Way	1

Major St. Volume:	1314
Minor St. Volume:	550
Warrant Met?:	Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

**** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

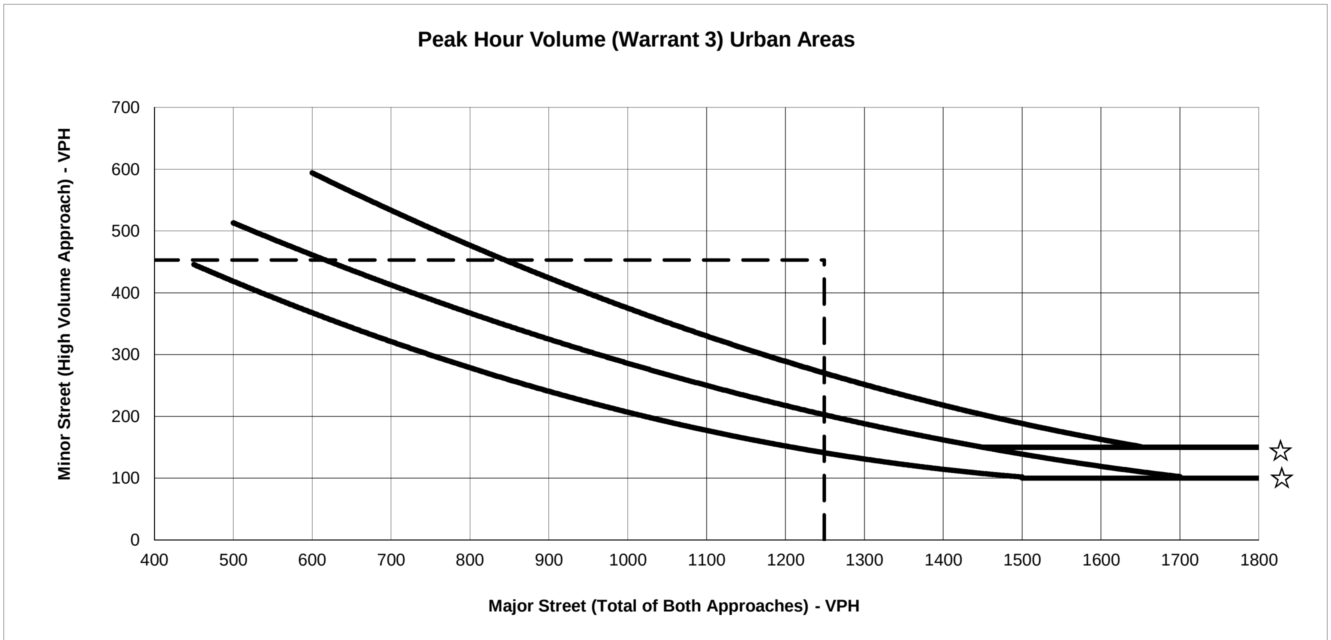
Year 2035 Plus Project PM - Alternative A

		Number of Lanes
Major Approach	Brunswick Road	1
Minor Approach	Idaho Maryland Road	1

Major St. Volume: 1418
Minor St. Volume: 358
Warrant Met?: Yes

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
500	420	500	505	500	N/A
600	360	600	460	600	590
700	325	700	420	700	540
800	285	800	360	800	475
900	245	900	325	900	425
1000	200	1000	285	1000	370
1100	175	1100	250	1100	340
1200	150	1200	220	1200	285
1300	130	1300	190	1300	250
1400	120	1400	155	1400	220
1500	100	1500	145	1500	180
1600	100	1600	120	1600	170
1700	100	1700	100	1650	150
1800	100	1800	100	1800	150

***** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation***



☆ NOTE:
150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Year 2035 Plus Project PM - Alternative A

		Number of Lanes
Major Approach	Idaho Maryland Road	1
Minor Approach	SR 49/20 NB Ramps	1

Major St. Volume:	1249
Minor St. Volume:	453
Warrant Met?:	Yes

Appendix E: Caltrans NOP Comments

DEPARTMENT OF TRANSPORTATION
DISTRICT 3
703 B STREET
MARYSVILLE, CA 95901
PHONE (530) 741-4199
FAX (530) 741-4245
TTY 711
www.dot.ca.gov/dist3

Serious drought.
Help save water!

March 17, 2016

Mr. Thomas Last
Community Development Director
City of Grass Valley
125 E. Main Street
Grass Valley, CA 95945

Dorsey Marketplace Project

Dear Mr. Thomas Last:

Thank you for including California Department of Transportation (Caltrans) in the environmental review process for Dorsey Marketplace Project. Caltrans' new mission, vision, and goals signal a modernization of our approach to California's transportation system. We review this local development for impacts to the State Highway System in keeping with our mission, vision and goals for sustainability/livability/economy, and safety/heath. We provide these comments consistent with the state's mobility goals that support a vibrant economy, and build communities, not sprawl.

The proposed project is located on 26.9 acres at the southeast freeway interchange of Dorsey Drive and State Route (SR) 20/49. The commercial area is proposed to include nine buildings with multiple tenants ranging in size from 3,000 to 92,000 square feet (sq. ft.). There would be four major tenant spaces ranging from 20,000 to 48,000 sq. ft. in size. The residential area is proposed to include six residential structures that are two to three stories in height, a 3,200 sq. ft. clubhouse, and a pool. The following comments are based on the Notice of Preparation (NOP) received:

Transportation & Circulation

We note that the City of Grass Valley recognizes that the proposed project may result in impacts on area roadways, intersections, and transportation facilities. We also note that the Environmental Impact Report (EIR) will evaluate impacts to the transportation network resulting from construction and operational phases of the proposed project. However, this proposed project will generate more than 100 PM peak hour trips onto the State facilities, it will be necessary to adequately assess impacts on the State Highway System (SHS) through a Traffic Impact Study (TIS).

The analysis should include the following:

- Dorsey Drive/SR 20/SR 49 Interchange –
    - Evaluate the potential for queuing on the off ramps which could back up onto the mainline and create a potential for collisions
    - Analyze ramp intersection interactions
    - Consider impacts from the existing Springhill Garden Apartments driveway
    - Include evaluation of transit connections in the vicinity
    - Address bicycle and pedestrian needs along the project frontage
    - Evaluate all intersections, including ramp intersections for the most effective intersection control solutions, such as roundabouts, signalization, etc.

In addition to the Dorsey Drive Interchange, impacts to all nearby interchanges from Brunswick Road to the Empire Street/SR 20 interchange should also be analyzed.

Hydraulics/Hydrology

We note that the EIR will include a drainage study to address potential downstream storm drainage impacts on Caltrans and City facilities. Please provide a copy of the drainage study for our review to the address below:

Office of Transportation Planning
703 B Street
Marysville, CA 95901

Please provide our office with copies of any further actions regarding this project. We would appreciate the opportunity to review and comment on any changes related to this development.

We would be pleased to meet with the City of Grass Valley and the project proponent to further discuss our concerns.

If you have any question regarding these comments or require additional information, please contact Jennifer Jacobson, Intergovernmental Review Coordinator for Nevada County, by phone (530) 741-5435 or via email to jennifer.jacobson@dot.ca.gov.

Sincerely,

Susan Zanchi

SUSAN ZANCHI, Branch Chief
Transportation Planning—North

c: Scott Morgan, State Clearinghouse

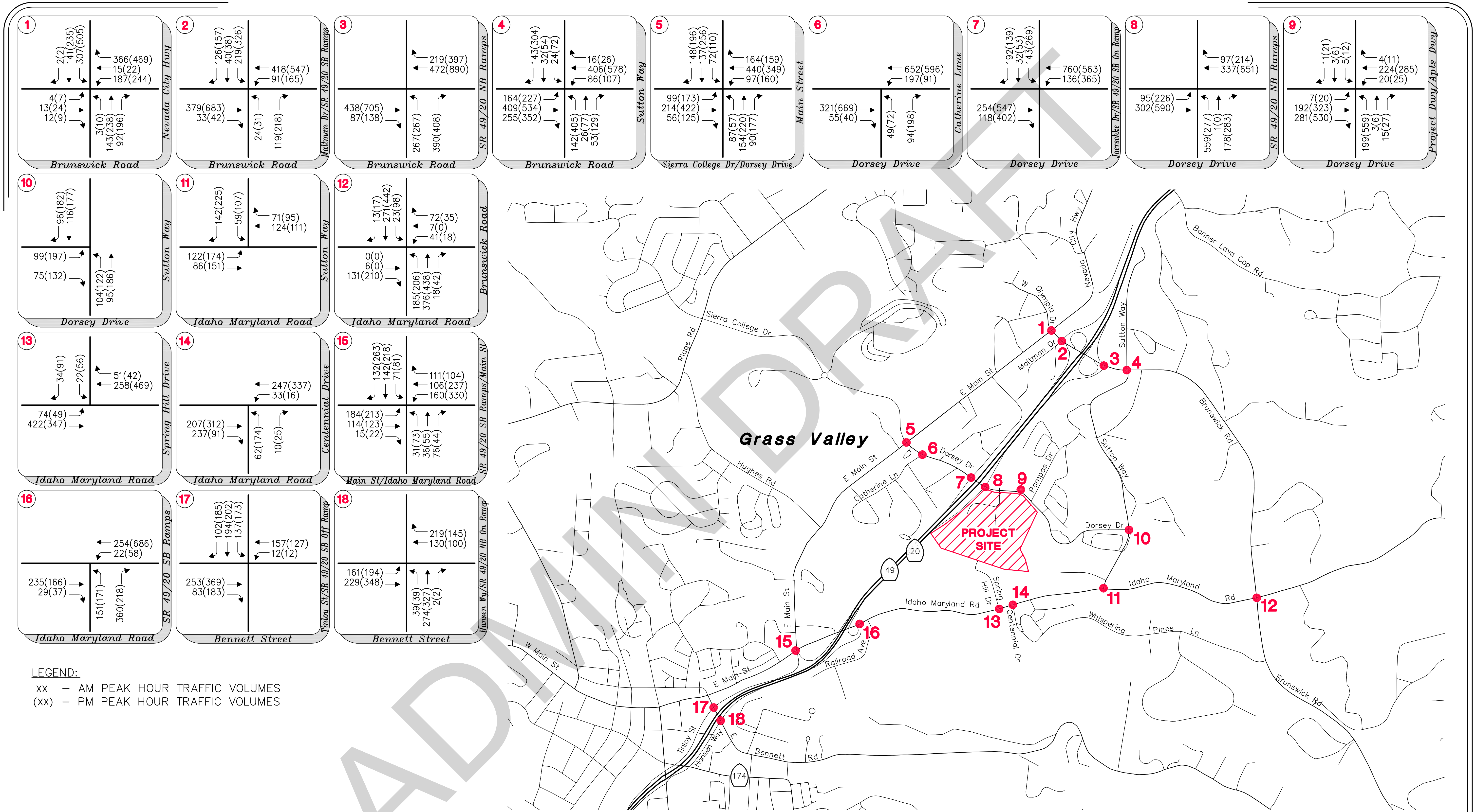
Appendix F: Grass Valley Traffic Impact Fee 2016 Nexus Fee Update Exhibit 23

GV TIF ID	Facility	Segment	Cost Estimate	Costs Attributable to New Development	Costs Attributable to Existing Deficiencies (not New Development)	Funding from Other Sources - State/Federal Grants and Funding (I.e. CMAQ, RSTP, others)	City funds (i.e. Gas Tax) *
7	East Main	Bennett St to Idaho-Maryland Rd	$1,849,391	$1,849,391	$0	$0	$0
10	East Main	Idaho-Maryland Rd to Hughes Rd	$1,335,148	$130,258	$1,204,890	$1,024,156	$180,733
14	Idaho-Maryland Rd	@ Centennial Dr	$3,082,724	$3,082,724	$0	$0	$0
15	Idaho-Maryland Rd	East Main to SR-20/49 Ramps	$213,879	$213,879	$0	$0	$0
27	Ophir St	@ Bennett St	$828,953	$828,953	$0	$0	$0
29	Ridge Rd	Hughes Rd to Sierra College Dr	$751,376	$173,394	$577,981	$491,284	$86,697
35	Dorsey Drive	@ Sutton Way	$1,121,115	$1,121,115	$0	$0	$0
42	Brunswick Rd	@ Idaho-Maryland Rd	$1,299,107	$958,091	$341,016	$289,863	$51,152
45	Dorsey Drive	Extension to Brunswick Road	$5,464,511	$5,464,511	$0	$0	$0
46	Railroad Ave Extension	Extension to Bennett Rd	$2,011,362	$2,011,362	$0	$0	$0
48	Bank Street Bridge		$549,773	$142,941	$406,832	$345,807	$61,025
49	Admin Costs and 5-year reviews		1% of fees	$161,266	$0	$0	$0
50	Traffic Model		$150,000	$150,000	$0	$0	$0
	Total		$18,842,412	$16,287,886	$2,530,719	$2,151,111	$379,608

Notes
* Typically a match is required for grant funds. 15% was the assumed match.

Exhibit 23: Recommended Allocation of GVTIF Revenues to Projects

Appendix G: Exhibits for Alternative B



Dorsey Marketplace TIAR

Figure 6

Existing Plus Project Peak Hour Traffic Volumes

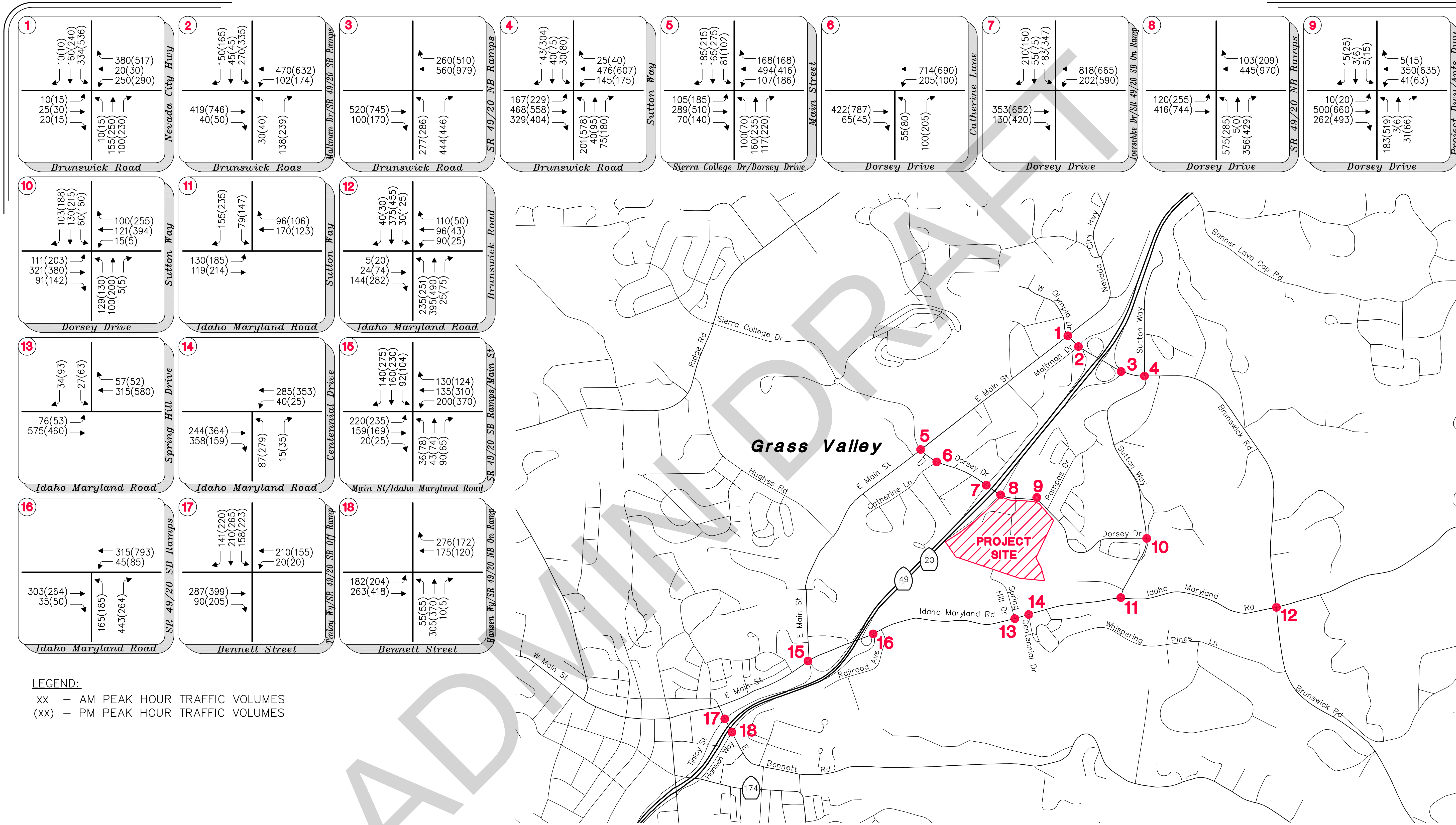
11/11/2016 8:48 AM \\ROSEVILLE-DC\COMMON\PRJ\2147\T2147\T2147TG001.DWG

Job No:

Dorsey Marketplace TIAR

Figure 8

Year 2035 Plus Project Peak Hour Traffic Volumes



LEGEND:
XX – AM PEAK HOUR TRAFFIC VOLUMES
(XX) – PM PEAK HOUR TRAFFIC VOLUMES

Job No:

Appendix H: LOS Worksheets for Alternative B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	13	12	187	15	366	3	143	92	307	141	2
Future Volume (vph)	4	13	12	187	15	366	3	143	92	307	141	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.94		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1729		1665	1681	1568	1752	1845	1568	3400	1840	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1729		1665	1681	1568	1752	1845	1568	3400	1840	
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	5	16	15	234	19	458	4	179	115	384	176	2
RTOR Reduction (vph)	0	15	0	0	0	132	0	0	101	0	1	0
Lane Group Flow (vph)	0	21	0	126	127	326	4	179	14	384	178	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		4.0		70.4	70.4	88.8	15.6	15.6	15.6	18.4	18.4	
Effective Green, g (s)		4.0		70.4	70.4	88.8	15.6	15.6	15.6	18.4	18.4	
Actuated g/C Ratio		0.03		0.56	0.56	0.71	0.12	0.12	0.12	0.15	0.15	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		55		938	947	1114	218	230	195	500	271	
v/s Ratio Prot		c0.01		0.08	0.08	c0.04	0.00	c0.10		c0.11	0.10	
v/s Ratio Perm						0.16			0.01			
v/c Ratio		0.39		0.13	0.13	0.29	0.02	0.78	0.07	0.77	0.66	
Uniform Delay, d1		59.3		12.9	12.9	6.6	47.9	53.0	48.3	51.2	50.3	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.7		0.3	0.3	0.1	0.0	14.0	0.1	6.3	4.3	
Delay (s)		60.9		13.2	13.2	6.6	47.9	66.9	48.3	57.5	54.6	
Level of Service		E		B	B	A	D	E	D	E	D	
Approach Delay (s)		60.9			9.0			59.5			56.6	
Approach LOS		E			A			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	124.9	Sum of lost time (s)	16.5
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	379	33	91	418	0	24	0	119	219	40	126
Future Volume (vph)	0	379	33	91	418	0	24	0	119	219	40	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3462		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3462		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	399	35	96	440	0	25	0	125	231	42	133
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	111	0	0	121
Lane Group Flow (vph)	0	432	0	96	440	0	25	0	14	231	42	12
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		103.1		11.8	118.4		4.8		16.6	13.7	13.7	13.7
Effective Green, g (s)		103.1		11.8	118.4		4.8		16.6	13.7	13.7	13.7
Actuated g/C Ratio		0.69		0.08	0.79		0.03		0.11	0.09	0.09	0.09
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		2377		137	2764		56		173	310	168	143
v/s Ratio Prot		c0.12		c0.05	0.13		c0.01		0.01	c0.07	0.02	
v/s Ratio Perm									0.00			0.01
v/c Ratio		0.18		0.70	0.16		0.45		0.08	0.75	0.25	0.08
Uniform Delay, d1		8.4		67.4	3.8		71.3		59.9	66.5	63.4	62.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2		12.4	0.1		2.1		0.1	8.2	0.3	0.1
Delay (s)		8.6		79.8	4.0		73.4		60.0	74.7	63.7	62.6
Level of Service		A		E	A		E		E	E	E	E
Approach Delay (s)		8.6			17.5			62.2			69.6	
Approach LOS		A			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	33.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	150.1	Sum of lost time (s)	16.7
Intersection Capacity Utilization	41.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	438	87	0	472	219	267	0	390	0	0	0
Future Volume (vph)	0	438	87	0	472	219	267	0	390	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	498	99	0	536	249	303	0	443	0	0	0
RTOR Reduction (vph)	0	0	33	0	0	0	0	0	265	0	0	0
Lane Group Flow (vph)	0	498	66	0	536	249	303	0	178	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		58.8	58.8		58.8	80.5	21.2		21.2			
Effective Green, g (s)		58.8	58.8		58.8	80.5	21.2		21.2			
Actuated g/C Ratio		0.66	0.66		0.66	0.91	0.24		0.24			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2326	1040		2326	1486	419		375			
v/s Ratio Prot		0.14			c0.15	0.04	c0.17		0.11			
v/s Ratio Perm			0.04			0.12						
v/c Ratio		0.21	0.06		0.23	0.17	0.72		0.48			
Uniform Delay, d1		5.8	5.2		5.9	0.4	31.0		28.9			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.2	0.1		0.1	0.1	6.1		1.0			
Delay (s)		6.1	5.3		6.0	0.5	37.1		29.9			
Level of Service		A	A		A	A	D		C			
Approach Delay (s)		5.9			4.2			32.8			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	164	409	255	86	406	16	142	26	53	24	32	143
Future Volume (vph)	164	409	255	86	406	16	142	26	53	24	32	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3484		3400	1660		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3484		3400	1660		1752	1845	1568
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	180	449	280	95	446	18	156	29	58	26	35	157
RTOR Reduction (vph)	0	0	113	0	1	0	0	53	0	0	0	137
Lane Group Flow (vph)	180	449	167	95	463	0	156	34	0	26	35	20
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	10.7	82.1	82.1	23.0	94.4		10.8	13.0		4.4	6.6	17.3
Effective Green, g (s)	10.7	82.1	82.1	23.0	94.4		10.8	13.0		4.4	6.6	17.3
Actuated g/C Ratio	0.08	0.60	0.60	0.17	0.69		0.08	0.09		0.03	0.05	0.13
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	264	2091	935	292	2390		266	156		56	88	197
v/s Ratio Prot	c0.05	c0.13		c0.05	0.13		c0.05	0.02		0.01	c0.02	0.01
v/s Ratio Perm			0.11									0.00
v/c Ratio	0.68	0.21	0.18	0.33	0.19		0.59	0.22		0.46	0.40	0.10
Uniform Delay, d1	61.8	12.8	12.5	50.5	7.8		61.2	57.6		65.4	63.6	53.3
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.7	0.2	0.4	0.2	0.2		2.1	0.3		2.2	1.1	0.1
Delay (s)	67.5	13.1	12.9	50.7	8.0		63.4	57.9		67.7	64.6	53.3
Level of Service	E	B	B	D	A		E	E		E	E	D
Approach Delay (s)		23.8			15.3			61.4			56.9	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	99	214	56	91	440	157	87	154	81	63	137	148
Future Volume (veh/h)	99	214	56	91	440	157	87	154	81	63	137	148
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	109	235	62	100	484	173	96	169	89	69	151	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	142	674	573	132	664	564	130	318	270	108	296	251
Arrive On Green	0.08	0.37	0.37	0.08	0.36	0.36	0.07	0.17	0.17	0.06	0.16	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	109	235	62	100	484	173	96	169	89	69	151	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	3.0	4.6	1.3	2.8	11.3	4.0	2.7	4.2	2.5	1.9	3.7	0.0
Cycle Q Clear(g_c), s	3.0	4.6	1.3	2.8	11.3	4.0	2.7	4.2	2.5	1.9	3.7	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	142	674	573	132	664	564	130	318	270	108	296	251
V/C Ratio(X)	0.77	0.35	0.11	0.76	0.73	0.31	0.74	0.53	0.33	0.64	0.51	0.00
Avail Cap(c_a), veh/h	441	978	831	335	1015	862	229	1126	957	229	1163	988
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	22.4	11.5	10.4	22.6	13.8	11.5	22.6	18.8	18.1	22.8	19.1	0.0
Incr Delay (d2), s/veh	8.5	0.3	0.1	8.5	1.6	0.3	8.0	1.4	0.7	6.0	1.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	2.4	0.6	1.6	5.9	1.7	1.6	2.2	1.1	1.1	2.0	0.0
LnGrp Delay(d),s/veh	30.9	11.8	10.5	31.1	15.4	11.8	30.6	20.2	18.8	28.9	20.5	0.0
LnGrp LOS	C	B	B	C	B	B	C	C	B	C	C	
Approach Vol, veh/h		406			757			354			220	
Approach Delay, s/veh		16.7			16.6			22.7			23.1	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.6	13.2	7.2	22.8	7.2	12.6	7.5	22.5
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	3.9	6.2	4.8	6.6	4.7	5.7	5.0	13.3
Green Ext Time (p_c), s	0.0	2.1	0.1	5.3	0.0	2.2	0.1	4.6

Intersection Summary			
HCM 2010 Ctrl Delay			18.7
HCM 2010 LOS			B

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	303	55	201	639	49	100
Future Volume (Veh/h)	303	55	201	639	49	100
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	361	65	239	761	58	119
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			910		
pX, platoon unblocked			0.91		0.80	0.91
vC, conflicting volume			426		1632	394
vC1, stage 1 conf vol					394	
vC2, stage 2 conf vol					1239	
vCu, unblocked vol			325		1423	289
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			79		66	83
cM capacity (veh/h)			1123		172	683

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	426	239	761	58	119
Volume Left	0	239	0	58	0
Volume Right	65	0	0	0	119
cSH	1700	1123	1700	172	683
Volume to Capacity	0.25	0.21	0.45	0.34	0.17
Queue Length 95th (ft)	0	20	0	35	16
Control Delay (s)	0.0	9.1	0.0	36.1	11.4
Lane LOS		A		E	B
Approach Delay (s)	0.0	2.2		19.5	
Approach LOS				C	

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	251	118	120	758	0	0	0	0	132	32	192
Future Volume (vph)	0	251	118	120	758	0	0	0	0	132	32	192
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1773	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1773	1568
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	302	142	145	913	0	0	0	0	159	39	231
RTOR Reduction (vph)	0	0	80	0	0	0	0	0	0	0	0	188
Lane Group Flow (vph)	0	302	62	145	913	0	0	0	0	0	198	43
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		43.4	43.4	20.7	52.6						18.4	18.4
Effective Green, g (s)		43.4	43.4	20.7	46.2						18.4	18.4
Actuated g/C Ratio		0.44	0.44	0.21	0.47						0.19	0.19
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1531	685	365	1630						328	290
v/s Ratio Prot		c0.09		0.08	c0.26						c0.11	
v/s Ratio Perm			0.04									0.03
v/c Ratio		0.20	0.09	0.40	0.56						0.60	0.15
Uniform Delay, d1		17.2	16.4	33.9	19.2						37.1	33.9
Progression Factor		1.00	1.00	0.57	0.25						1.00	1.00
Incremental Delay, d2		0.0	0.0	2.9	0.2						2.1	0.1
Delay (s)		17.2	16.4	22.3	5.1						39.3	34.0
Level of Service		B	B	C	A						D	C
Approach Delay (s)		17.0			7.5			0.0			36.4	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	99.3	Sum of lost time (s)	24.6
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	288	0	0	319	83	559	1	147	0	0	0
Future Volume (vph)	95	288	0	0	319	83	559	1	147	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.97		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4880		1665	1669	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4880		1665	1669	1568			
Peak-hour factor, PHF	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Adj. Flow (vph)	116	351	0	0	389	101	682	1	179	0	0	0
RTOR Reduction (vph)	0	0	0	0	36	0	0	0	127	0	0	0
Lane Group Flow (vph)	116	351	0	0	454	0	341	342	52	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	10.6	35.9			46.0		25.0	25.0	25.0			
Effective Green, g (s)	10.6	29.5			46.0		25.0	25.0	25.0			
Actuated g/C Ratio	0.11	0.30			0.46		0.25	0.25	0.25			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	187	548			2260		419	420	394			
v/s Ratio Prot	0.07	c0.19			c0.09		0.20	c0.20				
v/s Ratio Perm									0.03			
v/c Ratio	0.62	0.64			0.20		0.81	0.81	0.13			
Uniform Delay, d1	42.4	30.3			15.8		35.0	35.0	28.7			
Progression Factor	0.71	0.92			1.00		1.00	1.00	1.00			
Incremental Delay, d2	4.5	1.9			0.0		10.9	10.9	0.1			
Delay (s)	34.4	29.9			15.8		45.9	45.9	28.8			
Level of Service	C	C			B		D	D	C			
Approach Delay (s)		31.0			15.8			42.3			0.0	
Approach LOS		C			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	99.3	Sum of lost time (s)	24.6
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	189	238	23	220	4	169	2	16	5	3	11
Future Volume (vph)	7	189	238	23	220	4	169	2	16	5	3	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.2	4.6	4.6	4.2	4.6		4.6	4.6	4.6		4.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)	1752	1845	1568	1752	1840		1665	1670	1568		1678	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)	1752	1845	1568	1752	1840		1665	1670	1568		1678	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	9	233	294	28	272	5	209	2	20	6	4	14
RTOR Reduction (vph)	0	0	196	0	1	0	0	0	17	0	14	0
Lane Group Flow (vph)	9	233	98	28	276	0	104	107	3	0	10	0
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.6	12.6	12.6	0.8	12.8		5.8	5.8	5.8		0.7	
Effective Green, g (s)	0.6	12.6	12.6	0.8	12.8		5.8	5.8	5.8		0.7	
Actuated g/C Ratio	0.02	0.33	0.33	0.02	0.34		0.15	0.15	0.15		0.02	
Clearance Time (s)	4.2	4.6	4.6	4.2	4.6		4.6	4.6	4.6		4.6	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	27	613	521	36	621		254	255	239		30	
v/s Ratio Prot	0.01	0.13		c0.02	c0.15		0.06	c0.06			c0.01	
v/s Ratio Perm			0.06						0.00			
v/c Ratio	0.33	0.38	0.19	0.78	0.44		0.41	0.42	0.01		0.34	
Uniform Delay, d1	18.5	9.7	9.0	18.5	9.8		14.5	14.5	13.6		18.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	7.2	0.4	0.2	66.9	0.5		1.1	1.1	0.0		6.7	
Delay (s)	25.6	10.1	9.2	85.4	10.3		15.6	15.6	13.6		25.1	
Level of Service	C	B	A	F	B		B	B	B		C	
Approach Delay (s)		9.8			17.2			15.4			25.1	
Approach LOS		A			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	37.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	10.2
Intersection LOS	B

Movement	EBU	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations									
Traffic Vol, veh/h	0	99	73	0	101	95	0	116	96
Future Vol, veh/h	0	99	73	0	101	95	0	116	96
Peak Hour Factor	0.92	0.79	0.79	0.92	0.79	0.79	0.92	0.79	0.79
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	125	92	0	128	120	0	147	122
Number of Lanes	0	1	0	0	0	1	0	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	10.2	10.5	9.9
HCM LOS	B	B	A

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	52%	58%	0%
Vol Thru, %	48%	0%	55%
Vol Right, %	0%	42%	45%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	196	172	212
LT Vol	101	99	0
Through Vol	95	0	116
RT Vol	0	73	96
Lane Flow Rate	248	218	268
Geometry Grp	1	1	1
Degree of Util (X)	0.339	0.302	0.339
Departure Headway (Hd)	4.917	4.989	4.542
Convergence, Y/N	Yes	Yes	Yes
Cap	727	716	786
Service Time	2.977	3.056	2.599
HCM Lane V/C Ratio	0.341	0.304	0.341
HCM Control Delay	10.5	10.2	9.9
HCM Lane LOS	B	B	A
HCM 95th-tile Q	1.5	1.3	1.5

Intersection	
Intersection Delay, s/veh	9.4
Intersection LOS	A

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations									
Traffic Vol, veh/h	0	122	89	0	126	68	0	57	142
Future Vol, veh/h	0	122	89	0	126	68	0	57	142
Peak Hour Factor	0.92	0.93	0.93	0.92	0.93	0.93	0.92	0.93	0.93
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	131	96	0	135	73	0	61	153
Number of Lanes	0	0	1	0	1	0	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	10	9.2	9.1
HCM LOS	A	A	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	58%	0%	100%	0%
Vol Thru, %	42%	65%	0%	0%
Vol Right, %	0%	35%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	211	194	57	142
LT Vol	122	0	57	0
Through Vol	89	126	0	0
RT Vol	0	68	0	142
Lane Flow Rate	227	209	61	153
Geometry Grp	2	2	7	7
Degree of Util (X)	0.305	0.264	0.103	0.206
Departure Headway (Hd)	4.838	4.549	6.061	4.85
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	740	786	590	736
Service Time	2.883	2.594	3.818	2.607
HCM Lane V/C Ratio	0.307	0.266	0.103	0.208
HCM Control Delay	10	9.2	9.5	8.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.3	1.1	0.3	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	6	132	41	7	72	184	376	18	23	271	13
Future Volume (Veh/h)	0	6	132	41	7	72	184	376	18	23	271	13
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	6	140	44	7	77	196	400	19	24	288	14
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1132	1147	288	1280	1152	410	302			419		
vC1, stage 1 conf vol	336	336		802	802							
vC2, stage 2 conf vol	796	811		479	350							
vCu, unblocked vol	1132	1147	288	1280	1152	410	302			419		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	81	79	98	88	84			98		
cM capacity (veh/h)	241	289	749	211	291	640	1253			1135		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	146	128	196	419	24	288	14
Volume Left	0	44	196	0	24	0	0
Volume Right	140	77	0	19	0	0	14
cSH	703	558	1253	1700	1135	1700	1700
Volume to Capacity	0.21	0.23	0.16	0.25	0.02	0.17	0.01
Queue Length 95th (ft)	19	22	14	0	2	0	0
Control Delay (s)	11.5	17.2	8.4	0.0	8.2	0.0	0.0
Lane LOS	B	C	A		A		
Approach Delay (s)	11.5	17.2	2.7		0.6		
Approach LOS	B	C					

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	105	418	253	59	27	57
Future Vol, veh/h	105	418	253	59	27	57
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	115	459	278	65	30	63

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	343	0	-	0	1000	310
Stage 1	-	-	-	-	310	-
Stage 2	-	-	-	-	690	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1210	-	-	-	268	728
Stage 1	-	-	-	-	741	-
Stage 2	-	-	-	-	496	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1210	-	-	-	243	728
Mov Cap-2 Maneuver	-	-	-	-	355	-
Stage 1	-	-	-	-	741	-
Stage 2	-	-	-	-	449	-

Approach	EB	WB	SB
HCM Control Delay, s	1.7	0	13
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1210	-	-	-	544
HCM Lane V/C Ratio	0.095	-	-	-	0.17
HCM Control Delay (s)	8.3	-	-	-	13
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.6

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	210	236	33	249	63	10
Future Vol, veh/h	210	236	33	249	63	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	231	259	36	274	69	11

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	231	0	577	231
Stage 1	-	-	-	-	231	-
Stage 2	-	-	-	-	346	-
Critical Hdwy	-	-	4.13	-	7.13	6.23
Critical Hdwy Stg 1	-	-	-	-	6.13	-
Critical Hdwy Stg 2	-	-	-	-	6.13	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1331	-	426	806
Stage 1	-	-	-	-	770	-
Stage 2	-	-	-	-	668	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1331	-	417	806
Mov Cap-2 Maneuver	-	-	-	-	509	-
Stage 1	-	-	-	-	770	-
Stage 2	-	-	-	-	650	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	12.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	536	-	-	1331	-
HCM Lane V/C Ratio	0.15	-	-	0.027	-
HCM Control Delay (s)	12.9	-	-	7.8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.5	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	16
Intersection LOS	C

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Lane Configurations									
Traffic Vol, veh/h	0	257	46	0	28	267	0	151	365
Future Vol, veh/h	0	257	46	0	28	267	0	151	365
Peak Hour Factor	0.92	0.91	0.91	0.92	0.91	0.91	0.92	0.91	0.91
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	282	51	0	31	293	0	166	401
Number of Lanes	0	1	0	0	0	2	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	17.9	12.7	16.8
HCM LOS	C	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	24%	0%
Vol Thru, %	0%	0%	85%	76%	100%
Vol Right, %	0%	100%	15%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	151	365	303	117	178
LT Vol	151	0	0	28	0
Through Vol	0	0	257	89	178
RT Vol	0	365	46	0	0
Lane Flow Rate	166	401	333	129	196
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.322	0.643	0.583	0.244	0.365
Departure Headway (Hd)	6.987	5.769	6.306	6.832	6.71
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	514	626	569	523	534
Service Time	4.743	3.525	4.363	4.599	4.477
HCM Lane V/C Ratio	0.323	0.641	0.585	0.247	0.367
HCM Control Delay	13.1	18.4	17.9	11.8	13.3
HCM Lane LOS	B	C	C	B	B
HCM 95th-tile Q	1.4	4.6	3.7	0.9	1.7

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	239	83	12	157	0	0	0	0	129	194	86
Future Vol, veh/h	0	239	83	12	157	0	0	0	0	129	194	86
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	81	81	81	81	81	81	81	81	81
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	295	102	15	194	0	0	0	0	159	240	106

Major/Minor	Major1			Minor2		
Conflicting Flow All	-	0	0	346	398	0
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	346	398	-
Critical Hdwy	-	-	-	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	6.13	5.53	-
Follow-up Hdwy	-	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	0	-	-	606	538	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	668	601	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	-	-	-	606	538	-
Mov Cap-2 Maneuver	-	-	-	606	538	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	668	601	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	575	-
HCM Lane V/C Ratio	-	-	0.485	-
HCM Control Delay (s)	-	-	17	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	2.6	-

Intersection	
Intersection Delay, s/veh	15.4
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	139	229	0	0	0	130	219	0	39	274	2
Future Vol, veh/h	0	139	229	0	0	0	130	219	0	39	274	2
Peak Hour Factor	0.92	0.88	0.88	0.88	0.92	0.88	0.88	0.88	0.92	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	158	260	0	0	0	148	249	0	44	311	2
Number of Lanes	0	1	1	0	0	0	1	0	0	0	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	13.5	19.4	13.1
HCM LOS	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	22%	0%	100%	0%	0%
Vol Thru, %	78%	99%	0%	100%	37%
Vol Right, %	0%	1%	0%	0%	63%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	176	139	139	229	349
LT Vol	39	0	139	0	0
Through Vol	137	137	0	229	130
RT Vol	0	2	0	0	219
Lane Flow Rate	200	158	158	260	397
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.382	0.296	0.298	0.454	0.651
Departure Headway (Hd)	6.867	6.744	6.787	6.278	5.906
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	524	532	529	573	611
Service Time	4.621	4.498	4.542	4.033	3.954
HCM Lane V/C Ratio	0.382	0.297	0.299	0.454	0.65
HCM Control Delay	13.8	12.3	12.4	14.2	19.4
HCM Lane LOS	B	B	B	B	C
HCM 95th-tile Q	1.8	1.2	1.2	2.4	4.7

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	0
Future Vol, veh/h	0	0	0	0
Peak Hour Factor	0.92	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3
Mvmt Flow	0	0	0	0
Number of Lanes	0	0	0	0

Approach	
Opposing Approach	
Opposing Lanes	
Conflicting Approach Left	
Conflicting Lanes Left	
Conflicting Approach Right	
Conflicting Lanes Right	
HCM Control Delay	
HCM LOS	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	24	9	244	22	469	10	238	196	505	235	2
Future Volume (vph)	7	24	9	244	22	469	10	238	196	505	235	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frpb, ped/bikes		1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1789		1681	1699	1559	1770	1863	1553	3433	1860	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1789		1681	1699	1559	1770	1863	1553	3433	1860	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	8	26	10	268	24	515	11	262	215	555	258	2
RTOR Reduction (vph)	0	8	0	0	0	155	0	0	133	0	0	0
Lane Group Flow (vph)	0	36	0	145	147	360	11	262	82	555	260	0
Confl. Peds. (#/hr)						1			4			4
Confl. Bikes (#/hr)									2			
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		6.9		54.5	54.5	79.6	21.0	21.0	21.0	25.1	25.1	
Effective Green, g (s)		6.9		54.5	54.5	79.6	21.0	21.0	21.0	25.1	25.1	
Actuated g/C Ratio		0.06		0.44	0.44	0.64	0.17	0.17	0.17	0.20	0.20	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		3.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		99		738	746	1000	299	315	263	694	376	
v/s Ratio Prot		c0.02		0.09	0.09	c0.07	0.01	c0.14		c0.16	0.14	
v/s Ratio Perm						0.16			0.05			
v/c Ratio		0.36		0.20	0.20	0.36	0.04	0.83	0.31	0.80	0.69	
Uniform Delay, d1		56.4		21.3	21.3	10.3	43.0	49.8	45.2	47.1	45.9	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.2		0.6	0.6	0.1	0.0	16.2	0.2	6.0	4.4	
Delay (s)		58.6		21.9	21.9	10.4	43.1	65.9	45.4	53.1	50.2	
Level of Service		E		C	C	B	D	E	D	D	D	
Approach Delay (s)		58.6			14.6			56.4			52.2	
Approach LOS		E			B			E			D	

Intersection Summary				
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	0.55			
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5	
Intersection Capacity Utilization	58.7%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	683	42	165	547	0	31	0	218	326	38	157
Future Volume (vph)	0	683	42	165	547	0	31	0	218	326	38	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Flpb, ped/bikes		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3500		1770	3539		1770		1583	3433	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3500		1770	3539		1770		1583	3433	1863	1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	804	49	194	644	0	36	0	256	384	45	185
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	44	0	0	160
Lane Group Flow (vph)	0	851	0	194	644	0	36	0	212	384	45	25
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)						1						
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		80.4		19.6	104.6		6.7		26.3	20.1	20.1	20.1
Effective Green, g (s)		80.4		19.6	104.6		6.7		26.3	20.1	20.1	20.1
Actuated g/C Ratio		0.55		0.13	0.71		0.05		0.18	0.14	0.14	0.14
Clearance Time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		1918		236	2523		80		283	470	255	216
v/s Ratio Prot		c0.24		c0.11	0.18		0.02		c0.10	c0.11	0.02	
v/s Ratio Perm									0.03			0.02
v/c Ratio		0.44		0.82	0.26		0.45		0.75	0.82	0.18	0.12
Uniform Delay, d1		19.8		61.9	7.4		68.2		57.1	61.5	56.0	55.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.7		19.2	0.2		1.5		9.1	10.0	0.1	0.1
Delay (s)		20.5		81.1	7.6		69.7		66.1	71.5	56.1	55.6
Level of Service		C		F	A		E		E	E	E	E
Approach Delay (s)		20.5			24.6			66.6			65.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	146.7	Sum of lost time (s)	19.9
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱		↑↑	↱	↰		↱			
Traffic Volume (vph)	0	705	138	0	890	397	267	0	408	0	0	0
Future Volume (vph)	0	705	138	0	890	397	267	0	408	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frpb, ped/bikes		1.00	0.97		1.00	0.99	1.00		1.00			
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1537		3539	1560	1770		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1537		3539	1560	1770		1583			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	766	150	0	967	432	290	0	443	0	0	0
RTOR Reduction (vph)	0	0	53	0	0	0	0	0	134	0	0	0
Lane Group Flow (vph)	0	766	97	0	967	432	290	0	309	0	0	0
Confl. Peds. (#/hr)			5									
Confl. Bikes (#/hr)						1						
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		57.4	57.4		57.4	80.5	22.6		22.6			
Effective Green, g (s)		57.4	57.4		57.4	80.5	22.6		22.6			
Actuated g/C Ratio		0.65	0.65		0.65	0.91	0.26		0.26			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2292	995		2292	1479	451		403			
v/s Ratio Prot		0.22			c0.27	0.08	0.16		c0.20			
v/s Ratio Perm			0.06			0.20						
v/c Ratio		0.33	0.10		0.42	0.29	0.64		0.77			
Uniform Delay, d1		7.0	5.9		7.6	0.5	29.4		30.6			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.4	0.2		0.1	0.1	3.1		8.5			
Delay (s)		7.4	6.1		7.7	0.6	32.5		39.0			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		7.2			5.5			36.5			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	227	534	352	107	578	26	405	77	129	72	54	304
Future Volume (vph)	227	534	352	107	578	26	405	77	129	72	54	304
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00		1.00	0.98		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1522	1770	3514		3433	1661		1770	1863	1578
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1522	1770	3514		3433	1661		1770	1863	1578
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	258	607	400	122	657	30	460	88	147	82	61	345
RTOR Reduction (vph)	0	0	193	0	2	0	0	48	0	0	0	60
Lane Group Flow (vph)	258	607	207	122	685	0	460	187	0	82	61	285
Confl. Peds. (#/hr)			8			1			10			
Confl. Bikes (#/hr)												2
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	22.1	69.4	69.4	22.3	69.6		23.4	20.6		10.2	7.4	29.5
Effective Green, g (s)	22.1	69.4	69.4	22.3	69.6		23.4	20.6		10.2	7.4	29.5
Actuated g/C Ratio	0.16	0.50	0.50	0.16	0.51		0.17	0.15		0.07	0.05	0.21
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	551	1784	767	286	1777		583	248		131	100	338
v/s Ratio Prot	0.08	0.17		c0.07	c0.19		c0.13	0.11		0.05	0.03	c0.14
v/s Ratio Perm			0.14									0.05
v/c Ratio	0.47	0.34	0.27	0.43	0.39		0.79	0.75		0.63	0.61	0.84
Uniform Delay, d1	52.4	20.4	19.6	51.9	20.9		54.7	56.1		61.8	63.7	51.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.5	0.9	0.4	0.6		6.5	10.8		6.6	7.0	16.4
Delay (s)	52.6	20.9	20.4	52.3	21.5		61.2	66.9		68.4	70.7	68.2
Level of Service	D	C	C	D	C		E	E		E	E	E
Approach Delay (s)		27.2			26.1			63.1			68.6	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	173	422	125	147	349	143	57	220	165	95	256	196
Future Volume (veh/h)	173	422	125	147	349	143	57	220	165	95	256	196
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	201	491	145	171	406	166	66	256	192	110	298	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	247	622	528	212	586	496	113	418	355	140	447	380
Arrive On Green	0.14	0.33	0.33	0.12	0.31	0.31	0.06	0.22	0.22	0.08	0.24	0.00
Sat Flow, veh/h	1774	1863	1581	1774	1863	1576	1774	1863	1580	1774	1863	1583
Grp Volume(v), veh/h	201	491	145	171	406	166	66	256	192	110	298	0
Grp Sat Flow(s),veh/h/ln	1774	1863	1581	1774	1863	1576	1774	1863	1580	1774	1863	1583
Q Serve(g_s), s	7.3	15.9	4.5	6.3	12.7	5.4	2.4	8.2	7.2	4.1	9.7	0.0
Cycle Q Clear(g_c), s	7.3	15.9	4.5	6.3	12.7	5.4	2.4	8.2	7.2	4.1	9.7	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	247	622	528	212	586	496	113	418	355	140	447	380
V/C Ratio(X)	0.82	0.79	0.27	0.81	0.69	0.33	0.59	0.61	0.54	0.78	0.67	0.00
Avail Cap(c_a), veh/h	332	737	625	253	765	647	173	848	720	173	876	745
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	27.9	20.1	16.3	28.6	20.0	17.5	30.4	23.3	22.8	30.2	22.9	0.0
Incr Delay (d2), s/veh	10.8	4.9	0.3	14.9	1.8	0.4	4.8	1.5	1.3	17.0	1.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	9.0	2.0	3.9	6.8	2.4	1.3	4.4	3.3	2.6	5.2	0.0
LnGrp Delay(d),s/veh	38.7	25.0	16.6	43.6	21.9	17.9	35.2	24.7	24.1	47.2	24.6	0.0
LnGrp LOS	D	C	B	D	C	B	D	C	C	D	C	
Approach Vol, veh/h		837			743			514			408	
Approach Delay, s/veh		26.8			26.0			25.8			30.7	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.8	19.6	11.5	26.9	7.7	20.6	12.8	25.6
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	6.1	10.2	8.3	17.9	4.4	11.7	9.3	14.7
Green Ext Time (p_c), s	0.0	4.0	0.1	4.2	0.0	3.9	0.2	5.5

Intersection Summary	
HCM 2010 Ctrl Delay	27.0
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	641	40	100	567	72	206
Future Volume (Veh/h)	641	40	100	567	72	206
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	728	45	114	644	82	234
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	3.5					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			908		
pX, platoon unblocked			0.75		0.85	0.75
vC, conflicting volume			773		1628	750
vC1, stage 1 conf vol					750	
vC2, stage 2 conf vol					877	
vCu, unblocked vol			534		1126	505
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			85		72	45
cM capacity (veh/h)			778		293	427

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	773	114	644	82	234
Volume Left	0	114	0	82	0
Volume Right	45	0	0	0	234
cSH	1700	778	1700	293	427
Volume to Capacity	0.45	0.15	0.38	0.28	0.55
Queue Length 95th (ft)	0	13	0	28	80
Control Delay (s)	0.0	10.4	0.0	22.0	23.2
Lane LOS		B		C	C
Approach Delay (s)	0.0	1.6		22.9	
Approach LOS				C	

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	543	402	284	558	0	0	0	0	209	53	139
Future Volume (vph)	0	543	402	284	558	0	0	0	0	209	53	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Flpb, ped/bikes		1.00	1.00	1.00	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3539	1583	1770	3539						1791	1583
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3539	1583	1770	3539						1791	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	610	452	319	627	0	0	0	0	235	60	156
RTOR Reduction (vph)	0	0	267	0	0	0	0	0	0	0	0	119
Lane Group Flow (vph)	0	610	185	319	627	0	0	0	0	0	295	37
Confl. Peds. (#/hr)						5						
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		43.2	43.2	20.5	45.5						25.0	25.0
Effective Green, g (s)		43.2	43.2	20.5	39.1						25.0	25.0
Actuated g/C Ratio		0.41	0.41	0.19	0.37						0.24	0.24
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1449	648	343	1311						424	375
v/s Ratio Prot		c0.17		c0.18	0.18						c0.16	
v/s Ratio Perm			0.12									0.02
v/c Ratio		0.42	0.29	0.93	0.48						0.70	0.10
Uniform Delay, d1		22.2	20.8	41.8	25.4						36.8	31.4
Progression Factor		1.00	1.00	0.65	0.55						1.00	1.00
Incremental Delay, d2		0.1	0.1	33.1	0.1						4.0	0.0
Delay (s)		22.3	20.9	60.5	14.1						40.8	31.5
Level of Service		C	C	E	B						D	C
Approach Delay (s)		21.7			29.7			0.0			37.6	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	105.5	Sum of lost time (s)	24.6
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	226	526	0	0	565	186	277	0	240	0	0	0
Future Volume (vph)	226	526	0	0	565	186	277	0	240	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00	1.00			
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00	1.00			
Frt	1.00	1.00			0.96		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1770	1863			4856		1681	1681	1583			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1770	1863			4856		1681	1681	1583			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	238	554	0	0	595	196	292	0	253	0	0	0
RTOR Reduction (vph)	0	0	0	0	43	0	0	0	210	0	0	0
Lane Group Flow (vph)	238	554	0	0	748	0	146	146	43	0	0	0
Confl. Peds. (#/hr)						5						
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	17.3	49.2			52.4		18.1	18.1	18.1			
Effective Green, g (s)	17.3	42.8			52.4		18.1	18.1	18.1			
Actuated g/C Ratio	0.16	0.41			0.50		0.17	0.17	0.17			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	290	755			2411		288	288	271			
v/s Ratio Prot	c0.13	c0.30			c0.15		c0.09	0.09				
v/s Ratio Perm									0.03			
v/c Ratio	0.82	0.73			0.31		0.51	0.51	0.16			
Uniform Delay, d1	42.6	26.5			15.8		39.7	39.7	37.2			
Progression Factor	0.69	0.94			1.00		1.00	1.00	1.00			
Incremental Delay, d2	15.1	3.0			0.0		0.5	0.5	0.1			
Delay (s)	44.6	28.0			15.8		40.2	40.2	37.3			
Level of Service	D	C			B		D	D	D			
Approach Delay (s)		33.0			15.8			38.8			0.0	
Approach LOS		C			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	105.5	Sum of lost time (s)	24.6
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	310	436	43	272	11	460	4	45	12	4	21
Future Volume (vph)	20	310	436	43	272	11	460	4	45	12	4	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85		0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)	1770	1863	1583	1770	1851		1681	1687	1583		1693	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)	1770	1863	1583	1770	1851		1681	1687	1583		1693	
Peak-hour factor, PHF	0.96	0.96	0.92	0.92	0.96	0.96	0.92	0.92	0.92	0.96	0.92	0.96
Adj. Flow (vph)	21	323	474	47	283	11	500	4	49	12	4	22
RTOR Reduction (vph)	0	0	310	0	1	0	0	0	35	0	21	0
Lane Group Flow (vph)	21	323	164	47	293	0	250	254	14	0	18	0
Confl. Peds. (#/hr)						3						
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	1.9	22.1	22.1	3.5	23.7		18.4	18.4	18.4		3.1	
Effective Green, g (s)	1.9	22.1	22.1	3.5	23.7		18.4	18.4	18.4		3.1	
Actuated g/C Ratio	0.03	0.35	0.35	0.05	0.37		0.29	0.29	0.29		0.05	
Clearance Time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0		2.0	
Lane Grp Cap (vph)	52	644	547	96	686		484	485	455		82	
v/s Ratio Prot	0.01	c0.17		c0.03	0.16		0.15	c0.15			c0.01	
v/s Ratio Perm			0.10						0.01			
v/c Ratio	0.40	0.50	0.30	0.49	0.43		0.52	0.52	0.03		0.22	
Uniform Delay, d1	30.4	16.5	15.3	29.3	15.0		19.0	19.1	16.3		29.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.9	0.6	0.3	1.4	0.4		0.9	1.0	0.0		0.5	
Delay (s)	32.3	17.2	15.6	30.8	15.5		20.0	20.1	16.4		29.7	
Level of Service	C	B	B	C	B		B	C	B		C	
Approach Delay (s)		16.6			17.6			19.7			29.7	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	63.9	Sum of lost time (s)	16.8
Intersection Capacity Utilization	52.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Intersection	
Intersection Delay, s/veh	14
Intersection LOS	B

Movement	EBU	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Lane Configurations									
Traffic Vol, veh/h	0	197	127	0	118	186	0	177	182
Future Vol, veh/h	0	197	127	0	118	186	0	177	182
Peak Hour Factor	0.92	0.97	0.97	0.92	0.97	0.97	0.92	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	203	131	0	122	192	0	182	188
Number of Lanes	0	1	0	0	0	1	0	1	0

Approach	EB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	SB	EB	
Conflicting Lanes Left	1	1	0
Conflicting Approach Right	NB		EB
Conflicting Lanes Right	1	0	1
HCM Control Delay	14.5	13.7	13.7
HCM LOS	B	B	B

Lane	NBLn1	EBLn1	SBLn1
Vol Left, %	39%	61%	0%
Vol Thru, %	61%	0%	49%
Vol Right, %	0%	39%	51%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	304	324	359
LT Vol	118	197	0
Through Vol	186	0	177
RT Vol	0	127	182
Lane Flow Rate	313	334	370
Geometry Grp	1	1	1
Degree of Util (X)	0.482	0.517	0.525
Departure Headway (Hd)	5.541	5.569	5.109
Convergence, Y/N	Yes	Yes	Yes
Cap	649	648	703
Service Time	3.586	3.613	3.153
HCM Lane V/C Ratio	0.482	0.515	0.526
HCM Control Delay	13.7	14.5	13.7
HCM Lane LOS	B	B	B
HCM 95th-tile Q	2.6	3	3.1

Intersection	
Intersection Delay, s/veh	11.7
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations									
Traffic Vol, veh/h	0	174	155	0	115	91	0	103	225
Future Vol, veh/h	0	174	155	0	115	91	0	103	225
Peak Hour Factor	0.92	0.96	0.96	0.92	0.96	0.96	0.92	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	181	161	0	120	95	0	107	234
Number of Lanes	0	0	1	0	1	0	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	13.5	10.3	10.7
HCM LOS	B	B	B

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	53%	0%	100%	0%
Vol Thru, %	47%	56%	0%	0%
Vol Right, %	0%	44%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	329	206	103	225
LT Vol	174	0	103	0
Through Vol	155	115	0	0
RT Vol	0	91	0	225
Lane Flow Rate	343	215	107	234
Geometry Grp	2	2	7	7
Degree of Util (X)	0.502	0.303	0.193	0.343
Departure Headway (Hd)	5.273	5.078	6.487	5.273
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	689	708	554	682
Service Time	3.273	3.106	4.217	3.001
HCM Lane V/C Ratio	0.498	0.304	0.193	0.343
HCM Control Delay	13.5	10.3	10.8	10.7
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.8	1.3	0.7	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	210	18	0	35	206	438	42	98	442	17
Future Volume (Veh/h)	0	0	210	18	0	35	206	438	42	98	442	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	233	20	0	39	229	487	47	109	491	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1654	1701	491	1910	1696	510	510			534		
vC1, stage 1 conf vol	709	709		968	968							
vC2, stage 2 conf vol	945	992		942	728							
vCu, unblocked vol	1654	1701	491	1910	1696	510	510			534		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	60	15	100	93	78			89		
cM capacity (veh/h)	115	137	578	24	140	563	1055			1034		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	233	59	229	534	109	491	19
Volume Left	0	20	229	0	109	0	0
Volume Right	233	39	0	47	0	0	19
cSH	578	66	1055	1700	1034	1700	1700
Volume to Capacity	0.40	0.89	0.22	0.31	0.11	0.29	0.01
Queue Length 95th (ft)	49	107	21	0	9	0	0
Control Delay (s)	15.4	184.1	9.4	0.0	8.9	0.0	0.0
Lane LOS	C	F	A		A		
Approach Delay (s)	15.4	184.1	2.8		1.6		
Approach LOS	C	F					

Intersection Summary			
Average Delay	10.5		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	6.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	109	330	452	63	78	154
Future Vol, veh/h	109	330	452	63	78	154
Conflicting Peds, #/hr	0	0	0	2	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	121	367	502	70	87	171

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	574	0	-	0	1148	539
Stage 1	-	-	-	-	539	-
Stage 2	-	-	-	-	609	-
Critical Hdwy	4.12	-	-	-	7.12	6.22
Critical Hdwy Stg 1	-	-	-	-	6.12	-
Critical Hdwy Stg 2	-	-	-	-	6.12	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	999	-	-	-	176	542
Stage 1	-	-	-	-	527	-
Stage 2	-	-	-	-	482	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	999	-	-	-	159	541
Mov Cap-2 Maneuver	-	-	-	-	274	-
Stage 1	-	-	-	-	462	-
Stage 2	-	-	-	-	424	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	27.9
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	999	-	-	-	407
HCM Lane V/C Ratio	0.121	-	-	-	0.633
HCM Control Delay (s)	9.1	-	-	-	27.9
HCM Lane LOS	A	-	-	-	D
HCM 95th %tile Q(veh)	0.4	-	-	-	4.2

Intersection	
Int Delay, s/veh	3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	316	91	16	341	174	25
Future Vol, veh/h	316	91	16	341	174	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	347	100	18	375	191	27

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	347	0	757	347
Stage 1	-	-	-	-	347	-
Stage 2	-	-	-	-	410	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1212	-	375	696
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	670	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1212	-	369	696
Mov Cap-2 Maneuver	-	-	-	-	481	-
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	660	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	17.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	500	-	-	1212	-
HCM Lane V/C Ratio	0.437	-	-	0.015	-
HCM Control Delay (s)	17.7	-	-	8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	2.2	-	-	0	-

Intersection	
Intersection Delay, s/veh	38.9
Intersection LOS	E

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Lane Configurations									
Traffic Vol, veh/h	0	200	62	0	71	718	0	171	227
Future Vol, veh/h	0	200	62	0	71	718	0	171	227
Peak Hour Factor	0.92	0.84	0.84	0.92	0.84	0.84	0.92	0.84	0.84
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	238	74	0	85	855	0	204	270
Number of Lanes	0	1	0	0	0	2	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	18.6	56.9	16.7
HCM LOS	C	F	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	23%	0%
Vol Thru, %	0%	0%	76%	77%	100%
Vol Right, %	0%	100%	24%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	171	227	262	310	479
LT Vol	171	0	0	71	0
Through Vol	0	0	200	239	479
RT Vol	0	227	62	0	0
Lane Flow Rate	204	270	312	369	570
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.447	0.504	0.576	0.694	1.052
Departure Headway (Hd)	8.092	6.864	6.798	6.764	6.647
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	448	530	533	536	547
Service Time	5.792	4.564	4.798	4.5	4.384
HCM Lane V/C Ratio	0.455	0.509	0.585	0.688	1.042
HCM Control Delay	17.2	16.3	18.6	23.5	78.5
HCM Lane LOS	C	C	C	C	F
HCM 95th-tile Q	2.3	2.8	3.6	5.4	16.4

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	353	183	12	127	0	0	0	0	155	202	150
Future Vol, veh/h	0	353	183	12	127	0	0	0	0	155	202	150
Conflicting Peds, #/hr	0	0	2	0	0	7	0	0	1	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	384	199	13	138	0	0	0	0	168	220	163

Major/Minor	Major1									Minor2		
Conflicting Flow All	-	0	0							483	585	0
Stage 1	-	-	-							0	0	-
Stage 2	-	-	-							483	585	-
Critical Hdwy	-	-	-							7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-							-	-	-
Critical Hdwy Stg 2	-	-	-							6.12	5.52	-
Follow-up Hdwy	-	-	-							3.518	4.018	3.318
Pot Cap-1 Maneuver	0	-	-							494	423	-
Stage 1	0	-	-							-	-	-
Stage 2	0	-	-							565	498	-
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-							494	423	-
Mov Cap-2 Maneuver	-	-	-							494	423	-
Stage 1	-	-	-							-	-	-
Stage 2	-	-	-							565	498	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	463	-
HCM Lane V/C Ratio	-	-	0.601	-
HCM Control Delay (s)	-	-	23.8	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	3.9	-

Intersection	
Intersection Delay, s/veh	14.6
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	160	348	0	0	0	100	145	0	39	327	2
Future Vol, veh/h	0	160	348	0	0	0	100	145	0	39	327	2
Peak Hour Factor	0.92	0.97	0.97	0.97	0.92	0.97	0.97	0.97	0.92	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	165	359	0	0	0	103	149	0	40	337	2
Number of Lanes	0	1	1	0	0	0	1	0	0	0	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	16.2	13.6	13.1
HCM LOS	C	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	19%	0%	100%	0%	0%
Vol Thru, %	81%	99%	0%	100%	41%
Vol Right, %	0%	1%	0%	0%	59%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	203	166	160	348	245
LT Vol	39	0	160	0	0
Through Vol	164	164	0	348	100
RT Vol	0	2	0	0	145
Lane Flow Rate	209	171	165	359	253
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.39	0.314	0.303	0.609	0.426
Departure Headway (Hd)	6.723	6.616	6.618	6.111	6.07
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	534	543	543	592	594
Service Time	4.47	4.364	4.363	3.856	4.117
HCM Lane V/C Ratio	0.391	0.315	0.304	0.606	0.426
HCM Control Delay	13.7	12.4	12.2	18	13.6
HCM Lane LOS	B	B	B	C	B
HCM 95th-tile Q	1.8	1.3	1.3	4.1	2.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	0
Future Vol, veh/h	0	0	0	0
Peak Hour Factor	0.92	0.97	0.97	0.97
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	0	0	0
Number of Lanes	0	0	0	0

Approach	
Opposing Approach	
Opposing Lanes	
Conflicting Approach Left	
Conflicting Lanes Left	
Conflicting Approach Right	
Conflicting Lanes Right	
HCM Control Delay	
HCM LOS	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	25	20	250	20	380	10	155	100	334	160	10
Future Volume (vph)	10	25	20	250	20	380	10	155	100	334	160	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.95		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1737		1665	1681	1568	1752	1845	1568	3400	1829	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1737		1665	1681	1568	1752	1845	1568	3400	1829	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	28	23	284	23	432	11	176	114	380	182	11
RTOR Reduction (vph)	0	18	0	0	0	133	0	0	100	0	2	0
Lane Group Flow (vph)	0	44	0	153	154	299	11	176	14	380	191	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		6.2		67.8	67.8	85.9	15.4	15.4	15.4	18.1	18.1	
Effective Green, g (s)		6.2		67.8	67.8	85.9	15.4	15.4	15.4	18.1	18.1	
Actuated g/C Ratio		0.05		0.55	0.55	0.69	0.12	0.12	0.12	0.15	0.15	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		86		910	919	1086	217	229	194	496	266	
v/s Ratio Prot		c0.03		0.09	0.09	c0.04	0.01	c0.10		c0.11	0.10	
v/s Ratio Perm						0.15			0.01			
v/c Ratio		0.51		0.17	0.17	0.28	0.05	0.77	0.07	0.77	0.72	
Uniform Delay, d1		57.4		14.0	14.0	7.2	47.9	52.6	48.0	50.9	50.5	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.1		0.4	0.4	0.1	0.0	13.0	0.1	6.3	7.5	
Delay (s)		59.5		14.4	14.4	7.3	47.9	65.6	48.0	57.2	58.0	
Level of Service		E		B	B	A	D	E	D	E	E	
Approach Delay (s)		59.5			10.2			58.3			57.5	
Approach LOS		E			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	419	40	102	470	0	30	0	138	270	45	150
Future Volume (vph)	0	419	40	102	470	0	30	0	138	270	45	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3459		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3459		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	441	42	107	495	0	32	0	145	284	47	158
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	126	0	0	141
Lane Group Flow (vph)	0	481	0	107	495	0	32	0	19	284	47	17
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		100.0		12.8	116.3		6.7		19.5	16.3	16.3	16.3
Effective Green, g (s)		100.0		12.8	116.3		6.7		19.5	16.3	16.3	16.3
Actuated g/C Ratio		0.66		0.08	0.76		0.04		0.13	0.11	0.11	0.11
Clearance Time (s)		4.6		3.5	4.6		4.0		3.5	4.6	4.6	4.6
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		2268		147	2672		76		200	363	197	167
v/s Ratio Prot		c0.14		c0.06	0.14		c0.02		0.01	c0.08	0.03	
v/s Ratio Perm									0.00			0.01
v/c Ratio		0.21		0.73	0.19		0.42		0.09	0.78	0.24	0.10
Uniform Delay, d1		10.5		68.2	5.0		71.0		58.7	66.4	62.4	61.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.2		14.1	0.2		1.4		0.1	9.7	0.2	0.1
Delay (s)		10.7		82.2	5.2		72.4		58.8	76.1	62.6	61.6
Level of Service		B		F	A		E		E	E	E	E
Approach Delay (s)		10.7			18.9			61.2			70.1	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	152.5	Sum of lost time (s)	16.7
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱		↑↑	↱	↰		↱			
Traffic Volume (vph)	0	520	100	0	559	260	277	0	444	0	0	0
Future Volume (vph)	0	520	100	0	559	260	277	0	444	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	591	114	0	635	295	315	0	505	0	0	0
RTOR Reduction (vph)	0	0	40	0	0	0	0	0	207	0	0	0
Lane Group Flow (vph)	0	591	74	0	635	295	315	0	298	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		57.2	57.2		57.2	80.5	22.8		22.8			
Effective Green, g (s)		57.2	57.2		57.2	80.5	22.8		22.8			
Actuated g/C Ratio		0.65	0.65		0.65	0.91	0.26		0.26			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2262	1012		2262	1486	450		403			
v/s Ratio Prot		0.17			c0.18	0.05	0.18		c0.19			
v/s Ratio Perm			0.05			0.14						
v/c Ratio		0.26	0.07		0.28	0.20	0.70		0.74			
Uniform Delay, d1		6.7	5.8		6.8	0.5	29.8		30.2			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.3	0.1		0.1	0.1	4.7		6.9			
Delay (s)		7.0	6.0		6.9	0.5	34.5		37.1			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		6.8			4.9			36.1			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	15.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	468	329	145	476	25	201	40	75	30	40	143
Future Volume (vph)	167	468	329	145	476	25	201	40	75	30	40	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3479		3400	1665		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3479		3400	1665		1752	1845	1568
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	184	514	362	159	523	27	221	44	82	33	44	157
RTOR Reduction (vph)	0	0	151	0	1	0	0	57	0	0	0	137
Lane Group Flow (vph)	184	514	211	159	549	0	221	69	0	33	44	20
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	10.9	80.1	80.1	22.5	91.7		13.1	15.3		4.6	6.8	17.7
Effective Green, g (s)	10.9	80.1	80.1	22.5	91.7		13.1	15.3		4.6	6.8	17.7
Actuated g/C Ratio	0.08	0.58	0.58	0.16	0.67		0.10	0.11		0.03	0.05	0.13
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	269	2040	912	286	2318		323	185		58	91	201
v/s Ratio Prot	c0.05	c0.15		c0.09	0.16		c0.07	0.04		0.02	c0.02	0.01
v/s Ratio Perm			0.13									0.00
v/c Ratio	0.68	0.25	0.23	0.56	0.24		0.68	0.37		0.57	0.48	0.10
Uniform Delay, d1	61.7	14.1	13.9	53.0	9.1		60.2	56.7		65.5	63.7	52.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.6	0.3	0.6	1.3	0.2		4.7	0.5		7.4	1.5	0.1
Delay (s)	67.3	14.4	14.5	54.3	9.3		65.0	57.2		72.9	65.2	53.0
Level of Service	E	B	B	D	A		E	E		E	E	D
Approach Delay (s)		23.6			19.4			62.1			58.1	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	15.1
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	105	289	70	101	494	164	100	160	108	76	165	185
Future Volume (veh/h)	105	289	70	101	494	164	100	160	108	76	165	185
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	115	318	77	111	543	180	110	176	119	84	181	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	149	704	599	143	698	593	140	341	290	114	313	266
Arrive On Green	0.09	0.38	0.38	0.08	0.38	0.38	0.08	0.19	0.19	0.06	0.17	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	115	318	77	111	543	180	110	176	119	84	181	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	3.6	7.3	1.8	3.5	14.7	4.6	3.5	4.9	3.8	2.7	5.1	0.0
Cycle Q Clear(g_c), s	3.6	7.3	1.8	3.5	14.7	4.6	3.5	4.9	3.8	2.7	5.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	149	704	599	143	698	593	140	341	290	114	313	266
V/C Ratio(X)	0.77	0.45	0.13	0.78	0.78	0.30	0.78	0.52	0.41	0.74	0.58	0.00
Avail Cap(c_a), veh/h	389	862	733	295	895	760	202	993	844	202	1025	872
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	25.3	13.0	11.3	25.4	15.5	12.3	25.5	20.7	20.3	25.9	21.6	0.0
Incr Delay (d2), s/veh	8.1	0.5	0.1	8.6	3.4	0.3	11.8	1.2	0.9	8.9	1.7	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	3.8	0.8	2.0	8.0	2.0	2.1	2.6	1.7	1.6	2.7	0.0
LnGrp Delay(d),s/veh	33.4	13.5	11.4	34.1	18.8	12.6	37.3	21.9	21.2	34.9	23.3	0.0
LnGrp LOS	C	B	B	C	B	B	D	C	C	C	C	
Approach Vol, veh/h		510			834			405			265	
Approach Delay, s/veh		17.7			19.5			25.9			26.9	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.2	15.1	8.1	26.2	8.0	14.2	8.3	26.0
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	4.7	6.9	5.5	9.3	5.5	7.1	5.6	16.7
Green Ext Time (p_c), s	0.0	2.5	0.1	6.1	0.0	2.5	0.1	4.7

Intersection Summary	
HCM 2010 Ctrl Delay	21.3
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	408	65	209	704	55	106
Future Volume (Veh/h)	408	65	209	704	55	106
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	464	74	238	800	63	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			912		
pX, platoon unblocked			0.88		0.80	0.88
vC, conflicting volume			538		1777	501
vC1, stage 1 conf vol					501	
vC2, stage 2 conf vol					1276	
vCu, unblocked vol			401		1495	358
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			76		60	80
cM capacity (veh/h)			1009		156	598

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	538	238	800	63	120
Volume Left	0	238	0	63	0
Volume Right	74	0	0	0	120
cSH	1700	1009	1700	156	598
Volume to Capacity	0.32	0.24	0.47	0.40	0.20
Queue Length 95th (ft)	0	23	0	44	19
Control Delay (s)	0.0	9.7	0.0	43.0	12.5
Lane LOS		A		E	B
Approach Delay (s)	0.0	2.2		23.0	
Approach LOS				C	

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	347	130	187	814	0	0	0	0	170	55	210
Future Volume (vph)	0	347	130	187	814	0	0	0	0	170	55	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1778	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1778	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	394	148	212	925	0	0	0	0	193	62	239
RTOR Reduction (vph)	0	0	84	0	0	0	0	0	0	0	0	186
Lane Group Flow (vph)	0	394	64	213	925	0	0	0	0	0	256	53
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		46.0	46.0	20.6	53.5						23.5	23.5
Effective Green, g (s)		46.0	46.0	20.6	47.1						23.5	23.5
Actuated g/C Ratio		0.43	0.43	0.19	0.44						0.22	0.22
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1508	674	337	1544						390	344
v/s Ratio Prot		c0.11		c0.12	c0.26						c0.14	
v/s Ratio Perm			0.04									0.03
v/c Ratio		0.26	0.09	0.63	0.60						0.66	0.15
Uniform Delay, d1		19.5	18.1	39.7	22.7						38.0	33.7
Progression Factor		1.00	1.00	0.58	0.30						1.00	1.00
Incremental Delay, d2		0.0	0.0	7.8	0.4						3.0	0.1
Delay (s)		19.6	18.1	30.6	7.1						41.0	33.7
Level of Service		B	B	C	A						D	C
Approach Delay (s)		19.2			11.5			0.0			37.5	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	19.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	106.9	Sum of lost time (s)	24.6
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	397	0	0	426	88	575	5	323	0	0	0
Future Volume (vph)	120	397	0	0	426	88	575	5	323	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.97		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4907		1665	1670	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4907		1665	1670	1568			
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	136	451	0	0	484	100	653	6	367	0	0	0
RTOR Reduction (vph)	0	0	0	0	24	0	0	0	271	0	0	0
Lane Group Flow (vph)	136	451	0	0	560	0	326	333	96	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	12.2	42.6			51.0		26.0	26.0	26.0			
Effective Green, g (s)	12.2	36.2			51.0		26.0	26.0	26.0			
Actuated g/C Ratio	0.11	0.34			0.48		0.24	0.24	0.24			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	199	624			2341		404	406	381			
v/s Ratio Prot	0.08	c0.24			c0.11		0.20	c0.20				
v/s Ratio Perm									0.06			
v/c Ratio	0.68	0.72			0.24		0.81	0.82	0.25			
Uniform Delay, d1	45.5	31.0			16.5		38.1	38.2	32.6			
Progression Factor	0.73	1.03			1.00		1.00	1.00	1.00			
Incremental Delay, d2	7.2	3.4			0.0		10.6	11.9	0.1			
Delay (s)	40.2	35.4			16.5		48.7	50.2	32.7			
Level of Service	D	D			B		D	D	C			
Approach Delay (s)		36.5			16.5			43.5			0.0	
Approach LOS		D			B			D			A	

Intersection Summary			
HCM 2000 Control Delay	34.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	106.9	Sum of lost time (s)	24.6
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	494	215	43	344	5	152	2	30	5	3	15
Future Volume (vph)	10	494	215	43	344	5	152	2	30	5	3	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (prot)	1752	1845	1568	1752	1840		1665	1671	1568		1663	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.99	
Satd. Flow (perm)	1752	1845	1568	1752	1840		1665	1671	1568		1663	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	11	561	244	49	391	6	173	2	34	6	3	17
RTOR Reduction (vph)	0	0	82	0	0	0	0	0	29	0	17	0
Lane Group Flow (vph)	11	561	162	49	397	0	88	87	5	0	9	0
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.8	29.2	29.2	3.5	31.9		8.4	8.4	8.4		1.7	
Effective Green, g (s)	0.8	29.2	29.2	3.5	31.9		8.4	8.4	8.4		1.7	
Actuated g/C Ratio	0.01	0.49	0.49	0.06	0.54		0.14	0.14	0.14		0.03	
Clearance Time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0		2.0	
Lane Grp Cap (vph)	23	903	768	102	984		234	235	220		47	
v/s Ratio Prot	0.01	c0.30		c0.03	c0.22		c0.05	0.05			c0.01	
v/s Ratio Perm			0.10						0.00			
v/c Ratio	0.48	0.62	0.21	0.48	0.40		0.38	0.37	0.02		0.20	
Uniform Delay, d1	29.2	11.1	8.6	27.2	8.2		23.2	23.2	22.1		28.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	5.6	1.3	0.1	1.3	0.3		1.0	1.0	0.0		0.8	
Delay (s)	34.8	12.5	8.8	28.5	8.5		24.2	24.2	22.1		29.1	
Level of Service	C	B	A	C	A		C	C	C		C	
Approach Delay (s)		11.7			10.7			23.9			29.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	59.6	Sum of lost time (s)	16.8
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	59
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations			✥				✥				✥	
Traffic Vol, veh/h	0	111	305	101	0	15	100	100	0	142	100	5
Future Vol, veh/h	0	111	305	101	0	15	100	100	0	142	100	5
Peak Hour Factor	0.92	0.88	0.88	0.88	0.92	0.88	0.88	0.88	0.92	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	126	347	115	0	17	114	114	0	161	114	6
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	110.6	19.2	23.8
HCM LOS	F	C	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	57%	21%	7%	20%
Vol Thru, %	40%	59%	47%	44%
Vol Right, %	2%	20%	47%	35%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	247	517	215	293
LT Vol	142	111	15	60
Through Vol	100	305	100	130
RT Vol	5	101	100	103
Lane Flow Rate	281	588	244	333
Geometry Grp	1	1	1	1
Degree of Util (X)	0.614	1.143	0.514	0.69
Departure Headway (Hd)	8.363	7.004	8.007	7.919
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	435	517	454	459
Service Time	6.363	5.068	6.007	5.919
HCM Lane V/C Ratio	0.646	1.137	0.537	0.725
HCM Control Delay	23.8	110.6	19.2	26.7
HCM Lane LOS	C	F	C	D
HCM 95th-tile Q	4	20	2.9	5.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			✣	
Traffic Vol, veh/h	0	60	130	103
Future Vol, veh/h	0	60	130	103
Peak Hour Factor	0.92	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3
Mvmt Flow	0	68	148	117
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	26.7
HCM LOS	D

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations									
Traffic Vol, veh/h	0	130	124	0	174	90	0	75	155
Future Vol, veh/h	0	130	124	0	174	90	0	75	155
Peak Hour Factor	0.92	0.93	0.93	0.92	0.93	0.93	0.92	0.93	0.93
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	140	133	0	187	97	0	81	167
Number of Lanes	0	0	1	0	1	0	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	11.2	10.6	9.8
HCM LOS	B	B	A

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	51%	0%	100%	0%
Vol Thru, %	49%	66%	0%	0%
Vol Right, %	0%	34%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	254	264	75	155
LT Vol	130	0	75	0
Through Vol	124	174	0	0
RT Vol	0	90	0	155
Lane Flow Rate	273	284	81	167
Geometry Grp	2	2	7	7
Degree of Util (X)	0.381	0.373	0.142	0.238
Departure Headway (Hd)	5.027	4.728	6.349	5.136
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	710	755	560	692
Service Time	3.098	2.796	4.14	2.926
HCM Lane V/C Ratio	0.385	0.376	0.145	0.241
HCM Control Delay	11.2	10.6	10.2	9.6
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	1.8	1.7	0.5	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	24	145	90	96	110	234	395	25	30	375	40
Future Volume (Veh/h)	5	24	145	90	96	110	234	395	25	30	375	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	5	26	154	96	102	117	249	420	27	32	399	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6			1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1432	1408	399	1484	1438	434	442			447		
vC1, stage 1 conf vol	463	463		932	932							
vC2, stage 2 conf vol	969	945		553	506							
vCu, unblocked vol	1432	1408	399	1484	1438	434	442			447		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	88	76	11	51	81	78			97		
cM capacity (veh/h)	84	218	649	108	208	620	1113			1108		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	185	315	249	447	32	399	43
Volume Left	5	96	249	0	32	0	0
Volume Right	154	117	0	27	0	0	43
cSH	779	206	1113	1700	1108	1700	1700
Volume to Capacity	0.24	1.53	0.22	0.26	0.03	0.23	0.03
Queue Length 95th (ft)	23	492	21	0	2	0	0
Control Delay (s)	14.7	304.2	9.2	0.0	8.3	0.0	0.0
Lane LOS	B	F	A		A		
Approach Delay (s)	14.7	304.2	3.3		0.6		
Approach LOS	B	F					

Intersection Summary			
Average Delay	60.5		
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	105	571	310	67	34	56
Future Vol, veh/h	105	571	310	67	34	56
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	115	627	341	74	37	62

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	414	0	-	0	1235	377
Stage 1	-	-	-	-	377	-
Stage 2	-	-	-	-	858	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1140	-	-	-	194	667
Stage 1	-	-	-	-	691	-
Stage 2	-	-	-	-	414	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1140	-	-	-	174	667
Mov Cap-2 Maneuver	-	-	-	-	290	-
Stage 1	-	-	-	-	691	-
Stage 2	-	-	-	-	372	-

Approach	EB	WB	SB
HCM Control Delay, s	1.3	0	15.3
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1140	-	-	-	447
HCM Lane V/C Ratio	0.101	-	-	-	0.221
HCM Control Delay (s)	8.5	-	-	-	15.3
HCM Lane LOS	A	-	-	-	C
HCM 95th %tile Q(veh)	0.3	-	-	-	0.8

Intersection	
Int Delay, s/veh	1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	249	357	40	289	88	15
Future Vol, veh/h	249	357	40	289	88	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	274	392	44	318	97	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	274	0	679	274
Stage 1	-	-	-	-	274	-
Stage 2	-	-	-	-	405	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1283	-	416	762
Stage 1	-	-	-	-	770	-
Stage 2	-	-	-	-	671	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1283	-	402	762
Mov Cap-2 Maneuver	-	-	-	-	502	-
Stage 1	-	-	-	-	770	-
Stage 2	-	-	-	-	648	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	13.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	528	-	-	1283	-
HCM Lane V/C Ratio	0.214	-	-	0.034	-
HCM Control Delay (s)	13.7	-	-	7.9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.8	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	27.2
Intersection LOS	D

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Lane Configurations									
Traffic Vol, veh/h	0	323	52	0	50	328	0	165	448
Future Vol, veh/h	0	323	52	0	50	328	0	165	448
Peak Hour Factor	0.92	0.91	0.91	0.92	0.91	0.91	0.92	0.91	0.91
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	355	57	0	55	360	0	181	492
Number of Lanes	0	1	0	0	0	2	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	30.4	16.1	32
HCM LOS	D	C	D

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	31%	0%
Vol Thru, %	0%	0%	86%	69%	100%
Vol Right, %	0%	100%	14%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	165	448	375	159	219
LT Vol	165	0	0	50	0
Through Vol	0	0	323	109	219
RT Vol	0	448	52	0	0
Lane Flow Rate	181	492	412	175	240
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.384	0.874	0.781	0.368	0.494
Departure Headway (Hd)	7.618	6.392	6.935	7.57	7.408
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	475	571	523	476	488
Service Time	5.318	4.092	4.935	5.297	5.135
HCM Lane V/C Ratio	0.381	0.862	0.788	0.368	0.492
HCM Control Delay	15	38.3	30.4	14.7	17.2
HCM Lane LOS	B	E	D	B	C
HCM 95th-tile Q	1.8	9.9	7.1	1.7	2.7

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	273	90	20	210	0	0	0	0	150	210	125
Future Vol, veh/h	0	273	90	20	210	0	0	0	0	150	210	125
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	310	102	23	239	0	0	0	0	170	239	142

Major/Minor	Major1									Minor2		
Conflicting Flow All	-	0	0							361	413	0
Stage 1	-	-	-							0	0	-
Stage 2	-	-	-							361	413	-
Critical Hdwy	-	-	-							7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-							-	-	-
Critical Hdwy Stg 2	-	-	-							6.13	5.53	-
Follow-up Hdwy	-	-	-							3.527	4.027	3.327
Pot Cap-1 Maneuver	0	-	-							593	528	-
Stage 1	0	-	-							-	-	-
Stage 2	0	-	-							655	592	-
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-							593	528	-
Mov Cap-2 Maneuver	-	-	-							593	528	-
Stage 1	-	-	-							-	-	-
Stage 2	-	-	-							655	592	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	564	-
HCM Lane V/C Ratio	-	-	0.514	-
HCM Control Delay (s)	-	-	17.9	-
HCM Lane LOS	-	-	C	-
HCM 95th %tile Q(veh)	-	-	2.9	-

Intersection	
Intersection Delay, s/veh	25.1
Intersection LOS	D

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	160	263	0	0	0	175	276	0	55	305	10
Future Vol, veh/h	0	160	263	0	0	0	175	276	0	55	305	10
Peak Hour Factor	0.92	0.88	0.88	0.88	0.92	0.88	0.88	0.88	0.92	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	182	299	0	0	0	199	314	0	63	347	11
Number of Lanes	0	1	1	0	0	0	1	0	0	0	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	16.6	40.8	15.8
HCM LOS	C	E	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	27%	0%	100%	0%	0%
Vol Thru, %	73%	94%	0%	100%	39%
Vol Right, %	0%	6%	0%	0%	61%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	208	163	160	263	451
LT Vol	55	0	160	0	0
Through Vol	153	153	0	263	175
RT Vol	0	10	0	0	276
Lane Flow Rate	236	185	182	299	512
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.484	0.37	0.368	0.562	0.891
Departure Headway (Hd)	7.386	7.206	7.282	6.771	6.262
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	486	497	491	529	574
Service Time	5.163	4.983	5.068	4.556	4.332
HCM Lane V/C Ratio	0.486	0.372	0.371	0.565	0.892
HCM Control Delay	17	14.2	14.3	18	40.8
HCM Lane LOS	C	B	B	C	E
HCM 95th-tile Q	2.6	1.7	1.7	3.4	10.4

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	0
Future Vol, veh/h	0	0	0	0
Peak Hour Factor	0.92	0.88	0.88	0.88
Heavy Vehicles, %	3	3	3	3
Mvmt Flow	0	0	0	0
Number of Lanes	0	0	0	0

Approach	
Opposing Approach	
Opposing Lanes	
Conflicting Approach Left	
Conflicting Lanes Left	
Conflicting Approach Right	
Conflicting Lanes Right	
HCM Control Delay	
HCM LOS	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	30	15	290	30	517	15	250	230	536	240	10
Future Volume (vph)	15	30	15	290	30	517	15	250	230	536	240	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Lane Util. Factor		1.00		0.95	0.95	1.00	1.00	1.00	1.00	0.97	1.00	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1762		1665	1684	1568	1752	1845	1568	3400	1834	
Flt Permitted		0.99		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		1762		1665	1684	1568	1752	1845	1568	3400	1834	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	16	33	16	319	33	568	16	275	253	589	264	11
RTOR Reduction (vph)	0	9	0	0	0	146	0	0	148	0	2	0
Lane Group Flow (vph)	0	56	0	175	177	422	16	275	105	589	273	0
Turn Type	Split	NA		Split	NA	pm+ov	Split	NA	Perm	Split	NA	
Protected Phases	5	5		6	6	7	8	8		7	7	
Permitted Phases						6			8			
Actuated Green, G (s)		6.7		52.0	52.0	78.8	22.0	22.0	22.0	26.8	26.8	
Effective Green, g (s)		6.7		52.0	52.0	78.8	22.0	22.0	22.0	26.8	26.8	
Actuated g/C Ratio		0.05		0.42	0.42	0.64	0.18	0.18	0.18	0.22	0.22	
Clearance Time (s)		3.5		4.6	4.6	4.2	4.2	4.2	4.2	4.2	4.2	
Vehicle Extension (s)		1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lane Grp Cap (vph)		95		698	706	996	310	327	278	734	396	
v/s Ratio Prot		c0.03		0.11	0.11	c0.09	0.01	c0.15		c0.17	0.15	
v/s Ratio Perm						0.18			0.07			
v/c Ratio		0.58		0.25	0.25	0.42	0.05	0.84	0.38	0.80	0.69	
Uniform Delay, d1		57.3		23.4	23.4	11.3	42.3	49.3	45.0	46.1	44.8	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		5.8		0.9	0.9	0.1	0.0	16.8	0.3	6.0	4.2	
Delay (s)		63.1		24.2	24.2	11.4	42.4	66.1	45.3	52.1	48.9	
Level of Service		E		C	C	B	D	E	D	D	D	
Approach Delay (s)		63.1			16.3			55.7			51.1	
Approach LOS		E			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	746	50	174	632	0	40	0	239	335	45	165
Future Volume (vph)	0	746	50	174	632	0	40	0	239	335	45	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	0.97	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3472		1752	3505		1752		1568	3400	1845	1568
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3472		1752	3505		1752		1568	3400	1845	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	848	57	198	718	0	45	0	272	381	51	188
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	47	0	0	162
Lane Group Flow (vph)	0	903	0	198	718	0	45	0	225	381	51	26
Turn Type		NA		Prot	NA		Prot		pm+ov	Split	NA	Perm
Protected Phases		2		1	6		8		1	7	7	
Permitted Phases									8			7
Actuated Green, G (s)		83.5		20.9	109.0		7.2		28.1	20.7	20.7	20.7
Effective Green, g (s)		83.5		20.9	109.0		7.2		28.1	20.7	20.7	20.7
Actuated g/C Ratio		0.55		0.14	0.72		0.05		0.18	0.14	0.14	0.14
Clearance Time (s)		5.1		4.6	5.1		5.1		4.6	5.1	5.1	5.1
Vehicle Extension (s)		1.0		1.0	1.0		1.0		1.0	1.0	1.0	1.0
Lane Grp Cap (vph)		1904		240	2510		82		289	462	250	213
v/s Ratio Prot		c0.26		c0.11	0.20		0.03		c0.11	c0.11	0.03	
v/s Ratio Perm									0.04			0.02
v/c Ratio		0.47		0.82	0.29		0.55		0.78	0.82	0.20	0.12
Uniform Delay, d1		21.0		63.9	7.7		70.9		59.1	64.0	58.4	57.8
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.8		19.2	0.3		4.0		11.3	10.9	0.1	0.1
Delay (s)		21.8		83.1	8.0		74.9		70.4	74.9	58.6	57.8
Level of Service		C		F	A		E		E	E	E	E
Approach Delay (s)		21.8			24.2			71.1			68.4	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	38.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	152.2	Sum of lost time (s)	19.9
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	745	170	0	980	510	286	0	446	0	0	0
Future Volume (vph)	0	745	170	0	980	510	286	0	446	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Lane Util. Factor		0.95	1.00		0.95	1.00	1.00		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3505	1568		3505	1568	1752		1568			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3505	1568		3505	1568	1752		1568			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	810	185	0	1065	554	311	0	485	0	0	0
RTOR Reduction (vph)	0	0	71	0	0	0	0	0	117	0	0	0
Lane Group Flow (vph)	0	810	114	0	1065	554	311	0	368	0	0	0
Turn Type		NA	Perm		NA	custom	Prot		Prot			
Protected Phases		2			6	1	3		3			
Permitted Phases			2			6						
Actuated Green, G (s)		54.4	54.4		54.4	80.5	25.6		25.6			
Effective Green, g (s)		54.4	54.4		54.4	80.5	25.6		25.6			
Actuated g/C Ratio		0.61	0.61		0.61	0.91	0.29		0.29			
Clearance Time (s)		4.6	4.6		4.6	3.5	4.0		4.0			
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0		3.0			
Lane Grp Cap (vph)		2152	962		2152	1486	506		453			
v/s Ratio Prot		0.23			c0.30	0.11	0.18		c0.23			
v/s Ratio Perm			0.07			0.24						
v/c Ratio		0.38	0.12		0.49	0.37	0.61		0.81			
Uniform Delay, d1		8.6	7.1		9.5	0.6	27.2		29.3			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.5	0.3		0.2	0.2	2.2		10.6			
Delay (s)		9.1	7.4		9.7	0.7	29.5		39.9			
Level of Service		A	A		A	A	C		D			
Approach Delay (s)		8.8			6.6			35.8			0.0	
Approach LOS		A			A			D			A	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	8.6
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	229	558	404	175	607	40	578	95	180	80	75	304
Future Volume (vph)	229	558	404	175	607	40	578	95	180	80	75	304
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		0.97	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3400	3505	1568	1752	3473		3400	1663		1752	1845	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3400	3505	1568	1752	3473		3400	1663		1752	1845	1568
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	260	634	459	199	690	45	657	108	205	91	85	345
RTOR Reduction (vph)	0	0	241	0	3	0	0	50	0	0	0	60
Lane Group Flow (vph)	260	634	218	199	732	0	657	263	0	91	85	285
Turn Type	Prot	NA	Perm	Prot	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	5	2		1	6		3	8		7	4	5
Permitted Phases			2									4
Actuated Green, G (s)	19.5	60.2	60.2	23.2	63.9		31.1	30.6		10.9	10.4	29.9
Effective Green, g (s)	19.5	60.2	60.2	23.2	63.9		31.1	30.6		10.9	10.4	29.9
Actuated g/C Ratio	0.14	0.43	0.43	0.17	0.46		0.22	0.22		0.08	0.07	0.21
Clearance Time (s)	3.5	4.6	4.6	3.5	4.6		3.5	3.5		3.5	3.5	3.5
Vehicle Extension (s)	1.0	1.0	1.0	1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)	473	1507	674	290	1585		755	363		136	137	334
v/s Ratio Prot	0.08	0.18		c0.11	c0.21		c0.19	0.16		0.05	0.05	c0.12
v/s Ratio Perm			0.14									0.06
v/c Ratio	0.55	0.42	0.32	0.69	0.46		0.87	0.72		0.67	0.62	0.85
Uniform Delay, d1	56.2	27.8	26.4	55.0	26.2		52.5	50.8		62.8	62.9	53.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.9	1.3	5.3	1.0		10.4	6.0		9.3	6.1	18.1
Delay (s)	56.9	28.6	27.7	60.3	27.2		62.9	56.8		72.1	69.0	71.0
Level of Service	E	C	C	E	C		E	E		E	E	E
Approach Delay (s)		33.7			34.2			60.9			70.9	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	46.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	15.1
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	510	140	173	416	150	70	235	208	85	275	215
Future Volume (veh/h)	185	510	140	173	416	150	70	235	208	85	275	215
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845	1845
Adj Flow Rate, veh/h	210	580	159	197	473	170	80	267	236	97	312	0
Adj No. of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	252	646	549	229	622	529	102	419	356	124	442	375
Arrive On Green	0.14	0.35	0.35	0.13	0.34	0.34	0.06	0.23	0.23	0.07	0.24	0.00
Sat Flow, veh/h	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Grp Volume(v), veh/h	210	580	159	197	473	170	80	267	236	97	312	0
Grp Sat Flow(s),veh/h/ln	1757	1845	1568	1757	1845	1568	1757	1845	1568	1757	1845	1568
Q Serve(g_s), s	8.5	21.8	5.4	8.0	16.7	5.9	3.3	9.6	10.0	4.0	11.3	0.0
Cycle Q Clear(g_c), s	8.5	21.8	5.4	8.0	16.7	5.9	3.3	9.6	10.0	4.0	11.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	252	646	549	229	622	529	102	419	356	124	442	375
V/C Ratio(X)	0.83	0.90	0.29	0.86	0.76	0.32	0.78	0.64	0.66	0.78	0.71	0.00
Avail Cap(c_a), veh/h	301	667	567	229	692	588	156	768	653	156	793	674
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	30.4	22.5	17.1	31.1	21.6	18.0	33.9	25.5	25.7	33.4	25.4	0.0
Incr Delay (d2), s/veh	15.7	14.7	0.3	26.9	4.4	0.3	13.1	1.6	2.1	18.0	2.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	13.6	2.4	5.6	9.2	2.6	2.0	5.0	4.5	2.5	6.0	0.0
LnGrp Delay(d),s/veh	46.1	37.2	17.4	58.0	26.0	18.3	47.0	27.1	27.8	51.4	27.5	0.0
LnGrp LOS	D	D	B	E	C	B	D	C	C	D	C	
Approach Vol, veh/h		949			840			583			409	
Approach Delay, s/veh		35.8			32.0			30.1			33.2	
Approach LOS		D			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.6	21.2	13.0	30.2	7.8	22.1	14.0	29.2
Change Period (Y+Rc), s	3.5	4.6	3.5	4.6	3.5	4.6	3.5	4.6
Max Green Setting (Gmax), s	6.5	30.4	9.5	26.4	6.5	31.4	12.5	27.4
Max Q Clear Time (g_c+I1), s	6.0	12.0	10.0	23.8	5.3	13.3	10.5	18.7
Green Ext Time (p_c), s	0.0	4.2	0.0	1.8	0.0	4.2	0.1	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	33.1
HCM 2010 LOS	C

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	757	45	109	659	80	213
Future Volume (Veh/h)	757	45	109	659	80	213
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	860	51	124	749	91	242
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			TWLTL		
Median storage veh)				2		
Upstream signal (ft)	351			912		
pX, platoon unblocked			0.69		0.81	0.69
vC, conflicting volume			911		1882	886
vC1, stage 1 conf vol					886	
vC2, stage 2 conf vol					997	
vCu, unblocked vol			651		1310	614
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)			2.2		3.5	3.3
p0 queue free %			81		60	29
cM capacity (veh/h)			646		230	340

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2
Volume Total	911	124	749	91	242
Volume Left	0	124	0	91	0
Volume Right	51	0	0	0	242
cSH	1700	646	1700	230	340
Volume to Capacity	0.54	0.19	0.44	0.40	0.71
Queue Length 95th (ft)	0	18	0	45	130
Control Delay (s)	0.0	11.9	0.0	30.6	37.9
Lane LOS		B		D	E
Approach Delay (s)	0.0	1.7		35.9	
Approach LOS				E	

Intersection Summary			
Average Delay	6.3		
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	652	420	500	665	0	0	0	0	283	75	150
Future Volume (vph)	0	652	420	500	665	0	0	0	0	283	75	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4	5.9	5.4						6.4	6.4
Lane Util. Factor		0.95	1.00	1.00	0.95						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (prot)		3505	1568	1752	3505						1774	1568
Flt Permitted		1.00	1.00	0.95	1.00						0.96	1.00
Satd. Flow (perm)		3505	1568	1752	3505						1774	1568
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	0	733	472	562	747	0	0	0	0	318	84	169
RTOR Reduction (vph)	0	0	241	0	0	0	0	0	0	0	0	126
Lane Group Flow (vph)	0	733	231	562	747	0	0	0	0	0	402	43
Turn Type		NA	Perm	Prot	NA					Split	NA	Perm
Protected Phases		2 12		1	6 8					4	4	
Permitted Phases			2 12									4
Actuated Green, G (s)		51.0	51.0	20.2	50.5						29.8	29.8
Effective Green, g (s)		51.0	51.0	20.2	44.1						29.8	29.8
Actuated g/C Ratio		0.43	0.43	0.17	0.37						0.25	0.25
Clearance Time (s)				5.9							6.4	6.4
Vehicle Extension (s)				1.0							0.5	0.5
Lane Grp Cap (vph)		1517	678	300	1312						448	396
v/s Ratio Prot		c0.21		c0.32	0.21						c0.23	
v/s Ratio Perm			0.15									0.03
v/c Ratio		0.48	0.34	1.87	0.57						0.90	0.11
Uniform Delay, d1		24.0	22.2	48.8	29.3						42.5	33.8
Progression Factor		1.00	1.00	0.88	0.64						1.00	1.00
Incremental Delay, d2		0.1	0.1	404.7	0.3						19.7	0.0
Delay (s)		24.0	22.3	447.5	19.1						62.3	33.8
Level of Service		C	C	F	B						E	C
Approach Delay (s)		23.4			203.0			0.0			53.8	
Approach LOS		C			F			A			D	

Intersection Summary			
HCM 2000 Control Delay	105.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	117.8	Sum of lost time (s)	24.6
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	255	680	0	0	880	175	285	0	376	0	0	0
Future Volume (vph)	255	680	0	0	880	175	285	0	376	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	5.4			5.4		6.4	6.4	6.4			
Lane Util. Factor	1.00	1.00			0.91		0.95	0.95	1.00			
Frt	1.00	1.00			0.98		1.00	1.00	0.85			
Flt Protected	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (prot)	1752	1845			4911		1665	1665	1568			
Flt Permitted	0.95	1.00			1.00		0.95	0.95	1.00			
Satd. Flow (perm)	1752	1845			4911		1665	1665	1568			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	268	716	0	0	926	184	300	0	396	0	0	0
RTOR Reduction (vph)	0	0	0	0	22	0	0	0	317	0	0	0
Lane Group Flow (vph)	268	716	0	0	1088	0	150	150	79	0	0	0
Turn Type	Prot	NA			NA		Split	NA	Perm			
Protected Phases	5	2 4			6 10		8	8				
Permitted Phases									8			
Actuated Green, G (s)	19.8	56.5			56.9		23.4	23.4	23.4			
Effective Green, g (s)	19.8	50.1			56.9		23.4	23.4	23.4			
Actuated g/C Ratio	0.17	0.43			0.48		0.20	0.20	0.20			
Clearance Time (s)	5.9						6.4	6.4	6.4			
Vehicle Extension (s)	1.0						0.5	0.5	0.5			
Lane Grp Cap (vph)	294	784			2372		330	330	311			
v/s Ratio Prot	0.15	c0.39			c0.22		c0.09	0.09				
v/s Ratio Perm									0.05			
v/c Ratio	0.91	0.91			0.46		0.45	0.45	0.25			
Uniform Delay, d1	48.1	31.8			20.2		41.6	41.6	39.8			
Progression Factor	0.77	0.98			1.00		1.00	1.00	1.00			
Incremental Delay, d2	26.5	12.7			0.1		0.4	0.4	0.2			
Delay (s)	63.4	43.8			20.3		41.9	41.9	40.0			
Level of Service	E	D			C		D	D	D			
Approach Delay (s)		49.1			20.3			40.8			0.0	
Approach LOS		D			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	35.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	117.8	Sum of lost time (s)	24.6
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	639	397	76	614	15	418	4	80	15	4	25
Future Volume (vph)	20	639	397	76	614	15	418	4	80	15	4	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)	1752	1845	1568	1752	1838		1665	1670	1568		1675	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)	1752	1845	1568	1752	1838		1665	1670	1568		1675	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	21	666	414	79	640	16	435	4	83	16	4	26
RTOR Reduction (vph)	0	0	111	0	0	0	0	0	66	0	25	0
Lane Group Flow (vph)	21	666	303	79	656	0	217	222	17	0	21	0
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	2.3	38.4	38.4	6.1	42.2		17.3	17.3	17.3		3.6	
Effective Green, g (s)	2.3	38.4	38.4	6.1	42.2		17.3	17.3	17.3		3.6	
Actuated g/C Ratio	0.03	0.47	0.47	0.07	0.51		0.21	0.21	0.21		0.04	
Clearance Time (s)	3.7	4.7	4.7	3.7	4.7		4.7	4.7	4.7		3.7	
Vehicle Extension (s)	2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0		2.0	
Lane Grp Cap (vph)	49	861	732	130	943		350	351	330		73	
v/s Ratio Prot	0.01	c0.36		c0.05	0.36		0.13	c0.13			c0.01	
v/s Ratio Perm			0.19						0.01			
v/c Ratio	0.43	0.77	0.41	0.61	0.70		0.62	0.63	0.05		0.29	
Uniform Delay, d1	39.3	18.3	14.5	36.9	15.1		29.5	29.6	25.9		38.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	2.2	4.4	0.4	5.4	2.2		3.3	3.7	0.1		0.8	
Delay (s)	41.5	22.6	14.9	42.3	17.4		32.7	33.2	26.0		38.9	
Level of Service	D	C	B	D	B		C	C	C		D	
Approach Delay (s)		20.1			20.1			31.9			38.9	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	23.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	82.2	Sum of lost time (s)	16.8
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	335
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations			✥				✥				✥	
Traffic Vol, veh/h	0	203	345	165	0	5	360	255	0	154	200	5
Future Vol, veh/h	0	203	345	165	0	5	360	255	0	154	200	5
Peak Hour Factor	0.92	0.97	0.97	0.97	0.92	0.97	0.97	0.97	0.92	0.97	0.97	0.97
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	209	356	170	0	5	371	263	0	159	206	5
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	470.6	349.6	108.7
HCM LOS	F	F	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	43%	28%	1%	28%
Vol Thru, %	56%	48%	58%	38%
Vol Right, %	1%	23%	41%	33%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	359	713	620	563
LT Vol	154	203	5	160
Through Vol	200	345	360	215
RT Vol	5	165	255	188
Lane Flow Rate	370	735	639	580
Geometry Grp	1	1	1	1
Degree of Util (X)	1	1.953	1.669	1.532
Departure Headway (Hd)	17.352	13.205	13.993	13.948
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	215	287	268	267
Service Time	15.352	11.205	11.993	11.948
HCM Lane V/C Ratio	1.721	2.561	2.384	2.172
HCM Control Delay	108.7	470.6	349.6	291.4
HCM Lane LOS	F	F	F	F
HCM 95th-tile Q	8.8	37.8	27.4	23.5

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations			✥	
Traffic Vol, veh/h	0	160	215	188
Future Vol, veh/h	0	160	215	188
Peak Hour Factor	0.92	0.97	0.97	0.97
Heavy Vehicles, %	3	3	3	3
Mvmt Flow	0	165	222	194
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	291.4
HCM LOS	F

Intersection	
Intersection Delay, s/veh	14.2
Intersection LOS	B

Movement	EBU	EBL	EBT	WBU	WBT	WBR	SBU	SBL	SBR
Lane Configurations									
Traffic Vol, veh/h	0	185	221	0	130	100	0	140	235
Future Vol, veh/h	0	185	221	0	130	100	0	140	235
Peak Hour Factor	0.92	0.96	0.96	0.92	0.96	0.96	0.92	0.96	0.96
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	193	230	0	135	104	0	146	245
Number of Lanes	0	0	1	0	1	0	0	1	1

Approach	EB	WB	SB
Opposing Approach	WB	EB	
Opposing Lanes	1	1	0
Conflicting Approach Left	SB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right		SB	EB
Conflicting Lanes Right	0	2	1
HCM Control Delay	17.9	11.5	11.9
HCM LOS	C	B	B

Lane	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	46%	0%	100%	0%
Vol Thru, %	54%	57%	0%	0%
Vol Right, %	0%	43%	0%	100%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	406	230	140	235
LT Vol	185	0	140	0
Through Vol	221	130	0	0
RT Vol	0	100	0	235
Lane Flow Rate	423	240	146	245
Geometry Grp	2	2	7	7
Degree of Util (X)	0.643	0.361	0.277	0.382
Departure Headway (Hd)	5.476	5.418	6.832	5.613
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	660	664	526	641
Service Time	3.513	3.461	4.571	3.352
HCM Lane V/C Ratio	0.641	0.361	0.278	0.382
HCM Control Delay	17.9	11.5	12.2	11.8
HCM Lane LOS	C	B	B	B
HCM 95th-tile Q	4.7	1.6	1.1	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	74	282	25	43	50	251	490	75	125	455	30
Future Volume (Veh/h)	20	74	282	25	43	50	251	490	75	125	455	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	22	82	313	28	48	56	279	544	83	139	506	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6			1						
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1910	1969	506	2125	1960	586	539			627		
vC1, stage 1 conf vol	784	784		1144	1144							
vC2, stage 2 conf vol	1126	1185		982	817							
vCu, unblocked vol	1910	1969	506	2125	1960	586	539			627		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)	6.1	5.5		6.1	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	0	45	0	7	89	73			85		
cM capacity (veh/h)	6	50	564	0	52	509	1024			950		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	417	132	279	627	139	506	33
Volume Left	22	28	279	0	139	0	0
Volume Right	313	56	0	83	0	0	33
cSH	93	3	1024	1700	950	1700	1700
Volume to Capacity	4.47	44.35	0.27	0.37	0.15	0.30	0.02
Queue Length 95th (ft)	Err	Err	28	0	13	0	0
Control Delay (s)	Err	Err	9.8	0.0	9.4	0.0	0.0
Lane LOS	F	F	A		A		
Approach Delay (s)	Err	Err	3.0		1.9		
Approach LOS	F	F					

Intersection Summary			
Average Delay	2575.5		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Intersection	
Int Delay, s/veh	7.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	110	443	563	76	88	154
Future Vol, veh/h	110	443	563	76	88	154
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	90	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	122	492	626	84	98	171

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	710	0	-	0	1405	668
Stage 1	-	-	-	-	668	-
Stage 2	-	-	-	-	737	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	885	-	-	-	153	456
Stage 1	-	-	-	-	508	-
Stage 2	-	-	-	-	472	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	885	-	-	-	132	456
Mov Cap-2 Maneuver	-	-	-	-	265	-
Stage 1	-	-	-	-	508	-
Stage 2	-	-	-	-	407	-

Approach	EB	WB	SB
HCM Control Delay, s	1.9	0	39
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	885	-	-	-	361
HCM Lane V/C Ratio	0.138	-	-	-	0.745
HCM Control Delay (s)	9.7	-	-	-	39
HCM Lane LOS	A	-	-	-	E
HCM 95th %tile Q(veh)	0.5	-	-	-	5.8

Intersection	
Int Delay, s/veh	8.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	371	159	25	360	279	35
Future Vol, veh/h	371	159	25	360	279	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	408	175	27	396	307	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	408	0	859	408
Stage 1	-	-	-	-	408	-
Stage 2	-	-	-	-	451	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1145	-	326	641
Stage 1	-	-	-	-	669	-
Stage 2	-	-	-	-	640	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1145	-	318	641
Mov Cap-2 Maneuver	-	-	-	-	440	-
Stage 1	-	-	-	-	669	-
Stage 2	-	-	-	-	625	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	33.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	456	-	-	1145	-
HCM Lane V/C Ratio	0.757	-	-	0.024	-
HCM Control Delay (s)	33.6	-	-	8.2	-
HCM Lane LOS	D	-	-	A	-
HCM 95th %tile Q(veh)	6.4	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	65
Intersection LOS	F

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Lane Configurations									
Traffic Vol, veh/h	0	296	75	0	96	825	0	185	273
Future Vol, veh/h	0	296	75	0	96	825	0	185	273
Peak Hour Factor	0.92	0.88	0.88	0.92	0.88	0.88	0.92	0.88	0.88
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	336	85	0	109	938	0	210	310
Number of Lanes	0	1	0	0	0	2	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	2	1	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	1
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	2
HCM Control Delay	32	100.9	19.4
HCM LOS	D	F	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2
Vol Left, %	100%	0%	0%	26%	0%
Vol Thru, %	0%	0%	80%	74%	100%
Vol Right, %	0%	100%	20%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	185	273	371	371	550
LT Vol	185	0	0	96	0
Through Vol	0	0	296	275	550
RT Vol	0	273	75	0	0
Lane Flow Rate	210	310	422	422	625
Geometry Grp	7	7	4	7	7
Degree of Util (X)	0.476	0.596	0.795	0.846	1.231
Departure Headway (Hd)	8.43	7.196	7.013	7.222	7.09
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	431	506	519	506	519
Service Time	6.13	4.896	5.013	4.922	4.79
HCM Lane V/C Ratio	0.487	0.613	0.813	0.834	1.204
HCM Control Delay	18.6	20	32	38.1	143.2
HCM Lane LOS	C	C	D	E	F
HCM 95th-tile Q	2.5	3.8	7.4	8.7	24.3

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	383	205	20	155	0	0	0	0	205	265	185
Future Vol, veh/h	0	383	205	20	155	0	0	0	0	205	265	185
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	50	-	-	-	-	-	-	-	105
Veh in Median Storage, #	-	0	-	-	-	-	-	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	416	223	22	168	0	0	0	0	223	288	201

Major/Minor	Major1									Minor2		
Conflicting Flow All	-	0	0							528	639	0
Stage 1	-	-	-							0	0	-
Stage 2	-	-	-							528	639	-
Critical Hdwy	-	-	-							7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-							-	-	-
Critical Hdwy Stg 2	-	-	-							6.13	5.53	-
Follow-up Hdwy	-	-	-							3.527	4.027	3.327
Pot Cap-1 Maneuver	0	-	-							459	393	-
Stage 1	0	-	-							-	-	-
Stage 2	0	-	-							532	469	-
Platoon blocked, %		-	-									
Mov Cap-1 Maneuver	-	-	-							459	393	-
Mov Cap-2 Maneuver	-	-	-							459	393	-
Stage 1	-	-	-							-	-	-
Stage 2	-	-	-							532	469	-

Approach	EB	SB
HCM Control Delay, s	0	
HCM LOS		-

Minor Lane/Major Mvmt	EBT	EBR	SBLn1	SBLn2
Capacity (veh/h)	-	-	431	-
HCM Lane V/C Ratio	-	-	0.851	-
HCM Control Delay (s)	-	-	45.6	-
HCM Lane LOS	-	-	E	-
HCM 95th %tile Q(veh)	-	-	8.4	-

Intersection	
Intersection Delay, s/veh	19.6
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations		↰	↑				↱				↰↑↱	
Traffic Vol, veh/h	0	170	418	0	0	0	120	172	0	55	370	5
Future Vol, veh/h	0	170	418	0	0	0	120	172	0	55	370	5
Peak Hour Factor	0.92	0.97	0.97	0.97	0.92	0.97	0.97	0.97	0.92	0.97	0.97	0.97
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	0	175	431	0	0	0	124	177	0	57	381	5
Number of Lanes	0	1	1	0	0	0	1	0	0	0	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	24	16.9	15.5
HCM LOS	C	C	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	23%	0%	100%	0%	0%
Vol Thru, %	77%	97%	0%	100%	41%
Vol Right, %	0%	3%	0%	0%	59%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	240	190	170	418	292
LT Vol	55	0	170	0	0
Through Vol	185	185	0	418	120
RT Vol	0	5	0	0	172
Lane Flow Rate	247	196	175	431	301
Geometry Grp	7	7	7	7	6
Degree of Util (X)	0.49	0.381	0.341	0.776	0.54
Departure Headway (Hd)	7.133	6.998	6.995	6.486	6.452
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	505	513	512	556	557
Service Time	4.9	4.765	4.76	4.25	4.516
HCM Lane V/C Ratio	0.489	0.382	0.342	0.775	0.54
HCM Control Delay	16.6	14	13.4	28.3	16.9
HCM Lane LOS	C	B	B	D	C
HCM 95th-tile Q	2.7	1.8	1.5	7.1	3.2

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	0	0	0
Future Vol, veh/h	0	0	0	0
Peak Hour Factor	0.92	0.97	0.97	0.97
Heavy Vehicles, %	3	3	3	3
Mvmt Flow	0	0	0	0
Number of Lanes	0	0	0	0

Approach	
Opposing Approach	
Opposing Lanes	
Conflicting Approach Left	
Conflicting Lanes Left	
Conflicting Approach Right	
Conflicting Lanes Right	
HCM Control Delay	
HCM LOS	

LANE SUMMARY

Site: 101 [E+P AM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	200	3.0	721	0.278	100	8.3	LOS A	1.7	43.7	Full	1035	0.0	0.0
Approach	200	3.0		0.278		8.3	LOS A	1.7	43.7				
East: Idaho Maryland Road													
Lane 1	214	3.0	925	0.231	100	6.2	LOS A	1.4	35.2	Short	65	0.0	NA
Lane 2[d]	283	3.0	1049	0.270	100	6.0	LOS A	1.7	43.7	Full	600	0.0	0.0
Approach	496	3.0		0.270		6.1	LOS A	1.7	43.7				
North: E Main St													
Lane 1[d]	270	3.0	928	0.291	100	6.9	LOS A	1.4	34.7	Full	225	0.0	0.0
Lane 2	163	3.0	1067	0.153	100	4.7	LOS A	0.7	18.4	Short	60	0.0	NA
Approach	433	3.0		0.291		6.1	LOS A	1.4	34.7				
West: E Main St													
Lane 1[d]	417	3.0	720	0.579	100	14.6	LOS B	4.4	113.7	Full	290	0.0	0.0
Approach	417	3.0		0.579		14.6	LOS B	4.4	113.7				
Intersection	1547	3.0		0.579		8.7	LOS A	4.4	113.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [E+P PM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	231	3.0	711	0.325	100	9.1	LOS A	2.1	53.6	Full	1035	0.0	0.0
Approach	231	3.0		0.325		9.1	LOS A	2.1	53.6				
East: Idaho Maryland Road													
Lane 1	369	3.0	900	0.410	100	8.8	LOS A	2.8	72.0	Short	65	0.0	NA
Lane 2[d]	391	3.0	987	0.397	100	8.0	LOS A	2.8	70.8	Full	600	0.0	0.0
Approach	761	3.0		0.410		8.4	LOS A	2.8	72.0				
North: E Main St													
Lane 1[d]	327	3.0	750	0.435	100	10.6	LOS B	2.3	59.2	Full	225	0.0	0.0
Lane 2	280	3.0	914	0.306	100	7.2	LOS A	1.7	43.2	Short	60	0.0	NA
Approach	606	3.0		0.435		9.0	LOS A	2.3	59.2				
West: E Main St													
Lane 1[d]	417	3.0	582	0.716	100	23.8	LOS C	7.1	181.4	Full	290	0.0	0.0
Approach	417	3.0		0.716		23.8	LOS C	7.1	181.4				
Intersection	2015	3.0		0.716		11.9	LOS B	7.1	181.4				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [C+P AM]

New Site
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	231	3.0	634	0.364	100	10.7	LOS B	2.5	62.8	Full	1035	0.0	0.0
Approach	231	3.0		0.364		10.7	LOS B	2.5	62.8				
East: Idaho Maryland Road													
Lane 1	260	3.0	882	0.295	100	7.3	LOS A	1.9	48.4	Short	65	0.0	NA
Lane 2[d]	342	3.0	1022	0.335	100	7.0	LOS A	2.3	59.0	Full	600	0.0	0.0
Approach	602	3.0		0.335		7.1	LOS A	2.3	59.0				
North: E Main St													
Lane 1[d]	322	3.0	910	0.354	100	7.9	LOS A	1.7	44.4	Full	225	0.0	0.0
Lane 2	173	3.0	1065	0.162	100	4.8	LOS A	0.8	20.2	Short	60	0.0	NA
Approach	495	3.0		0.354		6.8	LOS A	1.7	44.4				
West: E Main St													
Lane 1[d]	522	3.0	685	0.762	100	23.9	LOS C	8.6	220.2	Full	290	0.0	0.0
Approach	522	3.0		0.762		23.9	LOS C	8.6	220.2				
Intersection	1851	3.0		0.762		12.2	LOS B	8.6	220.2				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d   Dominant lane on roundabout approach

LANE SUMMARY

Site: 101 [C+P PM]

New Site
Roundabout

Lane Use and Performance														
	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: SR 49/20 SB/WB Ramps													
Lane 1[d]	276	3.0	650	0.424	100	11.7	LOS B	3.1	78.6	Full	1035	0.0	0.0
Approach	276	3.0		0.424		11.7	LOS B	3.1	78.6				
East: Idaho Maryland Road													
Lane 1	413	3.0	852	0.484	100	10.5	LOS B	3.7	94.5	Short	65	0.0	NA
Lane 2[d]	486	3.0	977	0.497	100	9.8	LOS A	4.0	101.4	Full	600	0.0	0.0
Approach	899	3.0		0.497		10.1	LOS B	4.0	101.4				
North: E Main St													
Lane 1[d]	365	3.0	716	0.510	100	12.7	LOS B	3.0	77.6	Full	225	0.0	0.0
Lane 2	293	3.0	877	0.333	100	7.8	LOS A	2.0	50.3	Short	60	0.0	NA
Approach	657	3.0		0.510		10.5	LOS B	3.0	77.6				
West: E Main St													
Lane 1[d]	497	3.0	552	0.900	100	44.5	LOS D	14.4	368.9	Full	290	0.0	12.6
Approach	497	3.0		0.900		44.5	LOS D	14.4	368.9				
Intersection	2329	3.0		0.900		17.8	LOS B	14.4	368.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

d Dominant lane on roundabout approach

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1469	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	399	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	822	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	822	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.7	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1250	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	219	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	87	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1250	219	87	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	340	62	25	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV             0.917       1.000       1.000
Driver population factor, fP              1.00        1.00        1.00
Flow rate, vp                             1481        249         99         pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1481   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1730          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1481                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1730          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   16.3    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.315
                                              S
Space mean speed in ramp influence area,     S  = 54.3    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.3    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1163	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	87	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	219	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1163	87	219	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	316	25	62	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV         0.917       1.000       1.000
Driver population factor, fP          1.00        1.00        1.00
Flow rate, vp                         1378        99          249        pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1378   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     1477          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1378                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area______________________
                      Actual        Max Desirable        Violation?
     v                1477          4600                 No
      R12
_________________Level of Service Determination (if not F)______________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   14.1    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.307
                                              S
Space mean speed in ramp influence area,     S  = 54.5    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	970	193	657	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.88	0.82	
Peak 15-min volume, v15	264	59	187	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1149	235	747	0	pc/h
Volume ratio, VR		0.461			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	982	lc/h
Weaving lane changes, LCW	1283	lc/h
Non-weaving vehicle index, INW	379	
Non-weaving lane change, LCNW	255	lc/h
Total lane changes, LCALL	1538	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.294

Average weaving speed, SW	49.8	mi/h
Average non-weaving speed, SNW	49.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.6	mi/h
Weaving segment density, D	14.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.426	
Weaving segment flow rate, v	2037	veh/h
Weaving segment capacity, cW	4778	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7372	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1820	c
		Maximum	Analyzed	
v/c ratio		1.00	0.426	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1606	51	738	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	436	14	225	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1903	56	900	0	pc/h

Volume ratio, VR 0.334

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	956	lc/h
Weaving lane changes, LCW	1309	lc/h
Non-weaving vehicle index, INW	799	
Non-weaving lane change, LCNW	573	lc/h
Total lane changes, LCALL	1882	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.285

Average weaving speed, SW	50.0	mi/h
Average non-weaving speed, SNW	48.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.0	mi/h
Weaving segment density, D	19.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.503	
Weaving segment flow rate, v	2702	veh/h
Weaving segment capacity, cW	5370	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5956	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1951	c
		Maximum	Analyzed	
v/c ratio		1.00	0.503	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

```
                     HCS 2010: Freeway Weaving Release 6.70
Phone:                                      Fax:
E-mail:

______________________________Operational Analysis_____________________________

Analyst:                     KI3
Agency/Co.:                  Omni Means
Date Performed:              8/15/2016
Analysis Time Period:        AM Peak Hour
Freeway/Dir of Travel:       SR 49/20 NB/EB
Weaving Location:            Bennett to Idaho Maryland
Analysis Year:               Existing + Project
Description:                 Grass Valley Marketplace EIR

___________________________________Inputs______________________________________

Segment Type                                Freeway
Weaving configuration                       One-Sided
Number of lanes, N                          3           ln
Weaving segment length, LS                  1000        ft
Freeway free-flow speed, FFS                60          mi/h
Minimum segment speed, SMIN                 15          mi/h
Freeway maximum capacity, cIFL              2300        pc/h/ln

Terrain type                                Rolling
    Grade                                   0.00        %
    Length                                  0.00        mi

___________________Conversion to pc/h Under Base Conditions____________________
                                         Volume Components
                                        VFF     VRF     VFR     VRR
Volume, V                                1690    654     511     0    veh/h
Peak hour factor, PHF                    0.92    0.88    0.91    0.94
Peak 15-min volume, v15                  459     186     140     0
Trucks and buses                         6       0       0       0         %
Recreational vehicles                    0       0       0       0         %
Trucks and buses PCE, ET                 2.5     2.5     2.5     2.5
Recreational vehicle PCE, ER             2.0     2.0     2.0     2.0
Heavy vehicle adjustment, fHV            0.917   1.000   1.000   1.000
Driver population adjustment, fP         1.00    1.00    1.00    1.00
Flow rate, v                             2002    743     562     0     pc/h

Volume ratio, VR                                 0.395

_________________________Configuration Characteristics_________________________
Number of maneuver lanes, NWL                2           ln
Interchange density, ID                      3.0         int/mi
Minimum RF lane changes, LCRF                1           lc/pc
Minimum FR lane changes, LCFR                1           lc/pc
Minimum RR lane changes, LCRR                            lc/pc

Minimum weaving lane changes, LCMIN          1305        lc/h
Weaving lane changes, LCW                    1587        lc/h
Non-weaving vehicle index, INW               601
Non-weaving lane change, LCNW                377         lc/h
Total lane changes, LCALL                    1964        lc/h

_______________________Weaving and Non-Weaving Speeds__________________________
Weaving intensity factor, W                  0.385
```

Average weaving speed, SW	47.5	mi/h
Average non-weaving speed, SNW	45.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.1	mi/h
Weaving segment density, D	23.9	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.610	
Weaving segment flow rate, v	3142	veh/h
Weaving segment capacity, cW	5147	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6621	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1870	c
		Maximum	Analyzed	
v/c ratio		1.00	0.610	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	2201	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	598	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1304	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1304	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	21.7	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1024	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	278	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	607	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	607	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	10.1	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1024	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	385	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1024		385			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	278		101			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1213	405	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1213 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	1213	4600	No
$v_{FO} = v_F - v_R$	808	4600	No
v_R	405	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 1213 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1213	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 7.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D_S = 0.464	
Space mean speed in ramp influence area,	S_R = 51.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 51.6	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	639	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	230	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	639	230		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	174	61		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	757	242	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 757 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	999	4600	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 757 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	999	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 10.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.302	
Space mean speed in ramp influence area,	S_R = 54.6	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.6	mph

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	634	192	235	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	169	51	63	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	735	204	250	0	pc/h

Volume ratio, VR 0.382

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	210	lc/h
Total lane changes, LCALL	314	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.080

Average weaving speed, SW	56.7	mi/h
Average non-weaving speed, SNW	58.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	57.5	mi/h
Weaving segment density, D	6.9	pc/mi/ln
Level of service, LOS	A	
Weaving segment v/c ratio	0.217	
Weaving segment flow rate, v	1129	veh/h
Weaving segment capacity, cW	5213	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6478	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1894	c
		Maximum	Analyzed	
v/c ratio		1.00	0.217	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	683	242	143	0	veh/h
Peak hour factor, PHF	0.92	0.83	0.81	0.94	
Peak 15-min volume, v15	186	73	44	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	809	292	177	0	pc/h

Volume ratio, VR 0.367

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	469	lc/h
Weaving lane changes, LCW	909	lc/h
Non-weaving vehicle index, INW	488	
Non-weaving lane change, LCNW	678	lc/h
Total lane changes, LCALL	1587	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.188

Average weaving speed, SW	52.9	mi/h
Average non-weaving speed, SNW	54.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	53.9	mi/h
Weaving segment density, D	7.9	pc/mi/ln
Level of service, LOS	A	
Weaving segment v/c ratio	0.223	
Weaving segment flow rate, v	1211	veh/h
Weaving segment capacity, cW	5425	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6313	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1971	c
		Maximum	Analyzed	
v/c ratio		1.00	0.223	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	492	317	433	0	veh/h
Peak hour factor, PHF	0.92	0.81	0.81	0.94	
Peak 15-min volume, v15	134	98	134	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	551	391	535	0	pc/h
Volume ratio, VR		0.627			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	926	lc/h
Weaving lane changes, LCW	1017	lc/h
Non-weaving vehicle index, INW	46	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1017	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.458

Average weaving speed, SW	45.9	mi/h
Average non-weaving speed, SNW	51.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.6	mi/h
Weaving segment density, D	10.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.393	
Weaving segment flow rate, v	1461	veh/h
Weaving segment capacity, cW	3717	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	9348	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1617	c
		Maximum	Analyzed	
v/c ratio		1.00	0.393	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	809	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	220	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	479	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	479	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	8.0	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1261	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	343	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	706	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	706	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	11.8	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	864	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	397	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	138	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	864	397	138	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	235	113	39	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV             0.917       1.000       1.000
Driver population factor, fP              1.00        1.00        1.00
Flow rate, vp                             1024        451         157        pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1024   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1475          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1024                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1475          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   14.3    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation___________________________________

Intermediate speed variable,                 M  = 0.310
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	726	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	138	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	397	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	726	138	397	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	197	39	113	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	860	157	451	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 860 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1017	4600	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 860 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1017	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 10.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.300

Space mean speed in ramp influence area, S_R = 54.6 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 54.6 mph

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	286	440	675	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.92	0.82	
Peak 15-min volume, v15	78	134	183	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	339	537	734	0	pc/h

Volume ratio, VR 0.789

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1271	lc/h
Weaving lane changes, LCW	1572	lc/h
Non-weaving vehicle index, INW	112	
Non-weaving lane change, LCNW	88	lc/h
Total lane changes, LCALL	1660	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.313

Average weaving speed, SW	49.3	mi/h
Average non-weaving speed, SNW	48.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.1	mi/h
Weaving segment density, D	10.9	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.567	
Weaving segment flow rate, v	1582	veh/h
Weaving segment capacity, cW	2789	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	11401	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1512	c
		Maximum	Analyzed	
v/c ratio		1.00	0.567	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	866	95	560	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	235	26	171	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1026	104	683	0	pc/h

Volume ratio, VR 0.434

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	787	lc/h
Weaving lane changes, LCW	1140	lc/h
Non-weaving vehicle index, INW	431	
Non-weaving lane change, LCNW	392	lc/h
Total lane changes, LCALL	1532	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.243

Average weaving speed, SW	51.2	mi/h
Average non-weaving speed, SNW	51.4	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	51.3	mi/h
Weaving segment density, D	11.8	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.341	
Weaving segment flow rate, v	1729	veh/h
Weaving segment capacity, cW	5072	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7066	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1867	c
		Maximum	Analyzed	
v/c ratio		1.00	0.341	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	760	666	389	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	207	189	107	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	900	757	427	0	pc/h

Volume ratio, VR 0.568

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1184	lc/h
Weaving lane changes, LCW	1466	lc/h
Non-weaving vehicle index, INW	270	
Non-weaving lane change, LCNW	150	lc/h
Total lane changes, LCALL	1616	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.330

Average weaving speed, SW	48.8	mi/h
Average non-weaving speed, SNW	48.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.5	mi/h
Weaving segment density, D	14.3	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.519	
Weaving segment flow rate, v	2011	veh/h
Weaving segment capacity, cW	3876	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	8634	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1716	c
		Maximum	Analyzed	
v/c ratio		1.00	0.519	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1200	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	326	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	711	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	711	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	11.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1726	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	469	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1022	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1022	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1726	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	521	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1726		521			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	469		137			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV           0.917       1.000
Driver population factor, fP            1.00        1.00
Flow rate, vp                           2045        548                     pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    1.000   Using Equation  0
                   FD
                  v  = v  + (v - v ) P  =  2045   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                             Actual        Maximum         LOS F?
     v  = v                  2045          4600            No
      Fi   F
     v  = v - v              1497          4600            No
      FO   F   R
     v                       548           2000            No
      R
     v  or v                 0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?             No
      3     av34
Is   v  or v      > 1.5 v  /2              No
      3     av34         12
If yes, v    = 2045                     (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                2045          4400                  No
      12
_________________Level of Service Determination (if not F)_____________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   15.1    pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 D  = 0.477
                                              S
Space mean speed in ramp influence area,     S  = 51.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 51.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1205	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	445	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1205		445			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	327		117			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV           0.917       1.000
Driver population factor, fP            1.00        1.00
Flow rate, vp                           1428        468                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1428   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     1896          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1428                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1896          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   17.4    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.318
                                              S
Space mean speed in ramp influence area,     S  = 54.3    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.3    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1367	384	283	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	364	102	75	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1585	409	301	0	pc/h
Volume ratio, VR		0.309			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	386	lc/h
Total lane changes, LCALL	490	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.113

Average weaving speed, SW	55.4	mi/h
Average non-weaving speed, SNW	56.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.0	mi/h
Weaving segment density, D	13.7	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.402	
Weaving segment flow rate, v	2164	veh/h
Weaving segment capacity, cW	5381	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5685	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1955	c
		Maximum	Analyzed	
v/c ratio		1.00	0.402	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1579	820	172	0	veh/h
Peak hour factor, PHF	0.92	0.89	0.94	0.94	
Peak 15-min volume, v15	429	230	46	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1871	921	183	0	pc/h
Volume ratio, VR		0.371			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1104	lc/h
Weaving lane changes, LCW	1544	lc/h
Non-weaving vehicle index, INW	1128	
Non-weaving lane change, LCNW	897	lc/h
Total lane changes, LCALL	2441	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.263

Average weaving speed, SW	50.6	mi/h
Average non-weaving speed, SNW	47.3	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.5	mi/h
Weaving segment density, D	20.5	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.521	
Weaving segment flow rate, v	2821	veh/h
Weaving segment capacity, cW	5414	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6359	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1967	c
		Maximum	Analyzed	
v/c ratio		1.00	0.521	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1839	570	560	0	veh/h
Peak hour factor, PHF	0.92	0.94	0.92	0.94	
Peak 15-min volume, v15	500	152	152	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2059	606	609	0	pc/h
Volume ratio, VR		0.371			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1215	lc/h
Weaving lane changes, LCW	1306	lc/h
Non-weaving vehicle index, INW	171	
Non-weaving lane change, LCNW	71	lc/h
Total lane changes, LCALL	1377	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.582

Average weaving speed, SW	43.4	mi/h
Average non-weaving speed, SNW	46.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	45.0	mi/h
Weaving segment density, D	24.2	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.598	
Weaving segment flow rate, v	3214	veh/h
Weaving segment capacity, cW	5374	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6359	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1845	c
		Maximum	Analyzed	
v/c ratio		1.00	0.598	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing + Project
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	2409	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	655	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1427	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1427	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	23.8	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1605	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	436	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	898	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	898	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	15.0	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1345	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	260	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	100	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1345	260	100	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	365	74	28	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

Heavy vehicle adjustment, fHV	0.917	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	1594	295	114	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1594 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1889	4600	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1594 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1889	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.319	
Space mean speed in ramp influence area,	S_R = 54.3	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.3	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1245	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	260	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1245	100	260	vph
Peak-hour factor, PHF	0.92	0.88	0.88	
Peak 15-min volume, v15	338	28	74	v
Trucks and buses	6	0	0	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          1475        114         295       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1475   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1589          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1475                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area______________________
                      Actual        Max Desirable        Violation?
     v                1589          4600                 No
      R12
_________________Level of Service Determination (if not F)______________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.0    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.309
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.4    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1017	228	695	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.88	0.82	
Peak 15-min volume, v15	276	70	197	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1205	278	790	0	pc/h
Volume ratio, VR		0.470			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1068	lc/h
Weaving lane changes, LCW	1369	lc/h
Non-weaving vehicle index, INW	398	
Non-weaving lane change, LCNW	267	lc/h
Total lane changes, LCALL	1636	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.309

Average weaving speed, SW	49.4	mi/h
Average non-weaving speed, SNW	48.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.0	mi/h
Weaving segment density, D	15.5	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.464	
Weaving segment flow rate, v	2174	veh/h
Weaving segment capacity, cW	4686	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7476	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1812	c
		Maximum	Analyzed	
v/c ratio		1.00	0.464	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1632	80	936	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	443	22	285	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1934	88	1141	0	pc/h

Volume ratio, VR 0.389

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1229	lc/h
Weaving lane changes, LCW	1582	lc/h
Non-weaving vehicle index, INW	812	
Non-weaving lane change, LCNW	579	lc/h
Total lane changes, LCALL	2161	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.318

Average weaving speed, SW	49.1	mi/h
Average non-weaving speed, SNW	46.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.2	mi/h
Weaving segment density, D	22.3	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.572	
Weaving segment flow rate, v	3004	veh/h
Weaving segment capacity, cW	5246	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6553	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1906	c
		Maximum	Analyzed	
v/c ratio		1.00	0.572	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1818	750	605	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	494	213	166	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2154	852	665	0	pc/h

Volume ratio, VR 0.413

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1517	lc/h
Weaving lane changes, LCW	1799	lc/h
Non-weaving vehicle index, INW	646	
Non-weaving lane change, LCNW	408	lc/h
Total lane changes, LCALL	2207	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.422

Average weaving speed, SW	46.6	mi/h
Average non-weaving speed, SNW	43.2	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	44.6	mi/h
Weaving segment density, D	27.5	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.685	
Weaving segment flow rate, v	3494	veh/h
Weaving segment capacity, cW	5103	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6830	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1854	c
		Maximum	Analyzed	
v/c ratio		1.00	0.685	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	2423	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	658	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1435	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1435	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	23.9	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1118	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	304	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	662	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	662	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	11.0+	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1118	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	465	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1118		465			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	304		122			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1325        489                   pcph

_________________________Estimation of V12 Diverge Areas_______________________

                  L  =            (Equation 13-12 or 13-13)
                   EQ
                  P  =    1.000   Using Equation  0
                   FD
                  v  = v  + (v - v ) P  =  1325   pc/h
                   12   R     F   R   FD

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v  = v                1325          4600            No
      Fi   F
     v  = v - v            836           4600            No
      FO   F   R
     v                     489           2000            No
      R
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1325                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

______________________Flow Entering Diverge Influence Area______________________
                      Actual        Max Desirable        Violation?
     v                1325          4400                 No
      12
_________________Level of Service Determination (if not F)______________________

Density,               D = 4.252 + 0.0086 v  - 0.009  L   =   8.9     pc/mi/ln
                        R                  12          D
Level of service for ramp-freeway junction areas of influence A

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                D  = 0.472
                                             S
Space mean speed in ramp influence area,    S  = 51.5    mph
                                             R
Space mean speed in outer lanes,            S  =  N/A    mph
                                             0
Space mean speed for all vehicles,          S  = 51.5    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst: KI3
Agency/Co.: Omni Means
Date performed: 8/15/2016
Analysis time period: AM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB-WB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	653	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	245	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	653	245		vph
Peak-hour factor, PHF	0.92	0.95		
Peak 15-min volume, v15	177	64		v
Trucks and buses	6	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5		
Recreational vehicle PCE, ER	2.0	1.2		

```
Heavy vehicle adjustment, fHV           0.917       1.000
Driver population factor, fP            1.00        1.00
Flow rate, vp                           774         258                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =             (Equation 13-6 or 13-7)
                   EQ
                  P   =    1.000   Using Equation  0
                   FM
                  v   = v  (P   ) =  774    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     1032          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 774                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                1032          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   10.8    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.303
                                              S
Space mean speed in ramp influence area,     S  = 54.6    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	615	190	283	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	164	51	75	0	
Trucks and buses	0	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	1.000	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	654	202	301	0	pc/h

Volume ratio, VR 0.435

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	194	lc/h
Total lane changes, LCALL	298	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.077

Average weaving speed, SW	56.8	mi/h
Average non-weaving speed, SNW	58.1	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	57.6	mi/h
Weaving segment density, D	6.7	pc/mi/ln
Level of service, LOS	A	
Weaving segment v/c ratio	0.210	
Weaving segment flow rate, v	1158	veh/h
Weaving segment capacity, cW	5520	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7074	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1849	c
		Maximum	Analyzed	
v/c ratio		1.00	0.210	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	645	332	160	0	veh/h
Peak hour factor, PHF	0.92	0.83	0.81	0.94	
Peak 15-min volume, v15	175	100	49	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	764	400	198	0	pc/h

Volume ratio, VR 0.439

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	598	lc/h
Weaving lane changes, LCW	1038	lc/h
Non-weaving vehicle index, INW	461	
Non-weaving lane change, LCNW	669	lc/h
Total lane changes, LCALL	1707	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.199

Average weaving speed, SW	52.5	mi/h
Average non-weaving speed, SNW	53.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	53.1	mi/h
Weaving segment density, D	8.6	pc/mi/ln
Level of service, LOS	A	
Weaving segment v/c ratio	0.259	
Weaving segment flow rate, v	1299	veh/h
Weaving segment capacity, cW	5015	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7123	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1909	c
		Maximum	Analyzed	
v/c ratio		1.00	0.259	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	492	380	485	0	veh/h
Peak hour factor, PHF	0.92	0.81	0.81	0.94	
Peak 15-min volume, v15	134	117	150	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	551	469	599	0	pc/h

Volume ratio, VR 0.660

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1068	lc/h
Weaving lane changes, LCW	1159	lc/h
Non-weaving vehicle index, INW	46	
Non-weaving lane change, LCNW	0	lc/h
Total lane changes, LCALL	1159	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.508

Average weaving speed, SW	44.8	mi/h
Average non-weaving speed, SNW	49.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.4	mi/h
Weaving segment density, D	11.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.454	
Weaving segment flow rate, v	1603	veh/h
Weaving segment capacity, cW	3532	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	9752	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1586	c
		Maximum	Analyzed	
v/c ratio		1.00	0.454	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	872	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	237	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	517	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	517	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	8.6	pc/mi/ln
Level of service, LOS	A	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	North of Brunswick Road
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1377	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	374	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	771	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	771	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	12.9	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	867	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	510	vph
Length of first accel/decel lane	400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	170	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	867		510		170	vph
Peak-hour factor, PHF	0.92		0.88		0.88	
Peak 15-min volume, v15	236		145		48	v
Trucks and buses	6		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.917	1.000	1.000	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	1027	580	193	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1027 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1607	4600	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	

If yes, v_{12A} = 1027 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{R12}	1607	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 15.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M_S = 0.312	
Space mean speed in ramp influence area,	S_R = 54.4	mph
Space mean speed in outer lanes,	S_0 = N/A	mph
Space mean speed for all vehicles,	S = 54.4	mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Junction:	Brunswick Loop On Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	697	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	170	vph
Length of first accel/decel lane	450	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	510	vph
Position of adjacent Ramp	Downstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	400	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	697		170		510	vph
Peak-hour factor, PHF	0.92		0.88		0.88	
Peak 15-min volume, v15	189		48		145	v
Trucks and buses	6		0		0	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

```
Heavy vehicle adjustment, fHV          0.917       1.000       1.000
Driver population factor, fP           1.00        1.00        1.00
Flow rate, vp                          826         193         580       pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  826    pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     1019          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 826                    (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                1019          4600                  No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   10.5    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.300
                                              S
Space mean speed in ramp influence area,     S  = 54.6    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.6    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Dorsey Dr/Brunswick Rd
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1100	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	233	464	732	0	veh/h
Peak hour factor, PHF	0.92	0.82	0.92	0.82	
Peak 15-min volume, v15	63	141	199	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	276	566	796	0	pc/h

Volume ratio, VR 0.832

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1362	lc/h
Weaving lane changes, LCW	1663	lc/h
Non-weaving vehicle index, INW	91	
Non-weaving lane change, LCNW	75	lc/h
Total lane changes, LCALL	1738	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.324

Average weaving speed, SW	49.0	mi/h
Average non-weaving speed, SNW	47.6	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.7	mi/h
Weaving segment density, D	11.2	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.610	
Weaving segment flow rate, v	1615	veh/h
Weaving segment capacity, cW	2648	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	11951	1100	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1470	c
		Maximum	Analyzed	
v/c ratio		1.00	0.610	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Idaho Maryland to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1400	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	830	135	714	0	veh/h
Peak hour factor, PHF	0.92	0.91	0.82	0.94	
Peak 15-min volume, v15	226	37	218	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	983	148	871	0	pc/h

Volume ratio, VR 0.509

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1019	lc/h
Weaving lane changes, LCW	1372	lc/h
Non-weaving vehicle index, INW	413	
Non-weaving lane change, LCNW	383	lc/h
Total lane changes, LCALL	1755	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.270

Average weaving speed, SW	50.4	mi/h
Average non-weaving speed, SNW	49.5	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	49.9	mi/h
Weaving segment density, D	13.4	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.444	
Weaving segment flow rate, v	1922	veh/h
Weaving segment capacity, cW	4326	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	7932	1400	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1800	c
		Maximum	Analyzed	
v/c ratio		1.00	0.444	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 NB/EB
Weaving Location:	Bennett to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1000	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	798	746	449	0	veh/h
Peak hour factor, PHF	0.92	0.88	0.91	0.94	
Peak 15-min volume, v15	217	212	123	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	945	848	493	0	pc/h
Volume ratio, VR		0.587			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1341	lc/h
Weaving lane changes, LCW	1623	lc/h
Non-weaving vehicle index, INW	284	
Non-weaving lane change, LCNW	159	lc/h
Total lane changes, LCALL	1782	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.357

Average weaving speed, SW	48.2	mi/h
Average non-weaving speed, SNW	46.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.5	mi/h
Weaving segment density, D	16.0	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.588	
Weaving segment flow rate, v	2209	veh/h
Weaving segment capacity, cW	3753	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	8856	1000	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1699	c
		Maximum	Analyzed	
v/c ratio		1.00	0.588	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 NB/EB
From/To:	South of Bennett
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1247	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	339	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	739	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	739	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	12.3	pc/mi/ln
Level of service, LOS	B	

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	North of Brunswick
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	1885	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	512	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1117	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1117	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.6	pc/mi/ln
Level of service, LOS	C	

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date performed:	8/15/2016
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Junction:	Brunswick Off Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1885	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	545	vph
Length of first accel/decel lane	750	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1885		545			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	512		143			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade	0.00	%	0.00	%		%
Length	0.00	mi	0.00	mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

Heavy vehicle adjustment, fHV	0.917	1.000	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2233	574	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2233 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2233	4600	No
$v_{FO} = v_F - v_R$	1659	4600	No
v_R	574	2000	No
v_3 or v_{av34}	0 pc/h	(Equation 13-14 or 13-17)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 No

If yes, v_{12A} = 2233 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2233	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 16.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.480

Space mean speed in ramp influence area, S_R = 51.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 51.4 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.70

Phone: Fax:
E-mail:

Merge Analysis

Analyst: KI3
Agency/Co.: Omni Means
Date performed: 8/15/2016
Analysis time period: PM Peak Hour
Freeway/Dir of Travel: SR 49/20 SB-WB
Junction: Brunswick Loop On Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Grass Valley Marketplace EIR

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	60.0	mph
Volume on freeway	1340	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	459	vph
Length of first accel/decel lane	420	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	1340		459			vph
Peak-hour factor, PHF	0.92		0.95			
Peak 15-min volume, v15	364		121			v
Trucks and buses	6		0			%
Recreational vehicles	0		0			%
Terrain type:	Rolling		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5			
Recreational vehicle PCE, ER	2.0		1.2			

```
Heavy vehicle adjustment, fHV          0.917       1.000
Driver population factor, fP           1.00        1.00
Flow rate, vp                          1588        483                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    1.000   Using Equation  0
                   FM
                  v  = v  (P  ) =  1588   pc/h
                   12   F   FM

_______________________________Capacity Checks________________________________

                           Actual        Maximum         LOS F?
     v                     2071          4600            No
      FO
     v  or v               0    pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            No
      3     av34         12
If yes, v    = 1588                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2071          4600                 No
      R12
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   18.8    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.323
                                              S
Space mean speed in ramp influence area,     S  = 54.2    mph
                                              R
Space mean speed in outer lanes,             S  =  N/A    mph
                                              0
Space mean speed for all vehicles,           S  = 54.2    mph
_______________________________________________________________________________
```

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/15/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB-WB
Weaving Location:	Brunswick to Dorsey
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	1175	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1457	405	342	0	veh/h
Peak hour factor, PHF	0.94	0.94	0.94	0.94	
Peak 15-min volume, v15	388	108	91	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1690	431	364	0	pc/h
Volume ratio, VR		0.320			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	0.0	int/mi
Minimum RF lane changes, LCRF	0	lc/pc
Minimum FR lane changes, LCFR	0	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	104	lc/h
Non-weaving vehicle index, INW	0	
Non-weaving lane change, LCNW	407	lc/h
Total lane changes, LCALL	511	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.117

Average weaving speed, SW	55.3	mi/h
Average non-weaving speed, SNW	56.0	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	55.8	mi/h
Weaving segment density, D	14.8	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.438	
Weaving segment flow rate, v	2345	veh/h
Weaving segment capacity, cW	5356	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5799	1175	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1946	c
		Maximum	Analyzed	
v/c ratio		1.00	0.438	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:

E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	SR 49/20 SB/WB
Weaving Location:	Dorsey to Idaho Maryland
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	2010	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Rolling	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1657	1085	205	0	veh/h
Peak hour factor, PHF	0.92	0.89	0.94	0.94	
Peak 15-min volume, v15	450	305	55	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.917	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1963	1219	218	0	pc/h

Volume ratio, VR 0.423

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	3.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1437	lc/h
Weaving lane changes, LCW	1877	lc/h
Non-weaving vehicle index, INW	1184	
Non-weaving lane change, LCNW	916	lc/h
Total lane changes, LCALL	2793	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.293

Average weaving speed, SW	49.8	mi/h
Average non-weaving speed, SNW	44.2	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	46.4	mi/h
Weaving segment density, D	24.4	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.622	
Weaving segment flow rate, v	3239	veh/h
Weaving segment capacity, cW	5210	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6936	2010	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1923	c
		Maximum	Analyzed	
v/c ratio		1.00	0.622	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Freeway Weaving Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency/Co.:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Dir of Travel:	Sr 49/20 SB/WB
Weaving Location:	Idaho Maryland to Bennett
Analysis Year:	Existing
Description:	Grass Valley Marketplace EIR

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	3	ln
Weaving segment length, LS	415	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	15	mi/h
Freeway maximum capacity, cIFL	2300	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	2034	625	708	0	veh/h
Peak hour factor, PHF	0.92	0.94	0.92	0.94	
Peak 15-min volume, v15	553	166	192	0	
Trucks and buses	6	0	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	1.000	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2277	665	770	0	pc/h

Volume ratio, VR 0.387

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	2.0	int/mi
Minimum RF lane changes, LCRF	1	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	1435	lc/h
Weaving lane changes, LCW	1526	lc/h
Non-weaving vehicle index, INW	189	
Non-weaving lane change, LCNW	116	lc/h
Total lane changes, LCALL	1642	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W 0.669

Average weaving speed, SW	42.0	mi/h
Average non-weaving speed, SNW	43.7	mi/h

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	43.0	mi/h
Weaving segment density, D	28.8	pc/mi/ln
Level of service, LOS	D	
Weaving segment v/c ratio	0.683	
Weaving segment flow rate, v	3646	veh/h
Weaving segment capacity, cW	5336	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	6531	415	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2300	1832	c
		Maximum	Analyzed	
v/c ratio		1.00	0.683	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Basic Freeway Segments Release 6.70

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	KI3
Agency or Company:	Omni Means
Date Performed:	8/16/2016
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	SR 49/20 SB/WB
From/To:	South of Bennett St
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Grass Valley Marketplace EIR

Flow Inputs and Adjustments

Volume, V	2659	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	723	v
Trucks and buses	6	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.917	
Driver population factor, fp	1.00	
Flow rate, vp	1575	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	60.0	mi/h

LOS and Performance Measures

Flow rate, vp	1575	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	26.3	pc/mi/ln
Level of service, LOS	D	

Appendix A: Synchro/SimTraffic Outputs
(Alternative A)

Appendix B: Sidra Outputs
(Alternative A)

Appendix C: HCS Outputs
(Alternative A)

Appendix D: Signal Warrant Analysis Worksheets (Alternative A)

Appendix E: Caltrans NOP Comments

Appendix F: Grass Valley Traffic Impact Fee 2016 Nexus Fee Update Exhibit 23

Appendix G: Exhibits for Alternative B

Appendix H: LOS Worksheets for Alternative B

APPENDIX I

CalEEMod Results

CalEEMod Version: CalEEMod.2016.3.2

Date: 3/11/2019 8:07 AM

Dorsey Marketplace (Alternative A)

Northern Sierra AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	1.60	Acre	1.60	69,696.00	0
Other Non-Asphalt Surfaces	7.30	Acre	7.30	317,988.00	0
Parking Lot	926.00	Space	8.33	370,400.00	0
Apartments Low Rise	90.00	Dwelling Unit	5.70	119,260.00	184
Regional Shopping Center	181.40	1000sqft	21.00	181,400.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	72
Climate Zone	1			**Operational Year**	2022
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	499.66	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Dorsey Marketplace. NSAQMD. Adjusted CO2 to meet a 33% RPS by 2020.

Land Use - Alternative A includes 90 DU, 181.4 KSF in retail, 926 parking spaces, 1.6 acres in driveway, and 7.3 acres in landscaping/drainage. Population based on a average household size of 2.04.

Construction Phase - Construction would occur July 2019 through February 2021.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Trips and VMT - Adjusted trips per client.

Architectural Coating - Use of low VOC coatings.

Vehicle Trips - Defaults assumed.

Woodstoves - Installation of natural gas fireplaces.

Construction Off-road Equipment Mitigation - Basic fugitive dust control measures included.

Mobile Land Use Mitigation - Neighborhood enhancements options selected.

Water Mitigation - 20% indoor/outdoor reduction in water assumed for CALGreen compliance.

Waste Mitigation - 75% waste diversion consistent with AB 341.

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	90,700.00	0.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	272,100.00	0.00
tblArchitecturalCoating	ConstArea_Parking	45,485.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Exterior	80,501.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Interior	241,502.00	0.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblConstructionPhase	NumDays	30.00	10.00
tblConstructionPhase	NumDays	75.00	115.00

tblConstructionPhase	NumDays	30.00	20.00
tblConstructionPhase	NumDays	55.00	10.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	47.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	48.00
tblFireplaces	FireplaceWoodMass	3,078.40	0.00
tblFireplaces	NumberGas	49.50	81.00
tblFireplaces	NumberWood	31.50	0.00
tblLandUse	LandUseSquareFeet	90,000.00	119,260.00
tblLandUse	LotAcreage	5.63	5.70
tblLandUse	LotAcreage	4.16	21.00
tblLandUse	Population	257.00	184.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	499.66
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripNumber	0.00	300.00
tblTripsAndVMT	VendorTripNumber	164.00	92.00
tblTripsAndVMT	VendorTripNumber	164.00	10.00
tblTripsAndVMT	WorkerTripNumber	23.00	24.00
tblTripsAndVMT	WorkerTripNumber	15.00	16.00
tblTripsAndVMT	WorkerTripNumber	441.00	216.00
tblTripsAndVMT	WorkerTripNumber	88.00	44.00
tblTripsAndVMT	WorkerTripNumber	441.00	66.00
tblTripsAndVMT	WorkerTripNumber	88.00	14.00
tblVehicleTrips	HS_TTP	20.70	21.00
tblVehicleTrips	HW_TTP	37.30	37.00
tblWoodstoves	WoodstoveDayYear	82.00	0.00
tblWoodstoves	WoodstoveWoodMass	3,019.20	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.3492	3.8067	2.3738	4.4000e-003	0.6736	0.1747	0.8483	0.2969	0.1608	0.4577	0.0000	395.9565	395.9565	0.1175	0.0000	398.8930
2020	2.1052	3.6256	3.6970	7.8200e-003	0.3909	0.1613	0.5522	0.1382	0.1516	0.2898	0.0000	698.8005	698.8005	0.0990	0.0000	701.2764
2021	0.4718	0.2571	0.2894	5.3000e-004	0.0130	0.0133	0.0263	3.4700e-003	0.0126	0.0160	0.0000	46.0539	46.0539	7.8600e-003	0.0000	46.2505
Maximum	**2.1052**	**3.8067**	**3.6970**	**7.8200e-003**	**0.6736**	**0.1747**	**0.8483**	**0.2969**	**0.1608**	**0.4577**	**0.0000**	**698.8005**	**698.8005**	**0.1175**	**0.0000**	**701.2764**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.3492	3.8067	2.3738	4.4000e-003	0.3148	0.1747	0.4895	0.1367	0.1608	0.2975	0.0000	395.9561	395.9561	0.1175	0.0000	398.8926
2020	2.1052	3.6256	3.6970	7.8200e-003	0.3264	0.1613	0.4876	0.1027	0.1516	0.2543	0.0000	698.8001	698.8001	0.0990	0.0000	701.2760
2021	0.4718	0.2571	0.2894	5.3000e-004	0.0130	0.0133	0.0263	3.4700e-003	0.0126	0.0160	0.0000	46.0539	46.0539	7.8600e-003	0.0000	46.2504
Maximum	**2.1052**	**3.8067**	**3.6970**	**7.8200e-003**	**0.3264**	**0.1747**	**0.4895**	**0.1367**	**0.1608**	**0.2975**	**0.0000**	**698.8001**	**698.8001**	**0.1175**	**0.0000**	**701.2760**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**39.29**	**0.00**	**29.67**	**44.61**	**0.00**	**25.63**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.6740	0.0629	0.7027	3.9000e-004		8.1900e-003	8.1900e-003		8.1900e-003	8.1900e-003	0.0000	64.9112	64.9112	2.3300e-003	1.1700e-003	65.3180
Energy	0.0123	0.1089	0.0729	6.7000e-004		8.4900e-003	8.4900e-003		8.4900e-003	8.4900e-003	0.0000	803.9635	803.9635	0.0419	0.0104	808.1180
Mobile	3.4197	19.0257	34.6498	0.0880	5.8265	0.0929	5.9194	1.5649	0.0874	1.6523	0.0000	8,085.6055	8,085.6055	0.5060	0.0000	8,098.2555
Waste						0.0000	0.0000		0.0000	0.0000	47.0675	0.0000	47.0675	2.7816	0.0000	116.6078
Water						0.0000	0.0000		0.0000	0.0000	6.1232	33.1347	39.2579	0.6308	0.0153	59.5726
Total	**5.1059**	**19.1975**	**35.4254**	**0.0890**	**5.8265**	**0.1096**	**5.9361**	**1.5649**	**0.1041**	**1.6690**	**53.1907**	**8,987.6149**	**9,040.8056**	**3.9627**	**0.0268**	**9,147.8718**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.6740	0.0629	0.7027	3.9000e-004		8.1900e-003	8.1900e-003		8.1900e-003	8.1900e-003	0.0000	64.9112	64.9112	2.3300e-003	1.1700e-003	65.3180
Energy	0.0123	0.1089	0.0729	6.7000e-004		8.4900e-003	8.4900e-003		8.4900e-003	8.4900e-003	0.0000	803.9635	803.9635	0.0419	0.0104	808.1180
Mobile	3.0172	15.5151	25.9614	0.0588	3.5417	0.0620	3.6037	0.9512	0.0583	1.0095	0.0000	5,410.4209	5,410.4209	0.4114	0.0000	5,420.7060
Waste						0.0000	0.0000		0.0000	0.0000	11.7669	0.0000	11.7669	0.6954	0.0000	29.1519
Water						0.0000	0.0000		0.0000	0.0000	4.8986	26.5078	31.4063	0.5047	0.0122	47.6581
Total	**4.7034**	**15.6869**	**26.7370**	**0.0599**	**3.5417**	**0.0787**	**3.6204**	**0.9512**	**0.0750**	**1.0262**	**16.6654**	**6,305.8033**	**6,322.4687**	**1.6557**	**0.0238**	**6,370.9520**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	7.88	18.29	24.53	32.77	39.21	28.20	39.01	39.21	27.95	38.51	68.67	29.84	30.07	58.22	11.36	30.36

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	7/1/2019	7/12/2019	5	10	
2	Grading	Grading	7/13/2019	12/20/2019	5	115	
3	Laying Rock Base	Site Preparation	12/21/2019	1/17/2020	5	20	
4	Paving	Paving	1/18/2020	1/31/2020	5	10	
5	Building Construction (Non-Res)	Building Construction	2/1/2020	8/4/2020	5	132	
6	Architectural Coating (Non-Res)	Architectural Coating	6/1/2020	8/4/2020	5	47	
7	Building Construction (Res)	Building Construction	8/5/2020	2/4/2021	5	132	
8	Architectural Coating (Res)	Architectural Coating	12/1/2020	2/4/2021	5	48	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 287.5

Acres of Paving: 17.23

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 272,100; Non-Residential Outdoor: 90,700; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48

Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Trenchers	1	8.00	78	0.50
Laying Rock Base	Rubber Tired Dozers	3	8.00	247	0.40
Laying Rock Base	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction (Non-Res)	Cranes	1	7.00	231	0.29
Building Construction (Non-Res)	Forklifts	3	8.00	89	0.20
Building Construction (Non-Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Non-Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Non-Res)	Welders	1	8.00	46	0.45
Architectural Coating (Non-Res)	Air Compressors	1	6.00	78	0.48
Building Construction (Res)	Cranes	1	7.00	231	0.29
Building Construction (Res)	Forklifts	3	8.00	89	0.20
Building Construction (Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Res)	Welders	1	8.00	46	0.45
Architectural Coating (Res)	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	9	24.00	0.00	300.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Laying Rock Base	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	16.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Non-Res)	9	216.00	92.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Non-Res)	1	44.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Res)	9	66.00	10.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Res)	1	14.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0217	0.2279	0.1103	1.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195
Total	**0.0217**	**0.2279**	**0.1103**	**1.9000e-004**	**0.0903**	**0.0120**	**0.1023**	**0.0497**	**0.0110**	**0.0607**	**0.0000**	**17.0843**	**17.0843**	**5.4100e-003**	**0.0000**	**17.2195**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.9000e-004	7.2000e-004	6.3200e-003	1.0000e-005	1.1000e-003	1.0000e-005	1.1100e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0278	1.0278	6.0000e-005	0.0000	1.0292
Total	**7.9000e-004**	**7.2000e-004**	**6.3200e-003**	**1.0000e-005**	**1.1000e-003**	**1.0000e-005**	**1.1100e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0278**	**1.0278**	**6.0000e-005**	**0.0000**	**1.0292**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0407	0.0000	0.0407	0.0223	0.0000	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0217	0.2279	0.1103	1.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195
Total	**0.0217**	**0.2279**	**0.1103**	**1.9000e-004**	**0.0407**	**0.0120**	**0.0526**	**0.0223**	**0.0110**	**0.0333**	**0.0000**	**17.0843**	**17.0843**	**5.4100e-003**	**0.0000**	**17.2195**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.9000e-004	7.2000e-004	6.3200e-003	1.0000e-005	1.1000e-003	1.0000e-005	1.1100e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0278	1.0278	6.0000e-005	0.0000	1.0292
Total	**7.9000e-004**	**7.2000e-004**	**6.3200e-003**	**1.0000e-005**	**1.1000e-003**	**1.0000e-005**	**1.1100e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0278**	**1.0278**	**6.0000e-005**	**0.0000**	**1.0292**

3.3 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4987	0.0000	0.4987	0.2068	0.0000	0.2068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2975	3.3602	2.0709	3.7600e-003		0.1540	0.1540		0.1417	0.1417	0.0000	337.6974	337.6974	0.1068	0.0000	340.3685
Total	**0.2975**	**3.3602**	**2.0709**	**3.7600e-003**	**0.4987**	**0.1540**	**0.6528**	**0.2068**	**0.1417**	**0.3485**	**0.0000**	**337.6974**	**337.6974**	**0.1068**	**0.0000**	**340.3685**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.3900e-003	0.0470	7.6500e-003	1.2000e-004	2.5200e-003	2.2000e-004	2.7400e-003	6.9000e-004	2.1000e-004	9.0000e-004	0.0000	11.7082	11.7082	4.9000e-004	0.0000	11.7203
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0122	0.0110	0.0969	1.8000e-004	0.0169	1.4000e-004	0.0170	4.4900e-003	1.3000e-004	4.6200e-003	0.0000	15.7602	15.7602	8.5000e-004	0.0000	15.7814
Total	**0.0136**	**0.0580**	**0.1046**	**3.0000e-004**	**0.0194**	**3.6000e-004**	**0.0198**	**5.1800e-003**	**3.4000e-004**	**5.5200e-003**	**0.0000**	**27.4684**	**27.4684**	**1.3400e-003**	**0.0000**	**27.5017**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2244	0.0000	0.2244	0.0931	0.0000	0.0931	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2975	3.3602	2.0709	3.7600e-003		0.1540	0.1540		0.1417	0.1417	0.0000	337.6970	337.6970	0.1068	0.0000	340.3681
Total	**0.2975**	**3.3602**	**2.0709**	**3.7600e-003**	**0.2244**	**0.1540**	**0.3785**	**0.0931**	**0.1417**	**0.2348**	**0.0000**	**337.6970**	**337.6970**	**0.1068**	**0.0000**	**340.3681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.3900e-003	0.0470	7.6500e-003	1.2000e-004	2.5200e-003	2.2000e-004	2.7400e-003	6.9000e-004	2.1000e-004	9.0000e-004	0.0000	11.7082	11.7082	4.9000e-004	0.0000	11.7203
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0122	0.0110	0.0969	1.8000e-004	0.0169	1.4000e-004	0.0170	4.4900e-003	1.3000e-004	4.6200e-003	0.0000	15.7602	15.7602	8.5000e-004	0.0000	15.7814
Total	**0.0136**	**0.0580**	**0.1046**	**3.0000e-004**	**0.0194**	**3.6000e-004**	**0.0198**	**5.1800e-003**	**3.4000e-004**	**5.5200e-003**	**0.0000**	**27.4684**	**27.4684**	**1.3400e-003**	**0.0000**	**27.5017**

3.4 Laying Rock Base - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0632	0.0000	0.0632	0.0348	0.0000	0.0348	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0152	0.1595	0.0772	1.3000e-004		8.3700e-003	8.3700e-003		7.7000e-003	7.7000e-003	0.0000	11.9590	11.9590	3.7800e-003	0.0000	12.0536
Total	**0.0152**	**0.1595**	**0.0772**	**1.3000e-004**	**0.0632**	**8.3700e-003**	**0.0716**	**0.0348**	**7.7000e-003**	**0.0425**	**0.0000**	**11.9590**	**11.9590**	**3.7800e-003**	**0.0000**	**12.0536**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.6000e-004	5.0000e-004	4.4200e-003	1.0000e-005	7.7000e-004	1.0000e-005	7.8000e-004	2.0000e-004	1.0000e-005	2.1000e-004	0.0000	0.7195	0.7195	4.0000e-005	0.0000	0.7205
Total	**5.6000e-004**	**5.0000e-004**	**4.4200e-003**	**1.0000e-005**	**7.7000e-004**	**1.0000e-005**	**7.8000e-004**	**2.0000e-004**	**1.0000e-005**	**2.1000e-004**	**0.0000**	**0.7195**	**0.7195**	**4.0000e-005**	**0.0000**	**0.7205**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0285	0.0000	0.0285	0.0156	0.0000	0.0156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0152	0.1595	0.0772	1.3000e-004		8.3700e-003	8.3700e-003		7.7000e-003	7.7000e-003	0.0000	11.9590	11.9590	3.7800e-003	0.0000	12.0536
Total	**0.0152**	**0.1595**	**0.0772**	**1.3000e-004**	**0.0285**	**8.3700e-003**	**0.0368**	**0.0156**	**7.7000e-003**	**0.0233**	**0.0000**	**11.9590**	**11.9590**	**3.7800e-003**	**0.0000**	**12.0536**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.6000e-004	5.0000e-004	4.4200e-003	1.0000e-005	7.7000e-004	1.0000e-005	7.8000e-004	2.0000e-004	1.0000e-005	2.1000e-004	0.0000	0.7195	0.7195	4.0000e-005	0.0000	0.7205
Total	**5.6000e-004**	**5.0000e-004**	**4.4200e-003**	**1.0000e-005**	**7.7000e-004**	**1.0000e-005**	**7.8000e-004**	**2.0000e-004**	**1.0000e-005**	**2.1000e-004**	**0.0000**	**0.7195**	**0.7195**	**4.0000e-005**	**0.0000**	**0.7205**

3.4 Laying Rock Base - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1174	0.0000	0.1174	0.0646	0.0000	0.0646	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2757	0.1398	2.5000e-004		0.0143	0.0143		0.0131	0.0131	0.0000	21.7299	21.7299	7.0300e-003	0.0000	21.9056
Total	**0.0265**	**0.2757**	**0.1398**	**2.5000e-004**	**0.1174**	**0.0143**	**0.1317**	**0.0646**	**0.0131**	**0.0777**	**0.0000**	**21.7299**	**21.7299**	**7.0300e-003**	**0.0000**	**21.9056**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.5000e-004	8.2000e-004	7.2600e-003	1.0000e-005	1.4300e-003	1.0000e-005	1.4400e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2976	1.2976	6.0000e-005	0.0000	1.2991
Total	**9.5000e-004**	**8.2000e-004**	**7.2600e-003**	**1.0000e-005**	**1.4300e-003**	**1.0000e-005**	**1.4400e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2976**	**1.2976**	**6.0000e-005**	**0.0000**	**1.2991**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0528	0.0000	0.0528	0.0291	0.0000	0.0291	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2757	0.1398	2.5000e-004		0.0143	0.0143		0.0131	0.0131	0.0000	21.7299	21.7299	7.0300e-003	0.0000	21.9056
Total	**0.0265**	**0.2757**	**0.1398**	**2.5000e-004**	**0.0528**	**0.0143**	**0.0671**	**0.0291**	**0.0131**	**0.0422**	**0.0000**	**21.7299**	**21.7299**	**7.0300e-003**	**0.0000**	**21.9056**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.5000e-004	8.2000e-004	7.2600e-003	1.0000e-005	1.4300e-003	1.0000e-005	1.4400e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2976	1.2976	6.0000e-005	0.0000	1.2991
Total	**9.5000e-004**	**8.2000e-004**	**7.2600e-003**	**1.0000e-005**	**1.4300e-003**	**1.0000e-005**	**1.4400e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2976**	**1.2976**	**6.0000e-005**	**0.0000**	**1.2991**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.7800e-003	0.0703	0.0733	1.1000e-004		3.7600e-003	3.7600e-003		3.4600e-003	3.4600e-003	0.0000	10.0141	10.0141	3.2400e-003	0.0000	10.0951
Paving	0.0130					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0198**	**0.0703**	**0.0733**	**1.1000e-004**		**3.7600e-003**	**3.7600e-003**		**3.4600e-003**	**3.4600e-003**	**0.0000**	**10.0141**	**10.0141**	**3.2400e-003**	**0.0000**	**10.0951**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.5000e-004	5.6000e-004	4.9700e-003	1.0000e-005	9.8000e-004	1.0000e-005	9.9000e-004	2.6000e-004	1.0000e-005	2.7000e-004	0.0000	0.8872	0.8872	4.0000e-005	0.0000	0.8883
Total	**6.5000e-004**	**5.6000e-004**	**4.9700e-003**	**1.0000e-005**	**9.8000e-004**	**1.0000e-005**	**9.9000e-004**	**2.6000e-004**	**1.0000e-005**	**2.7000e-004**	**0.0000**	**0.8872**	**0.8872**	**4.0000e-005**	**0.0000**	**0.8883**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.7800e-003	0.0703	0.0733	1.1000e-004		3.7600e-003	3.7600e-003		3.4600e-003	3.4600e-003	0.0000	10.0141	10.0141	3.2400e-003	0.0000	10.0951
Paving	0.0130					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0198**	**0.0703**	**0.0733**	**1.1000e-004**		**3.7600e-003**	**3.7600e-003**		**3.4600e-003**	**3.4600e-003**	**0.0000**	**10.0141**	**10.0141**	**3.2400e-003**	**0.0000**	**10.0951**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.5000e-004	5.6000e-004	4.9700e-003	1.0000e-005	9.8000e-004	1.0000e-005	9.9000e-004	2.6000e-004	1.0000e-005	2.7000e-004	0.0000	0.8872	0.8872	4.0000e-005	0.0000	0.8883
Total	**6.5000e-004**	**5.6000e-004**	**4.9700e-003**	**1.0000e-005**	**9.8000e-004**	**1.0000e-005**	**9.9000e-004**	**2.6000e-004**	**1.0000e-005**	**2.7000e-004**	**0.0000**	**0.8872**	**0.8872**	**4.0000e-005**	**0.0000**	**0.8883**

3.6 Building Construction (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1399	1.2663	1.1120	1.7800e-003		0.0737	0.0737		0.0693	0.0693	0.0000	152.8626	152.8626	0.0373	0.0000	153.7949
Total	**0.1399**	**1.2663**	**1.1120**	**1.7800e-003**		**0.0737**	**0.0737**		**0.0693**	**0.0693**	**0.0000**	**152.8626**	**152.8626**	**0.0373**	**0.0000**	**153.7949**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0277	0.7286	0.1984	1.6300e-003	0.0359	3.6500e-003	0.0395	0.0104	3.4900e-003	0.0139	0.0000	154.9880	154.9880	9.5300e-003	0.0000	155.2263
Worker	0.1155	0.1004	0.8850	1.7500e-003	0.1743	1.4100e-003	0.1757	0.0464	1.3000e-003	0.0477	0.0000	158.1044	158.1044	7.5700e-003	0.0000	158.2936
Total	**0.1431**	**0.8290**	**1.0833**	**3.3800e-003**	**0.2102**	**5.0600e-003**	**0.2152**	**0.0568**	**4.7900e-003**	**0.0615**	**0.0000**	**313.0924**	**313.0924**	**0.0171**	**0.0000**	**313.5199**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1399	1.2663	1.1120	1.7800e-003		0.0737	0.0737		0.0693	0.0693	0.0000	152.8624	152.8624	0.0373	0.0000	153.7947
Total	**0.1399**	**1.2663**	**1.1120**	**1.7800e-003**		**0.0737**	**0.0737**		**0.0693**	**0.0693**	**0.0000**	**152.8624**	**152.8624**	**0.0373**	**0.0000**	**153.7947**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0277	0.7286	0.1984	1.6300e-003	0.0359	3.6500e-003	0.0395	0.0104	3.4900e-003	0.0139	0.0000	154.9880	154.9880	9.5300e-003	0.0000	155.2263
Worker	0.1155	0.1004	0.8850	1.7500e-003	0.1743	1.4100e-003	0.1757	0.0464	1.3000e-003	0.0477	0.0000	158.1044	158.1044	7.5700e-003	0.0000	158.2936
Total	**0.1431**	**0.8290**	**1.0833**	**3.3800e-003**	**0.2102**	**5.0600e-003**	**0.2152**	**0.0568**	**4.7900e-003**	**0.0615**	**0.0000**	**313.0924**	**313.0924**	**0.0171**	**0.0000**	**313.5199**

3.7 Architectural Coating (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.2094					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.6900e-003	0.0396	0.0430	7.0000e-005		2.6100e-003	2.6100e-003		2.6100e-003	2.6100e-003	0.0000	6.0002	6.0002	4.6000e-004	0.0000	6.0118
Total	**1.2151**	**0.0396**	**0.0430**	**7.0000e-005**		**2.6100e-003**	**2.6100e-003**		**2.6100e-003**	**2.6100e-003**	**0.0000**	**6.0002**	**6.0002**	**4.6000e-004**	**0.0000**	**6.0118**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.3700e-003	7.2800e-003	0.0642	1.3000e-004	0.0126	1.0000e-004	0.0127	3.3600e-003	9.0000e-005	3.4600e-003	0.0000	11.4675	11.4675	5.5000e-004	0.0000	11.4812
Total	**8.3700e-003**	**7.2800e-003**	**0.0642**	**1.3000e-004**	**0.0126**	**1.0000e-004**	**0.0127**	**3.3600e-003**	**9.0000e-005**	**3.4600e-003**	**0.0000**	**11.4675**	**11.4675**	**5.5000e-004**	**0.0000**	**11.4812**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.2094					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.6900e-003	0.0396	0.0430	7.0000e-005		2.6100e-003	2.6100e-003		2.6100e-003	2.6100e-003	0.0000	6.0001	6.0001	4.6000e-004	0.0000	6.0118
Total	**1.2151**	**0.0396**	**0.0430**	**7.0000e-005**		**2.6100e-003**	**2.6100e-003**		**2.6100e-003**	**2.6100e-003**	**0.0000**	**6.0001**	**6.0001**	**4.6000e-004**	**0.0000**	**6.0118**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.3700e-003	7.2800e-003	0.0642	1.3000e-004	0.0126	1.0000e-004	0.0127	3.3600e-003	9.0000e-005	3.4600e-003	0.0000	11.4675	11.4675	5.5000e-004	0.0000	11.4812
Total	**8.3700e-003**	**7.2800e-003**	**0.0642**	**1.3000e-004**	**0.0126**	**1.0000e-004**	**0.0127**	**3.3600e-003**	**9.0000e-005**	**3.4600e-003**	**0.0000**	**11.4675**	**11.4675**	**5.5000e-004**	**0.0000**	**11.4812**

3.8 Building Construction (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1134	1.0265	0.9014	1.4400e-003		0.0598	0.0598		0.0562	0.0562	0.0000	123.9113	123.9113	0.0302	0.0000	124.6671
Total	**0.1134**	**1.0265**	**0.9014**	**1.4400e-003**		**0.0598**	**0.0598**		**0.0562**	**0.0562**	**0.0000**	**123.9113**	**123.9113**	**0.0302**	**0.0000**	**124.6671**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.4400e-003	0.0642	0.0175	1.4000e-004	3.1600e-003	3.2000e-004	3.4800e-003	9.1000e-004	3.1000e-004	1.2200e-003	0.0000	13.6559	13.6559	8.4000e-004	0.0000	13.6769
Worker	0.0286	0.0249	0.2192	4.3000e-004	0.0432	3.5000e-004	0.0435	0.0115	3.2000e-004	0.0118	0.0000	39.1601	39.1601	1.8700e-003	0.0000	39.2070
Total	**0.0310**	**0.0891**	**0.2367**	**5.7000e-004**	**0.0463**	**6.7000e-004**	**0.0470**	**0.0124**	**6.3000e-004**	**0.0130**	**0.0000**	**52.8160**	**52.8160**	**2.7100e-003**	**0.0000**	**52.8839**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1134	1.0265	0.9014	1.4400e-003		0.0598	0.0598		0.0562	0.0562	0.0000	123.9112	123.9112	0.0302	0.0000	124.6669
Total	**0.1134**	**1.0265**	**0.9014**	**1.4400e-003**		**0.0598**	**0.0598**		**0.0562**	**0.0562**	**0.0000**	**123.9112**	**123.9112**	**0.0302**	**0.0000**	**124.6669**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.4400e-003	0.0642	0.0175	1.4000e-004	3.1600e-003	3.2000e-004	3.4800e-003	9.1000e-004	3.1000e-004	1.2200e-003	0.0000	13.6559	13.6559	8.4000e-004	0.0000	13.6769
Worker	0.0286	0.0249	0.2192	4.3000e-004	0.0432	3.5000e-004	0.0435	0.0115	3.2000e-004	0.0118	0.0000	39.1601	39.1601	1.8700e-003	0.0000	39.2070
Total	**0.0310**	**0.0891**	**0.2367**	**5.7000e-004**	**0.0463**	**6.7000e-004**	**0.0470**	**0.0124**	**6.3000e-004**	**0.0130**	**0.0000**	**52.8160**	**52.8160**	**2.7100e-003**	**0.0000**	**52.8839**

3.8 Building Construction (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0238	0.2179	0.2072	3.4000e-004		0.0120	0.0120		0.0113	0.0113	0.0000	28.9547	28.9547	6.9900e-003	0.0000	29.1293
Total	**0.0238**	**0.2179**	**0.2072**	**3.4000e-004**		**0.0120**	**0.0120**		**0.0113**	**0.0113**	**0.0000**	**28.9547**	**28.9547**	**6.9900e-003**	**0.0000**	**29.1293**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.8000e-004	0.0138	3.5900e-003	3.0000e-005	7.4000e-004	4.0000e-005	7.8000e-004	2.1000e-004	4.0000e-005	2.5000e-004	0.0000	3.1684	3.1684	1.9000e-004	0.0000	3.1731
Worker	6.2500e-003	5.2000e-003	0.0461	1.0000e-004	0.0101	8.0000e-005	0.0102	2.6800e-003	7.0000e-005	2.7600e-003	0.0000	8.8599	8.8599	3.9000e-004	0.0000	8.8696
Total	**6.7300e-003**	**0.0190**	**0.0497**	**1.3000e-004**	**0.0108**	**1.2000e-004**	**0.0109**	**2.8900e-003**	**1.1000e-004**	**3.0100e-003**	**0.0000**	**12.0283**	**12.0283**	**5.8000e-004**	**0.0000**	**12.0427**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0238	0.2179	0.2072	3.4000e-004		0.0120	0.0120		0.0113	0.0113	0.0000	28.9546	28.9546	6.9900e-003	0.0000	29.1293
Total	**0.0238**	**0.2179**	**0.2072**	**3.4000e-004**		**0.0120**	**0.0120**		**0.0113**	**0.0113**	**0.0000**	**28.9546**	**28.9546**	**6.9900e-003**	**0.0000**	**29.1293**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.8000e-004	0.0138	3.5900e-003	3.0000e-005	7.4000e-004	4.0000e-005	7.8000e-004	2.1000e-004	4.0000e-005	2.5000e-004	0.0000	3.1684	3.1684	1.9000e-004	0.0000	3.1731
Worker	6.2500e-003	5.2000e-003	0.0461	1.0000e-004	0.0101	8.0000e-005	0.0102	2.6800e-003	7.0000e-005	2.7600e-003	0.0000	8.8599	8.8599	3.9000e-004	0.0000	8.8696
Total	**6.7300e-003**	**0.0190**	**0.0497**	**1.3000e-004**	**0.0108**	**1.2000e-004**	**0.0109**	**2.8900e-003**	**1.1000e-004**	**3.0100e-003**	**0.0000**	**12.0283**	**12.0283**	**5.8000e-004**	**0.0000**	**12.0427**

3.9 Architectural Coating (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.4023					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7900e-003	0.0194	0.0211	3.0000e-005		1.2800e-003	1.2800e-003		1.2800e-003	1.2800e-003	0.0000	2.9362	2.9362	2.3000e-004	0.0000	2.9419
Total	**0.4051**	**0.0194**	**0.0211**	**3.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.2800e-003**	**1.2800e-003**	**0.0000**	**2.9362**	**2.9362**	**2.3000e-004**	**0.0000**	**2.9419**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.1300e-003	9.9900e-003	2.0000e-005	1.9700e-003	2.0000e-005	1.9800e-003	5.2000e-004	1.0000e-005	5.4000e-004	0.0000	1.7856	1.7856	9.0000e-005	0.0000	1.7877
Total	**1.3000e-003**	**1.1300e-003**	**9.9900e-003**	**2.0000e-005**	**1.9700e-003**	**2.0000e-005**	**1.9800e-003**	**5.2000e-004**	**1.0000e-005**	**5.4000e-004**	**0.0000**	**1.7856**	**1.7856**	**9.0000e-005**	**0.0000**	**1.7877**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.4023					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7900e-003	0.0194	0.0211	3.0000e-005		1.2800e-003	1.2800e-003		1.2800e-003	1.2800e-003	0.0000	2.9362	2.9362	2.3000e-004	0.0000	2.9419
Total	**0.4051**	**0.0194**	**0.0211**	**3.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.2800e-003**	**1.2800e-003**	**0.0000**	**2.9362**	**2.9362**	**2.3000e-004**	**0.0000**	**2.9419**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.1300e-003	9.9900e-003	2.0000e-005	1.9700e-003	2.0000e-005	1.9800e-003	5.2000e-004	1.0000e-005	5.4000e-004	0.0000	1.7856	1.7856	9.0000e-005	0.0000	1.7877
Total	**1.3000e-003**	**1.1300e-003**	**9.9900e-003**	**2.0000e-005**	**1.9700e-003**	**2.0000e-005**	**1.9800e-003**	**5.2000e-004**	**1.0000e-005**	**5.4000e-004**	**0.0000**	**1.7856**	**1.7856**	**9.0000e-005**	**0.0000**	**1.7877**

3.9 Architectural Coating (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.4373					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7400e-003	0.0191	0.0227	4.0000e-005		1.1800e-003	1.1800e-003		1.1800e-003	1.1800e-003	0.0000	3.1916	3.1916	2.2000e-004	0.0000	3.1970
Total	**0.4400**	**0.0191**	**0.0227**	**4.0000e-005**		**1.1800e-003**	**1.1800e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**3.1916**	**3.1916**	**2.2000e-004**	**0.0000**	**3.1970**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3300e-003	1.1000e-003	9.7800e-003	2.0000e-005	2.1400e-003	2.0000e-005	2.1600e-003	5.7000e-004	2.0000e-005	5.8000e-004	0.0000	1.8794	1.8794	8.0000e-005	0.0000	1.8814
Total	**1.3300e-003**	**1.1000e-003**	**9.7800e-003**	**2.0000e-005**	**2.1400e-003**	**2.0000e-005**	**2.1600e-003**	**5.7000e-004**	**2.0000e-005**	**5.8000e-004**	**0.0000**	**1.8794**	**1.8794**	**8.0000e-005**	**0.0000**	**1.8814**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.4373					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7400e-003	0.0191	0.0227	4.0000e-005		1.1800e-003	1.1800e-003		1.1800e-003	1.1800e-003	0.0000	3.1916	3.1916	2.2000e-004	0.0000	3.1970
Total	**0.4400**	**0.0191**	**0.0227**	**4.0000e-005**		**1.1800e-003**	**1.1800e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**3.1916**	**3.1916**	**2.2000e-004**	**0.0000**	**3.1970**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3300e-003	1.1000e-003	9.7800e-003	2.0000e-005	2.1400e-003	2.0000e-005	2.1600e-003	5.7000e-004	2.0000e-005	5.8000e-004	0.0000	1.8794	1.8794	8.0000e-005	0.0000	1.8814
Total	**1.3300e-003**	**1.1000e-003**	**9.7800e-003**	**2.0000e-005**	**2.1400e-003**	**2.0000e-005**	**2.1600e-003**	**5.7000e-004**	**2.0000e-005**	**5.8000e-004**	**0.0000**	**1.8794**	**1.8794**	**8.0000e-005**	**0.0000**	**1.8814**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Diversity

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	3.0172	15.5151	25.9614	0.0588	3.5417	0.0620	3.6037	0.9512	0.0583	1.0095	0.0000	5,410.4209	5,410.4209	0.4114	0.0000	5,420.7060
Unmitigated	3.4197	19.0257	34.6498	0.0880	5.8265	0.0929	5.9194	1.5649	0.0874	1.6523	0.0000	8,085.6055	8,085.6055	0.5060	0.0000	8,098.2555

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	593.10	644.40	546.30	2,115,339	1,285,831
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	7,745.78	9,064.56	4578.54	13,564,943	8,245,598
Total	8,338.88	9,708.96	5,124.84	15,680,281	9,531,429

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	16.80	7.10	7.90	37.00	21.00	42.00	86	11	3
Other Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Other Non-Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Parking Lot	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Regional Shopping Center	14.70	6.60	6.60	16.30	64.70	19.00	54	35	11

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Low Rise	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Non-Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Parking Lot	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Regional Shopping Center	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	682.3017	682.3017	0.0396	8.1900e-003	685.7333
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	682.3017	682.3017	0.0396	8.1900e-003	685.7333
NaturalGas Mitigated	0.0123	0.1089	0.0729	6.7000e-004		8.4900e-003	8.4900e-003		8.4900e-003	8.4900e-003	0.0000	121.6618	121.6618	2.3300e-003	2.2300e-003	122.3848
NaturalGas Unmitigated	0.0123	0.1089	0.0729	6.7000e-004		8.4900e-003	8.4900e-003		8.4900e-003	8.4900e-003	0.0000	121.6618	121.6618	2.3300e-003	2.2300e-003	122.3848

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Apartments Low Rise	971962	5.2400e-003	0.0448	0.0191	2.9000e-004		3.6200e-003	3.6200e-003		3.6200e-003	3.6200e-003	0.0000	51.8676	51.8676	9.9000e-004	9.5000e-004	52.1758
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30789e+006	7.0500e-003	0.0641	0.0539	3.8000e-004		4.8700e-003	4.8700e-003		4.8700e-003	4.8700e-003	0.0000	69.7942	69.7942	1.3400e-003	1.2800e-003	70.2090
Total		**0.0123**	**0.1089**	**0.0729**	**6.7000e-004**		**8.4900e-003**	**8.4900e-003**		**8.4900e-003**	**8.4900e-003**	**0.0000**	**121.6618**	**121.6618**	**2.3300e-003**	**2.2300e-003**	**122.3848**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Apartments Low Rise	971962	5.2400e-003	0.0448	0.0191	2.9000e-004		3.6200e-003	3.6200e-003		3.6200e-003	3.6200e-003	0.0000	51.8676	51.8676	9.9000e-004	9.5000e-004	52.1758
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	1.30789e+006	7.0500e-003	0.0641	0.0539	3.8000e-004		4.8700e-003	4.8700e-003		4.8700e-003	4.8700e-003	0.0000	69.7942	69.7942	1.3400e-003	1.2800e-003	70.2090
Total		**0.0123**	**0.1089**	**0.0729**	**6.7000e-004**		**8.4900e-003**	**8.4900e-003**		**8.4900e-003**	**8.4900e-003**	**0.0000**	**121.6618**	**121.6618**	**2.3300e-003**	**2.2300e-003**	**122.3848**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Low Rise	428315	97.0740	5.6300e-003	1.1700e-003	97.5623
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	129640	29.3819	1.7100e-003	3.5000e-004	29.5296
Regional Shopping Center	2.45253e+006	555.8458	0.0323	6.6700e-003	558.6413
Total		**682.3017**	**0.0396**	**8.1900e-003**	**685.7333**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Low Rise	428315	97.0740	5.6300e-003	1.1700e-003	97.5623
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	129640	29.3819	1.7100e-003	3.5000e-004	29.5296
Regional Shopping Center	2.45253e+006	555.8458	0.0323	6.6700e-003	558.6413
Total		**682.3017**	**0.0396**	**8.1900e-003**	**685.7333**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.6740	0.0629	0.7027	3.9000e-004		8.1900e-003	8.1900e-003		8.1900e-003	8.1900e-003	0.0000	64.9112	64.9112	2.3300e-003	1.1700e-003	65.3180
Unmitigated	1.6740	0.0629	0.7027	3.9000e-004		8.1900e-003	8.1900e-003		8.1900e-003	8.1900e-003	0.0000	64.9112	64.9112	2.3300e-003	1.1700e-003	65.3180

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.4231					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.2232					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	6.4500e-003	0.0551	0.0234	3.5000e-004		4.4500e-003	4.4500e-003		4.4500e-003	4.4500e-003	0.0000	63.7996	63.7996	1.2200e-003	1.1700e-003	64.1788
Landscaping	0.0212	7.8100e-003	0.6793	4.0000e-005		3.7300e-003	3.7300e-003		3.7300e-003	3.7300e-003	0.0000	1.1115	1.1115	1.1100e-003	0.0000	1.1392
Total	**1.6740**	**0.0629**	**0.7027**	**3.9000e-004**		**8.1800e-003**	**8.1800e-003**		**8.1800e-003**	**8.1800e-003**	**0.0000**	**64.9112**	**64.9112**	**2.3300e-003**	**1.1700e-003**	**65.3179**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.4231					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.2232					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	6.4500e-003	0.0551	0.0234	3.5000e-004		4.4500e-003	4.4500e-003		4.4500e-003	4.4500e-003	0.0000	63.7996	63.7996	1.2200e-003	1.1700e-003	64.1788
Landscaping	0.0212	7.8100e-003	0.6793	4.0000e-005		3.7300e-003	3.7300e-003		3.7300e-003	3.7300e-003	0.0000	1.1115	1.1115	1.1100e-003	0.0000	1.1392
Total	**1.6740**	**0.0629**	**0.7027**	**3.9000e-004**		**8.1800e-003**	**8.1800e-003**		**8.1800e-003**	**8.1800e-003**	**0.0000**	**64.9112**	**64.9112**	**2.3300e-003**	**1.1700e-003**	**65.3179**

7.0 Water Detail

7.1 Mitigation Measures Water

Apply Water Conservation Strategy

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	31.4063	0.5047	0.0122	47.6581
Unmitigated	39.2579	0.6308	0.0153	59.5726

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Low Rise	5.86386 / 3.69678	11.9840	0.1917	4.6300e-003	18.1562
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	13.4368 / 8.23543	27.2739	0.4392	0.0106	41.4164
Total		**39.2579**	**0.6308**	**0.0152**	**59.5726**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Low Rise	4.69109 / 2.95743	9.5872	0.1533	3.7100e-003	14.5250
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	10.7494 / 6.58834	21.8191	0.3513	8.4900e-003	33.1331
Total		**31.4063**	**0.5047**	**0.0122**	**47.6581**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	11.7669	0.6954	0.0000	29.1519
Unmitigated	47.0675	2.7816	0.0000	116.6078

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Low Rise	41.4	8.4038	0.4967	0.0000	20.8201
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	190.47	38.6637	2.2850	0.0000	95.7877
Total		**47.0675**	**2.7816**	**0.0000**	**116.6078**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Low Rise	10.35	2.1010	0.1242	0.0000	5.2050
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	47.6175	9.6659	0.5712	0.0000	23.9469
Total		**11.7669**	**0.6954**	**0.0000**	**29.1519**

CalEEMod Version: CalEEMod.2016.3.2

Date: 3/11/2019 8:08 AM

Dorsey Marketplace (Alternative A)

Northern Sierra AQMD Air District, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	1.60	Acre	1.60	69,696.00	0
Other Non-Asphalt Surfaces	7.30	Acre	7.30	317,988.00	0
Parking Lot	926.00	Space	8.33	370,400.00	0
Apartments Low Rise	90.00	Dwelling Unit	5.70	119,260.00	184
Regional Shopping Center	181.40	1000sqft	21.00	181,400.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	72
Climate Zone	1			**Operational Year**	2022
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	499.66	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Dorsey Marketplace. NSAQMD. Adjusted CO2 to meet a 33% RPS by 2020.

Land Use - Alternative A includes 90 DU, 181.4 KSF in retail, 926 parking spaces, 1.6 acres in driveway, and 7.3 acres in landscaping/drainage. Population based on a average household size of 2.04.

Construction Phase - Construction would occur July 2019 through February 2021.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Trips and VMT - Adjusted trips per client.

Architectural Coating - Use of low VOC coatings.

Vehicle Trips - Defaults assumed.

Woodstoves - Installation of natural gas fireplaces.

Construction Off-road Equipment Mitigation - Basic fugitive dust control measures included.

Mobile Land Use Mitigation - Neighborhood enhancements options selected.

Water Mitigation - 20% indoor/outdoor reduction in water assumed for CALGreen compliance.

Waste Mitigation - 75% waste diversion consistent with AB 341.

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	90,700.00	0.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	272,100.00	0.00
tblArchitecturalCoating	ConstArea_Parking	45,485.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Exterior	80,501.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Interior	241,502.00	0.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblConstructionPhase	NumDays	30.00	10.00
tblConstructionPhase	NumDays	75.00	115.00

tblConstructionPhase	NumDays	30.00	20.00
tblConstructionPhase	NumDays	55.00	10.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	47.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	48.00
tblFireplaces	FireplaceWoodMass	3,078.40	0.00
tblFireplaces	NumberGas	49.50	81.00
tblFireplaces	NumberWood	31.50	0.00
tblLandUse	LandUseSquareFeet	90,000.00	119,260.00
tblLandUse	LotAcreage	5.63	5.70
tblLandUse	LotAcreage	4.16	21.00
tblLandUse	Population	257.00	184.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	499.66
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripNumber	0.00	300.00
tblTripsAndVMT	VendorTripNumber	164.00	92.00
tblTripsAndVMT	VendorTripNumber	164.00	10.00
tblTripsAndVMT	WorkerTripNumber	23.00	24.00
tblTripsAndVMT	WorkerTripNumber	15.00	16.00
tblTripsAndVMT	WorkerTripNumber	441.00	216.00
tblTripsAndVMT	WorkerTripNumber	88.00	44.00
tblTripsAndVMT	WorkerTripNumber	441.00	66.00
tblTripsAndVMT	WorkerTripNumber	88.00	14.00
tblVehicleTrips	HS_TTP	20.70	21.00
tblVehicleTrips	HW_TTP	37.30	37.00
tblWoodstoves	WoodstoveDayYear	82.00	0.00
tblWoodstoves	WoodstoveWoodMass	3,019.20	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4135	59.3938	37.8908	0.0708	18.2962	2.6851	20.6884	9.9917	2.4704	12.1925	0.0000	7,023.4337	7,023.4337	2.0740	0.0000	7,075.2849
2020	56.3915	42.5223	38.2015	0.0892	18.2962	2.1992	20.4954	9.9917	2.0233	12.0149	0.0000	8,859.8188	8,859.8188	1.2029	0.0000	8,883.6807
2021	37.7586	20.4640	23.3323	0.0428	1.0831	1.0632	2.1463	0.2886	1.0051	1.2937	0.0000	4,130.9750	4,130.9750	0.6947	0.0000	4,148.3427
Maximum	**56.3915**	**59.3938**	**38.2015**	**0.0892**	**18.2962**	**2.6851**	**20.6884**	**9.9917**	**2.4704**	**12.1925**	**0.0000**	**8,859.8188**	**8,859.8188**	**2.0740**	**0.0000**	**8,883.6807**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4135	59.3938	37.8908	0.0708	8.3597	2.6851	10.7520	4.5298	2.4704	6.7306	0.0000	7,023.4337	7,023.4337	2.0740	0.0000	7,075.2849
2020	56.3915	42.5223	38.2015	0.0892	8.3597	2.1992	10.5589	4.5298	2.0233	6.5530	0.0000	8,859.8188	8,859.8188	1.2029	0.0000	8,883.6807
2021	37.7586	20.4640	23.3323	0.0428	1.0831	1.0632	2.1463	0.2886	1.0051	1.2937	0.0000	4,130.9750	4,130.9750	0.6947	0.0000	4,148.3426
Maximum	**56.3915**	**59.3938**	**38.2015**	**0.0892**	**8.3597**	**2.6851**	**10.7520**	**4.5298**	**2.4704**	**6.7306**	**0.0000**	**8,859.8188**	**8,859.8188**	**2.0740**	**0.0000**	**8,883.6807**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.75**	**0.00**	**45.86**	**53.89**	**0.00**	**42.84**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398
Energy	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117
Mobile	26.0728	120.4525	217.9100	0.6059	39.9191	0.6059	40.5250	10.6824	0.5700	11.2525		61,389.7075	61,389.7075	3.5777		61,479.1489
Total	**35.5535**	**122.4796**	**226.4286**	**0.6185**	**39.9191**	**0.8025**	**40.7216**	**10.6824**	**0.7667**	**11.4491**	**0.0000**	**63,853.4605**	**63,853.4605**	**3.6382**	**0.0449**	**63,957.8004**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398
Energy	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117
Mobile	23.3783	99.3209	155.7118	0.4050	24.2653	0.4029	24.6681	6.4934	0.3788	6.8722		41,107.4966	41,107.4966	2.8524		41,178.8066
Total	**32.8591**	**101.3480**	**164.2304**	**0.4177**	**24.2653**	**0.5995**	**24.8648**	**6.4934**	**0.5755**	**7.0689**	**0.0000**	**43,571.2496**	**43,571.2496**	**2.9129**	**0.0449**	**43,657.4582**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**7.58**	**17.25**	**27.47**	**32.47**	**39.21**	**25.30**	**38.94**	**39.21**	**24.94**	**38.26**	**0.00**	**31.76**	**31.76**	**19.93**	**0.00**	**31.74**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	7/1/2019	7/12/2019	5	10	
2	Grading	Grading	7/13/2019	12/20/2019	5	115	
3	Laying Rock Base	Site Preparation	12/21/2019	1/17/2020	5	20	
4	Paving	Paving	1/18/2020	1/31/2020	5	10	
5	Building Construction (Non-Res)	Building Construction	2/1/2020	8/4/2020	5	132	
6	Architectural Coating (Non-Res)	Architectural Coating	6/1/2020	8/4/2020	5	47	
7	Building Construction (Res)	Building Construction	8/5/2020	2/4/2021	5	132	
8	Architectural Coating (Res)	Architectural Coating	12/1/2020	2/4/2021	5	48	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 287.5

Acres of Paving: 17.23

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 272,100; Non-Residential Outdoor: 90,700; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Trenchers	1	8.00	78	0.50
Laying Rock Base	Rubber Tired Dozers	3	8.00	247	0.40
Laying Rock Base	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction (Non-Res)	Cranes	1	7.00	231	0.29
Building Construction (Non-Res)	Forklifts	3	8.00	89	0.20
Building Construction (Non-Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Non-Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Non-Res)	Welders	1	8.00	46	0.45
Architectural Coating (Non-Res)	Air Compressors	1	6.00	78	0.48
Building Construction (Res)	Cranes	1	7.00	231	0.29
Building Construction (Res)	Forklifts	3	8.00	89	0.20
Building Construction (Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Res)	Welders	1	8.00	46	0.45
Architectural Coating (Res)	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	9	24.00	0.00	300.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Laying Rock Base	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	16.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Non-Res)	9	216.00	92.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Non-Res)	1	44.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Res)	9	66.00	10.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Res)	1	14.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.452 9	3,766.452 9	1.1917		3,796.244 5
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.452 9**	**3,766.452 9**	**1.1917**		**3,796.244 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

3.3 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645		6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**8.6733**	**2.6788**	**11.3522**	**3.5965**	**2.4645**	**6.0610**		**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0237	0.7984	0.1244	2.1600e-003	0.0456	3.7800e-003	0.0494	0.0125	3.6100e-003	0.0161		226.5745	226.5745	8.7900e-003		226.7942
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2166	0.1579	1.7506	3.2500e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		322.9862	322.9862	0.0170		323.4110
Total	**0.2403**	**0.9563**	**1.8750**	**5.4100e-003**	**0.3521**	**6.2800e-003**	**0.3584**	**0.0938**	**5.9200e-003**	**0.0997**		**549.5607**	**549.5607**	**0.0258**		**550.2052**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645	0.0000	6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**3.9030**	**2.6788**	**6.5818**	**1.6184**	**2.4645**	**4.0829**	**0.0000**	**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0237	0.7984	0.1244	2.1600e-003	0.0456	3.7800e-003	0.0494	0.0125	3.6100e-003	0.0161		226.5745	226.5745	8.7900e-003		226.7942
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2166	0.1579	1.7506	3.2500e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		322.9862	322.9862	0.0170		323.4110
Total	**0.2403**	**0.9563**	**1.8750**	**5.4100e-003**	**0.3521**	**6.2800e-003**	**0.3584**	**0.0938**	**5.9200e-003**	**0.0997**		**549.5607**	**549.5607**	**0.0258**		**550.2052**

3.4 Laying Rock Base - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

3.4 Laying Rock Base - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216		3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**18.0663**	**2.1974**	**20.2637**	**9.9307**	**2.0216**	**11.9523**		**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1495	0.1050	1.1668	2.3700e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		235.2645	235.2645	0.0111		235.5417
Total	**0.1495**	**0.1050**	**1.1668**	**2.3700e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**235.2645**	**235.2645**	**0.0111**		**235.5417**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216	0.0000	3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**8.1298**	**2.1974**	**10.3272**	**4.4688**	**2.0216**	**6.4904**	**0.0000**	**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1495	0.1050	1.1668	2.3700e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		235.2645	235.2645	0.0111		235.5417
Total	**0.1495**	**0.1050**	**1.1668**	**2.3700e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**235.2645**	**235.2645**	**0.0111**		**235.5417**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926		2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6017					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.9582**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**		**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1329	0.0933	1.0371	2.1000e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		209.1240	209.1240	9.8600e-003		209.3704
Total	**0.1329**	**0.0933**	**1.0371**	**2.1000e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**209.1240**	**209.1240**	**9.8600e-003**		**209.3704**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926	0.0000	2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6017					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.9582**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**	**0.0000**	**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1329	0.0933	1.0371	2.1000e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		209.1240	209.1240	9.8600e-003		209.3704
Total	**0.1329**	**0.0933**	**1.0371**	**2.1000e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**209.1240**	**209.1240**	**9.8600e-003**		**209.3704**

3.6 Building Construction (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4060	10.8759	2.6680	0.0251	0.5633	0.0547	0.6180	0.1622	0.0523	0.2145		2,627.0429	2,627.0429	0.1497		2,630.7846
Worker	1.7936	1.2599	14.0014	0.0284	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,823.1739	2,823.1739	0.1331		2,826.5003
Total	**2.1996**	**12.1358**	**16.6695**	**0.0535**	**3.3223**	**0.0760**	**3.3983**	**0.8938**	**0.0720**	**0.9658**		**5,450.2167**	**5,450.2167**	**0.2827**		**5,457.2849**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4060	10.8759	2.6680	0.0251	0.5633	0.0547	0.6180	0.1622	0.0523	0.2145		2,627.0429	2,627.0429	0.1497		2,630.7846
Worker	1.7936	1.2599	14.0014	0.0284	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,823.1739	2,823.1739	0.1331		2,826.5003
Total	**2.1996**	**12.1358**	**16.6695**	**0.0535**	**3.3223**	**0.0760**	**3.3983**	**0.8938**	**0.0720**	**0.9658**		**5,450.2167**	**5,450.2167**	**0.2827**		**5,457.2849**

3.7 Architectural Coating (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	51.4645					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**51.7067**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3654	0.2567	2.8521	5.7900e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		575.0910	575.0910	0.0271		575.7686
Total	**0.3654**	**0.2567**	**2.8521**	**5.7900e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**575.0910**	**575.0910**	**0.0271**		**575.7686**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	51.4645					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**51.7067**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3654	0.2567	2.8521	5.7900e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		575.0910	575.0910	0.0271		575.7686
Total	**0.3654**	**0.2567**	**2.8521**	**5.7900e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**575.0910**	**575.0910**	**0.0271**		**575.7686**

3.8 Building Construction (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0441	1.1822	0.2900	2.7300e-003	0.0612	5.9400e-003	0.0672	0.0176	5.6800e-003	0.0233		285.5481	285.5481	0.0163		285.9549
Worker	0.5480	0.3850	4.2782	8.6800e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		862.6365	862.6365	0.0407		863.6529
Total	**0.5922**	**1.5671**	**4.5682**	**0.0114**	**0.9043**	**0.0125**	**0.9167**	**0.2412**	**0.0117**	**0.2529**		**1,148.1846**	**1,148.1846**	**0.0569**		**1,149.6077**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0441	1.1822	0.2900	2.7300e-003	0.0612	5.9400e-003	0.0672	0.0176	5.6800e-003	0.0233		285.5481	285.5481	0.0163		285.9549
Worker	0.5480	0.3850	4.2782	8.6800e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		862.6365	862.6365	0.0407		863.6529
Total	**0.5922**	**1.5671**	**4.5682**	**0.0114**	**0.9043**	**0.0125**	**0.9167**	**0.2412**	**0.0117**	**0.2529**		**1,148.1846**	**1,148.1846**	**0.0569**		**1,149.6077**

3.8 Building Construction (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013		2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**		**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0369	1.0873	0.2546	2.7100e-003	0.0612	2.9100e-003	0.0641	0.0176	2.7800e-003	0.0204		283.5955	283.5955	0.0156		283.9858
Worker	0.5130	0.3446	3.8651	8.4000e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		835.3682	835.3682	0.0361		836.2709
Total	**0.5499**	**1.4319**	**4.1197**	**0.0111**	**0.9043**	**9.1400e-003**	**0.9134**	**0.2412**	**8.5200e-003**	**0.2497**		**1,118.9637**	**1,118.9637**	**0.0517**		**1,120.2567**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013	0.0000	2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**	**0.0000**	**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0369	1.0873	0.2546	2.7100e-003	0.0612	2.9100e-003	0.0641	0.0176	2.7800e-003	0.0204		283.5955	283.5955	0.0156		283.9858
Worker	0.5130	0.3446	3.8651	8.4000e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		835.3682	835.3682	0.0361		836.2709
Total	**0.5499**	**1.4319**	**4.1197**	**0.0111**	**0.9043**	**9.1400e-003**	**0.9134**	**0.2412**	**8.5200e-003**	**0.2497**		**1,118.9637**	**1,118.9637**	**0.0517**		**1,120.2567**

3.9 Architectural Coating (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**35.2223**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1163	0.0817	0.9075	1.8400e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		182.9835	182.9835	8.6200e-003		183.1991
Total	**0.1163**	**0.0817**	**0.9075**	**1.8400e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**182.9835**	**182.9835**	**8.6200e-003**		**183.1991**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**35.2223**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1163	0.0817	0.9075	1.8400e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		182.9835	182.9835	8.6200e-003		183.1991
Total	**0.1163**	**0.0817**	**0.9075**	**1.8400e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**182.9835**	**182.9835**	**8.6200e-003**		**183.1991**

3.9 Architectural Coating (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941		281.4481	281.4481	0.0193		281.9309
Total	**35.1990**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**		**281.4481**	**281.4481**	**0.0193**		**281.9309**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1088	0.0731	0.8199	1.7800e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		177.1993	177.1993	7.6600e-003		177.3908
Total	**0.1088**	**0.0731**	**0.8199**	**1.7800e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**177.1993**	**177.1993**	**7.6600e-003**		**177.3908**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941	0.0000	281.4481	281.4481	0.0193		281.9309
Total	**35.1990**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**	**0.0000**	**281.4481**	**281.4481**	**0.0193**		**281.9309**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1088	0.0731	0.8199	1.7800e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		177.1993	177.1993	7.6600e-003		177.3908
Total	**0.1088**	**0.0731**	**0.8199**	**1.7800e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**177.1993**	**177.1993**	**7.6600e-003**		**177.3908**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Diversity

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	23.3783	99.3209	155.7118	0.4050	24.2653	0.4029	24.6681	6.4934	0.3788	6.8722		41,107.49 66	41,107.49 66	2.8524		41,178.80 66
Unmitigated	26.0728	120.4525	217.9100	0.6059	39.9191	0.6059	40.5250	10.6824	0.5700	11.2525		61,389.70 75	61,389.70 75	3.5777		61,479.14 89

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	593.10	644.40	546.30	2,115,339	1,285,831
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	7,745.78	9,064.56	4578.54	13,564,943	8,245,598
Total	8,338.88	9,708.96	5,124.84	15,680,281	9,531,429

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	16.80	7.10	7.90	37.00	21.00	42.00	86	11	3
Other Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Other Non-Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Parking Lot	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Regional Shopping Center	14.70	6.60	6.60	16.30	64.70	19.00	54	35	11

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Low Rise	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Non-Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Parking Lot	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Regional Shopping Center	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117
NaturalGas Unmitigated	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	2662.91	0.0287	0.2454	0.1044	1.5700e-003		0.0198	0.0198		0.0198	0.0198		313.2836	313.2836	6.0000e-003	5.7400e-003	315.1452
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3583.27	0.0386	0.3513	0.2951	2.1100e-003		0.0267	0.0267		0.0267	0.0267		421.5613	421.5613	8.0800e-003	7.7300e-003	424.0665
Total		**0.0674**	**0.5967**	**0.3995**	**3.6800e-003**		**0.0465**	**0.0465**		**0.0465**	**0.0465**		**734.8449**	**734.8449**	**0.0141**	**0.0135**	**739.2117**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	2.66291	0.0287	0.2454	0.1044	1.5700e-003		0.0198	0.0198		0.0198	0.0198		313.2836	313.2836	6.0000e-003	5.7400e-003	315.1452
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3.58327	0.0386	0.3513	0.2951	2.1100e-003		0.0267	0.0267		0.0267	0.0267		421.5613	421.5613	8.0800e-003	7.7300e-003	424.0665
Total		**0.0674**	**0.5967**	**0.3995**	**3.6800e-003**		**0.0465**	**0.0465**		**0.0465**	**0.0465**		**734.8449**	**734.8449**	**0.0141**	**0.0135**	**739.2117**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398
Unmitigated	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	6.7026					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.1572	1.3437	0.5718	8.5800e-003		0.1086	0.1086		0.1086	0.1086	0.0000	1,715.2941	1,715.2941	0.0329	0.0315	1,725.4873
Landscaping	0.2351	0.0868	7.5473	4.0000e-004		0.0415	0.0415		0.0415	0.0415		13.6140	13.6140	0.0135		13.9526
Total	**9.4134**	**1.4304**	**8.1190**	**8.9800e-003**		**0.1501**	**0.1501**		**0.1501**	**0.1501**	**0.0000**	**1,728.9081**	**1,728.9081**	**0.0464**	**0.0315**	**1,739.4398**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	6.7026					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.1572	1.3437	0.5718	8.5800e-003		0.1086	0.1086		0.1086	0.1086	0.0000	1,715.2941	1,715.2941	0.0329	0.0315	1,725.4873
Landscaping	0.2351	0.0868	7.5473	4.0000e-004		0.0415	0.0415		0.0415	0.0415		13.6140	13.6140	0.0135		13.9526
Total	**9.4134**	**1.4304**	**8.1190**	**8.9800e-003**		**0.1501**	**0.1501**		**0.1501**	**0.1501**	**0.0000**	**1,728.9081**	**1,728.9081**	**0.0464**	**0.0315**	**1,739.4398**

CalEEMod Version: CalEEMod.2016.3.2

Date: 3/11/2019 8:09 AM

Dorsey Marketplace (Alternative A)
Northern Sierra AQMD Air District, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	1.60	Acre	1.60	69,696.00	0
Other Non-Asphalt Surfaces	7.30	Acre	7.30	317,988.00	0
Parking Lot	926.00	Space	8.33	370,400.00	0
Apartments Low Rise	90.00	Dwelling Unit	5.70	119,260.00	184
Regional Shopping Center	181.40	1000sqft	21.00	181,400.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	72
Climate Zone	1			**Operational Year**	2022
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	499.66	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Dorsey Marketplace. NSAQMD. Adjusted CO2 to meet a 33% RPS by 2020.

Land Use - Alternative A includes 90 DU, 181.4 KSF in retail, 926 parking spaces, 1.6 acres in driveway, and 7.3 acres in landscaping/drainage. Population based on a average household size of 2.04.

Construction Phase - Construction would occur July 2019 through February 2021.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Trips and VMT - Adjusted trips per client.

Architectural Coating - Use of low VOC coatings.

Vehicle Trips - Defaults assumed.

Woodstoves - Installation of natural gas fireplaces.

Construction Off-road Equipment Mitigation - Basic fugitive dust control measures included.

Mobile Land Use Mitigation - Neighborhood enhancements options selected.

Water Mitigation - 20% indoor/outdoor reduction in water assumed for CALGreen compliance.

Waste Mitigation - 75% waste diversion consistent with AB 341.

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	90,700.00	0.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	272,100.00	0.00
tblArchitecturalCoating	ConstArea_Parking	45,485.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Exterior	80,501.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Interior	241,502.00	0.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblConstructionPhase	NumDays	30.00	10.00
tblConstructionPhase	NumDays	75.00	115.00

tblConstructionPhase	NumDays	30.00	20.00
tblConstructionPhase	NumDays	55.00	10.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	47.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	48.00
tblFireplaces	FireplaceWoodMass	3,078.40	0.00
tblFireplaces	NumberGas	49.50	81.00
tblFireplaces	NumberWood	31.50	0.00
tblLandUse	LandUseSquareFeet	90,000.00	119,260.00
tblLandUse	LotAcreage	5.63	5.70
tblLandUse	LotAcreage	4.16	21.00
tblLandUse	Population	257.00	184.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	499.66
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblTripsAndVMT	HaulingTripNumber	0.00	300.00
tblTripsAndVMT	VendorTripNumber	164.00	92.00
tblTripsAndVMT	VendorTripNumber	164.00	10.00
tblTripsAndVMT	WorkerTripNumber	23.00	24.00
tblTripsAndVMT	WorkerTripNumber	15.00	16.00
tblTripsAndVMT	WorkerTripNumber	441.00	216.00
tblTripsAndVMT	WorkerTripNumber	88.00	44.00
tblTripsAndVMT	WorkerTripNumber	441.00	66.00
tblTripsAndVMT	WorkerTripNumber	88.00	14.00
tblVehicleTrips	HS_TTP	20.70	21.00
tblVehicleTrips	HW_TTP	37.30	37.00
tblWoodstoves	WoodstoveDayYear	82.00	0.00
tblWoodstoves	WoodstoveWoodMass	3,019.20	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4350	59.4647	37.8942	0.0705	18.2962	2.6852	20.6884	9.9917	2.4705	12.1925	0.0000	6,993.0228	6,993.0228	2.0746	0.0000	7,044.8871
2020	56.6274	42.5567	38.5564	0.0856	18.2962	2.1992	20.4954	9.9917	2.0233	12.0149	0.0000	8,500.9861	8,500.9861	1.2024	0.0000	8,525.1667
2021	37.8216	20.6086	23.2876	0.0419	1.0831	1.0633	2.1464	0.2886	1.0053	1.2939	0.0000	4,041.3120	4,041.3120	0.6946	0.0000	4,058.6760
Maximum	**56.6274**	**59.4647**	**38.5564**	**0.0856**	**18.2962**	**2.6852**	**20.6884**	**9.9917**	**2.4705**	**12.1925**	**0.0000**	**8,500.9861**	**8,500.9861**	**2.0746**	**0.0000**	**8,525.1667**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4350	59.4647	37.8942	0.0705	8.3597	2.6852	10.7520	4.5298	2.4705	6.7306	0.0000	6,993.0228	6,993.0228	2.0746	0.0000	7,044.8870
2020	56.6274	42.5567	38.5564	0.0856	8.3597	2.1992	10.5589	4.5298	2.0233	6.5530	0.0000	8,500.9861	8,500.9861	1.2024	0.0000	8,525.1667
2021	37.8216	20.6086	23.2876	0.0419	1.0831	1.0633	2.1464	0.2886	1.0053	1.2939	0.0000	4,041.3120	4,041.3120	0.6946	0.0000	4,058.6760
Maximum	**56.6274**	**59.4647**	**38.5564**	**0.0856**	**8.3597**	**2.6852**	**10.7520**	**4.5298**	**2.4705**	**6.7306**	**0.0000**	**8,500.9861**	**8,500.9861**	**2.0746**	**0.0000**	**8,525.1667**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.75**	**0.00**	**45.86**	**53.89**	**0.00**	**42.84**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398
Energy	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117
Mobile	22.4275	126.9659	242.7288	0.5679	39.9191	0.6183	40.5374	10.6824	0.5819	11.2644		57,499.1999	57,499.1999	3.8371		57,595.1276
Total	**31.9082**	**128.9930**	**251.2474**	**0.5806**	**39.9191**	**0.8150**	**40.7341**	**10.6824**	**0.7786**	**11.4610**	**0.0000**	**59,962.9529**	**59,962.9529**	**3.8976**	**0.0449**	**60,073.7791**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398
Energy	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117
Mobile	19.7733	103.0218	185.6711	0.3782	24.2653	0.4153	24.6806	6.4934	0.3907	6.8842		38,317.2072	38,317.2072	3.1582		38,396.1624
Total	**29.2541**	**105.0489**	**194.1897**	**0.3908**	**24.2653**	**0.6120**	**24.8772**	**6.4934**	**0.5874**	**7.0808**	**0.0000**	**40,780.9602**	**40,780.9602**	**3.2187**	**0.0449**	**40,874.8139**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**8.32**	**18.56**	**22.71**	**32.68**	**39.21**	**24.91**	**38.93**	**39.21**	**24.56**	**38.22**	**0.00**	**31.99**	**31.99**	**17.42**	**0.00**	**31.96**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	7/1/2019	7/12/2019	5	10	
2	Grading	Grading	7/13/2019	12/20/2019	5	115	
3	Laying Rock Base	Site Preparation	12/21/2019	1/17/2020	5	20	
4	Paving	Paving	1/18/2020	1/31/2020	5	10	
5	Building Construction (Non-Res)	Building Construction	2/1/2020	8/4/2020	5	132	
6	Architectural Coating (Non-Res)	Architectural Coating	6/1/2020	8/4/2020	5	47	
7	Building Construction (Res)	Building Construction	8/5/2020	2/4/2021	5	132	
8	Architectural Coating (Res)	Architectural Coating	12/1/2020	2/4/2021	5	48	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 287.5

Acres of Paving: 17.23

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 272,100; Non-Residential Outdoor: 90,700; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Trenchers	1	8.00	78	0.50
Laying Rock Base	Rubber Tired Dozers	3	8.00	247	0.40
Laying Rock Base	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction (Non-Res)	Cranes	1	7.00	231	0.29
Building Construction (Non-Res)	Forklifts	3	8.00	89	0.20
Building Construction (Non-Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Non-Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Non-Res)	Welders	1	8.00	46	0.45
Architectural Coating (Non-Res)	Air Compressors	1	6.00	78	0.48
Building Construction (Res)	Cranes	1	7.00	231	0.29
Building Construction (Res)	Forklifts	3	8.00	89	0.20
Building Construction (Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Res)	Welders	1	8.00	46	0.45
Architectural Coating (Res)	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	9	24.00	0.00	300.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Laying Rock Base	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	16.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Non-Res)	9	216.00	92.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Non-Res)	1	44.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Res)	9	66.00	10.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Res)	1	14.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

3.3 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645		6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**8.6733**	**2.6788**	**11.3522**	**3.5965**	**2.4645**	**6.0610**		**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0247	0.8176	0.1431	2.1100e-003	0.0456	3.8700e-003	0.0495	0.0125	3.7000e-003	0.0162		221.5226	221.5226	9.9100e-003		221.7703
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2372	0.2096	1.7352	3.0000e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		297.6272	297.6272	0.0164		298.0371
Total	**0.2618**	**1.0272**	**1.8783**	**5.1100e-003**	**0.3521**	**6.3700e-003**	**0.3585**	**0.0938**	**6.0100e-003**	**0.0998**		**519.1498**	**519.1498**	**0.0263**		**519.8074**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645	0.0000	6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**3.9030**	**2.6788**	**6.5818**	**1.6184**	**2.4645**	**4.0829**	**0.0000**	**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0247	0.8176	0.1431	2.1100e-003	0.0456	3.8700e-003	0.0495	0.0125	3.7000e-003	0.0162		221.5226	221.5226	9.9100e-003		221.7703
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2372	0.2096	1.7352	3.0000e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		297.6272	297.6272	0.0164		298.0371
Total	**0.2618**	**1.0272**	**1.8783**	**5.1100e-003**	**0.3521**	**6.3700e-003**	**0.3585**	**0.0938**	**6.0100e-003**	**0.0998**		**519.1498**	**519.1498**	**0.0263**		**519.8074**

3.4 Laying Rock Base - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.452 9	3,766.452 9	1.1917		3,796.244 5
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.452 9**	**3,766.452 9**	**1.1917**		**3,796.244 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

3.4 Laying Rock Base - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216		3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**18.0663**	**2.1974**	**20.2637**	**9.9307**	**2.0216**	**11.9523**		**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1636	0.1393	1.1471	2.1800e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		216.7630	216.7630	0.0106		217.0274
Total	**0.1636**	**0.1393**	**1.1471**	**2.1800e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**216.7630**	**216.7630**	**0.0106**		**217.0274**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216	0.0000	3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**8.1298**	**2.1974**	**10.3272**	**4.4688**	**2.0216**	**6.4904**	**0.0000**	**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1636	0.1393	1.1471	2.1800e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		216.7630	216.7630	0.0106		217.0274
Total	**0.1636**	**0.1393**	**1.1471**	**2.1800e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**216.7630**	**216.7630**	**0.0106**		**217.0274**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926		2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6017					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.9582**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**		**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1455	0.1239	1.0196	1.9400e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		192.6782	192.6782	9.4000e-003		192.9132
Total	**0.1455**	**0.1239**	**1.0196**	**1.9400e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**192.6782**	**192.6782**	**9.4000e-003**		**192.9132**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926	0.0000	2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6017					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.9582**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**	**0.0000**	**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1455	0.1239	1.0196	1.9400e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		192.6782	192.6782	9.4000e-003		192.9132
Total	**0.1455**	**0.1239**	**1.0196**	**1.9400e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**192.6782**	**192.6782**	**9.4000e-003**		**192.9132**

3.6 Building Construction (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4373	10.9910	3.3080	0.0242	0.5633	0.0561	0.6194	0.1622	0.0536	0.2158		2,535.4545	2,535.4545	0.1698		2,539.6999
Worker	1.9636	1.6721	13.7646	0.0262	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,601.1555	2,601.1555	0.1269		2,604.3282
Total	**2.4009**	**12.6631**	**17.0726**	**0.0504**	**3.3223**	**0.0775**	**3.3998**	**0.8938**	**0.0734**	**0.9672**		**5,136.6100**	**5,136.6100**	**0.2967**		**5,144.0281**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4373	10.9910	3.3080	0.0242	0.5633	0.0561	0.6194	0.1622	0.0536	0.2158		2,535.4545	2,535.4545	0.1698		2,539.6999
Worker	1.9636	1.6721	13.7646	0.0262	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,601.1555	2,601.1555	0.1269		2,604.3282
Total	**2.4009**	**12.6631**	**17.0726**	**0.0504**	**3.3223**	**0.0775**	**3.3998**	**0.8938**	**0.0734**	**0.9672**		**5,136.6100**	**5,136.6100**	**0.2967**		**5,144.0281**

3.7 Architectural Coating (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	51.4645					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**51.7067**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4000	0.3406	2.8039	5.3400e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		529.8650	529.8650	0.0259		530.5113
Total	**0.4000**	**0.3406**	**2.8039**	**5.3400e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**529.8650**	**529.8650**	**0.0259**		**530.5113**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	51.4645					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**51.7067**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4000	0.3406	2.8039	5.3400e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		529.8650	529.8650	0.0259		530.5113
Total	**0.4000**	**0.3406**	**2.8039**	**5.3400e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**529.8650**	**529.8650**	**0.0259**		**530.5113**

3.8 Building Construction (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0475	1.1947	0.3596	2.6300e-003	0.0612	6.1000e-003	0.0673	0.0176	5.8300e-003	0.0235		275.5929	275.5929	0.0185		276.0543
Worker	0.6000	0.5109	4.2059	8.0000e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		794.7975	794.7975	0.0388		795.7669
Total	**0.6475**	**1.7056**	**4.5654**	**0.0106**	**0.9043**	**0.0126**	**0.9169**	**0.2412**	**0.0119**	**0.2531**		**1,070.3904**	**1,070.3904**	**0.0572**		**1,071.8213**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0475	1.1947	0.3596	2.6300e-003	0.0612	6.1000e-003	0.0673	0.0176	5.8300e-003	0.0235		275.5929	275.5929	0.0185		276.0543
Worker	0.6000	0.5109	4.2059	8.0000e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		794.7975	794.7975	0.0388		795.7669
Total	**0.6475**	**1.7056**	**4.5654**	**0.0106**	**0.9043**	**0.0126**	**0.9169**	**0.2412**	**0.0119**	**0.2531**		**1,070.3904**	**1,070.3904**	**0.0572**		**1,071.8213**

3.8 Building Construction (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013		2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**		**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0400	1.0957	0.3172	2.6100e-003	0.0612	3.0400e-003	0.0643	0.0176	2.9100e-003	0.0205		273.6239	273.6239	0.0177		274.0669
Worker	0.5624	0.4571	3.7766	7.7400e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		769.6228	769.6228	0.0343		770.4790
Total	**0.6024**	**1.5527**	**4.0938**	**0.0104**	**0.9043**	**9.2700e-003**	**0.9135**	**0.2412**	**8.6500e-003**	**0.2499**		**1,043.2467**	**1,043.2467**	**0.0520**		**1,044.5458**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013	0.0000	2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**	**0.0000**	**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0400	1.0957	0.3172	2.6100e-003	0.0612	3.0400e-003	0.0643	0.0176	2.9100e-003	0.0205		273.6239	273.6239	0.0177		274.0669
Worker	0.5624	0.4571	3.7766	7.7400e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		769.6228	769.6228	0.0343		770.4790
Total	**0.6024**	**1.5527**	**4.0938**	**0.0104**	**0.9043**	**9.2700e-003**	**0.9135**	**0.2412**	**8.6500e-003**	**0.2499**		**1,043.2467**	**1,043.2467**	**0.0520**		**1,044.5458**

3.9 Architectural Coating (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**35.2223**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1273	0.1084	0.8922	1.7000e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		168.5934	168.5934	8.2300e-003		168.7991
Total	**0.1273**	**0.1084**	**0.8922**	**1.7000e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**168.5934**	**168.5934**	**8.2300e-003**		**168.7991**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**35.2223**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1273	0.1084	0.8922	1.7000e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		168.5934	168.5934	8.2300e-003		168.7991
Total	**0.1273**	**0.1084**	**0.8922**	**1.7000e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**168.5934**	**168.5934**	**8.2300e-003**		**168.7991**

3.9 Architectural Coating (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941		281.4481	281.4481	0.0193		281.9309
Total	**35.1990**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**		**281.4481**	**281.4481**	**0.0193**		**281.9309**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1193	0.0970	0.8011	1.6400e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		163.2533	163.2533	7.2600e-003		163.4349
Total	**0.1193**	**0.0970**	**0.8011**	**1.6400e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**163.2533**	**163.2533**	**7.2600e-003**		**163.4349**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	34.9801					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941	0.0000	281.4481	281.4481	0.0193		281.9309
Total	**35.1990**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**	**0.0000**	**281.4481**	**281.4481**	**0.0193**		**281.9309**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1193	0.0970	0.8011	1.6400e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		163.2533	163.2533	7.2600e-003		163.4349
Total	**0.1193**	**0.0970**	**0.8011**	**1.6400e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**163.2533**	**163.2533**	**7.2600e-003**		**163.4349**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Diversity

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	19.7733	103.0218	185.6711	0.3782	24.2653	0.4153	24.6806	6.4934	0.3907	6.8842		38,317.2072	38,317.2072	3.1582		38,396.1624
Unmitigated	22.4275	126.9659	242.7288	0.5679	39.9191	0.6183	40.5374	10.6824	0.5819	11.2644		57,499.1999	57,499.1999	3.8371		57,595.1276

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	593.10	644.40	546.30	2,115,339	1,285,831
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	7,745.78	9,064.56	4578.54	13,564,943	8,245,598
Total	8,338.88	9,708.96	5,124.84	15,680,281	9,531,429

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	16.80	7.10	7.90	37.00	21.00	42.00	86	11	3
Other Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Other Non-Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Parking Lot	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Regional Shopping Center	14.70	6.60	6.60	16.30	64.70	19.00	54	35	11

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Low Rise	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Non-Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Parking Lot	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Regional Shopping Center	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117
NaturalGas Unmitigated	0.0674	0.5967	0.3995	3.6700e-003		0.0465	0.0465		0.0465	0.0465		734.8449	734.8449	0.0141	0.0135	739.2117

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	2662.91	0.0287	0.2454	0.1044	1.5700e-003		0.0198	0.0198		0.0198	0.0198		313.2836	313.2836	6.0000e-003	5.7400e-003	315.1452
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3583.27	0.0386	0.3513	0.2951	2.1100e-003		0.0267	0.0267		0.0267	0.0267		421.5613	421.5613	8.0800e-003	7.7300e-003	424.0665
Total		**0.0674**	**0.5967**	**0.3995**	**3.6800e-003**		**0.0465**	**0.0465**		**0.0465**	**0.0465**		**734.8449**	**734.8449**	**0.0141**	**0.0135**	**739.2117**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	2.66291	0.0287	0.2454	0.1044	1.5700e-003		0.0198	0.0198		0.0198	0.0198		313.2836	313.2836	6.0000e-003	5.7400e-003	315.1452
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	3.58327	0.0386	0.3513	0.2951	2.1100e-003		0.0267	0.0267		0.0267	0.0267		421.5613	421.5613	8.0800e-003	7.7300e-003	424.0665
Total		**0.0674**	**0.5967**	**0.3995**	**3.6800e-003**		**0.0465**	**0.0465**		**0.0465**	**0.0465**		**734.8449**	**734.8449**	**0.0141**	**0.0135**	**739.2117**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398
Unmitigated	9.4134	1.4304	8.1190	8.9800e-003		0.1501	0.1501		0.1501	0.1501	0.0000	1,728.9081	1,728.9081	0.0464	0.0315	1,739.4398

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	6.7026					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.1572	1.3437	0.5718	8.5800e-003		0.1086	0.1086		0.1086	0.1086	0.0000	1,715.2941	1,715.2941	0.0329	0.0315	1,725.4873
Landscaping	0.2351	0.0868	7.5473	4.0000e-004		0.0415	0.0415		0.0415	0.0415		13.6140	13.6140	0.0135		13.9526
Total	**9.4134**	**1.4304**	**8.1190**	**8.9800e-003**		**0.1501**	**0.1501**		**0.1501**	**0.1501**	**0.0000**	**1,728.9081**	**1,728.9081**	**0.0464**	**0.0315**	**1,739.4398**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	6.7026					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.1572	1.3437	0.5718	8.5800e-003		0.1086	0.1086		0.1086	0.1086	0.0000	1,715.2941	1,715.2941	0.0329	0.0315	1,725.4873
Landscaping	0.2351	0.0868	7.5473	4.0000e-004		0.0415	0.0415		0.0415	0.0415		13.6140	13.6140	0.0135		13.9526
Total	**9.4134**	**1.4304**	**8.1190**	**8.9800e-003**		**0.1501**	**0.1501**		**0.1501**	**0.1501**	**0.0000**	**1,728.9081**	**1,728.9081**	**0.0464**	**0.0315**	**1,739.4398**

CalEEMod Version: CalEEMod.2016.3.2

Date: 3/11/2019 7:50 AM

Dorsey Marketplace (Alternative B)
Northern Sierra AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	1.60	Acre	1.60	69,696.00	0
Other Non-Asphalt Surfaces	8.00	Acre	8.00	348,480.00	0
Parking Lot	962.00	Space	8.66	384,800.00	0
Apartments Low Rise	171.00	Dwelling Unit	12.00	229,854.00	476
Regional Shopping Center	181.40	1000sqft	12.50	112,850.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	72
Climate Zone	1			**Operational Year**	2022
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	499.66	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Dorsey Marketplace. NSAQMD. Adjusted CO2 to meet a 33% RPS by 2020.

Land Use - Alternative B includes 171 DU, 112.85 KSF in retail/office, 962 parking spaces, 1.6 acres in driveway, and 8 acres in landscaping/drainage. Population based on a average household size of 2.04.

Construction Phase - Construction would occur July 2019 through February 2021.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Trips and VMT - Adjusted trips per client.

Architectural Coating - Use of low VOC coatings.

Vehicle Trips - Defaults assumed.

Woodstoves - Installation of natural gas fireplaces.

Construction Off-road Equipment Mitigation - Basic fugitive dust control measures included.

Mobile Land Use Mitigation - Neighborhood enhancements options selected.

Water Mitigation - 20% indoor/outdoor reduction in water assumed for CALGreen compliance.

Waste Mitigation - 75% waste diversion consistent with AB 341.

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	56,425.00	0.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	169,275.00	0.00
tblArchitecturalCoating	ConstArea_Parking	48,179.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Exterior	155,151.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Interior	465,454.00	0.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblAreaCoating	Area_Nonresidential_Exterior	56425	90700
tblAreaCoating	Area_Nonresidential_Interior	169275	272100

tblAreaCoating	Area_Parking	48179	45485
tblAreaCoating	Area_Residential_Exterior	155151	80501
tblAreaCoating	Area_Residential_Interior	465454	241502
tblConstructionPhase	NumDays	30.00	10.00
tblConstructionPhase	NumDays	75.00	115.00
tblConstructionPhase	NumDays	30.00	20.00
tblConstructionPhase	NumDays	55.00	10.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	47.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	48.00
tblFireplaces	FireplaceWoodMass	3,078.40	0.00
tblFireplaces	NumberGas	94.05	153.90
tblFireplaces	NumberWood	59.85	0.00
tblLandUse	LandUseSquareFeet	171,000.00	229,854.00
tblLandUse	LandUseSquareFeet	181,400.00	112,850.00
tblLandUse	LotAcreage	10.69	12.00
tblLandUse	LotAcreage	4.16	12.50
tblLandUse	Population	489.00	476.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	499.66
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSolidWaste	SolidWasteGenerationRate	78.66	41.40
tblTripsAndVMT	HaulingTripNumber	0.00	300.00
tblTripsAndVMT	VendorTripNumber	168.00	92.00
tblTripsAndVMT	VendorTripNumber	168.00	10.00
tblTripsAndVMT	WorkerTripNumber	23.00	24.00
tblTripsAndVMT	WorkerTripNumber	15.00	16.00
tblTripsAndVMT	WorkerTripNumber	496.00	216.00
tblTripsAndVMT	WorkerTripNumber	99.00	44.00
tblTripsAndVMT	WorkerTripNumber	496.00	66.00
tblTripsAndVMT	WorkerTripNumber	99.00	14.00

tblVehicleTrips	HS_TTP	20.70	21.00
tblVehicleTrips	HW_TTP	37.30	37.00
tblWater	IndoorWaterUseRate	11,141,338.38	5,863,862.31
tblWater	OutdoorWaterUseRate	7,023,887.24	3,696,782.76
tblWoodstoves	WoodstoveDayYear	82.00	0.00
tblWoodstoves	WoodstoveWoodMass	3,019.20	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.3492	3.8067	2.3738	4.4000e-003	0.6736	0.1747	0.8483	0.2969	0.1608	0.4577	0.0000	395.9565	395.9565	0.1175	0.0000	398.8930
2020	2.1368	3.6256	3.6970	7.8200e-003	0.3909	0.1613	0.5522	0.1382	0.1516	0.2898	0.0000	698.8005	698.8005	0.0990	0.0000	701.2764
2021	0.8773	0.2571	0.2894	5.3000e-004	0.0130	0.0133	0.0263	3.4700e-003	0.0126	0.0160	0.0000	46.0539	46.0539	7.8600e-003	0.0000	46.2505
Maximum	**2.1368**	**3.8067**	**3.6970**	**7.8200e-003**	**0.6736**	**0.1747**	**0.8483**	**0.2969**	**0.1608**	**0.4577**	**0.0000**	**698.8005**	**698.8005**	**0.1175**	**0.0000**	**701.2764**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.3492	3.8067	2.3738	4.4000e-003	0.3148	0.1747	0.4895	0.1367	0.1608	0.2975	0.0000	395.9561	395.9561	0.1175	0.0000	398.8926
2020	2.1368	3.6256	3.6970	7.8200e-003	0.3264	0.1613	0.4876	0.1027	0.1516	0.2543	0.0000	698.8001	698.8001	0.0990	0.0000	701.2760
2021	0.8773	0.2571	0.2894	5.3000e-004	0.0130	0.0133	0.0263	3.4700e-003	0.0126	0.0160	0.0000	46.0539	46.0539	7.8600e-003	0.0000	46.2504
Maximum	**2.1368**	**3.8067**	**3.6970**	**7.8200e-003**	**0.3264**	**0.1747**	**0.4895**	**0.1367**	**0.1608**	**0.2975**	**0.0000**	**698.8001**	**698.8001**	**0.1175**	**0.0000**	**701.2760**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**39.29**	**0.00**	**29.67**	**44.61**	**0.00**	**25.63**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.8651	0.1194	1.3262	7.4000e-004		0.0155	0.0155		0.0155	0.0155	0.0000	123.3139	123.3139	4.3800e-003	2.2200e-003	124.0857
Energy	0.0144	0.1250	0.0697	7.8000e-004		9.9100e-003	9.9100e-003		9.9100e-003	9.9100e-003	0.0000	702.7275	702.7275	0.0353	9.3400e-003	706.3915
Mobile	3.7027	20.7793	38.1666	0.0979	6.5340	0.1034	6.6374	1.7549	0.0973	1.8522	0.0000	8,997.5082	8,997.5082	0.5528	0.0000	9,011.3284
Waste						0.0000	0.0000		0.0000	0.0000	47.0675	0.0000	47.0675	2.7816	0.0000	116.6078
Water						0.0000	0.0000		0.0000	0.0000	6.1232	33.1347	39.2579	0.6308	0.0153	59.5726
Total	**5.5821**	**21.0237**	**39.5625**	**0.0994**	**6.5340**	**0.1288**	**6.6628**	**1.7549**	**0.1227**	**1.8776**	**53.1907**	**9,856.6844**	**9,909.8751**	**4.0049**	**0.0268**	**10,017.9859**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.8651	0.1194	1.3262	7.4000e-004		0.0155	0.0155		0.0155	0.0155	0.0000	123.3139	123.3139	4.3800e-003	2.2200e-003	124.0857
Energy	0.0144	0.1250	0.0697	7.8000e-004		9.9100e-003	9.9100e-003		9.9100e-003	9.9100e-003	0.0000	702.7275	702.7275	0.0353	9.3400e-003	706.3915
Mobile	3.2506	16.8367	28.4093	0.0651	3.9680	0.0687	4.0368	1.0657	0.0646	1.1303	0.0000	5,993.1960	5,993.1960	0.4466	0.0000	6,004.3605
Waste						0.0000	0.0000		0.0000	0.0000	11.7669	0.0000	11.7669	0.6954	0.0000	29.1519
Water						0.0000	0.0000		0.0000	0.0000	4.8986	26.5078	31.4063	0.5047	0.0122	47.6581
Total	**5.1301**	**17.0811**	**29.8052**	**0.0667**	**3.9680**	**0.0941**	**4.0622**	**1.0657**	**0.0901**	**1.1558**	**16.6654**	**6,845.7453**	**6,862.4107**	**1.6863**	**0.0238**	**6,911.6476**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	8.10	18.75	24.66	32.96	39.27	26.93	39.03	39.27	26.63	38.44	68.67	30.55	30.75	57.89	11.38	31.01

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	7/1/2019	7/12/2019	5	10	
2	Grading	Grading	7/13/2019	12/20/2019	5	115	
3	Laying Rock Base	Site Preparation	12/21/2019	1/17/2020	5	20	
4	Paving	Paving	1/18/2020	1/31/2020	5	10	
5	Building Construction (Non-Res)	Building Construction	2/1/2020	8/4/2020	5	132	
6	Architectural Coating (Non-Res)	Architectural Coating	6/1/2020	8/4/2020	5	47	
7	Building Construction (Res)	Building Construction	8/5/2020	2/4/2021	5	132	
8	Architectural Coating (Res)	Architectural Coating	12/1/2020	2/4/2021	5	48	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 287.5

Acres of Paving: 18.26

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 169,275; Non-Residential Outdoor: 56,425; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Trenchers	1	8.00	78	0.50
Laying Rock Base	Rubber Tired Dozers	3	8.00	247	0.40
Laying Rock Base	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction (Non-Res)	Cranes	1	7.00	231	0.29
Building Construction (Non-Res)	Forklifts	3	8.00	89	0.20
Building Construction (Non-Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Non-Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Non-Res)	Welders	1	8.00	46	0.45
Architectural Coating (Non-Res)	Air Compressors	1	6.00	78	0.48
Building Construction (Res)	Cranes	1	7.00	231	0.29
Building Construction (Res)	Forklifts	3	8.00	89	0.20
Building Construction (Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Res)	Welders	1	8.00	46	0.45
Architectural Coating (Res)	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	9	24.00	0.00	300.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Laying Rock Base	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	16.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Non-Res)	9	216.00	92.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Non-Res)	1	44.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Res)	9	66.00	10.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Res)	1	14.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0217	0.2279	0.1103	1.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195
Total	**0.0217**	**0.2279**	**0.1103**	**1.9000e-004**	**0.0903**	**0.0120**	**0.1023**	**0.0497**	**0.0110**	**0.0607**	**0.0000**	**17.0843**	**17.0843**	**5.4100e-003**	**0.0000**	**17.2195**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.9000e-004	7.2000e-004	6.3200e-003	1.0000e-005	1.1000e-003	1.0000e-005	1.1100e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0278	1.0278	6.0000e-005	0.0000	1.0292
Total	**7.9000e-004**	**7.2000e-004**	**6.3200e-003**	**1.0000e-005**	**1.1000e-003**	**1.0000e-005**	**1.1100e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0278**	**1.0278**	**6.0000e-005**	**0.0000**	**1.0292**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0407	0.0000	0.0407	0.0223	0.0000	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0217	0.2279	0.1103	1.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	17.0843	17.0843	5.4100e-003	0.0000	17.2195
Total	**0.0217**	**0.2279**	**0.1103**	**1.9000e-004**	**0.0407**	**0.0120**	**0.0526**	**0.0223**	**0.0110**	**0.0333**	**0.0000**	**17.0843**	**17.0843**	**5.4100e-003**	**0.0000**	**17.2195**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.9000e-004	7.2000e-004	6.3200e-003	1.0000e-005	1.1000e-003	1.0000e-005	1.1100e-003	2.9000e-004	1.0000e-005	3.0000e-004	0.0000	1.0278	1.0278	6.0000e-005	0.0000	1.0292
Total	**7.9000e-004**	**7.2000e-004**	**6.3200e-003**	**1.0000e-005**	**1.1000e-003**	**1.0000e-005**	**1.1100e-003**	**2.9000e-004**	**1.0000e-005**	**3.0000e-004**	**0.0000**	**1.0278**	**1.0278**	**6.0000e-005**	**0.0000**	**1.0292**

3.3 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4987	0.0000	0.4987	0.2068	0.0000	0.2068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2975	3.3602	2.0709	3.7600e-003		0.1540	0.1540		0.1417	0.1417	0.0000	337.6974	337.6974	0.1068	0.0000	340.3685
Total	**0.2975**	**3.3602**	**2.0709**	**3.7600e-003**	**0.4987**	**0.1540**	**0.6528**	**0.2068**	**0.1417**	**0.3485**	**0.0000**	**337.6974**	**337.6974**	**0.1068**	**0.0000**	**340.3685**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.3900e-003	0.0470	7.6500e-003	1.2000e-004	2.5200e-003	2.2000e-004	2.7400e-003	6.9000e-004	2.1000e-004	9.0000e-004	0.0000	11.7082	11.7082	4.9000e-004	0.0000	11.7203
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0122	0.0110	0.0969	1.8000e-004	0.0169	1.4000e-004	0.0170	4.4900e-003	1.3000e-004	4.6200e-003	0.0000	15.7602	15.7602	8.5000e-004	0.0000	15.7814
Total	**0.0136**	**0.0580**	**0.1046**	**3.0000e-004**	**0.0194**	**3.6000e-004**	**0.0198**	**5.1800e-003**	**3.4000e-004**	**5.5200e-003**	**0.0000**	**27.4684**	**27.4684**	**1.3400e-003**	**0.0000**	**27.5017**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2244	0.0000	0.2244	0.0931	0.0000	0.0931	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2975	3.3602	2.0709	3.7600e-003		0.1540	0.1540		0.1417	0.1417	0.0000	337.6970	337.6970	0.1068	0.0000	340.3681
Total	**0.2975**	**3.3602**	**2.0709**	**3.7600e-003**	**0.2244**	**0.1540**	**0.3785**	**0.0931**	**0.1417**	**0.2348**	**0.0000**	**337.6970**	**337.6970**	**0.1068**	**0.0000**	**340.3681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.3900e-003	0.0470	7.6500e-003	1.2000e-004	2.5200e-003	2.2000e-004	2.7400e-003	6.9000e-004	2.1000e-004	9.0000e-004	0.0000	11.7082	11.7082	4.9000e-004	0.0000	11.7203
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0122	0.0110	0.0969	1.8000e-004	0.0169	1.4000e-004	0.0170	4.4900e-003	1.3000e-004	4.6200e-003	0.0000	15.7602	15.7602	8.5000e-004	0.0000	15.7814
Total	**0.0136**	**0.0580**	**0.1046**	**3.0000e-004**	**0.0194**	**3.6000e-004**	**0.0198**	**5.1800e-003**	**3.4000e-004**	**5.5200e-003**	**0.0000**	**27.4684**	**27.4684**	**1.3400e-003**	**0.0000**	**27.5017**

3.4 Laying Rock Base - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0632	0.0000	0.0632	0.0348	0.0000	0.0348	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0152	0.1595	0.0772	1.3000e-004		8.3700e-003	8.3700e-003		7.7000e-003	7.7000e-003	0.0000	11.9590	11.9590	3.7800e-003	0.0000	12.0536
Total	**0.0152**	**0.1595**	**0.0772**	**1.3000e-004**	**0.0632**	**8.3700e-003**	**0.0716**	**0.0348**	**7.7000e-003**	**0.0425**	**0.0000**	**11.9590**	**11.9590**	**3.7800e-003**	**0.0000**	**12.0536**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.6000e-004	5.0000e-004	4.4200e-003	1.0000e-005	7.7000e-004	1.0000e-005	7.8000e-004	2.0000e-004	1.0000e-005	2.1000e-004	0.0000	0.7195	0.7195	4.0000e-005	0.0000	0.7205
Total	**5.6000e-004**	**5.0000e-004**	**4.4200e-003**	**1.0000e-005**	**7.7000e-004**	**1.0000e-005**	**7.8000e-004**	**2.0000e-004**	**1.0000e-005**	**2.1000e-004**	**0.0000**	**0.7195**	**0.7195**	**4.0000e-005**	**0.0000**	**0.7205**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0285	0.0000	0.0285	0.0156	0.0000	0.0156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0152	0.1595	0.0772	1.3000e-004		8.3700e-003	8.3700e-003		7.7000e-003	7.7000e-003	0.0000	11.9590	11.9590	3.7800e-003	0.0000	12.0536
Total	**0.0152**	**0.1595**	**0.0772**	**1.3000e-004**	**0.0285**	**8.3700e-003**	**0.0368**	**0.0156**	**7.7000e-003**	**0.0233**	**0.0000**	**11.9590**	**11.9590**	**3.7800e-003**	**0.0000**	**12.0536**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.6000e-004	5.0000e-004	4.4200e-003	1.0000e-005	7.7000e-004	1.0000e-005	7.8000e-004	2.0000e-004	1.0000e-005	2.1000e-004	0.0000	0.7195	0.7195	4.0000e-005	0.0000	0.7205
Total	**5.6000e-004**	**5.0000e-004**	**4.4200e-003**	**1.0000e-005**	**7.7000e-004**	**1.0000e-005**	**7.8000e-004**	**2.0000e-004**	**1.0000e-005**	**2.1000e-004**	**0.0000**	**0.7195**	**0.7195**	**4.0000e-005**	**0.0000**	**0.7205**

3.4 Laying Rock Base - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1174	0.0000	0.1174	0.0646	0.0000	0.0646	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2757	0.1398	2.5000e-004		0.0143	0.0143		0.0131	0.0131	0.0000	21.7299	21.7299	7.0300e-003	0.0000	21.9056
Total	**0.0265**	**0.2757**	**0.1398**	**2.5000e-004**	**0.1174**	**0.0143**	**0.1317**	**0.0646**	**0.0131**	**0.0777**	**0.0000**	**21.7299**	**21.7299**	**7.0300e-003**	**0.0000**	**21.9056**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.5000e-004	8.2000e-004	7.2600e-003	1.0000e-005	1.4300e-003	1.0000e-005	1.4400e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2976	1.2976	6.0000e-005	0.0000	1.2991
Total	**9.5000e-004**	**8.2000e-004**	**7.2600e-003**	**1.0000e-005**	**1.4300e-003**	**1.0000e-005**	**1.4400e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2976**	**1.2976**	**6.0000e-005**	**0.0000**	**1.2991**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0528	0.0000	0.0528	0.0291	0.0000	0.0291	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2757	0.1398	2.5000e-004		0.0143	0.0143		0.0131	0.0131	0.0000	21.7299	21.7299	7.0300e-003	0.0000	21.9056
Total	**0.0265**	**0.2757**	**0.1398**	**2.5000e-004**	**0.0528**	**0.0143**	**0.0671**	**0.0291**	**0.0131**	**0.0422**	**0.0000**	**21.7299**	**21.7299**	**7.0300e-003**	**0.0000**	**21.9056**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.5000e-004	8.2000e-004	7.2600e-003	1.0000e-005	1.4300e-003	1.0000e-005	1.4400e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2976	1.2976	6.0000e-005	0.0000	1.2991
Total	**9.5000e-004**	**8.2000e-004**	**7.2600e-003**	**1.0000e-005**	**1.4300e-003**	**1.0000e-005**	**1.4400e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2976**	**1.2976**	**6.0000e-005**	**0.0000**	**1.2991**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.7800e-003	0.0703	0.0733	1.1000e-004		3.7600e-003	3.7600e-003		3.4600e-003	3.4600e-003	0.0000	10.0141	10.0141	3.2400e-003	0.0000	10.0951
Paving	0.0134					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0202**	**0.0703**	**0.0733**	**1.1000e-004**		**3.7600e-003**	**3.7600e-003**		**3.4600e-003**	**3.4600e-003**	**0.0000**	**10.0141**	**10.0141**	**3.2400e-003**	**0.0000**	**10.0951**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.5000e-004	5.6000e-004	4.9700e-003	1.0000e-005	9.8000e-004	1.0000e-005	9.9000e-004	2.6000e-004	1.0000e-005	2.7000e-004	0.0000	0.8872	0.8872	4.0000e-005	0.0000	0.8883
Total	**6.5000e-004**	**5.6000e-004**	**4.9700e-003**	**1.0000e-005**	**9.8000e-004**	**1.0000e-005**	**9.9000e-004**	**2.6000e-004**	**1.0000e-005**	**2.7000e-004**	**0.0000**	**0.8872**	**0.8872**	**4.0000e-005**	**0.0000**	**0.8883**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.7800e-003	0.0703	0.0733	1.1000e-004		3.7600e-003	3.7600e-003		3.4600e-003	3.4600e-003	0.0000	10.0141	10.0141	3.2400e-003	0.0000	10.0951
Paving	0.0134					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0202**	**0.0703**	**0.0733**	**1.1000e-004**		**3.7600e-003**	**3.7600e-003**		**3.4600e-003**	**3.4600e-003**	**0.0000**	**10.0141**	**10.0141**	**3.2400e-003**	**0.0000**	**10.0951**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.5000e-004	5.6000e-004	4.9700e-003	1.0000e-005	9.8000e-004	1.0000e-005	9.9000e-004	2.6000e-004	1.0000e-005	2.7000e-004	0.0000	0.8872	0.8872	4.0000e-005	0.0000	0.8883
Total	**6.5000e-004**	**5.6000e-004**	**4.9700e-003**	**1.0000e-005**	**9.8000e-004**	**1.0000e-005**	**9.9000e-004**	**2.6000e-004**	**1.0000e-005**	**2.7000e-004**	**0.0000**	**0.8872**	**0.8872**	**4.0000e-005**	**0.0000**	**0.8883**

3.6 Building Construction (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1399	1.2663	1.1120	1.7800e-003		0.0737	0.0737		0.0693	0.0693	0.0000	152.8626	152.8626	0.0373	0.0000	153.7949
Total	**0.1399**	**1.2663**	**1.1120**	**1.7800e-003**		**0.0737**	**0.0737**		**0.0693**	**0.0693**	**0.0000**	**152.8626**	**152.8626**	**0.0373**	**0.0000**	**153.7949**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0277	0.7286	0.1984	1.6300e-003	0.0359	3.6500e-003	0.0395	0.0104	3.4900e-003	0.0139	0.0000	154.9880	154.9880	9.5300e-003	0.0000	155.2263
Worker	0.1155	0.1004	0.8850	1.7500e-003	0.1743	1.4100e-003	0.1757	0.0464	1.3000e-003	0.0477	0.0000	158.1044	158.1044	7.5700e-003	0.0000	158.2936
Total	**0.1431**	**0.8290**	**1.0833**	**3.3800e-003**	**0.2102**	**5.0600e-003**	**0.2152**	**0.0568**	**4.7900e-003**	**0.0615**	**0.0000**	**313.0924**	**313.0924**	**0.0171**	**0.0000**	**313.5199**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1399	1.2663	1.1120	1.7800e-003		0.0737	0.0737		0.0693	0.0693	0.0000	152.8624	152.8624	0.0373	0.0000	153.7947
Total	**0.1399**	**1.2663**	**1.1120**	**1.7800e-003**		**0.0737**	**0.0737**		**0.0693**	**0.0693**	**0.0000**	**152.8624**	**152.8624**	**0.0373**	**0.0000**	**153.7947**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0277	0.7286	0.1984	1.6300e-003	0.0359	3.6500e-003	0.0395	0.0104	3.4900e-003	0.0139	0.0000	154.9880	154.9880	9.5300e-003	0.0000	155.2263
Worker	0.1155	0.1004	0.8850	1.7500e-003	0.1743	1.4100e-003	0.1757	0.0464	1.3000e-003	0.0477	0.0000	158.1044	158.1044	7.5700e-003	0.0000	158.2936
Total	**0.1431**	**0.8290**	**1.0833**	**3.3800e-003**	**0.2102**	**5.0600e-003**	**0.2152**	**0.0568**	**4.7900e-003**	**0.0615**	**0.0000**	**313.0924**	**313.0924**	**0.0171**	**0.0000**	**313.5199**

3.7 Architectural Coating (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.8676					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.6900e-003	0.0396	0.0430	7.0000e-005		2.6100e-003	2.6100e-003		2.6100e-003	2.6100e-003	0.0000	6.0002	6.0002	4.6000e-004	0.0000	6.0118
Total	**0.8733**	**0.0396**	**0.0430**	**7.0000e-005**		**2.6100e-003**	**2.6100e-003**		**2.6100e-003**	**2.6100e-003**	**0.0000**	**6.0002**	**6.0002**	**4.6000e-004**	**0.0000**	**6.0118**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.3700e-003	7.2800e-003	0.0642	1.3000e-004	0.0126	1.0000e-004	0.0127	3.3600e-003	9.0000e-005	3.4600e-003	0.0000	11.4675	11.4675	5.5000e-004	0.0000	11.4812
Total	**8.3700e-003**	**7.2800e-003**	**0.0642**	**1.3000e-004**	**0.0126**	**1.0000e-004**	**0.0127**	**3.3600e-003**	**9.0000e-005**	**3.4600e-003**	**0.0000**	**11.4675**	**11.4675**	**5.5000e-004**	**0.0000**	**11.4812**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.8676					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.6900e-003	0.0396	0.0430	7.0000e-005		2.6100e-003	2.6100e-003		2.6100e-003	2.6100e-003	0.0000	6.0001	6.0001	4.6000e-004	0.0000	6.0118
Total	**0.8733**	**0.0396**	**0.0430**	**7.0000e-005**		**2.6100e-003**	**2.6100e-003**		**2.6100e-003**	**2.6100e-003**	**0.0000**	**6.0001**	**6.0001**	**4.6000e-004**	**0.0000**	**6.0118**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.3700e-003	7.2800e-003	0.0642	1.3000e-004	0.0126	1.0000e-004	0.0127	3.3600e-003	9.0000e-005	3.4600e-003	0.0000	11.4675	11.4675	5.5000e-004	0.0000	11.4812
Total	**8.3700e-003**	**7.2800e-003**	**0.0642**	**1.3000e-004**	**0.0126**	**1.0000e-004**	**0.0127**	**3.3600e-003**	**9.0000e-005**	**3.4600e-003**	**0.0000**	**11.4675**	**11.4675**	**5.5000e-004**	**0.0000**	**11.4812**

3.8 Building Construction (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1134	1.0265	0.9014	1.4400e-003		0.0598	0.0598		0.0562	0.0562	0.0000	123.9113	123.9113	0.0302	0.0000	124.6671
Total	**0.1134**	**1.0265**	**0.9014**	**1.4400e-003**		**0.0598**	**0.0598**		**0.0562**	**0.0562**	**0.0000**	**123.9113**	**123.9113**	**0.0302**	**0.0000**	**124.6671**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.4400e-003	0.0642	0.0175	1.4000e-004	3.1600e-003	3.2000e-004	3.4800e-003	9.1000e-004	3.1000e-004	1.2200e-003	0.0000	13.6559	13.6559	8.4000e-004	0.0000	13.6769
Worker	0.0286	0.0249	0.2192	4.3000e-004	0.0432	3.5000e-004	0.0435	0.0115	3.2000e-004	0.0118	0.0000	39.1601	39.1601	1.8700e-003	0.0000	39.2070
Total	**0.0310**	**0.0891**	**0.2367**	**5.7000e-004**	**0.0463**	**6.7000e-004**	**0.0470**	**0.0124**	**6.3000e-004**	**0.0130**	**0.0000**	**52.8160**	**52.8160**	**2.7100e-003**	**0.0000**	**52.8839**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1134	1.0265	0.9014	1.4400e-003		0.0598	0.0598		0.0562	0.0562	0.0000	123.9112	123.9112	0.0302	0.0000	124.6669
Total	**0.1134**	**1.0265**	**0.9014**	**1.4400e-003**		**0.0598**	**0.0598**		**0.0562**	**0.0562**	**0.0000**	**123.9112**	**123.9112**	**0.0302**	**0.0000**	**124.6669**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	2.4400e-003	0.0642	0.0175	1.4000e-004	3.1600e-003	3.2000e-004	3.4800e-003	9.1000e-004	3.1000e-004	1.2200e-003	0.0000	13.6559	13.6559	8.4000e-004	0.0000	13.6769
Worker	0.0286	0.0249	0.2192	4.3000e-004	0.0432	3.5000e-004	0.0435	0.0115	3.2000e-004	0.0118	0.0000	39.1601	39.1601	1.8700e-003	0.0000	39.2070
Total	**0.0310**	**0.0891**	**0.2367**	**5.7000e-004**	**0.0463**	**6.7000e-004**	**0.0470**	**0.0124**	**6.3000e-004**	**0.0130**	**0.0000**	**52.8160**	**52.8160**	**2.7100e-003**	**0.0000**	**52.8839**

3.8 Building Construction (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0238	0.2179	0.2072	3.4000e-004		0.0120	0.0120		0.0113	0.0113	0.0000	28.9547	28.9547	6.9900e-003	0.0000	29.1293
Total	**0.0238**	**0.2179**	**0.2072**	**3.4000e-004**		**0.0120**	**0.0120**		**0.0113**	**0.0113**	**0.0000**	**28.9547**	**28.9547**	**6.9900e-003**	**0.0000**	**29.1293**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.8000e-004	0.0138	3.5900e-003	3.0000e-005	7.4000e-004	4.0000e-005	7.8000e-004	2.1000e-004	4.0000e-005	2.5000e-004	0.0000	3.1684	3.1684	1.9000e-004	0.0000	3.1731
Worker	6.2500e-003	5.2000e-003	0.0461	1.0000e-004	0.0101	8.0000e-005	0.0102	2.6800e-003	7.0000e-005	2.7600e-003	0.0000	8.8599	8.8599	3.9000e-004	0.0000	8.8696
Total	**6.7300e-003**	**0.0190**	**0.0497**	**1.3000e-004**	**0.0108**	**1.2000e-004**	**0.0109**	**2.8900e-003**	**1.1000e-004**	**3.0100e-003**	**0.0000**	**12.0283**	**12.0283**	**5.8000e-004**	**0.0000**	**12.0427**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0238	0.2179	0.2072	3.4000e-004		0.0120	0.0120		0.0113	0.0113	0.0000	28.9546	28.9546	6.9900e-003	0.0000	29.1293
Total	**0.0238**	**0.2179**	**0.2072**	**3.4000e-004**		**0.0120**	**0.0120**		**0.0113**	**0.0113**	**0.0000**	**28.9546**	**28.9546**	**6.9900e-003**	**0.0000**	**29.1293**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.8000e-004	0.0138	3.5900e-003	3.0000e-005	7.4000e-004	4.0000e-005	7.8000e-004	2.1000e-004	4.0000e-005	2.5000e-004	0.0000	3.1684	3.1684	1.9000e-004	0.0000	3.1731
Worker	6.2500e-003	5.2000e-003	0.0461	1.0000e-004	0.0101	8.0000e-005	0.0102	2.6800e-003	7.0000e-005	2.7600e-003	0.0000	8.8599	8.8599	3.9000e-004	0.0000	8.8696
Total	**6.7300e-003**	**0.0190**	**0.0497**	**1.3000e-004**	**0.0108**	**1.2000e-004**	**0.0109**	**2.8900e-003**	**1.1000e-004**	**3.0100e-003**	**0.0000**	**12.0283**	**12.0283**	**5.8000e-004**	**0.0000**	**12.0427**

3.9 Architectural Coating (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.7753					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7900e-003	0.0194	0.0211	3.0000e-005		1.2800e-003	1.2800e-003		1.2800e-003	1.2800e-003	0.0000	2.9362	2.9362	2.3000e-004	0.0000	2.9419
Total	**0.7781**	**0.0194**	**0.0211**	**3.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.2800e-003**	**1.2800e-003**	**0.0000**	**2.9362**	**2.9362**	**2.3000e-004**	**0.0000**	**2.9419**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.1300e-003	9.9900e-003	2.0000e-005	1.9700e-003	2.0000e-005	1.9800e-003	5.2000e-004	1.0000e-005	5.4000e-004	0.0000	1.7856	1.7856	9.0000e-005	0.0000	1.7877
Total	**1.3000e-003**	**1.1300e-003**	**9.9900e-003**	**2.0000e-005**	**1.9700e-003**	**2.0000e-005**	**1.9800e-003**	**5.2000e-004**	**1.0000e-005**	**5.4000e-004**	**0.0000**	**1.7856**	**1.7856**	**9.0000e-005**	**0.0000**	**1.7877**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.7753					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7900e-003	0.0194	0.0211	3.0000e-005		1.2800e-003	1.2800e-003		1.2800e-003	1.2800e-003	0.0000	2.9362	2.9362	2.3000e-004	0.0000	2.9419
Total	**0.7781**	**0.0194**	**0.0211**	**3.0000e-005**		**1.2800e-003**	**1.2800e-003**		**1.2800e-003**	**1.2800e-003**	**0.0000**	**2.9362**	**2.9362**	**2.3000e-004**	**0.0000**	**2.9419**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.1300e-003	9.9900e-003	2.0000e-005	1.9700e-003	2.0000e-005	1.9800e-003	5.2000e-004	1.0000e-005	5.4000e-004	0.0000	1.7856	1.7856	9.0000e-005	0.0000	1.7877
Total	**1.3000e-003**	**1.1300e-003**	**9.9900e-003**	**2.0000e-005**	**1.9700e-003**	**2.0000e-005**	**1.9800e-003**	**5.2000e-004**	**1.0000e-005**	**5.4000e-004**	**0.0000**	**1.7856**	**1.7856**	**9.0000e-005**	**0.0000**	**1.7877**

3.9 Architectural Coating (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.8427					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7400e-003	0.0191	0.0227	4.0000e-005		1.1800e-003	1.1800e-003		1.1800e-003	1.1800e-003	0.0000	3.1916	3.1916	2.2000e-004	0.0000	3.1970
Total	**0.8455**	**0.0191**	**0.0227**	**4.0000e-005**		**1.1800e-003**	**1.1800e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**3.1916**	**3.1916**	**2.2000e-004**	**0.0000**	**3.1970**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3300e-003	1.1000e-003	9.7800e-003	2.0000e-005	2.1400e-003	2.0000e-005	2.1600e-003	5.7000e-004	2.0000e-005	5.8000e-004	0.0000	1.8794	1.8794	8.0000e-005	0.0000	1.8814
Total	**1.3300e-003**	**1.1000e-003**	**9.7800e-003**	**2.0000e-005**	**2.1400e-003**	**2.0000e-005**	**2.1600e-003**	**5.7000e-004**	**2.0000e-005**	**5.8000e-004**	**0.0000**	**1.8794**	**1.8794**	**8.0000e-005**	**0.0000**	**1.8814**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.8427					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.7400e-003	0.0191	0.0227	4.0000e-005		1.1800e-003	1.1800e-003		1.1800e-003	1.1800e-003	0.0000	3.1916	3.1916	2.2000e-004	0.0000	3.1970
Total	**0.8455**	**0.0191**	**0.0227**	**4.0000e-005**		**1.1800e-003**	**1.1800e-003**		**1.1800e-003**	**1.1800e-003**	**0.0000**	**3.1916**	**3.1916**	**2.2000e-004**	**0.0000**	**3.1970**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3300e-003	1.1000e-003	9.7800e-003	2.0000e-005	2.1400e-003	2.0000e-005	2.1600e-003	5.7000e-004	2.0000e-005	5.8000e-004	0.0000	1.8794	1.8794	8.0000e-005	0.0000	1.8814
Total	**1.3300e-003**	**1.1000e-003**	**9.7800e-003**	**2.0000e-005**	**2.1400e-003**	**2.0000e-005**	**2.1600e-003**	**5.7000e-004**	**2.0000e-005**	**5.8000e-004**	**0.0000**	**1.8794**	**1.8794**	**8.0000e-005**	**0.0000**	**1.8814**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Diversity

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	3.2506	16.8367	28.4093	0.0651	3.9680	0.0687	4.0368	1.0657	0.0646	1.1303	0.0000	5,993.1960	5,993.1960	0.4466	0.0000	6,004.3605
Unmitigated	3.7027	20.7793	38.1666	0.0979	6.5340	0.1034	6.6374	1.7549	0.0973	1.8522	0.0000	8,997.5082	8,997.5082	0.5528	0.0000	9,011.3284

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	1,126.89	1,224.36	1037.97	4,019,143	2,440,809
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	7,745.78	9,064.56	4578.54	13,564,943	8,237,933
Total	8,872.67	10,288.92	5,616.51	17,584,086	10,678,741

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	16.80	7.10	7.90	37.00	21.00	42.00	86	11	3
Other Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Other Non-Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Parking Lot	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Regional Shopping Center	14.70	6.60	6.60	16.30	64.70	19.00	54	35	11

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Low Rise	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Non-Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Parking Lot	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Regional Shopping Center	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	560.7597	560.7597	0.0326	6.7300e-003	563.5800
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	560.7597	560.7597	0.0326	6.7300e-003	563.5800
NaturalGas Mitigated	0.0144	0.1250	0.0697	7.8000e-004		9.9100e-003	9.9100e-003		9.9100e-003	9.9100e-003	0.0000	141.9678	141.9678	2.7200e-003	2.6000e-003	142.8115
NaturalGas Unmitigated	0.0144	0.1250	0.0697	7.8000e-004		9.9100e-003	9.9100e-003		9.9100e-003	9.9100e-003	0.0000	141.9678	141.9678	2.7200e-003	2.6000e-003	142.8115

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Apartments Low Rise	1.84673e+006	9.9600e-003	0.0851	0.0362	5.4000e-004		6.8800e-003	6.8800e-003		6.8800e-003	6.8800e-003	0.0000	98.5485	98.5485	1.8900e-003	1.8100e-003	99.1341
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	813649	4.3900e-003	0.0399	0.0335	2.4000e-004		3.0300e-003	3.0300e-003		3.0300e-003	3.0300e-003	0.0000	43.4194	43.4194	8.3000e-004	8.0000e-004	43.6774
Total		**0.0144**	**0.1250**	**0.0697**	**7.8000e-004**		**9.9100e-003**	**9.9100e-003**		**9.9100e-003**	**9.9100e-003**	**0.0000**	**141.9678**	**141.9678**	**2.7200e-003**	**2.6100e-003**	**142.8115**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Apartments Low Rise	1.84673e+006	9.9600e-003	0.0851	0.0362	5.4000e-004		6.8800e-003	6.8800e-003		6.8800e-003	6.8800e-003	0.0000	98.5485	98.5485	1.8900e-003	1.8100e-003	99.1341
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	813649	4.3900e-003	0.0399	0.0335	2.4000e-004		3.0300e-003	3.0300e-003		3.0300e-003	3.0300e-003	0.0000	43.4194	43.4194	8.3000e-004	8.0000e-004	43.6774
Total		**0.0144**	**0.1250**	**0.0697**	**7.8000e-004**		**9.9100e-003**	**9.9100e-003**		**9.9100e-003**	**9.9100e-003**	**0.0000**	**141.9678**	**141.9678**	**2.7200e-003**	**2.6100e-003**	**142.8115**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Low Rise	813798	184.4407	0.0107	2.2100e-003	185.3683
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	134680	30.5241	1.7700e-003	3.7000e-004	30.6777
Regional Shopping Center	1.52573e+006	345.7949	0.0201	4.1500e-003	347.5340
Total		**560.7597**	**0.0325**	**6.7300e-003**	**563.5800**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Low Rise	813798	184.4407	0.0107	2.2100e-003	185.3683
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	134680	30.5241	1.7700e-003	3.7000e-004	30.6777
Regional Shopping Center	1.52573e+006	345.7949	0.0201	4.1500e-003	347.5340
Total		**560.7597**	**0.0325**	**6.7300e-003**	**563.5800**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.8651	0.1194	1.3262	7.4000e-004		0.0155	0.0155		0.0155	0.0155	0.0000	123.3139	123.3139	4.3800e-003	2.2200e-003	124.0857
Unmitigated	1.8651	0.1194	1.3262	7.4000e-004		0.0155	0.0155		0.0155	0.0155	0.0000	123.3139	123.3139	4.3800e-003	2.2200e-003	124.0857

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.4231					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.3903					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0123	0.1047	0.0445	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	121.2193	121.2193	2.3200e-003	2.2200e-003	121.9397
Landscaping	0.0394	0.0148	1.2817	7.0000e-005		7.0600e-003	7.0600e-003		7.0600e-003	7.0600e-003	0.0000	2.0946	2.0946	2.0600e-003	0.0000	2.1460
Total	**1.8651**	**0.1194**	**1.3262**	**7.4000e-004**		**0.0155**	**0.0155**		**0.0155**	**0.0155**	**0.0000**	**123.3139**	**123.3139**	**4.3800e-003**	**2.2200e-003**	**124.0857**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.4231					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.3903					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0123	0.1047	0.0445	6.7000e-004		8.4600e-003	8.4600e-003		8.4600e-003	8.4600e-003	0.0000	121.2193	121.2193	2.3200e-003	2.2200e-003	121.9397
Landscaping	0.0394	0.0148	1.2817	7.0000e-005		7.0600e-003	7.0600e-003		7.0600e-003	7.0600e-003	0.0000	2.0946	2.0946	2.0600e-003	0.0000	2.1460
Total	**1.8651**	**0.1194**	**1.3262**	**7.4000e-004**		**0.0155**	**0.0155**		**0.0155**	**0.0155**	**0.0000**	**123.3139**	**123.3139**	**4.3800e-003**	**2.2200e-003**	**124.0857**

7.0 Water Detail

7.1 Mitigation Measures Water

Apply Water Conservation Strategy

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	31.4063	0.5047	0.0122	47.6581
Unmitigated	39.2579	0.6308	0.0153	59.5726

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Low Rise	5.86386 / 3.69678	11.9840	0.1917	4.6300e-003	18.1562
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	13.4368 / 8.23543	27.2739	0.4392	0.0106	41.4164
Total		**39.2579**	**0.6308**	**0.0152**	**59.5726**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Low Rise	4.69109 / 2.95743	9.5872	0.1533	3.7100e-003	14.5250
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	10.7494 / 6.58834	21.8191	0.3513	8.4900e-003	33.1331
Total		**31.4063**	**0.5047**	**0.0122**	**47.6581**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Institute Recycling and Composting Services

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	11.7669	0.6954	0.0000	29.1519
Unmitigated	47.0675	2.7816	0.0000	116.6078

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Low Rise	41.4	8.4038	0.4967	0.0000	20.8201
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	190.47	38.6637	2.2850	0.0000	95.7877
Total		**47.0675**	**2.7816**	**0.0000**	**116.6078**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Low Rise	10.35	2.1010	0.1242	0.0000	5.2050
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	47.6175	9.6659	0.5712	0.0000	23.9469
Total		**11.7669**	**0.6954**	**0.0000**	**29.1519**

CalEEMod Version: CalEEMod.2016.3.2

Date: 3/11/2019 7:59 AM

Dorsey Marketplace (Alternative B)

Northern Sierra AQMD Air District, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	1.60	Acre	1.60	69,696.00	0
Other Non-Asphalt Surfaces	8.00	Acre	8.00	348,480.00	0
Parking Lot	962.00	Space	8.66	384,800.00	0
Apartments Low Rise	171.00	Dwelling Unit	12.00	229,854.00	476
Regional Shopping Center	181.40	1000sqft	12.50	112,850.00	0

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	72
Climate Zone	1			**Operational Year**	2022
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	499.66	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Dorsey Marketplace. NSAQMD. Adjusted CO2 to meet a 33% RPS by 2020.

Land Use - Alternative B includes 171 DU, 112.85 KSF in retail/office, 962 parking spaces, 1.6 acres in driveway, and 8 acres in landscaping/drainage. Population based on a average household size of 2.04.

Construction Phase - Construction would occur July 2019 through February 2021.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Trips and VMT - Adjusted trips per client.

Architectural Coating - Use of low VOC coatings.

Vehicle Trips - Defaults assumed.

Woodstoves - Installation of natural gas fireplaces.

Construction Off-road Equipment Mitigation - Basic fugitive dust control measures included.

Mobile Land Use Mitigation - Neighborhood enhancements options selected.

Water Mitigation - 20% indoor/outdoor reduction in water assumed for CALGreen compliance.

Waste Mitigation - 75% waste diversion consistent with AB 341.

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	56,425.00	0.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	169,275.00	0.00
tblArchitecturalCoating	ConstArea_Parking	48,179.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Exterior	155,151.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Interior	465,454.00	0.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblAreaCoating	Area_Nonresidential_Exterior	56425	90700
tblAreaCoating	Area_Nonresidential_Interior	169275	272100

tblAreaCoating	Area_Parking	48179	45485
tblAreaCoating	Area_Residential_Exterior	155151	80501
tblAreaCoating	Area_Residential_Interior	465454	241502
tblConstructionPhase	NumDays	30.00	10.00
tblConstructionPhase	NumDays	75.00	115.00
tblConstructionPhase	NumDays	30.00	20.00
tblConstructionPhase	NumDays	55.00	10.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	47.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	48.00
tblFireplaces	FireplaceWoodMass	3,078.40	0.00
tblFireplaces	NumberGas	94.05	153.90
tblFireplaces	NumberWood	59.85	0.00
tblLandUse	LandUseSquareFeet	171,000.00	229,854.00
tblLandUse	LandUseSquareFeet	181,400.00	112,850.00
tblLandUse	LotAcreage	10.69	12.00
tblLandUse	LotAcreage	4.16	12.50
tblLandUse	Population	489.00	476.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	499.66
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSolidWaste	SolidWasteGenerationRate	78.66	41.40
tblTripsAndVMT	HaulingTripNumber	0.00	300.00
tblTripsAndVMT	VendorTripNumber	168.00	92.00
tblTripsAndVMT	VendorTripNumber	168.00	10.00
tblTripsAndVMT	WorkerTripNumber	23.00	24.00
tblTripsAndVMT	WorkerTripNumber	15.00	16.00
tblTripsAndVMT	WorkerTripNumber	496.00	216.00
tblTripsAndVMT	WorkerTripNumber	99.00	44.00
tblTripsAndVMT	WorkerTripNumber	496.00	66.00
tblTripsAndVMT	WorkerTripNumber	99.00	14.00

tblVehicleTrips	HS_TTP	20.70	21.00
tblVehicleTrips	HW_TTP	37.30	37.00
tblWater	IndoorWaterUseRate	11,141,338.38	5,863,862.31
tblWater	OutdoorWaterUseRate	7,023,887.24	3,696,782.76
tblWoodstoves	WoodstoveDayYear	82.00	0.00
tblWoodstoves	WoodstoveWoodMass	3,019.20	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4135	59.3938	37.8908	0.0708	18.2962	2.6851	20.6884	9.9917	2.4704	12.1925	0.0000	7,023.4337	7,023.4337	2.0740	0.0000	7,075.2849
2020	70.4885	42.5223	38.2015	0.0892	18.2962	2.1992	20.4954	9.9917	2.0233	12.0149	0.0000	8,859.8188	8,859.8188	1.2029	0.0000	8,883.6807
2021	70.1966	20.4640	23.3323	0.0428	1.0831	1.0632	2.1463	0.2886	1.0051	1.2937	0.0000	4,130.9750	4,130.9750	0.6947	0.0000	4,148.3427
Maximum	**70.4885**	**59.3938**	**38.2015**	**0.0892**	**18.2962**	**2.6851**	**20.6884**	**9.9917**	**2.4704**	**12.1925**	**0.0000**	**8,859.8188**	**8,859.8188**	**2.0740**	**0.0000**	**8,883.6807**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4135	59.3938	37.8908	0.0708	8.3597	2.6851	10.7520	4.5298	2.4704	6.7306	0.0000	7,023.4337	7,023.4337	2.0740	0.0000	7,075.2849
2020	70.4885	42.5223	38.2015	0.0892	8.3597	2.1992	10.5589	4.5298	2.0233	6.5530	0.0000	8,859.8188	8,859.8188	1.2029	0.0000	8,883.6807
2021	70.1966	20.4640	23.3323	0.0428	1.0831	1.0632	2.1463	0.2886	1.0051	1.2937	0.0000	4,130.9750	4,130.9750	0.6947	0.0000	4,148.3426
Maximum	**70.4885**	**59.3938**	**38.2015**	**0.0892**	**8.3597**	**2.6851**	**10.7520**	**4.5298**	**2.4704**	**6.7306**	**0.0000**	**8,859.8188**	**8,859.8188**	**2.0740**	**0.0000**	**8,883.6807**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.75**	**0.00**	**45.86**	**53.89**	**0.00**	**42.84**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099
Energy	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902
Mobile	27.9777	130.3732	238.9492	0.6680	44.3227	0.6683	44.9910	11.8609	0.6287	12.4896		67,672.8314	67,672.8314	3.8849		67,769.9542
Total	**38.7293**	**133.7749**	**254.6584**	**0.6893**	**44.3227**	**1.0074**	**45.3301**	**11.8609**	**0.9679**	**12.8288**	**0.0000**	**71,815.0396**	**71,815.0396**	**3.9890**	**0.0755**	**71,937.2542**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099
Energy	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902
Mobile	24.9817	106.8767	169.7902	0.4447	26.9170	0.4425	27.3595	7.2031	0.4161	7.6192		45,120.7716	45,120.7716	3.0785		45,197.7338
Total	**35.7333**	**110.2784**	**185.4994**	**0.4660**	**26.9170**	**0.7817**	**27.6987**	**7.2031**	**0.7553**	**7.9583**	**0.0000**	**49,262.9797**	**49,262.9797**	**3.1826**	**0.0755**	**49,365.0339**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**7.74**	**17.56**	**27.16**	**32.40**	**39.27**	**22.41**	**38.90**	**39.27**	**21.97**	**37.96**	**0.00**	**31.40**	**31.40**	**20.22**	**0.00**	**31.38**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	7/1/2019	7/12/2019	5	10	
2	Grading	Grading	7/13/2019	12/20/2019	5	115	
3	Laying Rock Base	Site Preparation	12/21/2019	1/17/2020	5	20	
4	Paving	Paving	1/18/2020	1/31/2020	5	10	
5	Building Construction (Non-Res)	Building Construction	2/1/2020	8/4/2020	5	132	
6	Architectural Coating (Non-Res)	Architectural Coating	6/1/2020	8/4/2020	5	47	
7	Building Construction (Res)	Building Construction	8/5/2020	2/4/2021	5	132	
8	Architectural Coating (Res)	Architectural Coating	12/1/2020	2/4/2021	5	48	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 287.5

Acres of Paving: 18.26

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 169,275; Non-Residential Outdoor: 56,425; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Trenchers	1	8.00	78	0.50
Laying Rock Base	Rubber Tired Dozers	3	8.00	247	0.40
Laying Rock Base	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction (Non-Res)	Cranes	1	7.00	231	0.29
Building Construction (Non-Res)	Forklifts	3	8.00	89	0.20
Building Construction (Non-Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Non-Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Non-Res)	Welders	1	8.00	46	0.45
Architectural Coating (Non-Res)	Air Compressors	1	6.00	78	0.48
Building Construction (Res)	Cranes	1	7.00	231	0.29
Building Construction (Res)	Forklifts	3	8.00	89	0.20
Building Construction (Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Res)	Welders	1	8.00	46	0.45
Architectural Coating (Res)	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	9	24.00	0.00	300.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Laying Rock Base	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	16.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Non-Res)	9	216.00	92.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Non-Res)	1	44.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Res)	9	66.00	10.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Res)	1	14.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.452 9	3,766.452 9	1.1917		3,796.244 5
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.452 9**	**3,766.452 9**	**1.1917**		**3,796.244 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

3.3 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645		6,473.873 0	6,473.873 0	2.0483		6,525.079 7
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**8.6733**	**2.6788**	**11.3522**	**3.5965**	**2.4645**	**6.0610**		**6,473.873 0**	**6,473.873 0**	**2.0483**		**6,525.079 7**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0237	0.7984	0.1244	2.1600e-003	0.0456	3.7800e-003	0.0494	0.0125	3.6100e-003	0.0161		226.5745	226.5745	8.7900e-003		226.7942
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2166	0.1579	1.7506	3.2500e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		322.9862	322.9862	0.0170		323.4110
Total	**0.2403**	**0.9563**	**1.8750**	**5.4100e-003**	**0.3521**	**6.2800e-003**	**0.3584**	**0.0938**	**5.9200e-003**	**0.0997**		**549.5607**	**549.5607**	**0.0258**		**550.2052**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645	0.0000	6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**3.9030**	**2.6788**	**6.5818**	**1.6184**	**2.4645**	**4.0829**	**0.0000**	**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0237	0.7984	0.1244	2.1600e-003	0.0456	3.7800e-003	0.0494	0.0125	3.6100e-003	0.0161		226.5745	226.5745	8.7900e-003		226.7942
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2166	0.1579	1.7506	3.2500e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		322.9862	322.9862	0.0170		323.4110
Total	**0.2403**	**0.9563**	**1.8750**	**5.4100e-003**	**0.3521**	**6.2800e-003**	**0.3584**	**0.0938**	**5.9200e-003**	**0.0997**		**549.5607**	**549.5607**	**0.0258**		**550.2052**

3.4 Laying Rock Base - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.452 9	3,766.452 9	1.1917		3,796.244 5
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.452 9**	**3,766.452 9**	**1.1917**		**3,796.244 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1625	0.1184	1.3129	2.4400e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		242.2397	242.2397	0.0127		242.5582
Total	**0.1625**	**0.1184**	**1.3129**	**2.4400e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**242.2397**	**242.2397**	**0.0127**		**242.5582**

3.4 Laying Rock Base - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216		3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**18.0663**	**2.1974**	**20.2637**	**9.9307**	**2.0216**	**11.9523**		**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1495	0.1050	1.1668	2.3700e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		235.2645	235.2645	0.0111		235.5417
Total	**0.1495**	**0.1050**	**1.1668**	**2.3700e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**235.2645**	**235.2645**	**0.0111**		**235.5417**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216	0.0000	3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**8.1298**	**2.1974**	**10.3272**	**4.4688**	**2.0216**	**6.4904**	**0.0000**	**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1495	0.1050	1.1668	2.3700e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		235.2645	235.2645	0.0111		235.5417
Total	**0.1495**	**0.1050**	**1.1668**	**2.3700e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**235.2645**	**235.2645**	**0.0111**		**235.5417**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926		2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6881					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0447**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**		**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1329	0.0933	1.0371	2.1000e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		209.1240	209.1240	9.8600e-003		209.3704
Total	**0.1329**	**0.0933**	**1.0371**	**2.1000e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**209.1240**	**209.1240**	**9.8600e-003**		**209.3704**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926	0.0000	2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6881					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0447**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**	**0.0000**	**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1329	0.0933	1.0371	2.1000e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		209.1240	209.1240	9.8600e-003		209.3704
Total	**0.1329**	**0.0933**	**1.0371**	**2.1000e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**209.1240**	**209.1240**	**9.8600e-003**		**209.3704**

3.6 Building Construction (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4060	10.8759	2.6680	0.0251	0.5633	0.0547	0.6180	0.1622	0.0523	0.2145		2,627.0429	2,627.0429	0.1497		2,630.7846
Worker	1.7936	1.2599	14.0014	0.0284	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,823.1739	2,823.1739	0.1331		2,826.5003
Total	**2.1996**	**12.1358**	**16.6695**	**0.0535**	**3.3223**	**0.0760**	**3.3983**	**0.8938**	**0.0720**	**0.9658**		**5,450.2167**	**5,450.2167**	**0.2827**		**5,457.2849**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4060	10.8759	2.6680	0.0251	0.5633	0.0547	0.6180	0.1622	0.0523	0.2145		2,627.0429	2,627.0429	0.1497		2,630.7846
Worker	1.7936	1.2599	14.0014	0.0284	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,823.1739	2,823.1739	0.1331		2,826.5003
Total	**2.1996**	**12.1358**	**16.6695**	**0.0535**	**3.3223**	**0.0760**	**3.3983**	**0.8938**	**0.0720**	**0.9658**		**5,450.2167**	**5,450.2167**	**0.2827**		**5,457.2849**

3.7 Architectural Coating (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.9183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**37.1605**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3654	0.2567	2.8521	5.7900e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		575.0910	575.0910	0.0271		575.7686
Total	**0.3654**	**0.2567**	**2.8521**	**5.7900e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**575.0910**	**575.0910**	**0.0271**		**575.7686**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.9183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**37.1605**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.3654	0.2567	2.8521	5.7900e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		575.0910	575.0910	0.0271		575.7686
Total	**0.3654**	**0.2567**	**2.8521**	**5.7900e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**575.0910**	**575.0910**	**0.0271**		**575.7686**

3.8 Building Construction (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0441	1.1822	0.2900	2.7300e-003	0.0612	5.9400e-003	0.0672	0.0176	5.6800e-003	0.0233		285.5481	285.5481	0.0163		285.9549
Worker	0.5480	0.3850	4.2782	8.6800e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		862.6365	862.6365	0.0407		863.6529
Total	**0.5922**	**1.5671**	**4.5682**	**0.0114**	**0.9043**	**0.0125**	**0.9167**	**0.2412**	**0.0117**	**0.2529**		**1,148.1846**	**1,148.1846**	**0.0569**		**1,149.6077**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0441	1.1822	0.2900	2.7300e-003	0.0612	5.9400e-003	0.0672	0.0176	5.6800e-003	0.0233		285.5481	285.5481	0.0163		285.9549
Worker	0.5480	0.3850	4.2782	8.6800e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		862.6365	862.6365	0.0407		863.6529
Total	**0.5922**	**1.5671**	**4.5682**	**0.0114**	**0.9043**	**0.0125**	**0.9167**	**0.2412**	**0.0117**	**0.2529**		**1,148.1846**	**1,148.1846**	**0.0569**		**1,149.6077**

3.8 Building Construction (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013		2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**		**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0369	1.0873	0.2546	2.7100e-003	0.0612	2.9100e-003	0.0641	0.0176	2.7800e-003	0.0204		283.5955	283.5955	0.0156		283.9858
Worker	0.5130	0.3446	3.8651	8.4000e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		835.3682	835.3682	0.0361		836.2709
Total	**0.5499**	**1.4319**	**4.1197**	**0.0111**	**0.9043**	**9.1400e-003**	**0.9134**	**0.2412**	**8.5200e-003**	**0.2497**		**1,118.9637**	**1,118.9637**	**0.0517**		**1,120.2567**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013	0.0000	2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**	**0.0000**	**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0369	1.0873	0.2546	2.7100e-003	0.0612	2.9100e-003	0.0641	0.0176	2.7800e-003	0.0204		283.5955	283.5955	0.0156		283.9858
Worker	0.5130	0.3446	3.8651	8.4000e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		835.3682	835.3682	0.0361		836.2709
Total	**0.5499**	**1.4319**	**4.1197**	**0.0111**	**0.9043**	**9.1400e-003**	**0.9134**	**0.2412**	**8.5200e-003**	**0.2497**		**1,118.9637**	**1,118.9637**	**0.0517**		**1,120.2567**

3.9 Architectural Coating (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**67.6602**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1163	0.0817	0.9075	1.8400e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		182.9835	182.9835	8.6200e-003		183.1991
Total	**0.1163**	**0.0817**	**0.9075**	**1.8400e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**182.9835**	**182.9835**	**8.6200e-003**		**183.1991**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**67.6602**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1163	0.0817	0.9075	1.8400e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		182.9835	182.9835	8.6200e-003		183.1991
Total	**0.1163**	**0.0817**	**0.9075**	**1.8400e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**182.9835**	**182.9835**	**8.6200e-003**		**183.1991**

3.9 Architectural Coating (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941		281.4481	281.4481	0.0193		281.9309
Total	**67.6370**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**		**281.4481**	**281.4481**	**0.0193**		**281.9309**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1088	0.0731	0.8199	1.7800e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		177.1993	177.1993	7.6600e-003		177.3908
Total	**0.1088**	**0.0731**	**0.8199**	**1.7800e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**177.1993**	**177.1993**	**7.6600e-003**		**177.3908**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941	0.0000	281.4481	281.4481	0.0193		281.9309
Total	**67.6370**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**	**0.0000**	**281.4481**	**281.4481**	**0.0193**		**281.9309**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1088	0.0731	0.8199	1.7800e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		177.1993	177.1993	7.6600e-003		177.3908
Total	**0.1088**	**0.0731**	**0.8199**	**1.7800e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**177.1993**	**177.1993**	**7.6600e-003**		**177.3908**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Diversity

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	24.9817	106.8767	169.7902	0.4447	26.9170	0.4425	27.3595	7.2031	0.4161	7.6192		45,120.7716	45,120.7716	3.0785		45,197.7338
Unmitigated	27.9777	130.3732	238.9492	0.6680	44.3227	0.6683	44.9910	11.8609	0.6287	12.4896		67,672.8314	67,672.8314	3.8849		67,769.9542

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	1,126.89	1,224.36	1037.97	4,019,143	2,440,809
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	7,745.78	9,064.56	4578.54	13,564,943	8,237,933
Total	8,872.67	10,288.92	5,616.51	17,584,086	10,678,741

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	16.80	7.10	7.90	37.00	21.00	42.00	86	11	3
Other Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Other Non-Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Parking Lot	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Regional Shopping Center	14.70	6.60	6.60	16.30	64.70	19.00	54	35	11

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Low Rise	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Non-Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Parking Lot	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Regional Shopping Center	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902
NaturalGas Unmitigated	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	5059.53	0.0546	0.4663	0.1984	2.9800e-003		0.0377	0.0377		0.0377	0.0377		595.2387	595.2387	0.0114	0.0109	598.7759
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	2229.17	0.0240	0.2186	0.1836	1.3100e-003		0.0166	0.0166		0.0166	0.0166		262.2558	262.2558	5.0300e-003	4.8100e-003	263.8142
Total		**0.0786**	**0.6848**	**0.3820**	**4.2900e-003**		**0.0543**	**0.0543**		**0.0543**	**0.0543**		**857.4945**	**857.4945**	**0.0164**	**0.0157**	**862.5902**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	5.05953	0.0546	0.4663	0.1984	2.9800e-003		0.0377	0.0377		0.0377	0.0377		595.2387	595.2387	0.0114	0.0109	598.7759
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	2.22917	0.0240	0.2186	0.1836	1.3100e-003		0.0166	0.0166		0.0166	0.0166		262.2558	262.2558	5.0300e-003	4.8100e-003	263.8142

Total		**0.0786**	**0.6848**	**0.3820**	**4.2900e-003**		**0.0543**	**0.0543**		**0.0543**	**0.0543**		**857.4945**	**857.4945**	**0.0164**	**0.0157**	**862.5902**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099
Unmitigated	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.6183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.2988	2.5529	1.0864	0.0163		0.2064	0.2064		0.2064	0.2064	0.0000	3,259.0588	3,259.0588	0.0625	0.0598	3,278.4258
Landscaping	0.4375	0.1640	14.2408	7.5000e-004		0.0785	0.0785		0.0785	0.0785		25.6548	25.6548	0.0252		26.2841
Total	**10.6730**	**2.7169**	**15.3272**	**0.0171**		**0.2849**	**0.2849**		**0.2849**	**0.2849**	**0.0000**	**3,284.7136**	**3,284.7136**	**0.0876**	**0.0598**	**3,304.7099**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.6183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.2988	2.5529	1.0864	0.0163		0.2064	0.2064		0.2064	0.2064	0.0000	3,259.058 8	3,259.058 8	0.0625	0.0598	3,278.425 8
Landscaping	0.4375	0.1640	14.2408	7.5000e-004		0.0785	0.0785		0.0785	0.0785		25.6548	25.6548	0.0252		26.2841
Total	**10.6730**	**2.7169**	**15.3272**	**0.0171**		**0.2849**	**0.2849**		**0.2849**	**0.2849**	**0.0000**	**3,284.713 6**	**3,284.713 6**	**0.0876**	**0.0598**	**3,304.709 9**

CalEEMod Version: CalEEMod.2016.3.2

Date: 3/11/2019 8:01 AM

Dorsey Marketplace (Alternative B)

Northern Sierra AQMD Air District, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	1.60	Acre	1.60	69,696.00	0
Other Non-Asphalt Surfaces	8.00	Acre	8.00	348,480.00	0
Parking Lot	962.00	Space	8.66	384,800.00	0
Apartments Low Rise	171.00	Dwelling Unit	12.00	229,854.00	476
Regional Shopping Center	181.40	1000sqft	12.50	112,850.00	0

1.2 Other Project Characteristics

Urbanization Rural | **Wind Speed (m/s)** 2.2 | **Precipitation Freq (Days)** 72

Climate Zone 1 | **Operational Year** 2022

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 499.66 | **CH4 Intensity (lb/MWhr)** 0.029 | **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Dorsey Marketplace. NSAQMD. Adjusted CO2 to meet a 33% RPS by 2020.

Land Use - Alternative B includes 171 DU, 112.85 KSF in retail/office, 962 parking spaces, 1.6 acres in driveway, and 8 acres in landscaping/drainage. Population based on a average household size of 2.04.

Construction Phase - Construction would occur July 2019 through February 2021.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Off-road Equipment - Default equipment assumed.

Trips and VMT - Adjusted trips per client.

Architectural Coating - Use of low VOC coatings.

Vehicle Trips - Defaults assumed.

Woodstoves - Installation of natural gas fireplaces.

Construction Off-road Equipment Mitigation - Basic fugitive dust control measures included.

Mobile Land Use Mitigation - Neighborhood enhancements options selected.

Water Mitigation - 20% indoor/outdoor reduction in water assumed for CALGreen compliance.

Waste Mitigation - 75% waste diversion consistent with AB 341.

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Nonresidential_Exterior	56,425.00	0.00
tblArchitecturalCoating	ConstArea_Nonresidential_Interior	169,275.00	0.00
tblArchitecturalCoating	ConstArea_Parking	48,179.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Exterior	155,151.00	0.00
tblArchitecturalCoating	ConstArea_Residential_Interior	465,454.00	0.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Nonresidential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Exterior	250.00	150.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblArchitecturalCoating	EF_Residential_Interior	250.00	100.00
tblAreaCoating	Area_Nonresidential_Exterior	56425	90700
tblAreaCoating	Area_Nonresidential_Interior	169275	272100

tblAreaCoating	Area_Parking	48179	45485
tblAreaCoating	Area_Residential_Exterior	155151	80501
tblAreaCoating	Area_Residential_Interior	465454	241502
tblConstructionPhase	NumDays	30.00	10.00
tblConstructionPhase	NumDays	75.00	115.00
tblConstructionPhase	NumDays	30.00	20.00
tblConstructionPhase	NumDays	55.00	10.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	47.00
tblConstructionPhase	NumDays	740.00	132.00
tblConstructionPhase	NumDays	55.00	48.00
tblFireplaces	FireplaceWoodMass	3,078.40	0.00
tblFireplaces	NumberGas	94.05	153.90
tblFireplaces	NumberWood	59.85	0.00
tblLandUse	LandUseSquareFeet	171,000.00	229,854.00
tblLandUse	LandUseSquareFeet	181,400.00	112,850.00
tblLandUse	LotAcreage	10.69	12.00
tblLandUse	LotAcreage	4.16	12.50
tblLandUse	Population	489.00	476.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	499.66
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSolidWaste	SolidWasteGenerationRate	78.66	41.40
tblTripsAndVMT	HaulingTripNumber	0.00	300.00
tblTripsAndVMT	VendorTripNumber	168.00	92.00
tblTripsAndVMT	VendorTripNumber	168.00	10.00
tblTripsAndVMT	WorkerTripNumber	23.00	24.00
tblTripsAndVMT	WorkerTripNumber	15.00	16.00
tblTripsAndVMT	WorkerTripNumber	496.00	216.00
tblTripsAndVMT	WorkerTripNumber	99.00	44.00
tblTripsAndVMT	WorkerTripNumber	496.00	66.00
tblTripsAndVMT	WorkerTripNumber	99.00	14.00

tblVehicleTrips	HS_TTP	20.70	21.00
tblVehicleTrips	HW_TTP	37.30	37.00
tblWater	IndoorWaterUseRate	11,141,338.38	5,863,862.31
tblWater	OutdoorWaterUseRate	7,023,887.24	3,696,782.76
tblWoodstoves	WoodstoveDayYear	82.00	0.00
tblWoodstoves	WoodstoveWoodMass	3,019.20	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4350	59.4647	37.8942	0.0705	18.2962	2.6852	20.6884	9.9917	2.4705	12.1925	0.0000	6,993.0228	6,993.0228	2.0746	0.0000	7,044.8871
2020	70.5549	42.5567	38.5564	0.0856	18.2962	2.1992	20.4954	9.9917	2.0233	12.0149	0.0000	8,500.9861	8,500.9861	1.2024	0.0000	8,525.1667
2021	70.2596	20.6086	23.2876	0.0419	1.0831	1.0633	2.1464	0.2886	1.0053	1.2939	0.0000	4,041.3120	4,041.3120	0.6946	0.0000	4,058.6760
Maximum	**70.5549**	**59.4647**	**38.5564**	**0.0856**	**18.2962**	**2.6852**	**20.6884**	**9.9917**	**2.4705**	**12.1925**	**0.0000**	**8,500.9861**	**8,500.9861**	**2.0746**	**0.0000**	**8,525.1667**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	5.4350	59.4647	37.8942	0.0705	8.3597	2.6852	10.7520	4.5298	2.4705	6.7306	0.0000	6,993.0228	6,993.0228	2.0746	0.0000	7,044.8870
2020	70.5549	42.5567	38.5564	0.0856	8.3597	2.1992	10.5589	4.5298	2.0233	6.5530	0.0000	8,500.9861	8,500.9861	1.2024	0.0000	8,525.1667
2021	70.2596	20.6086	23.2876	0.0419	1.0831	1.0633	2.1464	0.2886	1.0053	1.2939	0.0000	4,041.3120	4,041.3120	0.6946	0.0000	4,058.6760
Maximum	**70.5549**	**59.4647**	**38.5564**	**0.0856**	**8.3597**	**2.6852**	**10.7520**	**4.5298**	**2.4705**	**6.7306**	**0.0000**	**8,500.9861**	**8,500.9861**	**2.0746**	**0.0000**	**8,525.1667**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.75**	**0.00**	**45.86**	**53.89**	**0.00**	**42.84**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099
Energy	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902
Mobile	24.1095	137.6385	264.5875	0.6263	44.3227	0.6815	45.0042	11.8609	0.6414	12.5022		63,408.0179	63,408.0179	4.1539		63,511.8650
Total	**34.8611**	**141.0402**	**280.2967**	**0.6477**	**44.3227**	**1.0206**	**45.3433**	**11.8609**	**0.9805**	**12.8414**	**0.0000**	**67,550.2260**	**67,550.2260**	**4.2580**	**0.0755**	**67,679.1650**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099
Energy	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902
Mobile	21.1583	111.0148	201.1443	0.4153	26.9170	0.4557	27.3727	7.2031	0.4287	7.6318		42,079.3053	42,079.3053	3.3990		42,164.2804
Total	**31.9099**	**114.4165**	**216.8535**	**0.4367**	**26.9170**	**0.7949**	**27.7119**	**7.2031**	**0.7679**	**7.9710**	**0.0000**	**46,221.5135**	**46,221.5135**	**3.5031**	**0.0755**	**46,331.5805**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**8.47**	**18.88**	**22.63**	**32.58**	**39.27**	**22.12**	**38.88**	**39.27**	**21.68**	**37.93**	**0.00**	**31.57**	**31.57**	**17.73**	**0.00**	**31.54**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	7/1/2019	7/12/2019	5	10	
2	Grading	Grading	7/13/2019	12/20/2019	5	115	
3	Laying Rock Base	Site Preparation	12/21/2019	1/17/2020	5	20	
4	Paving	Paving	1/18/2020	1/31/2020	5	10	
5	Building Construction (Non-Res)	Building Construction	2/1/2020	8/4/2020	5	132	
6	Architectural Coating (Non-Res)	Architectural Coating	6/1/2020	8/4/2020	5	47	
7	Building Construction (Res)	Building Construction	8/5/2020	2/4/2021	5	132	
8	Architectural Coating (Res)	Architectural Coating	12/1/2020	2/4/2021	5	48	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 287.5

Acres of Paving: 18.26

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 169,275; Non-Residential Outdoor: 56,425; Striped Parking

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Trenchers	1	8.00	78	0.50
Laying Rock Base	Rubber Tired Dozers	3	8.00	247	0.40
Laying Rock Base	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction (Non-Res)	Cranes	1	7.00	231	0.29
Building Construction (Non-Res)	Forklifts	3	8.00	89	0.20
Building Construction (Non-Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Non-Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Non-Res)	Welders	1	8.00	46	0.45
Architectural Coating (Non-Res)	Air Compressors	1	6.00	78	0.48
Building Construction (Res)	Cranes	1	7.00	231	0.29
Building Construction (Res)	Forklifts	3	8.00	89	0.20
Building Construction (Res)	Generator Sets	1	8.00	84	0.74
Building Construction (Res)	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction (Res)	Welders	1	8.00	46	0.45
Architectural Coating (Res)	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	9	24.00	0.00	300.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Laying Rock Base	7	18.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	16.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Non-Res)	9	216.00	92.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Non-Res)	1	44.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction (Res)	9	66.00	10.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating (Res)	1	14.00	0.00	0.00	16.80	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

3.3 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645		6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**8.6733**	**2.6788**	**11.3522**	**3.5965**	**2.4645**	**6.0610**		**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0247	0.8176	0.1431	2.1100e-003	0.0456	3.8700e-003	0.0495	0.0125	3.7000e-003	0.0162		221.5226	221.5226	9.9100e-003		221.7703
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2372	0.2096	1.7352	3.0000e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		297.6272	297.6272	0.0164		298.0371
Total	**0.2618**	**1.0272**	**1.8783**	**5.1100e-003**	**0.3521**	**6.3700e-003**	**0.3585**	**0.0938**	**6.0100e-003**	**0.0998**		**519.1498**	**519.1498**	**0.0263**		**519.8074**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.9030	0.0000	3.9030	1.6184	0.0000	1.6184			0.0000			0.0000
Off-Road	5.1732	58.4375	36.0159	0.0654		2.6788	2.6788		2.4645	2.4645	0.0000	6,473.8730	6,473.8730	2.0483		6,525.0797
Total	**5.1732**	**58.4375**	**36.0159**	**0.0654**	**3.9030**	**2.6788**	**6.5818**	**1.6184**	**2.4645**	**4.0829**	**0.0000**	**6,473.8730**	**6,473.8730**	**2.0483**		**6,525.0797**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0247	0.8176	0.1431	2.1100e-003	0.0456	3.8700e-003	0.0495	0.0125	3.7000e-003	0.0162		221.5226	221.5226	9.9100e-003		221.7703
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.2372	0.2096	1.7352	3.0000e-003	0.3066	2.5000e-003	0.3091	0.0813	2.3100e-003	0.0836		297.6272	297.6272	0.0164		298.0371
Total	**0.2618**	**1.0272**	**1.8783**	**5.1100e-003**	**0.3521**	**6.3700e-003**	**0.3585**	**0.0938**	**6.0100e-003**	**0.0998**		**519.1498**	**519.1498**	**0.0263**		**519.8074**

3.4 Laying Rock Base - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991		3,766.4529	3,766.4529	1.1917		3,796.2445
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**18.0663**	**2.3904**	**20.4566**	**9.9307**	**2.1991**	**12.1298**		**3,766.4529**	**3,766.4529**	**1.1917**		**3,796.2445**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.3350	45.5727	22.0630	0.0380		2.3904	2.3904		2.1991	2.1991	0.0000	3,766.452 9	3,766.452 9	1.1917		3,796.244 5
Total	**4.3350**	**45.5727**	**22.0630**	**0.0380**	**8.1298**	**2.3904**	**10.5202**	**4.4688**	**2.1991**	**6.6679**	**0.0000**	**3,766.452 9**	**3,766.452 9**	**1.1917**		**3,796.244 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.1572	1.3014	2.2500e-003	0.2299	1.8700e-003	0.2318	0.0610	1.7300e-003	0.0627		223.2204	223.2204	0.0123		223.5278
Total	**0.1779**	**0.1572**	**1.3014**	**2.2500e-003**	**0.2299**	**1.8700e-003**	**0.2318**	**0.0610**	**1.7300e-003**	**0.0627**		**223.2204**	**223.2204**	**0.0123**		**223.5278**

3.4 Laying Rock Base - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216		3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**18.0663**	**2.1974**	**20.2637**	**9.9307**	**2.0216**	**11.9523**		**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1636	0.1393	1.1471	2.1800e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		216.7630	216.7630	0.0106		217.0274
Total	**0.1636**	**0.1393**	**1.1471**	**2.1800e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**216.7630**	**216.7630**	**0.0106**		**217.0274**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	4.0765	42.4173	21.5136	0.0380		2.1974	2.1974		2.0216	2.0216	0.0000	3,685.1016	3,685.1016	1.1918		3,714.8975
Total	**4.0765**	**42.4173**	**21.5136**	**0.0380**	**8.1298**	**2.1974**	**10.3272**	**4.4688**	**2.0216**	**6.4904**	**0.0000**	**3,685.1016**	**3,685.1016**	**1.1918**		**3,714.8975**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1636	0.1393	1.1471	2.1800e-003	0.2299	1.7800e-003	0.2317	0.0610	1.6400e-003	0.0626		216.7630	216.7630	0.0106		217.0274
Total	**0.1636**	**0.1393**	**1.1471**	**2.1800e-003**	**0.2299**	**1.7800e-003**	**0.2317**	**0.0610**	**1.6400e-003**	**0.0626**		**216.7630**	**216.7630**	**0.0106**		**217.0274**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926		2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6881					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0447**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**		**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1455	0.1239	1.0196	1.9400e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		192.6782	192.6782	9.4000e-003		192.9132
Total	**0.1455**	**0.1239**	**1.0196**	**1.9400e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**192.6782**	**192.6782**	**9.4000e-003**		**192.9132**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3566	14.0656	14.6521	0.0228		0.7528	0.7528		0.6926	0.6926	0.0000	2,207.7334	2,207.7334	0.7140		2,225.5841
Paving	2.6881					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**4.0447**	**14.0656**	**14.6521**	**0.0228**		**0.7528**	**0.7528**		**0.6926**	**0.6926**	**0.0000**	**2,207.7334**	**2,207.7334**	**0.7140**		**2,225.5841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1455	0.1239	1.0196	1.9400e-003	0.2044	1.5800e-003	0.2060	0.0542	1.4600e-003	0.0557		192.6782	192.6782	9.4000e-003		192.9132
Total	**0.1455**	**0.1239**	**1.0196**	**1.9400e-003**	**0.2044**	**1.5800e-003**	**0.2060**	**0.0542**	**1.4600e-003**	**0.0557**		**192.6782**	**192.6782**	**9.4000e-003**		**192.9132**

3.6 Building Construction (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4373	10.9910	3.3080	0.0242	0.5633	0.0561	0.6194	0.1622	0.0536	0.2158		2,535.4545	2,535.4545	0.1698		2,539.6999
Worker	1.9636	1.6721	13.7646	0.0262	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,601.1555	2,601.1555	0.1269		2,604.3282
Total	**2.4009**	**12.6631**	**17.0726**	**0.0504**	**3.3223**	**0.0775**	**3.3998**	**0.8938**	**0.0734**	**0.9672**		**5,136.6100**	**5,136.6100**	**0.2967**		**5,144.0281**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.4373	10.9910	3.3080	0.0242	0.5633	0.0561	0.6194	0.1622	0.0536	0.2158		2,535.4545	2,535.4545	0.1698		2,539.6999
Worker	1.9636	1.6721	13.7646	0.0262	2.7590	0.0214	2.7804	0.7317	0.0197	0.7514		2,601.1555	2,601.1555	0.1269		2,604.3282
Total	**2.4009**	**12.6631**	**17.0726**	**0.0504**	**3.3223**	**0.0775**	**3.3998**	**0.8938**	**0.0734**	**0.9672**		**5,136.6100**	**5,136.6100**	**0.2967**		**5,144.0281**

3.7 Architectural Coating (Non-Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.9183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**37.1605**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4000	0.3406	2.8039	5.3400e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		529.8650	529.8650	0.0259		530.5113
Total	**0.4000**	**0.3406**	**2.8039**	**5.3400e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**529.8650**	**529.8650**	**0.0259**		**530.5113**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.9183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**37.1605**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.4000	0.3406	2.8039	5.3400e-003	0.5620	4.3500e-003	0.5664	0.1490	4.0200e-003	0.1531		529.8650	529.8650	0.0259		530.5113
Total	**0.4000**	**0.3406**	**2.8039**	**5.3400e-003**	**0.5620**	**4.3500e-003**	**0.5664**	**0.1490**	**4.0200e-003**	**0.1531**		**529.8650**	**529.8650**	**0.0259**		**530.5113**

3.8 Building Construction (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503		2,553.063 1	2,553.063 1	0.6229		2,568.634 5
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**		**2,553.063 1**	**2,553.063 1**	**0.6229**		**2,568.634 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0475	1.1947	0.3596	2.6300e-003	0.0612	6.1000e-003	0.0673	0.0176	5.8300e-003	0.0235		275.5929	275.5929	0.0185		276.0543
Worker	0.6000	0.5109	4.2059	8.0000e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		794.7975	794.7975	0.0388		795.7669
Total	**0.6475**	**1.7056**	**4.5654**	**0.0106**	**0.9043**	**0.0126**	**0.9169**	**0.2412**	**0.0119**	**0.2531**		**1,070.390 4**	**1,070.390 4**	**0.0572**		**1,071.821 3**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day								lb/day		
Off-Road	2.1198	19.1860	16.8485	0.0269		1.1171	1.1171		1.0503	1.0503	0.0000	2,553.0631	2,553.0631	0.6229		2,568.6345
Total	**2.1198**	**19.1860**	**16.8485**	**0.0269**		**1.1171**	**1.1171**		**1.0503**	**1.0503**	**0.0000**	**2,553.0631**	**2,553.0631**	**0.6229**		**2,568.6345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day								lb/day		
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0475	1.1947	0.3596	2.6300e-003	0.0612	6.1000e-003	0.0673	0.0176	5.8300e-003	0.0235		275.5929	275.5929	0.0185		276.0543
Worker	0.6000	0.5109	4.2059	8.0000e-003	0.8430	6.5300e-003	0.8496	0.2236	6.0300e-003	0.2296		794.7975	794.7975	0.0388		795.7669
Total	**0.6475**	**1.7056**	**4.5654**	**0.0106**	**0.9043**	**0.0126**	**0.9169**	**0.2412**	**0.0119**	**0.2531**		**1,070.3904**	**1,070.3904**	**0.0572**		**1,071.8213**

3.8 Building Construction (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013		2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**		**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0400	1.0957	0.3172	2.6100e-003	0.0612	3.0400e-003	0.0643	0.0176	2.9100e-003	0.0205		273.6239	273.6239	0.0177		274.0669
Worker	0.5624	0.4571	3.7766	7.7400e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		769.6228	769.6228	0.0343		770.4790
Total	**0.6024**	**1.5527**	**4.0938**	**0.0104**	**0.9043**	**9.2700e-003**	**0.9135**	**0.2412**	**8.6500e-003**	**0.2499**		**1,043.2467**	**1,043.2467**	**0.0520**		**1,044.5458**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.9009	17.4321	16.5752	0.0269		0.9586	0.9586		0.9013	0.9013	0.0000	2,553.3639	2,553.3639	0.6160		2,568.7643
Total	**1.9009**	**17.4321**	**16.5752**	**0.0269**		**0.9586**	**0.9586**		**0.9013**	**0.9013**	**0.0000**	**2,553.3639**	**2,553.3639**	**0.6160**		**2,568.7643**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0400	1.0957	0.3172	2.6100e-003	0.0612	3.0400e-003	0.0643	0.0176	2.9100e-003	0.0205		273.6239	273.6239	0.0177		274.0669
Worker	0.5624	0.4571	3.7766	7.7400e-003	0.8430	6.2300e-003	0.8493	0.2236	5.7400e-003	0.2293		769.6228	769.6228	0.0343		770.4790
Total	**0.6024**	**1.5527**	**4.0938**	**0.0104**	**0.9043**	**9.2700e-003**	**0.9135**	**0.2412**	**8.6500e-003**	**0.2499**		**1,043.2467**	**1,043.2467**	**0.0520**		**1,044.5458**

3.9 Architectural Coating (Res) - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**67.6602**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1273	0.1084	0.8922	1.7000e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		168.5934	168.5934	8.2300e-003		168.7991
Total	**0.1273**	**0.1084**	**0.8922**	**1.7000e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**168.5934**	**168.5934**	**8.2300e-003**		**168.7991**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**67.6602**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1273	0.1084	0.8922	1.7000e-003	0.1788	1.3900e-003	0.1802	0.0474	1.2800e-003	0.0487		168.5934	168.5934	8.2300e-003		168.7991
Total	**0.1273**	**0.1084**	**0.8922**	**1.7000e-003**	**0.1788**	**1.3900e-003**	**0.1802**	**0.0474**	**1.2800e-003**	**0.0487**		**168.5934**	**168.5934**	**8.2300e-003**		**168.7991**

3.9 Architectural Coating (Res) - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941		281.4481	281.4481	0.0193		281.9309
Total	**67.6370**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**		**281.4481**	**281.4481**	**0.0193**		**281.9309**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1193	0.0970	0.8011	1.6400e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		163.2533	163.2533	7.2600e-003		163.4349
Total	**0.1193**	**0.0970**	**0.8011**	**1.6400e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**163.2533**	**163.2533**	**7.2600e-003**		**163.4349**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	67.4181					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2189	1.5268	1.8176	2.9700e-003		0.0941	0.0941		0.0941	0.0941	0.0000	281.4481	281.4481	0.0193		281.9309
Total	**67.6370**	**1.5268**	**1.8176**	**2.9700e-003**		**0.0941**	**0.0941**		**0.0941**	**0.0941**	**0.0000**	**281.4481**	**281.4481**	**0.0193**		**281.9309**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1193	0.0970	0.8011	1.6400e-003	0.1788	1.3200e-003	0.1801	0.0474	1.2200e-003	0.0486		163.2533	163.2533	7.2600e-003		163.4349
Total	**0.1193**	**0.0970**	**0.8011**	**1.6400e-003**	**0.1788**	**1.3200e-003**	**0.1801**	**0.0474**	**1.2200e-003**	**0.0486**		**163.2533**	**163.2533**	**7.2600e-003**		**163.4349**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Increase Diversity

Increase Transit Accessibility

Improve Pedestrian Network

Provide Traffic Calming Measures

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	21.1583	111.0148	201.1443	0.4153	26.9170	0.4557	27.3727	7.2031	0.4287	7.6318		42,079.3053	42,079.3053	3.3990		42,164.2804
Unmitigated	24.1095	137.6385	264.5875	0.6263	44.3227	0.6815	45.0042	11.8609	0.6414	12.5022		63,408.0179	63,408.0179	4.1539		63,511.8650

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Low Rise	1,126.89	1,224.36	1037.97	4,019,143	2,440,809
Other Asphalt Surfaces	0.00	0.00	0.00		
Other Non-Asphalt Surfaces	0.00	0.00	0.00		
Parking Lot	0.00	0.00	0.00		
Regional Shopping Center	7,745.78	9,064.56	4578.54	13,564,943	8,237,933
Total	8,872.67	10,288.92	5,616.51	17,584,086	10,678,741

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Low Rise	16.80	7.10	7.90	37.00	21.00	42.00	86	11	3
Other Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Other Non-Asphalt Surfaces	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Parking Lot	14.70	6.60	6.60	0.00	0.00	0.00	0	0	0
Regional Shopping Center	14.70	6.60	6.60	16.30	64.70	19.00	54	35	11

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Low Rise	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Other Non-Asphalt Surfaces	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Parking Lot	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528
Regional Shopping Center	0.450218	0.041480	0.238529	0.144444	0.036492	0.006519	0.014682	0.056829	0.001848	0.001006	0.005817	0.000606	0.001528

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902
NaturalGas Unmitigated	0.0786	0.6848	0.3820	4.2900e-003		0.0543	0.0543		0.0543	0.0543		857.4945	857.4945	0.0164	0.0157	862.5902

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	5059.53	0.0546	0.4663	0.1984	2.9800e-003		0.0377	0.0377		0.0377	0.0377		595.2387	595.2387	0.0114	0.0109	598.7759
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	2229.17	0.0240	0.2186	0.1836	1.3100e-003		0.0166	0.0166		0.0166	0.0166		262.2558	262.2558	5.0300e-003	4.8100e-003	263.8142
Total		**0.0786**	**0.6848**	**0.3820**	**4.2900e-003**		**0.0543**	**0.0543**		**0.0543**	**0.0543**		**857.4945**	**857.4945**	**0.0164**	**0.0157**	**862.5902**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Low Rise	5.05953	0.0546	0.4663	0.1984	2.9800e-003		0.0377	0.0377		0.0377	0.0377		595.2387	595.2387	0.0114	0.0109	598.7759
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Non-Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Regional Shopping Center	2.22917	0.0240	0.2186	0.1836	1.3100e-003		0.0166	0.0166		0.0166	0.0166		262.2558	262.2558	5.0300e-003	4.8100e-003	263.8142
Total		**0.0786**	**0.6848**	**0.3820**	**4.2900e-003**		**0.0543**	**0.0543**		**0.0543**	**0.0543**		**857.4945**	**857.4945**	**0.0164**	**0.0157**	**862.5902**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099
Unmitigated	10.6730	2.7169	15.3272	0.0171		0.2849	0.2849		0.2849	0.2849	0.0000	3,284.7136	3,284.7136	0.0876	0.0598	3,304.7099

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.6183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.2988	2.5529	1.0864	0.0163		0.2064	0.2064		0.2064	0.2064	0.0000	3,259.0588	3,259.0588	0.0625	0.0598	3,278.4258
Landscaping	0.4375	0.1640	14.2408	7.5000e-004		0.0785	0.0785		0.0785	0.0785		25.6548	25.6548	0.0252		26.2841
Total	**10.6730**	**2.7169**	**15.3272**	**0.0171**		**0.2849**	**0.2849**		**0.2849**	**0.2849**	**0.0000**	**3,284.7136**	**3,284.7136**	**0.0876**	**0.0598**	**3,304.7099**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	2.3184					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.6183					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.2988	2.5529	1.0864	0.0163		0.2064	0.2064		0.2064	0.2064	0.0000	3,259.0588	3,259.0588	0.0625	0.0598	3,278.4258
Landscaping	0.4375	0.1640	14.2408	7.5000e-004		0.0785	0.0785		0.0785	0.0785		25.6548	25.6548	0.0252		26.2841
Total	**10.6730**	**2.7169**	**15.3272**	**0.0171**		**0.2849**	**0.2849**		**0.2849**	**0.2849**	**0.0000**	**3,284.7136**	**3,284.7136**	**0.0876**	**0.0598**	**3,304.7099**

APPENDIX J-1

Preliminary Geotechnical Engineering Report

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
for
FORMER SPRING HILL MINE PROPERTY
APNs 35-260-62, 63 and 64
Grass Valley, California

Prepared for:
Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3292-03
September 7, 2007

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 3292-03
September 7, 2007

Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677

Attention: Warren Hughes

Reference: Former Spring Hill Mine Property
APNs 35-260-62, 63, and 64
Grass Valley, California

Subject: Preliminary Geotechnical Engineering Report

Dear Mr. Hughes:

This report presents the results of our preliminary geotechnical engineering investigation for the former Spring Hill Mine property located southeast of Dorsey Drive and east of Highway 20/49 in Grass Valley, California. The site includes three parcels with a total area of approximately 26.7 acres. The Nevada County Assessor's Parcel Numbers (APNs) are 35-260-62, 63, and 64. As proposed, the project will include significant cut and fill grading to create building pads for commercial development and associated roads, parking areas, and underground utilities.

The preliminary findings presented in this report are based on a cursory surface reconnaissance at the site, review of selected geologic references and reports previously prepared for the site by Holdrege and Kull, and our experience with subsurface conditions in the area. Based on our preliminary findings, our opinion is the project as currently proposed appears to be feasible from a geotechnical engineering standpoint. We should be retained to perform a design-level investigation prior to construction to confirm the preliminary recommendations presented in this report and provide alternate recommendations, if appropriate, based on the subsurface conditions encountered. Furthermore, we should be allowed to perform testing and observation services during grading to confirm our design-level recommendations.

(530) 478-1305 • FAX (530) 478-1019 • E-mail: handk@HandK.net • 792 Searls Avenue • Nevada City, CA 95959 • A California Corporation

Please contact us if you have any questions regarding our observations or the preliminary recommendations presented in this report.

Sincerely,

HOLDREGE & KULL

Prepared by:

Zack Washburn, P.G. 8254
Staff Geologist

Reviewed by:

Rob Fingerson, G.E. 2699
Senior Engineer

copies: 4 to Gallelli & Sons / Attn: Warren Hughes

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1 INTRODUCTION

At the request of Warren Hughes of Gallelli & Sons, LLC, Holdrege & Kull (H&K) performed a preliminary geotechnical engineering investigation of the former Spring Hill Mine Property in Grass Valley, California. The preliminary geotechnical investigation was performed in general accordance with the scope of services presented in our July 17, 2007 proposal for the project, a copy of which is included as Appendix A of this report. For your review, Appendix B contains a document prepared by ASFE entitled *Important Information About Your Geotechnical Engineering Report*, which summarizes the general limitations, responsibilities, and use of geotechnical reports.

1.1 SITE DESCRIPTION

The site is comprised of three contiguous parcels, an eastern parcel (Assessor's Parcel Number (APN) 35-260-64, 11.37 acres), a northern parcel (APN 35-260-62, 1.7 acres), and a western parcel (APN 35-260-63, 13.67 acres). Figure 2 shows the approximate site boundary.

Surface topography at the site generally slopes toward the south and southwest from a relatively flat-lying area in the northern portion of the site and a knoll in the north central portion of the site. The site elevation ranges from approximately 2550 feet above mean sea level (MSL) in the southwestern portion of the site to approximately 2690 feet above MSL in the northern portion of the site. The site is generally vegetated by pine, manzanita, oak, and cottonwood trees in the southwestern portion of the site. Rock outcrop is present at several locations in the western, northern and eastern portions of the property.

1.2 PROPOSED IMPROVEMENTS

Our understanding of the project is based on our recent conversations with Warren Hughes and review of an August 2007 preliminary site plan prepared by Genesis Engineering. The preliminary site plan shows that up to 40 feet of cut is proposed in the central portion of the property and up to 60 feet of fill in the southwestern portion of the property. The plan also shows 6 smaller buildings proposed in the northern and eastern portions of the site, a large parking lot in the central and western portions of the site, and a large structure in the southwestern portion of the site.

1.3 SCOPE OF SERVICES

To prepare this report, we performed the following scope of services:

- We reviewed selected geologic and soil survey literature, as well as previous reports prepared for the site by H&K.
- We performed a cursory surface reconnaissance of the site.
- Based on observations made during our site reconnaissance, the results of our literature review, and our experience with soil conditions in the area, we prepared this report to provide preliminary geotechnical engineering recommendations for the proposed improvements.

2 SITE INVESTIGATION

The following sections summarize our literature review and field reconnaissance.

2.1 LITERATURE REVIEW

We performed a limited review of geologic literature pertaining to the project site. The following sections summarize our findings.

2.1.1 Soil Survey

The Soil Survey of Nevada County, California, Western Part (United States Department of Agriculture, Soil Conservation Service, August 1993) indicates that soil conditions across the majority of the site are mapped as Dubakella-rock outcrop complex, 5 to 50 percent slopes. Runoff is medium to rapid, based on degree of slope, and the erosion hazard is low to moderate. The central portion of the site is mapped as "Placer Diggings", although this classification appears to be incorrect based on the identification of past hard rock gold mining in this area. A limited area in the eastern portion of the site is mapped as Sites loam, 9 to 15 percent slopes. Runoff is medium on this soil and erosion hazard is moderate.

A typical profile of the Dubakella soil consists of an approximate 10-inch-thick surface layer of brown, gravelly heavy loam to gravelly clay loam. The surface layer is underlain by dark yellowish brown and brown, very cobbly clay to a depth of approximately 21 inches below the ground surface (bgs). Weathered ultrabasic rock is encountered below the cobbly clay loam.

A representative profile of the Sites Loam consists of brown and yellowish red heavy loam from the ground surface to an approximate depth of 12 inches bgs. The heavy loam is underlain by yellowish red loam and red clay, and light clay to an approximate depth of 78 inches bgs. The loam, clay, and light clay are underlain by weathered metasedimentary and basic rock.

2.1.2 Geology

The property is located in the Sierra Nevada Foothills, on the western side of the Sierra Nevada geomorphic province. The Sierra Nevada province is an elongate, north-west trending structural block that is tilted upward to form a steep scarp above the adjacent Basin and Range province to the east. The western slope of the Sierra Nevada dips gently westward, and extends beneath sediment of the Great Valley province. Sediment within the Great Valley is derived from continual uplift and erosion of the Sierra Nevada.

The Geologic Map of the Grass Valley - Colfax Area (A. Tuminas, 1983), shows that the site is underlain by serpentine rocks of the Early Mesozoic aged Ultramafic-Mafic "Basement" Unit of the Lake Combie Complex. According to the Mineral Land Classification of Nevada County (Special Report 164, California Department of Conservation Division of Mines and Geology, 1990), the site geology is mapped as the ultramafic unit of the Jurassic-aged Lake Combie Complex. The Mesozoic era occurred from approximately 245 to 65 million years ago. The Jurassic period occurred from approximately 206 to 144 million years ago.

The Map of the Spring Hill Mine (Uren, 1942) depicts buildings, mine shafts, tailing piles, and waste dumps comprising the western and central portion of the property.

The Nevada City Special Folio, California (United States Geologic Survey; 1896), depicts an east-west trending quartz vein passing through the central portion of the site. The vein apparently dips to the north.

We reviewed California Geological Survey Open File Report 96-08, Probabilistic Seismic Hazard Assessment for the State of California, and the 2002 update entitled California Fault Parameters. The documents indicate the property is located within the Foothills Fault System. The Foothills Fault System is designated as a Type C fault zone, with low seismicity and a low rate of recurrence. The 1997 edition of California Geological Survey Special Publication 43, Fault Rupture Hazard Zones in California, describes active faults and fault zones (activity within 11,000 years), as part of the Alquist-Priolo Earthquake Fault Zoning Act. The map and documents indicate the site is not located within an Alquist-Priolo active fault zone.

2.1.3 Previous Site Investigations

H&K performed a Preliminary Endangerment Assessment (PEA) for the site dated July 6, 2007. The draft PEA has been reviewed by the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) and we are currently addressing their review comments. Additional information pertaining to mining features and associated waste rock is presented in the draft PEA.

2.2 FIELD INVESTIGATION

We performed our site reconnaissance on August 28, 2007 to observe existing surface conditions at the project site.

2.2.1 Surface Conditions

At the time of our site visit, the western and central portions of the property contained significant abandoned mine features, while the eastern portion appeared to be generally undeveloped. However, dense manzanita generally obscured the surface conditions in the south-central and eastern portions of the site. The topography of the property generally slopes toward the south and southwest from a relatively flat lying area in the northern portion of the site and a knoll in the northern central portion of the site.

We observed the location of the Spring Hill shaft in the central portion of the property as depicted in the Map of the Spring Hill Mine (Uren, 1942). The Spring Hill shaft appeared to have been capped with concrete. Approximately 500 feet northeast of the Spring Hill shaft, we observed mounded soil, rock, and wood debris that appeared to be a shaft that was backfilled or capped. An apparent shaft, approximately 10 to 15 feet wide and open to a depth of 15 feet or greater, was observed approximately 400 feet southwest of the Spring Hill shaft. Our investigation did not include assessing the method or adequacy of physical shaft closure.

Several relic concrete foundations and concrete slabs were identified at the approximate locations of historic mining features depicted on the 1942 Uren map (bin, hoist, compressor, mill, machine shop, carpenter shop, dry, furnace, superintendent residence). No structures remain in these locations. The "bin" foundation (assumed to be for an ore bin), approximately 10 feet by 15 feet by 8 feet high, apparently served as an ore storage area between the Spring Hill shaft and the mill located to the southeast of the shaft. The mill foundation, located approximately 100 feet to the east of the bin foundation, was approximately 50 feet by 75 feet with concrete wall remnants up to 6 feet high.

Extensive surface exposures of mine waste rock were identified in the central and western portions of the site. Mine waste rock generally consisted of slightly to moderately weathered, mineralized serpentine and diabase rock with abundant quartz. The waste rock was coarse material with variable amounts of sand and gravel. The waste rock was present in several benches extending down slope to the south and southwest of the knoll-top, the location of the former mill and superintendent's residence. There was some evidence of disturbance or removal of waste rock in the area of the bin foundation. Smaller mine waste rock stockpiles of similar consistency were observed in the area between the bin and compressor foundations. Scattered waste rock was observed at the perimeter of the larger, main stockpiles of mine waste rock in the central and western portion of the site.

Mill tailings, consisting of light grey, grayish green and olive-brown silt with fine sand, were observed in the central and western portions of the site. The areas of observed tailings are down slope of the mill foundation. Two former "tailing ponds" were identified in this area.

Apparent glory holes with associated small volumes of apparent excavation spoils were observed in the eastern portion of the site.

H&K observed mine waste on approximately 6.5 acres of the 26.7-acre site, during their investigation for the PEA for the site.

2.2.2 Surface Water and Ground Water Conditions

Although we did not observe areas of saturated ground or seeps, our experience has shown that seepage will likely be encountered in excavations that reveal the contact between relatively permeable surface soil and resistant volcanic rock.

3 LABORATORY TESTING

Laboratory testing was not included in the scope of our preliminary geotechnical engineering investigation. Laboratory testing would be required as part of a design-level geotechnical engineering investigation for the project.

4 CONCLUSIONS

The following conclusions are based on our field observations and our experience in the area.

- Based on the results of our preliminary geotechnical investigation, our opinion is that the project is feasible from a geotechnical standpoint.

- Our primary concerns, from a geotechnical standpoint, are the presence of relic mine features and existing fill consisting of waste rock. In general, existing fill is not suitable to support structural improvements and we anticipate that areas of relatively shallow fill would be removed and replaced as compacted fill during site preparation and grading. Deeper areas of existing fill, particularly in the southern portion of the property will need to be evaluated as part of a design-level geotechnical investigation to determine what mitigation approaches, such as fill replacement or the use of deep foundation systems, are appropriate.

- The most notable historic mining features documented on the site were the Spring Hill shaft and the other two shafts located east and southwest of the Spring Hill shaft. If improvements are planned in the immediate vicinity of these mining features, the features should be closed per the recommendations of H&K or another qualified engineer. We would be able to provide closure recommendations as part of a design-level geotechnical engineering report.

- The July 6, 2007 draft PEA prepared by H&K recommended that the estimated 2,300 tons of waste and affected soil at the Former Mill Area should be excavated, transported offsite, and disposed at an appropriate solid waste facility. Additional characterization of the waste may be required by the landfill during the remedial action to meet their acceptance criteria.

- Based on the ultramafic and serpentine rock observed onsite and our past experience with serpentine rock in the area, we anticipate naturally-occurring asbestiform minerals may be encountered during grading. California Geological Survey Special Publication 124 (2002) states that an asbestos dust mitigation plan (ADMP) is required for grading in areas where naturally occurring asbestos (NOA) or asbestiform minerals are expected (areas where ultramafic, schistose, or serpentine rock is encountered), unless a comprehensive program of sampling and testing indicates the absence of asbestiform minerals. The ADMP is to be developed in accordance with

Section 93105 of the CalEPA's Asbestos Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying and Surface Mining Operations.

- Based on the site geology and the presence of rock outcrop we anticipate that relatively shallow, resistant rock may be encountered, particularly in the northern and eastern portions of the site, during grading or excavation for utilities. Preliminary recommendations for resistant rock are presented in the following sections. Fill material resulting from excavation onsite may contain significant gravel and oversized rock that may require specific recommendations for use as fill. General recommendations for placement of rock fill and oversized material are presented in the following sections.

- Although we did not observe saturated surface soil and daylighting seepage during our field reconnaissance, areas of seepage will likely be encountered during grading onsite, particularly during the rainy season and/or in excavations which reveal the surface soil/weathered rock contact. Preliminary recommendations regarding subsurface drainage are presented in this report.

5 PRELIMINARY RECOMMENDATIONS

The following preliminary geotechnical engineering recommendations are based on our understanding of the project as currently proposed, our literature review, our field observations during surface reconnaissance, and our experience in the area. The recommendations are preliminary, and are provided for planning purposes. The preliminary conclusions and recommendations in this report should be verified by a design-level geotechnical engineering investigation and/or observation during grading.

5.1 GRADING

The following preliminary grading recommendations address clearing and grubbing, soil preparation, fill placement, cut and fill slope grading, erosion control, subsurface drainage, surface drainage, and construction monitoring.

5.1.1 Clearing and Grubbing

Areas proposed for fill placement, paved areas, and building pads should be cleared and grubbed of vegetation and other deleterious materials as described below.

1. Strip and remove organic surface soil containing shallow vegetation and any other deleterious materials. This organic soil can be stockpiled onsite and used in landscape areas, but is not suitable for use as fill. The actual depth of stripping may vary across the site. Areas of deeper organic surface soil may be encountered in drainage swales and low lying areas.

2. Overexcavate any existing fill, waste rock piles less than 10 feet in depth, debris and/or other onsite excavations to underlying, competent material. Possible excavations include exploratory trenches excavated by others, mantles or soil test pits, and tree stump holes. The waste rock piles consisting of coarse-grained material in the southwestern portion of the site will need to be evaluated to determine appropriate mitigation of the fill to support structures.

3. Remove all rocks greater than 8 inches in greatest dimension (oversized rock) by scarifying to a depth of 12 inches in proposed building pads and areas to support pavement, slabs-on-grade, and other flatwork. Oversized rock should be placed in deep fill per the recommendations of the project geotechnical engineer, stockpiled for later use in landscape areas or stacked rock walls, or removed from the site.

4. Vegetation, tree stumps and exposed root systems, and any other deleterious materials and oversized rocks not used in landscape areas should be removed from the site.

5.1.2 Preparation for Fill Placement

Upon completion of site clearing, grubbing and overexcavation, the exposed native soil should be observed by a representative of our firm prior to placement of fill at the project site. Fill placed on slopes steeper than 5:1, horizontal:vertical (H:V), should be benched into the existing slope to allow placement of fill in horizontal lifts.

5.1.3 Fill Placement

Fill should be placed according to the following guidelines:

1. Material used for fill construction should consist of uncontaminated, predominantly granular, non-expansive native soil or approved import soil. Rock used in fill should be no larger than 8 inches in diameter. Rocks larger than 8 inches are considered oversized material and should be placed in deep

fill per the recommendations of the project geotechnical engineer, stockpiled for use in landscape areas or rock walls, or removed from the site.

2. Oversized material may be windrowed in deeper fill under the observation of the project geotechnical engineer. The windrows should be separated by at least one equipment width. Compacted fill should be worked into the sides of each windrow, and remaining voids should be filled with smaller rock. If the oversized material is to be incorporated into a rock fill that does not permit density testing by nuclear methods, the contractor should prepare a test fill during initial fill placement to facilitate establishing a procedural specification for fill placement. The means and methods of subsequent fill placement will be evaluated for conformance with the approved test fill.

3. Imported fill material should be predominantly granular, non-expansive and free of deleterious or organic material. If imported material is required to grade the site, it should be submitted to H&K for approval and laboratory analysis at least 72 hours prior to import to the site.

4. Clay soil, if encountered, may be used as fill if mixed with granular soil at a ratio determined by the project geotechnical engineer.

5. Fill should be uniformly moisture conditioned and placed in maximum 8-inch thick loose lifts (layers) prior to compacting.

6. The moisture content, density and relative compaction of all fill should be evaluated by our firm during construction.

7. Our observation of rock outcrop in western, northern, and eastern portions of the property and our experience in the area has shown that areas of moderately or slightly weathered rock that is difficult to trench with conventional trenching equipment may be encountered during grading or trenching. Pre-ripping, blasting, or splitting may be required in these areas. The scope of a future design-level investigation should include excavation of exploratory trenches along proposed road and utility trench alignments to allow observation of subsurface soil and rock conditions.

5.1.4 Differential Fill Depth

To reduce the magnitude of differential settlement associated with variable fill depth beneath structures, we recommend that differential fill depths beneath structures should not exceed 5 feet. For example, if the maximum fill depth is 8 feet across a building pad, the minimum fill depth beneath that pad should not be less than 3 feet. If a cut-fill building pad is used in this example, the cut portion would need to be overexcavated 3 feet and replaced with compacted fill.

5.1.5 Cut/Fill Slope Grading

1. Cut and fill slopes should generally be no steeper than 2:1, H:V. Based on our experience in the area, steeper cut slope gradients may be feasible in areas that have significant rock structure. Steeper slope gradients must be verified based on the results of laboratory testing and observation of slope conditions.

2. Fill slopes should be constructed by overbuilding the slope face and then cutting it back to the design slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking.

3. Benching during placement of fill on an existing slope must extend through loose surface soil into firm material, and be performed at intervals such that no loose soil is left beneath the fill.

5.1.6 Erosion Control

Graded portions of the site should be seeded following grading to allow vegetation to become established prior to and during the rainy season. In addition, grading that results in greater than one acre of soil disturbance or in sensitive areas may require the preparation of a storm water pollution prevention plan. As a minimum, the following controls should be installed prior to and during grading to reduce erosion.

1. Prior to commencement of site work, fiber rolls should be installed down slope of the proposed area of disturbance to reduce migration of sediment and small rocks from the site.

2. Soil exposed in permanent slope faces should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District.

3. Following seeding, jute netting or erosion control blankets should be placed and secured over graded slopes steeper than 2:1, H:V, to keep seeds and

straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.

4. Surface water drainage ditches should be established as necessary to intercept and redirect concentrated surface water away from cut and fill slope faces. Under no circumstances should surface water be directed over slope faces. The intercepted water should be discharged into natural drainage courses or into other collection and disposal structures.

5.1.7 Subsurface Drainage

If grading is performed during or immediately following the rainy season, seepage will likely be encountered. If groundwater or saturated soil conditions are encountered during grading, we anticipate that dewatering may be possible by gravity or by installation of sump pumps in excavations.

Control of subsurface seepage at the base of fill areas can typically be accomplished by placement of an area drain. Underlying, saturated soil is typically removed and replaced with free draining, granular drain rock enveloped in geotextile fabric. Fill soil can be placed over the granular rock. H&K should review proposed drainage improvements with regard to the site conditions prior to construction.

5.1.8 Surface Water Drainage

Proper surface water drainage is important to the successful development of the project. We recommend the following measures to help mitigate surface water drainage problems:

1. Slope final grade adjacent to structural areas so that surface water drains away from building pad finish subgrades at a minimum 2 percent slope for a minimum distance of 10 feet.

2. Compact and slope all soil placed adjacent to building foundations such that water is not retained to pond or infiltrate. Backfill should be free of deleterious material.

3. Direct downspouts to a solid collector pipe which discharges flow to positive drainage.

5.1.9 Construction Monitoring

Construction monitoring includes review of plans and specifications and observation of onsite activities during construction as described below.

1. We should be retained to review the final grading plans prior to construction to determine whether our recommendations have been implemented, and if necessary, to provide additional and/or modified recommendations.

2. We should be retained to perform construction monitoring during grading performed by the contractor to determine whether our recommendations have been implemented, and if necessary, provide additional and/or modified recommendations.

5.2 FOUNDATION SYSTEMS

Our preliminary opinion is that conventional shallow spread footings will be suitable for support of structures across much of the property. Footings should be founded on native, undisturbed soil, weathered rock or compacted and tested fill. Foundation design criteria and construction recommendations are typically provided as part of a design-level geotechnical engineering report.

Footings should be deepened through expansive clay soil, if encountered at the base of the footing excavations. Expansive clay soil is typically encountered in relatively thin layers near the soil/weathered rock interface.

Shallow, resistant rock which limits footing excavation may be encountered during construction in the northern and eastern portions of the property. The presence of shallow rock within building footprints may require the use of rock anchors or dowels to provide uplift and sliding resistance. H&K can provide site specific anchor recommendations during construction, if requested.

Existing deep fill is probably not suitable to support structures without mitigation. The mitigation options should be determined during the course of a design-level investigation.

6 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in northern California. This warranty is in lieu of all other warranties, either expressed or implied.

2. These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client. Any reliance on this report by a third party is at the risk of that party.

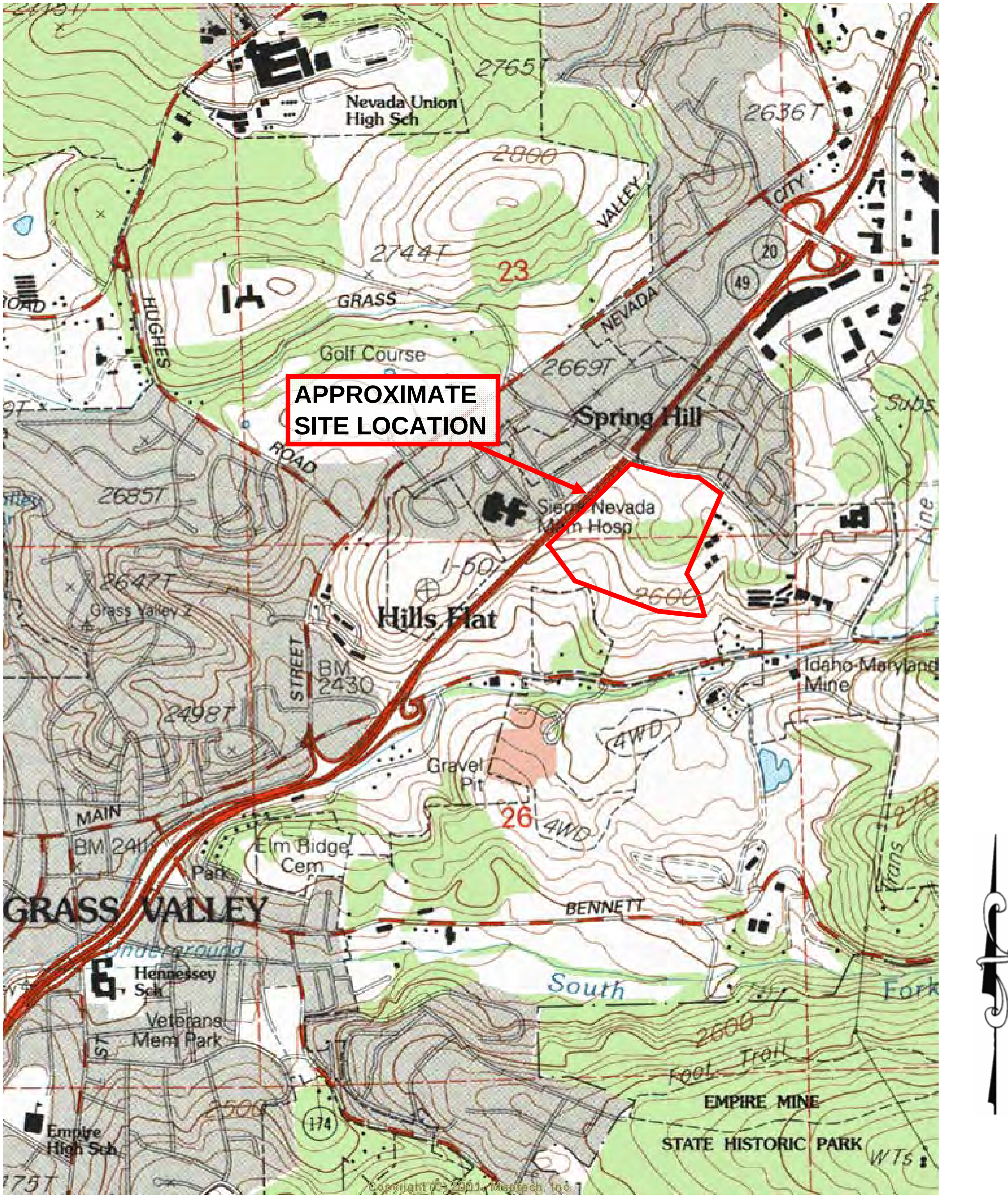
3. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid by all parties. Only our firm can determine the validity of the conclusions and recommendations presented in this report. Therefore, we should be retained to review all project changes and prepare written responses with regards to their impacts on our conclusions and recommendations. Subsurface investigation and laboratory testing will be required to develop design-level recommendations.

4. The analyses, conclusions and recommendations presented in this report are preliminary, based on site conditions as they existed at the time we performed our surface observations. The subsurface conditions should be confirmed by a design-level geotechnical investigation prior to construction.

5. Our scope of services for the preliminary geotechnical investigation did not include evaluating the project site for the presence of hazardous materials. Please review the July 6, 2007 draft PEA for information regarding hazardous materials. Project personnel should be careful and take the necessary precautions when working with hazardous materials during construction.

6. The findings of this report are valid as of the present date. Changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

FIGURES



NO SCALE

SOURCE: GRASS VALLEY QUADRANGLE MAP (USGS, PROVISIONAL EDITION 1995)

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 Searls Avenue • Nevada City, CA 95959
(530) 478-1305 • FAX (530) 478-1019

SITE LOCATION MAP

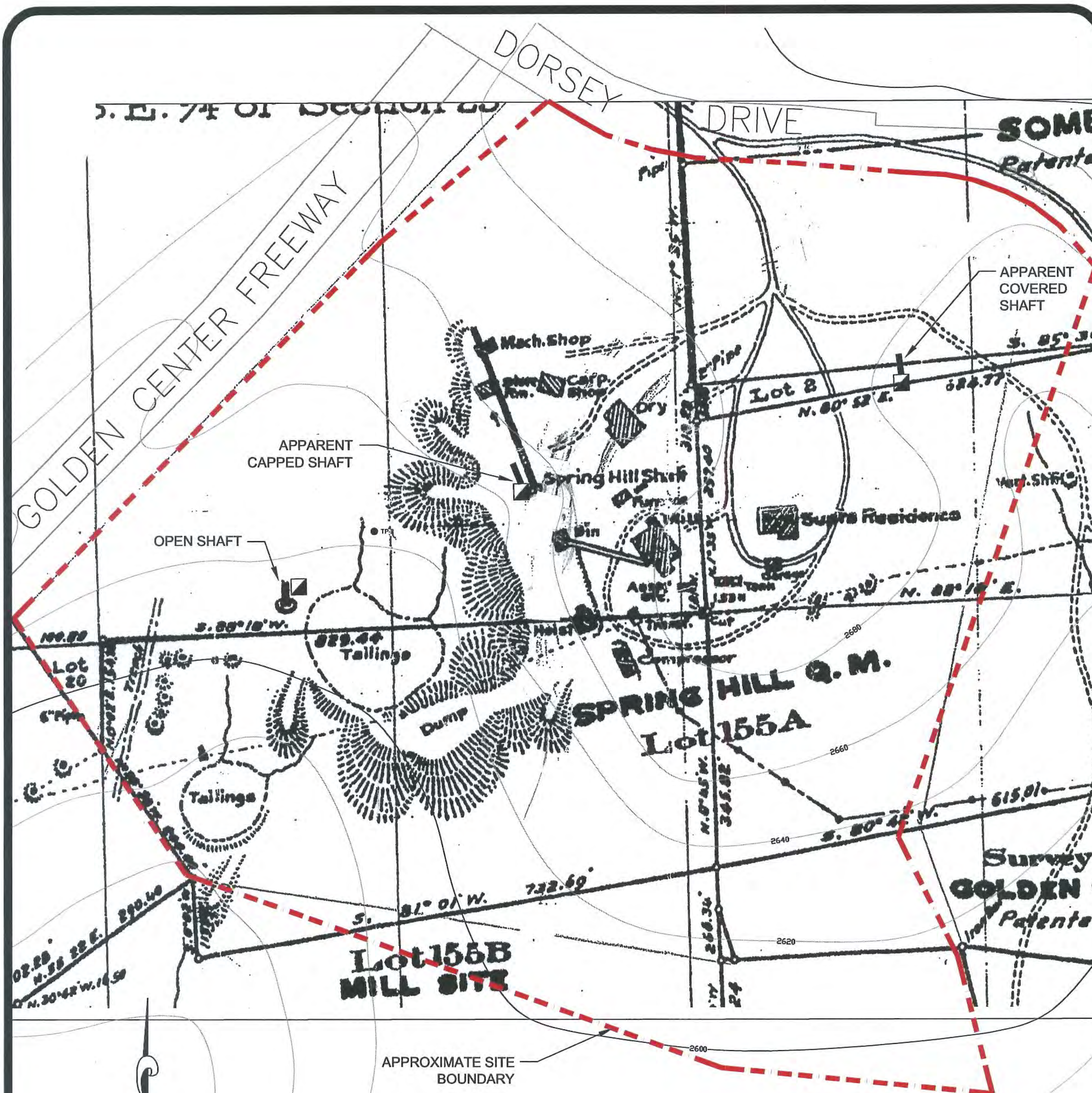
SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

PROJECT NO. 3292-03

SEPTEMBER 2007

FIGURE 1



50 0 50 100

APPROXIMATE SCALE
1 INCH = 100 FEET
CONTOUR INTERVAL: 20 FEET

BASE MAP: MAP OF SPRING HILL MINING CO. (E. UREN, 1942)

LEGEND

APPROXIMATE MINE SHAFT LOCATION

SITE MAP

FORMER SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

3292-03-FIG2

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959
(530) 478-1305 FAX 478-1019

DRAWN BY: DFD	CHECKED BY: ZW
PROJECT NO.: 3292-03	
DATE: SEPTEMBER 2007	
FIGURE NO.: 2	

APPENDIX A PROPOSAL

Proposal No. PN07219
July 17, 2007

Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677
fax: 916 415 0360

Attention: Mr. Warren Hughes

Reference: ***Former Spring Hill Mine Property***
APNs 35-260-62, 63, and 64
Nevada County, California

Subject: ***Contract Extension for Preliminary Geotechnical investigation***

Dear Mr. Hughes:

At your request, we are providing this proposal for preliminary geotechnical engineering services at the former Spring Hill Mine property located immediately southeast of Dorsey Drive and east of Highway 20/49 in Grass Valley, California. The site includes three parcels with a total area of approximately 26.7 acres. The Nevada County Assessor's Parcel Numbers (APNs) are 35-260-62, 63, and 64. The purpose of our services will be to evaluate the feasibility of the proposed development from a geotechnical/geological standpoint.

As currently proposed, the project will include commercial development of the property, with associated grading for access roads, building pads, and subsurface utilities.

SCOPE OF SERVICES

Based on our current understanding of the project, we propose to perform the following scope of services:

Field Investigation

We will perform a literature review of pertinent geologic and soil survey documents and previous reports prepared by H&K. Our field investigation will also involve a cursory site
visit to observe the existing condition of the subject property, noting existing fill, standing water and drainage, past mining features and other geotechnical or geologic features that may impact the development, as well as rock/soil types observed at the ground surface.

Preliminary Geotechnical Report

Following completion of the above tasks, we will compile a report which will include:

- Site plan showing approximate locations of geologic features;
- Description of soil and rock conditions;
- Preliminary grading and drainage recommendations;
- General conclusions regarding feasibility of the proposed improvements from a geotechnical engineering standpoint;
- Recommended foundation systems; and
- Preliminary recommendations to mitigate the presence of expansive soil, if encountered.

FEES

Our fee to provide the outlined services will be $2,400. Progress billing will be monthly on a percent complete basis. If this proposal meets your approval, please sign the enclosed terms and conditions and return one copy as our authorization to proceed.

TIMING

We will be able to start our field investigation for the project within one weeks of receiving authorization to proceed. Our report will be submitted within three weeks of completing our field investigation.

If you have any questions, please do not hesitate to contact us. Thank you for considering our firm to provide services for your project.

Sincerely,

HOLDREGE & KULL

Zack Washburn, P.G.
Staff Geologist

Authorization of Contract Extension

I hereby authorize Holdrege & Kull to implement the above scope of services for the fee outlined in this proposal. This authorization extends the existing signed contract between Gallelli & Sons, LLC and Holdrege & Kull dated March 5, 2007 to apply to the services and fees outlined in this proposal.

____
Name

____
Signature

____
Date

F:\1 Projects\3292 Spring Hill Mine\3292-03\3292-03 pro.wpd

APPENDIX B IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT (Included with permission of ASFE, Copyright 2004)

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

APPENDIX J-2

Preliminary Endangerment Assessment

DRAFT FINAL
PRELIMINARY ENDANGERMENT ASSESSMENT
for
FORMER SPRING HILL MINE PROPERTY
APNs 35-260-62, 63 and 64
Grass Valley, California

Prepared for:
Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3292-02
January 11, 2008

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 3292-02
January 11, 2008

Gallelli & Sons, LLC
4240 Rocklin Road, Suite 9
Rocklin, California 95677

Attention: Mr. Warren Hughes

Reference: Former Spring Hill Mine Property
APNs 35-260-62, 63, and 64
Grass Valley, California

Subject: Draft Final Preliminary Endangerment Assessment

Dear Mr. Hughes:

Holdrege & Kull (H&K) is pleased to present this draft final Preliminary Endangerment Assessment (PEA) report for the former Spring Hill Mine Property (site) in Grass Valley, California. The approximately 26-acre site is comprised of Assessor's Parcel Numbers 35-260-62, 63, and 64 located immediately south of Dorsey Drive and southeast of Highway 49/20. This report presents the results of sampling and laboratory analysis of mine waste and ambient native soil samples at the site, human health screening evaluation, evaluation of risk to surface water and groundwater quality, conclusions regarding the site characterization, and preliminary recommendations for mitigation.

H&K is submitting this draft PEA report to the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) for review in accordance with your Voluntary Cleanup Agreement (VCA) with DTSC.

Please contact us if you have any questions regarding the site characterization or the conclusions and recommendations presented in this report.

Sincerely,

HOLDREGE & KULL

PROFESSIONAL GEOLOGIST CHRISTOPHER D. ROSSITTO No. 7559 PROFESSIONAL GEOLOGIST STATE OF CALIFORNIA

Chris Rossitto, P.G. 7559
Senior Geologist

REGISTERED PROFESSIONAL ENGINEER JASON W. MUIR No. 60167 Exp. 6/08 CIVIL STATE OF CALIFORNIA

Jason W. Muir, C.E. 60167
Principal

copies: 2 Mr. Dean Wright, DTSC
2 to Mr. Warren Hughes, Gallelli & Sons, LLC
1 to Mr. Gary Gallelli, Gallelli & Sons, LLC

F:\1 Projects\3292 Spring Hill Mine\3292-02\3292-02.PEA.DRAFT FINAL.doc

TABLE OF CONTENTS

LIST OF ATTACHMENTS

LIST OF ACRONYMS

ABA	Acid-base accounting
AGP	Acid generating potential
APN	Assessor's Parcel Number
bgs	Below ground surface
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CHHSL	California Human Health Screening Level
COPC	Constituent of potential concern
DI	Deionized water
DLM	The Designated Level Methodology
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EPA	United States Environmental Protection Agency
EPC	Exposure point concentration
GPS	Global positioning system
H&K	Holdrege & Kull
mg/kg	Milligrams per kilogram
MSL	Mean sea level
MYBP	Million years before present
na	Not analyzed/ not available
NCDEH	Nevada County Department of Environmental Health
NP	Acid neutralizing potential
PEA	Preliminary Endangerment Assessment
RAW	Remedial Action Workplan
RL	Reporting limit
RME	Reasonable maximum exposure
RWQCB	California Regional Water Quality Control Board
SDL	Soluble designated level
TCLP	Toxicity Characteristic Leaching Procedure
UCL	Upper confidence limit
USGS	Unites States Geological Survey
VCA	Volunteer Cleanup Agreement
WET	Waste Extraction Test
μg/dL	Micrograms per deciliter
μg/L	Micrograms per liter

EXECUTIVE SUMMARY

The former Spring Hill Mine Property (site) is the subject of this Preliminary Endangerment Assessment (PEA), which is intended to determine whether past hard rock gold mining and ore processing activities have resulted in the release of metals and/or cyanide at concentrations that pose a threat to human health or the environment. The PEA findings indicate that remedial action is appropriate to restrict the exposure of future workers and visitors at the proposed commercial development to elevated metals concentrations in mine waste and affected soil.

The approximately 26-acre site is located south of Dorsey Drive and southeast of State Highway 49/20 in Grass Valley, Nevada County, California. The site is comprised of Nevada County Assessor's Parcel Numbers (APNs) 35-260-62, 35-260-63 and 35-260-64.

The gently to moderately sloping site is currently undeveloped. Commercial site development has been proposed. Nearby land uses include State Highway 49/20, commercial development, and residential apartment complexes. Sierra Nevada Memorial Hospital is located west across the highway from the site.

The site is located in the historic Grass Valley Mining District at the former location of the Spring Hill Mine, which operated intermittently from the late 1800s to the early 1940s. Abandoned mine features identified at the site include horizontal and inclined excavations, pits, relic foundations, stockpiles of mine waste rock, and tailing ponds.

An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of tailings are present at the site. Of this, an estimated 1,700 cubic yards of mine waste and affected soil identified at the Former Mill Area are not suitable to remain at the site under existing conditions. Off site disposal is proposed for this waste.

A human health risk assessment was performed to evaluate baseline conditions. Exposure media for the site are soil and air. Exposure pathways are incidental ingestion and dermal contact with the affected soil, and inhalation of particulates originating from the affected soil. In general, soil arsenic concentrations govern the calculated chronic human health hazard and excess lifetime cancer risk. Antimony, vanadium and other metals also contribute to the chronic human health hazard.

Mine waste in the Former Mill Area is not acceptable for use under the three exposure scenarios considered: standard (unrestricted land use), commercial indoor worker and construction worker.

Other mine waste identified at the site (excluding the Former Mill Area) is also not acceptable for use under the standard exposure scenario, but is potentially acceptable for use under the commercial indoor worker and construction worker exposure scenarios. On-site consolidation and burial of this waste beneath future commercial development appears to be a feasible remedial alternative. The proposed burial location should be identified on the site development plans and recorded with the County of Nevada.

Results of acid-base accounting indicate that the mine waste rock and tailings are not acid-generating; thus, soluble metals were evaluated by DI-WET. Soluble arsenic and lead were detected by DI-WET at concentrations exceeding the calculated SDL for surface water and groundwater under current conditions. However, the mine waste rock and tailings (excluding the Former Mill Area) are suitable for on-site consolidation and burial beneath the proposed commercial development and can be classified as Group C mine waste per CCR Title 27.

Based on the PEA findings, soil arsenic remediation goals are proposed. The mine waste and affected soil to be consolidated and buried on-site should have a 95% upper confidence limit (UCL) on the mean total arsenic concentration that is protective under the construction worker scenario (22 mg/kg), and soluble arsenic should not exceed the arsenic SDL (20 µg/L). Soil which is not to be consolidated and buried should have arsenic concentrations within the range of local background levels. Cleanup goals for other metals of potential concern (such as antimony, copper and vanadium) should be developed as part of a Remedial Action Workplan (RAW).

The abandoned mine excavations identified at the site, as well as other mine excavations that may be present on and adjacent to the site, present physical hazards and may not be suitable to support structural improvements. The excavations should be closed to address the possibility of entrapment, collapse, hazardous confined space conditions and other physical hazards. Temporary measures are appropriate to reduce the existing physical hazards. Final physical closure of the excavations should be performed in accordance with recommendations from a qualified geotechnical engineer and with the approval of the local building department.

The mine waste is to be cleaned up to background levels and either (1) consolidated and buried beneath the proposed commercial development or (2) excavated and removed from the site. The proposed commercial development will essentially eliminate exposure pathways for ecological receptors. Therefore, an ecological scoping assessment was not performed as part of this PEA.

A community profile performed by H&K determines that public notification is not warranted as part of the PEA investigation, although such notification is appropriate prior to site remediation.

1 INTRODUCTION

At the request of Gallelli & Sons, LLC, Holdrege & Kull (H&K) prepared this Preliminary Endangerment Assessment (PEA) report for the former Spring Hill Mine Property (site) in Grass Valley, California. The Nevada County Assessor's Parcel Numbers (APNs) for the site are 35-260-62, 63 and 64. Based on the assessor's office information, the total area of the three parcels is 26.7 acres. This PEA report was prepared pursuant to a Voluntary Cleanup Agreement (VCA) between the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) and the proponent, Gallelli & Sons, LLC.

A. Purpose

The purpose of the PEA, as defined in the California Health and Safety Code, Division 20, Chapter 6.8, Section 25319.5, is "to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous substances which pose a threat to public health or the environment." The PEA process was incorporated into DTSC's site mitigation process as part of Senate Bill 475 in July 1989, to establish a mechanism for determining whether sites containing known or potentially hazardous substances require remedial action. The purpose of this PEA is to provide information for use in determining whether past gold mining and ore processing performed on the site has released hazardous substances that present a risk to human health or to the environment.

B. Background

H&K performed historical literature review, site reconnaissance, and sampling and analysis pertaining to the abandoned mine features at the site for prospective purchasers of the property at different times since 2003. Investigations were conducted in May 2003, October 2005 and most recently in March and April 2007. The May 2003 and October 2005 investigation results were summarized in H&K's report, *Preliminary Characterization of the Spring Hill Mine Property* dated March 10, 2006. The March and April 2007 investigation results were summarized in H&K's report, *Results of Limited Subsurface Investigation of Spring Hill Mine Property* dated May 8, 2007. Data resulting from these investigations are included in this PEA report.

2 SITE DESCRIPTION

A. General Site Characteristics

1. Site Location

The approximately 26-acre site is located south of Dorsey Drive and southeast of State Highway 49/20 within the Grass Valley city limits in Nevada County, California. According to the Grass Valley Quadrangle topographic map (United States Geological Survey (USGS), 1995 provisional edition), the site is located in the southern half of the southeast quarter of Section 23 and the northern half of the northeastern quarter of Section 26, Township 16 North, Range 8 East. The site location is depicted on Figure 1.

2. Site Description

The site is comprised of three contiguous parcels, an eastern parcel (Assessor's Parcel Number (APN) 35-260-64, 11.37 acres), a northern parcel (APN 35-260-62, 1.7 acres) and a western parcel (APN 35-260-63, 13.67 acres). Figure 2 is an aerial photograph of the site and vicinity that shows the approximate site boundary.

Surface topography at the site generally slopes toward the south and southwest from a relatively flat-lying area in the northern portion of the site and a knoll in the northern central portion of the site. The northern portion of the eastern edge of the site slopes toward the southeast. The site elevation ranges from approximately 2550 feet above mean sea level (MSL) to approximately 2690 feet above MSL. The site is generally vegetated by oak, manzanita, pine and cedar. Rock outcrop is present at several locations on the north and west sides of the site.

3. Historic Mining Features

H&K performed site reconnaissance to confirm the presence of features depicted on historical mining maps and documents by others, which are discussed in Section III of this report. The locations of horizontal and inclined exploratory mining excavations, apparent prospecting trenches, building foundations, mine waste rock and mill tailings were observed at the site as depicted on Figure 3.

Extensive surface exposures of mine waste rock and mill tailings are present on the central and western portions of the property. An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of tailings were identified at the site. These volume estimates are based on observations during subsurface investigations and were not calculated using survey methods.

4. Current Land Use and Zoning

The site is currently undeveloped. Foundations of structures from the historic mining operations remain at the site. Several roads and trails are located within the site, some of which are depicted on Figure 3. The roads and trails may be used periodically by trespassers. The site is zoned corporate business park (CBP) by the City of Grass Valley Planning Department.

5. Adjacent Properties

The site is bordered by Dorsey Drive to the north, and across it an apartment complex; by State Highway 49/20 to the northwest, by commercial property to the south and southwest, and by an apartment complex to the east. Sierra Nevada Memorial Hospital is located approximately 500 feet west of the site, across State Highway 49/20 and at a higher elevation. The Spring Hill Manor convalescent hospital is also located west of the site, across State Highway 49/20.

6. Site Identification Information

Site Identification Information **Former Spring Hill Mine Property** Grass Valley, Nevada County, California	
Site Name	Former Spring Hill Mine Property
Contact Person	Warren Hughes, Gallelli & Sons, LLC
Site Address	Dorsey Drive, Grass Valley
Mailing Address of Contact Person	4240 Rocklin Road, Suite 9, Rocklin, CA 95677
Phone Number of Contact Person	(916) 580-4180, (916) 784-7550
Other Site Names	Spring Hill, Dorsey Drive property
USEPA Identification Number	none
CalSites Identification Number	none
Assessor's Parcel Numbers	35-260-62, 63 and 64
Township, Range, Section	Section 23 and 26, Township 16 North, Range 8 East
Land Use	currently undeveloped
Zoning	CBP – corporate business park

B. Site Maps

1. General Location Maps

Figure 1 is a site location map. Figure 2 is an aerial photograph of the site.

2. Detailed Site Diagrams

Figure 3 is a site map depicting historic mine features and roads, site boundaries and soil sample locations.

Figure 4 is a site map depicting historic mine features and roads, site boundaries, and the mine waste assessment areas including approximate aerial extent of waste rock piles and tailings deposits.

3 BACKGROUND

A. Site Status and History

Past operations at the site include hard rock gold mining, processing of mined ore, and extraction of gold from the processed ore. The site is located in the historic Grass Valley Gold Mining District at the former location of the Spring Hill Mine, which operated intermittently from the late 1800s to the early 1940s.

B. Historical Research

H&K reviewed several topographic surveys, historical mining maps and documents relating to site mining history, as well as a Phase 1 environmental site assessment of the Spring Hill Mine property prepared by others in 1997. Figure 3 and 4 depict the approximate locations of the identified mine features. The following documents were reviewed:

- *Nevada County Mining Review* (Grass Valley Daily Morning Union, 1895),
- Nevada City Special Folio, California (United States Geologic Survey; 1896),
- Map of the Vicinity of Grass Valley/Nevada City, California (Uren, 1897),
- *Gold Quartz Veins of Grass Valley* (Johnston, 1940),
- *State Mineralogists Report XXXVII*, (California State Mining Bureau, 1940),
- Map of Spring Hill Mining Co., (E. Uren, 1942), and
- *Phase I Environmental Site Assessment, Spring Hill Mine Area* (Anton Geological, July 10, 1997).

The 1897 Map of the Vicinity of Grass Valley/Nevada City, California depicts the Spring Hill Mine claim boundaries covering the site and extending onto adjacent property.

The 1896 Nevada City Special Folio shows an east-west trending quartz vein passing through the central portion of the site with three mine shafts on the site. The approximate shaft locations are indicated on Figure 3.

The 1895 *Nevada County Mining Review* indicates two mining locations and one mill site were present at the Spring Hill Mine and that a 2400-foot quartz vein passes through the site, which is described as 3 to 4 feet wide with “heavy outcrops”.

The 1940 *Gold Quartz Veins of Grass Valley* states that the quartz vein passing through the site strikes east and dips to the south (contrary to the earlier map depicting shafts inclined to the north). Only shallow shafts were advanced in the “early days” and the mine reopened in 1931. The ore body was reportedly located along the contact between serpentine and minor diorite rock. “Much carbonate” was present in the serpentine.

The 1940 *State Mineralogist’s Report* indicates prospecting had occurred at the Spring Hill Mine for many years. A 100-ton ore processing plant employing floatation operated part time (the likely source of the mill tailings observed at the site). The main shaft had reportedly been sunk to a depth of 1900 feet with many thousands of feet of drift. Results as of 1940 were reported to be “not satisfactory.”

The 1942 Map of the Spring Hill Mine Co. depicted the Spring Hill shaft, inclined to the north-northwest and numerous other features including apparent structures labeled “bin,” “hoist,” “compressor,” “mill,” “machine shop,” “carpenter shop,” “dry,” “furnace,” “superintendent residence,” and “garage”. Some labels on the map were not legible. The bin and hoist were depicted in-line with and south of the Spring Hill shaft. The mill was located to the east of the bin. Areas of mine waste labeled dump and tailings were depicted in the approximate locations where mine waste was observed during the site reconnaissance. Perimeter concrete foundations and slabs of former structures shown on the map were observed during site reconnaissance.

Record of mining activities at the site after the early 1940s was not encountered. Most hard rock gold mines in the area closed during World War II and did not reopen.

C. Site Status and Proposed Improvements

H&K understands that commercial development is planned for the site. The proposed development is to include several large commercial buildings and parking areas. Significant grading and fill placement will be required for the development of the sloping southern portion of the site. At this time, neither an Environmental Impact Report (EIR) nor a tentative map for the project has been submitted to the City of Grass Valley.

D. Hazardous Substance/Waste Management Information

H&K estimates that 44,000 cubic yards of mine waste rock and 20,000 cubic yards of tailings may be present at the site. An estimated 1,700 cubic yards of the mine waste rock, tailings and affected native soil were identified in the Former Mill Area. The material identified in the Former Mill Area contains elevated levels of arsenic, lead and mercury which are not likely suitable to remain at the site and likely will require off-site disposal at a Class I or Class II solid waste disposal facility. The mine waste identified outside of the Former Mill Area is potentially suitable for onsite placement. The volume estimates are not based on survey and are therefore approximate.

E. Site Reconnaissance and Results

H&K conducted site reconnaissance to observe existing surface conditions and to identify historic mining features. Dense vegetation obscured the ground surface in some areas, particularly on steep slopes in the southern central and southeastern portions of the site.

Significant abandoned mine features were identified in much of the central and western-central portions of the site where historic maps indicated the presence of shafts, foundations, mine waste rock and tailings. An isolated occurrence of apparent near-surface exploration spoils was identified in the eastern central portion of the site. Figure 3 and 4 depict the approximate locations of the identified site features, which are discussed below. The base map for Figures 3 and 4 is the 1942 Uren Map.

The apparent Spring Hill shaft was identified at the approximate location depicted in the 1942 Uren map (see Figure 3), in line and to the northwest of the foundations labeled “bin”, “hoist” and “compressor”. Approximately 500 feet northeast of the Spring Hill shaft, H&K observed mounded soil, rock and wood debris that appeared to be a shaft that was backfilled or capped, possibly one of the shafts identified on the 1986 folio map. An apparent collapsed shaft, approximately 10 to 15 feet wide and open to a depth of 15 feet or greater, was identified approximately 400 feet southwest of the Spring Hill shaft. This is the approximate location of a feature on the 1942 Uren map that may be a vertical shaft. Our investigation did not include assessing the method or adequacy of physical shaft closure.

Several relic concrete foundations and concrete slabs were identified at the approximate locations of historic mining features depicted on the 1942 Uren map (bin, hoist, compressor, mill, machine shop, carpenter shop, dry, furnace, superintendent residence). No structures remain in these locations. The “bin” foundation (assumed to be for an ore bin), approximately 10 feet by 15 feet by 8 feet high, apparently served as an ore storage area between the Spring Hill shaft and the mill located to the southeast of the shaft. The mill foundation, located approximately 100 feet to the east of the bin foundation, was approximately 50 feet by 75 feet with concrete wall remnants up to 6 feet high.

Extensive surface exposures of mine waste were identified in the central and western portions of the site. Mine waste rock generally consisted of slightly to moderately weathered, mineralized serpentine and diabase rock with abundant quartz. The waste rock was generally coarse grained with variable amounts of sand and gravel. The waste rock was present in several benches extending down slope to the south and southwest of the knoll-top, the location of the former mill and superintendent's residence. There was some evidence of disturbance or removal of waste rock in the area of the bin foundation in post-mining times. Smaller mine waste rock stockpiles of similar consistency were observed in the area between the bin and compressor foundations. Scattered waste rock was observed at the perimeter of the larger, main stockpiles of mine waste rock in the central and western portion of the site.

Somewhat finer grained waste rock (silty sand and gravel with approximately 10 to 30 percent rock over 2 inches in diameter) was observed in the area surrounding the ore bin foundation.

Mill tailings, consisting of light grey, grayish green and olive-brown silt with fine sand, were observed in the central and western portions of the site (see Figure 4). The areas of observed tailings are down slope of the mill foundation. Two former "tailing ponds" were identified in this area.

A small volume of apparent near surface excavation spoils was observed in the eastern portion of the site, in the areas of samples EXP-1, S-3, S-4, S-5 and S-7 (see Figure 3). The spoils consisted of silty sand and fine gravel and appeared to be between approximately 50 and 100 cubic yards in volume.

A thin layer of fine to medium sand was identified next to the south side of the foundation labeled "dry" on the 1942 Uren map. The sand did not appear to be native soil and may have originated from past mining activities. The sand covered an area of approximately 25 feet by 50 feet and was observed to be up to 2 feet deep.

Mine waste was observed on approximately 6.5 acres of the 26.7-acre site.

4 APPARENT PROBLEM

Arsenic occurs naturally in soil and is commonly associated with hydrothermal alteration and gold-bearing veins. Mineralized rock was mined from gold-bearing veins beneath the site and transported to the site surface. Some of the mined rock was crushed and chemically processed to extract gold, the tailings of which remain at the site. Mine waste rock was deposited in stockpiles without being milled or processed. Both the mill tailings and mine waste rock contain arsenic and other metals at concentrations above site background concentrations, as well as typical background concentrations for the Grass Valley area. Elevated soil metals concentrations present a potential human health risk resulting from potential exposure pathways including incidental soil ingestion, inhalation of soil dust, and dermal contact. Figure 5 is a conceptual site model. In addition, the mining excavations present potential physical hazards and may not be suitable in their present state to support structural improvements.

5 ENVIRONMENTAL SETTING

A. Regional Physiographic Conditions

The site is situated in the Sierra Nevada physiographic province. Physiographic conditions consist of gently to moderately rolling terrain. Typical vegetation includes ponderosa and gray pines, black oak, manzanita, and ceanothus.

B. Geologic Setting

The property is located within a region underlain by a complex assemblage of igneous and metamorphic rocks in the western foothills of the Sierra Nevada. The regional structure of the foothills is characterized by the north-northwest trending Foothills Fault System, a feature formed during the Mesozoic era (between 65 million and 248 million years before present (MYBP)) in a compressional tectonic environment. A change to an extensional tectonic environment during the late Cenozoic (last nine million years) resulted in normal faulting which has occurred coincident with some segments of the older faults in the region.

C. Geologic Conditions

Based on the Geologic Map of the Grass Valley - Colfax Area (A. Tuminas, 1983), the site is mapped as serpentine rocks of the Early Mesozoic aged Ultramafic-Mafic "Basement" Unit of the Lake Combie Complex. According to the Mineral Land Classification of Nevada County (Special Report 164, California Department of Conservation Division of Mines and Geology, 1990), the site geology is mapped as the ultramafic unit of the Jurassic-aged Lake Combie Complex. The Mesozoic era occurred from approximately 245 to 65 million years ago. The Jurassic period occurred from approximately 206 to 144 million years ago.

The *Nevada City Special Folio, California* (United States Geologic Survey; 1896) depicts an east-west trending quartz vein passing through the central portion of the site. The vein apparently dips to the north.

D. Soil Conditions

The *Soil Survey of Nevada County, California, Western Part* (United States Department of Agriculture, Soil Conservation Service, August 1993) indicates that soil conditions across the majority of the site are mapped as rock outcrop of the Dubakella Complex, 5 to 50% slopes. The central portion of the site is mapped as "Placer

Diggings", although this classification is incorrect based on the identification of past hard rock gold mining in this area. A limited area in the eastern portion of the site is mapped as Sites loam, 9 to 15% slopes.

H&K excavated exploratory trenches through native soil at the site. Native soil was encountered at the ground surface in some trenches and at depth beneath waste rock and tailings in other trenches. The native soil generally consisted of clay, sandy clay and gravelly sandy clay. Severely to moderately weathered diabase and serpentine was encountered in several trenches beneath the clay in the central portion of the site. In the trenches where rock was encountered, the clay was observed to be up to 2.5 feet thick.

E. Groundwater Conditions

H&K reviewed well completion reports provided by the California Department of Water Resources (DWR) for wells in the site vicinity. The DWR information reviewed is summarized in Table 1.

The DWR well completion reports indicate that depths to first encountered groundwater ranged from 60 to 152 feet in wells constructed within 2000 feet of the site. A well at Spring Hill Manor convalescent hospital located approximately 300 feet west of the site is screened from 65 to 85 feet bgs (water level not reported). Based on the well completion reports, groundwater in the site vicinity is typically encountered within bedrock fractures.

Potential groundwater pathways include domestic consumption of groundwater and dermal contact with groundwater extracted from beneath the site or adjacent properties that is potentially impacted by mine waste. H&K's opinion is that the mine waste at the site does not present significant risk to groundwater quality, based on the following:

- H&K's subsurface investigation indicates that the mine waste stockpiles are typically underlain by at least two to three feet of native clayey soil.

- Total metals concentrations in samples of the native clayey soil beneath waste rock piles and tailings ponds and beneath tailings deposits near the mill, ranged from non-detect (using a reporting limit of 2.0 milligrams per kilogram (mg/kg)) to 18.3 mg/kg. For comparison, total arsenic concentrations in background/ambient soil samples obtained from the site ranged from non-detect (using a reporting limit of 1.0 mg/kg) to 17 mg/kg. Local background arsenic concentrations range from non-detect to 48 mg/kg, as discussed below in Section 5.G and Appendix A of this PEA report.

- The depth to usable groundwater in the site vicinity is approximately 60 feet based on DWR reports for domestic wells.

The proposed site development likely will not include construction of water supply wells because the site is within the city limits and domestic water is provided by a treated municipal source.

F. Surface Water Conditions

Surface water was not encountered on the site, although seasonal surface water flow associated with storm water runoff is expected in the lower (southern) portion of the site. According to the 7.5-minute Grass Valley Quadrangle Map (U.S. Geological Survey (USGS), provisional edition 1995), Wolf Creek is located approximately 500 feet south and down-gradient of the site.

Wolf Creek flows approximately 14 miles south of its location near the site into the Bear River near the southern border of Nevada County. The Bear River then flows approximately nine miles northwest into Camp Far West Reservoir and then approximately 17 miles southwest from Camp Far West Reservoir into the Feather River.

Potential surface water pathways include domestic consumption of surface water and dermal contact with surface water, on or down-gradient from the site, that is potentially impacted by the mine waste. H&K's opinion is that the mine waste at the site does not present significant risk to surface water quality, based on the distance to Wolf Creek and the relatively low soluble metals concentrations detected in the waste.

G. Regional Arsenic Concentrations in Background Soil

H&K compiled background soil arsenic data obtained from eight PEA sites (including the subject site) near Grass Valley, California. The local PEA sites include Spring Hill, North Star, Kenny Ranch, Winds Aloft, Osborne Hill, Loma Rica, La Barr Meadows and Bear River Mill. The locations of the above-listed sites with respect to the subject site are depicted on Figure 1 of Appendix A. Background arsenic concentrations are presented in Table 1 of Appendix A. With the exception of the subject site, DTSC has reviewed and approved the PEAs from which the background data were obtained.

The 208 local background arsenic concentrations range from non-detect to 48 mg/kg. The mean is 5.3 mg/kg, the standard deviation is 6.9 mg/kg and the coefficient of variation (CV) is 1.3. Descriptive statistics for the non-transformed and base 10 log-transformed data are presented in Tables 2 and 3, respectively, of Appendix A.

DTSC (1997, 2007) provides a framework in which risk assessors may identify background arsenic concentrations. Based on these guidance documents, H&K performed visual and statistical evaluation of the local background arsenic data as described below.

Microsoft Excel Analyze-it™ version 1.73 was used to prepare normality plots of the non-transformed and log-transformed data. The plots are presented in Appendix A. The non-transformed data are clearly not normal, as is often the case with trace metals. Although the log-transformed data generally display a linear distribution, the data are not normally distributed based on the Shapiro-Wilk normality test. The CV (1.29), as well as gaps and inflections observed in the log-transformed data, attest to the fact that the data were obtained from different sites and different geologic units.

With the exception of the Winds Aloft site, the eight local PEA sites share similar geology. Published geologic descriptions generally indicate that the sites are underlain by quartz diorite, diabase and/or ultramafic rock, as plotted on the QAP diagram presented as Figure 2 in Appendix A. The QAP in figure 2 is a simplified depiction of the compositional ratio of quartz (Q), alkali feldspar (A), and plagioclase feldspar (P) in igneous plutonic rocks found at seven of the eight local PEA sites. Specific geologic descriptions are presented in Table 4 of Appendix A.

Outlying data were evaluated using the fourth spread procedure described by DTSC (2007). The fourth spread, f_s, is defined as the measure of spread in a data set that is resistant to outliers and is calculated according to the following equation: $f_s = Q_3 - Q_1$. By definition, any observation farther than $1.5f_s$ from the closest fourth is considered an outlier. For the log-transformed data set, $1.5f_s$ is equal to 1.25, and any observation below $Q_1 - 1.5f_s$ or above $Q_3 + 1.5f_s$ would be considered an outlier. By this method, none of the data were determined to be outliers.

The 95th percentile value for the local background arsenic data set is 17 mg/kg. This value is conservatively used to represent the local upper bound background soil arsenic concentration.

6 SAMPLING, ANALYSIS, AND RESULTS

A. Summary of Activities

1. 2003 and 2005 Sampling and Analysis

Near-Surface Soil Sampling

H&K obtained 42 samples of near-surface soil and mine waste in May 2003 and October 2005. Figure 3 shows the sample locations. Sampling was conducted as follows:

- Six background soil samples (BG-1 through BG-6) were obtained from surface soil in areas up slope and to the east, northeast and northwest of identified mine waste at the site.

- Eleven soil samples of mine waste rock and near-surface excavation spoils (EXP-1, FND-1, FND-2, FND-S3, FND-S4, FND-S5, FND-S6, SND-S1, WR1-S1, WR1-S2 and WR1-S3) were obtained from depths of 0 to 3.0 feet below ground surface (bgs) at the eastern and central portion of the site.

- Twenty-one soil samples of mine waste rock and tailings (WR-S1 through WR-S21) were obtained from depths of 0 to 2.0 feet bgs at the western and central portion of the site.

- Four samples of apparent mill tailings (SM-S1 through SM-S4) were obtained from depths of 0 to 2.0 feet bgs at the western portion of the site.

Sample Analysis

The samples from 2003 and 2005 were analyzed for total arsenic, lead and mercury (except the three background samples from 2005, which were not tested for mercury) using EPA Methods 6010B and 7471A. Three samples of mine waste rock obtained in October 2005 (FND-S5, WR-S13 and WR-S17) were analyzed for seventeen Title 22 metals using EPA Methods 6010B and 7471A. Four samples of apparent mill tailings (SM-S1 through SM-S4) were analyzed for cyanide using Standard Method 4500.

Two samples of mine waste rock obtained in October 2005 (FND-S5 and WR-S17) were analyzed for acid generating potential (AGP) and neutralizing potential (NP), using the Sobek method, and pH.

Based on acid-base accounting and total metals results, three samples of mine waste obtained in October 2005 (WR-17, FND-S5 and FND-S6) were analyzed for soluble arsenic, lead and nickel by the Title 22 Waste Extraction Test (WET) using deionized water as the extractant solution (DI-WET). One sample from the 2003 investigation (FND-1) was analyzed for soluble lead and arsenic by the standard WET test using a citrate solution as the extractant.

2. 2007 Sampling and Analysis

Near-Surface Soil Sampling

On March 22, March 23, April 5 and April 18, 2007 H&K obtained 13 near-surface soil samples (S-1 through S-13) from various locations of the site. The near-surface soil samples were obtained at depths of 0.25 feet and 0.5 feet bgs.

- Samples S-1 and S-8 were obtained from the area of the former furnace building (S-1 from the concrete floor and S-8 from just outside the foundation at what appeared to be a doorway).

- Sample S-2 was obtained from the area of the former garage of the superintendent's house.

- Samples S-3, S-4, S-5, S-6 and S-7 were obtained from apparent mining excavation soil/waste rock piles.

- Samples S-9, S-10 and S-11 were obtained from the area near the northeast corner of the former mill (S-9 and S-10 were from outside the mill foundation and S-11 was from the concrete floor from inside the mill).

- Samples S-12 and S-13 were ambient soil samples obtained from areas up slope and to the north of identified mine waste at the site (areas apparently not impacted by former mining activities).

Subsurface Investigation and Soil Sampling

On March 13, March 14 and April 5, 2007, H&K obtained subsurface soil samples. Thirty-one test pits (TP-1 through TP-31) were excavated for obtaining soil samples, and for observing subsurface conditions and depths of mine waste piles. Figure 3 shows the approximate test pit locations.

Test pits were excavated at the following locations:

- Waste Rock/Spoils Piles - TP-1, TP-2, TP-3, TP-6, TP-7, TP-8, TP-9, TP-10, TP-13, TP-14, TP-16 (waste rock/tailings contact), TP-26, TP-27 (tailings over waste rock), and TP-31

- Tailings Deposits - TP-4, TP-5, TP-15, TP-16 (waste rock/tailings contact), TP-17, TP-27 (tailings over waste rock), TP-28, TP-29, and TP-30

- South/Up Slope Side of Mill - TP-11 and TP-12

- North/Down Slope Side of Mill - TP-18 through TP-25

Sample Analysis

The samples from 2007, except for background samples S-12 and S-13, were analyzed for total arsenic, total lead, total mercury and total nickel using EPA Methods 6010B and 7471A. Sample S-12 and S-13 analysis did not include mercury. Thirteen of the test pit soil samples analyzed included native soil samples from beneath the waste rock piles and tailings deposits, and subsurface soil in the mill area. The samples include TP-2-10, TP-5-19, TP-10-12, TP-13-4, TP-14-2, TP-15-6, TP-16-1B, TP-18-1, TP-20-1, TP-21-1.5, TP-22-0.75, TP-23-0.75 and TP-24-0.25.

Selected samples were also analyzed for other metals and selected soluble metals. Six of the samples were analyzed for seventeen Title 22 metals using EPA Methods 6010B and 7471A. Two of the samples were analyzed for AGP and NP using the Sobek method, and pH. Nine samples were analyzed for total cyanide using EPA Method 9014. Twelve samples were analyzed for total nitrate using EPA Method 300.0. Seventeen samples were analyzed for soluble arsenic, lead and nickel by DI-WET followed by EPA Method 6010B. Six of the samples for were also analyzed for soluble mercury by DI-WET followed by EPA Method 7471A.

3. Sample Collection and Handling Methods

Near-surface samples were collected using hand tools and subsurface samples were collected using the excavator and hand tools. The soil samples were placed in four-ounce glass containers provided by the project laboratory. The sample containers were sealed with Teflon-lined plastic caps, labeled with project site, sample number, sampling date and time, and placed in a chilled, thermally insulated cooler for transportation to the project laboratory. Sampling equipment was cleaned between sampling points using disposable towelettes to remove soil.

The soil samples were transported under chain-of-custody protocol to Excelchem Environmental Labs (Excelchem) of Rocklin, California. Excelchem is a state certified analytical laboratory for the analysis requested.

B. Presentation of Data

Tables 2 through 6 summarize the laboratory analytical results of soil samples. Table 2 summarizes metals and inorganic analysis results. Table 3 summarizes metal results for background soil samples. Table 4 summarizes Title 22 metals analysis results. Table 5 summarizes metals solubility analysis results. Table 6 summarizes acid-base accounting results. Appendix B presents the laboratory reports and chain of custody documentation.

C. Discussion of Results

1. Total Metals Results

<u>Mine Waste Rock and Spoils Piles</u>

For samples obtained from waste rock and spoils piles, the laboratory reported arsenic concentrations ranging from non-detect (using reporting limits of either 1.0 or 2.0 mg/kg) to a concentration 180 mg/kg. Lead concentrations ranged from non-detect (using a reporting limit of 2.0 mg/kg) to 310 mg/kg. Mercury concentrations ranged from non-detect (using a reporting limit of 0.10 mg/kg) to 1.2 mg/kg. Nickel concentrations ranged from 96.3 to 1,290 mg/kg.

Tailings

For samples obtained from tailings deposits, the laboratory reported arsenic concentrations ranging from non-detect (using a reporting limit of 2.0 mg/kg) to 94.6 mg/kg. Lead concentrations ranged from 2.6 to 20.8 mg/kg. Mercury concentrations ranged from 0.023 to 19.5 mg/kg. Nickel concentrations ranged from 197 to 768 mg/kg.

South/Up Slope Side of Mill

For soil samples obtained from the south/up-slope side of the mill, arsenic concentrations ranged from 3.5 to 10.2 mg/kg. Lead concentrations ranged from 15.3 to 71.8 mg/kg. Mercury concentrations ranged from 0.06 to 0.432 mg/kg. Nickel concentrations ranged from 85.8 to 398 mg/kg.

North/Down Slope Side of Mill

For soil samples obtained from the north/down slope side of the mill, the laboratory reported arsenic concentrations ranging from non-detect (using a reporting limit of 1.0 mg/kg) to 579 mg/kg. Lead concentrations ranged from non-detect (using a reporting limit of 1.0 mg/kg) to 810 mg/kg. Mercury concentrations ranged from 0.039 to 22.5 mg/kg. Nickel concentrations ranged from 104 to 739 mg/kg.

Furnace Building Foundation

For soil samples obtained from the concrete floor and adjacent to the foundation of the former furnace building, arsenic concentrations ranged from 25.5 to 33.2 mg/kg. Lead concentrations ranged from 300 to 376 mg/kg. Mercury concentrations ranged from 0.059 to 0.507 mg/kg. Nickel concentrations ranged from 685 to 1,180 mg/kg.

Native Soil from the Subsurface

For the 13 native soil samples from beneath the waste rock piles and tailings deposits, and subsurface soil in the mill area, arsenic concentrations ranged from non-detect (using a reporting limit of 2.0 mg/kg) to 18.3 mg/kg. Lead concentrations ranged from non-detect (using a reporting limit of 2.0 mg/kg) to 70.2 mg/kg. Mercury concentrations ranged from 0.014 to 8.38 mg/kg. Nickel concentrations ranged from 96.3 to 940 mg/kg.

The analytical results indicate that total arsenic, lead, and mercury were detected in the samples at concentrations exceeding background levels. With the exception of arsenic, sample concentrations did not exceed the commercial/industrial California Human Health Screening Levels (CHHSLs). Table 4 lists residential and commercial/industrial CHHSLs.

Mine waste and soil samples obtained from the area surrounding the ore bin foundation and near the north side of the mill had significantly higher arsenic and lead concentrations than samples from other areas of the site.

2. Acid-Base Accounting Results

Acid-base accounting results of the waste rock/spoils pile samples FND-S5, WR-S17 and TP-8-6 indicated that the AGP was 1.9,2.5 and13 tons per 1000 tons respectively, the NP was180, 150 and 250 tons per 1000 tons respectively, the pH was relatively high at 9.14, 9.54 and 9.42 respectively, and the calculated NP/AGP ratio was 94.7, 60.0 and19.2 respectively. Acid-base accounting results of the tailing sample TP-17-4 indicated that the AGP was non-detect with a reporting limit of 0.3 tons per 1000 tons, the NP was 320 tons per 1000 tons, the pH was relatively high at 9.77, and the calculated NP/AGP ratio was 1066.7. The calculated NP/AGP ratios were significantly higher than the benchmark NP/AGP ratio of 3, indicating net neutralizing conditions in the waste.

Results of acid-base accounting and pH testing indicated that the mine waste is acid neutralizing (consistent with historical documents for the site that indicate the presence of carbonate minerals in the ore body). These results support the use of the DI-WET method for metals solubility testing of mine waste that is proposed to be left on-site.

3. Soluble Metals Results

Arsenic

Eighteen samples of mine waste rock and tailings (and one duplicate sample) were analyzed for soluble arsenic by DI-WET. Soluble arsenic concentrations ranged from below a reporting limit of 2.0 µg/L to 44.7 µg/L. Arsenic was not detected in eight of the 18 samples above reporting limits ranging from 2 to 10 µg/L. The sample (TP-5-10) having the highest soluble arsenic detection (44.7 µg/L) was re-analyzed, resulting in no soluble arsenic detected above a reporting limit of 2.0 µg/L. Two background soil samples were analyzed for soluble arsenic by DI-WET. Soluble arsenic was detected in one of the samples at 18.6 μg/L, and was not detected in the other above a reporting limit of 10 μg/L.

Lead

Eighteen samples of mine waste rock and tailings (and one duplicate analysis) were analyzed for soluble lead by DI-WET. Soluble lead concentrations ranged from less than 1.2 μg/L to 11.6 μg/L. Soluble lead was not detected in 13 of the 18 samples above reporting limits ranging from 1.2 to 10 μg/L. Two background soil samples were analyzed for soluble lead by DI-WET. Soluble lead was not detected in either of the samples above a reporting limit of 6 μg/L.

Mercury

Six samples of mine waste rock and tailings were analyzed for soluble mercury by DI-WET. Soluble mercury was not detected above a laboratory reporting limit of 0.333 μg/L.

Nickel

Seventeen samples of mine waste rock and tailings (and one duplicate sample) were analyzed for soluble nickel by DI-WET. Soluble nickel concentrations ranged from 2.3 to 48.1 μg/L. Nickel was not detected in five of the 17 samples above a reporting limit of 10 μg/L. Two background soil samples were analyzed for soluble nickel by DI-WET. Soluble nickel was detected in the samples at 58.5 and 26.2 μg/L

Solubility testing of a discrete sample of mine waste from the bin foundation area (FND-1) by the citrate WET method detected soluble lead at 13 milligrams per liter (mg/L), which exceeds the soluble threshold limit concentration (STLC) of 5 mg/L for lead. Citrate WET results and STLCs are levels used to characterize waste for landfill disposal purposes.

D. Data Validation

The quality of the chemical data reported by Excelchem was assessed from the results of internal laboratory spike, method blank and duplicate analysis. The internal laboratory spike, method blank and duplicate data were within acceptable recovery limits and/or were accepted based on acceptable laboratory control sample recovery according to Excelchem. The samples were also analyzed within U.S. EPA holding times.

7 HUMAN HEALTH SCREENING EVALUATION

The human health screening evaluation considers excess lifetime cancer risk and chronic health hazard associated with inorganic metals in site soil. The evaluation was performed in accordance with DTSC's PEA Guidance Manual (1999). As discussed under the heading "Risk Characterization", exposure parameters set forth in the Guidance Manual were modified based on U.S. EPA (2002 and 2004) and OEHHA (2004). This evaluation considers data obtained during the 2007 investigation, as well as data obtained during the 2003 and 2005 investigations.

H&K's investigation addresses the occurrence of Title 22 metals. Metals such as arsenic and lead occur naturally in soil and rock, and are often present at elevated concentrations in mine waste based on the natural concentration of the metals within mineralized veins, as well as the concentration and liberation that may occur during the processing of ore.

Selected soil samples were analyzed for cyanide and nitrate. Cyanide is believed to have been used near the mill site as part of the gold extraction process, and nitrate is a breakdown product of cyanide.

Table 2 summarizes analytical results for total arsenic, lead, mercury, nickel, cyanide and nitrate. Ninety-two samples of mine waste rock, tailings and associated soil were analyzed for total arsenic, lead and mercury. Fifty-six samples were analyzed for total nickel, thirteen were analyzed for total cyanide, and twelve were analyzed for total nitrate.

Table 3 presents total arsenic, lead, mercury and nickel concentrations in background soil. Eight background soil samples were analyzed for total arsenic and lead, three were analyzed for total mercury, and two were analyzed for total nickel.

Table 4 summarizes results of seventeen Title 22 metals analyses. Nine soil samples (all from mine waste rock or tailings assessment areas) were analyzed for seventeen Title 22 metals, and one of the samples was analyzed for hexavalent chromium.

A. Exposure Pathways and Media of Concern

Exposure media for the site are soil and air. Exposure pathways are incidental ingestion and dermal contact with the affected soil, and inhalation of particulates originating from the affected soil. A conceptual site model is presented as Figure 5.

Groundwater and surface water pathways are not considered in the risk assessment based on the low concentrations of soluble metals detected and the observed attenuation of metals in clayey native soil beneath the waste. The proposed commercial site development is to be provided with municipal water and sewer.

The data suggest that arsenic, lead, mercury and other metals occur in the mine waste rock and tailings at concentrations exceeding background levels. Per DTSC (1999) the metals are considered constituents of potential concern (COPCs). Arsenic concentrations typically exceeded the CHHSL (0.24 mg/kg) for industrial soil.

B. Exposure Point Concentrations and Chemical

Exposure point concentrations are summarized in Tables 1a, 1b and 1c of Appendix C. For data sets having a population greater than seven, the reasonable maximum exposure (RME) concentration was considered using the 95 percent upper confidence limit (UCL), as calculated by ProUCL Version 3.0 (U.S. EPA, 2004). Appendix C presents the ProUCL "General Statistics" summary sheets.

The data are grouped into three sets:

1. the area immediately adjacent to and down slope from the Former Mill Area,

2. the mine waste rock and tailings areas located on the remainder of the site, excluding the Former Mill Area, and

3. background soil apparently not impacted by past mining and processing activities.

These data sets are described below.

1. Former Mill Area

For this evaluation, data associated with twelve soil samples (FDN-1, FDN-2, FDN-S3, S-1, S-10, TP-18-0.25, TP-20-0.25, TP-20-1.0, TP-21-0.75, TP-22-0.25, TP-23-0.25, and S-11) obtained in the immediate vicinity of the Former Mill Area were culled from the site-wide data sets and evaluated separately. H&K anticipates that the mine waste and affected soil at these areas will be removed from the site and disposed at an appropriate solid waste facility. Arsenic, lead and mercury were detected at concentrations ranging up to 579, 810 and 19.5 mg/kg, respectively, in soil near the mill area. Exposure Point Concentrations (EPCs) for the Former Mill Area are summarized below and presented in Table 1a of Appendix C.

Antimony

Concentrations range from 4.3 to 12.4 mg/kg in the three samples analyzed for antimony. The maximum detection (12.4 mg/kg) is used as the EPC.

Arsenic

Concentrations range from less than 1 to 579 mg/kg. The mean arsenic detection is 153 mg/kg in the 12 samples analyzed for arsenic. ProUCL determines that the data follow gamma distribution and recommends the use of the Approximate Gamma UCL (348 mg/kg), which is used as the EPC.

Barium

Concentrations range from 44.3 to 103 mg/kg in the three samples analyzed for barium. The maximum detection (103 mg/kg) is used as the EPC.

Beryllium

Beryllium was not detected above a laboratory reporting limit of 0.5 mg/kg in the three samples analyzed for beryllium.

Cadmium

Concentrations range from 2.3 to 3.4 mg/kg in the three samples analyzed for cadmium. The maximum detection (3.4 mg/kg) is used as the EPC.

Chromium

Concentrations range from 43.2 to 962 mg/kg in the three samples analyzed for total chromium. The maximum detection (962 mg/kg) is used as the EPC.

Cobalt

Concentrations range from 21.4 to 79.4 mg/kg in the three samples analyzed for cobalt. The maximum detection (79.4 mg/kg) is used as the EPC.

Copper

Concentrations range from 72 to 467 mg/kg in the three samples analyzed for copper. The maximum detection (467 mg/kg) is used as the EPC.

Lead

Concentrations range from 18.4 to 810 mg/kg. The mean lead detection is 213 mg/kg in the 12 samples analyzed for lead. ProUCL determines that the data follow gamma distribution and recommends the use of the Approximate Gamma UCL (408 mg/kg), which is used as the EPC.

Mercury

Concentrations range from 0.059 to 19.5 mg/kg. The mean mercury detection is 4 mg/kg in the 12 samples analyzed for mercury. ProUCL determines that the data follow gamma distribution and recommends the use of the Approximate Gamma UCL (10.1 mg/kg), which is used as the EPC.

Molybdenum

Concentrations range from 1.1 to 3.7 mg/kg in the three samples analyzed for molybdenum. The maximum detection (3.7 mg/kg) is used as the EPC.

Nickel

Concentrations range from 104 to 1180 mg/kg. The mean nickel detection was 391 mg/kg in the 9 samples analyzed for nickel. ProUCL determined that the data follow gamma distribution and recommended the use of the Approximate Gamma UCL (640 mg/kg).

Selenium

Selenium was not detected above a laboratory reporting limit of 2.0 mg/kg in the three samples analyzed.

Silver

Concentrations range from less than 2 to 21.8 mg/kg in the three samples analyzed for silver. The maximum detection (21.8 mg/kg) is used as the EPC.

Thallium

Thallium was not detected above a laboratory reporting limit of 2.0 mg/kg in the three samples analyzed.

Vanadium

Concentrations range from 47.4 to 948 mg/kg in the three samples analyzed for vanadium. The maximum detection (948 mg/kg) is used as the EPC.

Zinc

Concentrations range from 129 to 318 mg/kg in the three samples analyzed for zinc. The maximum detection (318 mg/kg) is used as the EPC.

2. Mine Waste Rock and Tailings

Data pertaining to the mine waste rock and tailings, excluding the twelve samples of impacted soil near the mill site, are summarized below. EPCs are presented in Table 1b of Appendix C.

Antimony

Concentrations range from 5.0 to 12.2 mg/kg and average 7.9 mg/kg in the six samples analyzed for antimony. The maximum detection (12.2 mg/kg) is used as the EPC.

Arsenic

Concentrations range from less than 1.0 to 94.6 mg/kg. The mean arsenic detection is 9.1 mg/kg in the 86 samples analyzed for arsenic. ProUCL determines that the data are non-parametric and recommends the use of the 97.5% Chebyshev (Mean, Sd) UCL (21.9 mg/kg), which is used as the EPC.

Barium

Concentrations range from 4.0 to 12.5 mg/kg and average 8.3 mg/kg in the six samples analyzed for barium. The maximum detection (12.5 mg/kg) is used as the EPC.

Beryllium

Beryllium was not detected above a laboratory reporting limit of 0.5 mg/kg in the six samples analyzed for beryllium.

Cadmium

Concentrations range from 0.7 to 1.5 mg/kg and average 1.1 mg/kg in the six samples analyzed for cadmium. The maximum detection (1.5 mg/kg) is used as the EPC.

Chromium

Concentrations range from 20.8 to 60.4 mg/kg and average 38 mg/kg in the six samples analyzed for total chromium. The maximum detection (60.4 mg/kg) is used as the EPC.

Hexavalent Chromium

Hexavalent chromium was not detected above a laboratory reporting limit of 0.001 mg/kg in the one sample analyzed for hexavalent chromium.

Cobalt

Concentrations range from 13.1 to 56.3 mg/kg and average 37.8 mg/kg in the six samples analyzed for cobalt. The maximum detection (56.3 mg/kg) is used as the EPC.

Copper

Concentrations range from 11.0 to 94.2 mg/kg and average 36.3 mg/kg in the six samples analyzed for copper. The maximum detection (94.2 mg/kg) is used as the EPC.

Cyanide and Nitrate

Thirteen soil samples were analyzed for cyanide, and twelve soil samples were analyzed for total nitrate. Neither cyanide nor nitrate was detected in the samples. Laboratory reporting limits ranged from 0.25 to 1.0 mg/kg for cyanide, and the reporting limit for nitrate was 0.5 mg/kg.

Lead

Concentrations range from below a reporting limit of 1.0 to 341 mg/kg. The mean lead detection is 19.8 mg/kg in the 86 samples analyzed for lead. ProUCL determines that the data are non-parametric and recommends the use of the 97.5% Chebyshev (Mean, Sd) UCL (36.1 mg/kg), which is used as the EPC.

Mercury

Concentrations range from below a reporting limit of 0.01 to 1.29 mg/kg. The mean mercury detection is 0.18 mg/kg in the 86 samples analyzed for mercury. ProUCL determines that the data follow gamma distribution and recommends the use of the Approximate Gamma UCL (0.22 mg/kg), which is used as the EPC.

Molybdenum

Molybdenum was not detected above a laboratory reporting limit of 1.0 mg/kg in the six samples analyzed.

Nickel

Concentrations range from 85.8 to 1290 mg/kg. The mean nickel detection is 402 mg/kg in the 53 samples analyzed for nickel. ProUCL determines that the data follow gamma distribution and recommends the use of the Approximate Gamma UCL (466 mg/kg), which is used as the EPC.

Selenium

Selenium was not detected above a laboratory reporting limit of 2.0 mg/kg in the six samples analyzed.

Silver

Silver was not detected above a laboratory reporting limit of 2.0 mg/kg in the six samples analyzed.

Thallium

Thallium was not detected above a laboratory reporting limit of 2.0 mg/kg in the six samples analyzed.

Vanadium

Concentrations range from 16.6 to 54.6 mg/kg and average 32 mg/kg in the six samples analyzed for vanadium. The maximum detection (54.6 mg/kg) is used as the EPC.

Zinc

Concentrations range from 17.7 to 38.4 mg/kg and average 26.7 mg/kg in the six samples analyzed for zinc. The maximum detection (38.4 mg/kg) is used as the EPC.

3. Background Soil

EPCs are presented in Table 1c of Appendix C.

Arsenic

Arsenic was not detected above a reporting limit of 1.0 mg/kg in seven of the eight background soil samples analyzed for arsenic, and was detected at a concentration of 17 mg/kg in the remaining background sample. The mean detection (2.6 mg/kg) is used as the EPC. The mean detection was calculated using a value equal to half of the laboratory reporting limit for non-detections.

Lead

Lead was detected at concentrations ranging from 3.1 to 20.4 mg/kg in the eight background soil samples analyzed for lead. ProUCL determined that the background lead data are normal and recommended the use of the Student's-t UCL (13.7 mg/kg), which is used as the EPC.

Mercury

Mercury was detected at concentrations ranging from 0.066 to 0.14 mg/kg in the three background soil samples analyzed for mercury. The average detected concentration (0.09 mg/kg) is used as the EPC.

Nickel

Nickel was detected at concentrations of 1620 and 1680 mg/kg in the two background soil samples analyzed for nickel. The mean detection (1650 mg/kg) is used as the EPC.

C. Toxicity Values

Table 2 of Appendix C presents the toxicity values.

D. Risk Characterization

1. Standard Exposure Scenario

Risk and hazard calculations are performed under the standard exposure scenario using the following equations, which are based on Figures 5 through 8 of DTSC's PEA Guidance Manual (1999). Hazard is evaluated for child exposure. Exposure parameters are listed in Tables 3 through 5 of Appendix C.

$$Risk_{soil} = SF_o \times C_s \times [((IR_{s,child} \times EF \times ED_{child} \times 10^{-6}\ kg/mg) / (BW_{child} \times AT \times 365\ days/yr))+((SA_{child} \times AF \times ABS \times EF_{child} \times ED_{child} \times 10^{-6}\ kg/mg) / (BW_{child} \times AT \times 365\ days/yr)) +((IR_{s,adult} \times EF \times ED_{adult} \times 10^{-6}\ kg/mg)/(BW_{adult} \times AT \times 365\ days/yr)) + ((SA_{adult} \times AF \times ABS \times EF_{adult} \times ED_{adult} \times 10^{-6}\ kg/mg) / (BW_{adult} \times AT \times 365\ days/yr))]$$

$$Hazard_{soil} = (C_s / RfD_o) \times [((IR_s \times EF \times ED \times 10^{-6}\ kg/mg) / (BW \times AT \times 356\ days/yr)) + ((SA \times AF \times ABS \times EF \times ED \times 10^{-6}\ kg/mg) / (BW \times AT \times 365\ days/yr))]$$

$$Risk_{air} = SF_i \times C_a \times [((IR_{child} \times EF \times ED_{child}) / (BW_{child} \times AT \times 365\ days/yr))+ ((IR_{adult} \times EF \times ED_{adult}) / (BW_{adult} \times AT \times 365\ days/yr))]$$

$$Hazard_{air} = (C_a / RfD_i) \times (IR \times EF \times ED) / (BW \times AT \times 365\ days/yr)$$

Where:
ABS = absorption fraction of chemical from soil
AT = averaging time, 70 yr
AF = soil to skin adherence factor, mg/cm^2
BW = body weight, 70 kg adult, 15 kg child

C_a = concentration in air, mg/m^3 ($C_a = C_s$ / PEF)
C_s = concentration in soil, mg/kg
ED = exposure duration, years
EF = exposure frequency
ET = dermal exposure time for water, 0.14 hr/day child, 0.25 hr/day adult
$Hazard_{air}$ = non-cancer chronic health hazard for air pathways
$Hazard_{soil}$ = non-cancer chronic health hazard for soil pathways
IR_a = inhalation rate, 10 m^3/day child, 20 m^3/day adult
IR_s = incidental soil ingestion rate, 20 mg/day child, 100 mg/day adult
SA = exposed skin surface area, 2800 cm^2 child, 5700 cm^2 adult
SF_i = inhalation cancer slope factor, (mg/kg-day)$^{-1}$
SF_o = oral cancer slope factor, (mg/kg-day)$^{-1}$
RfD_i = inhalation reference dose, mg/kg-day
RfD_o = oral reference dose, mg/kg-day
$Risk_{air}$ = lifetime excess cancer risk for air pathways
$Risk_{soil}$ = lifetime excess cancer risk for soil pathways

Exposure parameters are adopted from the PEA Guidance Manual with the following updates:

- Exposure duration for adults is 30 years, per *Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil* (OEHHA, November 2004, revised January 2005).

- Exposed skin surface area is 2800 square centimeters (cm^2) for children and 5700 cm^2 for adults, per *Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil* (OEHHA, November 2004, revised January 2005).

- Adherence factor is 0.2 mg/cm^2 per *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final* (U.S. EPA, OSWER 9285.7-02EP, July 2004).

- Particulate emission factor is 1.36 x 10^9 cubic meters per kilogram (m^3/kg), per *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (U.S. EPA, OSWER 9355.4-24, December 2002).

2. Commercial Indoor Worker Exposure Scenario

Human health risk and hazard are assessed under a commercial indoor worker scenario using the formulae set forth above for the standard scenario and the exposure parameters listed in Tables 6 and 7 of Appendix C.

3. Construction Worker Exposure Scenario

Human health risk and hazard are assessed under a construction worker scenario using the formulae set forth above for the standard scenario and the exposure parameters listed in Tables 8 and 9 of Appendix C.

4. Risk Characterization Summary

Results of the human health risk assessment are summarized in Table 10 of Appendix C and are discussed below. In general, soil arsenic concentrations govern the calculated chronic human health hazard and excess lifetime cancer risk.

Antimony, vanadium and other metals also contribute to the chronic human health hazard, although the critical health effects vary from metal to metal. For example, the U.S. EPA Integrated Risk Information System (IRIS) website (http://www.epa.gov/iris/) cites the following critical chronic health effects from oral exposure:

- Arsenic: hyperpigmentation (darkening of an area of skin or nails caused by increased melanin), keratosis (growth of keratin (fibrous structural proteins) on the skin, and possible vascular complications
- Antimony: longevity, blood glucose and cholesterol
- Vanadium (as vanadium pentoxide): decreased hair cystine (an amino acid)

This screening evaluation does not differentiate chronic health hazards by critical health effect, but instead conservatively considers the aggregate hazard index irrespective of critical health effect.

For the purposes of this screening evaluation, all detected metals which exceed site background concentrations are considered COPCs. Nickel is not considered a COPC based on a comparison to background data. Additional background metals testing may demonstrate that other metals, such as vanadium, also occur in mine waste rock and tailings within the range of site background concentrations and therefore may be excluded from the risk assessment. However, such metals are included in the absence of background data.

Former Mill Area

Waste and affected soil in the former mill area present a chronic human health hazard and lifetime excess cancer risk under the standard exposure scenario which are not suitable for unrestricted land use. Table 3 in Appendix C summarizes the hazard and risk for the standard exposure scenario. The hazard index and risk under the standard exposure scenario are 3.E+01 and 6.E-03, respectively. The arsenic hazard quotient is 2.E+01, and the arsenic risk is 6.E-03.

Waste at the former mill area presents an unacceptable risk under the commercial indoor worker scenario. Table 6 in Appendix C summarizes the hazard and risk for the commercial indoor worker scenario. The hazard index and risk under the commercial indoor worker scenario are 1.E+00 and 8.E-04, respectively. The arsenic hazard quotient is 8.E-01, and the arsenic risk is 8.E-04.

Waste at the former mill area presents unacceptable hazard and risk under the construction worker scenario. Table 8 in Appendix C summarizes the hazard and risk for the construction worker scenario. The hazard index and risk under the construction worker scenario are 9.E+00 and 2.E-04, respectively. The arsenic hazard quotient is 5.E+00, and the arsenic risk is 2.E-04.

Mine Waste Rock and Tailings (excluding Former Mill Area)

Table 4 in Appendix C summarizes the hazard and risk for the standard exposure scenario. Mine waste rock and tailings (excluding the Former Mill Area) present a chronic human health hazard (2.E+00) and lifetime excess cancer risk (3.E-04) under the standard exposure scenario which are not suitable for unrestricted land use. The arsenic hazard quotient is 1.E+00, and the arsenic risk is 3.E-04.

Table 7 in Appendix C summarizes the hazard and risk for the commercial indoor worker scenario. Hazard and risk under the commercial indoor worker scenario are 1.E-01 and 5.E-05, respectively. The hazard is less than the benchmark value of 1, and the risk falls between the lower (1.E-06) and upper (1.E-04) benchmark values for risk management decision-making. The arsenic hazard quotient is 5.E-02, and the arsenic risk is 5.E-05.

Table 9 in Appendix C summarizes the hazard and risk for the construction worker scenario. Hazard and risk under the construction worker scenario are 7.E-01 and 1.E-05, respectively. The hazard is less than the benchmark value of 1, and the risk falls between the lower and upper benchmark risk values. The arsenic hazard quotient is 3.E-01, and the arsenic risk is 1.E-05.

Background Soil

Table 5 in Appendix C summarizes the hazard and risk for background soil under the standard (unrestricted land use) exposure scenario. Hazard and risk for background soil under the standard exposure scenario are 1.E-01 and 4.E-05, respectively. Arsenic is the primary contributor to risk, with a hazard quotient of 1.E-01 and a risk of 4.E-05.

The range of arsenic concentrations detected in background soil at the site is consistent with the range of arsenic concentrations in local background soil, as discussed in Section 5.G and Appendix A of this PEA report. Arsenic occurs naturally in soil as a result of the weathering of rocks and minerals. Low concentrations of arsenic are present in almost all foods and drinking water, which are the primary sources of human exposure (OEHHA 2004). The natural occurrence of arsenic in soil, water and food presents a human health risk that typically exceeds one per million.

5. Lead Risk Assessment

Lead hazards were evaluated using the *Lead Risk Assessment Spreadsheet Version 7* (DTSC) for the standard exposure scenario. Table 11 of Appendix C summarizes the lead risk assessment results. Calculations were performed using UCL values for lead in the Former Mill Area (408 mg/kg), Waste Rock and Tailings (excluding the Former Mill Area; 36.1 mg/kg), and background soil (13.7 mg/kg). The resulting 99th percentile blood lead levels for non-pica child are 19.9, 5.8 and 5.0 micrograms per deciliter (µg/dL), respectively. The resulting 99th percentile blood lead levels for an adult are 7.3, 3.7 and 3.4 µg/dL, respectively. The calculated value for the Former Mill Area exceeds the benchmark blood lead concentration of 10 µg/dL and is not acceptable for unrestricted use. The calculated values for Waste Rock and Tailings (excluding the Former Mill Area) and background soil are below the benchmark blood lead concentration. Appendix C presents the lead risk assessment calculation spreadsheets.

6. Uncertainty

Per OEHHA (2004), "systematic, logical and informed approaches to decision making about carcinogens in the environment call for quantitative assessments, because the absence of clearly definable thresholds does not permit identification of 'safe' levels of exposure. Unfortunately, due to the frequent lack of sufficient data, assumptions have to be made in order to complete quantitative assessments of cancer risk."

There are uncertainties associated with metals content of waste and affected soil, the amount of exposure to waste and soil; the biological uptake of metals from waste and soil; and the toxicological effects of biologically available metals. Such uncertainty must be discussed so that the assessment does not result in a "higher degree of implied certainty in the overall assessment than is warranted" (OEHHA, 2004).

As a result of the uncertainties described below, confidence in the exposure assessment is moderate. Confidence in toxicity values ranges from low to high based on the data available for specific metals. The risk assessment conservatively considers the commercial indoor worker exposure scenario for waste that will likely be consolidated beneath the proposed commercial development, thus eliminating the exposure pathways. The assessment also conservatively assumes that the metals are entirely bioavailable.

Sampling Uncertainty

Sampling uncertainty related to contaminant concentration in soil, as well as sampling uncertainty related to the literature-derived exposure and toxicity parameters, contribute to the overall uncertainty of the assessment. Statistical analysis is performed as part of the assessment to develop a reasonable maximum exposure level. Confidence in a population mean and variance increases as the number of samples taken from the population increases (USEPA, 2003).

Model Uncertainty

The literature-derived exposure factors and toxicity factors used in the assessment were obtained with the goal of reducing uncertainty; however, limitations of existing data pertaining to activity patterns for future site occupants, as well as health effects from metals exposure, result in model uncertainty.

Bioavailability

The assessment assumes that metals in soil are completely available for biological uptake. Unpublished studies of other abandoned mine land in Nevada County indicate that the actual bioavailability of arsenic, for example, may be lower than 15 percent. The assumption of 100 percent bioavailability likely overestimates the health effects presented by waste and affected soil at the site.

Detection Limits

The concentrations of metals of concern in soil generally exceed the corresponding laboratory detection limits. Therefore, detection limits are not expected to be a significant source of uncertainty.

Toxicity Values

The California slope factor for oral arsenic exposure (9.45 per mg/kg-day, OEHHA 2007) was used for the risk assessment presented herein. For comparison, the U.S. EPA slope factor is currently 1.5 per mg/kg-day. The slope factors imply a linear (no threshold) dose-response relationship; however, others have postulated a non-linear relationship, and the mechanisms for arsenic carcinogenicity are not known (OEHHA 2004). If the dose-response relationship is non-linear, the assumption of linearity would overestimate risks.

8 ECOLOGICAL SCREENING EVALUATION

An ecological screening evaluation was not performed based on the anticipated lack of complete ecological exposure pathways associated with the proposed site development. The assessment areas at the site comprise an estimated 64,000 cubic yards of mine waste rock and mill tailings. Some of the waste is to be removed from the site, and the remainder is to be consolidated beneath the proposed commercial development. The proposed development includes grading, paving and infrastructure construction that will likely reduce or eliminate ecological habitat in the assessment area.

9 COMMUNITY PROFILE

Appendix D presents the community profile. The community profile was performed in general accordance with guidelines provided in the *Preliminary Endangerment Assessment Guidance Manual* (DTSC, June 1999). H&K finds that public notification is not warranted as part of the PEA investigation, although such notification is appropriate if site remediation is performed.

10 EVALUATION OF RISK TO SURFACE WATER AND GROUNDWATER

A. Basis for Evaluation

The following documents are pertinent to the evaluation of surface water and groundwater at the site:

- *The Designated Level Methodology* (DLM) (RWQCB, June 1989),
- *A Compilation of Water Quality Goals* (Water Quality Goals) (RWQCB, August 2003),
- *Fourth Edition of the Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Basin Plan) (RWQCB, September 1998), and
- *Resolution No. 68-16 (Antidegradation Policy)* (California State Water Resources Control Board, October 28, 1968).

According to the Basin Plan and other RWQCB documents, California water bodies must be protected against water quality degradation for the most restrictive beneficial use. Surface water was not encountered during the investigation, although seasonal surface water flow associated with storm water runoff is expected in the lower (southern) portion of the site. Beneficial uses that could apply to surface water include domestic, agricultural and industrial water supply, recreation and aesthetic enjoyment, and preservation of fish, wildlife and other aquatic resources or preserves. We understand that groundwater at the site will not be used; however, domestic wells are located in the site vicinity. Review of well completion logs provided by DWR for the site vicinity indicates that useable groundwater may be located approximately 60 feet below the ground surface.

The DLM outlines a process for evaluating site specific conditions to determine whether a threat is posed to surface water or groundwater quality from soluble constituents in the mine waste rock and tailings identified at the site. The DLM allows for the assumption of attenuation of contaminant concentrations between the exploration deposits and groundwater or surface water, provided that specific parameters and assumptions are defined. Tables 7a, 7b, 8a and 8b present attenuation factors and soluble designated levels (SDLs) for surface water and groundwater.

H&K's rationale for selecting the simplified environmental attenuation factor for surface water was based on review of the characteristics listed for surface water in Figure 10 of the DLM. An environmental attenuation factor of 10 to 100 may be appropriate for assessing current site conditions. The mine waste rock and tailings on the southern portion of the site are subject to ephemeral storm water runoff and are located approximately 500 feet above Wolf Creek. The COPCs are not volatile or degradable, and are generally not subject to other waste constituents that could affect their mobility. However, arsenic is readily attenuated in the clayey, iron-rich soil that typifies the site vicinity, as demonstrated by the low metals concentrations in native soil below the waste.

The proposed commercial site development will likely include excavation of the mine waste rock and tailings, transport within the site, and placement of the mine waste rock and tailings within a fill area that is not subject to surface water infiltration or groundwater seepage. If the mine waste rock and tailings are placed on-site in such a manner, H&K's opinion is that an environmental attenuation factor of 100 would be applicable for evaluation of surface water quality.

H&K's rationale for selecting the simplified attenuation factor for groundwater was based on review of the characteristics listed for groundwater in Figure 10 of the DLM. An environmental attenuation factor of 10 to 100 may be appropriate for assessing current site conditions. The mine waste rock and tailings are generally underlain by low permeability clay. Acid-base accounting results indicate that the mine waste rock and tailings are acid neutralizing (NP:AGP results range from 19 to 1067).

As discussed above for surface water, the proposed commercial site development will likely include excavation of the mine waste rock and tailings, transport within the site, and placement of the mine waste rock and tailings within a fill area that is not subject to surface water infiltration or groundwater seepage. If the mine waste rock and tailings are placed on-site in such a manner, H&K's opinion is that an environmental attenuation factor of 100 would be applicable for evaluation of groundwater quality

B. Water Quality Goals

Tables 7a, 7b, 8a and 8b summarize the water quality goals used for this evaluation. The water quality goal for arsenic (2.0 µg/L) corresponds to a typically achievable laboratory reporting limit, which is greater than the California Public Health Goal for arsenic in drinking water (0.04 µg/L).

C. Laboratory Reporting Limits

Laboratory reporting limits ranged from 2 to 10 µg/L for DI-WET arsenic and from 1.2 to 10 µg/L for DI-WET lead. Reporting limits for mercury and nickel were 0.333 and 10 µg/L, respectively.

D. Summary of Laboratory Test Results

Arsenic

Eighteen samples of mine waste rock and tailings (and one duplicate sample) were analyzed for soluble arsenic by DI-WET. Soluble arsenic concentrations ranged from below a reporting limit of 2.0 µg/L to 44.7 µg/L. Arsenic was not detected in eight of the 18 samples above reporting limits ranging from 2 to 10 µg/L. The sample (TP-5-10) having the highest soluble arsenic detection (44.7 µg/L) was re-analyzed, resulting in no soluble arsenic detected above a reporting limit of 2.0 µg/L.

ProUCL determined that the soluble arsenic data follow gamma distribution and recommended the use of the Approximate Gamma UCL (17.3 µg/L). The data set used for statistical evaluation includes the duplicate analysis and uses a value of half the reporting limit for non-detections. ProUCL output is presented in Appendix C.

Two background soil samples were analyzed for soluble arsenic by DI-WET. Soluble arsenic was detected in one of the samples at 18.6 µg/L, and was not detected in the other above a reporting limit of 10 µg/L.

Lead

Eighteen samples of mine waste rock and tailings (and one duplicate analysis) were analyzed for soluble lead by DI-WET. Soluble lead concentrations ranged from less than 1.2 µg/L to 11.6 µg/L. Soluble lead was not detected in 13 of the 18 samples above reporting limits ranging from 1.2 to 10 µg/L.

ProUCL determined that the soluble lead data follow gamma distribution and recommended the use of the Approximate Gamma UCL (4.5 µg/L). The data set used for statistical evaluation includes the duplicate analysis and uses a value of half the reporting limit for non-detections. ProUCL output is presented in Appendix C.

Two background soil samples were analyzed for soluble lead by DI-WET. Soluble lead was not detected in either of the samples above a reporting limit of 6 µg/L.

Mercury

Six samples of mine waste rock and tailings were analyzed for soluble mercury by DI-WET. Soluble mercury was not detected above a laboratory reporting limit of 0.333 µg/L.

Nickel

Seventeen samples of mine waste rock and tailings (and one duplicate sample) were analyzed for soluble nickel by DI-WET. Soluble nickel concentrations ranged from 2.3 to 48.1 µg/L. Nickel was not detected in five of the 17 samples above a reporting limit of 10 µg/L.

ProUCL determined that the data are lognormal and recommended the use of the H-UCL (19.0 µg/L). The data set for statistical evaluation uses a value of half the reporting limit for non-detections. ProUCL output is presented in Appendix C.

Total nickel concentrations detected in the mine waste rock and tailings are within the range of nickel concentrations detected in background soil. Similarly, soluble nickel detections in mine waste rock and tailings are within the range of soluble nickel concentrations detected in background soil. Two background soil samples were analyzed for soluble nickel by DI-WET. Soluble nickel was detected in the samples at 58.5 and 26.2 µg/L.

E. Evaluation

Findings of the DLM evaluation indicate that the potential for water quality impact may exist under current site conditions. However, significant water quality impact is not anticipated in the case of the proposed on-site placement as part of commercial site development. Specific analytes are discussed below.

Arsenic

The maximum arsenic detection (44.7 µg/L) and UCL value (17.3 µg/L) exceed the SDL for current site conditions (2 µg/L). Soluble arsenic was not detected in a duplicate analysis of the sample displaying the maximum detected concentration, indicating that the maximum detected concentration may be anomalous. Other soluble arsenic detections are near the soluble arsenic concentration detected in background soil (18.6 µg/L). The UCL value (17.3 µg/L), which includes the potentially anomalous maximum detected value, is lower than the anticipated SDL for the proposed on-site placement (20 µg/L).

Lead

The maximum lead detection (11.6 µg/L) and UCL value (4.5 µg/L) exceed the SDL for current site conditions (2 µg/L). These values are lower than the anticipated SDL for the proposed on-site placement (20 µg/L).

Mercury

Soluble mercury was not detected by DI-WET. The reporting limit is less than the SDLs for both current conditions and on-site placement.

Nickel

The maximum nickel detection (48.1 µg/L) is within the range of soluble nickel concentrations detected in background soil (26.2 to 58.5 µg/L). Similarly, total nickel concentrations detected in mine waste and tailings are within the range of total nickel concentrations in background soil.

Based on the results of the DLM evaluation, the mine waste may be classified as Group B mine waste as defined in California Code of Regulations (CCR) Title 27, without taking any other factors into consideration. Per Section 22480(C) of CCR Title 27, which pertains to the management of mining waste, the mine waste may be classified as Group C waste because it contains hazardous constituents only at low concentrations, has low acid generation potential, and is readily containable by measures that are less stringent than those required for Group B waste.

11 SUMMARY AND CONCLUSIONS

The PEA findings, and conclusions based on the findings, are summarized below.

1. The site is located in an area that was subject to past gold mining and ore processing. Abandoned mine features identified at the site include horizontal and inclined excavations, pits, relic foundations, stockpiles of mine waste rock, and tailings ponds. Many of the abandoned mine features identified at the site are associated with the former Spring Hill Mine, which operated intermittently from the late 1800s to the early 1940s.

2. An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of tailings may be present at the site. These volume estimates are based on limited subsurface data and were not calculated using survey methods. Thus, the actual volume may vary significantly from the estimated volumes. Figures 3 and 4 show the areas of mine waste rock and tailings.

3. An estimated 1,700 cubic yards (approximately 2,300 tons) of mine waste rock, tailings and impacted native soil were identified at the Former Mill Area. The soil contains elevated levels of arsenic, lead and mercury which are not suitable to remain at the site under existing conditions. In addition, a pipe that originated from the Former Mill Area may have deposited materials with elevated metals concentrations down slope of the former mill site. Although such deposits were not encountered as part of the site investigation, other deposits which require off-site disposal may be present at the site. The possibility of other “hot spots” may be addressed during a future remedial action as set forth in a verification sampling and analysis plan.

4. The site investigation evaluated concentrations of seventeen Title 22 metals and cyanide in soil. Metals such as arsenic and lead occur naturally in soil and rock and are present in mine waste at concentrations exceeding background levels as a result of past mining and ore processing activities. Mercury and cyanide are associated with ore processing which was performed at the site.

5. In general, soil arsenic concentrations govern the calculated chronic human health hazard and excess lifetime cancer risk. Antimony, vanadium and other metals also contribute to the chronic human health hazard.

6. Arsenic was detected in site background soil up to 17 mg/kg. The range of background soil arsenic concentrations at the site is consistent with local

background levels. Local background arsenic concentrations range from non-detect to 48 mg/kg, as discussed in Section 5.G and Appendix A of this PEA report. The 95^{th} percentile value for the local background arsenic data set is 17 mg/kg. This value is conservatively used to represent the local upper bound background soil arsenic concentration.

7. A human health risk assessment was performed to evaluate baseline (current) conditions. The goal of the assessment is to predict potential adverse human health effects of chemical contaminants identified at the site. The risk assessment findings are also to be used to develop remedial alternatives for a non-time critical remedial action. Exposure media for the site are soil and air. Exposure pathways are incidental ingestion and dermal contact with the affected soil, and inhalation of particulates originating from the affected soil. Risk assessment findings are summarized below:

   a. Waste and affected soil in the Former Mill Area are not acceptable for use under the three exposure scenarios considered: standard (unrestricted land use), commercial indoor worker and construction worker.

   b. Mine Waste Rock and Tailings (excluding the Former Mill Area) are not acceptable for use under the standard exposure scenario. However, the Mine Waste and Tailings are potentially acceptable for use under the commercial indoor worker and construction worker exposure scenarios, as the hazard indices are less than the benchmark value of 1 and the risk values fall between the lower (1.E-06) and upper (1.E-04) benchmark values for risk management decision-making.

8. Because the risk values calculated for the Mine Waste Rock and Tailings (excluding the Former Mill Area) under the commercial indoor worker and construction worker exposure scenarios exceed the lower benchmark risk value, additional consideration should be given to the potential future exposure pathways. The Mine Waste Rock and Tailings are to be consolidated beneath the proposed commercial development, and are to be covered by structures and pavement. The exposure pathways considered under the commercial indoor exposure scenario will be eliminated in the case of burial and surface covering. Additionally, the proposed remedial action is to be performed per an approved soil management plan to reduce the chance of exposure under the construction worker scenario. Therefore, H&K's opinion is that the mine waste rock and tailings identified at the site (excluding the Former Mill Area) are appropriate for use in the proposed commercial development.

9. Results of acid-base accounting indicate that the mine waste rock and tailings are not acid-generating; thus, soluble metals were evaluated by DI-WET.

10. Soluble arsenic and lead were detected by DI-WET at concentrations exceeding the calculated SDL for surface water and groundwater under current conditions. However, the Mine Waste Rock and Tailings (excluding the Former Mill Area) are suitable for on-site consolidation and burial beneath the proposed commercial development and can be classified as Group C mine waste per CCR Title 27.

11. A community profile performed by H&K determines that public notification is not warranted as part of the PEA investigation, although public involvement is appropriate prior to remedial action.

12. Based on the local geology, naturally occurring asbestos (NOA) may be encountered at the site during remediation and site development. In the Sierra Nevada foothills area, ultramafic rock and serpentinite are associated with NOA minerals such as chrysotile, actinolite, and tremolite. Under California law, disturbance of soil and rock that contain ultramafic rock, serpentinite or NOA minerals must be handled as described in Cal/EPA Air Resources Board Regulation 93105, *Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations* (ATCM). Per the ACTM, site work must be performed according to protocols established by an Asbestos Dust Mitigation Plan (ADMP). An ADMP outlines engineering controls to reduce the risk of release of NOA fibers into the environment during mechanical soil disturbance. Mechanical soil disturbance includes site clearing, grading, underground utility work, transportation, and disposal activities.

13. The abandoned mine excavations identified at the site, as well as other mine excavations that may be present on and adjacent to the site, present physical hazards and may not be suitable to support structural improvements. The condition of the known excavations was not investigated, and other excavations that were not identified as part of this investigation may be obscured as a result of past grading, vegetative growth, or other causes.

12 RECOMMENDATIONS

H&K makes the following recommendations based on the PEA findings.

1. Mine waste rock and tailings identified at the site, particularly near the Former Mill Site, are not likely suitable for unrestricted use due to elevated metals concentrations. Exposure to the soil, including ingestion, inhalation of soil dust, and dermal contact, should be avoided.

2. The risk assessment findings should be used to develop remedial alternatives for a non-time critical remedial action. The evaluation of remedial alternatives, as well as methods and procedures to implement the selected remedial actions, should be set forth in a Removal Action Workplan (RAW) for review and approval by DTSC.

3. The estimated 2,300 tons of waste and affected soil at the Former Mill Area should be excavated, transported offsite, and disposed at an appropriate solid waste facility. Additional characterization of the waste may be required by the landfill during the remedial action to meet their acceptance criteria.

4. The remaining Mine Waste Rock and Tailings identified at the site (excluding the Former Mill Area) should be excavated, transported within the site, and consolidated in an area not subject to surface water infiltration or groundwater seepage. The relocation and burial of mine waste rock and tailings should be performed in accordance with an approved RAW, a geotechnical engineering report, and a grading plan.

5. The proposed Mine Waste Rock and Tailings burial location should be identified on the site development plans and recorded with the County of Nevada. The 95% UCL on the mean concentration of total arsenic in the Mine Waste Rock and Tailings is 21.9 mg/kg, which is acceptable under the construction worker scenario. Based on the results of the human health risk assessment, and because the waste is to be buried beneath structural improvements and pavement, additional land use controls are not required.

6. Based on the PEA findings, the following arsenic remediation goals are recommended. Cleanup goals for other metals of potential concern (such as antimony, copper and vanadium) should be developed as part of a RAW based on the evaluation of site background concentrations.

a. Mine waste and affected soil at the Former Mill Area is to be excavated, transported offsite, and disposed at an appropriate solid waste facility. If the resulting soil arsenic concentrations are within the background range (17 mg/kg and lower), further excavation will not be required with respect to soil arsenic concentrations. If arsenic concentrations exceed the site background range, total and soluble arsenic concentrations should be evaluated according to the methodology set forth in this PEA to determine whether the soil is suitable for on-site burial. Specifically, the resulting 95% UCL on the mean total arsenic concentration must be protective under the construction worker scenario (22 mg/kg), and soluble arsenic concentrations should not exceed the arsenic SDL (20 µg/L).

b. Mine Waste and Tailings identified at other locations of the site should be excavated, transported within the site, and buried. If the resulting soil arsenic concentrations are within the background range (17 mg/kg and lower), further excavation will not be required with respect to soil arsenic concentrations.

7. Recommendations for reducing fugitive dust generation and potential exposure to NOA during site remediation and development should be incorporated into a future RAW for the site.

8. Mining excavations on and near the site present physical hazards and may not be suitable for support of structural improvements. Mining excavation may extend beneath the site from adjacent property. The excavations should be closed to address the possibility of entrapment, collapse, hazardous confined space conditions and other physical hazards. Temporary measures are appropriate to reduce the existing physical hazards. Final physical closure of the excavations should be performed in accordance with recommendations from a qualified geotechnical engineer and with the approval of the local building department.

13 LIMITATIONS

The recommendations and conclusions in this report are preliminary in nature based on existing site conditions; interpretation of site history and site usage information; and the results of the investigation, sample screening, and laboratory analyses. The concentrations detected in the samples obtained during the site investigations may not be representative of conditions between locations sampled. Other forms of contamination may be present within the site that the investigation did not detect.

The purpose of the assessment was not to guarantee or certify a clean site, but to assess site conditions in accordance with DTSC protocol. H&K used judgment and experience to develop the PEA conclusions and recommendations. Therefore, the conclusions and recommendations are not to be considered scientific certainties. The recommendations provided herein are contingent upon H&K's review of future sampling results or any other pertinent information that becomes available, as well as review and approval by the appropriate regulatory agencies.

The scope of work did not include determining the presence of asbestos, radon, lead paint, geologic hazards, archeological sites, or ecologically sensitive areas (e.g., vernal pools and wetlands).

H&K prepared and issued this report for the exclusive use of our client. The information, conclusions and recommendations presented apply only to the subject property. Holdrege & Kull is not responsible for any other party's interpretations of the reported information.

H&K performed this work in accordance with present, regional, generally accepted standards of care. This report does not represent a legal opinion. No warranty, expressed or implied, including any implied warranty of merchantability or fitness for the purpose is made or intended in connection with the work.

The findings of this report are valid as of the present date. However, changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. Changes in regulations, interpretations, and/or enforcement policies may occur at any time. Such changes may affect the extent of remediation required.

14 REFERENCES

Anton Geological, July 10, 1997. Phase I Environmental Site Assessment, Spring Hill Mine Area.

California Department of Conservation, Division of Mines and Geology, 1990. Mineral Land Classification of Nevada County, California, Plate 1a.

California Environmental Protection Agency, Department of Toxic Substances Control, January 1998. Abandoned Mine Land Preliminary Assessment Handbook.

California Environmental Protection Agency, Regional Water Quality Control Board, June 1989. The Designated Level Methodology.

California Environmental Protection Agency, Regional Water Quality Control Board, August 2003. A Compilation of Water Quality Goals.

California Environmental Protection Agency, Regional Water Quality Control Board, September 25, 1998. Fourth Edition of the Water Quality Control Plan for the Sacramento and San Joaquin River Basins.

California Environmental Protection Agency, State Water Resources Control Board, October 28, 1968. Resolution No. 68-16 (Antidegradation Policy).

California State Mining Bureau, Biennial Period 1918. State Mineralogists Report, Mines and Mineral Resources of Nevada County, California.

California State Mining Bureau, 1940. Mines and Mineral Resources of Nevada County, State Mineralogists Report XXXVII.

Division of Mines, 1930. Map Showing Mining Properties of the Grass Valley Mining District, Nevada County, California.

DTSC, 1999. Preliminary Endangerment Assessment Guidance Manual. State of California Environmental Protection Agency, Department of Toxic Substances Control.

Grass Valley Daily Morning Union, 1895. Nevada County Mining Review.

Hartwell, J.G., County Surveyor, 1880. Map of Nevada County Mining District.

Johnston, W.D., Jr., 1940. The Gold Quartz Veins of Grass Valley, California: U.S. Geological Survey Professional Paper.

NJDEP, 1999. Soil cleanup criteria. Available at: www.state.nj.us/dep/srp/regs/scc/scc_0599.pdf. Accessed February 4, 2007. last updated may 12, 1999. New Jersey Department of Environmental Protection.

OEHHA, 2004. Public Health Goals for Chemicals in Drinking Water, Arsenic. Office of Environmental Health Hazard Assessment.

OEHHA, 2005. Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (revised). Office of Environmental Health Hazard Assessment.

OEHHA, 2007. Toxicity Criteria Database, http://www.oehha.ca.gov/risk.html. California Office of Environmental Health Hazard Assessment, accessed February 1, 2007.

Public Survey Office, Glendale, California, 1942. Mineral Survey No. 6285, North East Extension of the Old Rattlesnake Quartz Ledge.

Tuminas, A., 1983. Geologic Map of the Grass Valley - Colfax Area.

United States Department of Agriculture Soil Conservation Service and Forest Service, reissued August 1993. Soil Survey of Nevada County Area, California.

United States Geological Survey, 1896. Nevada City Special Folio, California. The Gold Quartz Veins of Nevada City and Grass Valley Districts, California, Department of the Interior - U.S. Geological Survey, extract from the seventeenth annual report of the survey, 1895-96.

United States Geological Survey, provisional edition 1995. Grass Valley Quadrangle topographic map, 7.5 minute series.

Uren, Charles, 1897. Map of the Vicinity of Grass Valley/Nevada City, California.

Uren, Edward, 1942. Map of Spring Hill Mining Co.

U.S. EPA, 1997. Exposure Factors Handbook.

U.S. EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. United States Environmental Protection Agency, OSWER 9355.4-24.

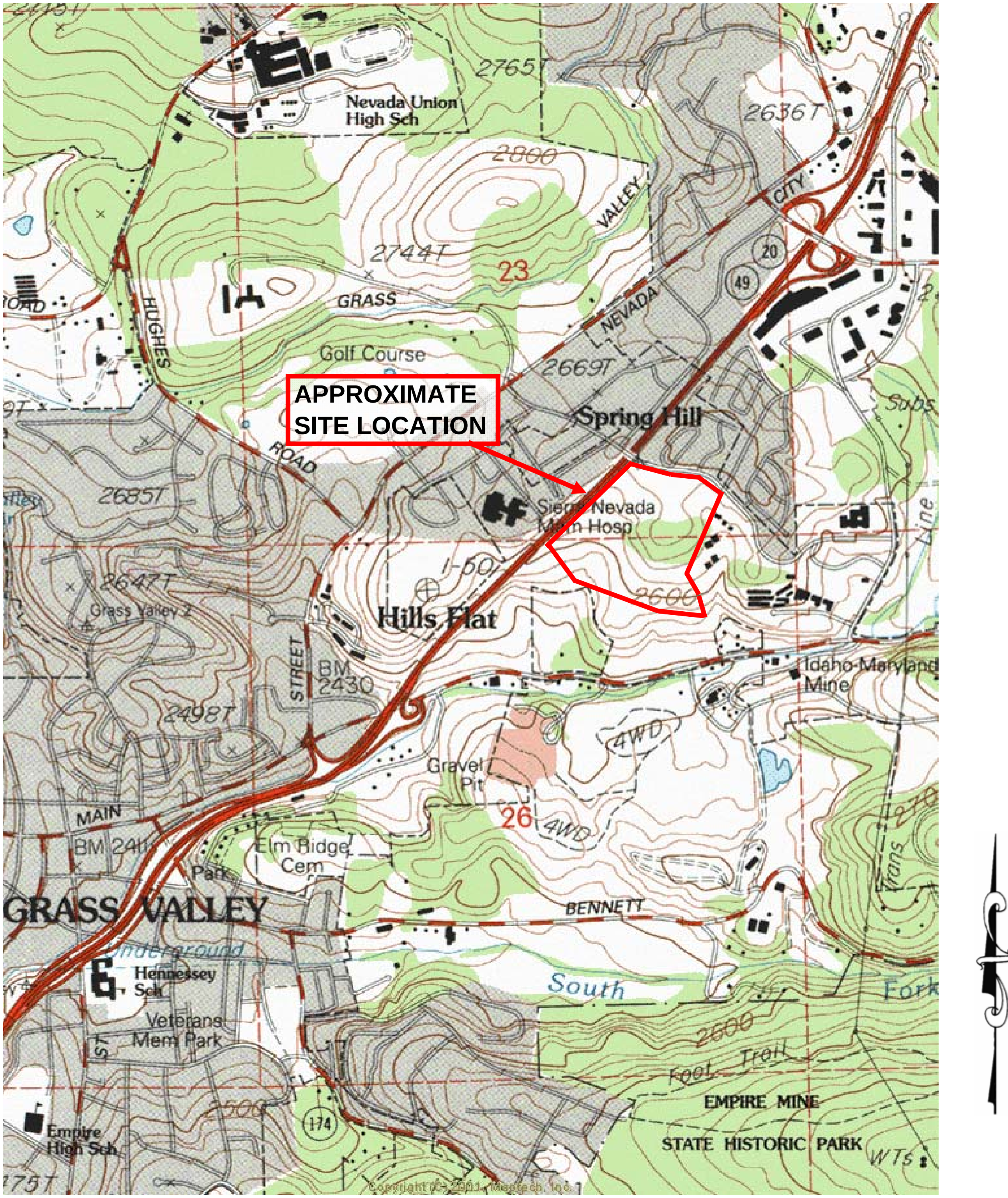
U.S. EPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. United States Environmental Protection Agency, OSWER 9285.7-02EP.

U.S. EPA, 2007. Integrated Risk Information System (IRIS). http://www.epa.gov/iris/, accessed June 26, 2007.

U.S. Geological Survey, 1896. Nevada City Special Folio, California. The Gold Quartz Veins of Nevada City and Grass Valley Districts, California, Department of the Interior - U.S. Geological Survey, extract from the seventeenth annual report of the survey, 1895-96.

U.S. Geological Survey, provisional edition 1995. Grass Valley Quadrangle topographic map, 7.5 minute series.

FIGURES



NO SCALE

SOURCE: GRASS VALLEY QUADRANGLE MAP (USGS, PROVISIONAL EDITION 1995)

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SITE LOCATION MAP

SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

PROJECT NO. 3292-02

JULY 2007

FIGURE 1

FIGURE 2

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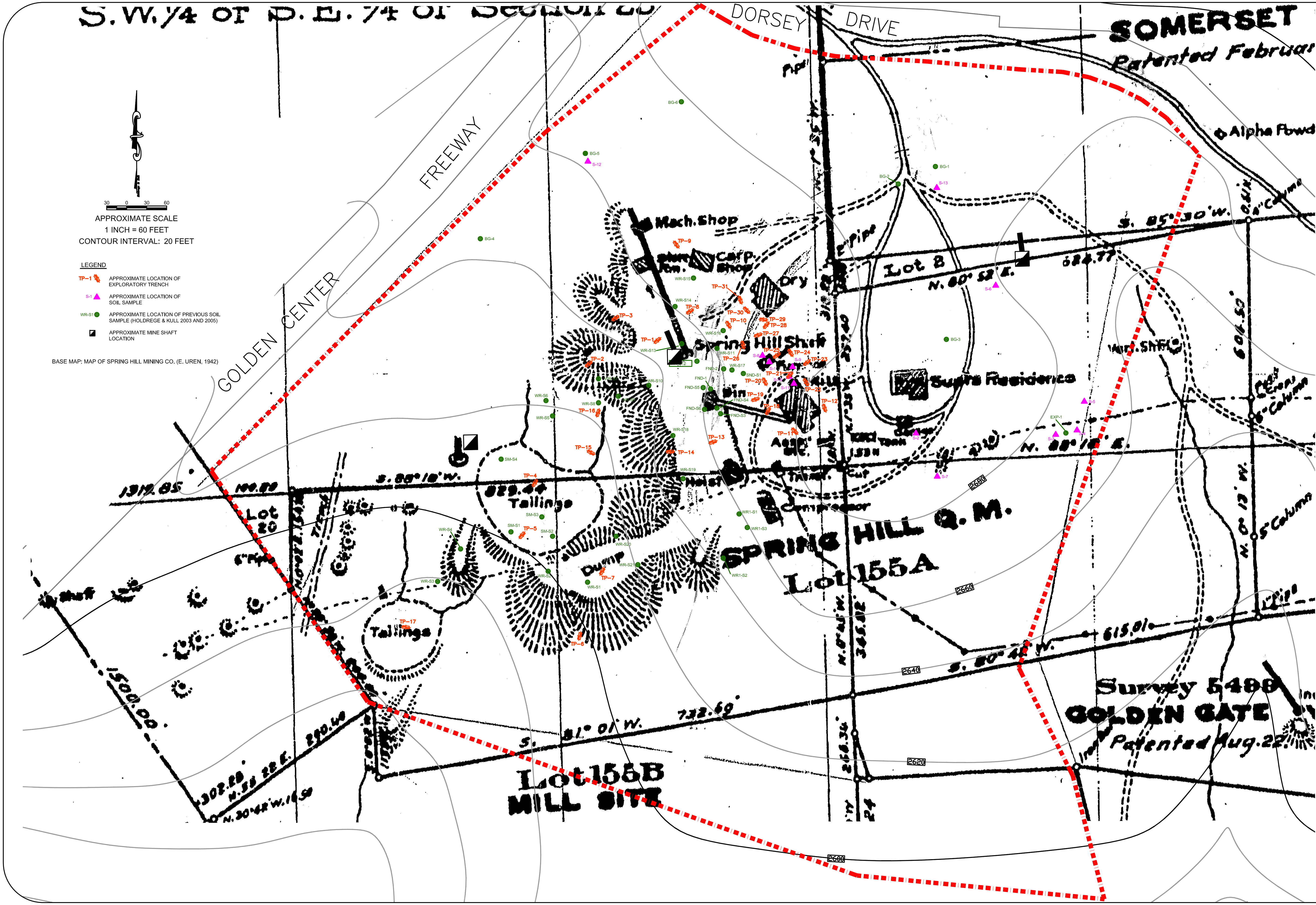
AERIAL PHOTOGRAPH OF SITE

SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

NO.	REVISIONS	DATE

CHECKED BY:	CDR
DRAWN BY:	DFD
DATE:	JULY 2007
DRAWING NAME:	3292-02-FIG2-4
PROJECT NO.:	3292-02



REVISIONS

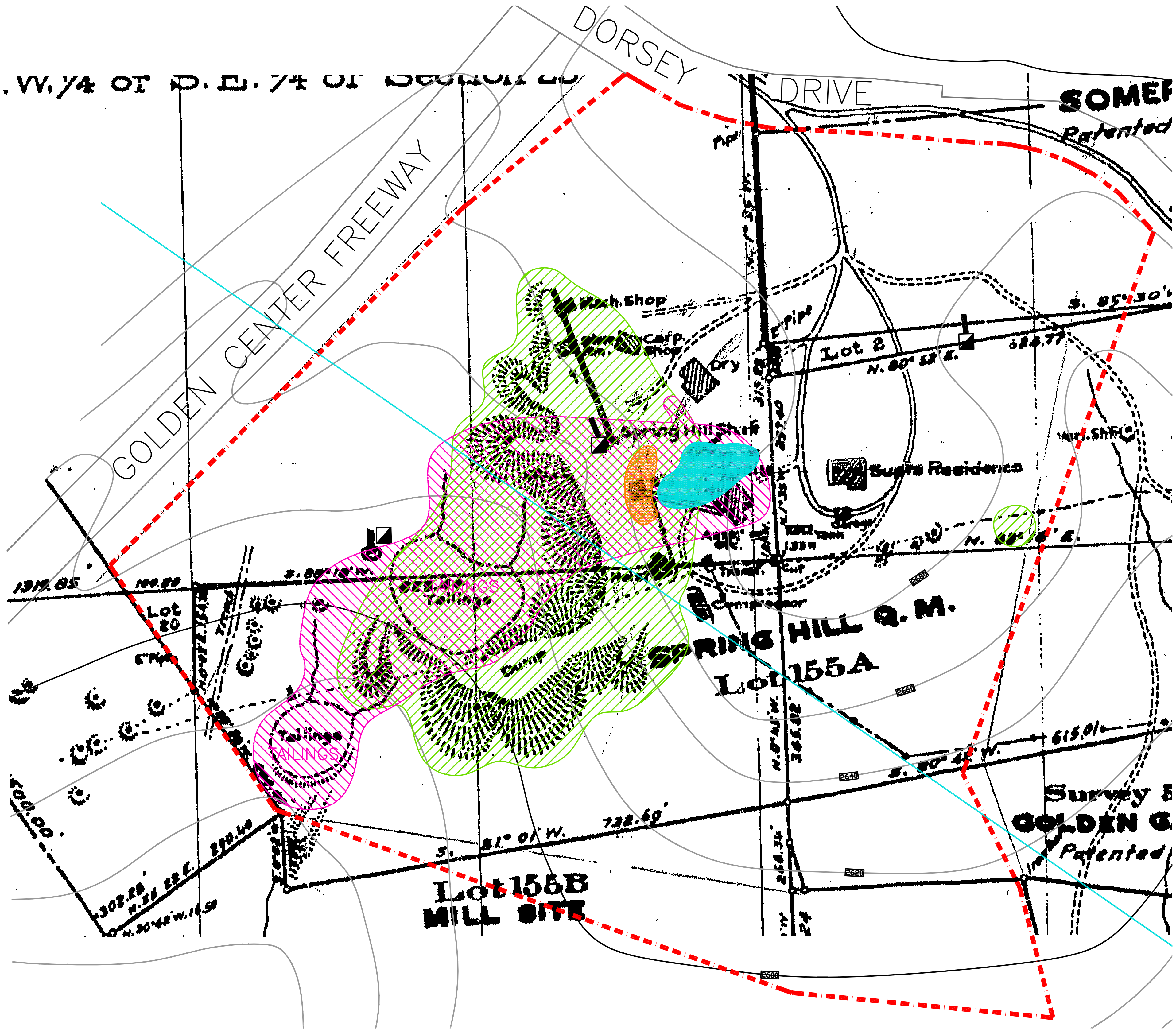
NO.	DATE

DESIGNED BY: CDR
DRAWN BY: JWM
DATE: JULY 2007
DRAWING NAME: 3292-02-FIG2-4
PROJECT No.: 3292-02

SAMPLE LOCATION MAP
SPRING HILL MINE PROPERTY
GRASS VALLEY, CALIFORNIA

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959

FIGURE 3



50 0 50 100

APPROXIMATE SCALE
1 INCH = 100 FEET
CONTOUR INTERVAL: 20 FEET

LEGEND

- TAILINGS DEPOSITS
- WASTE ROCK PILES
- ANTICIPATED SOIL / TAILINGS REQUIRING REMOVAL AND LANDFILL DISPOSAL AS HAZARDOUS WASTE (ESTIMATED 750 CUBIC YARDS / 1,050 TONS, BASED ON 2 FEET DEPTH)
- ANTICIPATED SOIL / WASTE ROCK REQUIRING REMOVAL AND LANDFILL DISPOSAL AS HAZARDOUS WASTE (ESTIMATED 900 CUBIC YARDS / 1,260 TONS, BASED ON 6 FEET DEPTH)
- APPROXIMATE MINE SHAFT LOCATION

BASE MAP: MAP OF SPRING HILL MINING CO. (E. UREN, 1942)

FIGURE 4

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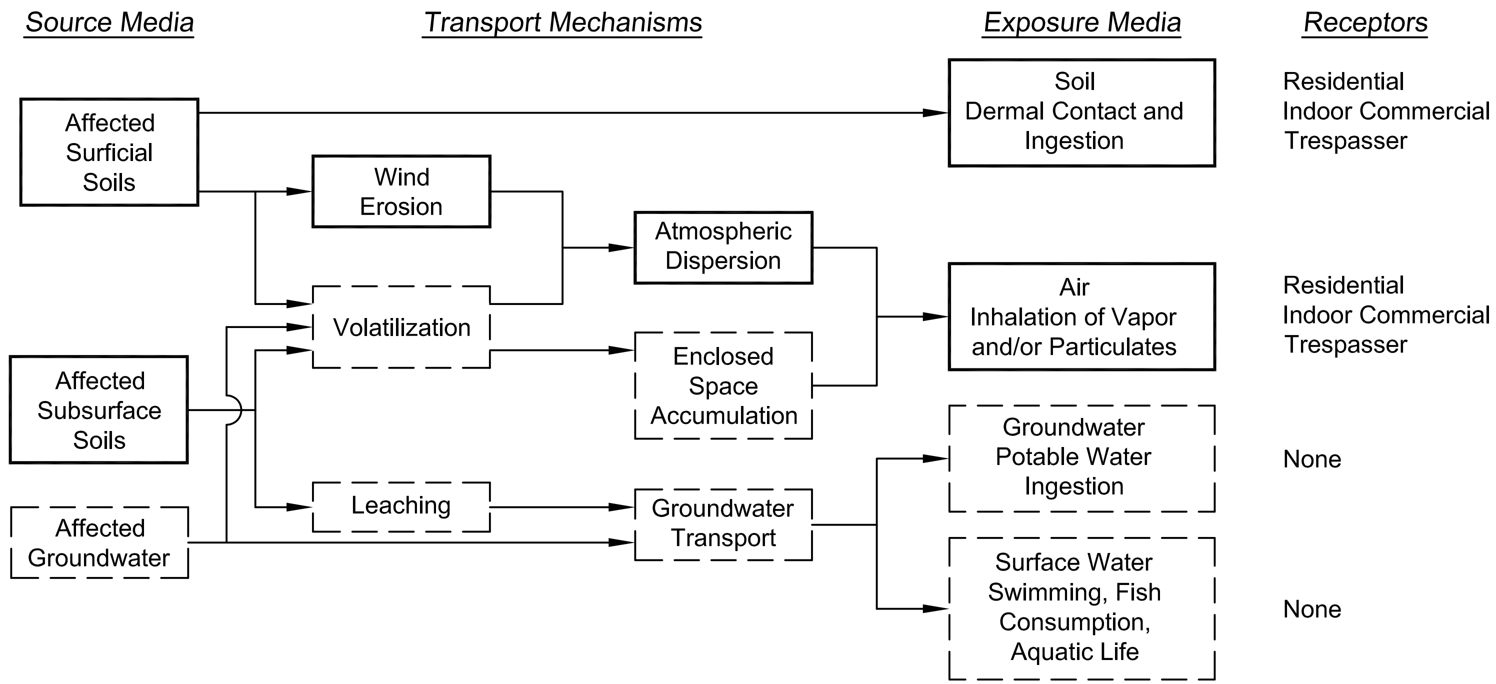
MINE WASTE ASSESSMENT AREAS

SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

NO.	REVISIONS	DATE

CHECKED BY:	CDR
DRAWN BY:	JWM
DATE:	JULY 2007
DRAWING NAME:	3292-02-FIG2-4
PROJECT NO.:	3292-02



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CONCEPTUAL SITE MODEL
SPRING HILL MINE PROPERTY
GRASS VALLEY, CALIFORNIA

DRAWN BY: DFD	CHECKED BY: JWM
PROJECT NO.: 3292-02	
DATE: JULY 2007	
FIGURE NO.: 5	

TABLES

Table 1 - Summary of DWR Well Completion Reports Fomer Spring Hill Mine Property APNs 35-260-62, 63 and 64 Grass Valley, California											
No.	**Reported Site Address[1]**	**Reported APN[1]**	**DWR Well Log No.**	**Estimated Elevation[2] (feet MSL)**	**Estimated Distance From Site[2] (feet)**	**Direction From Site[2] (feet)**	**Reported Depth to First Water[1] (feet)**	**Reported Depth of Static Water Level[1] (feet)**	**Reported Depth to Rock[1] (feet)**	**Reported Depth of Well[1] (feet)**
1	Dorsey Drive	NR	111604	2680	200	W	NR	NR	25 - 55	130
2	Sutton Way	NR	208239	2600	1400	NE	152	30	24	625
3	Hughes Road	NR	81784	2560	2000	W	60	35	14	225
4	1040 East Main Street	NR	305758	2600	2000	NW	60	NR	40	180
5	1040 East Main Street	NR	305767	2600	2000	NW	60	NR	40	400

Notes:
1 Based on DWR Well Completion Report
2 Based on USGS 7.5' Quadrangle Map of Grass Valley CA (Provisional Edition, 1995)
APN = Nevada County assessors parcel number
DWR = State of California Department of Water Resources
MSL = mean sea level
NR = not reported on well completion report

Owner Name and Mailing Address[1]

No. 1 - Spring Hill Manor Convalescent Hospital

No. 2 - Francis Teut, 13240 North Day Rd, Grass Valley

No. 3 - Timberline Homes, 154 Hughes Rd, Grass Valley

No. 4 and 5 - Nevada County Country Club, 1040 E. Main St., Grass Valley

Table 2 - Total Metals and Inorganics Results for Soil Samples **Former Spring Hill Mine Site** APNs 35-260-62, 63 and 64 Grass Valley, California										
Sample Number	**Sample Location**	**Sample Type**	**Sample Depth (feet bgs)**	**Sample Date**	**Total Arsenic (mg/kg)**	**Total Lead (mg/kg)**	**Total Mercury (mg/kg)**	**Total Nickel (mg/kg)**	**Total Cyanide (mg/kg)**	**Total Nitrate (mg/kg)**
EXP-1	EXP-1	WR/SP	0.5	5/20/03	19	5.2	0.045	na	na	na
FND-1	FND-1	WR/SP	0.5	5/20/03	130	190	0.670	na	na	na
FND-2	FND-2	WR/SP	0.5	5/20/03	74	44	1.2	na	na	na
FND-S3	FND-S3	WR/SP	1.5	5/20/03	180	310	0.150	na	na	na
WR1-S1	WR1-S1	WR/SP	0.5	5/20/03	ND<1.0	4.8	0.310	na	na	na
WR1-S2	WR1-S2	WR/SP	1.0	5/20/03	28	37	0.200	na	na	na
WR1-S3	WR1-S3	WR/SP	1.0	5/20/03	ND<1.0	ND<1.0	0.220	na	na	na
WR-S1	WR-S1	WR/SP	0 - 0.5	10/11/05	1.1	6.3	0.189	na	na	na
WR-S2	WR-S2	WR/SP	1	10/11/05	2.5	3.6	0.180	na	na	na
WR-S3	WR-S3	WR/SP	0 - 0.5	10/11/05	ND<1.0	7.2	0.034	na	na	na
WR-S4	WR-S4	WR/SP	1.5	10/11/05	5.6	8.6	0.020	na	na	na
WR-S5	WR-S5	WR/SP	0 - 0.5	10/11/05	4.0	8.3	0.067	na	na	na
WR-S6	WR-S6	WR/SP	2	10/11/05	10.5	5.0	0.072	na	na	na
WR-S7	WR-S7	WR/SP	0.7	10/11/05	2.4	17.1	0.056	na	na	na
WR-S8	WR-S8	WR/SP	1	10/11/05	ND<1.0	9.5	0.019	na	na	na
WR-S9	WR-S9	WR/SP	0 - 0.5	10/11/05	1.0	11.3	0.029	na	na	na
WR-S10	WR-S10	WR/SP	0 - 0.5	10/11/05	1.2	8.8	0.081	na	na	na
WR-S11	WR-S11	WR/SP	1	10/11/05	3.9	19.8	0.306	na	na	na
WR-S12	WR-S12	WR/SP	0 - 0.5	10/11/05	5.3	47.6	0.048	na	na	na
WR-S13	WR-S13	WR/SP	0 - 0.5	10/11/05	11.2	11.9	0.122	na	na	na
WR-S14	WR-S14	WR/SP	0 - 0.5	10/11/05	ND<1.0	4.5	0.117	na	na	na
WR-S15	WR-S15	WR/SP	0 - 0.5	10/11/05	ND<1.0	44.9	0.219	na	na	na
WR-S16	WR-S16	WR/SP	0 - 0.5	10/11/05	3.6	9.8	0.106	na	na	na
WR-S17	WR-S17	WR/SP	0.5	10/11/05	22	52.9	0.126	na	na	na
WR-S18	WR-S18	WR/SP	2	10/11/05	2.7	10.9	0.208	na	na	na
WR-S19	WR-S19	WR/SP	0.5	10/11/05	4.1	11.7	0.239	na	na	na
WR-S20	WR-S20	WR/SP	1	10/11/05	5.7	4.4	0.136	na	na	na
WR-S21	WR-S21	WR/SP	1.5	10/11/05	6.9	3.9	0.193	na	na	na
SM-S1	SM-S1	T	0 - 0.5	10/11/05	ND<1.0	3.2	0.023	na	ND<0.25	na
SM-S2	SM-S2	T	0 - 0.5	10/11/05	ND<1.0	3.0	0.025	na	ND<0.25	na
SM-S3	SM-S3	T	2	10/11/05	2.6	3.0	0.051	na	ND<0.25	na
SM-S4	SM-S4	T	0 - 0.5	10/11/05	ND<1.0	2.9	0.028	na	ND<0.25	na
FND-S4	FND-S4	WR/SP	0.5	10/25/05	34	52.1	0.129	na	na	na
FND-S5	FND-S5	WR/SP	3	10/25/05	52.1	48	0.190	na	na	na
FND-S6	FND-S6	WR/SP	0-0.5	10/25/05	36.2	103	0.273	na	na	na
SND-S1	SND-S1	WR/SP	0-0.5	10/25/05	17.8	17.5	0.253	na	na	na
TP-2-6	Test Pit 2	WR/SP	6	3/13/07	6.9	ND<2.0	0.086	486	na	na
TP-2-10	Test Pit 2	WR/SP	10	3/13/07	ND<2.0	ND<2.0	0.014	548	na	na
TP-4-3	Test Pit 4	T	3	3/13/07	ND<2.0	ND<2.0	0.025	201	ND<1.0	ND<0.5
TP-4-6	Test Pit 4	T	6	3/13/07	ND<2.0	4.4	0.039	275	na	na
TP-5-10	Test Pit 5	T	10	3/13/07	20.2	5.1	0.186	403	ND<1.0	ND<0.5
TP-5-15	Test Pit 5	T	15	3/13/07	ND<2.0	3.1	0.092	212	ND<1.0	ND<0.5
TP-5-19	Test Pit 5	T	19	3/13/07	ND<2.0	5.6	0.055	295	ND<1.0	ND<0.5

Table 2 - Total Metals and Inorganics Results for Soil Samples
Former Spring Hill Mine Site
APNs 35-260-62, 63 and 64
Grass Valley, California

Sample Number	Sample Location	Sample Type	Sample Depth (feet bgs)	Sample Date	Total Arsenic (mg/kg)	Total Lead (mg/kg)	Total Mercury (mg/kg)	Total Nickel (mg/kg)	Total Cyanide (mg/kg)	Total Nitrate (mg/kg)
TP-8-3	Test Pit 8	WR/SP	3	3/13/07	3.2	7.5	0.321	407	na	na
TP-8-6	Test Pit 8	WR/SP	6	3/13/07	6.2	5.0	0.243	296	na	na
TP-9-0.5	Test Pit 9	WR/SP	0.5	3/13/07	ND<2.0	16.8	0.139	1,290	na	na
TP-9-6	Test Pit 9	WR/SP	6	3/13/07	19.2	3.5	0.123	583	na	na
TP-10-8	Test Pit 10	WR/SP	8	3/13/07	2.1	2.2	0.283	585	na	na
TP-10-12	Test Pit 10	WR/SP	12	3/13/07	ND<2.0	70.2	0.127	940	na	na
TP-11-0.5	Test Pit 11	AS/NS	0.5	3/14/07	10.2	71.8	0.269	398	na	na
TP-12-0.5	Test Pit 12	AS/NS	0.5	3/14/07	8.2	15.3	0.432	421	na	na
TP-12-1.5	Test Pit 12	AS/NS	1.5	3/14/07	3.5	38.2	0.060	85.8	na	na
TP-13-2	Test Pit 13	WR/SP	2	3/14/07	ND<2.0	3.2	0.511	134	na	na
TP-13-4	Test Pit 13	WR/SP	4	3/14/07	ND<2.0	3.7	0.105	96.3	na	na
TP-14-0.5	Test Pit 14	WR/SP	0.5	3/14/07	ND<2.0	3.9	0.117	482	na	na
TP-14-2	Test Pit 14	WR/SP	2	3/14/07	4.2	4.9	0.065	206	na	na
TP-15-3	Test Pit 15	T	3	3/14/07	3.0	13.1	1.16	328	na	na
TP-15-5	Test Pit 15	T	5	3/14/07	2.0	4.2	0.030	238	na	na
TP-15-6	Test Pit 15	T	6	3/14/07	2.5	7.0	0.040	408	na	na
TP-16-0.5A	Test Pit 16	T	0.5	3/14/07	7.7	7.8	0.115	254	na	na
TP-16-1B	Test Pit 16	AS/NS	1	3/14/07	ND<2.0	4.1	0.054	709	na	na
TP-16-1C	Test Pit 16	WR/SP	1	3/14/07	ND<2.0	3.7	0.087	364	na	na
TP-17-4	Test Pit 17	T	4	3/14/07	6.4	5.7	0.070	197	ND<1.0	ND<0.5
TP-17-9	Test Pit 17	T	9	3/14/07	10.1	8.3	0.651	768	ND<1.0	ND<0.5
S-1	S-1	AS/NS	0.25	3/14/07	33.2	376	0.059	1,180	na	na
S-2	S-2	AS/NS	0.25	3/22/07	ND<1.0	65.9	0.166	121	na	ND<0.5
S-3	S-3	WR/SP	0.25	3/22/07	30.7	7.9	0.066	253	na	ND<0.5
S-4	S-4	WR/SP	0.25	3/22/07	ND<1.0	7.6	0.137	159	na	ND<0.5
S-5	S-5	WR/SP	0.5	3/22/07	ND<1.0	8.7	0.057	319	na	1.3
S-6	S-6	AS/NS	0.5	3/22/07	ND<1.0	50.0	0.105	796	na	1.6
S-7	S-7	WR/SP	0.5	3/22/07	ND<1.0	8.6	ND<0.010	142	na	0.5
S-8	S-8	AS/NS	0.5	3/23/07	25.5	341	0.507	685	ND<1.0	ND<0.5
S-9	S-9	AS/NS	0.25	3/23/07	50.2	76.6	1.29	111	ND<1.0	ND<0.5
S-10	S-10	AS/NS	0.25	3/23/07	579	418	8.69	400	ND<1.0	ND<0.5
TP-18-0.25	Test Pit 18	AS/NS	0.25	4/5/07	52.4	56.2	0.484	278	na	na
TP-18-1.0	Test Pit 18	AS/NS	1.0	4/5/07	18.3	12.3	0.108	182	na	na
TP-19-0.25	Test Pit 19	AS/NS	0.25	4/5/07	12.3	60.4	0.275	225	na	na
TP-19-0.75	Test Pit 19	AS/NS	0.75	4/5/07	ND<1.0	3.3	0.039	126	na	na
TP-20-0.25	Test Pit 20	AS/NS	0.25	4/5/07	ND<1.0	49.8	1.48	217	na	na
TP-20-1.0	Test Pit 20	AS/NS	1.0	4/5/07	4.6	18.4	8.38	174	na	na
TP-21-0.75	Test Pit 21	AS/NS	0.75	4/5/07	426	810	7.32	438	na	na
TP-21-1.5	Test Pit 21	AS/NS	1.5	4/5/07	ND<1.0	8.7	0.207	494	na	na
TP-22-0.25	Test Pit 22	AS/NS	0.25	4/5/07	52.3	196	3.76	239	na	na
TP-22-0.75	Test Pit 22	AS/NS	0.75	4/5/07	6.0	7.4	0.249	168	na	na
TP-23-0.25	Test Pit 23	AS/NS	0.25	4/5/07	271	69.5	0.964	104	na	na
TP-23-0.75	Test Pit 23	AS/NS	0.75	4/5/07	7.4	5.5	0.041	739	na	na

Table 2 - Total Metals and Inorganics Results for Soil Samples
Former Spring Hill Mine Site
APNs 35-260-62, 63 and 64
Grass Valley, California

Sample Number	Sample Location	Sample Type	Sample Depth (feet bgs)	Sample Date	Total Arsenic (mg/kg)	Total Lead (mg/kg)	Total Mercury (mg/kg)	Total Nickel (mg/kg)	Total Cyanide (mg/kg)	Total Nitrate (mg/kg)
TP-24-0.25	Test Pit 24	AS/NS	0.25	4/5/07	7.6	11.0	0.109	614	na	na
TP-25-0.75	Test Pit 25	AS/NS	0.75	4/5/07	2.5	1.6	0.171	314	na	na
TP-25-1.5	Test Pit 25	AS/NS	1.5	4/5/07	3.0	ND<1.0	0.105	274	na	na
TP-27-0.5	Test Pit 27	T	0.5	4/5/07	3.5	3.1	0.040	348	na	na
TP-27-2.0	Test Pit 27	T	2.0	4/5/07	2.6	2.6	0.039	211	na	na
S-11	S-11	T	0.25	4/5/07	35.0	20.8	19.5	488	na	na

Notes:
bgs- below ground surface
mg/kg - milligrams per kilogram
ND<1.0 - not detected at or above indicated laboratory reporting limit
na - not analyzed
WR/SP - waste rock and spoils pile
T - tailings
AS/NS - soil affected by mining or processing activities and native soil

Analysis for total arsenic, lead and nickel by U.S. EPA Test Method 6010B
Analysis for total mercury by U.S. EPA Test Method 7471A
Analysis for total cyanide by U.S. EPA Test Method 9014
Analysis for total nitrate by U.S. EPA Test Method 300.0

Table 3 - Total Metals Results for Background Soil Samples **Former Spring Hill Mine Site** APNs 35-260-62, 63 and 64 Grass Valley, California							
Sample Number	**Sample Location**	**Sample Depth (feet bgs)**	**Sample Date**	**Total Arsenic (mg/kg)**	**Total Lead (mg/kg)**	**Total Mercury (mg/kg)**	**Total Nickel (mg/kg)**
BG-1	BG-1	0 - 0.5	5/20/03	ND<1.0	6.0	0.069	na
BG-2	BG-2	0 - 0.5	5/20/03	ND<1.0	9.1	0.140	na
BG-3	BG-3	0 - 0.5	5/20/03	17	13	0.066	na
BG-4	BG-4	0 - 0.5	10/11/05	ND<1.0	20.4	na	na
BG-5	BG-5	0 - 0.5	10/11/05	ND<1.0	6.8	na	na
BG-6	BG-6	0 - 0.5	10/11/05	ND<1.0	15.0	na	na
S-12	S-12	0.25	4/18/07	ND<1.0	5.0	na	1,620
S-13	S-13	0.25	4/18/07	ND<1.0	3.1	na	1,680

Notes:
bgs- below ground surface
mg/kg - milligrams per kilogram
ND< - not detected at or above indicated laboratory reporting limit
na - not analyzed
Analysis for total arsenic, lead and nickel by U.S. EPA Test Method 6010B
Analysis for total mercury by U.S. EPA Test Method 7471A
Analysis for total cyanide by U.S. EPA Test Method 9014
Analysis for total nitrate by U.S. EPA Test Method 300.0

Table 4 - Title 22 Metals Results for Soil Samples
Former Spring Hill Mine Site
APNs 35-260-62, 63 and 64
Grass Valley, California

Analyte (mg/kg)	Sample Identification									*Laboratory Reporting Limit (mg/kg)*	*Residential CHHSL (mg/kg)*	*Industrial CHHSL (mg/kg)*	*TTLC (mg/kg)*	*STLC (mg/L)*
	FND-S5	WR-S13	WR-S17	TP-5-10	TP-9-0.5	TP-15-3	S-1	S-10	TP-21-0.75					
Antimony	10.2	12.2	6.9	5.0	7.0	6.2	4.3	9.9	12.4	*1.0*	*30*	*380*	*500*	*15*
Arsenic	22.3	20.2	45.8	94.6	ND	10.6	27.6	377	302	*1.0*	*0.07*	*0.24*	*500*	*5*
Barium	7.1	9.5	12.5	5.5	11.1	4.0	48.3	103	71.7	*2.0*	*5,200*	*63,000*	*10,000*	*100*
Beryllium	ND<0.3	ND<0.3	ND<0.3	ND	ND	ND	ND	ND	ND	*0.5*	*150*	*1,700*	*75*	*0.75*
Cadmium	0.8	1.1	0.7	1.2	1.5	1.0	2.3	2.6	3.4	*1.0*	*1.7*	*7.5*	*100*	*1.0*
Chromium	26	55.3	26.3	39.1	20.8	60.4	962	43.2	85.9	*1.0*	*100,000*	*100,000*	*2500*	*560*
Hex. Chromium	na	na	ND	na	na	na	na	na	na	*0.001*	*17*	*37*	*500*	*5*
Cobalt	49.5	41.3	47.3	19.1	56.3	13.1	41.3	21.4	79.4	*5.0*	*660*	*3,200*	*8000*	*80*
Copper	17.9	94.2	26.2	31.2	36.6	11.8	72.0	235	467	*2.0*	*3,000*	*38,000*	*2500*	*25*
Lead	21.6	12.2	37.1	12.3	6.9	18.4	300	348	615	*1.0*	*150*	*3,500*	*1000*	*5*
Mercury	0.276	0.189	0.129	0.193	0.215	1.08	0.231	22.5	10.8	*0.010*	*18*	*180*	*20*	*0.2*
Molybdenum	ND	ND	ND	ND	ND	ND	3.7	1.1	ND	*1.0*	*380*	*4,800*	*3500*	*350*
Nickel	677	464	680	285	1,050	278	977	303	471	*1.0*	*1,600*	*16,000*	*2000*	*20*
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	*2.0*	*380*	*4,800*	*100*	*1.0*
Silver	ND	ND	ND	ND	ND	ND	ND	16.7	21.8	*2.0*	*380*	*4,800*	*500*	*5*
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	*2.0*	*5.0*	*63*	*700*	*7.0*
Vanadium	23.5	48.1	20.4	29.0	16.6	54.6	948	47.4	79.4	*2.0*	*530*	*6,700*	*2400*	*24*
Zinc	38.4	31.9	29.8	20.9	17.7	21.4	129	165	318	*2.0*	*23,000*	*100,000*	*5000*	*250*

Notes:
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
ND = Not detected at or above the laboratory reporting limit
CHHSL = California Human Health Screening Level
TTLC = Total threshold limit concentration
STLC = Soluble threshold limit concentration
na = Not analyzed

The laboratory reporting limit for mercury in sample S-10 was 0.050 mg/kg.

Table 5 - DI-WET Solubility Analysis Results
Former Spring Hill Mine Site
APNs 35-260-62, 63 and 64

Grass Valley, California

Sample Number	Sample Date	DI-WET As (ug/L)	DI-WET Pb (ug/L)	DI-WET Hg (ug/L)	DI-WET Ni (ug/L)
WR-17	10/11/05	ND<10	ND<10	na	ND<10
FND-S5	10/25/05	ND<10	ND<10	na	ND<10
FND-S6	10/25/05	ND<10	ND<10	na	ND<10
TP-5-10	3/13/07	44.7	ND<6	ND<0.333	ND<10
TP-5-10*	3/13/07	ND<2.0	ND<1.2	na	32.7
TP-9-0.5	3/13/07	15.6	ND<6	ND<0.333	25.2
TP-15-3	3/14/07	15.1	ND<6	ND<0.333	ND<10
S-1	3/14/07	ND<10	ND<6	ND<0.333	48.1
S-10	3/23/07	26.1	9.3	ND<0.333	15.5
TP-21-0.75	4/5/07	26.5	11.6	ND<0.333	na
TP-2-6	3/13/07	11.3	1.4	na	4.5
TP-8-3	3/13/07	3.7	1.2	na	16.8
TP-8-6	3/13/07	6.3	ND<1.2	na	2.3
TP-9-6	3/13/07	24.7	ND<1.2	na	3.4
TP-13-2	3/14/07	3.4	1.4	na	10.9
TP-5-15	3/13/07	5.2	1.7	na	4.9
TP-15-5	3/14/07	ND<2.0	ND<1.2	na	6.2
TP-16-0.5A	3/14/07	ND<2.0	ND<1.2	na	10.5
TP-17-4	3/14/07	ND<2.0	ND<1.2	na	8.9
S-12**	4/18/07	ND<10.0	ND<6.0	na	58.5
S-13**	4/18/07	18.6	ND<6.0	na	26.2

Notes:

DI = Deionized water

WET = Waste Extraction Test

As = Arsenic

Pb = Lead

Hg = Mercury

Ni = Nickel

ug/L = micrograms per liter

ND< = Not detected above indicated laboratory reporting limit

na = Not analyzed

* = TP-5-10 was re-analyzed using lower reporting limits for As, Pb and Ni.

** = Background sample

The As, Pb and Ni analysis of the extract was conducted using EPA Test Method 6010B.

The mercury analysis of the extract was condcuted using EPA Test Method 7471.

Table 6 - Acid-Base Accounting Results **Spring Hill Property** APNs 35-260-62, 63 and 64 Grass Valley, California						
Sample Number	Sample Date	AGP Sulfide	AGP Total	NP	NP/Total AGP	pH
FND-S5	10/25/2005	0.9	1.9	180	94.7	9.14
WR-S17	10/11/2005	1.9	2.5	150	60.0	9.54
TP-8-6	3/13/2007	11	13	250	19.2	9.42
TP-17-4	3/13/2007	ND<0.3	ND<0.3	320	1066.7	9.77

Notes:

mg/kg = Milligrams per kilogram

AGP = Acid generating potential (tons/1000 tons)

NP = Neutralizing potential (tons/1000 tons)

Reporting limit used for non-detectable results to calculate NP/AGP.

Table 7a - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Surface Water for Current Site Conditions APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 µg/L[2]	10	2 µg/L
Lead	2.0 µg/L[3]	10	2 µg/L
Mercury	1.2 µg/L[4]	10	1.2 µg/L
Nickel	12 µg/L[5]	10	12 µg/L

Notes:

1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)

2 Laboratory quantitation limit (2.0 µg/L) is greater than California Public Health Goal for drinking water (0.004 µg/L)

3 California Public Health Goal for drinking water

4 California Public Health Goal for drinking water (non-methylmercury)

5 California Public Health Goal for drinking water

µg/L = micrograms per liter

Table 7b - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Surface Water Proposed On Site Placement APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 µg/L[2]	100	20 µg/L
Lead	2.0 µg/L[3]	100	20 µg/L
Mercury	1.2 µg/L[4]	100	12 µg/L
Nickel	12 µg/L[5]	100	120 µg/L

Notes:

1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)

2 Laboratory quantitation limit (2.0 µg/L) is greater than California Public Health Goal for drinking water (0.004 µg/L)

3 California Public Health Goal for drinking water

4 California Public Health Goal for drinking water (non-methylmercury)

5 California Public Health Goal for drinking water

µg/L = micrograms per liter

Table 8a - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Groundwater for Current Site Conditions APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 µg/L[2]	10	2 µg/L
Lead	2.0 µg/L[3]	10	2 µg/L
Mercury	1.2 µg/L[4]	10	1.2 µg/L
Nickel	12 µg/L[5]	10	12 µg/L

Notes:
1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)
2 Laboratory quantitation limit (2.0 µg/L) is greater than California Public Health Goal for drinking water (0.004 µg/L)
3 California Public Health Goal for drinking water
4 California Public Health Goal for drinking water (non-methylmercury)
5 California Public Health Goal for drinking water
µg/L = micrograms per liter

Table 8b - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Groundwater Proposed On Site Placement APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 µg/L[2]	100	20 µg/L
Lead	2.0 µg/L[3]	100	20 µg/L
Mercury	1.2 µg/L[4]	100	12 µg/L
Nickel	12 µg/L[5]	100	120 µg/L

Notes:
1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)
2 Laboratory quantitation limit (2.0 µg/L) is greater than California Public Health Goal for drinking water (0.004 µg/L)
3 California Public Health Goal for drinking water
4 California Public Health Goal for drinking water (non-methylmercury)
5 California Public Health Goal for drinking water
µg/L = micrograms per liter

APPENDIX J-3A

Removal Action Work Plan

DRAFT FINAL
REMOVAL ACTION WORK PLAN
for
SPRING HILL PROPERTY
APNs 35-260-62, 63 and 64
Grass Valley, California

Prepared for:

Department of Toxic Substances Control
8800 Cal Center Drive, Third Floor
Sacramento, California 95826

Prepared by:

Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3292-05
June 15, 2012

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 3292-05
June 15, 2012

Department of Toxic Substances Control
8800 Cal Center Drive, Third Floor
Sacramento, California 95826

Attention: Mr. Dean Wright

Reference: ***Spring Hill Property***
APNs 35-260-62, 63, and 64
Grass Valley, California

Subject: ***Draft Final Removal Action Work Plan***

Dear Mr. Wright:

Holdrege & Kull (H&K) prepared this Removal Action Work Plan (RAW) to describe procedures for conducting soil excavation, off-site disposal and on-site placement activities at the Spring Hill Property (the site) located in Grass Valley, Nevada County, California. The approximately 26-acre site comprises assessor's parcel numbers (APNs) 35-260-62, 63, and 64, which are located immediately south of Dorsey Drive and southeast of Highway 49/20. This RAW summarizes the results of H&K's January 11, 2008 Preliminary Endangerment Assessment (PEA) of the site, evaluates remedial alternatives, presents the recommended remedial actions and describes procedures for conducting the remediation.

If you have any questions regarding this RAW, please contact the undersigned.

Sincerely,

HOLDREGE & KULL

REGISTERED PROFESSIONAL ENGINEER
JASON W. MUIR
No. 60167
Exp. 6/14
STATE OF CALIFORNIA

Jason W. Muir, C.E. 60167
Principal Engineer

copies: 2 DTSC /Attn: Mr. Dean Wright

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LIST OF ATTACHMENTS

LIST OF ATTACHMENTS (continued)

APPENDICES

LIST OF ACRONYMS

AOC	Area of concern
APN	Assessor's Parcel Number
ARAR	Applicable, relevant and appropriate requirements
ASTM	American Society for Testing and Materials
ATCM	Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations
bgs	Below ground surface
BTV	Background threshold value
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CFR	Code of Federal Regulations
COPC	Constituent of potential concern
CHHSL	California Human Health Screening Level
DI	Deionized water
DLM	Designated Level Methodology
DMP	Dust Mitigation Plan
DTSC	California Department of Toxic Substances Control
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
HHSE	Human Health Screening Evaluation
HSC	California Health and Safety Code
H&K	Holdrege & Kull
LOS	Level of service
LUC	Land use covenant
mg/kg	Milligrams per kilogram
mg/m^3	Milligrams per cubic meter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOA	Naturally occurring asbestos
OMA	Operation and maintenance agreement
PEA	Preliminary Endangerment Assessment
RAO	Remedial action objective
RAW	Removal Action Workplan
RCRA	Resource Conservation and Recovery Act
RWQCB	California Regional Water Quality Control Board
SDL	Soluble designated level
SSP	Site Safety Plan
UCL	Upper confidence level

LIST OF ACRONYMS (continued)

UPL	Upper Percentile Limit
VCA	Voluntary Cleanup Agreement
VSAP	Verification Sampling and Analysis Plan
WET	Waste Extraction Test
XRF	X-ray fluorescence
µg/dL	Micrograms per deciliter
µg/m^3	Micrograms per cubic meter
µg/L	Micrograms per liter

EXECUTIVE SUMMARY

The R. Jeter Family Trust (the proponent) entered into a Voluntary Cleanup Agreement (VCA; Docket No. HSA-VCA 08/09-044) with the California Department of Toxic Substances Control (DTSC) to characterize and mitigate recognized environmental conditions at the Spring Hill Property (the site). On behalf of the proponent, Holdrege & Kull (H&K) prepared this Removal Action Workplan (RAW) to describe remedial action this is to be performed at the site

H&K prepared this RAW pursuant to California Health and Safety Code (HSC) Chapter 6.8, Sections 25323.1 and 25356.1, California Senate Bill 1706, and the National Contingency Plan (NCP). The purpose of this RAW is to describe procedures for conducting remedial activities to address recognized environmental conditions associated with past site use. The RAW presents remedial action objectives, proposes remedial procedures for the recommended remedial alternatives, and provides a verification soil sampling plan to document that remedial action objectives are achieved.

DTSC comments (October 2, 2008) on the Draft RAW (August 22, 2008) are included in Appendix A. Sections 6.2.4 and 6.3.5 of this RAW have been revised to address DTSC's comments on the Draft RAW.

Site Description

The approximately 26-acre site is located south of Dorsey Drive and southeast of State Highway 49/20 in Grass Valley, Nevada County, California. The site comprises Nevada County Assessor's Parcel Numbers (APNs) 35-260-62, 35-260-63 and 35-260-64.

The gently to moderately sloping site is currently undeveloped. Commercial site development has been proposed. Nearby land uses include State Highway 49/20, commercial development, and residential apartment complexes. Sierra Nevada Memorial Hospital is located west of the site, across State Highway 49/20.

The site is located in the Grass Valley Mining District at the former location of the Spring Hill Mine, which operated intermittently from the late 1800s to the early 1940s. Abandoned mine features identified at the site include horizontal and inclined excavations, pits, relic foundations, stockpiles of mine waste rock, and dry tailings ponds.

Preliminary Endangerment Assessment

H&K performed a Preliminary Endangerment Assessment (PEA) to provide information for use in determining whether past hard rock gold mining and ore processing activities resulted in the release of metals and/or cyanide at concentrations that pose a threat to human health or the environment. The PEA findings are presented in H&K's *Draft Final Preliminary Endangerment Assessment for Former Spring Hill Mine Property* (PEA report; January 11, 2008). DTSC approved the PEA report in a letter dated February 5, 2008.

An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of processed tailings are identified at the site. Of this, an estimated 1,700 cubic yards of mine waste and affected soil having elevated metals concentrations are identified adjacent to a former mill area. The former mill area is identified as area of concern (AOC) 1, and the remaining mine waste (generally located to the west of the mill) is identified as AOC 2.

A human health risk assessment was performed as part of the PEA to evaluate baseline conditions. Exposure media for the site are soil and air. Exposure pathways are incidental ingestion and dermal contact with the affected soil, and inhalation of particulates originating from the affected soil. In general, soil arsenic concentrations govern the calculated chronic human health hazard and excess lifetime cancer risk.

Other metals (including antimony, copper, lead, mercury and vanadium) are also considered constituents of potential concern (COPCs). The COPCs were identified by comparing upper confidence limit (UCL) values or maximum concentrations for the assessment areas to UCL values or mean concentrations for ambient data, as available.

Based on the local geology, naturally occurring asbestos (NOA) may be encountered at the site during remediation and site development. In the Sierra Nevada foothills area, ultramafic rock and serpentinite are associated with NOA minerals such as chrysotile, actinolite and tremolite.

Based on the human health risk assessment performed as part of the PEA, mine waste and affected soil in AOC 1 are not acceptable for use under the three exposure scenarios considered: standard (unrestricted land use), commercial indoor worker and construction worker.

The mine waste and affected soil in AOC 2 are also not acceptable for use under the standard exposure scenario. Considering the commercial indoor worker and construction worker exposure scenarios, the hazard indices are less than the benchmark value of 1 and the risk values fall between the lower (1.E-06) and upper (1.E-04) benchmark values for risk management decision-making.
Results of acid-base accounting indicate that the mine waste rock and tailings are not acid-generating; thus, soluble metals were evaluated by Waste Extraction Test method using deionized water (DI-WET). Soluble arsenic and lead were detected by DI-WET at concentrations exceeding the calculated soluble designated level (SDL) for surface water and groundwater under current conditions. However, the mine waste rock and tailings in AOC 2 are considered suitable for on-site consolidation and burial beneath the proposed commercial development and can be classified as Group C mine waste per CCR Title 27.

Proposed Remedial Measures

The mine waste is to be cleaned up to background levels and either (1) consolidated and buried beneath the proposed commercial development or (2) excavated and removed from the site. The proposed remediation goals are based on the results of human health risk assessment and the evaluation of local background soil concentrations. The remediation goals are summarized below.

- Mine waste and soil that is to be consolidated and buried on-site: The 95% UCL on the mean total arsenic concentration in soil must be protective under the construction worker scenario (less than or equal to 22 milligrams per kilogram (mg/kg)). Soluble arsenic concentrations must not exceed the arsenic SDL (20 micrograms per liter (µg/L)). Cleanup goals for other metals (such as copper, lead, mercury and vanadium) are described in this RAW. Materials that exceed these goals are to be removed from the site.

- Mine waste and soil that is to remain at the site without consolidation and burial: Total arsenic concentrations in soil must be within the range of local background levels. Cleanup goals for other metals of potential concern (such as copper, lead, mercury and vanadium) are described in this RAW.

Cost Analysis

The NCP requires the use of an Engineering Evaluation/Cost Analysis (EE/CA) or equivalent. This RAW is to serve as the equivalent of an EE/CA. Three remedial alternatives are evaluated within the RAW for remediation of mine waste. The evaluation of the remedial alternatives is based on effectiveness, implementability and cost.

Excavation and Off-site Disposal is the recommended remedial alternative for AOC 1. An estimated 1,700 cubic yards of mine waste and affected soil are to be excavated from AOC 1 and transported to an appropriate Class I or Class II solid waste disposal facility. The estimated cost for off-site disposal is $275,000.

Excavation and On-site Placement is the recommended alternative for AOC 2. An estimated 62,300 cubic yards of mine waste and affected soil are to be excavated, transported within the site, and consolidated in an area that is not subject to surface water infiltration or groundwater seepage. A conceptual placement plan and general grading recommendations are presented in this RAW. Prior to implementation, site development plans depicting the final development layout and waste placement details are to be prepared for review and approval by DTSC. The estimated cost for on-site placement is $719,000. This cost does not include general construction items such as rock excavation, fill slope grading and paving, which are to be performed as part of the proposed commercial development process.

Restrictions on Site Use Prior to Remediation

If site activities are performed prior to the site remediation activities presented in this RAW, the remediation areas must be identified and marked in the field so that the areas may be avoided. Potential site activities that may result in disturbance of the mine waste stockpiles and impacted soil areas include timber harvest, grading and road construction, brush clearing for fire prevention, and other ground disturbing activities. DTSC must be allowed to review any proposed ground disturbing activities if the activities are to be performed prior to the implementation of the recommended remedial procedures.

Dust Mitigation Plan

Under California law, disturbance of soil and rock that contain ultramafic rock, serpentinite or NOA minerals must be handled as described in California Environmental Protection Agency (Cal/EPA) Air Resources Board Regulation 93105, *Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations* (ATCM). Per the ATCM, site work must be performed according to protocols established by an Asbestos Dust Mitigation Plan. The Dust Mitigation Plan (DMP) appended to this RAW outlines engineering controls to reduce the risk of release of metals and NOA fibers into the environment during mechanical soil disturbance. Mechanical soil disturbance includes site clearing, excavation, grading, underground utility work, transportation, and disposal activities.

Mitigation of Physical Hazards

The abandoned mine excavations identified at the site, as well as other mine excavations that may be present on and adjacent to the site, present physical hazards and may not be suitable to support structural improvements. The excavations should be closed to address the possibility of entrapment, collapse, hazardous confined space conditions and other physical hazards. Temporary measures are appropriate to reduce the existing physical hazards. Final physical closure of the excavations is to be performed in accordance with recommendations from a qualified geotechnical engineer and with the approval of the local building department.

Public Participation

Section 25356.1 of the HSC outlines public participation requirements for the remedial action. Requirements include the preparation of a community profile report to determine public interest in the remedial action, notice of the RAW in a newspaper of general circulation, provision of a minimum 30-day public comment period, and preparation of a responsiveness summary. A community profile was prepared as part of the PEA.

1 INTRODUCTION

Holdrege & Kull (H&K) prepared this Removal Action Workplan (RAW) on behalf of the R. Jeter Family Trust (the proponent) to describe procedures for conducting remedial activities associated with recognized environmental conditions at the Spring Hill Property (the site). The approximately 26-acre site is comprised of Nevada County Assessor's parcel numbers (APNs) 35-260-62, 63, and 64. Figure 1 is a site vicinity map.

The proponent is completing a Voluntary Cleanup Agreement (VCA; Docket No. HSA-VCA 08/09-044) with the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substance Control (DTSC). Pursuant to the VCA, H&K performed a Preliminary Endangerment Assessment (PEA) to evaluate site conditions and potential risks to human health and the environment resulting from historical site use. The PEA findings are presented in H&K's *Draft Final Preliminary Endangerment Assessment of Former Spring Hill Mine Property* (PEA report; January 11, 2008). A summary of the PEA investigation is presented in Section 2.2 of this RAW. The DTSC approved the PEA findings in a letter dated February 5, 2008.

The requirement for preparation of a RAW was created by Senate Bill 1706 in 1994. The RAW is one of two remedy selection documents that may be prepared for a hazardous substance release site pursuant to Section 25356.1 of the California Health and Safety Code (HSC). A RAW was chosen over a Remedial Action Plan because the proposed remediation is not an emergency action, and the estimated cost of the recommended remedial action is projected to be less than the threshold cost of $1,000,000.

The remedial action outlined in this RAW is to be conducted in a manner consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations (CFR) 300.400 et seq). The NCP requires the use of an Engineering Evaluation/Cost Analysis (EE/CA) or equivalent. This RAW is to serve as the equivalent of an EE/CA.

Section 25356.1 of the HSC outlines public participation requirements for the RAW. Requirements include the preparation of a community profile report to determine public interest in the remedial action, notice of the RAW in a newspaper of general circulation, provision of a minimum 30-day public comment period, and preparation of a responsiveness summary.

1.1 BASIS FOR REMEDIAL ACTION

Pursuant to Section 25356.1.5 of the California HSC, the proposed remedial action shall be based upon, and be no less stringent than:

- Requirements established under federal regulation pursuant to Subpart E of the NCP (40 CFR 300.400 et seq), as amended, which pertains to remedial action and selection of remedial alternatives;
- Regulations established pursuant to Division 7 (commencing with Section 13000) of the California Water Code, which pertains to state and regional water quality control;
- Applicable water quality control plans adopted pursuant to Section 13170 of the California Water Code;
- Article 3 (commencing with Section 13240) of Chapter 4 of Division 7 of the California Water Code, which pertains to water quality control plans and waste discharge requirements;
- Applicable state policies for water quality control adopted pursuant to Article 3 (commencing with Section 13140) of Chapter 3 of Division 7 of the California Water Code, to the extent that those policies are consistent with the federal regulations;
- Applicable provisions of the California HSC, to the extent those provisions are consistent with the federal regulations; and the PEA risk assessment findings.

1.2 PURPOSE

The purpose of the RAW is to evaluate remedial alternatives and to select a remedial alternative that effectively reduces, to the extent feasible, the human health risks and water quality risks associated with mine waste and impacted soil at the site. The evaluation considers the effectiveness, implementability and cost associated with each alternative. This RAW presents the recommended remedial action, as well as a verification sampling plan to confirm that the proposed remedial goals are achieved.

1.3 ORGANIZATION

Per Section 25323.1 of the HSC, a RAW must include a plan for conducting the remedial action, a description of the on-site contamination, the goals to be achieved by the remedial action, and the rationale for consideration of alternative removal options.

This RAW contains components required by DTSC's Removal Action Workplans memorandum dated September 23, 1998, and is organized in the following sections:

1. *Introduction*. This section includes an overview of the proposed remedial action and associated regulations, purpose of the RAW, and organization of the RAW.

2. *Site Characterization*. This section includes site description, ownership and operational history, site conditions, brief description of site characterization activities conducted, nature and extent of contamination, and description of response actions taken, if any.

3. *Remedial Action Objectives*. This section includes a discussion of regulations, identification and review of applicable or relevant and appropriate requirements (ARARs), identification of media and constituents of concern, estimate of volumes, and remedial action goals.

4. *Evaluation of Remedial Action Alternatives*. This section includes a listing of alternative remedial measures and basis for selection of the recommended measure.

5. *Site Safety Plan*. This section includes a brief overall description of the methods that will be employed during the removal action to ensure the health and safety of workers and the public during the removal action.

6. *Remedial Procedures and Implementation*. This section includes a description of techniques and methods to be employed in the remedial action, including excavation, storing, handling, transportation, treating and disposing of material on or off the site, as applicable. The Verification Sampling and Analysis Plan (VSAP), which is intended to confirm the effectiveness of the RAW, is discussed in this section.

7. *Public Participation*. This section includes a discussion of public participation in the remedial action.

8. *Remedial Action Reporting*. This section includes a brief description of the post-remediation report which is to be prepared to summarize remedial activities and to document compliance with the RAW.

Appendix A presents a list of administrative record documents for the remedial action. DTSC comments (October 2, 2008) on the Draft RAW (August 22, 2008) are included in Appendix A. Sections 6.2.4 and 6.3.5 of this RAW have been revised to address DTSC's comments on the Draft RAW.

2 SITE CHARACTERIZATION

2.1 SITE LOCATION AND DESCRIPTION

The approximately 26-acre site is located south of Dorsey Drive and southeast of State Highway 49/20 within the Grass Valley city limits in Nevada County, California. The site comprises Nevada County APNs 35-260-62, 63 and 64.

Referencing the Grass Valley Quadrangle map (United States Geological Survey, provisional edition 1995), the site is located in the southern half of the southeast quarter of Section 23 and the northern half of the northeastern quarter of Section 26, Township 16 North, Range 8 East. Figure 1 is a vicinity map depicting the locations of other PEA investigations in the Grass Valley area. Figure 2 is a site map, showing APNs, existing site features, stockpile locations, selected sample locations and property boundaries.

2.1.1 Site Description and Current Site Uses

Surface topography at the site generally slopes toward the south and southwest from a relatively flat-lying area in the northern portion of the site and a knoll in the northern central portion of the site. The northern portion of the eastern edge of the site slopes toward the southeast. The site elevation ranges from approximately 2550 feet to approximately 2690 feet above mean sea level. The site is generally vegetated by oak, manzanita, pine and cedar. Rock outcrop is present at several locations on the north and west sides of the site.

The site is currently undeveloped. Foundations of structures from the historic mining operations remain at the site. Several roads and trails are located within the site, some of which are depicted on Figure 3. The roads and trails may be used periodically by trespassers. The site is zoned corporate business park by the City of Grass Valley Planning Department.

2.1.2 Adjacent Properties

The site is bordered by Dorsey Drive to the north, and across it an apartment complex; by State Highway 49/20 to the northwest, by Spring Hill Drive and commercial property to the south and southwest, and by an apartment complex to the east. Sierra Nevada Memorial Hospital is located approximately 500 feet west of the site, across State

Highway 49/20 and at a higher elevation. The Spring Hill Manor convalescent hospital is also located west of the site, across State Highway 49/20.

2.1.3 Geologic Setting

The site is located within a region underlain by a complex assemblage of igneous and metamorphic rocks in the western foothills of the Sierra Nevada. The regional structure of the foothills is characterized by the north-northwest trending Foothills Fault System, a feature formed during the Mesozoic era (between 65 million and 248 million years before present) in a compressional tectonic environment. A change to an extensional tectonic environment during the late Cenozoic (last nine million years) resulted in normal faulting, which has occurred coincident with some segments of the older faults in the region.

2.1.4 Geologic Conditions

Based on the Geologic Map of the Grass Valley - Colfax Area (A. Tuminas, 1983), the site is mapped as serpentine rocks of the Early Mesozoic aged Ultramafic-Mafic “Basement” Unit of the Lake Combie Complex. According to the Mineral Land Classification of Nevada County (Special Report 164, California Department of Conservation Division of Mines and Geology, 1990), the site geology is mapped as the ultramafic unit of the Jurassic-aged Lake Combie Complex. The Mesozoic era occurred from approximately 245 to 65 million years ago. The Jurassic period occurred from approximately 206 to 144 million years ago.

The Nevada City Special Folio, California (United States Geologic Survey; 1896) depicts an east-west trending quartz vein passing through the central portion of the site. The vein depicted dips to the north.

2.1.5 Soil Conditions

The *Soil Survey of Nevada County, California, Western Part* (United States Department of Agriculture, Soil Conservation Service, August 1993) indicates that soil conditions across the majority of the site are mapped as rock outcrop of the Dubakella Complex, 5 to 50% slopes. The central portion of the site is mapped as “Placer Diggings,” although this classification is incorrect based on the identification of past hard rock gold mining in this area. A small part of the eastern portion of the site is mapped as Sites loam, 9 to 15% slopes.

H&K excavated exploratory trenches through native soil at the site. Native soil was encountered at the ground surface in some trenches and at depth beneath waste rock and tailings in other trenches. The native soil generally consisted of clay, sandy clay and gravelly sandy clay. Severely to moderately weathered diabase and serpentine was encountered in several trenches beneath the clay in the central portion of the site. In the trenches where rock was encountered, the clay was observed to be up to 2.5 feet thick.

2.1.6 Groundwater Conditions

H&K reviewed well completion reports provided by the California Department of Water Resources for wells in the site vicinity. The well completion reports indicate that depths to first encountered groundwater ranged from 60 to 152 feet in wells constructed within 2000 feet of the site. A well at Spring Hill Manor convalescent hospital (located approximately 300 feet west of the site) is screened from 65 to 85 feet below ground surface (bgs)). The water level in the Spring Hill Manor well was not reported. Based on the well completion reports, groundwater in the site vicinity is typically encountered within bedrock fractures.

The proposed site development likely will not include construction of water supply wells because the site is within the city limits and domestic water is provided by a treated municipal source.

2.1.7 Surface Water Conditions

Surface water was not encountered on the site during the PEA investigation, although seasonal surface water flow associated with storm water runoff is expected in the lower (southern) portion of the site. According to the 7.5-minute Grass Valley Quadrangle Map (U.S. Geological Survey, provisional edition 1995), Wolf Creek is located approximately 500 feet south and down-gradient of the site.

Wolf Creek flows approximately 14 miles south of its location near the site into the Bear River near the southern border of Nevada County. The Bear River then flows approximately nine miles northwest into Camp Far West Reservoir and then approximately 17 miles southwest from Camp Far West Reservoir into the Feather River.

2.1.8 Site History

H&K reviewed several topographic surveys, historical mining maps and documents relating to site mining history, as well as a Phase 1 Environmental Site Assessment of the Spring Hill Mine property prepared by others in 1997. Figure 4 depicts the locations of the identified mine features. The following documents were reviewed:

- *Nevada County Mining Review* (Grass Valley Daily Morning Union, 1895),
- Nevada City Special Folio, California (United States Geologic Survey; 1896),
- Map of the Vicinity of Grass Valley/Nevada City, California (Uren, 1897),
- *Gold Quartz Veins of Grass Valley* (Johnston, 1940),
- *State Mineralogists Report XXXVII*, (California State Mining Bureau, 1940),
- Map of Spring Hill Mining Co., (E. Uren, 1942), and
- *Phase I Environmental Site Assessment, Spring Hill Mine Area* (Anton Geological, July 10, 1997).

The 1897 Map of the Vicinity of Grass Valley/Nevada City, California depicts the Spring Hill Mine claim boundaries covering the site and extending onto adjacent property.

The 1896 Nevada City Special Folio shows an east-west trending quartz vein passing through the central portion of the site with three mine shafts on the site. The approximate shaft locations are indicated on Figure 4.

The 1895 *Nevada County Mining Review* indicates two mining locations and one mill site were present at the Spring Hill Mine and that a 2400-foot quartz vein passes through the site, which is described as 3 to 4 feet wide with “heavy outcrops”.

The 1940 *Gold Quartz Veins of Grass Valley* states that the quartz vein passing through the site strikes east and dips to the south (contrary to the earlier map depicting shafts inclined to the north). Only shallow shafts were advanced in the “early days” and the mine reopened in 1931. The ore body was reportedly located along the contact between serpentine and minor diorite rock. “Much carbonate” was present in the serpentine.

The 1940 *State Mineralogist’s Report* indicates prospecting had occurred at the Spring Hill Mine for many years. A 100-ton ore processing plant employing floatation operated part time (the likely source of the mill tailings observed at the site). The main shaft had reportedly been sunk to a depth of 1900 feet with many thousands of feet of drift. Results as of 1940 were reported to be “not satisfactory.”

The 1942 Map of the Spring Hill Mine Co. depicted the Spring Hill shaft, inclined to the north-northwest and numerous other features including apparent structures labeled “bin,” “hoist,” “compressor,” “mill,” “machine shop,” “carpenter shop,” “dry,” “furnace,” “superintendent residence,” and “garage.” Some labels on the map were not legible. The bin and hoist were depicted in-line with and south of the Spring Hill shaft. The mill was located to the east of the bin. Areas of mine waste labeled dump and tailings were depicted in the approximate locations where mine waste was observed during the site reconnaissance. Perimeter concrete foundations and slabs of former structures shown on the map were observed during site reconnaissance.

Record of mining activities at the site after the early 1940s was not encountered. Most hard rock gold mines in the area closed during World War II and did not reopen.

2.2 SUMMARY OF PEA INVESTIGATION

2.2.1 Field Investigation and Analytical Results

Details of site observations, field procedures, and sampling programs are included in the PEA report and are summarized below. PEA data are presented in Appendix B.

An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of processed tailings are identified at the site. Of this, an estimated 1,700 cubic yards of mine waste and affected soil having elevated metals concentrations are identified adjacent to a former mill area. The former mill area is identified as area of concern (AOC) 1, and the remaining mine waste (generally located to the west of the mill) is identified as AOC 2. H&K obtained approximately 92 soil samples from the AOCs and 8 ambient soil samples from apparently unimpacted portions of the site.

AOC 1

Approximately 20 soil samples were obtained from the ground surface and from trenches excavated in AOC 1. The samples were analyzed for total arsenic, total lead, total mercury and total nickel using EPA (United States Environmental Protection Agency) Methods 6010B and 7471A. The laboratory reported arsenic concentrations ranging from below a reporting limit of 1 milligram per kilogram (mg/kg) to 579 mg/kg. Lead concentrations ranged from below a reporting limit of 1 mg/kg to 810 mg/kg. Mercury concentrations ranged from 0.039 to 22.5 mg/kg. Nickel concentrations ranged from 104 to 1180 mg/kg.

Three soil samples from AOC 1 were analyzed for Title 22 metals using EPA Methods 6010B and 7471A. Excepting arsenic, lead, mercury (discussed above) and cadmium, Title 22 metals concentrations in the three samples did not exceed the respective California Human Health Screening Levels (CHHSLs) for residential or industrial soil.

Three soil samples from AOC 1 were analyzed for soluble arsenic, lead, nickel and mercury by DI-WET using EPA Methods 6010B and 7471A. Soluble arsenic was detected in soil samples S-10 and TP-21-0.75 at respective concentrations of 9.3 micrograms per liter (µg/L) and 11.6 µg/L, which exceeded the calculated site soluble designated level (SDL) for current conditions (2 µg/L). Soluble mercury was not detected in soil samples S-10 and TP-21-0.75. Soluble nickel detections in mine waste rock and tailings were within the range of soluble nickel concentrations detected in ambient soil (26.2 to 58.5 µg/L).

AOC 2

Approximately 72 soil samples were obtained from AOC 2. The samples were analyzed for total arsenic, total lead, total nickel and total mercury using EPA Methods 6010B and 7471A. The laboratory reported arsenic concentrations ranging from below a reporting limit of 1.0 mg/kg to 180 mg/kg. Lead concentrations ranged from below a reporting limit of 1.0 mg/kg to 310 mg/kg. Mercury concentrations ranged from below a reporting limit of 0.010 mg/kg to 19.5 mg/kg. Nickel concentrations ranged from 96.3 to 1290 mg/kg.

Six soil samples from AOC 2 were analyzed for Title 22 metals using EPA Methods 6010B and 7471A. Excepting arsenic, lead and mercury (as discussed above), Title 22 metals concentrations in the six samples did not exceed the respective CHHSLs for residential or industrial soil.

Sixteen soil samples from AOC 2 were analyzed for soluble arsenic, lead, nickel and mercury by DI-WET using EPA Methods 6010B and 7471A. Soluble arsenic was detected in eight of the soil samples at concentrations that exceeded the calculated site SDL for current conditions. However, the soluble arsenic concentrations for the samples are lower than the anticipated SDL for the proposed on-site consolidation. Soluble lead and mercury were not detected in soil samples at concentrations above the SDL for current site conditions. Soluble nickel detections in mine waste from AOC 2 were within the range of soluble nickel concentrations detected in ambient soil (26.2 to 58.5 µg/L).

Ambient Soil

Eight soil samples were obtained from the ground surface in areas of the site apparently unaffected by former mining activities. The samples were analyzed for total arsenic, total lead, total nickel and total mercury using EPA Methods 6010B and 7471A. The laboratory reported arsenic concentrations ranging from below a reporting limit of 1.0 mg/kg to 17 mg/kg. Lead concentrations ranged from 3.1 mg/kg to 20.4 mg/kg. Mercury concentrations ranged from below a reporting limit of 0.066 mg/kg to 0.140 mg/kg. Title 22 metals analysis was not performed on site ambient soil samples.

Two ambient soil samples, S-12 and S-13, were analyzed for soluble arsenic, lead, and nickel by DI-WET using EPA Method 6010B. Soluble arsenic was detected in one soil sample (S-13) at a concentration of 18.6 µg/L. Soluble lead was not detected in either of the samples above a reporting limit of 6 µg/L. Soluble nickel detections were 58.5 µg/L (S-12) and 26.2 µg/L (S-13).

2.2.2 Arsenic Concentrations in Local Background Soil

H&K compiled background soil arsenic data obtained from eight PEA sites (including the subject site) near Grass Valley, California. The local PEA sites include Spring Hill, North Star, Kenny Ranch, Winds Aloft, Osborne Hill, Loma Rica, La Barr Meadows and Bear River Mill. The locations of the above-listed sites with respect to the subject site are depicted on Figure 1 of Appendix C. Background arsenic concentrations are presented in Table 1 of Appendix C. DTSC has reviewed and approved the PEAs from which the background data were obtained.

The 208 local background arsenic concentrations range from non-detect to 48 mg/kg. The mean is 5.3 mg/kg, the standard deviation is 6.9 mg/kg and the coefficient of variation is 1.3. Descriptive statistics for the non-transformed and base 10 log-transformed data are presented in Tables 2 and 3, respectively, of Appendix C.

DTSC (1997, 2007) provides a framework in which risk assessors may identify background arsenic concentrations. Based on these guidance documents, H&K performed visual and statistical evaluation of the local background arsenic data as described below.

Microsoft Excel Analyze-it™ version 1.73 was used to prepare normality plots of the non-transformed and log-transformed data. The plots are presented following Table 3 of Appendix C. The non-transformed data are clearly not normal, as is often the case with trace metals. Although the log-transformed data generally display a linear distribution, the data are not normally distributed based on the Shapiro-Wilk normality test. The coefficient of variation (1.29), as well as gaps and inflections observed in the log-transformed data, attest to the fact that the data were obtained from different sites and different geologic units.

With the exception of the Winds Aloft site, the eight local PEA sites share similar geology. Published geologic descriptions generally indicate that the sites are underlain by quartz diorite, diabase and/or ultramafic rock, as plotted on the QAP diagram presented as Figure 2 in Appendix C. The QAP in Figure 2 is a simplified depiction of the compositional ratio of quartz (Q), alkali feldspar (A), and plagioclase feldspar (P) in igneous plutonic rocks found at seven of the eight local PEA sites. Specific geologic descriptions are presented in Table 4 of Appendix C.

Outlying data were evaluated using the fourth spread procedure described by DTSC (2007). The fourth spread, f_s, is defined as the measure of spread in a data set that is resistant to outliers and is calculated according to the following equation: $f_s = Q_3 - Q_1$. By definition, any observation farther than $1.5f_s$ from the closest fourth is considered an outlier. For the log-transformed data set, $1.5f_s$ is equal to 1.25, and any observation below $Q_1 - 1.5f_s$ or above $Q_3 + 1.5f_s$ would be considered an outlier. By this method, none of the data were determined to be outliers.

The 95th percentile value for the local background arsenic data set is 17 mg/kg. This value is equal to the maximum arsenic concentration detected in background soil at the subject site.

2.2.3 Human Health Screening Evaluation

A human health screening evaluation (HHSE) was performed as part of the PEA to evaluate potential risks to human health from constituents of potential concern (COPCs) identified at the site. A site conceptual model diagram is presented as Figure 5. Exposure pathways and media of concern identified in the HHSE include:

- dermal contact and incidental ingestion of surface soil;
- inhalation of airborne particulates resulting from wind erosion of surface soil.

The potential for exposure associated with surface water or groundwater is considered to be low based on the results of solubility testing.

In general, the PEA findings indicate that arsenic is the most significant COPC relative to human health, and governs the proposed remedial action. Antimony, vanadium and other metals also contribute to the chronic human health hazard and are to be addressed as part of site remediation.

The HHSE included evaluation of residential, trespasser, commercial indoor worker and construction worker exposure scenarios. The results are summarized below and in Tables 10 and 11 of Appendix D. Details of the HHSE are presented in the PEA report. Appendix D of this RAW presents the HHSE data.

The mine waste in AOC 1 is not acceptable for unrestricted land use, and is also not acceptable for use under the other exposure scenarios considered.

The affected soil in AOC 2 is also not acceptable for unrestricted land use. Considering the commercial indoor worker and construction worker exposure scenarios, as the hazard indices are less than the benchmark value of 1 and the risk values fall between the lower (1.E-06) and upper (1.E-04) benchmark values for risk management decision-making.

Lead hazards were updated using the *Lead Risk Assessment Spreadsheet Version 8* (LeadSpread 8; DTSC, 2011) for child exposure, and the Modified USEPA Adult Lead Model (Modified ALM; DTSC, 2011) for adult exposure. These updated results are presented in Appendix D. Calculations were performed using standard exposure parameters and UCL values. The resulting 90^{th} percentile blood lead levels for non-pica child are 5.3, 0.5 and 0.2 micrograms per deciliter (µg/dL), respectively, for the mill area (AOC 1), other waste (AOC 2), and background soil. The resulting 90^{th}

percentile blood lead levels for an adult worker are 0.7, 0.1 and 0.0 µg/dL, respectively. The calculated child blood lead concentration for AOC 1 exceeds the 90th percentile benchmark blood lead concentration of 1 µg/dL and is not acceptable for unrestricted use. The calculated blood lead values for AOC 2 are below the benchmark blood lead concentration.

2.2.4 Evaluation of Risk to Surface Water and Groundwater

The potential risk to water quality (surface water and groundwater) was evaluated as part of the PEA using the Designated Level Methodology (DLM). The evaluation is summarized below, and details are presented in the PEA report:

AOC 1

Soluble arsenic and lead were detected by DI-WET at concentrations exceeding the calculated SDL for surface water and groundwater under current conditions.

AOC 2

The mine waste rock and tailings within the southern (down slope) portion of AOC 2 are subject to ephemeral storm water runoff. Soluble arsenic and lead were detected in AOC 2 by DI-WET at concentrations exceeding the calculated SDL for surface water and groundwater under current conditions. However, the mine waste in AOC 2 can be classified as Group C mine waste per CCR Title 27, and is considered suitable for on-site consolidation and burial beneath the proposed commercial development.

2.2.5 Additional Evaluation of Site Background Soil Metals Concentrations

As part of the development of this RAW, ten additional background soil samples (S-14 through S-23) were obtained from the northern portion of the site, up slope of the identified mining features, at locations depicted on Figure 4. The ten background soil samples were analyzed for total antimony, cadmium, cobalt, copper, and vanadium using EPA Method 6010B. Background soil metals data resulting from this analysis are presented in Table 13, and the laboratory report is presented in Appendix C. The data were used to characterize site background concentrations for these metals.

3 REMEDIAL ACTION OBJECTIVES

3.1 OVERVIEW

Pursuant to 40 CFR 300.430, remedial action objectives (RAOs) must be established. The RAOs must specify contaminants and media of concern, potential exposure pathways, and remediation goals. Remediation goals shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed by considering applicable, relevant and appropriate requirements (ARARs) under federal environmental or state environmental laws, if available.

For known or suspected carcinogens, acceptable exposure levels are generally concentrations that represent an excess upper bound lifetime cancer risk to an individual of between one in ten thousand and one in one million, using information on the relationship between dose and response. For systemic toxicants, remediation goals shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety.

Remediation goals must also consider factors related to technical limitations such as metals concentrations in ambient soil; detection/quantification limits for contaminants; factors related to uncertainty; and other pertinent information.

3.2 ARARs

The NCP requires compliance with ARARs during remedial actions to the extent practicable. ARARs include federal, state, and local environmental laws, regulations, and standards that can be chemical-specific, location-specific, or action specific. Chemical-specific ARARs are health-based or environmentally-based numerical limits pertaining to the amount of a contaminant released to the environment or allowed to remain in the environment as a result of the proposed remedial activity. Location-specific ARARs may restrict remedial action if the proposed action is located in an environmentally sensitive or historically significant area. Action-specific ARARs may restrict remedial action based on the specific remedial action and/or byproducts of the remedial action.

3.2.1 Chemical-Specific ARARs

Resource Conservation and Recovery Act (RCRA)

RCRA Subtitle C, contained in 40 CFR, pertains to the characterization of hazardous waste. Some of the mine waste within AOC 1 may meet federal criteria for classification as hazardous waste. Analytical laboratory results for composite samples of excavated soil will be evaluated to determine appropriate waste disposal requirements. Disposal of impacted soil is to comply with RCRA Subtitle C. Some mine waste may be exempt from classification as a hazardous waste per Section 261.4(b)(7) of CFR Title 40.

California Code of Regulations (CCR) Title 22

Section 66261 of CCR Title 22 pertains to the characterization of hazardous waste. Some total arsenic and lead concentrations detected in mine waste within AOC 1 exceed the state benchmark values for hazardous waste. Some mine waste may be exempt from classification as a hazardous waste per CCR Title 22 Section 66261.4(b)(5)(A).

California Human Health Screening Levels (CHHSLs)

CHHSLs established by Cal/EPA for residential soil may be used as a screening tool for individual constituents of concern. The CHHSLs were developed using methodology and toxicological parameters set forth by Cal/EPA, which were also generally used in the site-specific human health risk assessment performed as part of the PEA. The CHHSLs are applicable to the proposed remedial action as a screening tool. The remedial goals established for the remedial action are generally consistent with the CHHSLs; however, the cleanup goal for arsenic in soil is based on background concentrations.

California Water Code

Division 7 of the California Water Code establishes priorities for the California Regional Water Quality Control Board (RWQCB). RWQCB guidance and numerical limits are presented in various documents. The RWQCB Basin Plan, DLM, Antidegradation Policy and Water Quality Goals establish policies, procedures and numerical limits for protection of surface water and groundwater quality. Based on the documents listed above, H&K evaluated the potential risk to water quality as part of the PEA. The findings of the evaluation indicate that site mine waste poses a theoretical threat to water quality under current conditions. However, the mine waste that is to remain on-site was not found to have significant potential for acid generation, and investigation results indicate that soluble arsenic is attenuated in shallow, clayey, iron-rich soil that typifies the site vicinity, as demonstrated by the low metals concentrations in native soil below the waste. For these reasons, H&K's opinion is that significant water quality impact is not anticipated from the proposed on-site consolidation and burial of mine waste from AOC 2

3.2.2 Location-Specific ARARs

National Historic Preservation Act

The National Historic Preservation Act, as set forth in Sections 65 and 800 of CFR Title 36, pertains to cultural resources and historic sites. The type of mining activity performed at the site is common in the site vicinity. A cultural resources study and archeological report have not yet been performed for the site. The proposed site remediation will comply with the National Historic Preservation Act and will be performed in a manner that will not disturb significant cultural resources or historic sites, if such are identified in the study.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, as set forth in Section 6.302 of CFR Title 40, pertains in part to wetlands protection and flood management. As wetlands or flood-prone areas have not been identified at the proposed remedial action areas, this regulation is not applicable.

Clean Water Act

The Clean Water Act, as set forth in Section 230 of CFR Title 40, pertains to flood-prone areas and wetlands. As such areas have not been identified at the site, this regulation is not applicable.

RCRA

Section 264.18 of CFR Title 40 pertains to the treatment, storage and disposal of hazardous waste. The mine waste and impacted soil at the site are not anticipated to be RCRA waste, and therefore this regulation is not likely applicable. Disposal characterization sampling and analysis will be performed during the course of the

RAW. Disposal of soil at a Class I or Class II facility shall comply with RCRA Subtitle C requirements.

3.2.3 Action-Specific ARARs

California Water Code

The California Water Code governs the characterization of waste for disposal to land. Waste disposal must comply with the provisions of the California Water Code.

CCR Title 27

Sections 22470 through 22490 of CCR Title 27 pertain to classification of mine waste for disposal citing purposes. The mine waste in AOC 2 can be classified as Group C mine waste per CCR Title 27, and is considered suitable for on-site consolidation and burial beneath the proposed commercial development.

Northern Sierra Air Quality Management District Rule 226

Northern Sierra Air Quality Management District Rule 226 requires that a dust control plan be prepared for construction activity disturbing over one acre of land. Rule 226 is applicable and is addressed by the Dust Mitigation Plan in Appendix E.

Air Resources Board Regulation 93105

Under California law, disturbance of soil and rock that contains ultramafic rock, serpentinite or NOA minerals must be handled as described in Cal/EPA Air Resources Board Regulation 93105, *Asbestos Airborne Toxic Control Measure for Construction, Grading,* Quarrying*, and Surface Mining Operations* (ATCM). Per the ATCM, site work must be performed according to protocols established by an Asbestos Dust Mitigation Plan. The Dust Mitigation Plan (DMP) appended to this RAW outlines engineering controls to reduce the risk of release of metals and NOA fibers into the environment during mechanical soil disturbance. Mechanical soil disturbance includes site clearing, excavation, grading, underground utility work, transportation, and disposal activities.

Public Resources Code 4581 and 4621

The proposed remedial activities are not expected to include significant timber operations that involve the removal of conifers. A “significant” timber operation is generally considered to involve the disturbance of more than 2.99 acres of timberland.

A Timber Harvesting Plan (THP; Public Resources Code 4581) and a Timberland Conversion Permit (TCP; Public Resources Code 4621) are not expected to be required for the proposed remedial activities.

3.3 MEDIA AND CONSTITUENTS OF CONCERN

The primary medium of concern at the site is mine waste, including waste rock and processed tailings. Potential exposure pathways are associated with soil and include dermal absorption through direct contact, incidental ingestion, and inhalation of soil dust. Elevated metals concentrations are present in processed and unprocessed mine waste and affected soil in the assessment areas identified at the site. In general, soil arsenic concentrations govern the calculated chronic human health hazard and excess lifetime cancer risk. Other metals (including antimony, copper, lead, mercury and vanadium) are also considered COPCs.

3.4 QUANTITY ESTIMATE

An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of tailings are identified at the site. Figure 4 depicts the areas of mine waste rock and tailings. These volume estimates are based on limited subsurface data and were not calculated using survey methods. Thus, the actual volume may vary significantly from the estimated volumes.

An estimated 1,700 cubic yards (approximately 2,300 tons) of mine waste rock, tailings and impacted native soil were identified at AOC 1, and the remainder of the mine waste was designated as being within AOC 2. The mine waste and soil identified within AOC 1 contains elevated levels of arsenic, lead and mercury which are not suitable to remain at the site under existing conditions. In addition, a pipe that originated from the former mill area may have deposited materials with elevated metals concentrations down slope of the former mill site. Although such deposits were not encountered as part of the PEA investigation, other deposits which require off-site disposal may be present at the site. The possibility of other “hot spots” is addressed in the Verification Sampling and Analysis Plan (VSAP) appended to this RAW.

3.5 REMEDIAL ACTION GOALS

The goal of the remedial action is to reduce to acceptable levels the potential human health risk and water quality impact associated with the elevated metals concentrations in mine waste and affected soil.

Target cleanup levels are presented in Table 1 and are summarized below. The target cleanup levels for total metals are based on the evaluation of local background levels and the results of human health risk assessment, considering land use and activity patterns associated with future site development and commercial use. The target cleanup levels for soluble metals are based on evaluation of risk to water quality per the DLM.

<u>Protection of Human Health – Total Metals</u>

Mine waste and soil that is to remain at the site without consolidation and burial shall have total arsenic concentrations within the range of local background levels. Arsenic was detected in site background soil up to 17 mg/kg. The range of background soil arsenic concentrations at the site is consistent with local background levels. Local background arsenic concentrations range from non-detect to 48 mg/kg, as discussed in Section 2.2.2 and Appendix C of this RAW. The 95th percentile value (17 mg/kg) for the local background arsenic data set is applicable as an estimated background threshold value (BTV) and is to be used as a not-to-exceed cleanup goal for total arsenic in mine waste and affected soil.

Mine waste and affected soil that is to be consolidated and buried on-site shall have total arsenic concentrations with a central tendency value that is protective under the construction worker exposure scenario. Specifically, the 95% upper confidence limit (UCL) on the mean total arsenic concentration in soil is to be less than or equal to 22 mg/kg.

Cleanup goals for lead and mercury are based on the results of human health risk assessment under the commercial indoor scenario, which generally correspond to the CHHSLs for commercial soil, as listed in Table 2.

During the development of this RAW, additional background soil samples were obtained and analyzed for antimony, cadmium, cobalt, copper and vanadium, as discussed in Section 2.2.5 of this RAW. Background soil metals data are presented in Table 13. UCL values for background soil metals data were calculated using ProUCL

Version 4.00.02 (USEPA, 2007). Statistical analyses are summarized in the ProUCL output in Appendix C. Results are presented in Table 1 of Appendix C and are summarized below.

- Antimony concentrations range from 8.9 to 26.8 mg/kg. The mean is 18.6 mg/kg. The distribution is assumed to be normal, and the Shapiro Wilk test statistic is 0.979. The 95% Student's-t UCL is 21.7 mg/kg. Dixon's outlier test identified no outlying data. The 95% Upper Percentile Limit (UPL; 26.8 mg/kg) is used as an estimated BTV. Because the maximum detected antimony concentration in mine waste is less than the UCL background value, antimony is ruled out as a COPC.

- Cadmium concentrations range from 7.4 to 13.8 mg/kg. The mean is 10.9 mg/kg. The distribution is assumed to be normal, and the Shapiro Wilk test statistic is 0.921. The 95% Student's-t UCL is 12.2 mg/kg. Dixon's outlier test identified no outlying data. The 95% UPL (13.8 mg/kg) is used as an estimated BTV. Because the maximum detected cadmium concentration in mine waste is less than the UCL background value, cadmium is ruled out as a COPC.

- Cobalt concentrations range from 86.4 to 185 mg/kg. The mean is 139 mg/kg. The distribution is assumed to be normal, and the Shapiro Wilk test statistic is 0.923. The 95% Student's-t UCL is 160 mg/kg. Dixon's outlier test identified no outlying data. The 95% UPL (185 mg/kg) is used as an estimated BTV. Because the maximum detected cobalt concentration in mine waste is less than the UCL background value, cobalt is ruled out as a COPC.

- Copper concentrations range from 19.7 to 61.7 mg/kg. The mean is 38.8 mg/kg. The distribution is assumed to be normal, and the Shapiro Wilk test statistic is 0.95. The 95% Student's-t UCL is 46.4 mg/kg. Dixon's outlier test identified no outlying data. The 95% UPL (62 mg/kg) is used as an estimated BTV. Because the maximum detected copper concentration in mine waste exceeds than the UCL background value, copper is considered a COPC.

- Vanadium concentrations range from 51.9 to 117 mg/kg. The mean is 81.4 mg/kg. The distribution is assumed to be normal, and the Shapiro Wilk test statistic is 0.966. The 95% Student's-t UCL is 93.1 mg/kg. Dixon's outlier test identified no outlying data. The 95% UPL (117 mg/kg) is used as an estimated BTV. Because the maximum detected vanadium concentration in mine waste AOC 1 exceeds the UCL background value, vanadium is considered a COPC for AOC 1. Vanadium is ruled out as a COPC for AOC 2, as the maximum vanadium concentration detected in AOC 2 is less than the background UCL value.

If multiple metals are detected in verification soil samples at concentrations near their respective cleanup levels, additional human health risk assessment is to be performed to evaluate cumulative risk and hazard.

Risk-hazard calculations for site background soil are summarized in Table 14. Antimony and vanadium are the primary contributors to chronic health hazard, and arsenic is the primary contributor to cancer risk.

<u>Protection of Water Quality – Soluble Metals</u>

Soluble arsenic and lead were detected in mine waste at concentrations exceeding the corresponding SDLs based on the current location of the mine waste, as it may be subject to seepage and storm water runoff under current conditions.

The 95% UCL value for soluble arsenic detected in soil that is to remain on-site after the proposed remedial action shall not exceed the SDL for arsenic (20 µg/L) based on DI-WET. Similarly, the 95% UCL value for soluble lead detected in soil that is to remain on-site after the proposed remedial action shall not exceed the SDL for lead (20 µg/L) based on DI-WET. Soluble metals analysis may be required prior to landfill disposal of waste from AOC 1. Soluble metals concentrations for waste in AOC 2 were characterized as part of the PEA; therefore, additional soluble metals testing is not proposed for waste from AOC 2.

4 EVALUATION OF REMEDIAL ACTION ALTERNATIVES

H&K reviewed potentially applicable alternative soil remediation methods including: (1) No Action, (2) Excavation and On-Site Placement, and (3) Excavation and Off-Site Disposal. The review of potential soil remediation alternatives was conducted using an evaluation equivalent to an EE/CA as required by the NCP.

4.1 OVERVIEW

Pursuant to 40 CFR Part 300.430, as determined appropriate and to the extent sufficient information is available, the short- and long-term aspects of the following three criteria are to be used to guide the development and screening of remedial alternatives:

Effectiveness. This criterion focuses on the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks and affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection. Alternatives providing significantly less effectiveness than other, more promising alternatives are eliminated. Alternatives that do not provide adequate protection of human health and the environment are also eliminated from further consideration.

Implementability. This criterion focuses on the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative. Alternatives that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time are eliminated from further consideration.

Cost. The costs of construction and any long-term costs to operate and maintain the alternatives are to be considered. Costs that are grossly excessive compared to the overall effectiveness of alternatives are considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated.

The analysis of alternatives under review reflects the scope and complexity of site problems and alternatives being evaluated, and considers the relative significance of the factors within each of the following criteria:

Overall protection of human health and the environment. Alternatives are assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs. The alternatives are assessed to determine whether they attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility citing laws or provide grounds for invoking waivers from such laws.

Long-term effectiveness and permanence. Alternatives are assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. As appropriate, the following factors are considered: (1) magnitude of residual risk (taking into account the volume, toxicity, mobility, and propensity to bioaccumulate); (2) compliance with ARARs; (3) long term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state acceptance; and (9) community acceptance.

Reduction of toxicity, mobility, or volume through treatment. The degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume are assessed, including how treatment is used to address the principal threats posed by the site.

Short-term effectiveness. The short-term impacts of alternatives are assessed considering short-term risks that might be posed to the community during implementation of an alternative; potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and time until protection is achieved.

Implementability. The ease or difficulty of implementing the alternatives is assessed by considering technical feasibility, administrative feasibility, and availability of services and materials.

Cost. Costs include capital costs (direct and indirect) and operation and maintenance (O&M) costs.

State acceptance. State concerns include the state's position related to the preferred alternative and other alternatives, and state comments on ARARs or the proposed use of waivers.

Community acceptance. Public review is to be performed to assess community support, reservations and/or opposition of components of the proposed remedial action.

The nine criteria listed above are categorized into three groups:

Threshold criteria. Overall protection of human health and the environment and compliance with ARARs (unless a specific ARAR is waived) are threshold requirements that each alternative must meet in order to be eligible for selection.

Primary balancing criteria. The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

Modifying criteria. State and community acceptance are modifying criteria that shall be considered in remedy selection.

The remedial alternative that best meets the requirements above is to be identified and presented to the public in this RAW. The RAW:

- Provides a brief summary description of the remedial alternatives;
- Provides a discussion of the rationale that supports the preferred alternative;
- Provides a summary of any formal comments received from the support agency; and
- Provides a summary explanation of any proposed waiver from an ARAR.

DTSC comments (October 2, 2008) on the Draft RAW (August 22, 2008) are included in Appendix A. Sections 6.2.4 and 6.3.5 of this RAW have been revised to address DTSC's comments on the Draft RAW.

4.2 REMEDIAL ACTION ALTERNATIVES

4.2.1 Alternatives for AOC 1

4.2.1.1 No Action for AOC 1

The No Action alternative includes leaving mine waste and affected soil at AOC 1 in its existing condition without engineering or institutional controls. The evaluation of this alternative is summarized below.

Effectiveness

- Does not provide adequate protection of human health and the environment
- Does not effectively reduce risks
- Does not afford short-term or long-term protection
- Does not comply with ARARs

Implementability

- Immediately implemented
- Labor, material, and equipment not needed
- Administratively infeasible based on ARARs

Cost

- No direct costs
- Unknown future costs

The No Action alternative provides significantly less effectiveness than the other remedial alternatives, and does not provide adequate protection of human health and water quality. Therefore, the No Action alternative was eliminated from further consideration.

4.2.1.2 Excavation and On-Site Placement for AOC 1

The Excavation and On-Site Placement alternative includes the excavation of mine waste and affected soil that exceeds the remedial goals for metals of concern; verification soil sampling and analysis to confirm that the remedial goals have been achieved; and consolidation of the mine waste and affected soil on-site beneath a proposed commercial development. A land use covenant (LUC) and operation and maintenance agreement (OMA) are typically required. Worker health and safety would be addressed by Site Safety Plans (SSPs) prepared by the parties involved. Provided that soil verification sample results meet the proposed remedial goals, the former mine waste locations outside of the proposed on-site placement area would be suitable for unrestricted land use.

Effectiveness

- Burial of the mine waste effectively reduces human health risk by eliminating potential exposure pathways (incidental ingestion, inhalation of airborne particulates, and dermal contact with the impacted soil).
- On-site placement of mine waste associated with AOC 1 may not be compliant with ARARs based on the total and soluble metals concentrations detected in the mine waste associated with AOC 1.
- Short-term impacts associated with remediation would be reduced by provisions set forth in a Dust Mitigation Plan (DMP) and SSPs prepared by the parties involved.
- The Excavation and On-Site Placement alternative requires an LUC and OMA for the proposed placement location, which afford long-term protection of human health by restricting future disturbance.

Implementability

- Readily implemented
- Labor, material and equipment readily available
- Likely not acceptable to regulatory agencies and community based on the elevated metals content of mine waste within AOC 1.

Cost

- Relatively low capital costs (approximately $20,000) associated with excavation; on-site transportation; placement, moisture-conditioning and compaction; and quality assurance observation and testing. A cost estimate is presented in Table 15.
- Moderate indirect costs associated with engineering design, development of an LUC and OMA, and periodic reporting.

Based on the elevated metals concentrations detected in mine waste associated with AOC 1, as well as the potential for incompatibility with the California Water Code, the Excavation and On-Site Placement alternative was ruled out as a remedial option for AOC 1.

4.2.1.3 Excavation and Off-Site Disposal for AOC 1

The Excavation and Off-Site Disposal alternative for AOC 1 includes excavation of soil having metals concentrations that exceed the cleanup goals; verification soil sampling and analysis to confirm that the remedial goals are achieved; characterization of the excavated soil for disposal in accordance with landfill acceptance criteria; and transportation of the impacted soil for disposal at a licensed facility in accordance with applicable regulations. Procedures required for dust and erosion control would be addressed in a DMP. Worker health and safety would be addressed in SSPs prepared by the parties involved. The evaluation of this alternative is summarized below.

Effectiveness

- Effectively protects human health by eliminating the potential exposure pathways.
- Short-term impacts associated with remediation would be reduced by provisions set forth in a DMP and SSPs prepared by the parties involved.
- Affords long-term protection of human health and the environment.
- Complies with ARARs.

Implementability

- Readily implemented
- Technically feasible
- Administratively feasible
- Likely acceptable to regulatory agencies and community. Based on preliminary volume estimates from the PEA report, truck traffic is estimated to be approximately 150 truck loads for off-haul and approximately 150 truck loads for import of clean fill. The trucks used for off-haul will exit the site via Spring Hill Drive (a public roadway with single lanes in each direction) to the south and Idaho Maryland Road (a public roadway with single lanes in each direction) to the west. Trucks will enter State Highway 49 southbound from Idaho-Maryland Road, approximately one mile southwest of the site.
- Can be performed in a relatively short time frame immediately prior to commercial site development.

Cost

- Based on preliminary volume estimates from the PEA report, the direct cost of Excavation and Off-Site Disposal for AOC 1 is approximately $275,000, as summarized in Table 16. The cost estimate includes a 10% contingency, which is primarily related to uncertainties regarding the volume estimate. The cost estimate does not includes the importation of clean soil to replace the off-hauled material, nor does it include costs associated with erosion control and site structural development. These tasks are not included in the remediation cost estimate, as the remediation is to be performed immediately prior to and as part of site development.

- Indirect costs associated with Excavation and Off-Site Disposal for AOC 1 include verification soil sampling and analysis, landfill characterization sampling and analysis, possible air monitoring, and reporting. Engineering tasks such as the preparation of grading plans and storm water pollution prevention plans, surveying and obtaining grading permits are not included in the cost estimate, as the remediation is to be performed immediately prior to and as part of site development.
- No on-going costs associated with off-site disposal are anticipated.

Excavation and Off-Site Disposal is the recommended alternative for AOC 1 because it is compliant with ARARs and protective of human health and the environment.

4.2.2 Alternatives for AOC 2

4.2.2.1 No Action for AOC 2

The No Action alternative includes leaving mine waste and affected soil at AOC 2 in its existing condition without engineering or institutional controls. The evaluation of this alternative is summarized below.

<u>Effectiveness</u>

- Does not provide adequate protection of human health and the environment
- Does not effectively reduce risks
- Does not afford short-term or long-term protection
- Does not comply with ARARs

<u>Implementability</u>

- Immediately implemented
- Labor, material, and equipment not needed
- Administratively infeasible based on ARARs

<u>Cost</u>

- No direct costs
- Unknown future costs

The No Action alternative provides significantly less effectiveness than the other remedial alternatives, and does not provide adequate protection of human health and water quality. Therefore, the No Action alternative was eliminated from further consideration.

4.2.2.2 Excavation and On-Site Placement for AOC 2

The Excavation and On-Site Placement alternative includes the excavation of mine waste and affected soil that exceeds the remedial goals for metals of concern; verification soil sampling and analysis to confirm that the remedial goals have been achieved; and consolidation of the mine waste and affected soil on-site beneath a proposed commercial development. An LUC and OMA are typically required. Worker health and safety would be addressed by SSPs prepared by the parties involved. Provided that soil verification sample results meet the proposed remedial goals, the former mine waste locations outside of the proposed on-site placement area would be suitable for unrestricted land use.

<u>Effectiveness</u>

- Burial of the mine waste effectively reduces human health risk by eliminating potential exposure pathways (incidental ingestion, inhalation of airborne particulates, and dermal contact with the impacted soil).
- On-site placement of mine waste associated with AOC 2 is compliant with ARARs.
- Short-term impacts associated with remediation would be reduced by provisions set forth in a DMP and SSPs prepared by the parties involved.
- The Excavation and On-Site Placement alternative requires an LUC and OMA for the proposed placement location, which afford long-term protection of human health and water quality by restricting future disturbance.

<u>Implementability</u>

- Readily implemented
- Labor, material and equipment readily available
- Likely acceptable to regulatory agencies and community based on the protection of human health and the environment.

Cost

- Moderate direct costs (approximately $719,000) associated with excavation; on-site transportation; placement, moisture-conditioning and compaction; and quality assurance observation and testing. A cost estimate is presented in Table 17.
- Moderate indirect costs associated with engineering design, development of an LUC and OMA, and periodic reporting.

Excavation and On-Site Placement is the recommended alternative for AOC 2 because it is compliant with ARARs and protective of human health and the environment. The Excavation and On-Site Placement alternative does not afford significantly less protection than the more costly off-site disposal alternative, which is described below.

4.2.2.3 Excavation and Off-Site Disposal for AOC 2

The Excavation and Off-Site Disposal alternative for AOC 2 includes excavation of soil having metals concentrations that exceed the cleanup goals; verification soil sampling and analysis to confirm that the remedial goals are achieved; characterization of the excavated soil for disposal in accordance with landfill acceptance criteria; and transportation of the impacted soil for disposal at a licensed facility in accordance with applicable regulations. Procedures required for dust and erosion control would be addressed in a DMP. Worker health and safety would be addressed in SSPs prepared by the parties involved. The evaluation of this alternative is summarized below.

Effectiveness

- Effectively protects human health and the environment.
- Short-term impacts associated with remediation would be reduced by provisions set forth in a DMP and SSPs prepared by the parties involved.
- Affords long-term protection of human health and the environment.
- Complies with ARARs.

Implementability

- Readily implemented
- Technically feasible
- Administratively feasible
- Potentially unacceptable to regulatory agencies and community based on the excessive truck traffic required for off-haul. Based on preliminary volume

estimates from the PEA report, truck traffic is estimated to be approximately 4,000 truck loads for off-haul and approximately 4,000 truck loads for import of clean fill. The trucks used for off-haul would exit the site via Spring Hill Drive (a public roadway with single lanes in each direction) to the south and Idaho Maryland Road (a public roadway with single lanes in each direction) to the east. Trucks will enter State Highway 49 southbound from Idaho-Maryland Road, approximately one mile southeast of the site.
- Would require significant time for soil removal.

<u>Cost</u>

- Based on preliminary volume estimates from the PEA report, the direct cost of Excavation and Off-Site Disposal for AOC 2 is estimated to be approximately $5,400,000, as summarized in Table 18. The cost estimate includes a 10% contingency, which is primarily related to uncertainties regarding the volume estimate. The cost estimate includes the importation of a similar quantity of clean soil to replace the off-hauled material. Direct costs associated with regrading and erosion control after excavation are not included in the cost estimate, as the remediation is to be performed immediately prior to and as part of site development.
- Indirect costs associated with Excavation and Off-Site Disposal for AOC 2 include verification soil sampling and analysis, landfill characterization sampling and analysis, possible air monitoring, and reporting. Engineering tasks such as the preparation of grading plans and storm water pollution prevention plans, surveying and obtaining grading permits are not included in the cost estimate, as the remediation is to be performed immediately prior to and as part of site development.
- No on-going costs associated with off-site disposal are anticipated.

The Excavation and Off-Site Disposal alternative for AOC 2 is likely compliant with ARARs and protective of human health and the environment. The large amount of truck traffic required for off-site disposal is cause for community concern. Because the cost of off-site disposal is grossly excessive of the cost for on-site placement, Excavation and Off-Site Disposal for AOC 2 is eliminated from further consideration.

4.3 PROPOSED REMEDIAL ACTIONS

As described above, Excavation and Off-Site Disposal is the recommended remedial alternative for AOC 1, and Excavation and On-Site Placement is the recommended remedial alternative for AOC 2.

Costs associated with the proposed remedial action are estimated in Tables 16 and 17, and the overall cost estimate is summarized in Table 19. The estimates were based on (1) the removal and disposal of an estimated 1,700 cubic yards (2,210 tons) of Class I waste from AOC 1; and (2) the excavation and on-site placement of approximately 62,000 cubic yards (80,600 tons) of mine waste and affected soil from AOC 2. Costs for erosion control, soil import and construction of site structural improvements were not included in the cost estimate, and are expected to be performed as part of site development scheduled to take place immediately after the remedial action.

Capital costs for Excavation and Off-Site Disposal for AOC 1 are estimated to be approximately $275,000, and capital costs for Excavation and On-Site Placement for AOC 2 are estimated to be approximately $719,000, for a total estimated cost of approximately $993,000. The cost estimates presented in this RAW are based on preliminary waste volume estimates as presented in the PEA report. The cost estimate includes a 10% contingency. Uncertainty associated with the volume estimate may result in cost variation. Variation of subsurface conditions between locations sampled may also significantly affect the actual cost of the remediation. Preparation of volume estimates based on survey results, as well as additional subsurface investigation between the locations previously sampled, would help to reduce these cost uncertainties. H&K recommends that bids be obtained from remediation contractors prior to performing the remedial action.

The proposed remedial procedures are set forth in the following section. The proposed remedial actions are summarized below.

- Excavate the mine waste and impacted soil at AOC 1, and characterize the mine waste for landfill disposal;
- Transport the excavated and characterized soil from AOC 1 off-site to a licensed disposal facility in accordance with applicable regulations;
- Relocate on-site and consolidate soil from AOC 2 that exceeds the remediation goals for unrestricted land use;
- Obtain and analyze soil samples from areas of soil excavation at AOC 1 and AOC 2 to verify that remedial goals have been achieved; and
- Establish land use controls for the proposed soil relocation area, where elevated concentrations of COPCs will remain in place under a proposed commercial development, to provide additional protection of human health and water quality.

5 SITE SAFETY PLAN

An SSP has been prepared for H&K employees, which provides information regarding potential chemical and physical hazards that may exist at the site and describes safety measures to be followed by field personnel during remedial activities. The SSP conforms to requirements of Hazardous Waste Operations and Emergency Response, Title 8 CCR, Section 5192 and Title 8 CCR, Section 5155. Appendix F presents the SSP.

Remediation contractors and subcontractors selected to perform work associated with the remediation are responsible for their own health and safety and will be required to prepare a SSP for their activities. H&K will not be responsible for the safety of contractors and site visitors.

All personnel working at the site shall have completed 40 hours of comprehensive health and safety training, which meets the requirements of 29 CFR 1910.120.

During the remedial activities, soil moisture content is to be maintained to reduce the potential for dust generation and the need for respiratory protection. Details are provided in the SSP and DMP. Employee training and certification, dust monitoring and record keeping may be required to comply with OSHA regulations and to mitigate dust-related employee exposure during the cleanup. Permissible exposure limits and action levels for remediation workers should be determined by a Certified Industrial Hygienist.

Based on the required application of water for dust suppression during soil excavation, airborne levels of metals are expected to be low and air monitoring will not be necessary if soil moisture is maintained. If visible dust is generated during excavation or placement of the mine waste, air monitoring is to be performed, and additional dust suppression is to be performed as required to maintain dust concentrations below the permissible exposure level.

6 REMEDIAL PROCEDURES AND IMPLEMENTATION

Section 6.1 below describes pre-excavation sampling activities for AOC 1 and AOC 2. Section 6.2 describes procedures for excavation and off-site disposal of waste and affected soil from AOC 1, including verification soil sampling and landfill characterization sampling. Section 6.3 describes procedures for excavation and on-site placement of waste and affected soil from AOC 2, including verification soil sampling and LUCs for the proposed soil placement area. Section 6.4 presents recommendations for site restoration.

If site activities are performed prior to the site remediation activities presented in this RAW, the remediation areas must be identified and marked in the field so that the areas may be avoided. Potential site activities that may result in disturbance of the mine waste stockpiles and impacted soil areas include timber harvest, grading and road construction, brush clearing for fire prevention, and other ground disturbing activities.

Disturbance of soil and/or waste at the remediation areas could potentially result in human exposure and health hazard from soil ingestion, dermal contact and inhalation of airborne soil particulates. In addition, the soil disturbance could potentially cause inappropriate transport of mine waste by wind, surface water, or mechanical disturbance.

In the event that ground disturbing activities are to be performed at the site prior to site remediation activities, assessment areas AOC 1 and AOC 2 must be identified and precluded from disturbance.

DTSC must be allowed to review any proposed ground disturbing activities if the activities are to be performed prior to the implementation of the recommended remedial procedures.

6.1 PRE-EXCAVATION SOIL SAMPLING

Prior to initiation of soil excavation activities associated with site remediation, the perimeters of areas proposed for cleanup are to be marked in the field. Additional soil sampling and analysis may be performed to better define the lateral extent of soil exceeding the remediation goals. After the areas are marked, samples may be obtained approximately 100 feet apart along the marked perimeter from the upper 6 inches of soil. Such samples may be analyzed for metals of concern. Additional samples may be obtained at locations stepped-in or stepped-out from the marked perimeter to refine the remediation area boundaries. The lateral extent of the proposed remedial areas may be modified based on the results of pre-excavation soil sampling and consultation with DTSC.

6.2 EXCAVATION AND OFF-SITE DISPOSAL FOR AOC 1

Excavation and Off-site Disposal is recommended for mine waste and affected soil at AOC 1 that is not suitable for Excavation and On-site Placement. Verification soil sampling and analysis is to be performed after excavation of the affected soil. The excavated material is to be loaded onto trucks and transported to an appropriate off-site landfill for disposal. Protocol for reducing dust emissions during remediation activities is presented in the DMP in Appendix E. Remedial procedures are described below.

6.2.1 Excavation

The soil excavation methods will include mechanical excavation using rubber-tired or track-mounted backhoe excavators and loaders. Soil will be excavated and stockpiled on plastic sheeting, and covered with plastic sheeting, adjacent to the excavation. After characterization sampling, analysis, and landfill acceptance, the soil will be loaded into trucks and transported to an off-site landfill for disposal. During excavation, stockpiling and loading, soil will be moistened as necessary to reduce dust generation using water trucks or hoses.

Before removing the affected soil, vegetation in the areas to be excavated will be cut off at the ground surface, segregated, and removed from the work area. Removal of vegetation is to be performed using hand-held mechanical equipment to minimize disturbance of soil prior to excavation.

6.2.2 Post-Excavation Verification Soil Sampling

After excavation of affected soil, verification soil samples will be obtained from the base and perimeter of the excavations to confirm that the cleanup goals have been achieved. Table 1 presents cleanup goals. Sampling procedures are summarized below. Details are presented in the VSAP in Appendix G.

Soil samples will be obtained using a pre-cleaned hand trowel or individually wrapped disposable scoops, and placed in glass containers provided by the analytical laboratory. The laboratory will perform total metals analysis by EPA Method 6010B and 7471A. Sample handling, labeling, documentation and chain of custody procedures will be performed as described in the VSAP.

Alternately, verification soil samples may be analyzed in the field using a hand-held X-ray fluorescence (XRF) device. If field XRF analysis is performed, a minimum of ten percent of the field-analyzed samples will also be analyzed in the laboratory by EPA Method 6010B. XRF results will be compared to the corresponding laboratory results for data validation purposes.

The minimum sample frequency will be one soil sample per 400 square feet of footprint area. In addition, soil samples will be obtained from the perimeter of the excavation area at a maximum spacing of one sample per 100 feet.

The lateral and vertical extent of the excavations may be increased locally to facilitate removal of soil containing metals concentrations that exceed the target cleanup levels. Additional samples will be obtained if needed to achieve the minimum sample frequency, based on the actual footprint area of the excavation.

If the verification sample analysis indicates target cleanup levels have been attained, no further excavation will be conducted. If the results of verification sample analysis indicate target cleanup levels have not been attained, further excavation will be conducted. Excavation will continue until the results of further verification sampling and analysis indicate that the RAOs are achieved.

6.2.3 Soil/Waste Characterization

Sampling and analysis for soil/waste characterization is to be performed for stockpiled soil excavated from AOC 1. The stockpiled waste will be tested for COPCs according to frequencies and procedures required by the appropriate Class I or Class II solid waste facility.

6.2.4 Transportation to Off-Site Landfill

Affected soil from AOC 1 is to be transported off-site to appropriately permitted waste disposal facilities. Class II (non-hazardous) waste will be transported to and disposed at Norcal Waste Systems' Ostrom Road Landfill Inc., in Wheatland, California. Class I waste will be transported to and disposed at the Chem Waste Management facility in Kettleman Hills, California.

Transportation and disposal of waste from the site is to be conducted in accordance with applicable local, state and federal regulations. Safe work practices and traffic control measures are to be employed during the remediation. Truck drivers will have Class A licenses. The proposed staging area for truck loading is to be located immediately west of AOC 1. The staging area for waste to be transported off-site is accessible by Spring Hill Drive, which is a paved road near the southern property boundary.

Based on the volume of soil to be removed, approximately 150 truck loads will be removed from the site, in either closed-top bins or end dumps with tarp covers. H&K anticipates that off-haul of mine waste and impacted soil from AOC 1 that is not suitable for on-site placement will take ten working days. The soil will be loaded into trucks on-site adjacent to AOC 1. During loading, trucks shall be parked in the on-site staging areas at the site and shall not inhibit traffic on public roads. After loading and before leaving the site, the trucks and loading equipment will be decontaminated by removing visible soil, especially from the tires, using brooms, brushes and shovels according to the provisions of the DMP presented in Appendix E. Manifest records will be maintained for transportation and disposal of the waste.

The trucks used for off-haul will exit the site via Spring Hill Drive (a public roadway with single lanes in each direction) to the south. The trucks will turn right from Spring Hill Drive onto Idaho Maryland Road, proceed under State Route (SR) 20/49, and enter State Highway 20/49 south towards Auburn. H&K does not anticipate adverse impacts to the level of service at the listed intersections due to site remediation activities. Appendix H presents the transportation route maps for the waste disposal facilities identified above.

According to a traffic study prepared for Community Recovery Resources in Grass Valley (Kimley-Horn and Associates, Inc., July 24. 2009), the existing level of service (LOS) for the SR 20/49 ramps and Idaho Maryland intersection during PM peak hours is LOS A. Projected LOS for the intersection, assuming construction of approved projects, was determined to be LOS B. We also reviewed a traffic study prepared by RBF Consulting as a part of the *Loma Rica Ranch Specific Plan Environmental Impact Report* (September 2010). The existing LOS for the Spring Hill Drive/Idaho Maryland Road intersection during PM peak hours was rated LOS A overall, with the "worst approach" (the approach from the minor street) being LOS C. We contacted Trisha Tillotson, Senior Civil Engineer/Deputy Director for the City of Grass Valley and Mr.

Jim Brake, Caltrans District 3. Neither Ms. Tillotson nor Mr. Brake found the proposed truck traffic to be significant.

6.3 EXCAVATION AND ON-SITE PLACEMENT FOR AOC 2

Excavation and On-site Placement is recommended for mine waste and affected soil at AOC 2. Verification soil sampling and analysis are to be performed after excavation of the mine waste and impacted soil from the existing locations. The excavated material is to be placed as engineered fill beneath a proposed commercial building area.

A conceptual placement plan and cross section are presented in Sheets 1 and 2, respectively. Placement design details are to be provided as part of a grading plan for the proposed improvements, which must be approved by DTSC and the local building department prior to implementation. The waste is located centrally within the fill prism to reduce the likelihood of surface water infiltration or subsurface seepage through the waste. Drainage conditions and recommendations shall be verified during project geotechnical engineering design. Clean fill shall be placed above the waste so that excavation can be performed for utilities without disturbing the waste. The waste placement location shall be the subject to a LUC and OMA to reduce the chance of future unauthorized disturbance. Protocol for reducing dust emissions during remediation activities is presented in the DMP in Appendix E. Remedial procedures are described below.

6.3.1 Excavation

The soil excavation methods will include mechanical excavation using rubber-tired or track-mounted backhoe excavators and loaders. During excavation and loading onto trucks for on-site transport, soil in the affected areas will be moistened as necessary to reduce dust generation using water trucks or hoses.

Before removing the mine waste and impacted soil, vegetation in the areas to be excavated will be cut off at the ground surface, segregated, and removed from the work area. Removal of vegetation is to be performed using hand-held mechanical equipment to minimize disturbance of soil before removal.

6.3.2 Post-Excavation Verification Soil Sampling

After excavation of mine waste and affected soil, verification soil samples will be obtained from the base and perimeter of the excavations to confirm that the RAOs have been achieved. Sampling procedures are summarized below. Details are presented in the VSAP in Appendix G.

Soil samples will be obtained using a pre-cleaned hand trowel or individually wrapped disposable scoops, and placed in glass containers provided by the analytical laboratory. Laboratory total metals analysis will be performed by EPA Methods 6010B/7471A. Sample handling, labeling, documentation and chain of custody procedures will be performed as described in the VSAP.

Alternately, verification soil samples may be analyzed in the field using a hand-held XRF device. If field XRF analysis is performed, a minimum of ten percent of the field-analyzed samples will also be analyzed in the laboratory by EPA Method 6010B. XRF results will be compared to the corresponding laboratory results for data validation purposes.

The minimum sample frequency will be one soil sample per 400 square feet of footprint area. In addition, soil samples will be obtained from the perimeter of the excavation area at a maximum spacing of one sample per 100 feet.

The lateral and vertical extent of the excavations may be increased locally to facilitate removal of soil containing metals concentrations that exceed the target cleanup levels. Additional samples will be obtained if needed to achieve the minimum sample frequency, based on the actual footprint area of the excavation.

If the verification sample analysis indicates target cleanup levels have been attained, no further excavation will be conducted. If the results of verification sample analysis indicate target cleanup levels have not been attained, further excavation will be conducted. Excavation will continue until the results of further verification sampling and analysis indicate that the RAOs are achieved.

6.3.3 Soil/Waste Characterization

Characterization of mine waste was performed as part of the PEA investigation. Mine waste and affected soil that are to be placed on-site will not require further characterization.

6.3.4 On-Site Transportation

Transportation of mine waste and affected soil is to be performed within the site boundaries. Minor clearing and grading may be necessary to facilitate truck access to some mine waste locations. Mine waste and soil will be loaded onto trucks at staging areas adjacent to AOC 2 and will be transported to the placement area. In accordance with the DMP, truck speed is to be limited and soil moisture is to be maintained so that dust is not generated during transport.

6.3.5 On-Site Placement

An estimated 62,000 cubic yards of mine waste are to be placed and compacted in an area designated to support a future commercial building and paved parking area located in the western portion of the site. Sheet 1 depicts the location of the proposed on-site placement area. The 4.3-acre placement area measures approximately 330 feet by 570 feet. The mine waste fill will be up to approximately 30 feet deep.

H&K anticipates that clean fill may also be placed in the proposed mine waste placement area, as the capacity of the placement area is larger than the estimated waste volume. Fill that is imported to the site is to be sampled as per the DTSC Information Advisory titled *Clean Imported Fill Material (October 2001)* to demonstrate that the imported fill meets the cleanup standards established in this RAW.

The conceptual plan (Sheet 1) and cross-section (Sheet 2) were prepared using topography, conceptual site layout and cross-sectional elevation data provided by Genesis Engineering, of Marysville, California. Final design of the placement area is to be based on the final site development plan. Geotechnical design criteria are to be verified based on the findings of a geotechnical engineering investigation. DTSC must be allowed to review the final design drawings for the on-site placement area prior to commencement of the remedial action.

Placement and compaction of the mine waste and soil are to be performed in general accordance with the specifications presented below. The mine waste and impacted soil are to be covered with ten feet of clean soil that is imported or borrowed from an on-site location. The grading plan shall incorporate these recommendations, modified as necessary based on the results of a geotechnical engineering investigation, and shall provide specific provisions for slope gradients, slope protection and/or retaining wall design, surface and subsurface drainage, and erosion and sediment control.

1. Native Soil Preparation for Fill Placement

    a. Strip and remove organic debris and loose soil from the existing ground surface.

    b. Scarify native soil to a depth of 8 inches below the existing ground surface, and then uniformly moisture condition to within approximately 2 percentage points of the American Society for Testing and Materials (ASTM) D1557 optimum moisture content.

    c. Compact native soil to a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.

    d. The moisture content, density and relative percent compaction must be verified by an H&K construction quality assurance (CQA) monitor prior to fill placement. The earthwork contractor shall assist the CQA monitor by excavating test pads with on-site earth moving equipment.

2. Fill Placement

    a. Maintain moisture content in mine waste and associated soil to minimize the generation of visible dust during preparation, placement and compaction.

    b. Avoid contact with mine waste and associated soil.

    c. Oversize rock (rock that is greater than 12 inches in greatest dimension) shall be incorporated into deep fill by windrowing, so that compaction is performed around the rock, as approved by H&K.

    d. Mine waste and associated soil shall be uniformly moisture conditioned to the ASTM D1557 optimum moisture content or within approximately 3 percentage points above optimum moisture content.

    e. Fill shall be constructed by placing uniformly moisture conditioned soil in maximum 8-inch-thick loose lifts (layers) prior to compacting.

    f. Fill shall be compacted to a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density.

    g. The moisture content, density and relative percent compaction of fill must be verified by the CQA monitor during construction. The earthwork contractor shall assist the CQA monitor by excavating test pads with the on-site earth moving equipment.

h. The average fill thickness will be less than approximately 30 feet.

3. Cover Soil Placement

a. Cover soil shall be imported from an approved source or native soil borrowed from an approved on-site source.

b. Clean soil is to be used to construct the slope. No mine waste or affected soil is to be placed within 10 horizontal feet of the finished slope face, as measured from the finished slope face back into the fill.

c. Cover soil shall be uniformly moisture conditioned to within two percentage points of the ASTM D1557 optimum moisture content.

d. Cover soil shall be constructed by placing uniformly moisture conditioned soil in maximum 8-inch-thick loose lifts (layers) prior to compacting.

e. Cover soil shall be compacted to a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. The upper 8 inches of cover soil shall be compacted to a minimum relative compaction of 95 percent of the ASTM D1557 maximum dry density.

f. The moisture content, density and relative percent compaction of cover soil must be verified by the CQA monitor during construction. The earthwork contractor shall assist our CQA monitor by excavating test pads with the on-site earth moving equipment.

g. Thickness of the cover soil shall be at least 10 feet to allow for future placement and repair of utilities associated with the proposed commercial development.

4. Fill Slope Grading

a. Place fill in horizontal lifts.

b. Clean soil is to be used to construct the slope. No mine waste or affected soil is to be placed within 6 horizontal feet of the finished slope face, as measured from the finished slope face back into the fill.

c. Benching must extend through loose surface soil into firm native soil in the side walls of the excavation, and be performed at intervals such that no loose surface soil is left beneath the fill. An equipment width bench should be made at least every 3 vertical feet.

d. Fill slopes shall be constructed by overbuilding the slope face and then cutting back into the compacted fill surface to the design slope gradient. Fill slopes shall not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking.

e. Fill slope gradients shall be designed based on the results of a geotechnical engineering investigation.

f. Surface water drainage design shall allow for the redirection of surface water away from the fill placement area. The intercepted water shall be discharged into natural drainage courses.

g. The finished slope contours shall drain at a minimum slope of 2 percent towards natural drainage channels and shall not allow surface water to pond. Under no circumstances shall surface water flow be directed over the constructed fill slope.

6. Erosion Controls

a. Specific erosion and sediment control recommendations shall be presented as part of the grading plan for the development project.

b. Exposed fill surfaces that are not covered by gravel, and areas disturbed by construction activity, shall be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District.

c. Jute netting, tackifiers and/or binding agents shall be placed on the seeded slopes to retain the seed and straw on the slope.

d. Straw wattles shall be installed at the down slope perimeter of the placement area and on contour within the placement area as needed to retain sediment on the slope.

e. The earthwork contractor shall maintain and protect exposed soil from wind and water erosion. If a storm is forecasted for the area, exposed fill areas shall be sloped to drain and compacted to facilitate runoff. Plastic sheeting shall be secured over the fill prior to storm events. All existing surface drainage facilities must be kept free of soil and debris during construction. The contractor shall provide siltation control and management during construction.

Best management practices shall be implemented to reduce the chance of potential sediment discharges. Best management practice types are described in Section 6.4.1 of this RAW.

6.3.6 Land Use Covenant Agreement for On-Site Placement Area

An LUC agreement and OMA are recommended for the on-site placement area. LUC agreements are intended to protect public health and the environment by: 1) preventing inappropriate land use, 2) increasing the probability that the public will have information about residual contamination, 3) disclosing information for real estate transactions about residual contamination, 4) ensuring that long-term mitigation measures are carried out by protecting the engineering controls and remedy; and 5) ensuring that subsequent owners assume responsibility for preventing exposure to contamination.

6.3.6.1 Deed Restriction

Deed restriction pertaining to the approximately 330-foot by 570-foot on-site placement area will comply with the following general provisions:

1. No activities that will disturb the mine waste within the on-site placement area (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be allowed on the property without a soil management plan approved by DTSC. Appendix I contains the soil management plan.

2. Restriction of the land use within the on-site placement area is to be established by LUC agreement between the property owner and DTSC. Successive owners, heirs and assignees are to be expressly bound by the covenant.

4. Prior to the sale, lease or sublease of the property containing the on-site placement area, the owner, lessor, or sublessor shall give the buyer, lessee, or sublessee notice that hazardous substances are located in the area.

5. The land use controls shall be incorporated by reference in each and all deeds and leases for the property.

6. The owner shall provide notice to DTSC not later than 30 days after any conveyance of any ownership interest in the property containing the on-site placement area (excluding mortgages, liens, and other non-possessory encumbrances). DTSC shall not, by reason of the covenant, have authority to approve, disapprove, or otherwise affect proposed conveyance, except as otherwise provided by law or by administrative order.

7. The LUC shall be recorded in the County of Nevada.

8. The terms of the deed restriction run with the land and will continue in perpetuity unless a variance is granted or unless terminated. The property owner agrees to pay DTSC's costs in administering the deed restriction.

9. An OMA agreement will establish requirements for monitoring, reporting and financial assurance.

10. Commercial site development will coincide with site remediation. Upon construction of the proposed commercial building and paved parking area over the soil repository area, in accordance with the project development plans, DTSC will be notified that the development project is complete. The structures and pavement are intended to provide access restriction. If structures and pavement are not immediately constructed upon completion of site remediation, the waste placement area shall be fenced and posted until the structures and pavement are constructed.

11. Periodic monitoring of the pavement condition and annual reporting to DTSC will continue to be required after the commercial development is complete. Periodic monitoring of temporary fencing and posting, if used, and annual reporting to DTSC will be required until structures and pavement are constructed over the waste placement area.

6.3.6.2 Financial Assurance

DTSC may require an OMA that includes provisions for financial assurance adopted from the Hazardous Waste Control Law, as set forth in CCR Title 22, including Sections 66264.147, 66265.143, 66265.145 and 66265.147. H&K anticipates that a trust fund, letter of credit or other appropriate financial assurance mechanism will be applicable. The OMA is to be discussed with DTSC after approval of the RAW.

6.3.7 Temporary Fencing and Posting

Fencing, posting and deed restriction are recommended for the on-site placement area if the pavement and buildings associated with the proposed commercial site development are not constructed over the waste placement area immediately after completion of the remedial activities. Recommendations for temporary fencing and posting are described below.

6.3.7.1 Fencing for On-Site Placement Area

The perimeter of the on-site placement area, as depicted on Sheet 1, is to be fenced. Fencing materials are to be 5-foot “no climb” field fence, supported by pressure-treated 4x4 wood posts at angle points and as needed to maintain tension, and by metal T-posts at other locations.

6.3.7.2 Signage for On-Site Placement Area

The perimeter fence is to be posted on each of the four sides, at locations that would be most likely visible to trespassers or other site visitors. The metal signs should include the following general language:

This area is subject to a deed restriction recorded in Nevada County on (insert recording date in month, day, year format) in Book (insert book number) and Page (insert page number). This Deed restriction was recorded because naturally occurring metals, such as arsenic, are present in mining waste in concentrations in this area that do not allow for unrestricted use. Human contact with the soil buried at this location should be avoided. For more information please contact the Department of Toxic Substances Control at (insert telephone number)."

6.4 SITE RESTORATION

After excavation, verification that RAOs have been achieved, and consultation with DTSC, minor grading will likely be performed to smooth the excavated areas at the former mine waste and affected soil locations. Backfilling will be performed only to approximate native contours, to promote positive drainage and to reduce the chance of surface water ponding. Where appropriate, site restoration activities will include broadcasting seed, fertilizer and straw within the excavation footprint for erosion control measures. Fiber wattles will be placed along the perimeter of the down slope sides of the disturbed areas as needed for erosion and sediment control. H&K

anticipates that these restoration activities will be performed as part of site grading for the commercial development, which is to take place immediately following site remediation.

6.4.1 Best Management Practices

Best Management Practices associated with erosion control and sediment retention are discussed below.

1. Straw with Jute Netting or Tackifiers: Jute netting or tackifiers should be placed and secured over the slopes to keep the straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.

2. Fiber Rolls: Fiber rolls (wattles) shall be installed on fill slopes. Fiber rolls shall be anchored with wood stakes placed 4 feet on center or closer. Fiber rolls placed on slopes should be trenched 2 to 4 inches into the soil. Additional wattles may be stored on-site during the rainy season in the event that the installed wattles are filled with sediment.

    a. Prior to fiber roll installation, the subgrade shall be prepared by removing local surface irregularities and larger rock or debris that would inhibit contact of the fiber roll with the subgrade. A contoured key trench shall be excavated 2 to 4 inches deep along the proposed installation route. Soil excavated from the key trench shall be placed on the up slope side of the fiber roll to reduce the chance of surface water undercutting the roll. When more than one fiber roll is placed in a row, the rolls shall be abutted securely to one another to provide a tight joint, not overlapped.

    b. Split, torn, unraveling or slumping fiber rolls shall be repaired or replaced. Fiber rolls shall be observed for damage when rain is forecasted, following rain events, and periodically as needed during prolonged rainfall.

    c. Fiber rolls typically do not require removal and can be abandoned in place, once permanent erosion control is established.

7 PUBLIC PARTICIPATION

H&K will work with DTSC to conduct the appropriate and necessary public participation activities prior to and during the proposed removal action. Appendix J presents a copy of the community profile report prepared by H&K.

8 REMEDIAL ACTION REPORTING

The results of the remedial activities will be presented in a post-remediation report. The purpose of the report is to describe remedial activities and to document compliance with this RAW. The report will present:

- a summary of remedial activities performed;
- a description and basis for deviations, if any, from this RAW;
- limits of excavation and volume of soil excavated;
- results of the verification soil sampling and laboratory analyses;
- as-built drawings of the on-site placement area;
- a summary of CQA performed during placement and compaction at the approved on-site burial location; and
- a summary of site restoration activities.

The post-remediation report will be presented to DTSC for review. Provided that the RAOs are achieved, the post remediation report will request a No Further Action decision from DTSC.

9 LIMITATIONS

The following limitations apply to the findings, conclusions and recommendations presented in this plan:

H&K's professional services were performed consistent with the generally accepted engineering principles and practices employed in northern California. No warranty is expressed or implied.

These services were performed per H&K's agreement with H&K's client. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan. This plan is solely for the use of our client unless noted otherwise. Any reliance on this plan by a third party is at the party's sole risk.

If changes are made to the nature or design of the project as described in this plan, then the conclusions and recommendations presented in this plan should be considered invalid by all parties. Only H&K can determine the validity of the conclusions and recommendations presented in this plan. Therefore, H&K should be retained to review all project changes and prepare written responses with regards to their impacts on H&K's conclusions and recommendations. However, H&K may require additional field work and laboratory testing to develop any modifications to the plan. Costs to review project changes and perform additional fieldwork and laboratory testing necessary to modify H&K's recommendations are beyond the scope of services presented in this plan. Additional work will require an approved scope of services, budget, and authorization to proceed.

H&K is not responsible for the health and safety of non-H&K personnel, on or off the project site.

The analyses, conclusions and recommendations presented in this plan are based on site conditions as they existed at the time H&K's investigations were performed. Changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of knowledge. Therefore, the recommendations presented in this plan may need to be revised based on site conditions or regulatory requirements.

10 REFERENCES

California Department of Conservation, Division of Mines and Geology, (1992). Geologic Map of the Chico Quadrangle.

California Environmental Protection Agency, Regional Water Quality Control Board (June 1989). The Designated Level Methodology.

California Environmental Protection Agency, Regional Water Quality Control Board (September 15, 1998). Fourth Edition of the Water Quality Control Plan for the Sacramento and San Joaquin River Basins.

California Environmental Protection Agency, Regional Water Quality Control Board (August 2003). A Compilation of Water Quality Goals.

California Environmental Protection Agency, State Water Resources Control Board (October 28, 1968). Resolution No. 68-16, Policy with Respect to Maintaining Higher Quality Waters in California.

Holdrege & Kull (January 11, 2008). Preliminary Endangerment Assessment for Former Spring Hill Mine Property.

Lindgren, Waldemar (1896). Nevada City Special Folio, California: U.S. Geological Survey Folio 29.

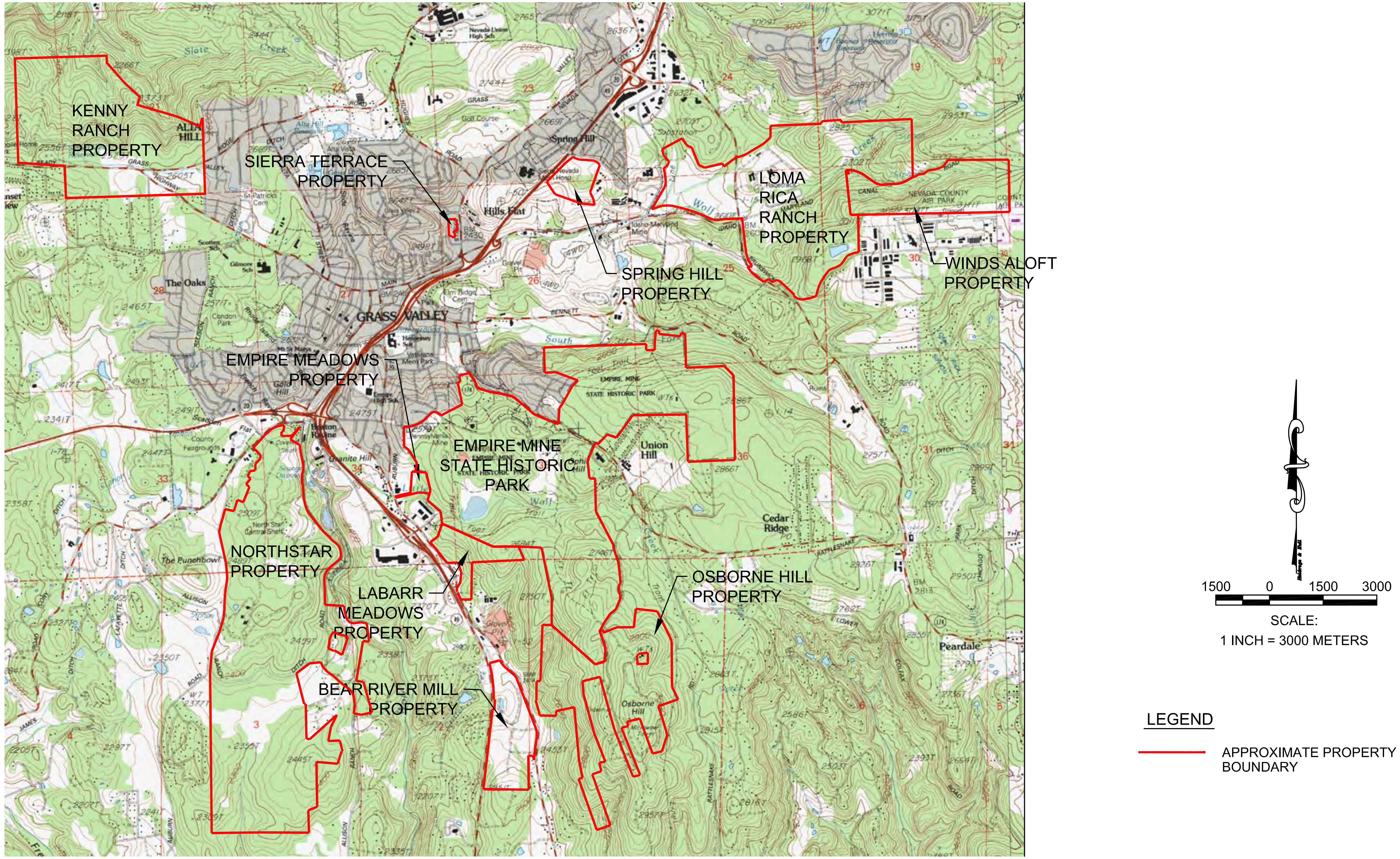
Tuminas, A. (1983). Geologic Map of the Grass Valley - Colfax Area.

United States Department of Agriculture Soil Conservation Service and Forest Service (reissued August 1993). Soil Survey of Nevada County Area, California.

United States Geological Survey (1995 Provisional Edition). Grass Valley Quadrangle California, 7.5 Minute Series Topographic Map.

Uren, Chas., C.E. (1897). Map of the Vicinity of Grass Valley and Nevada City.

FIGURES



SOURCE: USGS 7.5 minute topographic map, Grass Valley, California quadrangle, 1995.

3292–04–FIG1

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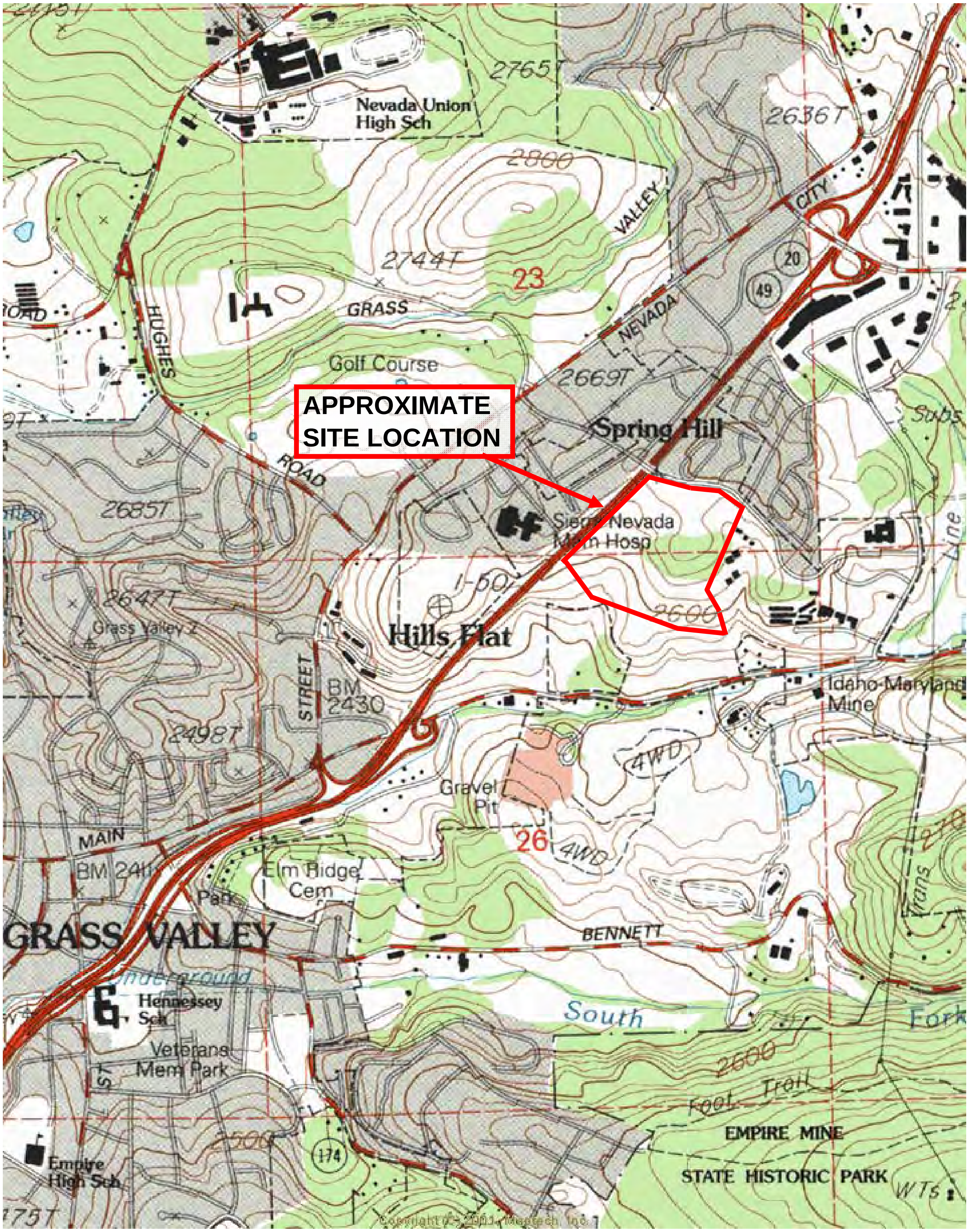
SITE VICINITY MAP SHOWING NEARBY PEA SITES

SPRING HILL PROPERTY

GRASS VALLEY, CALIFORNIA

DRAWN BY: DFD	CHECKED BY: CDR
PROJECT NO.: 3292–04	
DATE: AUGUST 2008	
FIGURE NO.: 1	



NO SCALE

SOURCE: GRASS VALLEY QUADRANGLE MAP (USGS, PROVISIONAL EDITION 1995)

HOLDREGE & KULL CONSULTING ENGINEERS • GEOLOGISTS 792 Searls Avenue • Nevada City, CA 95959 (530) 478-1305 • FAX (530) 478-1019	**SITE LOCATION MAP** SPRING HILL PROPERTY GRASS VALLEY, CALIFORNIA	PROJECT NO. 3292-04 AUGUST 2008 FIGURE 2

FIGURE 3

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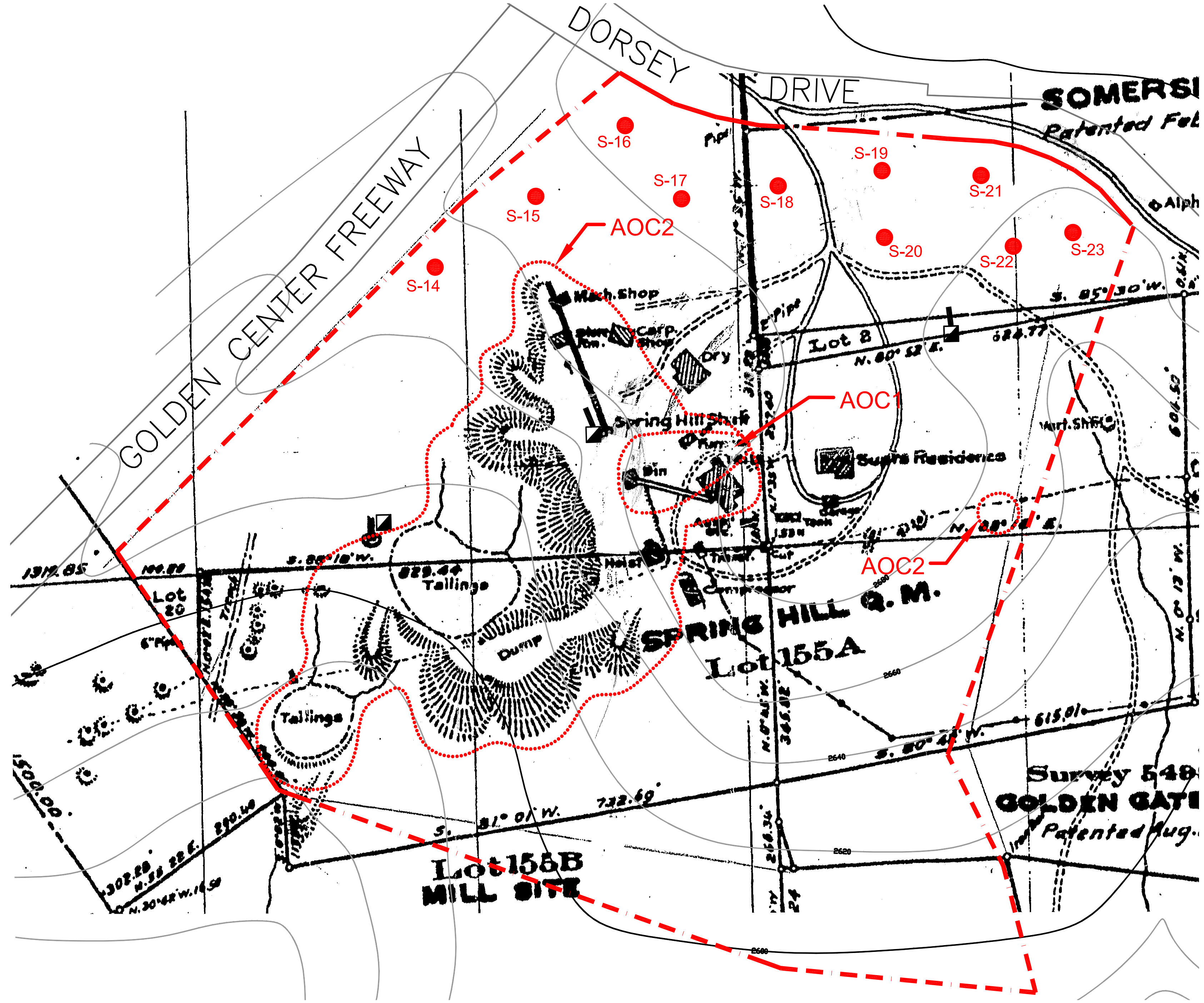
AERIAL PHOTOGRAPH
SPRING HILL PROPERTY
GRASS VALLEY, CALIFORNIA

NO.	REVISIONS	DATE

CHECKED BY:	CDR
DRAWN BY:	DFD
DATE:	AUGUST 2008
DRAWING NAME:	3292-04-FIG3
PROJECT NO.:	3292-04



LEGEND

SITE BOUNDARY

AREA OF CONCERN (AOC) BOUNDARY

APPROXIMATE RECORDED LOCATION OF MINE SHAFT

S-14 APPROXIMATE LOCATION OF BACKGROUND SOIL SAMPLE

BASE MAP: MAP OF SPRING HILL MINING CO. (E. UREN, 1942)

3292–04–FIG4

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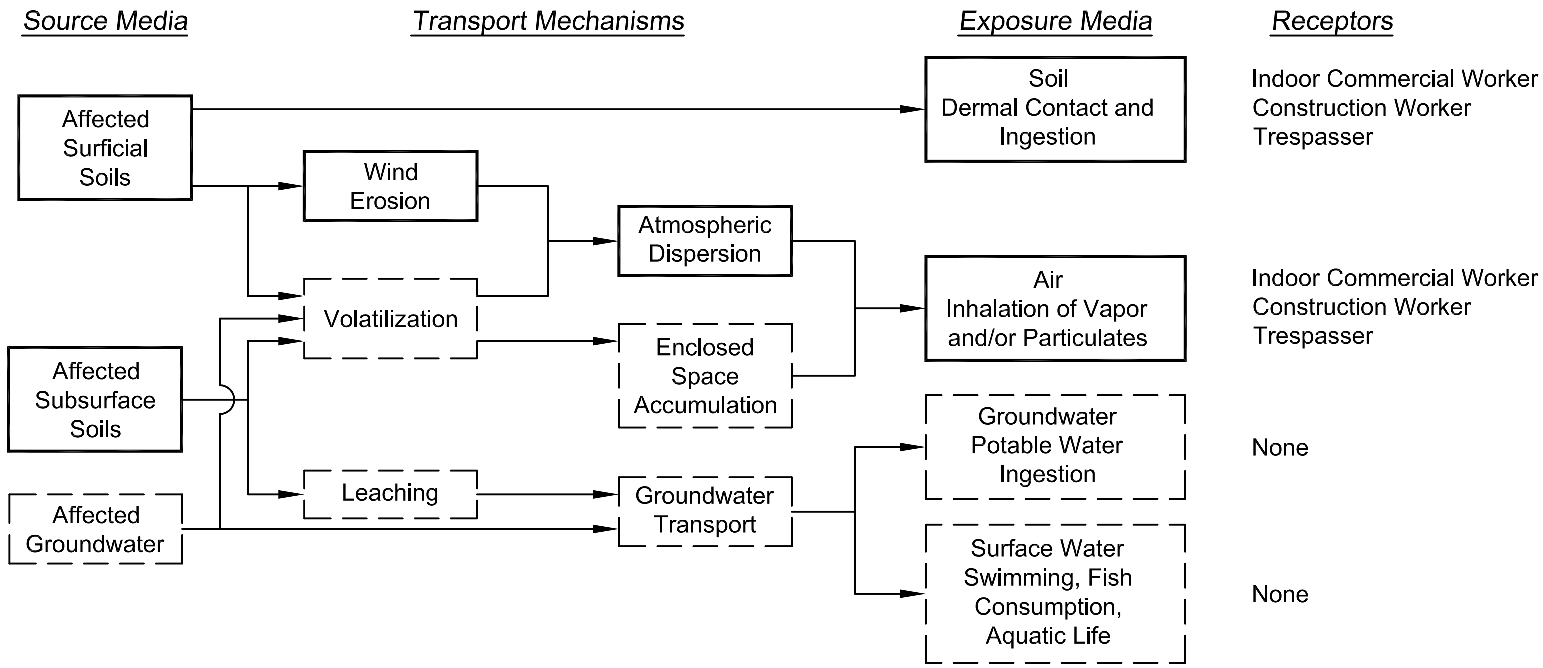
MINE WASTE ASSESSMENT AREAS

SPRING HILL PROPERTY

GRASS VALLEY, CALIFORNIA

DRAWN BY: DFD	CHECKED BY: JWM
PROJECT NO.: 3292–04	
DATE: AUGUST 2008	
FIGURE NO.: 4	



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SITE CONCEPTUAL MODEL DIAGRAM

SPRING HILL PROPERTY

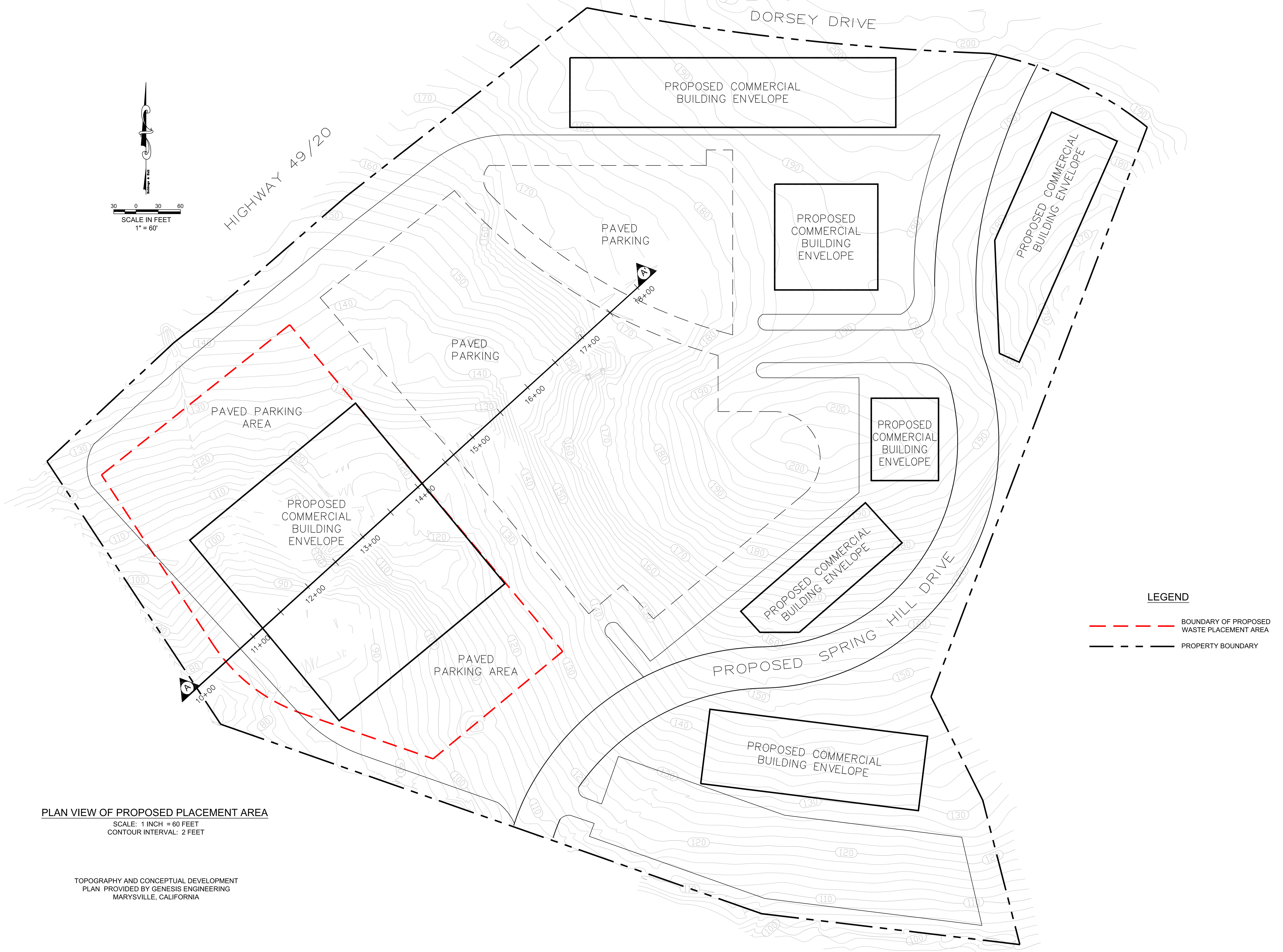
GRASS VALLEY, CALIFORNIA

DRAWN BY: DFD	CHECKED BY: JWM
PROJECT NO.: 3292-04	
DATE: AUGUST 2008	
FIGURE NO.: 5	

SHEETS

Sheet 1 Conceptual On-Site Placement Plan

Sheet 2 Conceptual Placement Area Section



PLAN VIEW OF PROPOSED PLACEMENT AREA

SCALE: 1 INCH = 60 FEET
CONTOUR INTERVAL: 2 FEET

TOPOGRAPHY AND CONCEPTUAL DEVELOPMENT PLAN PROVIDED BY GENESIS ENGINEERING MARYSVILLE, CALIFORNIA

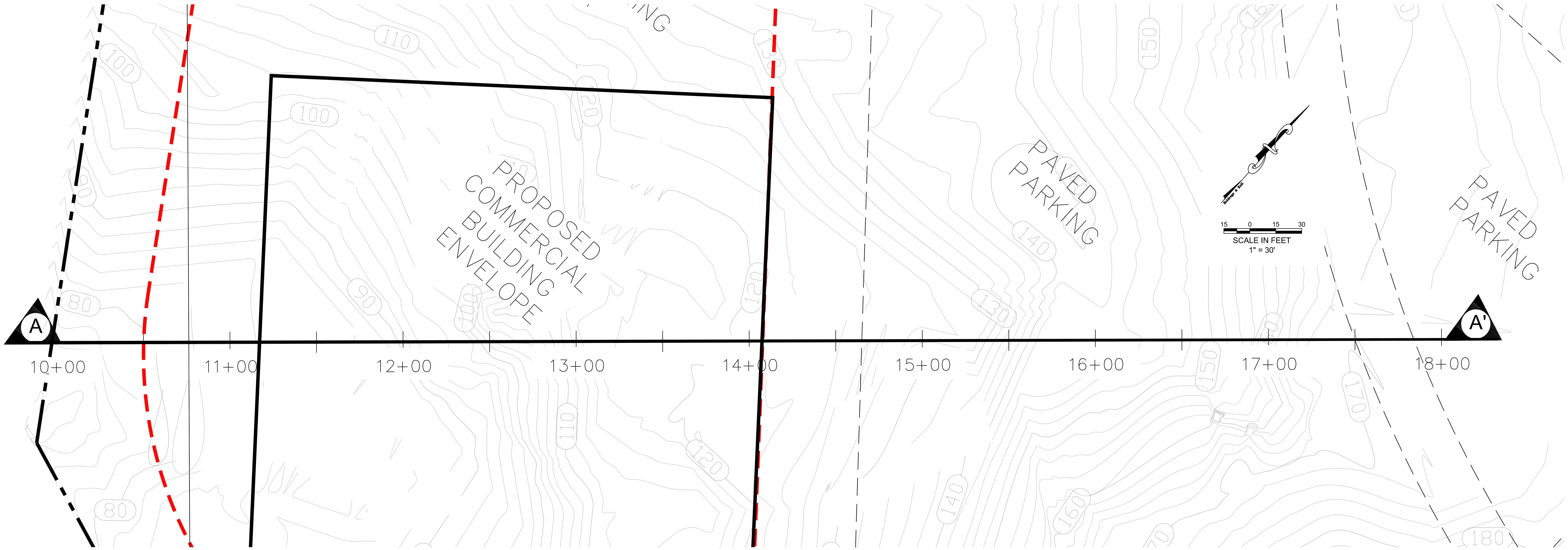
NO.	DATE	REVISIONS

DESIGNED BY: JWM
DRAWN BY: SLD
DATE: AUGUST 2008
DRAWING NAME: 3292-04-SH1&2
PROJECT No.: 3292-04

CONCEPTUAL ON-SITE PLACEMENT PLAN
SPRING HILL PROPERTY
GRASS VALLEY, CALIFORNIA

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959
(530) 478-1305 FAX 478-1019

SHEET 1



PLAN VIEW OF PROPOSED PLACEMENT AREA

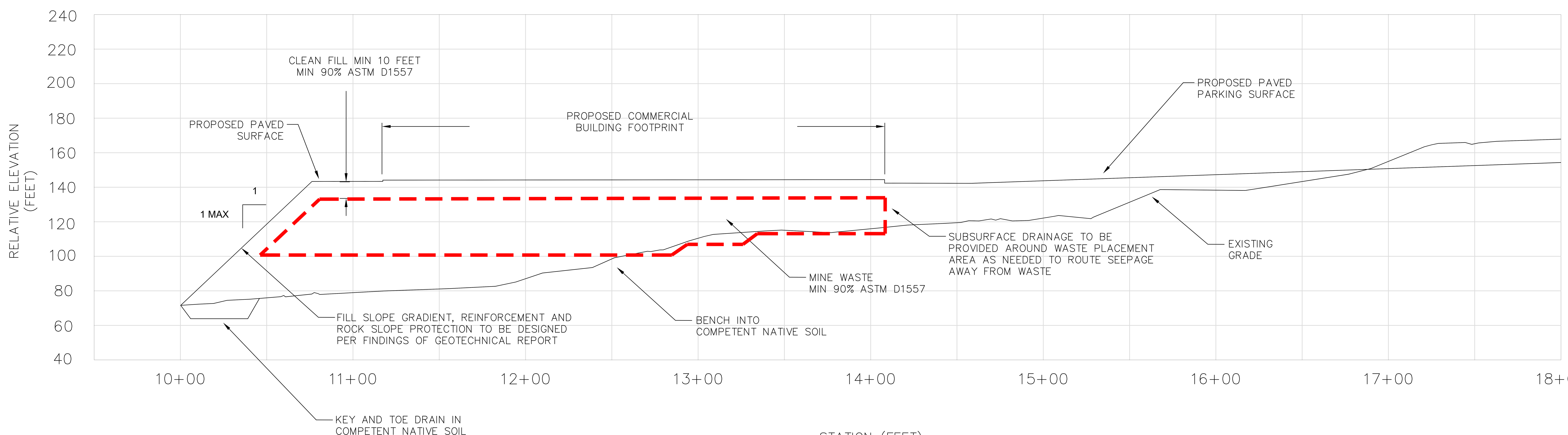
SCALE: 1 INCH = 30 FEET

CONTOUR INTERVAL: 2 FEET

LEGEND

BOUNDARY OF PROPOSED WASTE PLACEMENT AREA

PROPERTY BOUNDARY



LEGEND

BOUNDARY OF PROPOSED WASTE PLACEMENT AREA

SECTION A-A'

HORIZONTAL SCALE: 1 INCH = 30 FEET

VERTICAL SCALE: 1 INCH = 30 FEET

TOPOGRAPHY AND CONCEPTUAL DEVELOPMENT PLAN PROVIDED BY GENESIS ENGINEERING MARYSVILLE, CALIFORNIA

NO.	REVISIONS	DATE

DESIGNED BY: JWM

DRAWN BY: SLD

DATE: AUGUST 2008

DRAWING NAME: 3292-04-SH1&2

PROJECT No.: 3292-04

CONCEPTUAL PLACEMENT AREA SECTION

SPRING HILL PROPERTY

GRASS VALLEY, CALIFORNIA

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SHEET 2

TABLES

Table 1 - Proposed Cleanup Goals
Spring Hill Property
Project No. 3292-04

Constituent	Maximum Detected Soil Concentration (mg/kg)		UCL Soil Concentration (mg/kg)		UCL Background Soil Concentration (mg/kg)	BTV Soil Concentration (mg/kg)	CHHSL for Residential Soil (mg/kg)	CHHSL for Commercial Soil (mg/kg)	COPC?	Proposed Cleanup Goals for Unrestricted Land Use		Proposed Cleanup Goals for Placement Beneath Commercial Development		Basis for Proposed Cleanup Goals	
	AOC 1	AOC 2	AOC 1	AOC 2						Total Concentration[1] (mg/kg)	Soluble Concentration[2] (µg/L)	Total Concentration[1] (mg/kg)	Soluble Concentration[2] (µg/L)	Protection of Human Health	Protection of Water Quality
Antimony	**12.4**	**12.2**	na	na	21.7	26.8	30	380	no	na	na	na	na	na	na
Arsenic	579	94.6	**348**	**21.9**	na	**17**	0.07	0.24	**yes**	**17**	**2**	**22**	**20**	**BTV/RBCL[3]**	**SDL**
Barium	**103**	**12.5**	na	na	na	na	5,200	63,000	no	na	na	na	na	na	na
Beryllium	ND<0.5	ND<0.5	na	na	na	na	150	1,700	no	na	na	na	na	na	na
Cadmium	**3.4**	**1.5**	na	na	12.2	13.8	1.7	7.5	no	na	na	na	na	na	na
Chromium	**962**	**60.4**	na	na	na	na	100,000	100,000	no	na	na	na	na	na	na
Cobalt	**79.4**	**56.3**	na	na	160	185	660	3,200	no	na	na	na	na	na	na
Copper	**467**	**94.2**	na	na	46.4	62	3,000	38,000	**yes**	**2,800**	na	**10,000**	na	**RBCL[4]**	na
Lead	810	341	**408**	**36.1**	13.7	na	80	320	**yes**	**80**	**2**	**260**	**20**	**RBCL[5]**	**SDL**
Mercury	19.5	1.29	**10.1**	**0.22**	na	na	18	180	**yes**	**18**	na	**82**	na	**RBCL[6]**	na
Molybdneum	**3.7**	ND<1	na	na	na	na	380	4,800	no	na	na	na	na	na	na
Nickel	1180	1290	**640**	**466**	na	na	1,600	16,000	no	na	na	na	na	na	na
Selenium	ND<2	ND<2	na	na	na	na	380	4,800	no	na	na	na	na	na	na
Silver	**21.8**	ND<2	na	na	na	na	380	4,800	no	na	na	na	na	na	na
Thallium	ND<2	ND<2	na	na	na	na	5	63	no	na	na	na	na	na	na
Vanadium	**948**	**54.6**	na	na	93.1	**117**	530	6,700	**yes[7]**	**117**	na	**260**	na	**BTV/RBCL[7]**	na
Zinc	**318**	**38.4**	na	na	na	na	23,000	100,000	no	na	na	na	na	na	na

Notes:
1 Total concentrations are based on USEPA Method 6010B/7471A.
2 Soluble concentrations are based on DI-WET and USEPA Method 6010B.
3 Arsenic cleanup goal for unrestricted land use is based on a BTV equal to the 95th percentile value for local background concentrations. Arsenic cleanup goal for commercial development is based on construction worker exposure.
4 Copper RBCL for unrestricted land use is based on the standard exposure scenario (Table 8), and copper RBCL for commercial development is based on construction worker exposure (Table 10).
5 Lead RBCLs are based on Lead Risk Assessment Spreadsheet Version 8 (DTSC). Results are presented in Tables 2 through 5. As indicated by lead levels in Table 5, dust suppression will be required to limit construction worker exposure.
6 Mercury RBCLs are derived in Tables 5 through 7.
7 Vanadium is considered a COPC for AOC 1 only. BTV is equal to 95% UPL for unrestricted land use. RBCL for commercial development is based on construction worker exposure (Table 12).
BTV = Background threshold value (95th percentile value for arsenic, 95% Upper Percentile Limit for other metals)
DI-WET = Title 22 Waste Extraction Test using deionized water as the extractant solution
mg/kg = milligrams per kilogram of soil
na = not applicable or not available
ND< = constituent not detected at concentration greater than the listed laboratory reporting limit
RBCL = risk-based cleanup level
SDL = soluble designated level based on Designated Level Methodology (see PEA report)
UCL = upper confidence limit (95%) on the arithmetic mean
µg/L = micrograms per liter of water

Table 2 - Derivation of Proposed Lead Cleanup Goal, Standard (Unrestricted) Exposure Scenario
Spring Hill Property
Project No. 3292-04

LEAD RISK ASSESSMENT SPREADSHEET 8
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	80.0
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl)						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	0.6	1.0	1.2	1.5	1.7	77
BLOOD Pb, PICA CHILD	1.1	2.1	2.4	3.0	3.4	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.00	1%		0.00	0%
Soil Ingestion	7.0E-3	0.56	99%	1.4E-2	1.13	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Click here for REFERENCES

Table 3 - Derivation of Proposed Lead Cleanup Goal, Adult Exposure
Spring Hill Property
Project No. 3292-04

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	260
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**0.4**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	0.8
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**5.2%**

PRG90 **318**

Click here for REFERENCES

Table 4 - Derivation of Proposed Lead Cleanup Goal, Construction Worker Exposure Scenario
Spring Hill Property
Project No. 3292-04

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	260
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.330
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**2.8**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	5.4
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**94.4%**

PRG90 **48**

Click here for REFERENCES

Note: Becasuse benchmark level is exceeded, dust control will be necessary during construction.

Table 5 - Derivation of Proposed Total Mercury Cleanup Goal, Standard (Unrestricted) Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi**[1] (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Mercury	Proposed Cleanup Goal	3.E-04	8.57E-05	NL	NL	0.01	18	1.37E-08	7.89E-01	1.02E-04	**7.89E-01**			0.00E+00
TOTAL									7.89E-01	1.02E-04	**8.E-01**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	6	n/a	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	350	350	days/yr	PEA Guidance Manual
EFd, exposure frequency (dermal)	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	350	350	days/yr	PEA Guidance Manual
ED, exposure duration	6	24	yr	Human-Exposure-Based Screening Numbers
IRs, soil ingestion rate	200	100	mg/day	PEA Guidance Manual
IRa, inhalation rate	10	20	m^3/day	PEA Guidance Manual
BW, body weight	15	70	kg	PEA Guidance Manual
SA, exposed skin surface area	2,800	5,700	cm^2	Human-Exposure-Based Screening Numbers
AF, adherance factor	0.2	0.07	mg/cm^2	Human-Exposure-Based Screening Numbers
PEF, particulate emission factor	1.316E+09	1.316E+09	m^3/kg	Human-Exposure-Based Screening Numbers

Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)

Table 6 - Derivation of Proposed Total Mercury Cleanup Goal, Commercial Indoor Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** $(mg/kg\text{-}day)^{-1}$	**Sfi**[1] $(mg/kg\text{-}day)^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Mercury	Proposed Cleanup Goal	3.E-04	8.57E-05	NL	NL	0.01	82	6.03E-08	1.51E-01	9.64E-05	1.51E-01			0.00E+00
TOTAL									1.51E-01	9.64E-05	**2.E-01**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca $[mg/m^3]$ = air concentration = Cs [mg/kg] * (PEF $[m^3/kg])^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	25	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	25	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	50	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	14	m^3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	3,300	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.2	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.36E+09	m^3/kg	US EPA Supplimental Guidance

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa).
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)

Table 7 - Derivation of Proposed Total Mercury Cleanup Goal, Construction Worker Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Mercury	Proposed Cleanup Goal	3.E-04	8.57E-05	NL	NL	0.01	82	6.21E-08	1.00E+00	1.42E-04	1.00E+00			0.00E+00
TOTAL									1.00E+00	1.42E-04	**1.E+00**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	1	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	1	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	330	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	20	m3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	5,700	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.8	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.32.E+09	m^3/kg	US EPA (2004)

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa): Linn W.S., Spier C.E., and J.D. Hackney. 1993. Activity Patterns in Ozone-exposed contstruction workers. J. Occ. Med.
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
Threshold Limit Values and Biological Exposure Indices, American Converence of Governmental Industrial Hygenists (ACGIH 2004)

Table 8 - Derivation of Proposed Total Copper Cleanup Goal, Standard (Unrestricted) Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Copper	proposed cleanup goal	3.7E-02	3.7E-02	NL	NL	0.01	2800	2.13E-06	9.95E-01	3.68E-05	**9.95E-01**			0.00E+00
TOTAL									9.95E-01	3.68E-05	**1.E+00**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$ 5.00E-05
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	6	n/a	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	350	350	days/yr	PEA Guidance Manual
EFd, exposure frequency (dermal)	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	350	350	days/yr	PEA Guidance Manual
ED, exposure duration	6	24	yr	Human-Exposure-Based Screening Numbers
IRs, soil ingestion rate	200	100	mg/day	PEA Guidance Manual
IRa, inhalation rate	10	20	m^3/day	PEA Guidance Manual
BW, body weight	15	70	kg	PEA Guidance Manual
SA, exposed skin surface area	2,800	5,700	cm^2	Human-Exposure-Based Screening Numbers
AF, adherance factor	0.2	0.07	mg/cm^2	Human-Exposure-Based Screening Numbers
PEF, particulate emission factor	1.316E+09	1.316E+09	m^3/kg	Human-Exposure-Based Screening Numbers

Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)

Table 9 - Derivation of Proposed Total Copper Cleanup Goal, Commercial Indoor Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi [1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Copper	proposed cleanup goal	3.7E-02	3.7E-02	NL	NL	0.01	38,000	2.79E-05	5.69E-01	1.03E-04	5.69E-01			0.00E+00
TOTAL									5.69E-01	1.03E-04	**6.E-01**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	25	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	25	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	50	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	14	m^3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	3,300	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.2	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.36E+09	m^3/kg	US EPA Supplimental Guidance

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa).
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)

Table 10 - Derivation of Proposed Total Copper Cleanup Goal, Construction Worker Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Copper	proposed cleanup goal	3.7E-02	3.7E-02	NL	NL	0.01	10,000	7.58E-06	9.93E-01	4.01E-05	9.93E-01			0.00E+00
TOTAL									9.93E-01	4.01E-05	**1.E+00**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	1	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	1	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	330	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	20	m3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	5,700	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.8	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.32.E+09	m^3/kg	US EPA (2004)

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa): Linn W.S., Spier C.E., and J.D. Hackney. 1993. Activity Patterns in Ozone-exposed contstruction workers. J. Occ. Med.
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
Threshold Limit Values and Biological Exposure Indices, American Converence of Governmental Industrial Hygenists (ACGIH 2004)

Table 11 - Derivation of Proposed Total Vanadium Cleanup Goal, Commercial Indoor Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	1,800	1.32E-06	9.97E-01	1.81E-04	9.97E-01			0.00E+00
TOTAL									9.97E-01	1.81E-04	**1.E+00**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	25	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	25	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	50	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	14	m^3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	3,300	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.2	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.36E+09	m^3/kg	US EPA Supplimental Guidance

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa).
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)

Table 12 - Derivation of Proposed Total Vanadium Cleanup Goal, Construction Worker Exposure Scenario
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	260	1.97E-07	9.56E-01	3.85E-05	9.56E-01			0.00E+00
TOTAL									9.56E-01	3.85E-05	**1.E+00**	0.00E+00	0.00E+00	**0.E+00**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	1	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	1	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	330	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	20	m3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	5,700	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.8	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.32.E+09	m^3/kg	US EPA (2004)

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa): Linn W.S., Spier C.E., and J.D. Hackney. 1993. Activity Patterns in Ozone-exposed contstruction workers. J. Occ. Med.
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
Threshold Limit Values and Biological Exposure Indices, American Converence of Governmental Industrial Hygenists (ACGIH 2004)

Table 13 - Total Metals in Background Soil

Spring Hill Property

Project No. 3292-04

Sample Number	Sample Depth (feet bgs)	Sample Date	Easting[1] (UTM)	Northing[1] (UTM)	Total Antimony (mg/kg)	Total Arsenic (mg/kg)	Total Cadmium (mg/kg)	Total Cobalt (mg/kg)	Total Copper (mg/kg)	Total Lead (mg/kg)	Total Mercury (mg/kg)	Total Nickel (mg/kg)	Total Vanadium (mg/kg)
BG-1	0 - 0.5	5/20/03	na	na	na	ND<1.0	na	na	na	6.0	0.069	na	na
BG-2	0 - 0.5	5/20/03	na	na	na	ND<1.0	na	na	na	9.1	0.140	na	na
BG-3	0 - 0.5	5/20/03	na	na	na	17	na	na	na	13	0.066	na	na
BG-4	0 - 0.5	10/11/05	na	na	na	ND<1.0	na	na	na	20.4	na	na	na
BG-5	0 - 0.5	10/11/05	na	na	na	ND<1.0	na	na	na	6.8	na	na	na
BG-6	0 - 0.5	10/11/05	na	na	na	ND<1.0	na	na	na	15.0	na	na	na
S-12	0.25	4/18/07	na	na	na	ND<1.0	na	na	na	5.0	na	1,620	na
S-13	0.25	4/18/07	na	na	na	ND<1.0	na	na	na	3.1	na	1,680	na
S-14	0 - 0.5	6/27/08	608863	4343944	8.9	na	7.6	94.7	61.7	na	na	na	117
S-15	0 - 0.5	6/27/08	668907	4343975	17.1	na	9.7	128	55.9	na	na	na	92.7
S-16	0 - 0.5	6/27/08	668946	4344006	20.1	na	11.5	126	49.3	na	na	na	98.7
S-17	0 - 0.5	6/27/08	668971	4343974	21.1	na	12.7	177	39.6	na	na	na	91.6
S-18	0 - 0.5	6/27/08	669015	4343980	15.1	na	9.3	134	35.4	na	na	na	51.9
S-19	0 - 0.5	6/27/08	669061	4343986	16.1	na	10.8	122	19.7	na	na	na	67.9
S-20	0 - 0.5	6/27/08	669076	4343957	21.6	na	12.8	161	25.3	na	na	na	56.2
S-21	0 - 0.5	6/27/08	669105	4343984	25.2	na	12.9	185	34.3	na	na	na	75.5
S-22	0 - 0.5	6/27/08	669119	4343953	26.8	na	13.8	179	31.0	na	na	na	89.9
S-23	0 - 0.5	6/27/08	669145	4343959	13.9	na	7.4	86.4	35.3	na	na	na	72.5

Notes:

1 UTM coordinates are based on NAD (North American Datum) 83 and were obtained using a hand-held GPS device of resource-grade accuracy (typically less than 30 feet, as reported by the GPS unit.

bgs = below ground surface

mg/kg = milligrams per kilogram

ND< = not detected at or above the indicated laboratory reporting limit

na = not analyzed

Analysis for total metals performed by Excelchem Environmental Labs using U.S. EPA Test Method 6010B

Table 14 - Summary of Risk/Hazard Calculations for Background Soil, Standard Exposure Scenario (Unrestricted Land Use)
Spring Hill Property
Project No. 3292-04

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Antimony	UCL	4.E-04	4.E-04	NL	NL	0.01	21.7	1.65E-08	7.13E-01	2.64E-05	7.13E-01			0.00E+00
Arsenic	mean	3.E-04	8.57E-06	9.45	12.0	0.03	2.6	1.98E-09	1.20E-01	1.47E-04	1.20E-01	4.11E-05	3.53E-09	4.11E-05
Cadmium	UCL	5.E-04	5.7E-06	NL	6.3	0.001	12.2	9.27E-09	3.13E-01	1.04E-03	3.14E-01		8.69E-09	8.69E-09
Cobalt	UCL	2.E-02	5.7E-06	NL	9.8	0.01	160	1.22E-07	1.05E-01	1.36E-02	1.19E-01		1.77E-07	1.77E-07
Copper	UCL	3.7E-02	3.7E-02	NL	NL	0.01	46.4	3.53E-08	1.65E-02	6.09E-07	1.65E-02			0.00E+00
Mercury	mean	3.E-04	8.57E-05	NL	NL	0.01	0.09	6.84E-11	3.94E-03	5.10E-07	3.94E-03			0.00E+00
Vanadium	UCL	1.E-03	1.E-03	NL	NL	0.01	93.1	7.07E-08	1.22E+00	4.52E-05	1.22E+00			0.00E+00
TOTAL									2.50E+00	1.49E-02	**3.E+00**	4.11E-05	1.89E-07	**4.E-05**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	6	n/a	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	350	350	days/yr	PEA Guidance Manual
EFd, exposure frequency (dermal)	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	350	350	days/yr	PEA Guidance Manual
ED, exposure duration	6	24	yr	Human-Exposure-Based Screening Numbers
IRs, soil ingestion rate	200	100	mg/day	PEA Guidance Manual
IRa, inhalation rate	10	20	m^3/day	PEA Guidance Manual
BW, body weight	15	70	kg	PEA Guidance Manual
SA, exposed skin surface area	2,800	5,700	cm^2	Human-Exposure-Based Screening Numbers
AF, adherance factor	0.2	0.07	mg/cm^2	Human-Exposure-Based Screening Numbers
PEF, particulate emission factor	1.316E+09	1.316E+09	m^3/kg	Human-Exposure-Based Screening Numbers

Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)

Table 15 - Cost Estimate for AOC 1 Excavation and On Site Placement
Spring Hill Property
Project No. 3292-04

Estimated Capital Costs[1]	Estimated Quantity[2]	Unit	Unit Cost	Estimated Cost
Excavation[2]	1,700	cubic yards	$5	$8,500
Import and Placement of Clean Fill[3]	0	cubic yards	$19	$0
On Site Transport and Placement[4]	1,700	cubic yards	$5	$8,500
Off Site Transport and Disposal[5]	0	tons	$100	$0
Erosion Control[6]	0	acres	$2,500	$0
Aggregate Base[7]	0	cubic yards	$19	$0
Asphalt Cap[7]	0	square feet	$3	$0
Management and Engineering[8]	1	% of direct costs	10%	$1,700
Contingency[9]	1	% of direct costs	15%	$1,530
Total Estimated Capital Cost				**$20,230**
Estimated Annual Cost (inspection and annual reporting to DTSC)				**$2,000**

Notes:
1 Estimate based on rates obtained from local contractors. Actual costs may vary significantly based on actual rates, material quantities and site conditions.
2 Excavation unit cost provided by Robinson Enterprises of Grass Valley, California.
3 Import of clean fill is not necessary for the On Site Placement alternative.
4 Transport and placement unit cost provided by Robinson Enterprises of Grass Valley, California.
5 Off site transport and disposal is not applicable to the On Site Placement alternative.
6 The remedial action is to be performed concurrently with site grading; thus, specific erosion control costs are not presented in this estimate.
7 The waste placement area includes a paved parking area (95,000 square feet) and a commercial building envelope (91,500 square feet). Costs for building construction, aggregate base and paving are not presented in this estimate.
8 Indirect manaagement and engineering costs are estimated as a percentage of direct costs.
9 A contingency is added as a percent of direct costs. Waste voumes have not been determined by survey. Waste volumes, waste characteristics and unit costs may vary.
AOC = Area of Concern

Table 16 - Cost Estimate for AOC 1 Excavation and Off Site Disposal
Spring Hill Property
Project No. 3292-04

Estimated Capital Costs[1]	**Estimated Quantity**[2]	**Unit**	**Unit Cost**	**Estimated Cost**
Excavation[2]	1,700	cubic yards	$5	$8,500
Import and Placement of Clean Fill[3]	0	cubic yards	$19	$0
On Site Transport and Placement[4]	0	cubic yards	$5	$0
Off Site Transport and Disposal[5]	2,300	tons	$100	$230,000
Erosion Control[6]	0	acres	$2,500	$0
Aggregate Base[6]	0	cubic yards	$19	$0
Asphalt Cap[7]	0	square feet	$3	$0
Management and Engineering[8]	1	% of direct costs	5%	$11,925
Contingency[9]	1	% of direct costs	10%	$24,193
Total Estimated Capital Cost				**$274,618**
Estimated Annual Cost				**$0**

Notes:
1 Estimate based on rates obtained from local contractors. Actual costs may vary significantly based on actual rates, material quantities and site conditions.
2 Excavation unit cost provided by Robinson Enterprises of Grass Valley, California.
3 Unit cost provided by Robinson Enterprises of Grass Valley, California. Cost will vary based on borrow source, which has not yet been determined.
4 Transport and placement unit cost provided by Robinson Enterprises of Grass Valley, California.
5 Unit cost assumes Class I non-RCRA disposal.
6 The remedial action is to be performed concurrently with site grading; thus, specific erosion control costs are not presented in this estimate.
7 Not applicable to the Off Site Disposal Alternative.
8 Indirect management and engineering costs are estimated as a percentage of direct costs.
9 A contingency is added as a percent of direct costs. Waste voumes have not been determined by survey. Waste volumes, waste characteristics and unit costs may vary.
AOC = Area of Concern

Table 17 - Cost Estimate for AOC 2 Excavation and On Site Placement
Spring Hill Property
Project No. 3292-04

Estimated Capital Costs[1]	**Estimated Quantity**[2]	**Unit**	**Unit Cost**	**Estimated Cost**
Excavation[2]	62,000	cubic yards	$5	$310,000
Import and Placement of Clean Fill[3]	0	cubic yards	$19	$0
On Site Transport and Placement[4]	62,000	cubic yards	$5	$310,000
Off Site Transport and Disposal[5]	0	tons	$40	$0
Erosion Control[6]	0	acres	$2,500	$0
Aggregate Base[7]	0	cubic yards	$19	$0
Asphalt Cap[7]	0	square feet	$3	$0
Management and Engineering[8]	1	% of direct costs	10%	$62,000
Contingency[9]	1	% of direct costs	10%	$37,200
Total Estimated Capital Cost				**$719,200**
Estimated Annual Cost (inspection and annual reporting to DTSC)				**$2,000**

Notes:
1 Estimate based on rates obtained from local contractors. Actual costs may vary significantly based on actual rates, material quantities and site conditions.
2 Excavation unit cost provided by Robinson Enterprises of Grass Valley, California.
3 Import of clean fill is not necessary for the On Site Placement alternative.
4 Transport and placement unit cost provided by Robinson Enterprises of Grass Valley, California.
5 Off site transport and disposal is not applicable to the On Site Placement alternative.
6 The remedial action is to be performed concurrently with site grading; thus, specific erosion control costs are not presented in this estimate.
7 The waste placement area includes a paved parking area (95,000 square feet) and a commercial building envelope (91,500 square feet). Costs for building construction, aggregate base and paving are not presented in this estimate.
8 Indirect manaagement and engineering costs are estimated as a percentage of direct costs.
9 A contingency is added as a percent of direct costs. Waste voumes have not been determined by survey. Waste volumes, waste characteristics and unit costs may vary.
AOC = Area of Concern

Table 18 - Cost Estimate for AOC 2 Excavation and Off Site Disposal
Spring Hill Property
Project No. 3292-04

Estimated Capital Costs[1]	**Estimated Quantity**[2]	**Unit**	**Unit Cost**	**Estimated Cost**
Excavation[2]	62,000	cubic yards	$5	$310,000
Import and Placement of Clean Fill[3]	62,000	cubic yards	$19	$1,178,000
On Site Transport and Placement[4]	0	cubic yards	$5	$0
Off Site Transport and Disposal[5]	83,700	tons	$40	$3,348,000
Erosion Control[6]	0	acres	$2,500	$0
Aggregate Base[6]	0	cubic yards	$19	$0
Asphalt Cap[7]	0	square feet	$3	$0
Management and Engineering[8]	1	% of direct costs	1%	$62,868
Contingency[9]	1	% of direct costs	10%	$458,887
Total Estimated Capital Cost				**$5,357,755**
Estimated Annual Cost				**$0**

Notes:
1 Estimate based on rates obtained from local contractors. Actual costs may vary significantly based on actual rates, material quantities and site conditions.
2 Excavation unit cost provided by Robinson Enterprises of Grass Valley, California.
3 Unit cost provided by Robinson Enterprises of Grass Valley, California. Cost will vary based on borrow source, which has not yet been determined.
4 Transport and placement unit cost provided by Robinson Enterprises of Grass Valley, California.
5 Unit cost assumes Class I non-RCRA disposal.
6 The remedial action is to be performed concurrently with site grading; thus, specific erosion control costs are not presented in this estimate.
7 Not applicable to the Off Site Disposal Alternative.
8 Indirect management and engineering costs are estimated as a percentage of direct costs.
9 A contingency is added as a percent of direct costs. Waste voumes have not been determined by survey. Waste volumes, waste characteristics and unit costs may vary.
AOC = Area of Concern

Table 19 - Cost Estimate Summary for Proposed Remedial Alternative
Spring Hill Property
Project No. 3292-04

Estimated Capital Costs	Estimated Cost
Excavation and Off Site Disposal for AOC 1 (see Table 16)	$274,618
Excavation and On Site Placement for AOC 2 (see Table 17)	$719,200
Total Estimated Capital Cost	**$993,818**
Estimated Annual Cost	**$2,000**

Notes:
See referenced tables for methodology and limitations.
AOC = Area of Concern

APPENDIX A

Administrative Record List and DTSC Comments

Table A1. Administrative Record List
Spring Hill Property
Updated June 14, 2012

Document Date	Document Author	Document Title
7/6/2007	H&K	Draft Preliminary Endangerment Assessment for Former Spring Hill Mine Property, APNs 35-260-62, 63 and 64 Grass Valley, California
7/17/2007	DTSC	Voluntary Cleanup Agreement, Docket No. HAS-VCA 07/08-008
8/27/2007	DTSC	Review of the Draft Preliminary Endangerment Assessment for the Former Spring Hill Mine Property In Grass Valley, California, Assessor's Parcel Numbers 35-260-62, 63, and 64
9/27/2007	DTSC	Preliminary Endangerment Assessment (PEA) Report for the Former Spring Hill Mine Property, Grass Valley, Nevada County
1/11/2008	H&K	Response to DTSC Comments on Draft Preliminary Endangerment Assessment, Former Spring Hill Property, Grass Valley, California
1/11/2008	H&K	Draft Final Preliminary Endangerment Assessment for Former Spring Hill Mine Property, APNs 35-260-62, 63 and 64 Grass Valley, California
2/5/2008	DTSC	Review of Draft Final Preliminary Endangerment Assessment for the Former Spring Hill Mine Property in Grass Valley, California, APNs 35-260-62, 63 and 64
8/22/2008	H&K	Draft Removal Action Work Plan for Spring Hill Property, APNs 35-260-62, 63 and 64 Grass Valley, California
10/2/2008	DTSC	Review of the Draft Removal Action Work Plan for Spring Hill Mine Property, Grass Valley, California, Assessor's Parcel Numbers 35-260-62, 63, and 64

Notes:
DTSC = California Enviornmental Protection Agency, Department of Toxic Substances Control
H&K = Holdrege & Kull Consulting Engineers and Geologists

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Linda S. Adams
Secretary for
Environmental Protection

Arnold Schwarzenegger
Governor

October 2, 2008

Mr. Sean M. O'Niell
Genesis Engineering
1402 D Street
Marysville, California 95901

REVIEW OF THE DRAFT REMOVAL ACTION WORKPLAN FOR SPRING HILL MINE PROPERTY, GRASS VALLEY, CALIFORNIA, ASSESSOR'S PARCEL NUMBERS (APNs) 35-260-62, 63, AND 64

Dear Mr. O'Niell:

The Department of Toxic Substances Control (DTSC) reviewed the Draft Removal Action Workplan (RAW) received on August 26, 2008 for the Spring Hill Mine property located south of Dorsey Drive and south east of State Highway 49/20 in Grass Valley, California (Site).

The Site consists of approximately 26 acres and is identified by APNs 35-260-62, 35-260-63, and 35-260-64. The Site is currently being evaluated for commercial development. The Preliminary Endangerment Assessment (PEA) completed in January 2008 identified mine waste in soils on the property containing arsenic and lead concentrations ranging up to 579 milligrams per kilogram (mg/kg) and 418 mg/kg respectively.

The proposed RAW indicates that the contaminated soil that is not acceptable for unrestricted land use or the exposure scenarios for the developed site will be dig up and transported to an appropriate landfill. Soil with contaminant concentrations that are below the level that must be taken off site but above background will be placed under a cap to eliminate the possibility of any contact. The cap will be integrated into the construction of the future development which includes a building and parking lot. Deed restrictions and land use controls will also be employed as part of the remedy to ensure appropriate use of the site in the future.

The following comments on the draft RAW are provided to ensure an adequate final RAW is achieved:

- Section 4.2.1.3 indicates that approximately 150 truck loads will be necessary to haul off the AOC 1 waste material while Section 6.2.4

indicates that only 100 truck loads will be required for this task. This discrepancy should be rectified in the final RAW. The estimated number of truck loads should be consistent and as accurate as possible as this information will be used to support California Environmental Quality Act (CEQA) related documents for the project.

- Section 6.3 indicates that clean fill will be placed over the waste that will remain on site. It is recommended that the fill material be sampled as per the DTSC Information Advisory titled *Clean Imported Fill Material* (October, 2001) to ensure that it meets the cleanup standards established for the project.

Once the comments above are addressed DTSC will issue an approval of the RAW for public review. Prior to scheduling the thirty day public comment period, a Notice of Exemption (NOE) from CEQA and public participation tasks including a fact sheet on the proposed RAW and mail out of a public notice must be completed. DTSC will work with you and H&K to complete these items in a timely manner.

If you have any questions regarding this matter, please contact Mr. Dean Wright at (916) 255-6528.

Sincerely,

Dean Wright, P.G.
Engineering Geologist
Sacramento Office
Brownsfields and Environmental Restoration Program

cc: Mr. Sean Dunbar, P.G.
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

APPENDIX B

PEA Data

Table 1 - Summary of DWR Well Completion Reports
Fomer Spring Hill Mine Property
APNs 35-260-62, 63 and 64
Grass Valley, California

No.	Reported Site Address[1]	Reported APN[1]	DWR Well Log No.	Estimated Elevation[2] (feet MSL)	Estimated Distance From Site[2] (feet)	Direction From Site[2] (feet)	Reported Depth to First Water[1] (feet)	Reported Depth of Static Water Level[1] (feet)	Reported Depth to Rock[1] (feet)	Reported Depth of Well[1] (feet)
1	Dorsey Drive	NR	111604	2680	200	W	NR	NR	25 - 55	130
2	Sutton Way	NR	208239	2600	1400	NE	152	30	24	625
3	Hughes Road	NR	81784	2560	2000	W	60	35	14	225
4	1040 East Main Street	NR	305758	2600	2000	NW	60	NR	40	180
5	1040 East Main Street	NR	305767	2600	2000	NW	60	NR	40	400

Notes:
1 Based on DWR Well Completion Report
2 Based on USGS 7.5' Quadrangle Map of Grass Valley CA (Provisional Edition, 1995)
APN = Nevada County assessors parcel number
DWR = State of California Department of Water Resources
MSL = mean sea level
NR = not reported on well completion report

Owner Name and Mailing Address[1]

No. 1 - Spring Hill Manor Convalescent Hospital

No. 2 - Francis Teut, 13240 North Day Rd, Grass Valley

No. 3 - Timberline Homes, 154 Hughes Rd, Grass Valley

No. 4 and 5 - Nevada County Country Club, 1040 E. Main St., Grass Valley

Table 2 - Total Metals and Inorganics Results for Soil Samples Former Spring Hill Mine Site APNs 35-260-62, 63 and 64 Grass Valley, California										
Sample Number	**Sample Location**	**Sample Type**	**Sample Depth (feet bgs)**	**Sample Date**	**Total Arsenic (mg/kg)**	**Total Lead (mg/kg)**	**Total Mercury (mg/kg)**	**Total Nickel (mg/kg)**	**Total Cyanide (mg/kg)**	**Total Nitrate (mg/kg)**
EXP-1	EXP-1	WR/SP	0.5	5/20/03	19	5.2	0.045	na	na	na
FND-1	FND-1	WR/SP	0.5	5/20/03	130	190	0.670	na	na	na
FND-2	FND-2	WR/SP	0.5	5/20/03	74	44	1.2	na	na	na
FND-S3	FND-S3	WR/SP	1.5	5/20/03	180	310	0.150	na	na	na
WR1-S1	WR1-S1	WR/SP	0.5	5/20/03	ND<1.0	4.8	0.310	na	na	na
WR1-S2	WR1-S2	WR/SP	1.0	5/20/03	28	37	0.200	na	na	na
WR1-S3	WR1-S3	WR/SP	1.0	5/20/03	ND<1.0	ND<1.0	0.220	na	na	na
WR-S1	WR-S1	WR/SP	0 - 0.5	10/11/05	1.1	6.3	0.189	na	na	na
WR-S2	WR-S2	WR/SP	1	10/11/05	2.5	3.6	0.180	na	na	na
WR-S3	WR-S3	WR/SP	0 - 0.5	10/11/05	ND<1.0	7.2	0.034	na	na	na
WR-S4	WR-S4	WR/SP	1.5	10/11/05	5.6	8.6	0.020	na	na	na
WR-S5	WR-S5	WR/SP	0 - 0.5	10/11/05	4.0	8.3	0.067	na	na	na
WR-S6	WR-S6	WR/SP	2	10/11/05	10.5	5.0	0.072	na	na	na
WR-S7	WR-S7	WR/SP	0.7	10/11/05	2.4	17.1	0.056	na	na	na
WR-S8	WR-S8	WR/SP	1	10/11/05	ND<1.0	9.5	0.019	na	na	na
WR-S9	WR-S9	WR/SP	0 - 0.5	10/11/05	1.0	11.3	0.029	na	na	na
WR-S10	WR-S10	WR/SP	0 - 0.5	10/11/05	1.2	8.8	0.081	na	na	na
WR-S11	WR-S11	WR/SP	1	10/11/05	3.9	19.8	0.306	na	na	na
WR-S12	WR-S12	WR/SP	0 - 0.5	10/11/05	5.3	47.6	0.048	na	na	na
WR-S13	WR-S13	WR/SP	0 - 0.5	10/11/05	11.2	11.9	0.122	na	na	na
WR-S14	WR-S14	WR/SP	0 - 0.5	10/11/05	ND<1.0	4.5	0.117	na	na	na
WR-S15	WR-S15	WR/SP	0 - 0.5	10/11/05	ND<1.0	44.9	0.219	na	na	na
WR-S16	WR-S16	WR/SP	0 - 0.5	10/11/05	3.6	9.8	0.106	na	na	na
WR-S17	WR-S17	WR/SP	0.5	10/11/05	22	52.9	0.126	na	na	na
WR-S18	WR-S18	WR/SP	2	10/11/05	2.7	10.9	0.208	na	na	na
WR-S19	WR-S19	WR/SP	0.5	10/11/05	4.1	11.7	0.239	na	na	na
WR-S20	WR-S20	WR/SP	1	10/11/05	5.7	4.4	0.136	na	na	na
WR-S21	WR-S21	WR/SP	1.5	10/11/05	6.9	3.9	0.193	na	na	na
SM-S1	SM-S1	T	0 - 0.5	10/11/05	ND<1.0	3.2	0.023	na	ND<0.25	na
SM-S2	SM-S2	T	0 - 0.5	10/11/05	ND<1.0	3.0	0.025	na	ND<0.25	na
SM-S3	SM-S3	T	2	10/11/05	2.6	3.0	0.051	na	ND<0.25	na
SM-S4	SM-S4	T	0 - 0.5	10/11/05	ND<1.0	2.9	0.028	na	ND<0.25	na
FND-S4	FND-S4	WR/SP	0.5	10/25/05	34	52.1	0.129	na	na	na
FND-S5	FND-S5	WR/SP	3	10/25/05	52.1	48	0.190	na	na	na
FND-S6	FND-S6	WR/SP	0-0.5	10/25/05	36.2	103	0.273	na	na	na
SND-S1	SND-S1	WR/SP	0-0.5	10/25/05	17.8	17.5	0.253	na	na	na
TP-2-6	Test Pit 2	WR/SP	6	3/13/07	6.9	ND<2.0	0.086	486	na	na
TP-2-10	Test Pit 2	WR/SP	10	3/13/07	ND<2.0	ND<2.0	0.014	548	na	na
TP-4-3	Test Pit 4	T	3	3/13/07	ND<2.0	ND<2.0	0.025	201	ND<1.0	ND<0.5
TP-4-6	Test Pit 4	T	6	3/13/07	ND<2.0	4.4	0.039	275	na	na
TP-5-10	Test Pit 5	T	10	3/13/07	20.2	5.1	0.186	403	ND<1.0	ND<0.5
TP-5-15	Test Pit 5	T	15	3/13/07	ND<2.0	3.1	0.092	212	ND<1.0	ND<0.5
TP-5-19	Test Pit 5	T	19	3/13/07	ND<2.0	5.6	0.055	295	ND<1.0	ND<0.5

Table 2 - Total Metals and Inorganics Results for Soil Samples Former Spring Hill Mine Site APNs 35-260-62, 63 and 64 Grass Valley, California										
Sample Number	**Sample Location**	**Sample Type**	**Sample Depth (feet bgs)**	**Sample Date**	**Total Arsenic (mg/kg)**	**Total Lead (mg/kg)**	**Total Mercury (mg/kg)**	**Total Nickel (mg/kg)**	**Total Cyanide (mg/kg)**	**Total Nitrate (mg/kg)**
TP-8-3	Test Pit 8	WR/SP	3	3/13/07	3.2	7.5	0.321	407	na	na
TP-8-6	Test Pit 8	WR/SP	6	3/13/07	6.2	5.0	0.243	296	na	na
TP-9-0.5	Test Pit 9	WR/SP	0.5	3/13/07	ND<2.0	16.8	0.139	1,290	na	na
TP-9-6	Test Pit 9	WR/SP	6	3/13/07	19.2	3.5	0.123	583	na	na
TP-10-8	Test Pit 10	WR/SP	8	3/13/07	2.1	2.2	0.283	585	na	na
TP-10-12	Test Pit 10	WR/SP	12	3/13/07	ND<2.0	70.2	0.127	940	na	na
TP-11-0.5	Test Pit 11	AS/NS	0.5	3/14/07	10.2	71.8	0.269	398	na	na
TP-12-0.5	Test Pit 12	AS/NS	0.5	3/14/07	8.2	15.3	0.432	421	na	na
TP-12-1.5	Test Pit 12	AS/NS	1.5	3/14/07	3.5	38.2	0.060	85.8	na	na
TP-13-2	Test Pit 13	WR/SP	2	3/14/07	ND<2.0	3.2	0.511	134	na	na
TP-13-4	Test Pit 13	WR/SP	4	3/14/07	ND<2.0	3.7	0.105	96.3	na	na
TP-14-0.5	Test Pit 14	WR/SP	0.5	3/14/07	ND<2.0	3.9	0.117	482	na	na
TP-14-2	Test Pit 14	WR/SP	2	3/14/07	4.2	4.9	0.065	206	na	na
TP-15-3	Test Pit 15	T	3	3/14/07	3.0	13.1	1.16	328	na	na
TP-15-5	Test Pit 15	T	5	3/14/07	2.0	4.2	0.030	238	na	na
TP-15-6	Test Pit 15	T	6	3/14/07	2.5	7.0	0.040	408	na	na
TP-16-0.5A	Test Pit 16	T	0.5	3/14/07	7.7	7.8	0.115	254	na	na
TP-16-1B	Test Pit 16	AS/NS	1	3/14/07	ND<2.0	4.1	0.054	709	na	na
TP-16-1C	Test Pit 16	WR/SP	1	3/14/07	ND<2.0	3.7	0.087	364	na	na
TP-17-4	Test Pit 17	T	4	3/14/07	6.4	5.7	0.070	197	ND<1.0	ND<0.5
TP-17-9	Test Pit 17	T	9	3/14/07	10.1	8.3	0.651	768	ND<1.0	ND<0.5
S-1	S-1	AS/NS	0.25	3/14/07	33.2	376	0.059	1,180	na	na
S-2	S-2	AS/NS	0.25	3/22/07	ND<1.0	65.9	0.166	121	na	ND<0.5
S-3	S-3	WR/SP	0.25	3/22/07	30.7	7.9	0.066	253	na	ND<0.5
S-4	S-4	WR/SP	0.25	3/22/07	ND<1.0	7.6	0.137	159	na	ND<0.5
S-5	S-5	WR/SP	0.5	3/22/07	ND<1.0	8.7	0.057	319	na	1.3
S-6	S-6	AS/NS	0.5	3/22/07	ND<1.0	50.0	0.105	796	na	1.6
S-7	S-7	WR/SP	0.5	3/22/07	ND<1.0	8.6	ND<0.010	142	na	0.5
S-8	S-8	AS/NS	0.5	3/23/07	25.5	341	0.507	685	ND<1.0	ND<0.5
S-9	S-9	AS/NS	0.25	3/23/07	50.2	76.6	1.29	111	ND<1.0	ND<0.5
S-10	S-10	AS/NS	0.25	3/23/07	579	418	8.69	400	ND<1.0	ND<0.5
TP-18-0.25	Test Pit 18	AS/NS	0.25	4/5/07	52.4	56.2	0.484	278	na	na
TP-18-1.0	Test Pit 18	AS/NS	1.0	4/5/07	18.3	12.3	0.108	182	na	na
TP-19-0.25	Test Pit 19	AS/NS	0.25	4/5/07	12.3	60.4	0.275	225	na	na
TP-19-0.75	Test Pit 19	AS/NS	0.75	4/5/07	ND<1.0	3.3	0.039	126	na	na
TP-20-0.25	Test Pit 20	AS/NS	0.25	4/5/07	ND<1.0	49.8	1.48	217	na	na
TP-20-1.0	Test Pit 20	AS/NS	1.0	4/5/07	4.6	18.4	8.38	174	na	na
TP-21-0.75	Test Pit 21	AS/NS	0.75	4/5/07	426	810	7.32	438	na	na
TP-21-1.5	Test Pit 21	AS/NS	1.5	4/5/07	ND<1.0	8.7	0.207	494	na	na
TP-22-0.25	Test Pit 22	AS/NS	0.25	4/5/07	52.3	196	3.76	239	na	na
TP-22-0.75	Test Pit 22	AS/NS	0.75	4/5/07	6.0	7.4	0.249	168	na	na
TP-23-0.25	Test Pit 23	AS/NS	0.25	4/5/07	271	69.5	0.964	104	na	na
TP-23-0.75	Test Pit 23	AS/NS	0.75	4/5/07	7.4	5.5	0.041	739	na	na

Table 2 - Total Metals and Inorganics Results for Soil Samples										
Former Spring Hill Mine Site										
APNs 35-260-62, 63 and 64										
Grass Valley, California										
Sample Number	**Sample Location**	**Sample Type**	**Sample Depth (feet bgs)**	**Sample Date**	**Total Arsenic (mg/kg)**	**Total Lead (mg/kg)**	**Total Mercury (mg/kg)**	**Total Nickel (mg/kg)**	**Total Cyanide (mg/kg)**	**Total Nitrate (mg/kg)**
TP-24-0.25	Test Pit 24	AS/NS	0.25	4/5/07	7.6	11.0	0.109	614	na	na
TP-25-0.75	Test Pit 25	AS/NS	0.75	4/5/07	2.5	1.6	0.171	314	na	na
TP-25-1.5	Test Pit 25	AS/NS	1.5	4/5/07	3.0	ND<1.0	0.105	274	na	na
TP-27-0.5	Test Pit 27	T	0.5	4/5/07	3.5	3.1	0.040	348	na	na
TP-27-2.0	Test Pit 27	T	2.0	4/5/07	2.6	2.6	0.039	211	na	na
S-11	S-11	T	0.25	4/5/07	35.0	20.8	19.5	488	na	na

Notes:

bgs- below ground surface

mg/kg - milligrams per kilogram

ND<1.0 - not detected at or above indicated laboratory reporting limit

na - not analyzed

WR/SP - waste rock and spoils pile

T - tailings

AS/NS - soil affected by mining or processing activities and native soil

Analysis for total arsenic, lead and nickel by U.S. EPA Test Method 6010B

Analysis for total mercury by U.S. EPA Test Method 7471A

Analysis for total cyanide by U.S. EPA Test Method 9014

Analysis for total nitrate by U.S. EPA Test Method 300.0

Table 3 - Total Metals Results for Background Soil Samples

Former Spring Hill Mine Site

APNs 35-260-62, 63 and 64

Grass Valley, California

Sample Number	Sample Location	Sample Depth (feet bgs)	Sample Date	Total Arsenic (mg/kg)	Total Lead (mg/kg)	Total Mercury (mg/kg)	Total Nickel (mg/kg)
BG-1	BG-1	0 - 0.5	5/20/03	ND<1.0	6.0	0.069	na
BG-2	BG-2	0 - 0.5	5/20/03	ND<1.0	9.1	0.140	na
BG-3	BG-3	0 - 0.5	5/20/03	17	13	0.066	na
BG-4	BG-4	0 - 0.5	10/11/05	ND<1.0	20.4	na	na
BG-5	BG-5	0 - 0.5	10/11/05	ND<1.0	6.8	na	na
BG-6	BG-6	0 - 0.5	10/11/05	ND<1.0	15.0	na	na
S-12	S-12	0.25	4/18/07	ND<1.0	5.0	na	1,620
S-13	S-13	0.25	4/18/07	ND<1.0	3.1	na	1,680

Notes:
bgs- below ground surface
mg/kg - milligrams per kilogram
ND< - not detected at or above indicated laboratory reporting limit
na - not analyzed
Analysis for total arsenic, lead and nickel by U.S. EPA Test Method 6010B
Analysis for total mercury by U.S. EPA Test Method 7471A
Analysis for total cyanide by U.S. EPA Test Method 9014
Analysis for total nitrate by U.S. EPA Test Method 300.0

Table 4 - Title 22 Metals Results for Soil Samples
Former Spring Hill Mine Site
APNs 35-260-62, 63 and 64
Grass Valley, California

Analyte (mg/kg)	Sample Identification									*Laboratory Reporting Limit (mg/kg)*	*Residential CHHSL (mg/kg)*	*Industrial CHHSL (mg/kg)*	*TTLC (mg/kg)*	*STLC (mg/L)*
	FND-S5	WR-S13	WR-S17	TP-5-10	TP-9-0.5	TP-15-3	S-1	S-10	TP-21-0.75					
Antimony	10.2	12.2	6.9	5.0	7.0	6.2	4.3	9.9	12.4	*1.0*	*30*	*380*	*500*	*15*
Arsenic	22.3	20.2	45.8	94.6	ND	10.6	27.6	377	302	*1.0*	*0.07*	*0.24*	*500*	*5*
Barium	7.1	9.5	12.5	5.5	11.1	4.0	48.3	103	71.7	*2.0*	*5,200*	*63,000*	*10,000*	*100*
Beryllium	ND<0.3	ND<0.3	ND<0.3	ND	ND	ND	ND	ND	ND	*0.5*	*150*	*1,700*	*75*	*0.75*
Cadmium	0.8	1.1	0.7	1.2	1.5	1.0	2.3	2.6	3.4	*1.0*	*1.7*	*7.5*	*100*	*1.0*
Chromium	26	55.3	26.3	39.1	20.8	60.4	962	43.2	85.9	*1.0*	*100,000*	*100,000*	*2500*	*560*
Hex. Chromium	na	na	ND	na	na	na	na	na	na	*0.001*	*17*	*37*	*500*	*5*
Cobalt	49.5	41.3	47.3	19.1	56.3	13.1	41.3	21.4	79.4	*5.0*	*660*	*3,200*	*8000*	*80*
Copper	17.9	94.2	26.2	31.2	36.6	11.8	72.0	235	467	*2.0*	*3,000*	*38,000*	*2500*	*25*
Lead	21.6	12.2	37.1	12.3	6.9	18.4	300	348	615	*1.0*	*150*	*3,500*	*1000*	*5*
Mercury	0.276	0.189	0.129	0.193	0.215	1.08	0.231	22.5	10.8	*0.010*	*18*	*180*	*20*	*0.2*
Molybdenum	ND	ND	ND	ND	ND	ND	3.7	1.1	ND	*1.0*	*380*	*4,800*	*3500*	*350*
Nickel	677	464	680	285	1,050	278	977	303	471	*1.0*	*1,600*	*16,000*	*2000*	*20*
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	*2.0*	*380*	*4,800*	*100*	*1.0*
Silver	ND	ND	ND	ND	ND	ND	ND	16.7	21.8	*2.0*	*380*	*4,800*	*500*	*5*
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	*2.0*	*5.0*	*63*	*700*	*7.0*
Vanadium	23.5	48.1	20.4	29.0	16.6	54.6	948	47.4	79.4	*2.0*	*530*	*6,700*	*2400*	*24*
Zinc	38.4	31.9	29.8	20.9	17.7	21.4	129	165	318	*2.0*	*23,000*	*100,000*	*5000*	*250*

Notes:
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
ND = Not detected at or above the laboratory reporting limit
CHHSL = California Human Health Screening Level
TTLC = Total threshold limit concentration
STLC = Soluble threshold limit concentration
na = Not analyzed

The laboratory reporting limit for mercury in sample S-10 was 0.050 mg/kg.

Table 5 - DI-WET Solubility Analysis Results					
Former Spring Hill Mine Site					
APNs 35-260-62, 63 and 64					
Grass Valley, California					
Sample Number	Sample Date	DI-WET As (ug/L)	DI-WET Pb (ug/L)	DI-WET Hg (ug/L)	DI-WET Ni (ug/L)
WR-17	10/11/05	ND<10	ND<10	na	ND<10
FND-S5	10/25/05	ND<10	ND<10	na	ND<10
FND-S6	10/25/05	ND<10	ND<10	na	ND<10
TP-5-10	3/13/07	44.7	ND<6	ND<0.333	ND<10
TP-5-10*	3/13/07	ND<2.0	ND<1.2	na	32.7
TP-9-0.5	3/13/07	15.6	ND<6	ND<0.333	25.2
TP-15-3	3/14/07	15.1	ND<6	ND<0.333	ND<10
S-1	3/14/07	ND<10	ND<6	ND<0.333	48.1
S-10	3/23/07	26.1	9.3	ND<0.333	15.5
TP-21-0.75	4/5/07	26.5	11.6	ND<0.333	na
TP-2-6	3/13/07	11.3	1.4	na	4.5
TP-8-3	3/13/07	3.7	1.2	na	16.8
TP-8-6	3/13/07	6.3	ND<1.2	na	2.3
TP-9-6	3/13/07	24.7	ND<1.2	na	3.4
TP-13-2	3/14/07	3.4	1.4	na	10.9
TP-5-15	3/13/07	5.2	1.7	na	4.9
TP-15-5	3/14/07	ND<2.0	ND<1.2	na	6.2
TP-16-0.5A	3/14/07	ND<2.0	ND<1.2	na	10.5
TP-17-4	3/14/07	ND<2.0	ND<1.2	na	8.9
S-12**	4/18/07	ND<10.0	ND<6.0	na	58.5
S-13**	4/18/07	18.6	ND<6.0	na	26.2

Notes:

DI = Deionized water
WET = Waste Extraction Test
As = Arsenic
Pb = Lead
Hg = Mercury
Ni = Nickel
ug/L = micrograms per liter
ND< = Not detected above indicated laboratory reporting limit
na = Not analyzed
* = TP-5-10 was re-analyzed using lower reporting limits for As, Pb and Ni.
** = Background sample

The As, Pb and Ni analysis of the extract was conducted using EPA Test Method 6010B.
The mercury analysis of the extract was condcuted using EPA Test Method 7471.

Table 6 - Acid-Base Accounting Results
Spring Hill Property
APNs 35-260-62, 63 and 64
Grass Valley, California

Sample Number	Sample Date	AGP Sulfide	AGP Total	NP	NP/Total AGP	pH
FND-S5	10/25/2005	0.9	1.9	180	94.7	9.14
WR-S17	10/11/2005	1.9	2.5	150	60.0	9.54
TP-8-6	3/13/2007	11	13	250	19.2	9.42
TP-17-4	3/13/2007	ND<0.3	ND<0.3	320	1066.7	9.77

Notes:
mg/kg = Milligrams per kilogram
AGP = Acid generating potential (tons/1000 tons)
NP = Neutralizing potential (tons/1000 tons)
Reporting limit used for non-detectable results to calculate NP/AGP.

Table 7a - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Surface Water for Current Site Conditions APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 µg/L[2]	10	2 µg/L
Lead	2.0 µg/L[3]	10	2 µg/L
Mercury	1.2 µg/L[4]	10	1.2 µg/L
Nickel	12 µg/L[5]	10	12 µg/L

Notes:

1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)

2 Laboratory quantitation limit (2.0 µg/L) is greater than California Public Health Goal for drinking water (0.004 µg/L)

3 California Public Health Goal for drinking water

4 California Public Health Goal for drinking water (non-methylmercury)

5 California Public Health Goal for drinking water

µg/L = micrograms per liter

Table 7b - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Surface Water Proposed On Site Placement APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 µg/L[2]	100	20 µg/L
Lead	2.0 µg/L[3]	100	20 µg/L
Mercury	1.2 µg/L[4]	100	12 µg/L
Nickel	12 µg/L[5]	100	120 µg/L

Notes:

1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)

2 Laboratory quantitation limit (2.0 µg/L) is greater than California Public Health Goal for drinking water (0.004 µg/L)

3 California Public Health Goal for drinking water

4 California Public Health Goal for drinking water (non-methylmercury)

5 California Public Health Goal for drinking water

µg/L = micrograms per liter

Table 8a - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Groundwater for Current Site Conditions APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 μg/L[2]	10	2 μg/L
Lead	2.0 μg/L[3]	10	2 μg/L
Mercury	1.2 μg/L[4]	10	1.2 μg/L
Nickel	12 μg/L[5]	10	12 μg/L

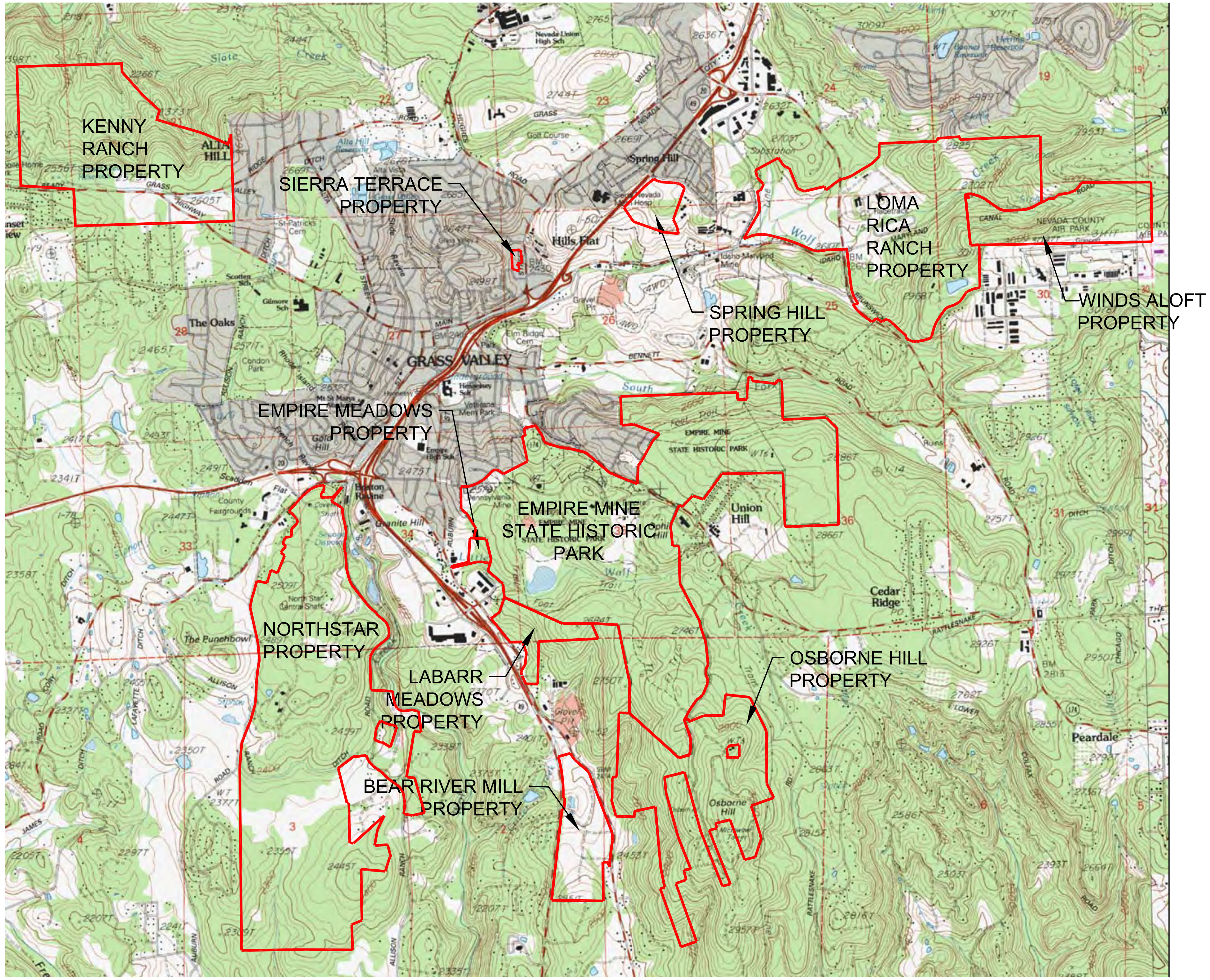
Notes:
1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)
2 Laboratory quantitation limit (2.0 μg/L) is greater than California Public Health Goal for drinking water (0.004 μg/L)
3 California Public Health Goal for drinking water
4 California Public Health Goal for drinking water (non-methylmercury)
5 California Public Health Goal for drinking water
μg/L = micrograms per liter

Table 8b - Water Quality Goals, Attenuation Factors and Soluble Designated Levels (SDLs) for Groundwater Proposed On Site Placement APNs 35-260-62, 63 and 64 Grass Valley, California			
Constituent of Potential Concern	Water Quality Goal	Attenuation Factor	Calculated SDL[1]
Arsenic	2.0 μg/L[2]	100	20 μg/L
Lead	2.0 μg/L[3]	100	20 μg/L
Mercury	1.2 μg/L[4]	100	12 μg/L
Nickel	12 μg/L[5]	100	120 μg/L

Notes:
1 SDL (for extract of a solid waste constituent, mg/L) = Water Quality Goal (mg/L) x Environmental Attenuation Factor / 10 (DLM, Equation 4)
2 Laboratory quantitation limit (2.0 μg/L) is greater than California Public Health Goal for drinking water (0.004 μg/L)
3 California Public Health Goal for drinking water
4 California Public Health Goal for drinking water (non-methylmercury)
5 California Public Health Goal for drinking water
μg/L = micrograms per liter

APPENDIX C

Background Soil Metals Data



SOURCE: USGS 7.5 minute topographic map, Grass Valley, California quadrangle, 1995.

3292–02–ARSENIC

HOLDREGE & KULL CONSULTING ENGINEERS • GEOLOGISTS 792 SEARLS AVENUE NEVADA CITY, CA 95959 (530) 478–1305 FAX 478–1019	SITE VICINITY MAP SHOWING NEARBY PEA SITES SPRING HILL MINE PROPERTY GRASS VALLEY, CALIFORNIA	DRAWN BY: DFD / CHECKED BY: SLD PROJECT NO.: 3292–02 DATE: JANUARY 2008 FIGURE NO.: A–1

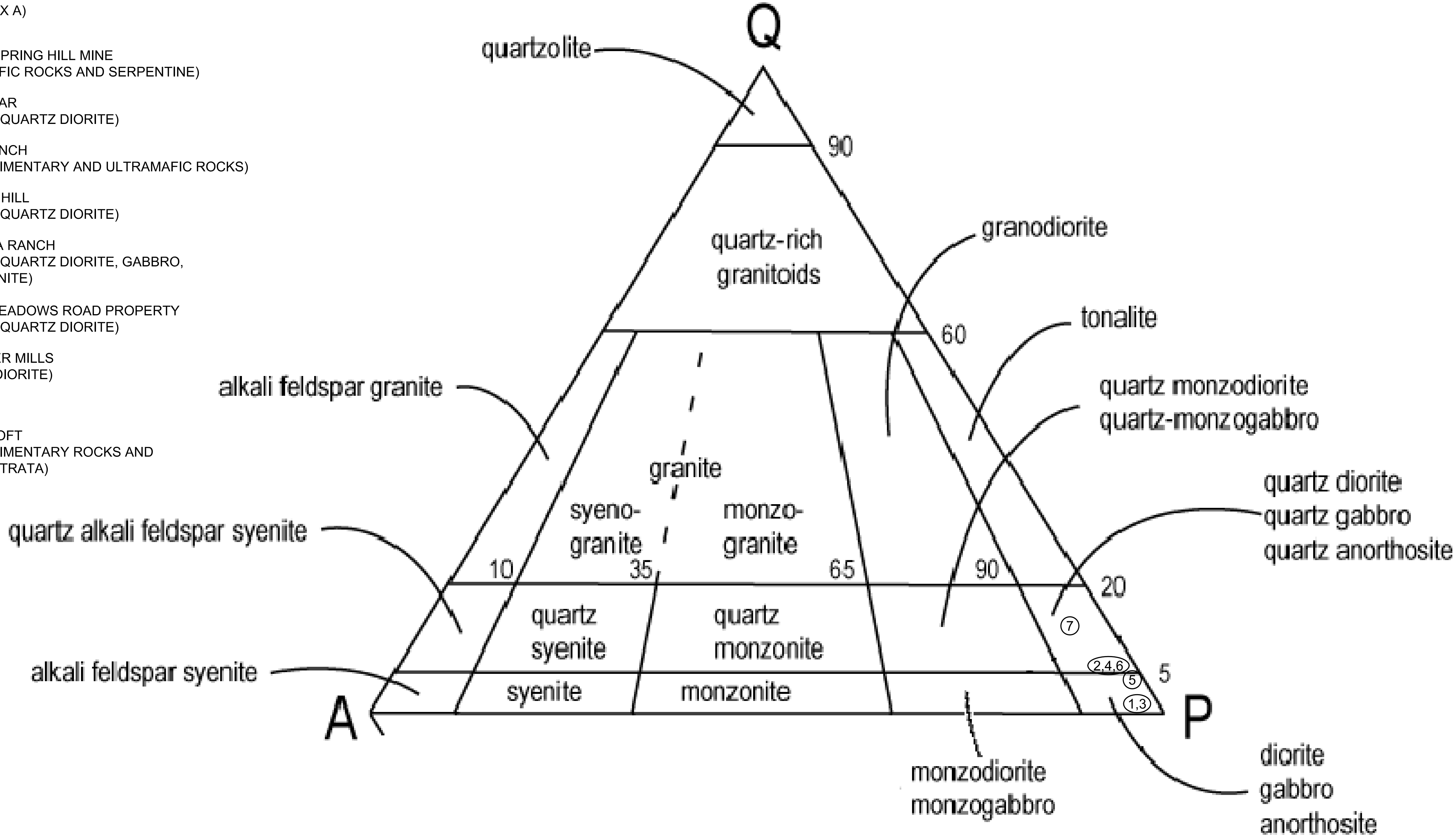
LEGEND

(FOR DETAILED GEOLOGIC DESCRIPTIONS SEE TABLE 4, APPENDIX A)

1. FORMER SPRING HILL MINE (ULTRAMAFIC ROCKS AND SERPENTINE)
2. NORTH STAR (DIABASE, QUARTZ DIORITE)
3. KENNY RANCH (METASEDIMENTARY AND ULTRAMAFIC ROCKS)
4. OSBORNE HILL (DIABASE, QUARTZ DIORITE)
5. LOMA RICA RANCH (DIABASE, QUARTZ DIORITE, GABBRO, SERPENTINITE)
6. LABARR MEADOWS ROAD PROPERTY (DIABASE, QUARTZ DIORITE)
7. BEAR RIVER MILLS (QUARTZ DIORITE)

NOT PLOTTED

8. WINDS ALOFT (METASEDIMENTARY ROCKS AND CLASTIC STRATA)



3292-02-FIG-APP-A

HK HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
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NEVADA CITY, CA 95959
(530) 478-1305 FAX 478-1019

PREDOMINANT GEOLOGIC COMPOSITION OF ROCKS AT PEA SITES IN THE VICINITY OF GRASS VALLEY, CA

FORMER SPRING HILL MINE PROPERTY

GRASS VALLEY, CALIFORNIA

DRAWN BY: DFD	CHECKED BY: SLD
PROJECT NO.: 3292-02	
DATE: JANUARY 2008	
FIGURE NO.: A-2	

Table 1
Total Arsenic in Background Soil Samples
Vicinity of Grass Valley, Nevada County, California

				EPA 6010B (mg/kg)
	Sample Number	Sample Date	Sample Depth (feet)	Total Arsenic
North Star Mine Property	BG-2	11/10/03	0 - 0.5	12
	BG-3	11/10/03	0 - 0.5	19
	BG-4	11/10/03	0 - 0.5	6.7
	BG-5	8/16/05	0 - 0.5	16.7
	BG-6	8/16/05	0 - 0.5	5.3
	BG-7	8/16/05	0 - 0.5	27.4
	BG-8	8/16/05	0 - 0.5	1.8
	BG-9	8/16/05	0 - 0.5	2.8
	BG-10	8/16/05	0 - 0.5	ND< 0.5
	BG-11	8/16/05	0 - 0.5	1.3
	BG-12	8/17/05	0 - 0.5	ND< 0.5
	BG-13	8/17/05	0 - 0.5	ND< 0.5
	BG-14	8/17/05	0 - 0.5	3.5
	BG-15	8/17/05	0 - 0.5	1.8
	BG-16	8/17/05	0 - 0.5	ND< 0.5
	BG-17	8/17/05	0 - 0.5	6.6
	BG-18	8/17/05	0 - 0.5	2.9
	BG-19	8/17/05	0 - 0.5	14.8
	BG-20	8/17/05	0 - 0.5	8.7
	BG-21	8/30/05	0 - 0.5	4.4
	BG-22	8/30/05	0 - 0.5	4.1
	BG-23	8/30/05	0 - 0.5	1.9
	BG-24	8/30/05	0 - 0.5	3.1
	BG-25	8/30/05	0 - 0.5	3.8
	BG-26	8/30/05	0 - 0.5	4.0
	BG-27	8/1/06	0 - 0.5	6.3
	BG-28	8/1/06	0 - 0.5	36.7
	BG-29	8/1/06	0 - 0.5	1.3
	BG-30	8/1/06	0 - 0.5	3.7
	BG-31	8/1/06	0 - 0.5	2.3
	BG-32	8/1/06	0 - 0.5	3.2
	BG-33	8/1/06	0 - 0.5	3.3
	BG-34	8/1/06	0 - 0.5	1.2
	BG-35	8/4/06	0 - 0.5	3.1
	BG-36	8/1/06	0 - 0.5	7.2
	BG-37	8/4/06	0 - 0.5	2.4
	BG-38	8/4/06	0 - 0.5	8.9
	BG-39	8/1/06	0 - 0.5	3.5
	BG-40	8/1/06	0 - 0.5	ND<1.0
	BG-41	8/3/06	0 - 0.5	2.7
	BG-42	8/3/06	0 - 0.5	ND<1.0
	BG-43	8/3/06	0 - 0.5	1.1
	BG-44	8/3/06	0 - 0.5	1.7
	BG-45	8/3/06	0 - 0.5	1.7
	BG-46	8/3/06	0 - 0.5	ND<1.0

Table 1
Total Arsenic in Background Soil Samples
Vicinity of Grass Valley, Nevada County, California

				EPA 6010B (mg/kg)
	Sample Number	Sample Date	Sample Depth (feet)	Total Arsenic
North Star Mine Property	BG-47	8/4/06	0 - 0.5	26.7
	BG-T1S1	9/28/05	0 - 0.5	6.1
	BG-T1S2	9/28/05	1.0	6.5
	BG-T1S3	9/28/05	2.0	10.1
	BG-T1S4	9/28/05	4.0	11.5
	BG-T2S1	9/28/05	0 - 0.5	13.9
	BG-T2S2	9/28/05	1.0	7.9
	BG-T2S3	9/28/05	2.0	14.8
	BG-T2S4	9/28/05	4.0	11.0
	BG-T2S5	9/28/05	6.0	7.8
	BG-T2S6	9/28/05	8.0	3.0
	BGT3-S1	10/5/05	0 - 0.5	13.7
	BGT3-S2	10/5/05	4.0	3.2
	BGT3-S3	10/5/05	8.0	ND<1.0
	BGT3-S3B	10/5/05	8.0	ND<1.0
	BGT4-S1	8/4/06	0 - 0.5	3.3
	BGT4@5'	8/4/06	5.0	ND<1.0
	BGT4@10'	8/4/06	10.0	1.5
	BGT5-S1	8/4/06	0 - 0.5	1.3
	BGT5@5'	8/4/06	5.0	3.8
	BGT5@10'	8/4/06	10.0	1.3
	BGT6-S1	8/4/06	0 - 0.5	3.2
	BGT6@5'	8/4/06	5.0	2.1
	BGT6@9.5'	8/4/06	9.5	2.5
	BGT7-S1	8/4/06	0 - 0.5	1.5
	BGT7@5'	8/4/06	5.0	5.3
	BGT7@10'	8/4/06	10.0	ND<1.0
	BGT8-S1	8/4/06	0 - 0.5	6.5
	BGT8@5'	8/4/06	5.0	ND<1.0
	BGT8@9'	8/4/06	9.0	ND<1.0
	BGT9-S1	8/4/06	0 - 0.5	10.1
	BGT9@5'	8/4/06	5.0	8.6
	BGT9@10'	8/4/06	10.0	6.3
	BGT10-S1	8/4/06	0 - 0.5	4.3
	BGT10@5'	8/4/06	5.0	6.4
	BGT10@10'	8/4/06	10.0	ND<1.0
	BGT11-S1	8/4/06	0 - 0.5	1.6
	BGT11@5'	8/4/06	5.0	ND<1.0
	BGT11@8'	8/4/06	8.0	1.0
	BGT12-S1	8/4/06	0 - 0.5	ND<1.0
	BGT12@4.5'	8/4/06	4.5	1.6
	BGT12@6.0'	8/4/06	6.0	ND<1.0
	BGT13-S1	8/4/06	0 - 0.5	3.0
	BGT13@5'	8/4/06	5.0	6.7
	BGT13@10'	8/4/06	10.0	10.3

Table 1
Total Arsenic in Background Soil Samples
Vicinity of Grass Valley, Nevada County, California

	Sample Number	Sample Date	Sample Depth (feet)	EPA 6010B (mg/kg) Total Arsenic
Kenny Ranch	BG-1A	11/13/01	0.5	8.0
	BG-2A	11/13/01	0.5	5.5
	BG-3A	11/13/01	0.5	6.0
	BG-4A	11/13/01	0.5	6.8
	BG-5	3/12/02	0.5	ND<0.3
	BG-6	3/12/02	0.5	ND<0.3
	BG-7	3/12/02	0.5	ND<0.3
	BG-8	3/12/02	0.5	ND<0.3
	BG-9	3/12/02	0.5	ND<0.3
	BG-10	3/12/02	0.5	ND<0.3
Winds Aloft Property	BG-1	8/12/04	0.5	2.3
	BG-2	8/12/04	0.5	ND<2.0
	BG-3	8/12/04	0.5	2.4
	BG-4	8/12/04	0.5	1.0
	BG-5	4/11/05	0.5	6.0
	BG-6	4/11/05	0.5	2.8
	BG-7	8/3/05	0.5	12.8
	BG-8	8/3/05	0.5	19.1
	BG-9	8/3/05	0.5	1.3
	BG-10	8/3/05	0.5	0.9
	BG-11	8/3/05	0.5	2.9
	BG-12	8/3/05	0.5	1.0
Osborne Hill Property	BG-1	4/5/2004	0.5	5.8
	BG-2	4/5/2004	0.5	7.6
	BG-3	4/2/2004	0.5	10
	BG-4	4/2/2004	0.5	6.5
	BG-5	4/2/2004	0.5	4.8
	BG-7	4/5/2004	0.5	3.6
	BG-9	4/5/2004	0.5	2.8
	OHE-1	4/13/2006	0.5	7.7
	OHE-2	4/13/2006	0.5	8.9
	OHE-3	4/13/2006	0.5	6.8
	OHE-4	4/13/2006	0.5	9.0
	OHE-5	4/13/2006	0.5	6.3
	OHE-6	4/13/2006	0.5	6.0
	OHE-6-2.0	4/18/2006	2.0	ND<1.0
	OHE-6-4.0	4/18/2006	4.0	ND<1.0
	OHE-6-6.0	4/18/2006	6.0	ND<1.0
	OHE-7	4/13/2006	0.5	4.4
	OHE-8	4/13/2006	0.5	5.3
	OHE-8-2.0	4/18/2006	2.0	ND<1.0
	OHE-8-4.0	4/18/2006	4.0	ND<1.0
	OHE-9	4/13/2006	0.5	9.2
	OHE-10	4/13/2006	0.5	2.5
	OHE-11	4/13/2006	0.5	ND<1.0
	OHE-12	4/13/2006	0.5	13.7

Table 1
Total Arsenic in Background Soil Samples
Vicinity of Grass Valley, Nevada County, California

				EPA 6010B (mg/kg)
	Sample Number	Sample Date	Sample Depth (feet)	Total Arsenic
Loma Rica Ranch	M1-BG1	11/26/2003	0.5	9.4
	M1-BG2	11/26/2003	0.5	14
	M2-BG1	12/4/2003	0.5	20
	M2-BG2	12/4/2003	0.5	5.6
	M3-BG1	11/26/2003	0.5	ND<2.0
	LR-BG1	10/25/2005	0.5	2.5
	LR-BG2	10/25/2005	0.5	7.3
	LR-BG3	10/25/2005	0.5	ND<1.0
	LR-BG4	10/25/2005	0.5	ND<1.0
	LR-BG5	10/25/2005	0.5	ND<1.0
	LR-BG6	10/25/2005	0.5	13.3
	LR-BG7	10/25/2005	0.5	2.1
	LR-BG8	10/25/2005	0.5	2.5
	LR-BG9	10/25/2005	0.5	1.0
	LR-BG10	10/25/2005	0.5	2.6
	LR-BG11	10/25/2005	0.5	2.8
	LR-BG12	10/25/2005	0.5	2.9
La Barr Meadows Property	LBM-4	9/11/2003	0.5	3.9
	BG-1	6/2/2005	0.5	4.0
	BG-2	5/25/2005	0.5	4.6
	BG-3	5/25/2005	0.5	4.5
	BG-4	5/25/2005	0.5	3.3
	BG-5	5/25/2005	0.5	7.4
	BG-6	6/2/2005	0.5	15.3
	BG-7	6/2/2005	0.5	4.4
	LBM-AMB1	8/10/2006	0.5	2.1
	LBM-AMB2	8/10/2006	0.5	7.7
	LBM-AMB3-0.5'	8/11/2006	0.5	1.2
	LBM-AMB3-5.0'	8/11/2006	5.0	3.4
	LBM-AMB3-10.0	8/11/2006	10.0	ND<1.0
	LBM-AMB4	8/10/2006	0.5	3.1
	LBM-AMB5	8/10/2006	0.5	2.5
	LBM-AMB6	8/10/2006	0.5	2.9
	LBM-AMB7	8/10/2006	0.5	3.1
	LBM-AMB8	8/10/2006	0.5	ND<1.0
	LBM-AMB9	8/10/2006	0.5	1.2
	LBM-AMB10-0.5'	8/11/2006	0.5	ND<1.0
	LBM-AMB10-5.0'	8/11/2006	5.0	1.3
	LBM-AMB10-10.0'	8/11/2006	10.0	ND<1.0
	LBM-AMB11	8/10/2006	0.5	4.1
	LBM-AMB-13	8/10/2006	0.5	5.1
	LBM-AMB-14	8/10/2006	0.5	1.0
	M2-SS5-5.0'	8/11/2006	5.0	2.7
	M5-SS1-5.0'	8/11/2006	5.0	2.0
	M8-SS7-5.0'	8/11/2006	5.0	ND<1.0
	Area1-SS2-0.5'	8/11/2006	0.5	ND<1.0

Table 1
Total Arsenic in Background Soil Samples
Vicinity of Grass Valley, Nevada County, California

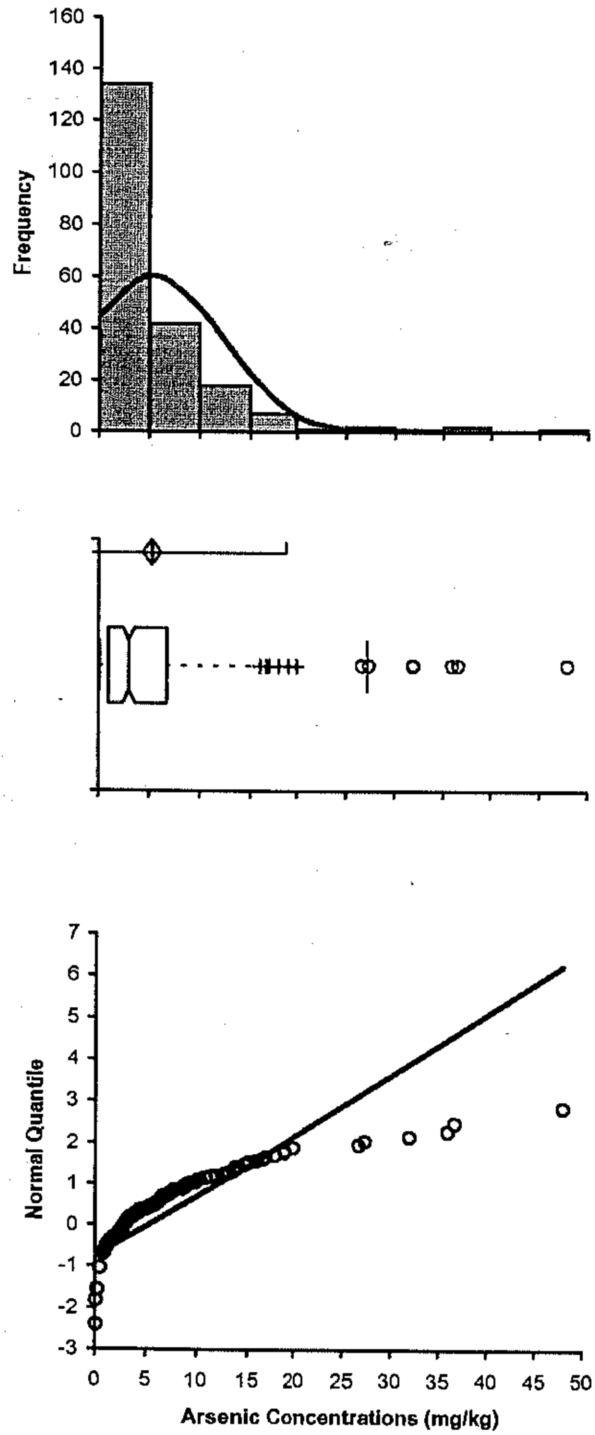
	Sample Number	Sample Date	Sample Depth (feet)	EPA 6010B (mg/kg) Total Arsenic
Bear River Mill Property	BG1A-6	--	0.5	11
	BG1B-6	--	0.5	4.4
	BG1C-6	--	0.5	9.6
	BG1A-10	--	10.0	6.7
	BG1B-10	--	10.0	18
	BG1C-8	--	10.0	9.1
	BG2A-6	--	0.5	36
	BG2B-6	--	0.5	14
	BG2C-6	--	0.5	13
	BG3A-6	--	0.5	32
	BG3B-6	--	0.5	ND<0.25
	BG3C-6	--	0.5	ND<0.25
	BG2A-7.5	--	7.5	48
	BG2B-7.5	--	7.5	0.85
	BG2C-7.5	--	7.5	1.2
	BG3A-7.5	--	7.5	16
	BG3B-7	--	7.5	ND<0.25
	BG3C-7.5	--	7.5	ND<0.25
Former Spring Hill Mine Property	BG-1	5/20/2003	0 - 0.5	ND<1.0
	BG-2	5/20/2003	0 - 0.5	ND<1.0
	BG-3	5/20/2003	0 - 0.5	17
	BG-4	10/11/2005	0 - 0.5	ND<1.0
	BG-5	10/11/2005	0 - 0.5	ND<1.0
	BG-6	10/11/2005	0 - 0.5	ND<1.0
	S-12	4/18/2007	0.25	ND<1.0
	S-13	4/18/2007	0.25	ND<1.0

Notes

EPA = Environmental Protection Agency
mg/kg = milligrams per kilogram
RL = laboratory reporting limit
ND< = not detected at or above the referenced reporting limit.
na = not analyzed

analysed with: Analyse-it + General 1.73

Test	**Continuous summary descriptives**
Variable	Non-transformed Background Arsenic Concentrations (mg/kg), Spring Hill Mine Property
Performed by	Holdrege and Kull
Date	10 December 2007

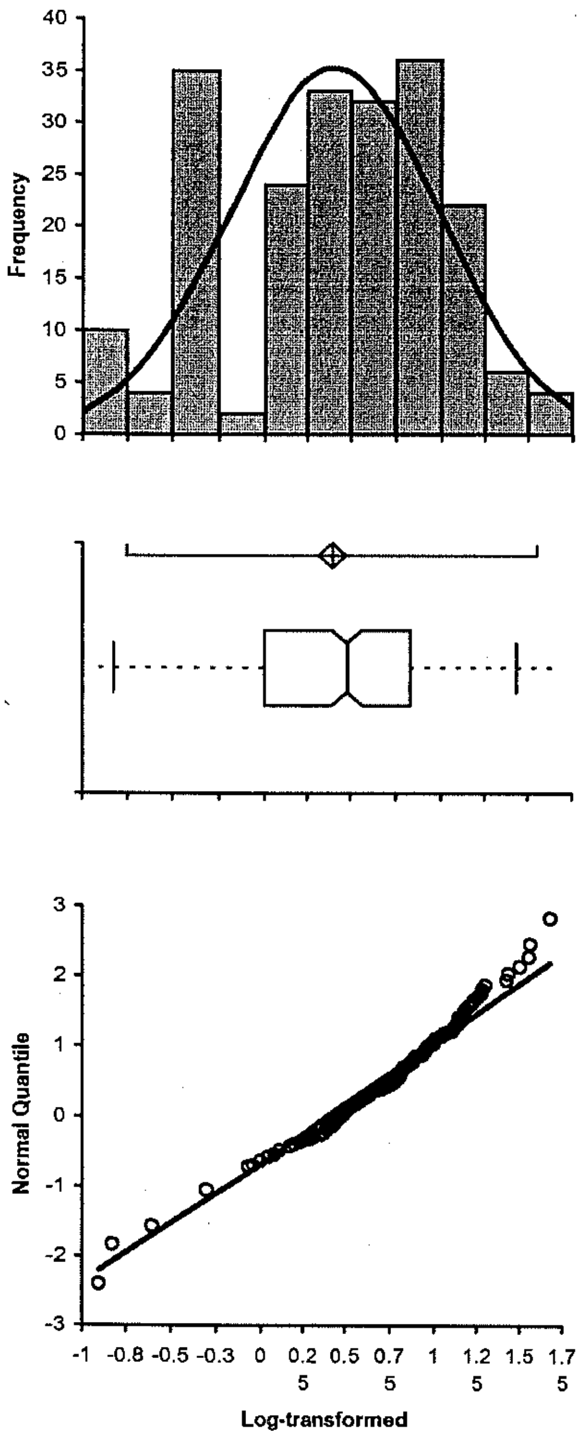


n	208
Mean	5.320
95% CI	4.383 to 6.257
Variance	47.0093
SD	6.8563
SE	0.4754
CV	129%
Median	3.050
95.6% CI	2.500 to 3.700
Range	47.875
IQR	5.775

Percentile	
2.5th	0.150
25th	1.000
50th	3.050
75th	6.775
97.5th	27.243

	Coefficient	**p**
Shapiro-Wilk	0.6945	<0.0001
Skewness	2.9120	<0.0001
Kurtosis	11.4269	<0.0001

Test	**Continuous summary descriptives**
Variable	Log-transformed Arsenic Background Concentrations, Spring Hill Mine Property
Performed by	Holdrege and Kull
Date	10 December 2007



n	208
Mean	0.401
95% CI	0.321 to 0.481
Variance	0.3453
SD	0.5876
SE	0.0407
CV	147%

Median	0.484
95.6% CI	0.398 to 0.568
Range	2.584331224
IQR	0.830900385

Percentile	
2.5th	-0.824
25th	0.000
50th	0.484
75th	0.831
97.5th	1.435

	Coefficient	p
Shapiro-Wilk	0.9676	0.0001
Skewness	-0.3185	0.0597
Kurtosis	-0.6099	0.0126

Table 2 - Descriptive Statistics for Local Background Arsenic Data
Former Spring Hill Mine Property
Project No. 3292-01

Descriptive Statistic	**Value**
Sample size (n)	208
Frequency of Arsenic Detection	157/208 (75%)
Mean (µ)	5.320
Median	3.050
Standard Deviation	6.8563
Standard Error on the Mean	0.4754
Coefficent of Variation (CV)	1.29
Minimum Value[1]	0.13
Maxmium Value	48.00
Lower Quartile (Q1)	1.000
Upper Quartile (Q3)	6.775

Note:
1 Minimum value corresponds to samples BG3B-6, BG3C-6, BG3B-7 and BG3C-7.5 from the Bear River Mill Property, in which total arsenic was not detected above the laboratory reporting limit of 0.25 mg/kg. A value equal to half of the reporting limit was used for total arsenic concentration. See Table 1.

Table 3 - Descriptive Statistics for Log-Transformed Local Background Arsenic Data
Former Spring Hill Mine Property
Project No. 3292-01

Descriptive Statistic	**Value**
Sample size (n)	208
Frequency of Arsenic Detection	157/208 (75%)
Mean (µ)	0.401
Median	0.484
Standard Deviation	0.5876
Standard Error on the Mean	0.0407
Coefficent of Variation (CV)	1.47
Minimum Value[1]	-0.903
Maxmium Value	1.681
Lower Quartile (Q1)	0.000
Upper Quartile (Q3)	0.831

Note:
1 Minimum value corresponds to samples BG3B-6, BG3C-6, BG3B-7 and BG3C-7.5 from the Bear River Mill Property, in which total arsenic was not detected above the laboratory reporting limit of 0.25 mg/kg. A value equal to half of the reporting limit was used for total arsenic concentration. See Table 1.

Table 4. Geologic Conditions at PEA Sites in the Vicinity of Grass Valley, California
Former Spring Hill Mine Property
Project No. 3292-02

PEA Site Location	Geologic Description
Former Spring Hill Mine Property	Based on the Geologic Map of the Grass Valley - Colfax Area (A. Tuminas, 1983)[1], the site is mapped as serpentine rocks of the Early Mesozoic aged Ultramafic- Mafic "Basement" Unit of the Lake Combie Complex. According to the Mineral Land Classification of Nevada County (Special Report 164, California Department of Conservation Division of Mines and Geology, 1990), the site geology is mapped as the ultramafic unit of the Jurassic-aged Lake Combie Complex.
North Star Mine Property	According to the Tuminas map[1], the northern approximately half of the subject site and a small area in the southwestern corner of the site are underlain by early Mesozoic massive diabase unit of the Lake Combie complex. Early Cretaceous La Barr Meadows quartz diorite is depicted in the southern third of the site and in areas to the east and northeast of the site. The middle portion of the site is underlain by Quaternary alluvium. A fault contact identified as the Wolf Creek Fracture Zone is depicted along and running parallel to the central and southern portions of the western property boundary. Areas to the east of the fracture zone, including a narrow strip of land along the western central property boundary are depicted as late Paleozoic to early Mesozoic aged, undifferentiated chert and shale of the Clipper Gap Unit.
Kenny Ranch Property	The Geologic Map of the Chico Quadrangle, California (Chico Quadrangle)[2] published by the California Department of Conservation Division of Mines and Geology in 1992 indicates that the northern portion of project site is underlain by Paleozoic and Mesozoic aged metasedimentary and ultramafic rock and that the southern portion of the site is underlain by Tertiary aged volcanic rock.
Winds Aloft Property	The Tuminas map[1] describes the geology underlying the majority of the site as Tertiary clastic strata. Metasedimentary rock is depicted on the northwestern portion of the site. The Tertiary clastic strata depicted on the site is likely underlain by metasedimentary rock, although the contact between the metasedimentary rock and the massive diabase and volcanic rocks associated with the adjacent Lake Combie Complex is obscured by the Tertiary clastic strata.
Osborne Hill Property	According to the Tuminas map[1], the subject site is underlain by early Mesozoic massive diabase associated with the Lake Combie complex. Intrusive, early Cretaceous La Barr Meadows quartz diorite is depicted near the westernmost property boundary, a short distance east of La Barr Meadows Road. Rocks associated with the Lake Combie complex are overlain by Tertiary clastic deposits northeast of the subject site.
Loma Rica Ranch Property	According to the Chico Quadrangle map[2], the subject site is underlain by Mesozoic to Paleozoic ultramafic rocks. According to the Tuminas map[1], four main rock units underlie the subject site. Oriented generally from west to east, these rock units are the early Mesozoic Lake Combie massive diabase, the undifferentiated Clipper Gap-Colfax transition zone, the early Mesozoic Lake Combie massive to undifferentiated gabbro to quartz diorite, and the Lake Combie serpentinite.
La Barr Meadows Road Property	According to the Chico Quadrangle map[2], the subject site is underlain by Mesozoic quartz diorite, intrusive rocks and massive diabase of the Lake Combie Complex.
Bear River Mill Property	According to the Tuminas map[1], the site is underlain by early Cretaceous, La Barr Meadows quartz diorite. The Chico Quadrangle map[2] indicates that the project site is underlain by Mesozoic plutonic rock, including quartz diorite, tonalite, trondhjemite, and quartz monzonite.

Notes:
1 Tuminas, A., 1983. Geologic Map of the Grass Valley - Colfax Area.
2 California Department of Conservation, Division of Mines and Geology, 1992, Geologic Map of the Chico Quadrangle.

EXCELCHEM
Environmental Labs

1135 W Sunset Boulevard
Suite A
Rocklin, CA 95765
Phone# 916-543-4445
Fax# 916-543-4449

ELAP Certificate No. : 2119

11 July 2008

Sean Dunbar

Holdrege & Kull-Nevada City

792 Searls Avenue

Nevada City, CA 95959

RE: Spring Hill RAW

Workorder number:0806211

Enclosed are the results of analyses for samples received by the laboratory on 06/30/08 10:05. All Quality Control results are within acceptable limits except where noted as a case narrative. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

John Somers, Lab Director

Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
S-14	0806211-01	Soil	06/27/08 08:00	06/30/08 10:05
S-15	0806211-02	Soil	06/27/08 08:00	06/30/08 10:05
S-16	0806211-03	Soil	06/27/08 08:00	06/30/08 10:05
S-17	0806211-04	Soil	06/27/08 08:00	06/30/08 10:05
S-18	0806211-05	Soil	06/27/08 08:00	06/30/08 10:05
S-19	0806211-06	Soil	06/27/08 08:00	06/30/08 10:05
S-20	0806211-07	Soil	06/27/08 08:00	06/30/08 10:05
S-21	0806211-08	Soil	06/27/08 08:00	06/30/08 10:05
S-22	0806211-09	Soil	06/27/08 08:00	06/30/08 10:05
S-23	0806211-10	Soil	06/27/08 08:00	06/30/08 10:05

Excelchem Environmental Lab.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-14

0806211-01 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**8.9**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**7.6**	1.0	"	"	"	"	"	
Cobalt	**94.7**	5.0	"	"	"	"	"	
Copper	**61.7**	2.0	"	"	"	"	"	
Vanadium	**117**	2.0	"	"	"	"	"	

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Laboratory Representative

Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-15

0806211-02 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**17.1**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**9.7**	1.0	"	"	"	"	"	
Cobalt	**128**	5.0	"	"	"	"	"	
Copper	**55.9**	2.0	"	"	"	"	"	
Vanadium	**92.7**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.

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Laboratory Representative

Excelchem Environmental Labs

Holdrege & Kull-Nevada City 792 Searls Avenue Nevada City, CA 95959	Project: Spring Hill RAW Project Number: 3292-04 Project Manager: Sean Dunbar	Date Reported: 07/11/08 11:24

S-16
0806211-03 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**20.1**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**11.5**	1.0	"	"	"	"	"	
Cobalt	**126**	5.0	"	"	"	"	"	
Copper	**49.3**	2.0	"	"	"	"	"	
Vanadium	**98.7**	2.0	"	"	"	"	"	

Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-17

0806211-04 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**21.1**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**12.7**	1.0	"	"	"	"	"	
Cobalt	**177**	5.0	"	"	"	"	"	
Copper	**39.6**	2.0	"	"	"	"	"	
Vanadium	**91.6**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.

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Laboratory Representative

Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-18

0806211-05 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**15.1**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**9.3**	1.0	"	"	"	"	"	
Cobalt	**134**	5.0	"	"	"	"	"	
Copper	**35.4**	2.0	"	"	"	"	"	
Vanadium	**51.9**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Laboratory Representative

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-19

0806211-06 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**16.1**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**10.8**	1.0	"	"	"	"	"	
Cobalt	**122**	5.0	"	"	"	"	"	
Copper	**19.7**	2.0	"	"	"	"	"	
Vanadium	**67.9**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.

Laboratory Representative

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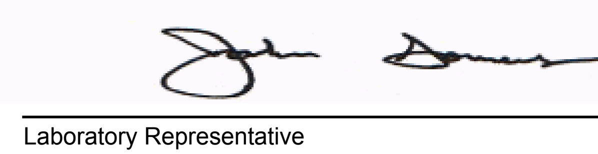
Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-20
0806211-07 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**21.6**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**12.8**	1.0	"	"	"	"	"	
Cobalt	**161**	5.0	"	"	"	"	"	
Copper	**25.3**	2.0	"	"	"	"	"	
Vanadium	**56.2**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.



Laboratory Representative

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Holdrege & Kull-Nevada City 792 Searls Avenue Nevada City, CA 95959	Project: Spring Hill RAW Project Number: 3292-04 Project Manager: Sean Dunbar	Date Reported: 07/11/08 11:24

S-21
0806211-08 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**25.2**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**12.9**	1.0	"	"	"	"	"	
Cobalt	**185**	5.0	"	"	"	"	"	
Copper	**34.3**	2.0	"	"	"	"	"	
Vanadium	**75.5**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.

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Laboratory Representative

Excelchem Environmental Labs

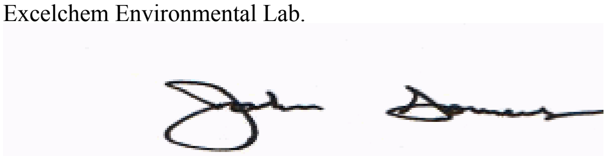
Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-22

0806211-09 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**26.8**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**13.8**	1.0	"	"	"	"	"	
Cobalt	**179**	5.0	"	"	"	"	"	
Copper	**31.0**	2.0	"	"	"	"	"	
Vanadium	**89.9**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Excelchem Environmental Labs

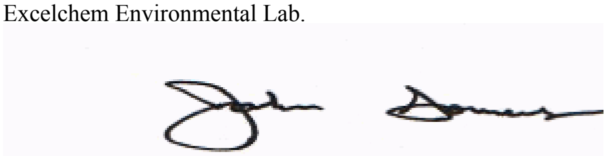
Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

S-23

0806211-10 (Soil)

Analyte	Result	Reporting Limit	Units	Batch	Date Prepared	Date Analyzed	Method	Notes
METALS BY 6000/7000 SERIES								
Antimony	**13.9**	1.0	mg/kg	ARG0055	07/09/08	07/09/08	EPA 6010B	
Cadmium	**7.4**	1.0	"	"	"	"	"	
Cobalt	**86.4**	5.0	"	"	"	"	"	
Copper	**35.3**	2.0	"	"	"	"	"	
Vanadium	**72.5**	2.0	"	"	"	"	"	

Excelchem Environmental Lab.



Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

METALS BY 6000/7000 SERIES - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch ARG0055 - EPA 6010B										
Blank (ARG0055-BLK1)				Prepared & Analyzed: 07/09/08						
Antimony	ND	1.0	mg/kg							
Cadmium	ND	1.0	"							
Cobalt	ND	5.0	"							
Copper	ND	2.0	"							
Vanadium	ND	2.0	"							
LCS (ARG0055-BS1)				Prepared: 07/08/08 Analyzed: 07/09/08						
Antimony	93.7	1.0	mg/kg	100		93.7	75-125			
Cadmium	94.6	1.0	"	100		94.6	75-125			
Cobalt	98.1	5.0	"	100		98.1	75-125			
Copper	93.4	2.0	"	100		93.4	75-125			
Vanadium	94.5	2.0	"	100		94.5	75-125			
LCS Dup (ARG0055-BSD1)				Prepared: 07/08/08 Analyzed: 07/09/08						
Antimony	94.0	1.0	mg/kg	100		94.0	75-125	0.349	25	
Cadmium	93.9	1.0	"	100		93.9	75-125	0.788	25	
Cobalt	97.1	5.0	"	100		97.1	75-125	0.967	25	
Copper	93.1	2.0	"	100		93.1	75-125	0.367	25	
Vanadium	93.2	2.0	"	100		93.2	75-125	1.38	25	
Matrix Spike (ARG0055-MS1)	**Source: 0806203-01**			Prepared: 07/08/08 Analyzed: 07/09/08						
Antimony	93.3	1.0	mg/kg	100	5.96	87.4	75-125			
Cadmium	95.5	1.0	"	100	5.92	89.5	75-125			
Cobalt	101	5.0	"	100	8.48	93.0	75-125			
Copper	191	2.0	"	100	69.9	121	75-125			
Vanadium	224	2.0	"	100	112	112	75-125			
Matrix Spike Dup (ARG0055-MSD1)	**Source: 0806203-01**			Prepared: 07/08/08 Analyzed: 07/09/08						
Antimony	92.6	1.0	mg/kg	100	5.96	86.7	75-125	0.778	25	
Cadmium	93.5	1.0	"	100	5.92	87.6	75-125	2.04	25	
Cobalt	100	5.0	"	100	8.48	91.9	75-125	1.15	25	
Copper	167	2.0	"	100	69.9	96.7	75-125	13.5	25	
Vanadium	203	2.0	"	100	112	90.9	75-125	10.0	25	

Notes and Definitions

ND - Analyte not detected at reporting limit.

NR - Not reported

Excelchem Environmental Labs

Holdrege & Kull-Nevada City	Project:	Spring Hill RAW	
792 Searls Avenue	Project Number:	3292-04	Date Reported:
Nevada City, CA 95959	Project Manager:	Sean Dunbar	07/11/08 11:24

Excelchem Environmental Labs — 1135 W. Sunset Blvd. Unit A, Rocklin, CA 95765 — Ph: 916-773-3664 Fx: 916-773-4784

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

Project Manager: SLD/JWN
Phone #: 478-1305
Company/Address: H&K 792 Searls Ave Nevada City CA 95959
Fax #: 478-1019
Project Number/P.O.#: 3292-04
Project Name: Spring Hill RAW
Project Location: Grass Valley, CA
Sampler Signature: [signature]
Electronic Data Deliverables Request:
Email Address: sdunbar@h-k.net
Page 1 of 1

ANALYSIS REQUEST

BTEX - TPH as Gasoline (602/8020/8015); TPH as Diesel (8015m); TPH as Oil (8015m); Total Oil & Grease (SM-18th 5520)1664; Pesticides (608/8081A) - PCBs (8082); Organophoshorous Pesticide (8141); Chlorinated Herbicides (8151); Semi VOC Full List (8270C); VOC Full list (8260B); MTBE (8020/8260B) circle the method; Methanol (8015M) Ethanol (8260); 5 Oxygenates (8260B); Lead Scavengers DCA/EDB (8260B); Tphg/BTEX/5 Oxygenates (8260B); Metals = Sb, Cd, Co (Total); Metals = Cu, V (Total); Metals =; Nitrate, Nitrite, Ammonia, Kjeldahl; Chloride, Sulfate, Sulfide, ph, conductance; Requested TAT: 12hr/24hr/48hr/72hr/(1wk)

Lab use only: Due Date: 7/8/08; Work Order: 0806211

Sample ID	Sampling Date	Container	Method Preserved	Matrix	Metals = Sb, Cd, Co	Metals = Cu, V	TAT	Lab Use Only
S-14	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	01
S-15	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	02
S-16	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	03
S-17	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	04
S-18	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	05
S-19	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	06
S-20	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	07
S-21	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	08
S-22	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	09
S-23	6/27/08	Glass 8oz	ICE	SOIL	X	X	X	10

Relinquished by: [signature] Date: 6/27/08 Time: 1650 Received by:
Relinquished by: Date: 6/30/08 Time: 10:05 Received by Laboratory: [signature]
Remarks/Condition of Sample:
Bill To:

Excelchem Environmental Lab.

[signature]

Laboratory Representative

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

APPENDIX D

HHSE Data

Risk and Hazard Calculation Spreadsheets

Table 1a - Summary of Statistics for Former Mill Area
Spring Hill Property
Project No. 3292-01

Constituent	As	Pb	Hg	Ni	Sb	Ba	Be	Cd	Cr	Co	Cu	Mo	Se	Ag	Tl	V	Z
Population	12	12	12	9	3	3	3	3	3	3	3	3	3	3	3	3	3
Minimum	ND<1	18.4	0.059	104	4.3	48.3	ND<0.5	2.3	43.2	21.4	72	1.1	ND<2	16.7	ND<2	47.4	129
Maximum	579	810	19.5	1180	**12.4**	**103**	ND<0.5	**3.4**	**962**	**79.4**	**467**	**3.7**	ND<2	**21.8**	ND<2	**948**	**318**
Mean	153	213	4	391	8.9	74.3	ND<0.5	2.8	364	47.4	258	2.4	ND<2	19.3	ND<2	358	204
Distribution	gamma	gamma	gamma	gamma	na	na	na	na	na	na	na	na	na	na	na	na	na
UCL method	App Gamma	App Gamma	App Gamma	App Gamma	na	na	na	na	na	na	na	na	na	na	na	na	na
UCL value	**348**	**408**	**10.1**	**640**	na	na	na	na	na	na	na	na	na	na	na	na	na

Table 1b - Summary of Statistics for Mine Waste Rock and Tailings, Exclusive of Former Mill Area
Spring Hill Property
Project No. 3292-01

Constituent	As	Pb	Hg	Ni	Sb	Ba	Be	Cd	Cr	Co	Cu	Mo	Se	Ag	Tl	V	Z
Population	86	86	86	53	6	6	6	6	6	6	6	6	6	6	6	6	6
Minimum	ND<1	ND<1	ND<0.01	85.8	5	4	ND<0.5	0.7	20.8	13.1	11	ND<1	ND<2	ND<2	ND<2	16.1	17.7
Maximum	94.6	341	1.29	1290	**12.2**	**12.5**	ND<0.5	**1.5**	**60.4**	**56.3**	**94.2**	ND<1	ND<2	ND<2	ND<2	**54.6**	**38.4**
Mean	9.1	19.8	0.81	402	7.9	8.3	ND<0.5	1.1	38	37.8	36.3	ND<1	ND<2	ND<2	ND<2	32	27.6
Distribution	non-param	non-param	gamma	gamma	na	na	na	na	na	na	na	na	na	na	na	na	na
UCL method	97.5 Cheb	97.5 Cheb	App Gamma	App gamma	na	na	na	na	na	na	na	na	na	na	na	na	na
UCL value	**21.9**	**36.1**	**0.22**	**466**	na	na	na	na	na	na	na	na	na	na	na	na	na

Table 1c - Summary of Statistics for Background Soil
Spring Hill Property
Project No. 3292-01

Constituent	As	Pb	Hg	Ni	Sb	Ba	Be	Cd	Cr	Co	Cu	Mo	Se	Ag	Tl	V	Z
Population	8	8	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	<1	3.1	0.066	1620	na	na	na	na	na	na	na	na	na	na	na	na	na
Maximum	17	20.4	0.14	1680	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean	**2.6**	9.8	**0.09**	**1650**	na	na	na	na	na	na	na	na	na	na	na	na	na
Distribution	non-param	normal	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
UCL method	99 Cheb	Student's-t	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
UCL value	23.1	**13.7**	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na

Notes:
Soil concentrations are shown in milligrams per kilograms (mg/kg)
Bold values are used as EPCs.
App Gamma = Approximate Gamma UCL
97.5 Cheb = 97.5% Chebyshev (Mean, Sd) UCL
99 Cheb = 99% Chebyshev (Mean, Sd) UCL
na = not applicable or not available
ND< = constituent not detected at concentration greater than the listed laboratory reporting limit
non-param = non-parametric

Table 2 - Toxicity Values[1]
Spring Hill Property
Project No. 3292-01

Analyte	RfDo (mg/kg-day)				RfDi (mg/kg-day)					Sfo (mg/kg-day)$^{-1}$		Sfi (mg/kg-day)$^{-1}$			ABS
	IRIS	PPRTV	HEAST	NCEA	IRIS	PPRTV	REL[2]	OEHHA[3]	HEAST	IRIS	OEHHA	IRIS	PPRTV	OEHHA	DTSC
Antimony	**4.E-04**	--	--	--	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01
Arsenic[4]	**3.E-04**	--	--	--	NL	--	0.03	**8.57E-06**	--	1.5	**9.45**	15.0	--	**12.0**	0.03
Barium	**2.E-01**	--	--	--	NL	--	NL	NL	**1.4E-04**	NL	NL	NL	--	NL	0.01
Cadmium[5]	**5.E-04**	--	--	--	NL	--	0.02	**5.71E-06**	--	**NL**	3.80E-01	**6.3**	--	15.0	0.001
Chromium III	**1.5**	--	--	--	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01
Cobalt	NL	**2.E-02**	6.0E-02	--	NL	**5.7E-06**	NL	NL	--	NL	NL	NL	**9.8**	NL	0.01
Copper	NL	--	**3.7E-02**	--	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01
Lead	NL	--	--	--	NL	--	NL	NL	--	NL	**8.50E-03**	NL	--	**4.20E-02**	0.01
Mercury[6]	**3.E-04**	--	--	--	**8.57.E-05**	--	0.09	2.57E-05	--	NL	NL	NL	--	NL	0.01
Molybdenum	**5.E-03**	--	5.0E-03	--	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01
Nickel	**2.E-02**	--	--	--	NL	--	0.05	**1.43E-05**	--	NL	NL	NL	--	**9.10E-01**	0.01
Silver	**5.E-03**	--	--	--	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01
Vanadium[7]	9.E-03	--	7.0E-03	**1.0E-03**	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01
Zinc	**3.E-01**	--	--	--	NL	--	NL	NL	--	NL	NL	NL	--	NL	0.01

Notes:
ABS = screening level dermal absorption fraction from soil (Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
HEAST = US EPA Office of Research and Development, Health Effects Assessment Summary Tables, July 1997 (cited in PRG Table)
IRIS = Integrated Risk Information System (http://www.epa.gov/iris/subst/index.html#z)
NL = not listed
OEHHA = Office of Environmental Health Hazard Assessment, California Cancer Potency Values, December 2001 (www.oehha.ca.gov/risk/chemicalDB/index.asp)
NCEA = US EPA National Center for Envrionmental Assessment (http://cfpub.epa.gov/ncea/)
PPRTV = Provisional Peer Reviewed Toxicity Values, US EPA OSWER Office of Superfund Remediation Technology Inovation (OSRTI) (cited in PRG Table)
PRG Table = US EPA Region 9 PRG Table (http://www.epa.gov/Region9/waste/sfund/prg/files/prgtable2004.xls)
REL = chronic reference exposure level
RfC = reference concentraton
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfi = cancer slope factor for inhalation exposure
Sfo = cancer slope factor for oral exposure
URF = unit risk factor
1 Toxicity values used for risk characterization are depicted in bold text.
2 RELs [ug/m^3] adopted by OEHHA as of December 2001 (http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html)
3 RfDi [mg/kg-day] = REL [ug/m^3] * (mg/10^{3}ug)(20m^3/day)(70 kg)$^{-1}$
4 Arsenic Sfi [(mg/kg-day)$^{-1}$] = IRIS inhalation unit risk (4.3E-3 per ug/m^3) * (10^{3}ug/mg)(70 kg)(20m3/day)$^{-1}$. Use of OEHHA Sfi for arsenic recommended by DTSC Human and Ecological Risk Division (HERD).
5 Cadmium Sfo not used, as HERD does not consider cadmium to be a carcinogen by the oral exposure route. Cadmium Sfi [(mg/kg-day)$^{-1}$] = 1.8E-3 per ug/m^3 * (1000 ug/mg)(70kg)(20 m^3/day)$^{-1}$.
6 Mercury RfDi [mg/kg-day] = RfC (3.4E-4 mg/m^3)*(20 m^3/day)(70 kg)$^{-1}$. Use of IRIS RfDi for Mercury recommended by HERD. Mercury RfDo listed by IRIS for mercuric chloride.
7 Use of NCEA RfDo for vanadium recommended by HERD. Value cited in PRG Table.

Table 3 - Summary of Risk/Hazard Calculations for Former Mill Area, Standard Exposure Scenario (Unrestricted Land Use)
Spring Hill Property
Project No. 3292-01

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** $(mg/kg\text{-}day)^{-1}$	**Sfi**[1] $(mg/kg\text{-}day)^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Antimony	maximum	4.E-04	4.E-04	NL	NL	0.01	12.4	9.42E-09	4.07E-01	1.51E-05	4.07E-01			0.00E+00
Arsenic	Approximate Gamma UCL	3.E-04	8.57E-06	9.45	12.0	0.03	348	2.64E-07	1.61E+01	1.97E-02	1.61E+01	5.50E-03	4.72E-07	5.50E-03
Barium	maximum	2.E-01	1.4E-04	NL	NL	0.01	103	7.83E-08	6.77E-03	3.57E-04	7.13E-03			0.00E+00
Cadmium	maximum	5.E-04	5.7E-06	NL	6.3	0.001	3.4	2.58E-09	8.72E-02	2.89E-04	8.75E-02		2.42E-09	2.42E-09
Chromium III	maximum	1.5	1.5	NL	NL	0.01	962	7.31E-07	8.43E-03	3.12E-07	8.43E-03			0.00E+00
Cobalt	maximum	2.E-02	5.7E-06	NL	9.8	0.01	79.4	6.03E-08	5.22E-02	6.77E-03	5.89E-02		8.79E-08	8.79E-08
Copper	maximum	3.7E-02	3.7E-02	NL	NL	0.01	467	3.55E-07	1.66E-01	6.13E-06	1.66E-01			0.00E+00
Mercury	Approximate Gamma UCL	3.E-04	8.57E-05	NL	NL	0.01	10.1	7.67E-09	4.42E-01	5.72E-05	4.43E-01			0.00E+00
Molybdenum	maximum	5.E-03	5.E-03	NL	NL	0.01	3.7	2.81E-09	9.73E-03	3.59E-07	9.73E-03			0.00E+00
Silver	maximum	5.E-03	5.E-03	NL	NL	0.01	21.8	1.66E-08	5.73E-02	2.12E-06	5.73E-02			0.00E+00
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	948	7.20E-07	1.25E+01	4.61E-04	1.25E+01			0.00E+00
Zinc	maximum	3.E-01	3.E-01	NL	NL	0.01	318	2.42E-07	1.39E-02	5.15E-07	1.39E-02			0.00E+00
TOTAL									2.98E+01	2.77E-02	**3.E+01**	5.50E-03	5.62E-07	**6.E-03**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca $[mg/m^3]$ = air concentration = Cs [mg/kg] * (PEF $[m^3/kg])^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	6	n/a	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	350	350	days/yr	PEA Guidance Manual
EFd, exposure frequency (dermal)	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	350	350	days/yr	PEA Guidance Manual
ED, exposure duration	6	24	yr	Human-Exposure-Based Screening Numbers
IRs, soil ingestion rate	200	100	mg/day	PEA Guidance Manual
IRa, inhalation rate	10	20	m^3/day	PEA Guidance Manual
BW, body weight	15	70	kg	PEA Guidance Manual
SA, exposed skin surface area	2,800	5,700	cm^2	Human-Exposure-Based Screening Numbers
AF, adherance factor	0.2	0.07	mg/cm^2	Human-Exposure-Based Screening Numbers
PEF, particulate emission factor	1.316E+09	1.316E+09	m^3/kg	Human-Exposure-Based Screening Numbers

Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)

Table 4 - Summary of Risk/Hazard Calculations for Mine Waste Rock and Tailings (excluding Former Mill Area), Standard Exposure Scenario (Unrestricted Land Use)
Spring Hill Property
Project No. 3292-01

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Antimony	maximum	4.E-04	4.E-04	NL	NL	0.01	12.2	9.27E-09	4.01E-01	1.48E-05	4.01E-01			0.00E+00
Arsenic	97.5% Chebyshev UCL	3.E-04	8.57E-06	9.45	12.0	0.03	21.9	1.66E-08	1.01E+00	1.24E-03	1.01E+00	3.46E-04	2.97E-08	3.46E-04
Barium	maximum	2.E-01	1.4E-04	NL	NL	0.01	12.5	9.50E-09	8.21E-04	4.34E-05	8.65E-04			0.00E+00
Cadmium	maximum	5.E-04	5.7E-06	NL	6.3	0.001	1.5	1.14E-09	3.85E-02	1.28E-04	3.86E-02		1.07E-09	1.07E-09
Chromium III	maximum	1.5	1.5	NL	NL	0.01	60.4	4.59E-08	5.29E-04	1.96E-08	5.29E-04			0.00E+00
Cobalt	maximum	2.E-02	5.7E-06	NL	9.8	0.01	56.3	4.28E-08	3.70E-02	4.80E-03	4.18E-02		6.24E-08	6.24E-08
Copper	maximum	3.7E-02	3.7E-02	NL	NL	0.01	94.2	7.16E-08	3.35E-02	1.24E-06	3.35E-02			0.00E+00
Mercury	Approximate Gamma UCL	3.E-04	8.57E-05	NL	NL	0.01	0.22	1.67E-10	9.64E-03	1.25E-06	9.64E-03			0.00E+00
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	54.6	4.15E-08	7.18E-01	2.65E-05	7.18E-01			0.00E+00
Zinc	maximum	3.E-01	3.E-01	NL	NL	0.01	38.4	2.92E-08	1.68E-03	6.22E-08	1.68E-03			0.00E+00
TOTAL									2.25E+00	6.25E-03	**2.E+00**	3.46E-04	9.31E-08	**3.E-04**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	6	n/a	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	350	350	days/yr	PEA Guidance Manual
EFd, exposure frequency (dermal)	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	350	350	days/yr	PEA Guidance Manual
ED, exposure duration	6	24	yr	Human-Exposure-Based Screening Numbers
IRs, soil ingestion rate	200	100	mg/day	PEA Guidance Manual
IRa, inhalation rate	10	20	m^3/day	PEA Guidance Manual
BW, body weight	15	70	kg	PEA Guidance Manual
SA, exposed skin surface area	2,800	5,700	cm^2	Human-Exposure-Based Screening Numbers
AF, adherance factor	0.2	0.07	mg/cm^2	Human-Exposure-Based Screening Numbers
PEF, particulate emission factor	1.316E+09	1.316E+09	m^3/kg	Human-Exposure-Based Screening Numbers

Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)

Table 5 - Summary of Risk/Hazard Calculations for Background Soil, Standard Exposure Scenario (Unrestricted Land Use)
Spring Hill Property
Project No. 3292-01

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi**[1] (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Arsenic	mean	3.E-04	8.57E-06	9.45	12.0	0.03	2.6	1.98E-09	1.20E-01	1.47E-04	1.20E-01	4.11E-05	3.53E-09	4.11E-05
Mercury	mean	3.E-04	8.57E-05	NL	NL	0.01	0.09	6.84E-11	3.94E-03	5.10E-07	3.94E-03			0.00E+00
TOTAL									1.24E-01	1.48E-04	**1.E-01**	4.11E-05	3.53E-09	**4.E-05**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value, child	Value, adult	Units	Reference
ATc, averaging time (carcinogen)	70	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	6	n/a	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	350	350	days/yr	PEA Guidance Manual
EFd, exposure frequency (dermal)	350	100	days/yr	PEA Guidance Manual
EFi, exposure frequency (inhalation)	350	350	days/yr	PEA Guidance Manual
ED, exposure duration	6	24	yr	Human-Exposure-Based Screening Numbers
IRs, soil ingestion rate	200	100	mg/day	PEA Guidance Manual
IRa, inhalation rate	10	20	m^3/day	PEA Guidance Manual
BW, body weight	15	70	kg	PEA Guidance Manual
SA, exposed skin surface area	2,800	5,700	cm^2	Human-Exposure-Based Screening Numbers
AF, adherance factor	0.2	0.07	mg/cm^2	Human-Exposure-Based Screening Numbers
PEF, particulate emission factor	1.316E+09	1.316E+09	m^3/kg	Human-Exposure-Based Screening Numbers

Preliminary Endangermant Assessment Guidance Manual (DTSC, June 1999)
Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (OEHHA, November 2004, revised January 2005)

Table 6 - Summary of Risk/Hazard Calculations for Former Mill Area, Commercial Indoor Exposure Scenario
Spring Hill Property
Project No. 3292-01

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi**[1] (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Antimony	maximum	4.E-04	4.E-04	NL	NL	0.01	12.4	9.12E-09	1.72E-02	3.12E-06	1.72E-02			0.00E+00
Arsenic	Approximate Gamma UCL	3.E-04	8.57E-06	9.45	12.0	0.03	348	2.56E-07	7.92E-01	4.09E-03	7.96E-01	8.02E-04	1.50E-07	8.02E-04
Barium	maximum	2.E-01	1.4E-04	NL	NL	0.01	103	7.57E-08	2.85E-04	7.41E-05	3.59E-04			0.00E+00
Cadmium	maximum	5.E-04	5.7E-06	NL	6.3	0.001	3.4	2.50E-09	3.37E-03	5.99E-05	3.43E-03		7.71E-10	7.71E-10
Chromium III	maximum	1.5	1.5	NL	NL	0.01	962	7.07E-07	3.55E-04	6.46E-08	3.55E-04			0.00E+00
Cobalt	maximum	2.E-02	5.7E-06	NL	9.8	0.01	79.4	5.84E-08	2.20E-03	1.40E-03	3.60E-03		2.80E-08	2.80E-08
Copper	maximum	3.7E-02	3.7E-02	NL	NL	0.01	467	3.43E-07	6.99E-03	1.27E-06	6.99E-03			0.00E+00
Mercury	Approximate Gamma UCL	3.E-04	8.57E-05	NL	NL	0.01	10.1	7.43E-09	1.86E-02	1.19E-05	1.87E-02			0.00E+00
Molybdenum	maximum	5.E-03	5.E-03	NL	NL	0.01	3.7	2.72E-09	4.10E-04	7.45E-08	4.10E-04			0.00E+00
Silver	maximum	5.E-03	5.E-03	NL	NL	0.01	21.8	1.60E-08	2.41E-03	4.39E-07	2.42E-03			0.00E+00
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	948	6.97E-07	5.25E-01	9.55E-05	5.25E-01			0.00E+00
Zinc	maximum	3.E-01	3.E-01	NL	NL	0.01	318	2.34E-07	5.87E-04	1.07E-07	5.87E-04			0.00E+00
TOTAL									1.37E+00	5.74E-03	**1.E+00**	8.02E-04	1.79E-07	**8.E-04**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	25	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	25	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	50	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	14	m^3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	3,300	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.2	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.36E+09	m^3/kg	US EPA Supplimental Guidance

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa).
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)

Table 7 - Summary of Risk/Hazard Calculations for Waste Rock and Tailings (excluding Former Mill Area), Commercial Indoor Exposure Scenario
Spring Hill Property
Project No. 3292-01

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi**[1] (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Antimony	maximum	4.E-04	4.E-04	NL	NL	0.01	12.2	8.97E-09	1.69E-02	3.07E-06	1.69E-02			0.00E+00
Arsenic	97.5% Chebyshev UCL	3.E-04	8.57E-06	9.45	12.0	0.03	21.9	1.61E-08	4.99E-02	2.57E-04	5.01E-02	5.05E-05	9.45E-09	5.05E-05
Barium	maximum	2.E-01	1.4E-04	NL	NL	0.01	12.5	9.19E-09	3.46E-05	8.99E-06	4.36E-05			0.00E+00
Cadmium	maximum	5.E-04	5.7E-06	NL	6.3	0.001	1.5	1.10E-09	1.49E-03	2.64E-05	1.51E-03		3.40E-10	3.40E-10
Chromium III	maximum	1.5	1.5	NL	NL	0.01	60.4	4.44E-08	2.23E-05	4.06E-09	2.23E-05			0.00E+00
Cobalt	maximum	2.E-02	5.7E-06	NL	9.8	0.01	56.3	4.14E-08	1.56E-03	9.95E-04	2.55E-03		1.98E-08	1.98E-08
Copper	maximum	3.7E-02	3.7E-02	NL	NL	0.01	94.2	6.93E-08	1.41E-03	2.56E-07	1.41E-03			0.00E+00
Mercury	Approximate Gamma UCL	3.E-04	8.57E-05	NL	NL	0.01	0.22	1.62E-10	4.06E-04	2.59E-07	4.06E-04			0.00E+00
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	54.6	4.01E-08	3.02E-02	5.50E-06	3.02E-02			0.00E+00
Zinc	maximum	3.E-01	3.E-01	NL	NL	0.01	38.4	2.82E-08	7.09E-05	1.29E-08	7.09E-05			0.00E+00
TOTAL									1.02E-01	1.30E-03	**1.E-01**	5.05E-05	2.96E-08	**5.E-05**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	25	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	25	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	50	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	14	m^3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	3,300	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.2	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.36E+09	m^3/kg	US EPA Supplimental Guidance

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa).
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)

Table 8 - Summary of Risk/Hazard Calculations for Former Mill Area, Construction Worker Exposure Scenario
Spring Hill Property
Project No. 3292-01

Analyte	**EPC Source**	**RfDo** (mg/kg-day)	**RfDi**[1] (mg/kg-day)	**Sfo** (mg/kg-day)$^{-1}$	**Sfi**[1] (mg/kg-day)$^{-1}$	**ABS**	**Cs** (mg/kg)	**Ca** (mg/m^3)	$Hazard_{soil}$	$Hazard_{air}$	Hazard, soil + air	$Risk_{soil}$	$Risk_{air}$	Risk, soil + air
Antimony	maximum	4.E-04	4.E-04	NL	NL	0.01	12.4	9.39E-09	1.14E-01	4.60E-06	1.14E-01			0.00E+00
Arsenic	Approximate Gamma UCL	3.E-04	8.57E-06	9.45	12.0	0.03	348	2.64E-07	5.30E+00	6.02E-03	5.30E+00	2.15E-04	8.84E-09	2.15E-04
Barium	maximum	2.E-01	1.4E-04	NL	NL	0.01	103	7.80E-08	1.89E-03	1.09E-04	2.00E-03			0.00E+00
Cadmium	maximum	5.E-04	5.7E-06	NL	6.3	0.001	3.4	2.58E-09	2.23E-02	8.82E-05	2.23E-02		4.54E-11	4.54E-11
Chromium	maximum	1.5	1.5	NL	NL	0.01	962	7.29E-07	2.36E-03	9.51E-08	2.36E-03			0.00E+00
Cobalt	maximum	2.E-02	5.7E-06	NL	9.8	0.01	79.4	6.02E-08	1.46E-02	2.07E-03	1.67E-02		1.65E-09	1.65E-09
Copper	maximum	3.7E-02	3.7E-02	NL	NL	0.01	467	3.54E-07	4.64E-02	1.87E-06	4.64E-02			0.00E+00
Mercury	Approximate Gamma UCL	3.E-04	8.57E-05	NL	NL	0.01	10.1	7.65E-09	1.24E-01	1.75E-05	1.24E-01			0.00E+00
Molybdenum	maximum	5.E-03	5.E-03	NL	NL	0.01	3.7	2.80E-09	2.72E-03	1.10E-07	2.72E-03			0.00E+00
Silver	maximum	5.E-03	5.E-03	NL	NL	0.01	21.8	1.65E-08	1.60E-02	6.46E-07	1.60E-02			0.00E+00
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	948	7.18E-07	3.48E+00	1.41E-04	3.48E+00			0.00E+00
Zinc	maximum	3.E-01	3.E-01	NL	NL	0.01	318	2.41E-07	3.90E-03	1.57E-07	3.90E-03			0.00E+00
TOTAL									9.13E+00	8.45E-03	**9.E+00**	2.15E-04	1.05E-08	**2.E-04**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	1	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	1	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	330	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	20	m3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	5,700	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.8	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.32.E+09	m^3/kg	US EPA (2004)

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa): Linn W.S., Spier C.E., and J.D. Hackney. 1993. Activity Patterns in Ozone-exposed contstruction workers. J. Occ. Med.
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
Threshold Limit Values and Biological Exposure Indices, American Converence of Governmental Industrial Hygenists (ACGIH 2004)

Table 9 - Summary of Risk/Hazard Calculations for Waste Rock and Tailings (excluding Former Mill Area), Construction Worker Exposure Scenario
Spring Hill Property
Project No. 3292-01

Analyte	EPC Source	RfDo (mg/kg-day)	RfDi[1] (mg/kg-day)	Sfo (mg/kg-day)$^{-1}$	Sfi[1] (mg/kg-day)$^{-1}$	ABS	Cs (mg/kg)	Ca (mg/m^3)	Hazard$_{soil}$	Hazard$_{air}$	Hazard, soil + air	Risk$_{soil}$	Risk$_{air}$	Risk, soil + air
Antimony	maximum	4.E-04	4.E-04	NL	NL	0.01	12.2	9.24E-09	1.12E-01	4.52E-06	1.12E-01			0.00E+00
Arsenic	97.5% Chebyshev UCL	3.E-04	8.57E-06	9.45	12.0	0.03	21.9	1.66E-08	3.33E-01	3.79E-04	3.34E-01	1.35E-05	5.57E-10	1.35E-05
Barium	maximum	2.E-01	1.4E-04	NL	NL	0.01	12.5	9.47E-09	2.30E-04	1.32E-05	2.43E-04			0.00E+00
Cadmium	maximum	5.E-04	5.7E-06	NL	6.3	0.001	1.5	1.14E-09	9.82E-03	3.89E-05	9.86E-03		2.00E-11	2.00E-11
Chromium	maximum	1.5	1.5	NL	NL	0.01	60.4	4.58E-08	1.48E-04	5.97E-09	1.48E-04			0.00E+00
Cobalt	maximum	2.E-02	5.7E-06	NL	9.8	0.01	56.3	4.27E-08	1.03E-02	1.46E-03	1.18E-02		1.17E-09	1.17E-09
Copper	maximum	3.7E-02	3.7E-02	NL	NL	0.01	94.2	7.14E-08	9.36E-03	3.77E-07	9.36E-03			0.00E+00
Mercury	Approximate Gamma UCL	3.E-04	8.57E-05	NL	NL	0.01	0.22	1.67E-10	2.70E-03	3.81E-07	2.70E-03			0.00E+00
Vanadium	maximum	1.E-03	1.E-03	NL	NL	0.01	54.6	4.14E-08	2.01E-01	8.09E-06	2.01E-01			0.00E+00
Zinc	maximum	3.E-01	3.E-01	NL	NL	0.01	38.4	2.91E-08	4.70E-04	1.90E-08	4.70E-04			0.00E+00
TOTAL									6.79E-01	1.91E-03	**7.E-01**	1.35E-05	1.75E-09	**1.E-05**

Notes:
1 Per PEA Manual 2.5.1.5, use oral SF or RfD if inhalation SF or RfD is not available.
2 Chromium VI not considered an oral carcinogen per DTSC.
ABS = dermal absorption fraction (PEA Guidance Manual, Appendix A, Table 2)
Ca [mg/m^3] = air concentration = Cs [mg/kg] * (PEF [m^3/kg])$^{-1}$
Cs [mg/kg] = soil concentration
ND = not detected
NL = not listed in reviewed toxicological data sources
RfDo = reference dose for chronic oral exposure
RfDi = reference dose for chronic inhalation exposure
Sfo = standard oral slope factor
Sfi = standard inhalation slope factor
UCL = upper confidence limit

Parameter	Value	Units	Reference
ATc, averaging time (carcinogen)	70	yr	AT = lifetime for carcinogens
ATnc, averaging time (non-carcinogen)	1	yr	AT = ED for non-carcinogens
EFs, exposure frequency (ingestion)	250	days/yr	US EPA Supplimental Guidance
EFd, exposure frequency (dermal)	250	days/yr	US EPA Supplimental Guidance
EFi, exposure frequency (inhalation)	250	days/yr	US EPA Supplimental Guidance
ED, exposure duration	1	yr	US EPA Supplimental Guidance
IRs, soil ingestion rate	330	mg/day	US EPA Supplimental Guidance
IRa, inhalation rate	20	m3/day	US EPA Exposure Factors Handbook
BW, body weight	70	kg	US EPA Supplimental Guidance
SA, exposed skin surface area	5,700	cm^2	US EPA Risk Assessment Guidance
AF, adherance factor	0.8	mg/cm^2	US EPA Risk Assessment Guidance
PEF, particulate emission factor	1.32.E+09	m^3/kg	US EPA (2004)

US EPA Exposure Factors Handbook (EPA/600/P-95/002Fa): Linn W.S., Spier C.E., and J.D. Hackney. 1993. Activity Patterns in Ozone-exposed contstruction workers. J. Occ. Med.
US EPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (OSWER 9355.4-24) December 2002.
US EPA Risk Assessment Guidance for Superfund (RAGS), Part E, Chapter 3 and Appendix C (2004)
Threshold Limit Values and Biological Exposure Indices, American Converence of Governmental Industrial Hygenists (ACGIH 2004)

Table 10 - Summary of Human Health Screening Evaluation
Spring Hill Property
Project No. 3292-01

Assessment Area	Exposure Scenario					
	Standard (Unrestricted Land Use)		Commercial Indoor Worker		Construction Worker	
	Hazard	Risk	Hazard	Risk	Hazard	Risk
Former Mill Area	3.E+01	6.E-03	1.E+00	8.E-04	9.E+00	2.E-04
Waste Rock and Tailings (excluding Former Mill Area)	2.E+00	3.E-04	1.E-01	5.E-05	7.E-01	1.E-05
Background Soil	1.E-01	4.E-05	na	na	na	na

Hazard = Chronic health hazard index
Risk = Excess lifetime cancer risk

Table 11 - Summary of Lead Hazard Assessment, Standard Exposure Scenario
Spring Hill Property
Project No. 3292-05

Assessment Area	Exposure Point Concentration (EPC, mg/kg)	EPC Source	90th Percentile Estimate of Blood Lead (ug/dl)	
			Non-Pica Child	Adult Worker
Former Mill Area	408	Approximate Gamma UCL	5.3	0.7
Waste Rock and Tailings (excluding Former Mill Area)	36	97.5 Cheb	0.5	0.1
Background Soil	14	Student's-t UCL	0.2	0.0

Hazard = Chronic health hazard index
UCL = Upper Confidence Limit on the arithmetic mean
App Gamma = Approximate Gamma UCL
97.5 Cheb = 97.5% Chebyshev (Mean, Sd) UCL

Summary of Statistical Calculations

Data File	F:\1 Projects\3292 Spring Hill Mine\RA\stats\M	Variable:	Mill As
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	12	Shapiro-Wilk Test Statisitic	0.7956
Number of Unique Samples	12	Shapiro-Wilk 5% Critical Value	0.859
Minimum	0.5	Data not normal at 5% significance level	
Maximum	579		
Mean	153.1667	95% UCL (Assuming Normal Distribution)	
Median	63.2	Student's-t UCL	248.407
Standard Deviation	183.7101		
Variance	33749.4	Gamma Distribution Test	
Coefficient of Variation	1.199413	A-D Test Statistic	0.193329
Skewness	1.520397	A-D 5% Critical Value	0.776646
		K-S Test Statistic	0.144125
Gamma Statistics		K-S 5% Critical Value	0.25702
k hat	0.607216	Data follow gamma distribution	
k star (bias corrected)	0.510968	at 5% significance level	
Theta hat	252.2441		
Theta star	299.7581	95% UCLs (Assuming Gamma Distribution)	
nu hat	14.57318	Approximate Gamma UCL	347.8443
nu star	12.26322	Adjusted Gamma UCL	397.6848
Approx.Chi Square Value (.05)	5.399878		
Adjusted Level of Significance	0.02896	Lognormal Distribution Test	
Adjusted Chi Square Value	4.723129	Shapiro-Wilk Test Statisitic	0.893617
		Shapiro-Wilk 5% Critical Value	0.859
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	6.361302	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	4.015761	95% H-UCL	7502.217
Standard Deviation of log data	1.982268	95% Chebyshev (MVUE) UCL	1026.481
Variance of log data	3.929385	97.5% Chebyshev (MVUE) UCL	1350.723
		99% Chebyshev (MVUE) UCL	1987.633
		95% Non-parametric UCLs	
		CLT UCL	240.3974
		Adj-CLT UCL (Adjusted for skewness)	265.2682
		Mod-t UCL (Adjusted for skewness)	252.2863
		Jackknife UCL	248.407
		Standard Bootstrap UCL	236.5253
		Bootstrap-t UCL	332.6275
RECOMMENDATION		Hall's Bootstrap UCL	323.9538
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	244.0583
		BCA Bootstrap UCL	261.3167
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	384.3301
		97.5% Chebyshev (Mean, Sd) UCL	484.3547
		99% Chebyshev (Mean, Sd) UCL	680.8337

Data File	F:\1 Projects\3292 Spring Hill Mine\RA\stats\M	Variable:	Mill Pb
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	12	Shapiro-Wilk Test Statisitic	0.805487
Number of Unique Samples	12	Shapiro-Wilk 5% Critical Value	0.859
Minimum	18.4	Data not normal at 5% significance level	
Maximum	810		
Mean	213.225	95% UCL (Assuming Normal Distribution)	
Median	129.75	Student's-t UCL	335.3497
Standard Deviation	235.5676		
Variance	55492.1	Gamma Distribution Test	
Coefficient of Variation	1.104784	A-D Test Statistic	0.385768
Skewness	1.633614	A-D 5% Critical Value	0.759227
		K-S Test Statistic	0.205968
Gamma Statistics		K-S 5% Critical Value	0.253041
k hat	0.929816	Data follow gamma distribution	
k star (bias corrected)	0.752918	at 5% significance level	
Theta hat	229.3195		
Theta star	283.1983	95% UCLs (Assuming Gamma Distribution)	
nu hat	22.31559	Approximate Gamma UCL	408.15
nu star	18.07002	Adjusted Gamma UCL	453.1183
Approx.Chi Square Value (.05)	9.440109		
Adjusted Level of Significance	0.02896	Lognormal Distribution Test	
Adjusted Chi Square Value	8.503256	Shapiro-Wilk Test Statisitic	0.941496
		Shapiro-Wilk 5% Critical Value	0.859
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	2.912351		
Maximum of log data	6.697034	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	4.736131	95% H-UCL	881.6684
Standard Deviation of log data	1.245741	95% Chebyshev (MVUE) UCL	606.125
Variance of log data	1.55187	97.5% Chebyshev (MVUE) UCL	771.3653
		99% Chebyshev (MVUE) UCL	1095.948
		95% Non-parametric UCLs	
		CLT UCL	325.0792
		Adj-CLT UCL (Adjusted for skewness)	359.3452
		Mod-t UCL (Adjusted for skewness)	340.6945
		Jackknife UCL	335.3497
		Standard Bootstrap UCL	320.5682
		Bootstrap-t UCL	404.7719
RECOMMENDATION		Hall's Bootstrap UCL	409.1273
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	329.15
		BCA Bootstrap UCL	360.7667
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	509.6411
		97.5% Chebyshev (Mean, Sd) UCL	637.9006
		99% Chebyshev (Mean, Sd) UCL	889.8415

Data File	F:\1 Projects\3292 Spring Hill Mine\RA\stats\M	Variable:	Mill Hg
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	12	Shapiro-Wilk Test Statisitic	0.754187
Number of Unique Samples	12	Shapiro-Wilk 5% Critical Value	0.859
Minimum	0.059	Data not normal at 5% significance level	
Maximum	19.5		
Mean	4.388083	95% UCL (Assuming Normal Distribution)	
Median	1.34	Student's-t UCL	7.386319
Standard Deviation	5.783331		
Variance	33.44691	Gamma Distribution Test	
Coefficient of Variation	1.317963	A-D Test Statistic	0.297856
Skewness	1.835147	A-D 5% Critical Value	0.77763
		K-S Test Statistic	0.182808
Gamma Statistics		K-S 5% Critical Value	0.257217
k hat	0.594492	Data follow gamma distribution	
k star (bias corrected)	0.501424	at 5% significance level	
Theta hat	7.381237		
Theta star	8.751238	95% UCLs (Assuming Gamma Distribution)	
nu hat	14.2678	Approximate Gamma UCL	10.06127
nu star	12.03418	Adjusted Gamma UCL	11.52208
Approx.Chi Square Value (.05)	5.248543		
Adjusted Level of Significance	0.02896	Lognormal Distribution Test	
Adjusted Chi Square Value	4.583115	Shapiro-Wilk Test Statisitic	0.959961
		Shapiro-Wilk 5% Critical Value	0.859
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-2.830218		
Maximum of log data	2.970414	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.43814	95% H-UCL	75.75532
Standard Deviation of log data	1.755901	95% Chebyshev (MVUE) UCL	19.21666
Variance of log data	3.083187	97.5% Chebyshev (MVUE) UCL	25.09812
		99% Chebyshev (MVUE) UCL	36.65112
		95% Non-parametric UCLs	
		CLT UCL	7.134173
		Adj-CLT UCL (Adjusted for skewness)	8.079208
		Mod-t UCL (Adjusted for skewness)	7.533726
		Jackknife UCL	7.386319
		Standard Bootstrap UCL	6.985879
		Bootstrap-t UCL	8.999414
RECOMMENDATION		Hall's Bootstrap UCL	8.958826
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	7.281583
		BCA Bootstrap UCL	7.944333
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	11.66528
		97.5% Chebyshev (Mean, Sd) UCL	14.81413
		99% Chebyshev (Mean, Sd) UCL	20.99944

Data File	F:\1 Projects\3292 Spring Hill Mine\RA\stats\M	Variable:	Mill Ni
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	9	Shapiro-Wilk Test Statisitic	0.760345
Number of Unique Samples	9	Shapiro-Wilk 5% Critical Value	0.829
Minimum	104	Data not normal at 5% significance level	
Maximum	1180		
Mean	390.8889	95% UCL (Assuming Normal Distribution)	
Median	278	Student's-t UCL	590.5231
Standard Deviation	322.0689		
Variance	103728.4	Gamma Distribution Test	
Coefficient of Variation	0.82394	A-D Test Statistic	0.343726
Skewness	2.157031	A-D 5% Critical Value	0.728865
		K-S Test Statistic	0.174195
Gamma Statistics		K-S 5% Critical Value	0.282132
k hat	2.304867	Data follow gamma distribution	
k star (bias corrected)	1.610652	at 5% significance level	
Theta hat	169.5928		
Theta star	242.6898	95% UCLs (Assuming Gamma Distribution)	
nu hat	41.48761	Approximate Gamma UCL	640.2533
nu star	28.99174	Adjusted Gamma UCL	714.2309
Approx.Chi Square Value (.05)	17.7001		
Adjusted Level of Significance	0.02308	Lognormal Distribution Test	
Adjusted Chi Square Value	15.86679	Shapiro-Wilk Test Statisitic	0.974663
		Shapiro-Wilk 5% Critical Value	0.829
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	4.644391		
Maximum of log data	7.07327	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	5.736077	95% H-UCL	762.4589
Standard Deviation of log data	0.699126	95% Chebyshev (MVUE) UCL	782.0436
Variance of log data	0.488777	97.5% Chebyshev (MVUE) UCL	954.582
		99% Chebyshev (MVUE) UCL	1293.5
		95% Non-parametric UCLs	
		CLT UCL	567.4743
		Adj-CLT UCL (Adjusted for skewness)	649.9532
		Mod-t UCL (Adjusted for skewness)	603.3881
		Jackknife UCL	590.5231
		Standard Bootstrap UCL	559.4828
		Bootstrap-t UCL	815.7225
RECOMMENDATION		Hall's Bootstrap UCL	1284.173
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	573.3333
		BCA Bootstrap UCL	630.7778
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	858.8441
		97.5% Chebyshev (Mean, Sd) UCL	1061.329
		99% Chebyshev (Mean, Sd) UCL	1459.071

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stat	Variable:	AOC As
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	86	Lilliefors Test Statisitic	0.280672
Number of Unique Samples	51	Lilliefors 5% Critical Value	0.09554
Minimum	0.5	Data not normal at 5% significance level	
Maximum	94.6		
Mean	9.1	95% UCL (Assuming Normal Distribution)	
Median	3.1	Student's-t UCL	11.75506
Standard Deviation	14.806		
Variance	219.2176	Gamma Distribution Test	
Coefficient of Variation	1.627033	A-D Test Statistic	2.829239
Skewness	3.21853	A-D 5% Critical Value	0.807313
		K-S Test Statistic	0.140066
Gamma Statistics		K-S 5% Critical Value	0.101191
k hat	0.612123	Data do not follow gamma distribution	
k star (bias corrected)	0.598522	at 5% significance level	
Theta hat	14.86628		
Theta star	15.20411	95% UCLs (Assuming Gamma Distribution)	
nu hat	105.2852	Approximate Gamma UCL	11.63301
nu star	102.9458	Adjusted Gamma UCL	11.68182
Approx.Chi Square Value (.05)	80.53005		
Adjusted Level of Significance	0.047209	Lognormal Distribution Test	
Adjusted Chi Square Value	80.19357	Lilliefors Test Statisitic	0.143929
		Lilliefors 5% Critical Value	0.09554
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	4.549657	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.201842	95% H-UCL	14.75977
Standard Deviation of log data	1.458164	95% Chebyshev (MVUE) UCL	18.15734
Variance of log data	2.126242	97.5% Chebyshev (MVUE) UCL	21.94834
		99% Chebyshev (MVUE) UCL	29.39504
		95% Non-parametric UCLs	
		CLT UCL	11.72613
		Adj-CLT UCL (Adjusted for skewness)	12.3182
		Mod-t UCL (Adjusted for skewness)	11.84742
		Jackknife UCL	11.75506
		Standard Bootstrap UCL	11.79148
		Bootstrap-t UCL	12.76613
RECOMMENDATION		Hall's Bootstrap UCL	12.96954
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	11.95116
		BCA Bootstrap UCL	12.54186
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	16.0593
		97.5% Chebyshev (Mean, Sd) UCL	19.07059
		99% Chebyshev (Mean, Sd) UCL	24.98569

General Statistics

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats		Variable:	AOC Pb	
Raw Statistics			Normal Distribution Test		
Number of Valid Samples		86	Lilliefors Test Statisitic		0.318178
Number of Unique Samples		72	Lilliefors 5% Critical Value		0.09554
Minimum		0.5	Data not normal at 5% significance level		
Maximum		341			
Mean		19.77558	95% UCL (Assuming Normal Distribution)		
Median		7.7	Student's-t UCL		27.08644
Standard Deviation		40.7691			
Variance		1662.12	Gamma Distribution Test		
Coefficient of Variation		2.061588	A-D Test Statistic		4.269476
Skewness		6.100453	A-D 5% Critical Value		0.79563
			K-S Test Statistic		0.208594
Gamma Statistics			K-S 5% Critical Value		0.100393
k hat		0.727764	Data do not follow gamma distribution		
k star (bias corrected)		0.710129	at 5% significance level		
Theta hat		27.17306			
Theta star		27.84787	95% UCLs (Assuming Gamma Distribution)		
nu hat		125.1754	Approximate Gamma UCL		24.74444
nu star		122.1422	Adjusted Gamma UCL		24.83908
Approx.Chi Square Value (.05)		97.61516			
Adjusted Level of Significance		0.047209	Lognormal Distribution Test		
Adjusted Chi Square Value		97.24326	Lilliefors Test Statisitic		0.106902
			Lilliefors 5% Critical Value		0.09554
Log-transformed Statistics			Data not lognormal at 5% significance level		
Minimum of log data		-0.693147			
Maximum of log data		5.831882	95% UCLs (Assuming Lognormal Distribution)		
Mean of log data		2.158496	95% H-UCL		24.8282
Standard Deviation of log data		1.211399	95% Chebyshev (MVUE) UCL		30.62355
Variance of log data		1.467487	97.5% Chebyshev (MVUE) UCL		36.18315
			99% Chebyshev (MVUE) UCL		47.1039
			95% Non-parametric UCLs		
			CLT UCL		27.00676
			Adj-CLT UCL (Adjusted for skewness)		30.09688
			Mod-t UCL (Adjusted for skewness)		27.56844
			Jackknife UCL		27.08644
			Standard Bootstrap UCL		26.81301
			Bootstrap-t UCL		33.97972
RECOMMENDATION			Hall's Bootstrap UCL		56.81939
Data are Non-parametric (0.05)			Percentile Bootstrap UCL		27.9814
			BCA Bootstrap UCL		31.95465
Use 97.5% Chebyshev (Mean, Sd) UCL			95% Chebyshev (Mean, Sd) UCL		38.93837
			97.5% Chebyshev (Mean, Sd) UCL		47.23012
			99% Chebyshev (Mean, Sd) UCL		63.51767

General Statistics

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats	Variable:	AOC Hg
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	86	Lilliefors Test Statisitic	0.216862
Number of Unique Samples	76	Lilliefors 5% Critical Value	0.09554
Minimum	0.005	Data not normal at 5% significance level	
Maximum	1.29		
Mean	0.181523	95% UCL (Assuming Normal Distribution)	
Median	0.1195	Student's-t UCL	0.22191
Standard Deviation	0.225217		
Variance	0.050723	Gamma Distribution Test	
Coefficient of Variation	1.240707	A-D Test Statistic	1.187321
Skewness	3.302299	A-D 5% Critical Value	0.779043
		K-S Test Statistic	0.090511
Gamma Statistics		K-S 5% Critical Value	0.098954
k hat	1.149958	Data follow approximate gamma distibution	
k star (bias corrected)	1.117595	at 5% significance level	
Theta hat	0.157852		
Theta star	0.162423	95% UCLs (Assuming Gamma Distribution)	
nu hat	197.7927	Approximate Gamma UCL	0.216535
nu star	192.2263	Adjusted Gamma UCL	0.217185
Approx.Chi Square Value (.05)	161.1451		
Adjusted Level of Significance	0.047209	Lognormal Distribution Test	
Adjusted Chi Square Value	160.6631	Lilliefors Test Statisitic	0.083659
		Lilliefors 5% Critical Value	0.09554
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-5.298317		
Maximum of log data	0.254642	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-2.20048	95% H-UCL	0.23648
Standard Deviation of log data	1.012759	95% Chebyshev (MVUE) UCL	0.288007
Variance of log data	1.025681	97.5% Chebyshev (MVUE) UCL	0.333304
		99% Chebyshev (MVUE) UCL	0.422282
		95% Non-parametric UCLs	
		CLT UCL	0.22147
		Adj-CLT UCL (Adjusted for skewness)	0.23071
		Mod-t UCL (Adjusted for skewness)	0.223351
		Jackknife UCL	0.22191
		Standard Bootstrap UCL	0.22082
		Bootstrap-t UCL	0.237717
RECOMMENDATION		Hall's Bootstrap UCL	0.239132
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	0.223663
		BCA Bootstrap UCL	0.229395
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	0.287383
		97.5% Chebyshev (Mean, Sd) UCL	0.333188
		99% Chebyshev (Mean, Sd) UCL	0.423164

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats	Variable:	AOC Ni

Raw Statistics		Normal Distribution Test	
Number of Valid Samples	53	Lilliefors Test Statisitic	0.140696
Number of Unique Samples	53	Lilliefors 5% Critical Value	0.121701
Minimum	85.8	Data not normal at 5% significance level	
Maximum	1290		
Mean	402.3604	95% UCL (Assuming Normal Distribution)	
Median	319	Student's-t UCL	462.2614
Standard Deviation	260.3981		
Variance	67807.17	Gamma Distribution Test	
Coefficient of Variation	0.647176	A-D Test Statistic	0.299934
Skewness	1.27242	A-D 5% Critical Value	0.75903
		K-S Test Statistic	0.077736
Gamma Statistics		K-S 5% Critical Value	0.123214
k hat	2.684995	Data follow gamma distribution	
k star (bias corrected)	2.545592	at 5% significance level	
Theta hat	149.8552		
Theta star	158.0616	95% UCLs (Assuming Gamma Distribution)	
nu hat	284.6094	Approximate Gamma UCL	466.3971
nu star	269.8328	Adjusted Gamma UCL	468.3252
Approx.Chi Square Value (.05)	232.7845		
Adjusted Level of Significance	0.045472	Lognormal Distribution Test	
Adjusted Chi Square Value	231.8262	Lilliefors Test Statisitic	0.055957
		Lilliefors 5% Critical Value	0.121701
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	4.452019		
Maximum of log data	7.162397	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	5.79972	95% H-UCL	485.5312
Standard Deviation of log data	0.645704	95% Chebyshev (MVUE) UCL	574.2317
Variance of log data	0.416934	97.5% Chebyshev (MVUE) UCL	647.5287
		99% Chebyshev (MVUE) UCL	791.5065
		95% Non-parametric UCLs	
		CLT UCL	461.1942
		Adj-CLT UCL (Adjusted for skewness)	467.8742
		Mod-t UCL (Adjusted for skewness)	463.3033
		Jackknife UCL	462.2614
		Standard Bootstrap UCL	460.1116
		Bootstrap-t UCL	472.7596
RECOMMENDATION		Hall's Bootstrap UCL	468.3802
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	463.3925
		BCA Bootstrap UCL	470.8264
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	558.2714
		97.5% Chebyshev (Mean, Sd) UCL	625.7342
		99% Chebyshev (Mean, Sd) UCL	758.2518

General Statistics

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats	Variable:	BKG As
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	8	Shapiro-Wilk Test Statisitic	0.418591
Number of Unique Samples	2	Shapiro-Wilk 5% Critical Value	0.818
Minimum	0.5	Data not normal at 5% significance level	
Maximum	17		
Mean	2.5625	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	6.470068
Standard Deviation	5.833631		
Variance	34.03125	Gamma Distribution Test	
Coefficient of Variation	2.276539	A-D Test Statistic	2.566482
Skewness	2.828427	A-D 5% Critical Value	0.76045
		K-S Test Statistic	0.547263
Gamma Statistics		K-S 5% Critical Value	0.308441
k hat	0.527847	Data do not follow gamma distribution	
k star (bias corrected)	0.413237	at 5% significance level	
Theta hat	4.85463		
Theta star	6.201035	95% UCLs (Assuming Gamma Distribution)	
nu hat	8.445546	Approximate Gamma UCL	8.646289
nu star	6.6118	Adjusted Gamma UCL	12.23158
Approx.Chi Square Value (.05)	1.959539		
Adjusted Level of Significance	0.01946	Lognormal Distribution Test	
Adjusted Chi Square Value	1.385164	Shapiro-Wilk Test Statisitic	0.418591
		Shapiro-Wilk 5% Critical Value	0.818
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	2.833213	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.252352	95% H-UCL	11.97343
Standard Deviation of log data	1.246757	95% Chebyshev (MVUE) UCL	4.336951
Variance of log data	1.554402	97.5% Chebyshev (MVUE) UCL	5.578688
		99% Chebyshev (MVUE) UCL	8.017841
		95% Non-parametric UCLs	
		CLT UCL	5.955011
		Adj-CLT UCL (Adjusted for skewness)	8.158822
		Mod-t UCL (Adjusted for skewness)	6.813818
		Jackknife UCL	6.470068
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/A
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	11.55273
		97.5% Chebyshev (Mean, Sd) UCL	15.44281
		99% Chebyshev (Mean, Sd) UCL	23.08412
Recommended UCL exceeds the maximum observation			
Consider using 95% or 97.5% Chebyshev (Mean, Sd) UCL			

General Statistics

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stat	Variable:	BKG Pb
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	8	Shapiro-Wilk Test Statisitic	0.929578
Number of Unique Samples	8	Shapiro-Wilk 5% Critical Value	0.818
Minimum	3.1	Data are normal at 5% significance level	
Maximum	20.4		
Mean	9.8	95% UCL (Assuming Normal Distribution)	
Median	7.95	Student's-t UCL	13.73439
Standard Deviation	5.87367		
Variance	34.5	Gamma Distribution Test	
Coefficient of Variation	0.599354	A-D Test Statistic	0.191148
Skewness	0.818543	A-D 5% Critical Value	0.720878
		K-S Test Statistic	0.16429
Gamma Statistics		K-S 5% Critical Value	0.296102
k hat	3.20411	Data follow gamma distribution	
k star (bias corrected)	2.085902	at 5% significance level	
Theta hat	3.058572		
Theta star	4.698207	95% UCLs (Assuming Gamma Distribution)	
nu hat	51.26576	Approximate Gamma UCL	15.45489
nu star	33.37443	Adjusted Gamma UCL	17.45081
Approx.Chi Square Value (.05)	21.16284		
Adjusted Level of Significance	0.01946	Lognormal Distribution Test	
Adjusted Chi Square Value	18.74236	Shapiro-Wilk Test Statisitic	0.980212
		Shapiro-Wilk 5% Critical Value	0.818
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	1.131402		
Maximum of log data	3.015535	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.118291	95% H-UCL	18.80949
Standard Deviation of log data	0.625701	95% Chebyshev (MVUE) UCL	19.46108
Variance of log data	0.391502	97.5% Chebyshev (MVUE) UCL	23.62419
		99% Chebyshev (MVUE) UCL	31.8018
		95% Non-parametric UCLs	
		CLT UCL	13.2158
		Adj-CLT UCL (Adjusted for skewness)	13.85795
		Mod-t UCL (Adjusted for skewness)	13.83455
		Jackknife UCL	13.73439
		Standard Bootstrap UCL	13.04788
		Bootstrap-t UCL	15.40713
RECOMMENDATION		Hall's Bootstrap UCL	13.8457
Data are normal (0.05)		Percentile Bootstrap UCL	13.175
		BCA Bootstrap UCL	13.525
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	18.85193
		97.5% Chebyshev (Mean, Sd) UCL	22.76871
		99% Chebyshev (Mean, Sd) UCL	30.46247

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats	Variable:	As WET
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	19	Shapiro-Wilk Test Statisitic	0.78604
Number of Unique Samples	13	Shapiro-Wilk 5% Critical Value	0.901
Minimum	1	Data not normal at 5% significance level	
Maximum	44.7		
Mean	10.87368	95% UCL (Assuming Normal Distribution)	
Median	5	Student's-t UCL	15.59958
Standard Deviation	11.87943		
Variance	141.1209	Gamma Distribution Test	
Coefficient of Variation	1.092494	A-D Test Statistic	0.611317
Skewness	1.59814	A-D 5% Critical Value	0.77067
		K-S Test Statistic	0.191489
Gamma Statistics		K-S 5% Critical Value	0.204587
k hat	0.962296	Data follow gamma distribution	
k star (bias corrected)	0.845442	at 5% significance level	
Theta hat	11.29973		
Theta star	12.86154	95% UCLs (Assuming Gamma Distribution)	
nu hat	36.56724	Approximate Gamma UCL	17.31917
nu star	32.1268	Adjusted Gamma UCL	18.05968
Approx.Chi Square Value (.05)	20.17052		
Adjusted Level of Significance	0.03687	Lognormal Distribution Test	
Adjusted Chi Square Value	19.34345	Shapiro-Wilk Test Statisitic	0.919907
		Shapiro-Wilk 5% Critical Value	0.901
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	0		
Maximum of log data	3.799974	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.783773	95% H-UCL	28.26448
Standard Deviation of log data	1.204647	95% Chebyshev (MVUE) UCL	27.5844
Variance of log data	1.451174	97.5% Chebyshev (MVUE) UCL	34.5093
		99% Chebyshev (MVUE) UCL	48.11192
		95% Non-parametric UCLs	
		CLT UCL	15.35645
		Adj-CLT UCL (Adjusted for skewness)	16.42412
		Mod-t UCL (Adjusted for skewness)	15.76611
		Jackknife UCL	15.59958
		Standard Bootstrap UCL	15.23266
		Bootstrap-t UCL	17.30398
RECOMMENDATION		Hall's Bootstrap UCL	16.64203
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	15.47368
		BCA Bootstrap UCL	16.11579
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	22.75312
		97.5% Chebyshev (Mean, Sd) UCL	27.89336
		99% Chebyshev (Mean, Sd) UCL	37.99036

General Statistics

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats	Variable:	Pb WET

Raw Statistics		Normal Distribution Test	
Number of Valid Samples	19	Shapiro-Wilk Test Statisitic	0.773346
Number of Unique Samples	8	Shapiro-Wilk 5% Critical Value	0.901
Minimum	0.6	Data not normal at 5% significance level	
Maximum	11.6		
Mean	3.010526	95% UCL (Assuming Normal Distribution)	
Median	1.7	Student's-t UCL	4.234031
Standard Deviation	3.075512		
Variance	9.458772	Gamma Distribution Test	
Coefficient of Variation	1.021586	A-D Test Statistic	0.754431
Skewness	1.719407	A-D 5% Critical Value	0.763578
		K-S Test Statistic	0.177119
Gamma Statistics		K-S 5% Critical Value	0.203281
k hat	1.22994	Data follow gamma distribution	
k star (bias corrected)	1.070826	at 5% significance level	
Theta hat	2.447703		
Theta star	2.811405	95% UCLs (Assuming Gamma Distribution)	
nu hat	46.73771	Approximate Gamma UCL	4.525225
nu star	40.6914	Adjusted Gamma UCL	4.693464
Approx.Chi Square Value (.05)	27.07104		
Adjusted Level of Significance	0.03687	Lognormal Distribution Test	
Adjusted Chi Square Value	26.10066	Shapiro-Wilk Test Statisitic	0.896532
		Shapiro-Wilk 5% Critical Value	0.901
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.510826		
Maximum of log data	2.451005	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.643406	95% H-UCL	5.766877
Standard Deviation of log data	0.995001	95% Chebyshev (MVUE) UCL	6.345554
Variance of log data	0.990027	97.5% Chebyshev (MVUE) UCL	7.788835
		99% Chebyshev (MVUE) UCL	10.62388
		95% Non-parametric UCLs	
		CLT UCL	4.171087
		Adj-CLT UCL (Adjusted for skewness)	4.468475
		Mod-t UCL (Adjusted for skewness)	4.280417
		Jackknife UCL	4.234031
		Standard Bootstrap UCL	4.124625
		Bootstrap-t UCL	4.800707
RECOMMENDATION		Hall's Bootstrap UCL	5.534954
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	4.194737
		BCA Bootstrap UCL	4.4
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	6.086038
		97.5% Chebyshev (Mean, Sd) UCL	7.416814
		99% Chebyshev (Mean, Sd) UCL	10.03087

General Statistics

Data File	F:\1 Projects\3292 Spring Hill Mine\TBLs\stats	Variable:	Ni WET		
Raw Statistics			Normal Distribution Test		
Number of Valid Samples	18		Shapiro-Wilk Test Statisitic		0.725475
Number of Unique Samples	14		Shapiro-Wilk 5% Critical Value		0.897
Minimum	2.3		Data not normal at 5% significance level		
Maximum	48.1				
Mean	11.93889		95% UCL (Assuming Normal Distribution)		
Median	5.6		Student's-t UCL		16.91876
Standard Deviation	12.14516				
Variance	147.5049		Gamma Distribution Test		
Coefficient of Variation	1.017277		A-D Test Statistic		1.062925
Skewness	2.015273		A-D 5% Critical Value		0.756093
			K-S Test Statistic		0.242344
Gamma Statistics			K-S 5% Critical Value		0.207191
k hat	1.521625		Data do not follow gamma distribution		
k star (bias corrected)	1.305058		at 5% significance level		
Theta hat	7.846143				
Theta star	9.148167		95% UCLs (Assuming Gamma Distribution)		
nu hat	54.7785		Approximate Gamma UCL		17.39261
nu star	46.98209		Adjusted Gamma UCL		18.04766
Approx.Chi Square Value (.05)	32.25012				
Adjusted Level of Significance	0.03574		Lognormal Distribution Test		
Adjusted Chi Square Value	31.07959		Shapiro-Wilk Test Statisitic		0.91965
			Shapiro-Wilk 5% Critical Value		0.897
Log-transformed Statistics			Data are lognormal at 5% significance level		
Minimum of log data	0.832909				
Maximum of log data	3.873282		95% UCLs (Assuming Lognormal Distribution)		
Mean of log data	2.116536		95% H-UCL		19.02332
Standard Deviation of log data	0.829162		95% Chebyshev (MVUE) UCL		21.96363
Variance of log data	0.687509		97.5% Chebyshev (MVUE) UCL		26.52342
			99% Chebyshev (MVUE) UCL		35.48023
			95% Non-parametric UCLs		
			CLT UCL		16.64751
			Adj-CLT UCL (Adjusted for skewness)		18.10045
			Mod-t UCL (Adjusted for skewness)		17.14539
			Jackknife UCL		16.91876
			Standard Bootstrap UCL		16.54964
			Bootstrap-t UCL		20.35379
RECOMMENDATION			Hall's Bootstrap UCL		20.75763
Data are lognormal (0.05)			Percentile Bootstrap UCL		17.07222
			BCA Bootstrap UCL		18.46667
Use H-UCL			95% Chebyshev (Mean, Sd) UCL		24.41685
			97.5% Chebyshev (Mean, Sd) UCL		29.81608
			99% Chebyshev (Mean, Sd) UCL		40.42181

Lead Risk Assessment Spreadsheets

LEAD RISK ASSESSMENT SPREADSHEET 8
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	408.0
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl)						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	2.9	5.3	6.3	7.6	8.7	77
BLOOD Pb, PICA CHILD	5.8	10.5	12.5	15.2	17.2	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.02	1%		0.02	0%
Soil Ingestion	7.0E-3	2.87	99%	1.4E-2	5.74	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Click here for REFERENCES

Spring Hill Property, Former Mill Area, Approximate Gamma UCL, Standard Exposure Scenario

LEAD RISK ASSESSMENT SPREADSHEET 8
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	36.0
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl)						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	0.3	0.5	0.6	0.7	0.8	77
BLOOD Pb, PICA CHILD	0.5	0.9	1.1	1.3	1.5	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.00	1%		0.00	0%
Soil Ingestion	7.0E-3	0.25	99%	1.4E-2	0.51	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Click here for REFERENCES

Spring Hill Property, Waste Rock and Tailings (Excluding Former Mill Area), 97.5 Chebyshev UCL (Mean, Sd), Standard Exposure Scenario

LEAD RISK ASSESSMENT SPREADSHEET 8

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	14.0
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl)						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	0.1	0.2	0.2	0.3	0.3	77
BLOOD Pb, PICA CHILD	0.2	0.4	0.4	0.5	0.6	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.00	1%		0.00	0%
Soil Ingestion	7.0E-3	0.10	99%	1.4E-2	0.20	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Click here for REFERENCES

Spring Hill Property, Background Soil, Student's-t UCL, Standard Exposure Scenario

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	408
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**0.7**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	1.3
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**19.5%**

PRG90 **318**

Click here for REFERENCES

Spring Hill Property, Former Mill Area, Approximate Gamma UCL, Adult Exposure

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	36
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**0.1**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	0.1
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.0%**

PRG90 **318**

Click here for REFERENCES

Spring Hill Property, Former Mill Area, Approximate Gamma UCL, Adult Exposure

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	14
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**0.0**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	0.0
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.0%**

PRG90 **318**

Click here for REFERENCES

Spring Hill Property, Former Mill Area, Approximate Gamma UCL, Adult Exposure

APPENDIX E

Dust Mitigation Plan

DUST MITIGATION PLAN
for
REMEDIAL ACTION
at
SPRING HILL PROPERTY
Grass Valley, California

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, CA 95959

Project No. 3292-04
August 22, 2008

TABLE OF CONTENTS

1 INTRODUCTION

This Dust Mitigation Plan (DMP) describes material handling protocols to reduce the release of metals into the atmosphere during remediation activities and wastewater disposal system installation. The DMP is an element of the Removal Action Workplan (RAW) for soil remediation of mine waste stockpiles within the Spring Hill Property (site) located immediately south of Dorsey Drive and southeast of Highway 49/20 in Grass Valley, Nevada County, California. The assessor's parcel numbers (APNs) for the property are 35-260-62, 35-260-63 and 35-260-64. The RAW describes procedures for excavation and on-site placement of soil that contains elevated concentrations of arsenic and other metals. Approximately 1,700 cubic yards of mine waste and affected soil from a former mill area (Area of Concern (AOC) 1) is to be excavated, transported off-site, and disposed at an appropriate solid waste facility. Approximately 62,300 cubic yards of mine waste and tailings identified at other locations on the site are to be excavated, transported within the site, and buried on-site in a deed-restricted location.

2 PURPOSE

The purpose of this DMP is to:

1. Outline engineering controls to be implemented during remediation activities, including fugitive dust prevention, track-out prevention, surface and stockpile protection, ingress/egress development, vehicle movement, and implementation of best management practices (BMPs).

2. Outline protocol for confirming that engineering controls, as designed, are implemented during mechanical soil disturbance, including site clearing, site grading, underground utility work, transportation, and disposal activities.

3. Outline post-remediation stabilization controls to be implemented after excavation and removal of mine waste and affected soil, and burial of other site mine waste in a deed-restricted location.

3 NOTIFICATION OF COMMENCEMENT OF GRADING

The Nevada County Department of Environmental Health (NCDEH) shall be notified at least ten days in advance of commencement of grading. Contact information is provided below:

Department of Environmental Health
Nevada County Community Development Agency
950 Maidu Avenue
Nevada City, CA 95959
Phone: 530-265-1222
Fax: 530-265-9853
Email: Env.Health@co.nevada.ca.us

4 ENGINEERING CONTROLS

Engineering controls and dust control measures apply to all mechanical soil disturbances in affected soil areas on the site, including mine waste stockpiles, mine waste placement areas, and naturally mineralized areas. Construction activities are defined in this document as any mechanical soil disturbance in the affected soil areas. Mechanical soil disturbance may result from activities such as clearing, grading, excavation, fill placement, compaction, and movement of equipment over unprotected surfaces.

4.1 SUMMARY OF GENERAL CONTROLS

The engineering controls described below shall be implemented during any mechanical soil disturbance associated with the proposed remediation activities. Alternate engineering controls proposed by the contractor that are not included in this DMP must be approved by the California Department of Toxic Substances Control (DTSC) prior to commencement of any soil disturbance.

4.1.1 Area of Disturbance

The areas of disturbance should be delineated by staking or marking prior to commencement of construction activity, including vertical extent of excavation and fill placement.

4.1.2 Track Out Prevention

No soil is allowed to leave the work areas through vehicle track-out or any other means. Track-out controls shall be implemented as follows:

- The ingress and egress route is to be developed prior to construction. If more than one ingress/egress route is used, track-out prevention protocol shall be maintained at each location.

- Vehicles and equipment shall be visually inspected for soil or mud accumulation, and shall be washed or brushed down as necessary at the ingress/egress location before leaving the property.

- A gravel pad or metal screen may be used to clean tires at the ingress/egress locations. The gravel pad should be composed of gravel at least 1-inch or larger, with a silt content of less than 5 percent. The gravel pad, if used, is to be maintained in good condition, and repaired as necessary to maintain the integrity of the pad.

- BMPs shall be implemented at the ingress/egress location. BMPs shall be adhered to during road wetting and rinsing of vehicles.

4.1.3 Soil Stockpiles

Soil stockpiles shall be protected by sufficient wetting with water spray, application of chemical dust suppressant, or by tarp or plastic covering.

- Active stockpiles are to be adequately wetted or covered with tarps.

- Inactive stockpiles (stockpiles that will remain inactive for more than seven days) shall be protected by (1) keeping the surface adequately wetted; (2) applying chemical dust suppressants or stabilizers according to manufacturer’s directions; or (3) covering with tarps.

4.1.4 Traffic Control

Proposed travel routes, parking areas, and staging areas must be established prior to commencement of grading.

- Maximum vehicle speed for any vehicle or equipment on the site shall be 15 miles per hour. Slower vehicle speeds may be necessary to reduce soil disturbance or dust generation.

- Vehicular and equipment travel should be limited to designated areas.

- Only vehicles and equipment directly involved with site grading and utility work, including refueling and maintenance vehicles, should be allowed in the designated work area during excavation and grading activities. All other vehicles and equipment shall remain parked in a designated clean area on-site.

- Access routes within the site must be stabilized by watering or applying chemical dust suppressants, according to manufacturer's directions, as necessary to control fugitive dust emissions.

- The remediation contractor is responsible for traffic control on-site and on public roadways.

4.1.5 Earthmoving Activities

Dust mitigation measures shall be initiated prior to commencement of remediation activities, and should continue until confirmation that waste and affected soil has been removed from the site. Recommendations to be implemented during site grading are provided below.

- Prior to and during any ground disturbance, water shall be sprayed to sufficiently wet areas of disturbance and stockpiled soil. The contractor shall supply a water truck of adequate size and capacity for this purpose. Wetting should fully extend to the anticipated depths of the excavation. All soil/rock material shall be adequately wetted such that no visible dust emissions occur. Sufficient moisture may be determined by the field test described below.

- Grading operations shall be suspended when, despite application of dust mitigation measures, wind speeds are high enough to result in fugitive dust emissions.

- BMPs shall be implemented during construction activities. All water that could potentially contain affected soil shall be retained on-site. All sediment collected shall be retained on-site.

4.1.6 Field Determination of Moisture

Field testing for determination of sufficient moisture content will be conducted as follows:

1. A one-quart soil sample shall be taken from the top 3 inches of the disturbed area or stockpile;

2. The sample shall be poured from a height of 4 feet above a clean hard surface; and

3. The material will be considered adequately wetted if no observable dust is emitted when the material is dropped.

4.1.7 On-Site Trucking

Hauled material must be adequately wetted to prevent dust from blowing out of the trucks. Additionally, the loads must be contained within cargo compartments that are covered with tarps, or loaded so that the material does not touch the front, back, or sides of the cargo compartment at any point less than 6 inches from the top of the compartment.

4.1.8 Air Monitoring

At this time, air monitoring will not be required for the project unless visible dust emissions are observed. The lead agency or local enforcement agency may require air monitoring at any time during the project. If conditions arise such that air monitoring is required, air monitoring shall be conducted in accordance with this DMP. All results of air monitoring shall be reported to NCDEH and DTSC within 48 hours of their collection during the first two weeks of sampling, and within 72 hours of collection for subsequent weeks.

4.2 ENGINEERING CONTROLS BY TASK

The engineering controls noted below are provided to assist in task planning. Engineering controls shall be modified, if necessary, based on observation of fugitive dust emission or air sampling results.

4.2.1 Site Preparation

Prior to commencement of any mechanical disturbance at the site, the following engineering controls should be in place.

- Proposed areas of disturbance, including the vertical extent of excavation and fill placement, should be clearly delineated.

- Ingress/egress and wheel-wash areas should be constructed prior to commencement of grading. The ingress/egress and wheel-wash areas are to be maintained throughout all phases of the project.

- BMP features such as jute mats, fiber rolls, basins, or silt traps should be installed.

- Parking areas should be clearly defined outside the area of disturbance.

4.2.2 Clearing and Grubbing

The following engineering controls shall be implemented prior to and during clearing and grubbing.

- Prior to commencement of clearing and grubbing activities, vegetation and soil surfaces within the areas to be cleared should be sufficiently pre-wetted to prevent generation of fugitive dust from clearing activities. A sufficient amount of water should be used and allowed to soak into the subsurface. No soil disturbance, including removal of vegetation, may occur in any area that has not been sufficiently pre-wetted. Note that pre-wetting may need to occur over a period of days during dry weather, and that pre-wetting may also be necessary during or following periods of rainy weather.

- Water application should continue throughout clearing operations. Water spraying should be fanned over the site, and directed at specific activities, as appropriate. Proposed routes of site access should be sprayed with an amount of water sufficient to prevent generation of visible dust from equipment travel.

4.2.3 Grading

Prior to any soil disturbance, the area of proposed disturbance must be sufficiently and repeatedly wetted, so that no fugitive dust is generated by the activities.

- No soil disturbance may occur in any area that has not been sufficiently pre-wetted. Areas to be excavated should be sufficiently wetted to the depths of the excavation, so that no dust is generated by the excavation.
- Any soil disturbance that results in generation of dust must cease immediately until the area has been sufficiently wetted to a depth necessary to prevent generation of fugitive dust.
- Disturbed areas are to be maintained in accordance with this DMP.

4.2.4 Fill Placement

The following engineering controls shall be implemented prior to and during fill placement.

- Fill material and areas where fill is to be placed should be adequately wetted so that no fugitive dust is generated during fill placement.
- Affected soil and rock is to be placed in a designated fill area within the site. The soil shall be sufficiently wetted prior to placement and throughout the work day, as necessary. At the end of each work day, the material should be wetted to enable crusting of the surface, or covered with plastic sheeting.

5 ADMINISTRATIVE CONTROLS

5.1 OCCUPATIONAL SAFETY & HEALTH ACT

The contractor and crew shall maintain current OSHA certification. Personal air monitoring equipment may be required by the lead agency.

5.2 DMP COMPLIANCE MONITORING

DMP compliance monitoring is to be conducted during any mechanical soil disturbance activity. The contractor shall provide adequate advance notice and information to the lead agency, local enforcement agency, and H&K about site activities so that they may perform the following tasks:

- Confirm implementation of engineering controls such as ingress/egress areas, wheel wash areas, and parking areas outside the area of construction.
- Confirm that sufficient water is available and applied so that no visual evidence of fugitive dust is observed beyond the site boundaries.
- Confirm on-site travel and wheel-wash protocols are regularly implemented.
- Coordinate air sampling with the air monitoring contractor, if air monitoring and/or sampling is required.
- Confirm that proper transportation protocol is observed by the contractor.
- Confirm that affected soil is contained on-site and stockpiled according to the DMP specifications.
- Confirm construction activities are in compliance with the guidelines of the DMP.

5.3 AIR MONITORING PROTOCOL

At this time, air monitoring is not required at the site. However, air monitoring may be required by NCDEH or DTSC at any time. If required, air monitoring and sampling is to be performed in accordance with protocol described below.

- Ambient air sampling should be conducted to establish base line values for ambient airborne PM10 concentrations upwind and downwind of the project site.

- Air sampling and monitoring should be conducted according to a schedule determined by NCDEH or DTSC.

- Air sampling results shall be submitted to NCDEH/DTSC within 48 hours of their collection during the first two weeks of sampling, and within 72 hours of collection for subsequent weeks. Engineering controls shall be modified, if necessary, based on the air sampling results.

- Air sampling should continue until monitoring results indicate that the environmental controls are sufficient to ensure that OSHA Permissible Exposure Levels are not exceeded, or until the termination of site activities.

APPENDIX F

Site Safety Plan

SITE SAFETY PLAN
for
REMEDIAL ACTION
At
SPRING HILL PROPERTY
Grass Valley, California

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, CA 95959

Project No. 3292-05
June 14, 2012

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1 INTRODUCTION

Holdrege & Kull (H&K) prepared this task specific Site Safety Plan (SSP) for services to be performed by H&K in the vicinity of mine waste and other impacted soil associated with historical mining activities at the proposed Spring Hill Property (site) located in Grass Valley, California. The SSP was prepared in accordance with guidelines set forth in the California Hazardous Waste Operations Standard, Section 5192 of Title 8 of the Code of California Regulations (8 CCR 5192); the Hazardous Communications Standard, 8 CCR 5194; OSHA's Safety and Health Standard of Title 29 of the Code of Federal Regulations (29 CFR 1910.120, 29 CFR 1926).

The purpose of this SSP is to establish safe procedures and practices for H&K employees engaged in field activities associated with excavation and sampling activities at the site. This SSP is for employees of H&K. However, it will be read and signed by site visitors and subcontractors prior to work associated with site remediation and sampling.

The health and safety guidelines and requirements presented herein are based on a review of available information and an evaluation of potential hazards. The plan describes the health and safety procedures and equipment required for excavation and soil sampling in order to minimize the potential for exposures to field personnel. Should circumstances during the course of field work be extraordinarily different than anticipated, field work shall be temporarily stopped, so that potential hazards can be evaluated and appropriate health and safety precautions implemented.

It is not possible in advance to discover, evaluate and protect against all possible hazards which may be encountered. Adherence to the requirements of this SSP will significantly reduce, but not eliminate, the potential for occupational injury and illness at the project site.

The provisions of this SSP will be implemented by H&K personnel. All contractors, subcontractors and other visitors are responsible for their own health and safety. However, all H&K subcontractors are to comply with the requirements of this SSP at a minimum. Subcontractors are to develop their own SSP which addresses all anticipated hazards associated with their scope of work.

Section 2 of this SSP describes the site location and field activities. Section 3 presents the key personnel for this task. Section 4 provides a description of the known site hazards and procedures for protecting workers. Section 5 specifies routine and special training for this task. Section 6 discusses the levels of personal protection. Section 7 discusses medical surveillance requirements. Section 8 discusses the delineation of work areas and site access control. Section 9 contains the decontamination procedures. Section 10 presents references.

2 BACKGROUND AND SETTING

Relic features associated with historical mining activity were identified as part of a preliminary endangerment assessment of the site. Identified abandoned mine features are associated primarily with hard rock gold mining. Remedial activities have been proposed for mine waste and other impacted soil at the site.

2.1 FIELD ACTIVITIES

The proposed work includes observation of excavation activities and collection of confirmation soil samples. Excavation activity will include the use heavy equipment and sampling will be performed using hand-tools and hand operated sampling devices as described in the Removal Action Workplan (RAW) and Verification Sampling and Analysis Plan (VSAP).

3 KEY PERSONNEL AND RESPONSIBILITY

3.1 H&K CHAIN OF COMMAND

Jason W. Muir, PE, is the Project Manager. Pam Raynak, or another qualified H&K employee who is designated prior to the start of the remedial action, will perform confirmation sampling and act as site safety officer (SSO). Other H&K staff may also perform sampling and observation. The SSO has the authority to monitor and correct health and safety problems as noticed on site. The project field staff have completed 40 hours of comprehensive health and safety training which meets the requirements of 8 CCR 5192 and 29 CFR 1910.120. The SSO will make this SSP available to each member of the H&K field team, subcontractors and site visitors.

The project staff is responsible for ensuring that all data acquisition is performed in accordance with the project workplan and SSP, and that deviations from the plans are based upon field conditions encountered and are well documented in the field notes. The field team's health and safety responsibilities include:

1. Following the SSP;

2. Reporting any unsafe conditions or practices to the SSO;

3. Reporting all facts pertaining to incidents which result in injury or exposure to toxic materials to the SSO;

4. Reporting equipment malfunctions or deficiencies to the SSO.

The SSO has on-site responsibility for ensuring that all field team members, including H&K personnel, comply with the SSP. It is the SSO's responsibility to inform the subcontractors and other field personnel when chemical and physical hazards arise. Additional SSO responsibilities include:

1. Providing site safety briefing for team members;

2. Updating equipment or procedures to be used on site based on new information gathered during the site investigation;

3. Inspecting all personal protective equipment to be used by H&K or subcontractors to H&K;

4. Assisting the Project Manager by documenting compliance with the SSP by completing employee and subcontractor SSP acknowledgment forms (Appendix A);

5. Evaluating the effectiveness of field decontamination procedures for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles;

6. Discussing with H&K personnel the location and route to the nearest medical facility and arranging for emergency transportation to the nearest medical facility;

7. Discussing with H&K personnel the telephone numbers of local public emergency services (e.g., police and fire);

8. Reporting injuries and/or illnesses using the accident report form (Appendix B); and

9. Stopping operations that threaten the health and safety of the field team and/or surrounding populace.

3.2 SUBCONTRACTOR PERSONNEL RESPONSIBILITIES

All subcontractors are responsible for their own SSP. A written SSP must be available for County of Nevada review if requested.

3.3 VISITORS

Visitors to the work areas are responsible for their own health and safety, but will be provided with a copy of this SSP to read and sign. Following is a list of project contacts.

Jason W. Muir, PE (H&K) Office: 530-478-1305
Project Manager Mobile: 530-362-2776

Pam Raynak, PG (H&K) Office: 530-478-1305
Project Geologist/SSO Mobile: 530-362-0032

Wesley Nicks, Director Office: 530-265-1464
Nevada County Department of Environmental Health
Local Enforcement Agency (LEA) representative

Dean Wright, PE Office: 916-255-6528
California Department of Toxic Substances Control
Lead Agency representative

4 HAZARD EVALUATION

The potential hazards to personnel working at this site have been identified as chemical and physical. Each potential hazard relative to the potential for exposure is described below.

4.1 CHEMICAL HAZARDS

The soil to be excavated contains elevated concentrations of metals. Exposure to metals in the mine waste and affected soil may occur through the following exposure routes: ingestion of soil or soil dust, inhalation of soil dust, and dermal contact with soil. Application of water to the affected soil is essential to control fugitive dust emissions. Exposure may be reduced by the use of PPE such as boots, long-sleeved clothing, gloves and dust mask or respirator. Proper decontamination is important to remove contaminants prior to leaving the affected areas and to limit exposure. Table 4-1 presents general information for potential chemical hazards that could possibly be encountered during excavation and sampling. The information includes exposure limit recommendations, routes of exposure, and typical signs and systems of exposure. Contaminants other than those listed in Table 4-1 may be encountered.

4.2 PHYSICAL HAZARDS

Physical hazards associated with this project include working near heavy equipment (e.g., excavator and loader), heavy lifting, physical strain associated with sampling activities, pinching/cutting/crushing associated with use of mechanical sampling devices and hand tools, slip/trip/fall due to uneven ground surface or mine excavation, potential soil instability near steep excavations, weather conditions, venomous insects, poison oak and noise.

4.2.1 General

Uneven ground surface and/or debris may increase risk of injuries. Personnel shall wear appropriate footwear while on site. Personnel shall wear hard hats, brightly colored (orange/yellow) vest or equivalent, and shall be aware of equipment activities at all times. Keep within view of operators and out of the vicinity of heavy equipment unless required for a specific task. On-site personnel need to be aware of the position and movement of heavy equipment at all times. Adequate clearance from the equipment will be maintained at all times. Eye contact will be maintained by personnel with the equipment operator prior to passing in front of the equipment.

Based on the site characterization results, the limited number of days anticipated for site excavation (ten working days), and required application of water for dust suppression during soil excavation, airborne levels of metals are expected to be low. During excavation no respiratory protection is required and operations will be performed wearing normal work uniforms with disposable gloves and coveralls (modified Level D personal protection), and dust masks. During the remedial activities, soil moisture content will be maintained to reduce the potential for dust generation.

If, during the excavation or screening process, the site safety officer or any site worker observes fugitive dust emissions from the excavation or stockpiled material, water will be applied to the soil. If sufficient soil moisture cannot be maintained, the site safety officer will stop work and evaluate the appropriateness of additional personal protection measures (Level C), or resumption of work under more favorable conditions.

4.2.2 Noise

Noise levels around heavy equipment can exceed a comfortable range; ear plugs are recommended. Use of hearing protective devices (HPDs) is required whenever the noise level equals or exceeds 85 dBA. In the absence of noise monitoring equipment, an elevated noise level will be defined as a situation where a person cannot be heard above equipment noise while speaking in a normal voice from a distance of two feet. If this condition occurs, the SSO will require that personnel affected by the noise hazard use HPDs.

4.2.3 Equipment Safety

Standard operating safety procedures will be followed by H&K and its subcontractors working around mechanical equipment. Equipment shall be in good operating condition and used in accordance with manufacturer's specifications. Rags, towels or other absorbent materials will be available to clean up any incidental spills that may occur. No hazardous materials in excess of reportable quantities will be brought on-site by H&K personnel.

4.2.4 Sunburn

Working outdoors on sunny days for extended periods of time can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field personnel should take precautions to minimize the risk of sunburn by using sun-screen lotion of at least 15 SPF and/ or wearing hats and long-sleeved garments.

4.2.5 Venomous Insects, Arachnids and Snakes

The project site provides potential habitat for rattlesnakes, and venomous insects and arachnids. Field personnel will wear boots and long pants to reduce potential bite exposure areas. Care should be taken in approaching and accessing areas where snakes and insects may be hidden. Personnel should periodically check clothing, hair and skin during the workday for the presence of ticks.

4.2.6 Poison Oak

The project site provides potential habitat for poison oak, which commonly causes itching skin lesions when contacted. All field personnel should be able to identify poison oak and avoid contact with it during site work. In addition, personnel will wear long pants to minimize incidental contact with poison oak plants. If contact is unavoidable, additional protective clothing such as disposable coveralls should be worn to reduce potential transfer of plant oils to clothing and skin.

4.2.7 Hazards Associated with Soil Sampling Activities

The level of personal protection required for soil sampling is modified Level D, provided that fugitive dust emissions are controlled during on-site activities by application of water to affected mine waste and soil. Soil samples may be obtained using a backhoe, slide-actuated hand sampler, or other hand tools. If working near a backhoe, personnel should follow the guidelines for working near heavy equipment as described in the sections above. If using mechanical samplers or hand tools, personnel should maintain awareness for pinching, crushing, or cutting potential from moving parts or sharp edges. OSHA guidelines should be followed for entry into open excavations.

5 TRAINING REQUIREMENTS

All H&K personnel working on-site have completed training in hazard recognition and basic health and safety issues as required by OSHA regulations contained in 8 CCR 5192 and 29 CFR 1910.120 (e). In addition, each H&K employee working on site and each subcontractor will be familiar with the requirements of this task-specific SSP, and will participate in site activity and safety briefings. The SSO will document site safety activities and implementation of this plan. Prior to new field activities, H&K and subcontractor personnel will conduct a tailgate safety briefing in the field.

6 PERSONAL PROTECTIVE EQUIPMENT

Based on the chemical information and hazard analysis, Level D protection will be initially required for excavation activities and sampling activities. If excessive dust is generated during excavation, dust masks will be required.

Level D protection consists of steel-toed boots, long pants, hard hat, hearing protection, safety glasses or goggles, and gloves if in contact with mine waste and/or contaminated soil.

7 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance of H&K employees is to be conducted meets the requirements of 8 CCR 5192 and 29 CFR 1910.120 (f). There are no identified additional medical surveillance requirements associated with this project.

8 SITE CONTROL MEASURES

The potential chemical and physical hazards have been identified in this SSP; however, should site specific or unexpected conditions arise, the SSO will stop all work at the site and the Project Manager will be notified. Work will not be completed until the SSP has been revised or re-evaluated accordingly.

Break or eating areas shall be located away from the work zone and upwind. In the instance where work is continued to the next day, the work site shall be secured prior to leaving the site. Communication between field team members will consist of verbal communication and hand signals if necessary.

8.1 DAILY START-UP AND SHUTDOWN PROCEDURES

The following protocol will be followed prior to daily start-up and shutdown during field activities:

1. The SSO will review site conditions with respect to modification of work and the task specific SSP;

2. Field personnel will be briefed and updated on safety procedures;

3. The SSO will ensure that first aid equipment is readily available;

4. At the shutdown of daily operations, and in between individual field events, all reusable equipment will be decontaminated and secured.

8.2 WORK ZONES FOR EXCAVATION ACTIVITIES

Designated work zones will be established as appropriate for exclusionary work areas, contamination reduction, and support. The primary means of maintaining site control and reducing the potential for migration of hazardous materials into uncontaminated areas during sampling activities will be by the use of disposable sampling equipment and decontamination of reusable equipment between each sampling event.

8.3 TRAFFIC CONTROL

Based on the volume of soil to be removed, we anticipate that approximately 100 truck loads will be removed from the site. We anticipate that removal of the mine waste and affected soil will take ten working days and that between approximately

10 and 15 truckloads per day will be removed. The trucks will exit the site via Spring Hill Drive, a double lane public roadway. The trucks will turn right onto Idaho Maryland Road (a public road) and continue to State Highway 49 to haul soil to the landfill for disposal.

Safe work practices and traffic control measures are to be employed during the project. We propose to post signs on Spring Hill Drive near the property boundary and on Idaho-Maryland Road near the intersection with Spring Hill Drive to alert motorists of truck traffic. The contractor will use radio or cell phone communication on Spring Hill Drive to direct traffic. When trucks are ready to enter Idaho Maryland Road, a flagman will be informed so they can stop residential traffic until the road is clear of trucks. During truck hauling of equipment and soil, contractors are to use reasonable precautions to avoid damaging the road. Precautions such as operating trucks at a speed of 15 miles per hour or less while traveling on Spring Hill Drive, staying on the pavement and avoiding tire contact on the pavement edge, and avoiding hard braking are to be used.

A Start Work Notification will be distributed to residents within a quarter mile of the job site. Project contact information will be provided in the Start Work Notification.

8.4 WORK PRACTICES

Safe work practices for this project are listed below:

1. Set-up, assemble, and check all equipment for integrity and proper function before starting work activities.

2. Do not use faulty or suspect equipment.

3. Use only new and intact protective clothing. Change gloves, etc., if they tear.

4. Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.

5. Practice contamination avoidance at all times.

6. Do not smoke, eat, or drink within the excavation and sampling areas.

7. Wash hands, face and arms at all breaks and prior to leaving the site at the end of the work day.

8. Perform decontamination procedures completely as required.

9. Notify the Project Manager immediately if there is an accident that causes an injury or illness.

8.5 EMERGENCY MEDICAL TREATMENT

In the event of a medical emergency, local rescue agencies should be contacted by calling 911.

In the event that non-emergency medical treatment is necessary, the nearest medical facility is Sierra Nevada Memorial Hospital at 155 Glasson Way in Grass Valley, California. The hospital phone number is 530-274-6000.

Directions to the hospital are as follows:
From the site go northwest on Dorsey Drive towards East Main Street.
Turn left on Catherine Lane.
Turn left on Glasson Way. The hospital is on the right.

9 DECONTAMINATION

Decontamination procedures associated with excavation and soil sampling activities will take place prior to leaving all work areas and sample locations and/or prior to reusing equipment at a new sampling location, as set forth in the scope of work.

10 REFERENCES

10.1 FEDERAL HEALTH AND SAFETY REQUIREMENTS

EPA Order 1440.1- Respiratory Protection

EPA Order 1440.3- Health and Safety

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. June 1994.

OSHA Safety and Health Standards 29 CFR 1910 (General Industry), U.S. Department of Labor, Occupational Safety and Health Administration.

OSHA 29 CFR 1910.120 Hazardous waste Operations and Emergency Response, Final Rule, U.S. Department of Labor, Occupational Safety and Health Administration.

OSHA Safety and Health Standards 29 CFR 1926 (Construction Industry), U.S. Department of Labor, Occupational Safety and Health Administration.

Standard Operating Safety Guidelines, USEPA, Environmental Response Branch, Hazardous Response Support Division, Office of Emergency Response.

10.2 STATE HEALTH AND SAFETY REQUIREMENTS

California Code of Regulations, Title 8, Chapter 4, Subchapter 4, Construction Safety Orders.

California Code of Regulations, Title 8, Chapter 4, Subchapter 5, Electrical Safety Orders.

California Code of Regulations, Title 8, Chapter 4, Subchapter 7, commencing with Section 3200, CAL/ OSHA General Industry Safety Orders.

California Code of Regulations, Title 22, Division 4, Chapter 30, commencing with Section 66000, California Department of Health Services, Toxic Substances Control Program.

Table 4-1 – Potential Chemical Hazards Spring Hill Property RAW						
Chemical Name	NIOSH Recommended Exposure Limit (REL)	OSHA Permissible Exposure Limit (PEL)	IDLH Level	Routes of Exposure	Symptoms of Exposure	Ionization Potential/ Flammable Limits
Asbestos	0.1 fiber/cm^3	8-hour time weighted average (TWA) airborne concentration of 0.1 fiber/cm^3 (averaged over a sampling period of 30 minutes)	Not determined	Inhalation, ingestion, contact	Asbestosis (chronic exposure): dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function, finger clubbing; irritation eyes; [potential occupational carcinogen]	n/a
Arsenic (organic)	none	0.5 mg/m^3 TWA	Not determined	Inhalation, ingestion, contact	In animals: irritation skin, possible dermatitis; respiratory distress; diarrhea; kidney damage; muscle tremor, convulsions; possible gastrointestinal tract, reproductive effects; possible liver damage	n/a
Lead	0.050 mg/m^3 TWA	0.050 mg/m^3 TWA	100 mg/m^3 (as Pb)	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	n/a
Mercury (colloidal or metallic)	0.05 mg/m^3 TWA	0.1 mg/m^3 TWA	10 mg/m^3	Inhalation, skin and eye contact, absorption, ingestion	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	n/a
Title 22 Metals	Varies depending on specific metal—see NIOSH guide for specific REL	Varies depending on specific metal—see NIOSH guide for specific PEL	Varies depending on specific metal	Inhalation, skin absorption and contact, ingestion	Varies depending on specific metal	n/a

APPENDIX

Health and Safety Plan Acknowledgment Form

Accident Report Form

Hospital Route Map

HEALTH AND SAFETY PLAN ACKNOWLEDGMENT FORM

The undersigned acknowledges that he/she has received a copy of the Task Specific Health and Safety Plan for the Spring Hill Property RAW and that he/she has read and understands the contents of the plan.

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

Name Company

Signature Date

ACCIDENT REPORT FORM

This form should be completed in the event of an accident on-site which involves H&K, subcontractor, LEA or client personnel resulting in illness or injury.

H&K Project No.____________ Date________________

Project Name ____

Project Location____

Accident Location____

Personnel Involved ____

____

Description of Incident ____

____

____

____

____

Action Taken ____

____

____

____

Results ____

____

SSO notified? Yes_____ No_____

If not, why? ____

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HOSPITAL ROUTE MAP
SPRING HILL PROPERTY
Dorsey Drive
Grass Valley, California

PROJECT NO. 3765-05

JUNE 2012

APPENDIX G

Verification Sampling and Analysis Plan

VERIFICATION SAMPLING AND ANALYSIS PLAN for REMOVAL ACTION at SPRING HILL PROPERTY

Grass Valley, California

Prepared By:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3292-04
August 22, 2008 (Updated June 14, 2012)

TABLE OF CONTENTS

1 INTRODUCTION

This Verification Sampling and Analysis Plan (VSAP) is an element of the Removal Action Workplan (RAW) for soil remediation of mine waste and affected soil within the Spring Hill Property (site) located off of Dorsey Drive in Grass Valley, California. The site comprises assessor's parcel numbers (APNs) 35-260-62,63 and 64. The RAW describes procedures for excavation and on-site placement of soil that contains elevated concentrations of arsenic and other metals. In addition, approximately 1,700 cubic yards of mine waste (mill tailings and affected soil) are to be removed from Area of Concern (AOC) 1 and transported to appropriate solid waste disposal facilities. Approximately 62,000 cubic yards of mine waste (mill tailings and waste rock) are to be excavated from AOC 2 and relocated on-site in a deed-restricted location. The objective of verification sampling is to confirm the removal of soil that contains total and soluble metals concentrations which exceed the remediation goals.

2 PERFORMANCE STANDARDS AND GUIDANCE

Sampling and analysis will be performed in accordance with applicable guidance and requirements set forth pursuant to the Comprehensive Environmental Response Compensation Liability Act (CERCLA) as amended by the Superfund Amendment and Reauthorization Act (SARA); the National Contingency Plan (NCP); and local, state, and federal practices in effect at the time of performance of the work.

3 DESIGN AND PLACEMENT OF SAMPLING GRID

Systematic verification will be performed within the soil removal areas to distribute sample locations uniformly over the areas of excavated soil. Systematic sampling will be implemented by establishing a sample grid over portions of the excavation areas located outside of the proposed on-site waste placement area.

The areas of concern (AOC 1 and AOC 2) comprise approximately 280,000 square feet (6.4 acres). Of this, approximately 99,000 square feet (2.3 acres) are located within the on-site placement area. Verification sampling and analysis is to be performed in the portions of AOC 1 and AOC 2 outside of the waste placement area, which comprises approximately 181,000 square feet (4.1 acres).

The minimum sample frequency is one sample per 2,500 square feet of footprint area (50 feet by 50 feet), resulting in an estimated 72 verification soil samples. In addition, samples will be obtained from the perimeter of the excavation areas (outside of the placement area boundary) at a maximum spacing of one sample per 100 feet, resulting in an estimated 15 samples for 1,430 feet of excavation perimeter.

In total, an estimated 87 verification soil samples will be obtained from the base and perimeter of the excavation areas. An additional nine samples (at least 10 percent of the total number of samples) will be obtained as field duplicates.

The samples will be analyzed for total arsenic, lead, mercury, and copper, which are considered constituents of potential concern (COPCs) for both AOC 1 and AOC 2. In addition, samples obtained from AOC 1 will be analyzed for total vanadium, which is considered a COPC for only AOC 1. COPC evaluation and remediation goals are summarized in Table 1 of the RAW.

Soluble metals concentrations were characterized as part of the PEA. Soluble arsenic and lead concentrations detected in AOC 1 are not suitable for on-site placement and may require further characterization prior to landfill disposal. The soluble arsenic and lead concentrations detected in AOC 2 have been deemed suitable for on-site placement and do not require further characterization.

Provided that the results of verification soil sample analysis for total metals meet the remediation goals, verification soil sample analysis for soluble metals is not anticipated to be necessary. However, if the results of total metals analysis suggest that soluble metals concentrations may exceed the remediation goals, the associated verification soil samples will be analyzed for the corresponding soluble metals.

The lateral and vertical extent of the proposed excavations shall be increased locally to facilitate removal of soil that contains metals concentrations which exceed the target cleanup levels. If the initial results of verification soil sampling indicate that further excavation is warranted, additional verification soil sampling will be required to confirm the effectiveness of the additional excavation. If the excavation is enlarged, additional samples will be obtained as needed to achieve the minimum sample frequency.

4 SAMPLING PROCEDURES

Following soil removal activities, grid cell locations will be identified using a graduated tape measure and a fixed site feature as the control point to reference the grid. Grid node locations will be identified by wood stakes placed on north-south and east-west axes of the perimeter of the excavation. Each grid cell will be identified with a sequential alphanumeric numbering system (A-1, A-2, B-1, etc.).

One verification soil sample will be collected from each cell. Samples will be collected from cells that are completely within the removal area or that overlay the removal area by 50 percent or more (i.e., cells along borders). Sample locations and the number of samples may be adjusted in the field if necessary.

The following is a summary of equipment that may be used during verification soil sampling activities:

- Hand trowel;
- Disposable scoops;
- Hand-held impact sampler;
- Measuring tape;
- 8-ounce pre-cleaned, laboratory-supplied, glass sample jars;
- Stainless steel sample tubes;
- Zip-lock plastic bags;
- Paper towels;
- Personal protective equipment;
- Pre-moistened towelettes;
- Insulated transport/storage container and appropriate packing supplies;
- Buckets, brushes and laboratory-grade soap for equipment decontamination;
- Sample labels;
- Chain-of-custody forms; and
- Sample collection log, sub-area field map, water-resistant ink pen, and daily field report forms.

Verification sampling will be conducted according to the procedures described below. A pre-cleaned trowel or hand-held impact sampler will be used to collect approximately four ounces of soil from each sampling point within the excavation. The soil will be placed directly into clean 4-ounce glass containers provided by the laboratory. Sample containers will be sealed with Teflon™-lined lids and will be labeled and placed in a refrigerated container for shipment to the laboratory.

5 DECONTAMINATION AND SAMPLE HANDLING PROCEDURES

The sample collection equipment, if not pre-cleaned, will be cleaned with a laboratory grade soap and distilled water solution and rinsed with distilled water between sample locations, or by using pre-moistened towelettes if only metals are to be analyzed. Used sampling materials and personal protective equipment (i.e., spent decontamination towelettes, gloves, paper towels, etc.) will be properly disposed off-site.

Sample jars will be sealed with Teflon™-lined lids. Sample containers will be labeled and placed in a refrigerated container for transport to the project analytical laboratory under chain-of-custody protocol.

The samples will be identified using a numbering system which will consist of the cell identification and the date the sample was collected. Samples will be identified with a label affixed to the sample jar. The following information will be specified on each label:

- Project name;
- Project number;
- Date and time of sample collection; and
- Sample identification number.

Samples will be transported to the laboratory by courier and will be accompanied by three-copy, pressure sensitive chain-of-custody forms. The form will accompany every sample shipment to the analytical laboratory to document sample possession from the time of collection. The form will contain the following information:

- Sample identification number;
- Signature of collector;

- Date and time of collection;
- Site name and project number;
- Sample matrix;
- Sample container description;
- Analyses requested;
- Special analytical procedures requested (if applicable);
- Remarks (expected interferences, hazards, unusual events at the time of sampling), if applicable;
- Preservatives added (if any);
- Special sample preparation (if applicable);
- Destination of samples (laboratory name);
- Signature of persons involved in chain of possession (relinquished by and received by); and
- Date and time of sample receipt at laboratory.

The two top sheets of the chain-of-custody form will be placed in a water-tight plastic bag which will be taped to or placed in the cooler for transport.

When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and record the time on the chain-of-custody form. A separate chain-of-custody form will accompany each sample shipment. The method of shipment and courier name(s) will be entered on the chain-of-custody form.

Daily field activities will be recorded on daily field report forms that indicate the date and time of field observations made by field personnel. All field forms will be signed by field personnel.

Information pertinent to soil sampling will be recorded in water-resistant ink on daily field logs. Entries in the field log will include the following information:

- Location of sampling site (cell coordinates);
- Names and affiliations of all sampling team members;
- Surface lithology;
- Date and time of sample collection;
- Description of deviations from sampling plan (if any);

- Sample destination (e.g., name of laboratory); and
- Signature of personnel responsible for sampling.

Original data recorded in field logs, chain-of-custody forms, and on other forms will be written in water-resistant ink. Original record documents (field logs and chain-of-custody forms) will not be destroyed or discarded, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on a document assigned to one individual, that individual will make corrections by drawing a line through the error, entering the correct information, and initialing and dating the change. The erroneous information should not be obliterated. If possible, any subsequent error(s) discovered on a document will be corrected by the person who made the entry.

6 LABORATORY PROCEDURES

Samples will be analyzed by a laboratory that is certified by the California Department of Health Services for performing the analyses requested. The verification soil samples will be analyzed for total metal COPCs using U.S. EPA Test Method 6010B/7471A. The laboratory reporting limits for arsenic, copper, lead, mercury and vanadium will be less than half of value of the corresponding cleanup goal.

The following table summarizes the analyses to be performed on verification samples from each remediation area.

Verification Soil Sample Analyses		
Remediation Area	Constituent	Analysis Method
AOC 1	Arsenic, Copper, Lead, Vanadium	EPA 6010B
AOC 1	Mercury	EPA 7471A
AOC 2	Arsenic, Copper, Lead	EPA 6010B
AOC 2	Mercury	EPA 7471A

Sample handling procedures used by the laboratory may vary from the procedures specified herein as long as they fulfill the objective of maintaining sample integrity and traceability.

6.1 Chain-of-Custody Procedures

The sample custodian at the laboratory will accept custody of delivered samples and verifies the following information:

1. All samples are present;
2. All samples are in good condition;
3. All samples are accompanied by a properly completed chain-of-custody form;
4. The sample identification is complete and corresponds to the chain-of-custody form; and
5. The condition of custody seals and temperature of the ice chest interior.

If sample integrity is questionable, the sample custodian will notify the laboratory's project administrator, who in turn will notify the H&K project manager. Arrangements can then be made for sample replacements to be shipped to the laboratory. The sample custodian will document the sample condition on the sample custody log and sign the chain-of-custody form.

6.2 Logging of Laboratory Samples

After chain-of-custody procedures are complete and acceptable, the sample custodian will assign laboratory identification numbers to the samples. Laboratory sample identification numbers may be written on the chain-of-custody form for tracing purposes. The custodian will transfer the samples to the proper analyst(s) or store the samples in an appropriate secure area.

Laboratory personnel are responsible for the care and custody of samples from the time they are received until the sample is exhausted. Data sheets and laboratory records are retained as part of the permanent documentation for at least three years.

6.3 Sample Preparation and Analysis

Samples collected from each grid will be thoroughly homogenized to ensure sample uniformity. Homogenization will be performed by thoroughly mixing the sample prior to obtaining a portion for digestion. Homogenization will be verified by the laboratory by analysis of duplicate samples. Duplicate samples will be obtained at a frequency of 10% of the total number of samples.

6.4 Sample Storage

Samples and extracts are retained by the analytical laboratory for up to 30 days after the data are reported by the laboratory. Unless notified by the program managers, excess or unused samples will be disposed by the laboratory in a manner consistent with appropriate government regulations.

6.5 Alternate Field Analysis by XRF

On-site field analyses for metals in soil may be conducted using portable X-ray fluorescence (XRF) equipment in accordance with USEPA Method 6200 in lieu of laboratory analysis. Initial and continuing calibration should be conducted in accordance with the manufacturer's instructions.

XRF operators should possess a Radioactive Materials License issued by the California Department of Health Services, and should be trained to operate the specific equipment used.

Provided that samples are well-homogenized, sieving and grinding for sample preparation are optional. Moisture content above 20% may interfere with analysis, and samples should be sufficiently dried to obtain an acceptable correlation coefficient as described below.

For data validation, laboratory analysis will be performed on a minimum of ten percent (not less than five) of the samples field-analyzed by XRF. Confirmatory soil samples should be split from the well-homogenized sample material. Confirmatory soil samples should be selected from the lower, middle and upper ranges measured using XRF. Results of least-squares regression of field and laboratory data must demonstrate a correlation coefficient (r^2) value of at least 0.8 for the XRF data to be considered valid.

7 REMEDIAL MEASURES CRITERIA

The goal of the remediation is to reduce the potential human health risk associated with metals in mine waste and affected soil. Target cleanup concentrations for COPCs are summarized below and in Table 1 of the RAW.

Proposed Cleanup Goals for Unrestricted Land Use

- Arsenic: 17 mg/kg, a background threshold value (BTV) estimated as the 95th percentile value for local background soil arsenic concentrations (see Appendix C of the RAW).
- Copper: 2,800 mg/kg, a risk-based cleanup level (RBCL) derived in Table 8 of the RAW.
- Lead: 80 mg/kg, a RBCL derived in Table 2 of the RAW.
- Mercury: 18 mg/kg, a RBCL derived in Table 5 of the RAW.
- Vanadium: 117 mg/kg, a BTV value estimated as the 95% Upper Percentile Limit (UPL) for site background soil vanadium concentrations (statistical output is presented in Appendix C of the RAW).

Proposed Cleanup Goals for On-Site Placement and Deed Restriction

- Arsenic: 22 mg/kg based on construction worker exposure.
- Copper: 10,000 mg/kg, a RBCL derived in Tables 9 and 10 of the RAW.
- Lead: 260 mg/kg, a RBCL derived in Tables 3 through 5 of the RAW.
- Mercury: 82 mg/kg, a RBCL derived in Tables 6 and 7 of the RAW.
- Vanadium: 260 mg/kg, a RBCL derived in Tables 11 and 12 of the RAW.

8 QUALITY ASSURANCE

The purpose of the following quality assurance plan is to specify procedures to be followed to maintain consistent quality of field and laboratory data.

8.1 Data Quality Objectives

H&K developed data quality objectives (DQOs) to address the level of uncertainty in data that will be used to address the study question and support the decision. The DQOs are to be used as measurement performance criteria for new data and as acceptance criteria for the inclusion of existing data. Laboratory quality control procedures address data quality indicators (DQIs) such as precision, bias and accuracy. DQIs such as representativeness and comparability are addressed in the *Quality Control* section below. Completeness will be assessed based on comparison of the number of valid measurements completed with the minimum frequencies set forth in the VSAP. Sensitivity is governed by the laboratory practical quantitation limits (PQLs), as discussed below.

PQLs, or laboratory reporting limits (RLs), for arsenic and lead in soil are to be no higher than 2 mg/kg. The DQOs are based on laboratory PQLs, which are lower than the corresponding remediation goals. H&K anticipate that the PQLs will be appropriate for the purposes of the VSAP.

8.2 Special Training/Certifications

Personnel working on the project site shall be certified under OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910). Analytical laboratories will be certified by the State of California.

8.3 Documentation and Records

The project manager will distribute the VSAP to the project staff. Project staff is to review the pertinent sections of the RAW and VSAP prior to performing the relevant tasks.

Global Positioning System (GPS) data, chain-of-custody documentation, field maps and photographs will be maintained at H&K's Nevada City office for a period of five years following the investigation.

Sample location maps, sample collection methodology and quality control procedures, laboratory reports and chain of custody documentation will be included in the closure report. Approved documents, including the PEA Report, RAW, and closure report, are to be retained at DTSC's Sacramento office.

8.4 Quality Control

The following quality control procedures will be employed:

- Duplicate soil samples will be obtained at a frequency of 10% of the total number of samples to assess comparability, precision and representativeness.

- The laboratory will perform laboratory quality control procedures such as method blanks and matrix spike samples to assess accuracy and bias.

- Laboratory analysis of samples analyzed in the field by XRF will be performed at a frequency of 10% of field-analyzed samples to validate the XRF results.

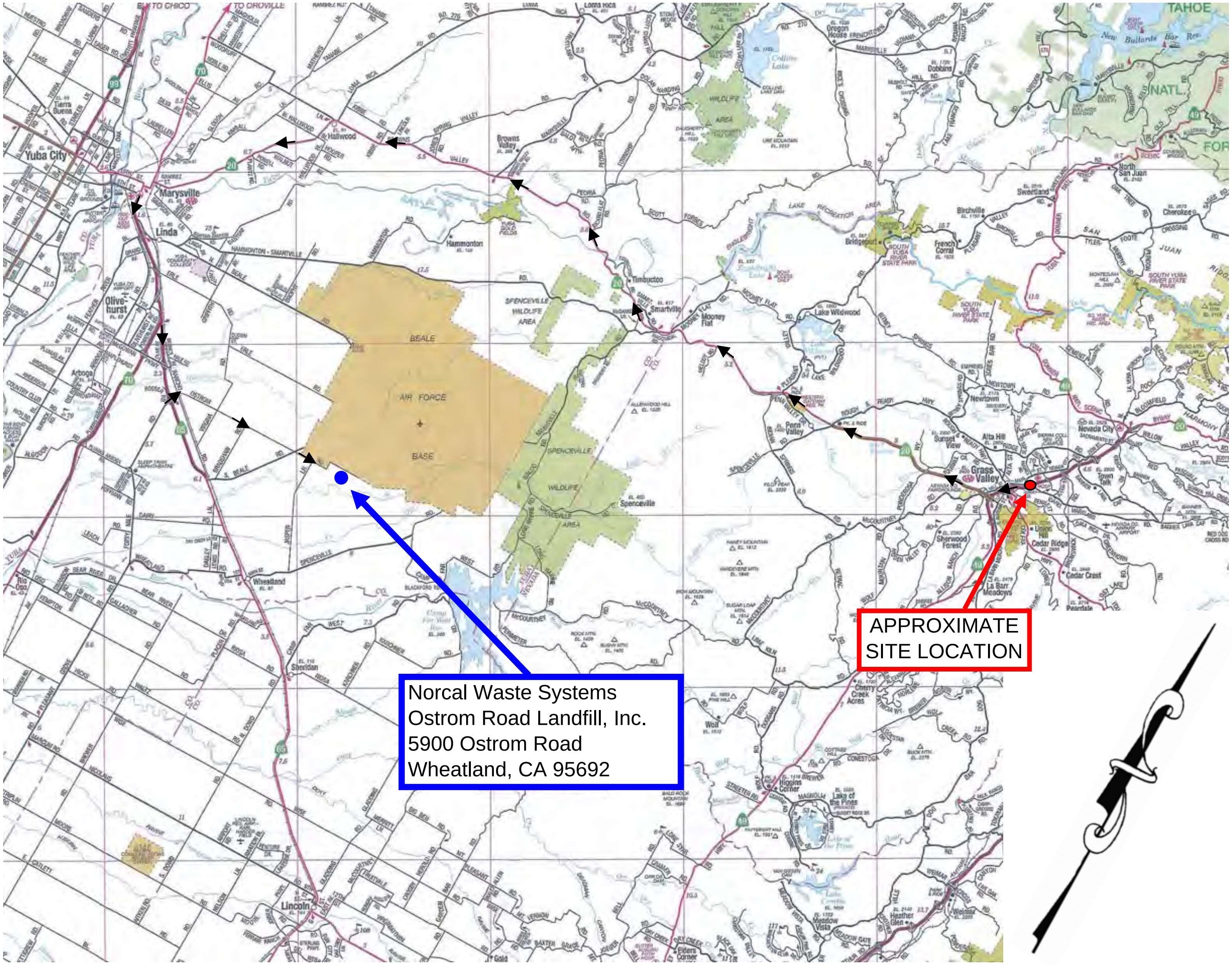
8.5 Data Validation

Data will be validated based on an estimate of the potential cumulative error from field, laboratory, and data manipulation. Data will be evaluated with regard to the DQIs (precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity). Based on the evaluation results, data will be accepted, accepted with qualification, or rejected.

Data review will be performed to assess the accuracy of data recording, processing and transmittal. Field and laboratory quality control data will be reviewed for completeness. Sample preservation and holding times will be verified.

APPENDIX H

Transportation Route Maps



HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 Searls Avenue • Nevada City, CA 95959
(530) 478-1305 • FAX (530) 478-1019

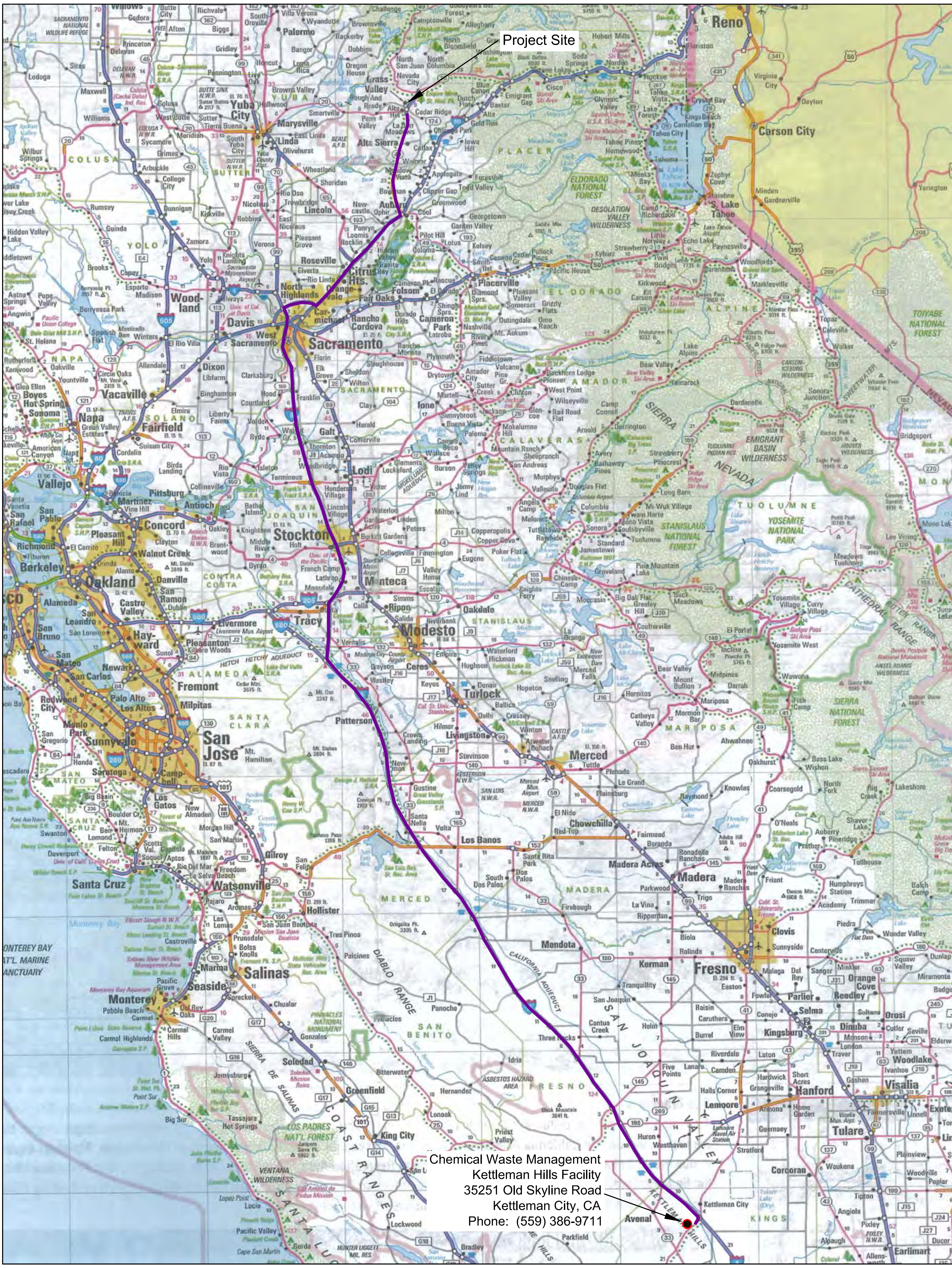
TRANSPORTATION ROUTE MAP

SPRING HILL PROPERTY

TO OSTROM ROAD LANDFILL, WHEATLAND, CA

PROJECT NO. 3292-04

AUGUST 2008



KETTLEMAN HILLS FACILITY, CALIFORNIA

TRUCK ROUTE MAP

FOR NON–RCRA OR RCRA HAZARDOUS SOLID WASTE

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DRAWN BY: DFD	CHECKED BY: LLW
PROJECT NO.: 3292-04	
DATE: AUGUST 2008	

APPENDIX I

Soil Management Plan

SOIL MANAGEMENT PLAN
for
WASTE PLACEMENT AREA
at
SPRING HILL PROPERTY
Grass Valley, California

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 3292-04
August 22, 2008

TABLE OF CONTENTS

1 INTRODUCTION

The Soil Management Plan is an element of the Removal Action Workplan (RAW) for remedial action at the Spring Hill Property (site) located in Grass Valley, California. The assessor's parcel numbers (APNs) for the site are 35-260-62, 63 and 64. The RAW describes procedures for excavation and on-site placement of soil that contains elevated concentrations of metals. Approximately 62,000 cubic yards of soil and rock are to be excavated from area of concern (AOC) 2 and reused as engineered fill at a deed-restricted placement location. A commercial development, including buildings and pavement, is to be consructed over the engineered fill. This Soil Management Plan provides recommendations for soil management in the event that the reused mine waste requires future excavation and/or handling. Protocol for reducing dust emissions during excavation and/or handling is presented in the Dust Mitigation Plan, which is also appended to the RAW.

1.1 PURPOSE

The mine waste to be used as engineered fill contains concentrations of metals, notably arsenic, which are elevated above background concentrations. Although the arsenic is naturally occurring in mineralized, gold bearing veins, past mining activity resulted in deposition of the mineralized soil and rock at the ground surface. Exposure to the soil (ingestion, dermal contact or inhalation of soil dust) presents a cancer risk and chronic health hazard. Thus, the soil is to be buried to limit exposure. In the event that the soil is excavated in the future, specific soil management procedures such as dust control are recommended to reduce the chance of human exposure to the metals concentrations.

2 DESCRIPTION OF WASTE PLACEMENT AREA

An estimated 62,000 cubic yards of mine waste are to be placed and compacted in an area designated to support a future commercial building and paved parking area located in the western portion of the site. Sheet 1 of the RAW depicts the location of the proposed on-site placement area.

The 4.3-acre placement area measures approximately 330 feet by 570 feet. The mine waste fill will be up to approximately 30 feet deep. The waste is to be located centrally within the fill prism to reduce the likelihood of surface water infiltration or subsurface seepage through the waste. Clean fill is to be placed above the waste so that excavation can be performed for utilities without disturbing the waste.

The placement area will require a land use covenant (LUC) agreement and operation and maintenance plan (OMA). The LUC agreement is intended to protect public health and the environment by: 1) preventing inappropriate land use, 2) increasing the probability that the public will have information about residual contamination, 3) disclosing information for real estate transactions about residual contamination, 4) ensuring that long-term mitigation measures are carried out by protecting the engineering controls and remedy; and 5) ensuring that subsequent owners assume responsibility for preventing exposure to contamination.

3 RECOMMENDED SOIL MANAGEMENT PROCEDURES

In the event of future disturbance of the placement area below the designated utility zone, the following soil management practices should be followed. Prior to any disturbance, the details and procedures must be submitted to DTSC for review, and approved by DTSC.

1. Soil Handling Procedures

    a. Per the Dust Mitigation Plan, maintain moisture content in soil to prevent the generation of visible dust during preparation, placement and compaction.

    b. Avoid contact with soil.

    c. Place and compact soil back in the designated placement area from which it was excavated. No soil is to be removed from the site or transported within the site.

    d. Segregate clean soil in the utility zone from mine waste (below the utility zone). The materials should be stockpiled separately. Mine waste must be placed and compacted below the utility zone.

2. Erosion Controls

   a. Permanent surface coverings (such as pavement) must be restored after replacement and recompaction of the mine waste and cover soil in the excavation.

3. Best Management Practices

   a. Best management practices shall be implemented to reduce the chance of potential sediment discharges from excavated areas or stockpiled soil prior to backfill and reinstallation of permanent surface coverings. Best management practice types are described below.

   b. Straw with Jute Netting or Tackifiers: Jute netting or tackifiers should be placed and secured over the slopes to keep the straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.

   c. Fiber Rolls: Fiber rolls (wattles) shall be installed on fill slopes. Fiber rolls shall be anchored with wood stakes placed 4 feet on center or closer. Fiber rolls placed on slopes should be trenched 2 to 4 inches into the soil. Additional wattles may be stored on-site during the rainy season in the event that the installed wattles are filled with sediment. Prior to fiber roll installation, the subgrade shall be prepared by removing local surface irregularities and larger rock or debris that would inhibit contact of the fiber roll with the subgrade. A contoured key trench shall be excavated 2 to 4 inches deep along the proposed installation route. Soil excavated from the key trench shall be placed on the up slope side of the fiber roll to reduce the chance of surface water undercutting the roll. When more than one fiber roll is placed in a row, the rolls shall be abutted securely to one another to provide a tight joint, not overlapped. Split, torn, unraveling or slumping fiber rolls shall be repaired or replaced. Fiber rolls shall be observed for damage when rain is forecasted, following rain events, and periodically as needed during prolonged rainfall. Fiber rolls typically do not require removal and can be abandoned in place, once permanent erosion control is established.

3.1 HEALTH AND SAFETY

The mine waste located below the utility zone contains elevated concentrations of metals, particularly arsenic. Exposure to metals in the soil may occur through exposure routes such as ingestion of soil or soil dust, inhalation of soil dust, and dermal contact with soil or soil dust.

Application of water to the affected soil is essential to control fugitive dust emissions. Exposure may be reduced by the use of personal protective equipment such as boots, long-sleeved clothing, gloves and dust mask or respirator. Proper decontamination is important to remove contaminants prior to leaving the affected areas and to limit exposure.

APPENDIX J

Community Profile

COMMUNITY PROFILE
SPRING HILL PROPERTY
Grass Valley, California

Site Location and Size

The approximately 26-acre site is located to the south of Dorsey Drive and to the southeast of State Highway 49/20 in Grass Valley, Nevada County, California. The subject site is comprised of three contiguous parcels, an eastern parcel (Assessor's Parcel Number (APN) 35-260-64, 11.37 acres), a northern parcel (APN 35-260-62, 1.7 acres) and a western parcel (APN 35-260-63, 13.67 acres).

The subject site is located in the southern half of the southeast quarter of Section 23 and the northern half of the northeastern quarter of Section 26, Township 16 North, Range 8 East of the Grass Valley Quadrangle topographic map (United States Geological Survey (USGS), 1995 provisional edition). Site elevations range from approximately 2550 feet above mean sea level (MSL) to approximately 2690 feet above MSL.

Figures 1 and 2 of the Preliminary Endangerment Assessment (PEA) report show the site and surrounding area. Figure 1 shows the approximate site location and property boundaries. Figure 2 is an aerial photograph of the site and immediate vicinity.

Description of Property

The subject site is situated in the Sierra Nevada physiographic province. Physiographic conditions consist of gently to moderately rolling terrain. Typical vegetation includes ponderosa and gray pines, black oak, manzanita, and ceanothus. Site vegetation is generally characterized by mixed conifer forest, oak woodland, manzanita, and other shrubs.

Surface topography at the site generally slopes toward the south and southwest from a relatively flat-lying area in the northern portion of the site and a knoll in the northern central portion of the site. The northern portion of the eastern edge of the site slopes toward the southeast.

The nearest perennial surface water to the site is Wolf Creek, located approximately 500 feet south of the site at an approximate elevation of 2480 feet MSL. Wolf Creek flows to the south and southwest through downtown Grass Valley. Seasonal stormwater flow is likely to cross the southern portion of the property.

At the time of Holdrege & Kull's (H&K's) investigations, the site was generally undeveloped other than the historic mining relics.

Description of Surrounding Land Uses

The subject property is bordered by State Highway 49/20 to the northwest, by commercial property to the south, and by an apartment complex to the east. Dorsey Drive borders the site to the north; an apartment complex is located beyond Dorsey Drive to the north.

Visibility of the Site to Neighbors

The mine features on the site are generally not visible from neighboring properties.

PROJECT DESCRIPTION

Proposed Site Improvements

As of the date of this community profile, no proposed project plans have been prepared for the site.

Potential Environmental Concerns

Historical research indicated the Spring Hill Mine operated at the site intermittently from the late 1800s to the early 1940s. At least three mine shafts, several structures including a mill, and mine waste including waste rock dumps and mill tailings are depicted on the historic maps and identified in the documents that were reviewed. An estimated 44,000 cubic yards of mine waste rock and 20,000 cubic yards of mine tailings may be present at the site. These volume estimates are based on limited subsurface data and were not calculated using survey methods.

To date, approximately 100 samples of background soil, mine waste rock and mine tailings have been collected from the site for chemical analysis. Total arsenic, lead and mercury concentrations were detected in samples of mine waste rock and tailings at concentrations exceeding site background values. Arsenic was detected at concentrations exceeding the California Human Health Screening Level (CHHSL) for industrial soil.

Elevated soil metals concentrations present a potential human health risk resulting from exposure pathways including incidental soil ingestion, dust inhalation, and dermal contact. Metals of potential concern include arsenic, lead and mercury.

Status of Environmental Investigation

The community profile was initially prepared for California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) review as part of a Preliminary Endangerment Assessment (PEA) equivalent report pursuant to a signed Voluntary Cleanup Agreement between the site owner and DTSC. Site investigations to date have included excavation of shallow exploratory trenches, and sampling of mine waste and native soil. DTSC approved the PEA report in a letter dated February 5, 2008. The community profile was updated for inclusion in the Removal Action Workplan (RAW).

Location of Nearby CalEPA and U.S. EPA Projects

H&K is currently involved with several PEA projects being performed or recently completed on nearby properties. The approximate locations of these and other projects in the Grass Valley area are shown on Figure 1 of the RAW.

LOCAL AWARENESS AND INTEREST

Community Demographics

The site is located within the Grass Valley city limits in Nevada County, California. To our knowledge, there are no specific language considerations for the subject site vicinity. The population is primarily white middle/working class. Demographic information listed on the U.S. Census Bureau website for the 2000 census is attached to this community profile.

Community Contact

To H&K's knowledge, no community members or groups have expressed interest in the subject property.

Community Interaction

To H&K's knowledge, no public meetings have taken place regarding the subject property.

A variety of public awareness groups in the Grass Valley area maintain web sites to discuss local environmental issues, schedule public meetings, and discuss local developments. These groups include Grass Valley Neighbors, Rural Quality Coalition, and Wolf Creek Community Alliance. These organizations could be contacted by phone or e-mail in the event that community outreach activities become necessary as a part of the PEA process. Their contact information is included in the Key Contact List presented below.

Media Coverage

To H&K's knowledge, no recent media coverage of the subject property has occurred.

Government Involvement

DTSC is the agency involved with the project at this time. Grass Valley and Nevada County agencies are likely to be involved with the project in the future, including Nevada County Department of Environmental Health (NCDEH) and City of Grass Community Development Department. Government contacts are included in the Key Contact List below.

KEY CONTACT LIST

Mr. Dean Wright, P.G., Project Manager
California Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826
(916) 255-6528
Dwright@dtsc.ca.gov

Mr. Dean Wright, P.G., Project Manager
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8800 Cal Center Drive
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Mr. Steve Becker, C.E.G., Unit Chief
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Ms. Heidi Nelson, External Affairs/Public Participation Specialist
California Department of Toxic Substances Control
8800 Cal Center Drive
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(916) 255-3575
HNelson@dtsc.ca.gov

Mr. Sean O'Neill
Genesis Engineering
1402 D Street
Marysville, Ca 95901
(916) 742-1300

Mr. Tom Last, Planning Director
City of Grass Valley Community Development Department
125 East Main Street
Grass Valley, CA 95945
(530) 274-4344

Ms. Mary Ann Mueller, CEO
Grass Valley/ Nevada County Chamber of Commerce
248 Mill Street
Grass Valley, CA 95945
(530) 273-1479
maryannmueller@msn.com

Mr. Wesley Nicks
Nevada County Department of Environmental Health
950 Maidu Avenue
Nevada City, CA 95959
(530) 265-1452

Nevada County Board of Supervisors
950 Maidu Avenue
Nevada City, CA 95959
(530) 265-1480

Nate Beason
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Ed Scofield
email: ed.scofield@co.nevada.ca.us

Terry Lamphier
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Hank Weston
email: hank.weston@co.nevada.ca.us

Ted Owens
email: ted.owens@co.nevada.ca.us

Grass Valley City Council
125 East Main Street
Grass Valley, CA 95945
Jan Arbuckle, Mayor
Dan Miller, Vice Mayor
Lisa Swarthout, Council Member
Yolanda Cookson, Council Member
Jason Fouyer, Council Member
(530) 274-4310

Grass Valley School District
10840 Gilmore Way
Grass Valley, CA 95945
(530) 273-4483

Sierra Nevada Memorial Hospital
155 Glasson Way
Grass Valley, CA 95945
Katherine Medeiros, President and CEO
(530) 274-6000

Nevada County Economic Resource Council
149 Crown Point Circle, Suite A
Grass Valley, CA 95945
www.ncerc.org
(530) 274-8455

Rural Quality Coalition
P.O. Box 1346
Nevada City, CA 95959
Paul Jorgenson, President
www.ruralquality.org
rqinfo@ruralquality.org

Wolf Creek Community Alliance
P.O. Box 477
Grass Valley, CA 95945
(530) 272-2347
www.wolfcreekalliance.org/
gvfowc@yahoo.com

KEY ISSUES AND CONCERNS

Historical research and field investigation has identified the potential for site impact resulting from past mining activity at the site. Based on the results of H&K's sampling to date, the metals of concern identified in onsite soil occur at concentrations lower than California hazardous levels in all but a few limited areas of the site. A possible exposure pathway to nearby residents would be dust raised during excavation and grading activities. We anticipate that dust generation will be minimal due to the ambient soil moisture content. Water will be used to wet soil and limit dust generation during excavation and grading activities if excessively dry soil conditions are encountered.

We are not aware of special interest groups expressing concern regarding environmental conditions. We anticipate that concern from local neighbors and interest groups regarding the proposed site development may focus on:

- Traffic and congestion;
- Growth of the community;
- Increase in population;
- Wildlife preservation; and
- Proposed land use.

We anticipate that community and interest groups can be informed of issues regarding the subject site via postal mail or e-mail.

RECOMMENDED PUBLIC PARTICIPATION

Appropriate community outreach activities will be performed for each phase of the project as determined by DTSC. Community outreach should be performed prior to site mitigation as part of RAW preparation.

Demographics of Nevada County, CA

January 2010

Population

Chart #1

Total Population Nevada County and California

	Population	Annual percent change	California	Annual Percent Change
1990	77,500	3.9%	29,558,000	n/a
2000	91,642	1.2%	33,721,583	1.8%
2005	98,172	0.9%	36,675,346	1.3%
2006	98,798	0.6%	37,114,598	1.2%
2007	99,026	0.2%	37,559,440	1.2%
2008	99,186	0.2%	38,049,462	1.3%

Source: CA Department of Finance, Demographic Research

Chart #2

City of Grass Valley Population

	Population	Annual Percent Change
1990	8,850	n/a
2000	10,040	0.5%
2005	12,905	5.6%
2006	12,868	-0.3%
2007	12,915	0.4%
2008	12,929	0.1%

Source: CA Department of Finance, Demographic Research

Chart #3

Town of Truckee Population

	Population	Annual Percent Change
1994	11,143	n/a
2000	13,778	3.6%
2005	15,532	2.1%
2006	15,710	1.1%
2007	15,901	1.2%
2008	16,165	1.7%

Source: CA Department of Finance, Demographic Research

Chart #4

City of Nevada City

	Population	Annual Percent Change
1990	2,860	n/a
2000	2,975	0.6%
2005	3,028	-0.1%
2006	3,049	0.7%
2007	3,057	0.3%
2008	3,074	0.6%

Source: CA Department of Finance, Demographic Research

Chart #5

Population Density Nevada County

Year	Population	Density per sq. Mile
1990	77,500	80.9
2000	91,642	95.7
2005	98,172	102.5
2006	98,798	103.2
2007	99,026	103.4
2008	99,186	103.6

Source: CA Department of Water Resources

Population of Nevada County

Chart #6

Population by Age Distribution

Year	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+
1990	10,962	9,634	7,148	13,290	12,345	7,431	9,414	6,348	2,431
2000	10,002	13,431	7,008	10,753	16,483	13,976	8,993	7,744	4,284
2005	8,839	14,486	8,085	9,611	16,603	17,683	11,672	7,652	4,815
2006	8,519	14,173	8,921	9,038	16,180	18,004	12,179	7,652	4,768
2007	8,374	13,857	9,619	8,699	15,932	18,187	13,038	7,698	4,815
2008	8,311	13,473	10,416	8,299	15,613	18,399	13,772	7,912	4,817

California Department of Finance

Chart #7

Population by Race/Ethnicity

Year	Total	White	Hispanic	Asian	Black	Native Am	Other
1990	79,003	74,122	3,316	627	173	765	0
2000	92,532	83,928	5,225	740	254	698	1,687
2005	99,303	89,666	5,964	761	257	710	1,945
2006	99,434	89,634	6,089	771	259	714	1,967
2007	100,219	90,250	6,221	780	261	718	1,989
2008	101,012	90,874	6,353	788	263	722	2,012

California Department of Finance

Population by Educational Attainment

Chart #8

Population 18 and Over, 1990

City	Less than 9th grade	9th to 12th no diploma	High school graduate	Some college	Associate's degree	Bachelors degree	Graduate degree	Total
Grass Valley	441	1,210	2,292	1,855	387	521	288	6,994
Nevada City	67	202	473	618	187	384	269	2,200
Nevada County	1,867	7,052	16,384	17,023	5,014	8,660	3,630	59,630
California	2,352,017	3,114,969	5,080,909	5,246,699	1,649,596	3,052,702	1,523,650	22,020,542

Source: U.S. Department of Commerce, Bureau of the Census

Population 18 and Over, 2000

City	Less than 9th grade	9th to 12th no diploma	High school graduate	Some college	Associate's degree	Bachelors degree	Graduate degree	Total
Grass Valley	234	980	2,835	2,623	524	927	382	8,505
Nevada City	16	232	446	705	193	405	328	2,325
Nevada County	1,180	6,838	17,201	22,082	6,385	11,496	5,743	70,925
California	2,687,841	3,235,504	5,192,997	5,981,132	1,657,058	3,847,654	2,047,999	24,650,185

Source: U.S. Department of Commerce, Bureau of the Census

Educational Attainment by Gender, Population 18 and Over, 2000

	Less than 9th grade	9th to 12th no diploma	High school graduate	Some college	Associate's degree	Bachelors degree	Graduate degree	Total
Nevada County								
Male	674	3,604	8,206	9,970	2,947	5,863	3,125	34,389
Female	506	3,234	8,995	12,112	3,438	5,633	2,618	36,536
California								
Male	1,315,431	1,664,851	2,486,048	2,820,371	758,112	1,901,008	1,161,751	12,107,572
Female	1,372,410	1,570,653	2,706,949	3,160,761	898,946	1,946,646	886,248	12,542,613
United States								
Male	7,338,038	13,942,950	28,211,869	22,272,543	5,539,281	14,846,954	8,757,637	100,909,272
Female	7,497,115	13,772,149	31,694,883	25,363,950	7,069,245	15,434,947	7,537,588	108,369,877
Total	14,835,153	27,715,099	59,906,752	47,636,493	12,608,526	30,281,901	16,295,149	209,279,149

Source: U.S. Department of Commerce, Bureau of the Census

Migration

Chart #9

Net Migration

	Migrants
1996	528
1997	541
1998	288
1999	677
2000	553
2001	464
2002	234
2003	274
2004	278
2005	-54

Source: Internal Revenue Service 2003

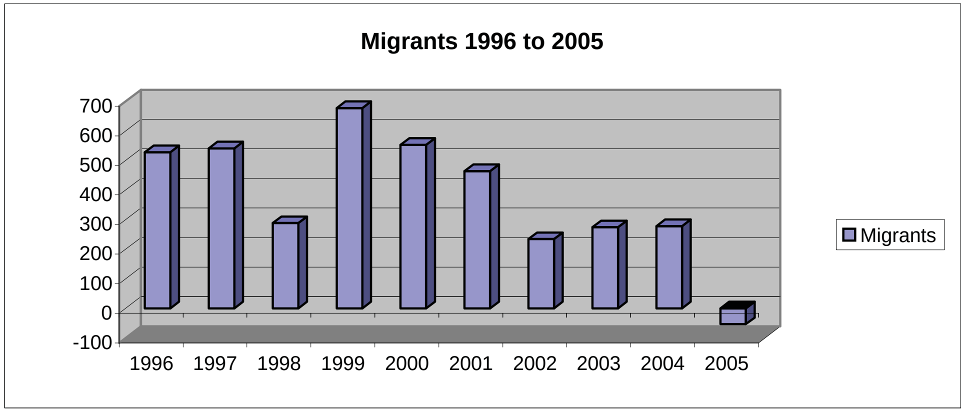


Chart #10

Top 5 In Migration and Median Income by County

County	2005 Median Income	2005 Number	2006 Med Income	2006 Percent
Placer	$32,584	427	$488,448	1.18%
Sacramento	$34,562	220	$48,841	0.61%
Santa Clara	$62,829	145	$160,234	0.40%
Contra Costa	$47,446	105	Source: www.city/Nevada-City	
Alameda	$27,038	97		

Source: Internal Revenue Service 2003

Chart #11

Top 5 Out Migration and Median Income by County

County	2005 Median Income	2005 Number	2006 Med Income	2006 Percent
Placer	$29,486	490	$56,388	1.35%
Washoe, NV	$37,304	222	$490,441	0.61%
Sacramento	$26,203	197	$38,934	0.54%
San Diego	$17,076	69	Source: www.city/Nevada-City	
Butte	$18,071	62		

Source: Internal Revenue Service 2003

Chart #12

Components of Population Change

Year	Change	Births	Deaths	Natural increase	Net Migration
1990	3700	950	719	231	3469
1995	1263	803	753	50	1213
2000	1533	772	843	-71	1604
2001	1909	800	914	-114	2023
2002	1092	790	912	-122	1214
2003	1450	884	989	-105	1555
2004	964	773	988	-215	1179
2005	710	827	1093	-266	976
2006	742	832	978	-146	888
2007	339	773	982	-209	548

Source: California Dep. of Finance

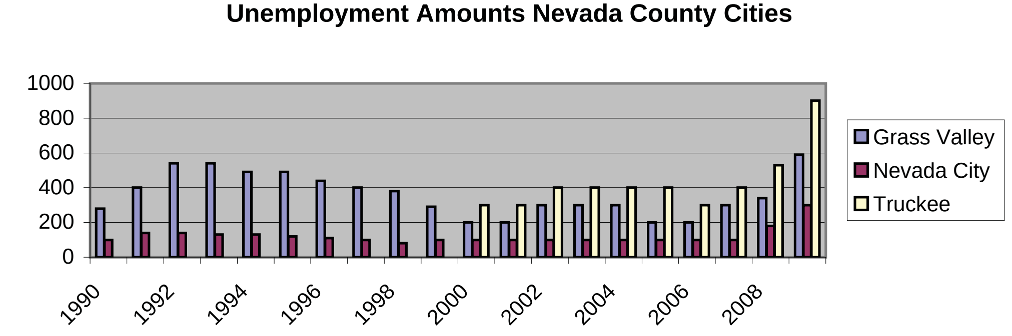
Unemployment

Chart #13

Unemployment Amounts Nevada County Cities

	Grass Valley	Nevada City	Truckee
1990	280	100	n/a
1991	400	140	n/a
1992	540	140	n/a
1993	540	130	n/a
1994	490	130	n/a
1995	490	120	n/a
1996	440	110	n/a
1997	400	100	n/a
1998	380	80	n/a
1999	290	100	n/a
2000	200	100	300
2001	200	100	300
2002	300	100	400
2003	300	100	400
2004	300	100	400
2005	200	100	400
2006	200	100	300
2007	300	100	400
2008	340	180	530
2009 Nov.	590	300	900

Source: California Employment Development Department



Source: California Employment Development Department

Unemployment Rate in California

November-09	12.3%

Source: California Employment Development Department

Chart #14

Nevada County

Average Monthly Labor Statistics, 5/2008-7/2009

Month	Labor force	Employed	Unempl.	Unempl. Rate
May	50,340	47,240	3,100	6.2%
June	51,670	48360	3,320	6.4%
July	52,110	48,680	3,430	6.6%
Aug.	52,540	49,170	3,370	6.4%
Sept.	51,300	48,010	3,280	6.4%
Oct.	50,730	47,180	3,550	7.0%
Nov.	50,600	46,700	3,890	7.7%
Dec.	50,810	46,500	4,310	8.5%
January	51,770	46,670	5,110	9.9%
Februar	51,520	46,160	5,360	10.4%
March	51,390	45,640	5,750	11.2%
April	50,250	44,820	5,420	10.8%
May	49,350	43,830	5,530	11.2%
June	50,630	44,820	5,810	11.5%
July	50,550	44,820	5,730	11.3%
Nov.	49,630	43,910	5,720	11.5%

Source: California Employment Development Department

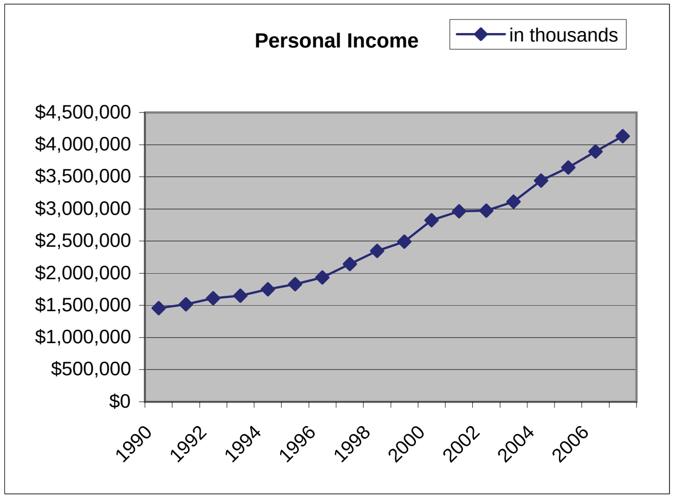
Personal Income

Chart #15

Total Personal Income Nevada County

	in thousands	Annual % Change
1990	$1,456,413	6.3
1991	$1,518,348	4.3%
1992	$1,608,635	5.9%
1993	$1,648,490	2.5%
1994	$1,751,140	6.2%
1995	$1,830,469	4.5%
1996	$1,934,551	5.7%
1997	$2,144,440	10.8%
1998	$2,348,951	9.5%
1999	$2,491,475	6.1%
2000	$2,826,443	13.4%
2001	$2,965,263	4.9%
2002	$2,975,115	0.3%
2003	$3,111,879	4.6%
2004	$3,440,613	10.6%
2005	$3,646,004	6.0%
2006	$3,892,500	5.0%
2007	$4,132,773	4.0%

Source: U.S. Department of Commerce



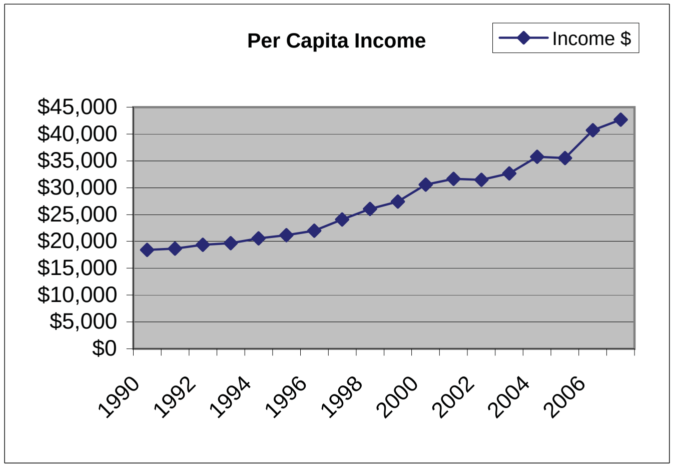


Chart #16

Per Capita Income Nevada County

	Income $	% Change
1990	$18,396	1.0%
1991	$18,679	1.5%
1992	$19,400	3.9%
1993	$19,651	1.3%
1994	$20,557	4.6%
1995	$21,156	2.9%
1996	$22,018	4.1%
1997	$24,058	9.3%
1998	$26,050	8.3%
1999	$27,409	5.2%
2000	$30,553	11.5%
2001	$31,676	3.7%
2002	$31,496	-0.6%
2003	$32,666	3.7%
2004	$35,787	9.6%
2005	$35,507	4.8%
2006	$40,736	7.9%
2007	$42,671	3.7%

Source: U.S. Department of Commerce

Median Household Income

Chart #17

Median Household Income by County (Nominal)

	Nevada County	California
2000	$46,777	$46,836
2001	$46,171	$47,064
2002	$47,478	$47,323
2003	$47,626	$48,440
2004	$49,811	$49,894
2005	$51,582	$53,627
2006	Not Avail	Not Avail
2007	$56,344	$58,361
2008	$56,890	$61,154

Source: U.S. Department of Commerce, Bureau of the Census

Chart #18

Median Household Income (Nominal)

	1989	1999	% Change
Grass Valley	$20,966	$28,182	34.4%
Nevada City	$25,061	$36,667	46.3%
Nevada County	$32,200	$45,864	42.4%
California	$35,798	$47,493	32.7%

Source: U.S. Department of Commerce

Chart #19

Per Capita Income by City or Town

	1989	**1989 adjusted for inflation**	**1999**
City of Grass Valley	$12,078	$16,227	$16,877
Nevada City	$15,412	$20,707	$22,399
Town of Truckee	$15,689	$21,079	$26,786

Chart #20

Poverty Rates

	1989	**1999**	**2007**
City of Grass Valley	13.8%	14.9%	13.0%
Nevada City	10.8%	7.9%	7.9%
Truckee	n/a	n/a	4.6%
Nevada County	7.7%	8.1%	(2006) 7.9%
California	12.5%	14.2%	12.4%

Source: U.S.DoC

Source: www.citydata.com

Chart #21

Number of Physicians

	Nevada County	California
1990	152	74,437
1995	181	78,169
2000	241	84,675
2005	274	94,546
2006	266	96,299

Source: Medical Board of California

Job Growth by Industry Sector

Employment by Industry

Chart #22

	Ag. & Mining	Construct.	Manuf.	Transp. & pub. utilities	Wholesale trade	Retail trade	Finance, insurance real est.	Services	Gov. & public admin.	Tourism
1990	1,095	4,247	3,468	752	739	6,699	2,876	10,702	4,201	n/a
1991	1,064	3,965	3,568	790	880	6,996	2,951	11,314	4,446	n/a
1992	1,101	3,644	3,308	847	996	7,027	3,278	11,404	4,562	n/a
1993	1,169	3,640	3,172	893	981	7,267	3,356	11,910	4,535	n/a
1994	1,301	3,803	3,162	925	1,080	7,587	3,849	12,606	4,590	n/a
1995	1,398	3,701	3,322	967	786	7,796	3,250	13,305	4,657	n/a
1996	482	3,772	3,488	997	816	8,128	3,229	12,480	4,704	n/a
1997	1,422	3,960	3,543	1,017	865	8,087	3,810	13,082	5,024	n/a
1998	1,415	4,820	3,467	1,027	981	8,640	4,766	15,943	4,990	n/a
1999	1,405	5,381	3,338	1,013	1,101	8,917	5,082	16,788	5,039	n/a
2000	1,315	5,825	3,298	1,064	1,163	9,150	5,619	17,700	5,185	n/a
2001	1,267	6,431	2,527	838	990	6,480	6,032	17,077	5,318	5,311
2002	1,253	6,431	2,099	D	921	6,464	6,093	17,488	5,521	5,775
2003	1,159	6,218	2,125	D	849	6,406	6,474	18,243	5,871	5,732
2004	1,129	6,665	2,328	D	D	6,349	6,847	18,572	5,769	5,976
2005	1,144	7,382	2,308	D	928	6,395	7,165	19,189	5,714	6,030

Source: U.S. Department of Commerce Some data which may disclose confidential information is not included (D)

	Ag. & Mining	Construct.	Manuf.	Transp. & pub. utilities	Wholesale trade	Retail trade	Finance, insurance real est.	Services	Gov. & public admin.	Tourism
2008 May	n/a	n/a	2,010	520	410	4,130	n/a	11,690	5,600	n/a
2009 May	n/a	n/a	1,790	470	410	3,710	n/a	10,880	5,180	n/a

Source: Employment Development Department

Business by Employment Size and Industry, October to December 2008

Chart #23

Number of Employees	Mining	Construct.	Manuf.	Transp. & pub. utilities	Wholesale trade	Retail trade	Finance, insurance real est.	Services	Gov. & public admin.	Ag., Forestry fishing	Total businesses by number employees
Unknown	2	2	13	2	2	71	6	48	22	0	168
1 to 4	5	912	315	150	216	633	355	2,571	15	233	5,405
5 to 9	1	91	40	19	26	130	46	243	11	18	625
10 to19	1	37	23	5	12	89	24	109	9	11	320
20 to 49	0	17	13	7	6	47	13	55	7	2	167
50 to 99	1	1	6	7	0	13	1	16	6	1	52
100 to 249	0	1	2	1	0	2	1	10	1	0	18
250 to 499	0	0	1	0	0	0	1	2	1	0	5
500 to 999	0	0	0	0	0	0	0	0	1	0	1
1,000 or mor	0	0	0	0	0	0	0	0	0	0	0
Total Bus. by Industry	8	1,061	413	191	262	985	447	3,054	73	265	6,759

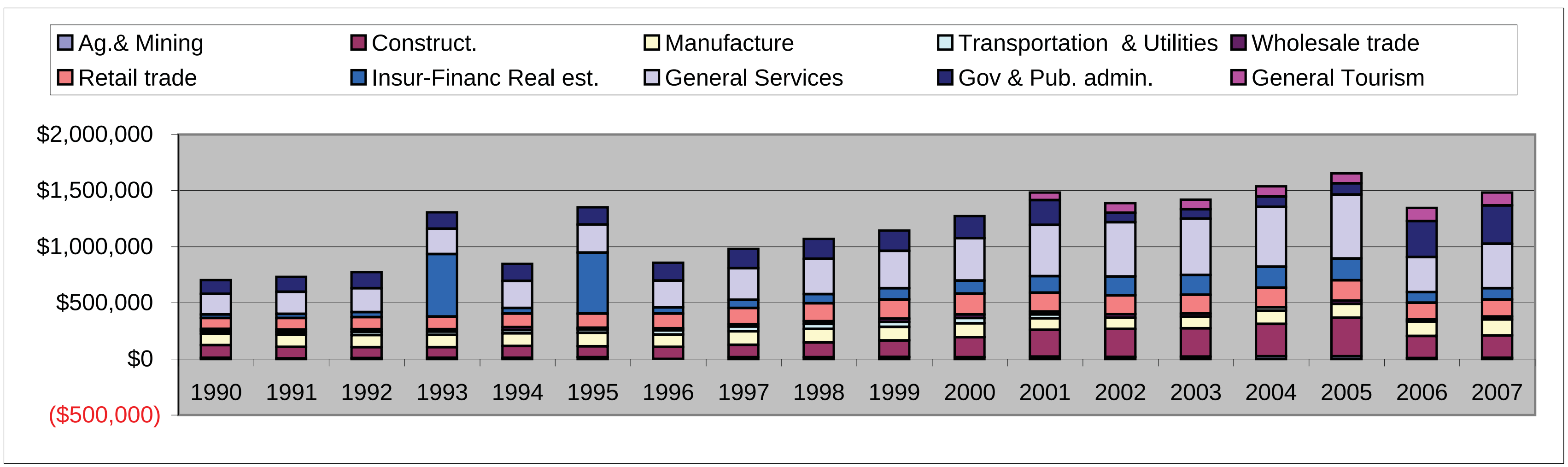
Source: Dun & Bradstreet

Earnings by Industry

Chart #24

	Ag.& Mining	Construct.	Manufacture	Transportatior & Utilities	Wholesale trade	Retail trade	Insur-Financ Real est.	General Services	Gov & Pub. admin.	General Tourism
1990	$9,158	$112,084	$104,574	$22,458	$19,690	$95,449	$31,980	$185,022	$121,320	n/a
1991	$5,290	$100,761	$110,964	$23,494	$21,120	$103,003	$37,262	$196,473	$131,950	n/a
1992	$6,199	$99,059	$107,404	$26,831	$23,844	$107,899	$44,767	$214,469	$142,825	n/a
1993	$8,222	$96,384	$108,889	$28,692	$22,566	$112,644	$555,585	$226,504	$146,511	n/a
1994	$10,028	$103,617	$115,018	$28,330	$25,658	$119,456	$52,360	$239,376	$154,541	n/a
1995	$14,168	$97,489	$120,131	$31,048	$15,527	$123,913	$544,713	$249,428	$156,221	n/a
1996	($1,907)	$106,819	$110,828	$34,903	$19,586	$130,638	$56,332	$239,623	$159,469	n/a
1997	$15,675	$110,240	$119,663	$43,340	$21,057	$142,178	$73,373	$281,021	$173,676	n/a
1998	$14,202	$131,951	$121,911	$44,407	$23,791	$160,168	$79,840	$314,515	$179,087	n/a
1999	$16,384	$148,756	$121,125	$43,860	$27,731	$171,735	$99,686	$332,935	$180,524	n/a
2000	$15,589	$178,293	$124,052	$45,619	$31,458	$188,088	$114,701	$377,141	$197,393	n/a
2001	$18,827	$239,922	$103,078	$32,604	$27,678	$167,698	$146,702	$457,458	$219,955	$67,741
2002	$17,815	$248,894	$99,714	D	$30,424	$168,815	$169,333	$483,409	$84,235	$84,235
2003	$20,391	$250,664	$106,875	D	$26,476	$167,731	$176,330	$499,660	$86,137	$85,163
2004	$22,979	$289,723	$115,783	$30,428	D	$174,691	$186,223	$533,505	$93,040	$91,919
2005	$22,979	$343,930	$123,678	D	$27,257	$182,450	$193,162	$571,054	$99,857	$89,857
2006	$7,801	$195,898	$129,676	$16,520	D	$150,900	$94,101	$312,737	$319,034	$120,423
2007	$9,318	$199,793	$142,007	D	$26,825	$151,152	$100,981	$395,979	$339,863	$116,466

Source: U.S., Department of Commerce, Bureau of Economic Analysis



Agriculture

Chart #25

Historical Top Crops Harvested Acreage

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Crops												
Wine grapes	201	201	201	201	201	303	348	404	356	349	350	358
Pasture, Range	95,000	95,000	95,000	95,000	95,000	95,000	94,000	93,500	91,500	93,000	95,000	95,000
Pasture, Irrigated	7180	7180	7180	7180	7180	7180	7180	7000	7180	7300	14000	10000
Chart #26												
Historical Top Crops by Value (Thousands $)												
Cattle	n/a	n/a	n/a	n/a	$1,692	$1,930	$1,975	$2,845	$2,579	$2,737	$2,815	$2,790
Wine Grapes	$504	$914	$1,168	$603	$930	$1,186	$1,243	$1,717	$1,722	$1,713	$1,848	$1,500
Pasture Irrigated	$1,622	$1,622	$1,527	$1,622	$1,658	$1,753	$1,744	$1,717	$1,722	$1,713	$1,848	$1,500
Chart #27												
Historical Wine Grapes Production (Tons)												
Wine Grapes	495	856	1063	546	902	1082	1043	1746	1307	1434	1302	1329
Chart #28												
Total Harvested Acreage												
Acres	102,381	102,381	102,381	102,381	102,381	102,483	101,528	100,904	99,036	100,649	109,350	95,716
% of all Land	16.7%	16.7%	16.7%	16.7%	16.7%	16.7%	16.6%	16.5%	16.2%	16.4%	17.8%	15.6%
Chart #29												
Agricultural and Timber Production (Thousands)												
Agricultural	$5,746	$6,515	$7,018	$6,020	$5,024	$7,144	$7,254	$8,190	$8,041	$8,663	$9,313	$8,938
Timber	$16,979	$20,258	$22,390	$19,037	$13,601	$15,169	$11,776	$11,538	$8,987	$9,397	$8,808	$7,322
Timber as %	74.7%	75.7%	76.1%	76.0%	73.0%	68.0%	61.9%	58.5%	52.8%	52.0%	48.6%	45.0%
Total	22,725	26,773	29,408	25,057	18,625	22,313	19,030	19,728	17,028	18,060	18,121	16,260

All above, Source: California Agricultural Statistics Service

Chart#30

Nevada County Value of New Construction (Thousands) Total valuation

$99,216	$85,508	$115,663	$130,076	$161,532	$169,550	$156,294	$181,838	$182,674	$211,046	$212,988	$199,079

Source: California Construction Industry Research Board

Chart#31

Total Annual Travel Expenditure in Nevada County (Millions)

$159.6	$170.7	$182.4	$182.3	$198.6	$217.0	$221.8	$225.5	$230.7	$239.1	$254.2	$267.7

Source: California Travel and Tourism Commission, Dean Runyan Associates

Service Industry

Chart #32

Service Industry Employment

Year	Information	Professional Scientific & Technical	Management of Companies & Enterprise	Administrative & Waste services	Educational services	Health Care & Social Assistance	Other Services	Total
2001	639	4,319	76	2,838	724	4,744	3,737	17,077
2002	618	4,179	81	3,085	740	4,844	3,941	17,488
2003	670	4,330	71	3,143	888	5,151	3,990	18,243
2004	711	4,616	122	2,900	935	5,179	4,109	18,572
2005	785	4,906	123	3,036	806	5,316	4,217	19,189

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Service Industry Earnings (Thousands)

Year	Information	Professional Scientific & Technical	Management of Companies & Enterprise	Administrative & Waste services	Educational services	Health Care & Social Assistance	Other Services	Total
2001	$18,417	$145,869	$3,392	$55,531	$8,864	$163,980	$61,405	$457,458
2002	$20,930	$133,485	$3,374	$67,690	$10,312	$179,534	$68,084	$483,409
2003	$20,720	$133,939	$3,567	$68,222	$12,812	$188,822	$71,578	$499,660
2004	$24,368	$147,980	$5,287	$61,835	$13,616	$204,947	$75,472	$533,505
2005	$26,685	$164,400	$5,587	$64,424	$12,551	$217,317	$80,090	$571,054

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Housing in Nevada County

Chart #33

Nevada County Total Housing Units

	Single Family units	Multiple-Family units	Mobile Homes	Total housing units	Annual percent change
1990	30,560	3,299	3,493	37,352	n/a
1995	34,734	3,621	3,771	42,126	2.2%
2000	37,198	3,699	3,385	44,282	-0.7%
2001	37,716	3,727	3,441	44,884	1.4%
2002	38,395	3,819	3,525	45,739	1.9%
2003	39,001	3,862	3,621	46,484	1.6%
2004	39,659	4,010	3,725	47,394	2.0%
2005	40,374	4,267	3,752	48,393	2.1%
2006	40,882	4,318	3,801	49,001	1.3%
2007	41,453	4,370	3,848	49,671	1.4%

Source: California Department of Finance, Demographic Research Unit

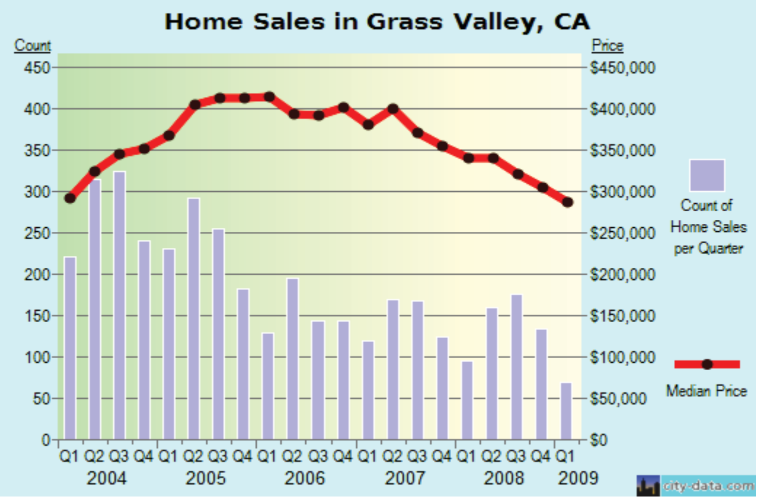
Chart #34

City of Grass Valley Total Housing Units

	Single Family units	Multiple-Family units	Mobile Homes	Total housing units	Annual percent change
1990	2,350	1,782	253	4,385	n/a
1995	2,537	1,844	253	4,634	1.1%
2000	2,706	2,060	500	5,266	5.7%
2001	2,799	2,182	692	5,673	7.7%
2002	2,856	2,182	692	5,730	1.0%
2003	2,916	2,182	692	5,790	1.0%
2004	3,035	2,182	692	5,909	2.1%
2005	3,219	2,404	695	6,318	6.9%
2006	3,240	2,404	695	6,339	0.3%
2007	3,266	2,404	692	6,365	0.4%

Source: California Department of Finance, Demographic Research Unit

Chart #35



Source: Onboard Informatics<city-data.com

Housing in Nevada County--Towns

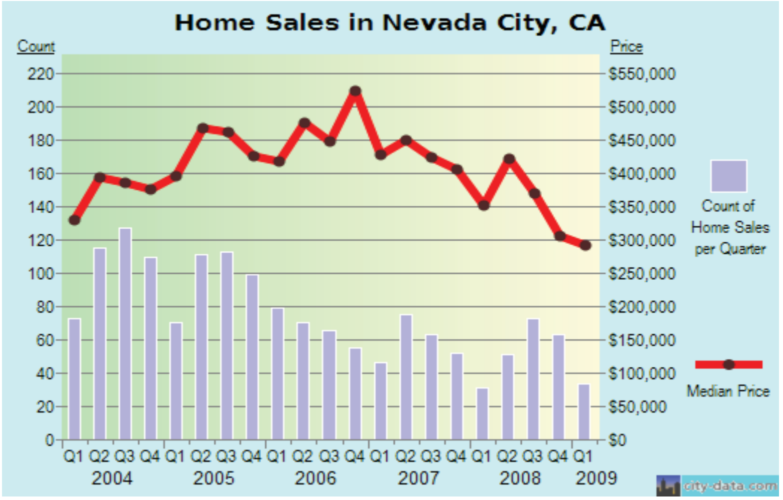
Chart #36

City of Nevada City Total Housing Units

	Single Family units	Multiple-Family units	Mobile Homes	Total housing units	Annual percent change
1990	1,038	322	39	1,399	n/a
1995	1,080	324	39	1,443	1.2%
2000	1,147	195	72	1,414	-5.2%
2001	1,159	195	72	1,426	0.8%
2002	1,164	195	72	1,431	0.4%
2003	1,169	195	74	1,438	0.5%
2004	1,175	195	74	1,444	0.4%
2005	1,188	195	74	1,457	0.9%
2006	1,190	213	74	1,477	1.4%
2007	1,195	229	74	1,498	1.4%

Source: California Department of Finance, Demographic Research Unit

Chart #37



Source: Onboard Informatics-<city-data.com>

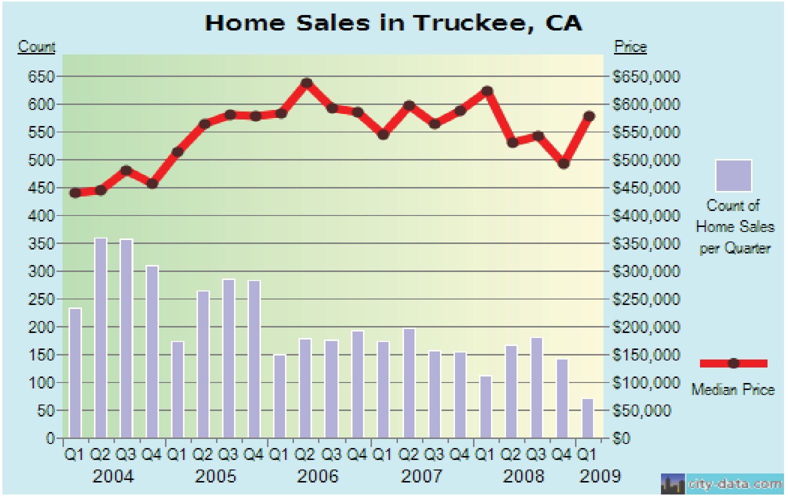
Chart #38

Town of Truckee Total Housing Units

	Single Family units	Multiple-Family units	Mobile Homes	Total housing units	Annual percent change
1994	7,477	949	286	8,712	n/a
1995	7,800	953	286	9,039	1.1%
2000	8,561	899	899	9,757	5.7%
2001	8,767	927	927	9,992	7.7%
2002	9,031	1,019	1,019	10,330	1.0%
2003	9,156	1,049	1,049	10,503	1.0%
2004	9,313	1,185	1,185	10,796	2.1%
2005	9,535	1,307	1,307	11,140	6.9%
2006	9,701	1,340	1,340	11,339	0.3%
2007	9,934	1,376	1,376	11,608	0.4%

Source: California Department of Finance, Demographic Research Unit

Chart #39



Source: Onboard Informatics-<city-data.com>

Taxable Sales

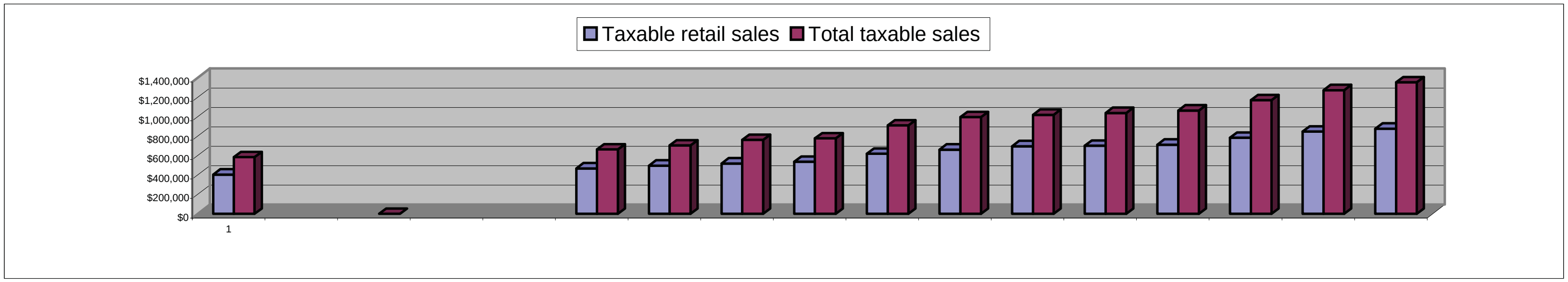
Chart #37

Taxable Sales by City and County

	Grass Valley		**Nevada City**		**Truckee**		**Nevada County (Thousands)**	
	Taxable retail sales	Total Taxable sales	Taxable retail sales	Total Taxable sales	Taxable retail sales	Total Taxable sales	Taxable retail sales	Total taxable sales
1990	$140,548	$169,168	$34,512	$46,480	n/a	n/a	$404,576	$584,996
1991	$132,835	$161,399	$35,588	$47,071	n/a	n/a		
1992	$147,915	$184,377	$35,572	$47,147	n/a	n/a		
1993	$146,817	$180,032	$35,600	$47,158	$74,222	$94,996		
1994	$154,753	$185,409	$35,406	$51,037	$98,026	$126,163		
1995	$159,501	$188,939	$35,904	$51,502	$102,174	$134,061	$469,001	$663,479
1996	$168,146	$201,182	$35,551	$48,442	$110,869	$143,486	$496,325	$705,378
1997	$171,548	$214,098	$38,596	$70,604	$123,561	$154,894	$519,355	$761,122
1998	$180,602	$223,689	$43,124	$64,065	$124,470	$157,848	$536,041	$778,139
1999	$208,885	$257,907	$49,379	$82,558	$141,821	$179,841	$618,867	$911,768
2000	$218,111	$269,147	$56,072	$94,402	$148,900	$201,645	$662,224	$997,050
2001	$239,076	$292,334	$53,539	$78,301	$150,200	$199,069	$697,305	$1,019,922
2002	$264,210	$312,393	$49,477	$83,979	$152,457	$200,100	$701,019	$1,039,617
2003	$278,661	$324,478	$46,698	$91,891	$153,472	$205,685	$712,764	$1,064,456
2004	$322,962	$373,124	$48,542	$112,822	$174,989	$230,973	$783,850	$1,170,443
2005	$398,945	$469,018	$46,678	$97,502	$182,146	$253,303	$846,860	$1,273,632
2006	$424,151	$500,094	$45,664	$108,721	$203,473	$286,339	$877,506	$1,354,634
2007	$441,544	$519,801	$47,183	$91,280	$222,280	$290,036	$883,818	$1,327,500
2008*	$194,798	$236,589	$22,337	$45,623	$99,063	$119,588	$393,611	$586,027

*1st & 2nd Quarter

CA Board of Equalization



APPENDIX J-3B

Removal Action Work Plan Approval Letter

Department of Toxic Substances Control

Matthew Rodriquez
Secretary for
Environmental Protection

Deborah O. Raphael, Director
8800 Cal Center Drive
Sacramento, California 95826-3200

Edmund G. Brown Jr.
Governor

November 12, 2013

Mr. Sean M. O'Neill
Genesis Engineering
1402 D Street
Marysville, California 95901

APPROVAL OF THE REMOVAL ACTION WORKPLAN FOR SPRING HILL MINE PROPERTY, GRASS VALLEY, CALIFORNIA, ASSESSOR'S PARCEL NUMBERS 35-260-62, 63, AND 64.

Mr. O'Neill:

The Removal Action Work Plan (RAW) and the proposed Notice of Exemption (NOE) from the California Environmental Quality Act (CEQA) for the Spring Hill Mine property located south of Dorsey Drive and south east of State Highway 49/20 in Grass Valley, California (Site) underwent a 30 day public comment period from August 8, 2013 to September 9, 2013. The comment period allowed the general public to review the proposed RAW and the proposed NOE and to write to The Department of Toxic Substances Control (DTSC) if they had any questions or comments. DTSC received written comments on the project from four community members during the comment period and one individual sent a comment by phone. The comments were addressed in the Response to Comments document that was issued to each person who commented and a copy of this document is included in the project file. None of the comments required changes to the draft RAW or NOE and thus DTSC now considers these documents as final and is hereby granting our decision of approval.

The Site consists of approximately 26 acres and is identified by Assessor's Parcel Numbers (APNs) 35-260-62, 25-260-63, and 35-260-64. The Site is currently being evaluated for commercial development. The Preliminary Endangerment Assessment (PEA) completed in January 2008 identified mine waste in soils on the property containing arsenic and lead concentrations ranging up to 579 milligrams per kilogram (mg/kg) and 418 mg/kg respectively. A draft RAW was submitted on August 26, 2008 to address the contamination found during the PEA investigation.

After reviewing the draft RAW, DTSC issued comments to the project consultants – Holdrege and Kull (H&K) on October 2, 2008. These comments were addressed in a draft Final RAW submitted on June 15, 2012. As part of the RAW review process, DTSC also prepared a draft NOE to address the requirements of CEQA. The draft RAW was approved for release for public review and comment on the dates specified above and a copy of the NOE was also made available to the public during the review period.

The Site has been divided into 3 areas of concern (AOCs). The final RAW indicates that AOC 1 and AOC 2 should undergo remediation to be protective of human health and the environment for the proposed future commercial usage of the Site. Excavation and removal of approximately 1,700 cubic yards (yds^3) or approximately 150 truckloads of mine wastes and soils in AOC 1 will be taken off-site to a permitted facility. In AOC 2 approximately 64,000 yds^3 of mine wastes and soils below AOC 1 concentration levels are proposed for on-site burial with a cap and land use restrictions. These buried materials will be placed under 10 feet of clean fill and then capped beneath a future building or parking lot foundation. A land use covenant (LUC) and operation and maintenance agreement (OMA) will also be enforced to prevent future disturbance of COC impacted mine wastes and soils and to ensure the Site continues to be used in an appropriate manner for the remedy.

You may proceed with implementing the RAW at your discretion, however please ensure that the enclosed public notice announcing DTSC's approval of the RAW is posted in the local area newspaper prior to commencing the cleanup. In addition, please notify Mr. Dean Wright at (916) 255-6528 at least one week prior to commencing the remediation effort.

Sincerely,

Dean Wright, P.G.
Brownfields & Environmental Restoration Program

Enclosure

cc: Mr. Jason Muir, P.E., G.E.
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Mr. Steven Becker, Chief
Supervising Senior Engineering Geologist
Brownfields and Environmental Restoration Program
8800 Cal Center Drive
Sacramento, California 95826-3200

DEPARTMENT OF TOXIC SUBSTANCES CONTROL APPROVES CLEANUP PLAN FOR THE SPRING HILL MINE SITE, GRASS VALLEY, CALIFORNIA

The Department of Toxic Substances Control (DTSC) has approved a Removal Action Work Plan (RAW) and Notice of Exemption (NOE) for the Spring Hill Mine property (Site) located south of Dorsey Drive and south east of State Highway 49/20 in Grass Valley, California, Nevada County, California. Historic mining activities at the Site resulted in contamination of soil with arsenic and lead that exceeded levels considered acceptable for the protection of human health given the Sites proposed future commercial use. The RAW states contaminated soil in certain areas of the Site will be dug up and taken off-site while contamination in other areas will be consolidated and place under 10 feet of clean fill and capped with a building or parking area once development occurs. Finally, land use controls (LUCs) and an operation and maintenance (O&M) agreement will be used ensure the integrity of the remedy into the future.

Copies of the RAW and NOE are available for review at:

Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California, 95826
Please contact DTSC at (916) 255-3545 to review the files at the Cal Center office.

Before the cleanup was approved, it had to meet the requirements of a California state law known as the California Environmental Quality Act (commonly referred to as CEQA) or it had to be shown to be exempt from CEQA. CEQA is important because it determines what impacts, if any, a proposed cleanup will have on the environment. After reviewing the cleanup measures to be taken, DTSC determined that a NOE from CEQA was appropriate and should be approved for this project. The NOE states that the project is exempt from CEQA because it is a minor cleanup action which will not have a significant effect on the environment given the activities outlined in the RAW.

If you have questions about the project, please contact the DTSC project manager Mr. Dean Wright at (916) 255-6528 or Radhika Majhail, the DTSC Public Participation Specialist at (916) 255-6681 or by e-mail at dean_wright@dtsc.ca.gov and radhika_majhail@dtsc.ca.gov respectively.

APPENDIX K

Drainage Analysis

GENESIS ENGINEERING

September 20, 2016

Public Works Department
City of Grass Valley
125 East Main Street
Grass Valley, CA 95945

To Whom it may concern:

Re: Preliminary storage sizing for Dorsey Drive

Attached is a preliminary hydraulic design for designing the required detention due to the increase in runoff from post developed construction. The City of Grass Valley Standards use the Rational Method to determine increase runoff however the Rational Method is not an accurate way to design detention. Therefore the SCS method was used to determine the increased runoff.

Autodesk Storm and Sanitary Sewer Analysis 2014 was used for hydraulic calculations using the SCS Unit Hydrograph Method. The main CN value used was 0.95 with 75% impervious using a Type 1A SCS storm. The rain depth was from Rain Gage Station GRASS VALLEY 2 NNE, station number A60 3572 00. There are two main runoff directions for the site, both run from north to south. One portion discharges from the site through an existing set of (3) 24" pipes and the other leaves an existing Drainage inlet and 12" pipe that outfalls into a rock lined swale. The design will detain enough runoff to not increase the pre developed flow rates through the swale and the 24" pipes.

The West portion of the site running north to south will require 3.35 acre-ft of storage which will be achieved using a stepped detention basin. The stepped detention basin will have inflow from each side of the site and will allow each stage of the pond to fill up between 2-4 feet before transferring to the next step of the pond. These ponds will also work as an extended detention basin to meet the Post-Construction design and LID requirements. The design is shown on the Preliminary Utility Plan

The East portion of the site running north to south will require 0.4 acre-ft of storage which will be achieved with a series of underground storage pipes, which were modeled using StormTech MC-4500 chambers. This resulted in approximately 600 LF of MC-4500. These pipes will be located along the southeast parking lot as shown on the Preliminary Utility Plan. From the StormTech the outfall will enter a shallow rock lined pond to keep velocity down when entering the existing Drainage Inlet. To meet the Post Construction design and LID requirements a Contech CDS separator will be used to treat low flow prior to entering the Stormtech MC-4500 chambers.

1402 D STREET · MARYSVILLE, CA 95901 · PHONE (530) 742-1300 · FAX (530) 742-1331

In addition to the hydraulics we ran preliminary Post Construction design and LID requirement calculations to ensure we had enough volume. The site is essentially broke up into 3 drainage management areas. Two of the drainage management areas will drain into the extended detention basins and the remaining drainage management area will enter the CDS separator and underground storage pipes.

Attached are the preliminary calculations for the volume required on the detention basin and the underground pipes. The first drainage management area (DMA1) takes the west portion of the site and the west portion of the detention basin before it steps down into the final detention basin. The required volume is 0.31 acre-ft of storage, we have provided 0.54 acre-ft of storage. The second drainage management area (DMA2) takes the east portion of the site and enters the east portion of the detention basin before it steps down into the final detention basin. The required volume is 0.32 acre-ft of storage, we have provided 1.49 acre-ft of storage. The final drainage management area (DMA3) takes the south east portion of the site and will enter the CDS before entering the underground detention pipes. The required volume is 0.13 acre-ft of storage, we have provided 0.4 acre-ft of storage.

The stepped detention basin in the upper tiers that are being used to meet the post construction LID requirements will have their soil amended and have 12 inches of crushed rock below the amended soil. Within the rock section a 4" perforated pipe will be placed and connect to the bottom tiers of the detention basin. The purpose of this is to allow drawdown and standing water in the ponds. The detention basins will have weirs at each top to allow overflow into the next tiered pond below.

Sean M. O'Neill

GENESIS ENGINEERING

PROJECT ______ BY ______ DATE ______ JOB NO. ______ SHEET ______ OF ______

DMA1: West side detention pond

Total Area = 9.85 acres = 429,066 ft^2
% Impervious = 75%

Impervious area = 7.38 acres = 321,800 ft^2

runoff coefficient "C" = 0.60

assume 75–85% capture per Casqa handbooks

Since 6V is between Sacramento and Truckee using CASQA rain gauge data. We take the average between the two.

unit basin storage volume = Sacramento = 0.48
Truckee = 0.52
average = 0.50 inches

$(321{,}800\ ft^2)(0.50\ inches)(1/12) = 13{,}408\ ft^3$ Storage required

$= 0.31$ acre-ft required.

GENESIS ENGINEERING

PROJECT
BY DATE
JOB NO.
SHEET OF

DMA 2: East side detention Pond

Total Area = 10.3 acres = 448,668 ft^2
% impervious = 75%

Impervious area = 7.725 acres = 336501 ft^2

runoff coefficient: 0.60

assume 75% - 80% capture.

average unit volume = 0.50 inches

$(336501)(0.50)(1/12) = 14,020\ ft^3$ storage required
$= 0.32$ acre-ft required.

GENESIS ENGINEERING

PROJECT ______ BY ______ DATE ______ JOB NO. ______ SHEET ______ OF ______

DMA 3: Apartment complex

Total Area = 4.25 acres = 185,130 ft²
75% impervious

impervious Area = 3.2 acres = 139,392 ft²

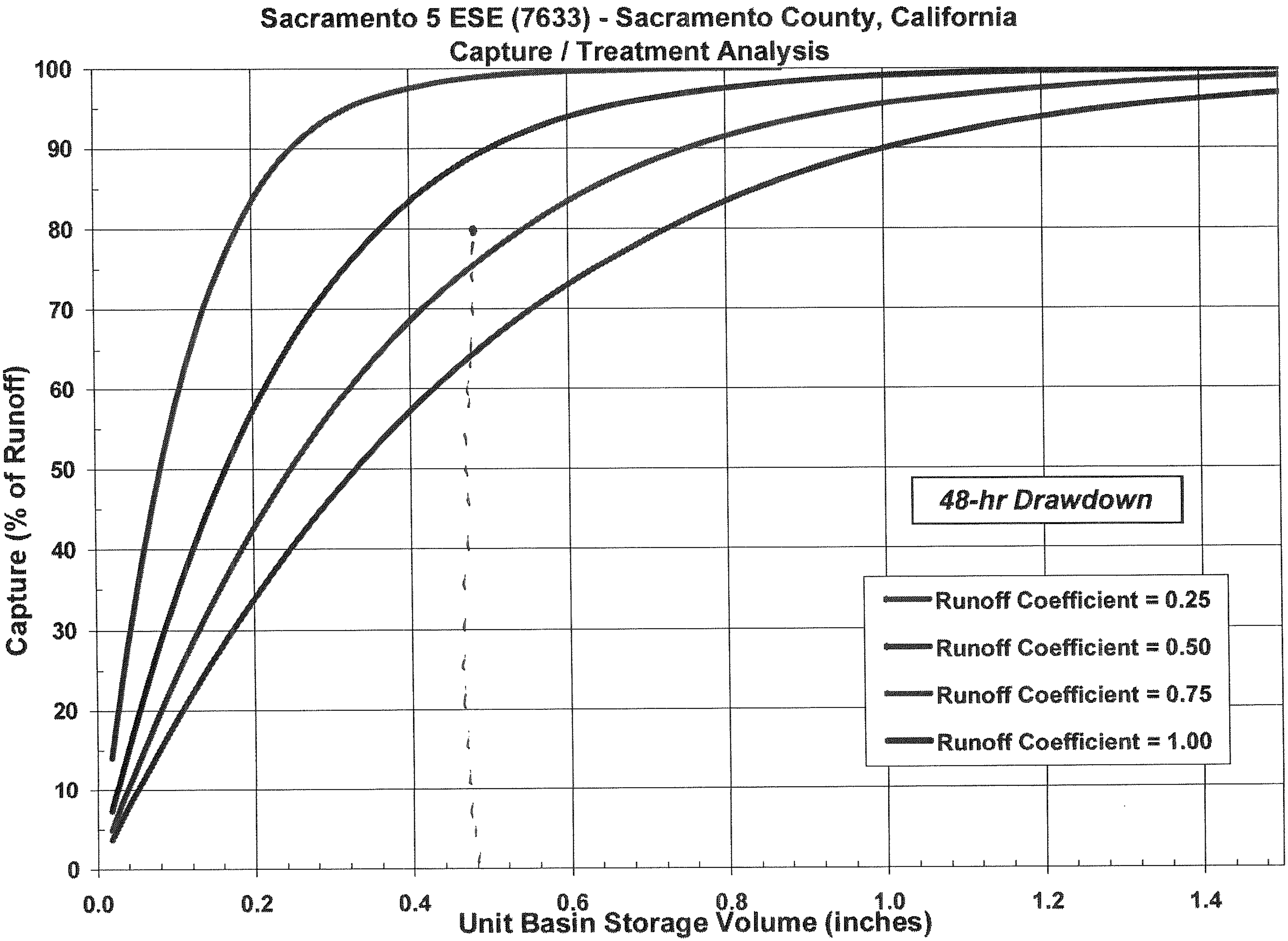
runoff coefficient = 0.6

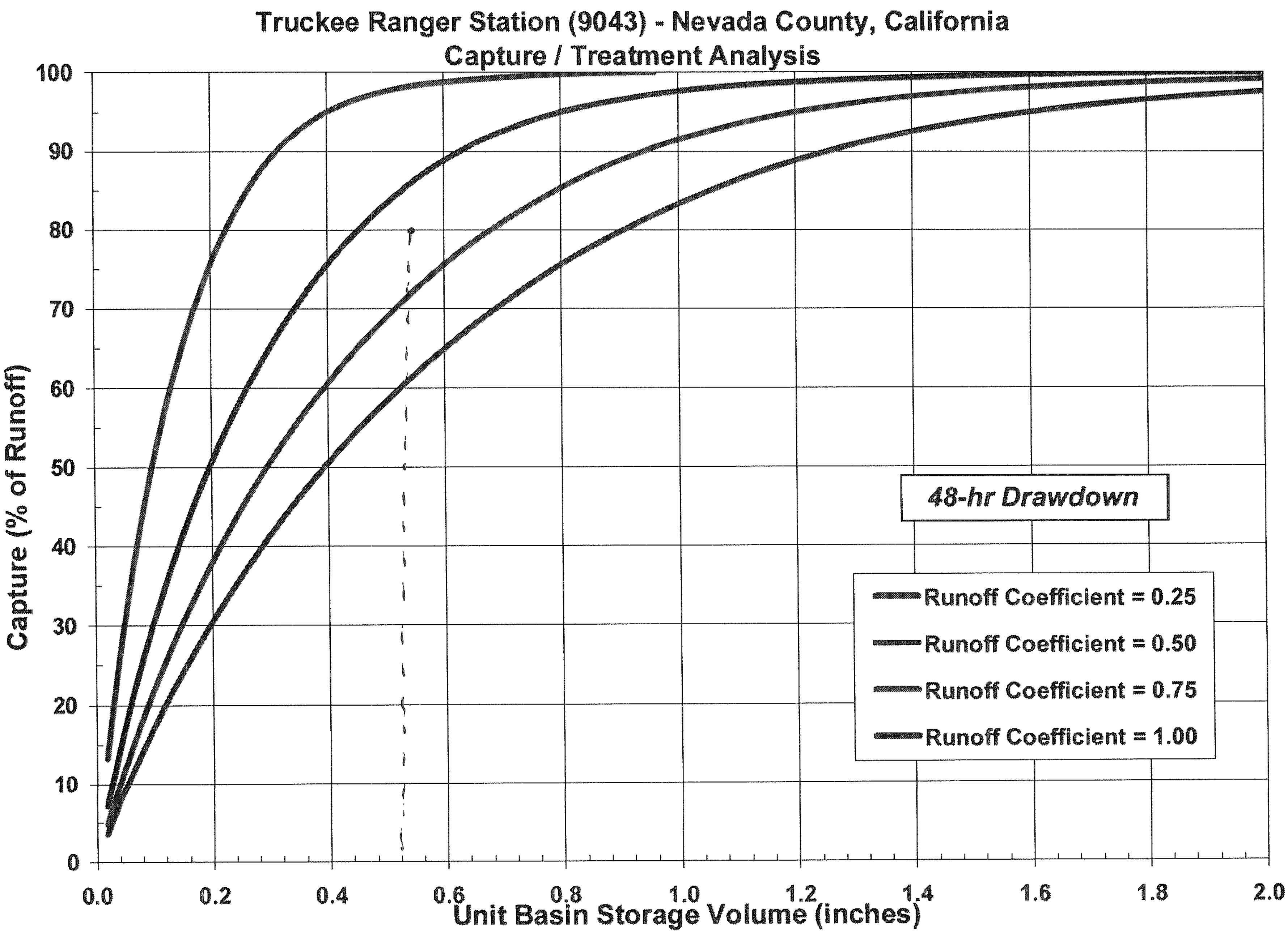
assume 75-85% capture

average unit volume = 0.50 inches

(139392)(0.50)(1/12) = 5808 ft³

= 0.13 acre-ft Storage required


Sacramento 5 ESE (7633) - Sacramento County, California
Capture / Treatment Analysis
Capture (% of Runoff)
100
90
80
70
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Unit Basin Storage Volume (inches)
48-hr Drawdown
Runoff Coefficient = 0.25
Runoff Coefficient = 0.50
Runoff Coefficient = 0.75
Runoff Coefficient = 1.00



Truckee Ranger Station (9043) - Nevada County, California
Capture / Treatment Analysis
Capture (% of Runoff)
Unit Basin Storage Volume (inches)
48-hr Drawdown
Runoff Coefficient = 0.25
Runoff Coefficient = 0.50
Runoff Coefficient = 0.75
Runoff Coefficient = 1.00
0
10
20
30
40
50
60
70
80
90
100
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0

Project Description

File Name	Pre Developed Dorsey.SPF
Description	S:\GENESIS JOB FILES\07-109 Dorsey Drive-GV\dwg\Dorsey site plan 10-30-14.dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Nov 04, 2014	00:00:00
End Analysis On	Nov 05, 2014	00:00:00
Start Reporting On	Nov 04, 2014	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	4
Nodes	5
Junctions	2
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	2
Channels	1
Pipes	1
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	25 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01	3.98	0.2000	0.55	0.11	0.43	1.32	0 00:19:47
2	Sub-02	3.86	0.2000	0.65	0.13	0.50	1.10	0 00:27:07
3	Sub-03	12.18	0.2000	0.73	0.15	1.77	3.04	0 00:34:46
4	Sub-04	5.10	0.2000	0.66	0.13	0.67	1.42	0 00:28:31

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	0.00	6.00	0.00	6.00	0.00	3.49	0.59	0.00	5.41	0 00:00	0.00	0.00
2	Jun-02	Junction	0.00	6.00	0.00	6.00	0.00	1.31	10.60	0.00	1.40	0 00:00	0.00	0.00
3	Out-02	Outfall	-0.20					3.49	0.37					
4	Out-03	Outfall	0.00					1.42	0.00					
5	Out-04	Outfall	0.00					1.10	0.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Link-01	Pipe	Jun-01	Out-02	20.00	0.00	-0.20	1.0000	24.000	0.0150	3.49	19.61	0.18	4.71	0.57	0.29	0.00	Calculated
2	Link-02	Channel	Jun-02	Jun-01	350.00	10.00	0.00	2.8600	24.000	0.0320	1.28	33.28	0.04	7.24	0.59	0.29	0.00	

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	Jun-01	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
2	Jun-02	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	3.49	3.04	0.59	0.59	0.00	5.41	0.02	0.02	0 00:21	0 00:00	0.00	0.00
2	Jun-02	1.31	1.31	10.60	10.60	0.00	1.40	10.01	10.01	0 00:20	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Link-02	350.00	10.00	10.00	0.00	0.00	10.00	2.8600	Triangular	2.000	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-02	1.28	0 00:21	33.28	0.04	7.24	0.81	0.59	0.29	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-01	20.00	0.00	0.00	-0.20	0.00	0.20	1.0000	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-01	3.49	0 00:35	19.61	0.18	4.71	0.07	0.57	0.29	0.00		Calculated

Project Description

File Name .... post developed dorsey-scs-detention pond-9-14-16.SPF
Description ....
25 Year Storm

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	HEC-1
Time of Concentration (TOC) Method	SCS TR-55
HEC-1 unit hydrograph method	Clark
HEC-1 loss method	SCS Curve Number
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Nov 10, 2014	00:00:00
End Analysis On	Nov 12, 2014	00:00:00
Start Reporting On	Nov 10, 2014	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	16
Nodes	29
Junctions	21
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	5
Links	26
Channels	2
Pipes	19
Pumps	0
Orifices	2
Weirs	3
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	25 Year	Time Series	25 Year	Intensity	inches	California	Nevada (Nevada City)	25	6.43	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01	2.39	6.42	3.69	8.83	3.60	0 00:09:37
2	Sub-02	1.52	6.42	3.80	5.78	2.35	0 00:12:12
3	Sub-03	2.09	6.42	3.77	7.87	3.21	0 00:14:18
4	Sub-04	1.71	6.42	3.80	6.50	2.64	0 00:12:09
5	Sub-05	1.64	6.42	3.82	6.26	2.54	0 00:12:29
6	Sub-08	0.93	6.42	3.89	3.61	1.46	0 00:15:00
7	Sub-10	0.70	6.42	3.79	2.65	1.08	0 00:13:46
8	Sub-11	0.66	6.42	3.63	2.40	0.97	0 00:10:20
9	Sub-12	3.52	6.42	3.76	13.25	5.38	0 00:11:18
10	Sub-16	2.55	6.42	2.36	6.02	2.43	0 00:13:09
11	Sub-17	0.87	6.42	3.88	3.37	1.37	0 00:10:30
12	Sub-18	1.49	6.42	3.72	5.54	2.25	0 00:12:09
13	Sub-20	3.59	6.42	3.76	13.49	5.47	0 00:10:30
14	Sub-21	0.75	6.42	3.84	2.88	1.17	0 00:10:20
15	Sub-23	1.09	6.42	3.76	4.09	1.67	0 00:07:42
16	Sub-24	0.63	6.42	3.82	2.41	0.98	0 00:08:47

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	Junction	2657.00	2661.00	0.00	6.00	0.00	3.60	2657.64	0.00	3.36	0 00:00	0.00	0.00
2	Jun-02	Junction	2653.00	2663.00	0.00	6.00	0.00	7.41	2653.82	0.00	9.18	0 00:00	0.00	0.00
3	Jun-03	Junction	2650.00	2656.00	0.00	6.00	0.00	9.94	2650.86	0.00	5.14	0 00:00	0.00	0.00
4	Jun-04	Junction	2645.00	2651.00	0.00	6.00	0.00	12.57	2651.00	0.00	0.00	0 04:49	0.00	3.00
5	Jun-05	Junction	2641.00	2647.00	0.00	6.00	0.00	13.01	2642.29	0.00	4.71	0 00:00	0.00	0.00
6	Jun-08	Junction	2645.00	2649.50	0.00	6.00	0.00	5.47	2645.78	0.00	3.72	0 00:00	0.00	0.00
7	Jun-09	Junction	2665.00	2670.00	0.00	6.00	0.00	1.66	2665.41	0.00	4.59	0 00:00	0.00	0.00
8	Jun-10	Junction	2667.00	2669.00	0.00	6.00	0.00	1.67	2667.41	0.00	1.59	0 00:00	0.00	0.00
9	Jun-12	Junction	2652.00	2658.00	0.00	6.00	0.00	1.66	2652.38	0.00	5.62	0 00:00	0.00	0.00
10	Jun-13	Junction	2645.00	2652.00	0.00	6.00	0.00	2.64	2645.40	0.00	6.60	0 00:00	0.00	0.00
11	Jun-14	Junction	2635.00	2641.00	0.00	6.00	0.00	1.08	2635.24	0.00	5.76	0 00:00	0.00	0.00
12	Jun-15	Junction	2628.00	2634.00	0.00	6.00	0.00	6.45	2628.46	0.00	5.54	0 00:00	0.00	0.00
13	Jun-16	Junction	2615.50	2625.00	0.00	6.00	0.00	6.44	2616.25	0.00	8.75	0 00:00	0.00	0.00
14	Jun-18	Junction	2632.00	2640.00	0.00	6.00	0.00	16.01	2633.49	0.00	6.51	0 00:00	0.00	0.00
15	Jun-20	Junction	2634.00	2646.00	0.00	6.00	0.00	15.09	2635.19	0.00	10.81	0 00:00	0.00	0.00
16	Jun-22	Junction	2644.00	2646.00	0.00	6.00	0.00	8.66	2644.88	0.00	1.12	0 00:00	0.00	0.00
17	Jun-23	Junction	2641.00	2643.00	0.00	0.00	0.00	9.82	2642.11	0.00	0.89	0 00:00	0.00	0.00
18	Jun-24	Junction	2625.00	2647.00	0.00	0.00	0.00	2.63	2625.40	0.00	21.60	0 00:00	0.00	0.00
19	Jun-26	Junction	2667.00	2677.00	0.00	0.00	0.00	1.46	2667.29	0.00	9.71	0 00:00	0.00	0.00
20	Out-01	Junction	2643.00	2645.00	0.00	0.00	0.00	9.82	2644.11	0.00	0.89	0 00:00	0.00	0.00
21	Out-02	Junction	2657.00	2659.00	0.00	0.00	0.00	3.21	2657.56	0.00	1.44	0 00:00	0.00	0.00
22	Out-04	Outfall	2571.50					3.59	2571.50					
23	Out-05	Outfall	2604.00					1.41	2604.00					
24	Out-06	Outfall	2605.00					2.63	2605.39					
25	Stor-02	Storage Node	2615.00	2620.00	0.00		0.00	6.44	2619.62				0.00	0.00
26	Stor-06	Storage Node	2604.00	2609.00	0.00		0.00	9.82	2608.21				0.00	0.00
27	Stor-07	Storage Node	2588.00	2593.00	0.00		0.00	9.81	2592.09				0.00	0.00
28	Stor-08	Storage Node	2574.00	2582.00	0.00		0.00	15.16	2578.68				0.00	0.00
29	Stor-09	Storage Node	2585.00	2590.00	0.00		0.00	15.99	2589.20				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	Link-03	Pipe	Jun-04	Jun-05	212.00	2645.00	2641.00	1.8900	18.000	0.0150	13.01	12.50	1.04	8.22	1.36	0.91	0.00	> CAPACITY
2	Link-04	Pipe	Jun-03	Jun-04	161.00	2650.00	2645.00	3.1100	18.000	0.0150	9.94	16.04	0.62	9.56	0.85	0.57	0.00	Calculated
3	Link-05	Pipe	Jun-02	Jun-03	150.00	2653.00	2650.00	2.0000	18.000	0.0150	7.41	12.87	0.58	7.54	0.81	0.54	0.00	Calculated
4	Link-06	Pipe	Jun-01	Jun-02	161.00	2657.00	2653.00	2.4800	12.000	0.0150	3.60	4.87	0.74	6.82	0.64	0.64	0.00	Calculated
5	Link-07	Pipe	Jun-10	Jun-09	83.00	2667.00	2665.00	2.4100	12.000	0.0150	1.66	4.79	0.35	5.55	0.40	0.41	0.00	Calculated
6	Link-08	Pipe	Jun-09	Jun-12	244.00	2665.00	2652.00	5.3300	12.000	0.0150	1.66	7.13	0.23	7.40	0.33	0.33	0.00	Calculated
7	Link-10	Pipe	Jun-12	Jun-13	232.00	2652.00	2645.00	3.0200	12.000	0.0150	1.66	5.36	0.31	6.04	0.38	0.38	0.00	Calculated
8	Link-13	Pipe	Jun-15	Jun-16	102.00	2628.00	2615.50	12.2500	18.000	0.0150	6.44	31.87	0.20	14.12	0.46	0.31	0.00	Calculated
9	Link-15	Pipe	Jun-18	Stor-09	130.00	2633.00	2585.00	36.9200	24.000	0.0150	15.99	119.14	0.13	26.42	0.49	0.25	0.00	Calculated
10	Link-20	Pipe	Jun-20	Jun-18	150.00	2634.00	2632.00	1.3300	24.000	0.0150	15.05	22.64	0.66	7.73	1.18	0.59	0.00	Calculated
11	Link-22	Pipe	Jun-16	Stor-02	40.85	2605.50	2605.00	1.2200	24.000	0.0150	6.44	21.69	0.30	6.02	0.74	0.37	0.00	Calculated
12	Link-23	Pipe	Jun-08	Jun-22	80.00	2645.00	2644.00	1.2500	18.000	0.0150	5.47	10.18	0.54	5.86	0.78	0.52	0.00	Calculated
13	Link-29	Pipe	Jun-23	Stor-06	128.00	2641.00	2606.00	27.3400	18.000	0.0150	9.82	47.60	0.21	21.21	0.46	0.31	0.00	Calculated
14	Link-30	Pipe	Jun-14	Jun-15	163.89	2635.00	2628.00	4.2700	18.000	0.0150	1.07	18.81	0.06	5.79	0.24	0.16	0.00	Calculated
15	Link-32	Pipe	Jun-24	Out-06	275.57	2625.00	2605.00	7.2600	12.000	0.0150	2.63	8.32	0.32	9.39	0.39	0.39	0.00	Calculated
16	Link-33	Pipe	Jun-13	Jun-24	303.56	2645.00	2625.00	6.5900	12.000	0.0150	2.63	7.93	0.33	9.07	0.40	0.40	0.00	Calculated
17	Link-34	Pipe	Jun-26	Jun-02	200.00	2667.00	2653.00	7.0000	12.000	0.0150	1.46	8.17	0.18	7.86	0.29	0.29	0.00	Calculated
18	Link-35	Pipe	Jun-05	Jun-20	103.86	2641.00	2634.00	6.7400	18.000	0.0150	12.87	23.63	0.54	13.68	0.78	0.53	0.00	Calculated
19	Link-38	Pipe	Jun-22	Out-01	30.00	2644.00	2643.00	3.3300	15.000	0.0150	8.66	10.22	0.85	9.34	0.88	0.71	0.00	Calculated
20	Link-24	Channel	Out-01	Jun-23	175.08	2643.00	2640.00	1.7100	24.000	0.0320	9.82	47.24	0.21	3.23	1.11	0.55	0.00	
21	Link-25	Channel	Out-02	Jun-22	270.24	2657.00	2643.00	5.1800	24.000	0.0320	3.20	96.93	0.03	4.78	0.56	0.28	0.00	
22	Orifice-04	Orifice	Stor-02	Out-05		2615.00	2604.00		5.000		1.41							
23	Orifice-05	Orifice	Stor-08	Out-04		2574.00	2571.50		8.000		3.59							
24	Weir-01	Weir	Stor-06	Stor-07		2604.00	2588.00				9.81							
25	Weir-02	Weir	Stor-07	Stor-08		2588.00	2574.00				3.85							
26	Weir-03	Weir	Stor-09	Stor-08		2585.00	2574.00				12.27							

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	Jun-01	2657.00	2661.00	4.00	0.00	-2657.00	6.00	-2655.00	0.00	0.00
2	Jun-02	2653.00	2663.00	10.00	0.00	-2653.00	6.00	-2657.00	0.00	0.00
3	Jun-03	2650.00	2656.00	6.00	0.00	-2650.00	6.00	-2650.00	0.00	0.00
4	Jun-04	2645.00	2651.00	6.00	0.00	-2645.00	6.00	-2645.00	0.00	0.00
5	Jun-05	2641.00	2647.00	6.00	0.00	-2641.00	6.00	-2641.00	0.00	0.00
6	Jun-08	2645.00	2649.50	4.50	0.00	-2645.00	6.00	-2643.50	0.00	0.00
7	Jun-09	2665.00	2670.00	5.00	0.00	-2665.00	6.00	-2664.00	0.00	0.00
8	Jun-10	2667.00	2669.00	2.00	0.00	-2667.00	6.00	-2663.00	0.00	0.00
9	Jun-12	2652.00	2658.00	6.00	0.00	-2652.00	6.00	-2652.00	0.00	0.00
10	Jun-13	2645.00	2652.00	7.00	0.00	-2645.00	6.00	-2646.00	0.00	0.00
11	Jun-14	2635.00	2641.00	6.00	0.00	-2635.00	6.00	-2635.00	0.00	0.00
12	Jun-15	2628.00	2634.00	6.00	0.00	-2628.00	6.00	-2628.00	0.00	0.00
13	Jun-16	2615.50	2625.00	9.50	0.00	-2615.50	6.00	-2619.00	0.00	0.00
14	Jun-18	2632.00	2640.00	8.00	0.00	-2632.00	6.00	-2634.00	0.00	0.00
15	Jun-20	2634.00	2646.00	12.00	0.00	-2634.00	6.00	-2640.00	0.00	0.00
16	Jun-22	2644.00	2646.00	2.00	0.00	-2644.00	6.00	-2640.00	0.00	0.00
17	Jun-23	2641.00	2643.00	2.00	0.00	-2641.00	0.00	-2643.00	0.00	0.00
18	Jun-24	2625.00	2647.00	22.00	0.00	-2625.00	0.00	-2647.00	0.00	0.00
19	Jun-26	2667.00	2677.00	10.00	0.00	-2667.00	0.00	-2677.00	0.00	0.00
20	Out-01	2643.00	2645.00	2.00	0.00	-2643.00	0.00	-2645.00	0.00	0.00
21	Out-02	2657.00	2659.00	2.00	0.00	-2657.00	0.00	-2659.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	Jun-01	3.60	3.60	2657.64	0.64	0.00	3.36	2657.07	0.07	0 04:48	0 00:00	0.00	0.00
2	Jun-02	7.41	2.35	2653.82	0.82	0.00	9.18	2653.09	0.09	0 04:48	0 00:00	0.00	0.00
3	Jun-03	9.94	2.54	2650.86	0.86	0.00	5.14	2650.10	0.10	0 04:48	0 00:00	0.00	0.00
4	Jun-04	12.57	2.64	2651.00	6.00	0.00	0.00	2645.13	0.13	0 04:48	0 04:49	0.00	3.00
5	Jun-05	13.01	0.00	2642.29	1.29	0.00	4.71	2641.12	0.12	0 04:50	0 00:00	0.00	0.00
6	Jun-08	5.47	5.47	2645.78	0.78	0.00	3.72	2645.09	0.09	0 04:48	0 00:00	0.00	0.00
7	Jun-09	1.66	0.00	2665.41	0.41	0.00	4.59	2665.05	0.05	0 04:47	0 00:00	0.00	0.00
8	Jun-10	1.67	1.67	2667.41	0.41	0.00	1.59	2667.05	0.05	0 04:47	0 00:00	0.00	0.00
9	Jun-12	1.66	0.00	2652.38	0.38	0.00	5.62	2652.05	0.05	0 04:47	0 00:00	0.00	0.00
10	Jun-13	2.64	0.97	2645.40	0.40	0.00	6.60	2645.05	0.05	0 04:48	0 00:00	0.00	0.00
11	Jun-14	1.08	1.08	2635.24	0.24	0.00	5.76	2635.03	0.03	0 04:48	0 00:00	0.00	0.00
12	Jun-15	6.45	5.38	2628.46	0.46	0.00	5.54	2628.06	0.06	0 04:48	0 00:00	0.00	0.00
13	Jun-16	6.44	0.00	2616.25	0.75	0.00	8.75	2615.59	0.09	0 04:48	0 00:00	0.00	0.00
14	Jun-18	16.01	0.98	2633.49	1.49	0.00	6.51	2633.06	1.06	0 04:51	0 00:00	0.00	0.00
15	Jun-20	15.09	2.25	2635.19	1.19	0.00	10.81	2634.13	0.13	0 04:50	0 00:00	0.00	0.00
16	Jun-22	8.66	0.00	2644.88	0.88	0.00	1.12	2644.09	0.09	0 04:48	0 00:00	0.00	0.00
17	Jun-23	9.82	0.00	2642.11	1.11	0.00	0.89	2641.17	0.17	0 04:49	0 00:00	0.00	0.00
18	Jun-24	2.63	0.00	2625.40	0.40	0.00	21.60	2625.05	0.05	0 04:48	0 00:00	0.00	0.00
19	Jun-26	1.46	1.46	2667.29	0.29	0.00	9.71	2667.04	0.04	0 04:48	0 00:00	0.00	0.00
20	Out-01	9.82	1.17	2644.11	1.11	0.00	0.89	2643.17	0.17	0 04:48	0 00:00	0.00	0.00
21	Out-02	3.21	3.21	2657.56	0.56	0.00	1.44	2657.08	0.08	0 04:48	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Link-24	175.08	2643.00	0.00	2640.00	-1.00	3.00	1.7100	Triangular	2.000	10.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Link-25	270.24	2657.00	0.00	2643.00	-1.00	14.00	5.1800	Triangular	2.000	10.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-24	9.82	0 04:49	47.24	0.21	3.23	0.90	1.11	0.55	0.00		
2	Link-25	3.20	0 04:49	96.93	0.03	4.78	0.94	0.56	0.28	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	Link-03	212.00	2645.00	0.00	2641.00	0.00	4.00	1.8900	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
2	Link-04	161.00	2650.00	0.00	2645.00	0.00	5.00	3.1100	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
3	Link-05	150.00	2653.00	0.00	2650.00	0.00	3.00	2.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
4	Link-06	161.00	2657.00	0.00	2653.00	0.00	4.00	2.4800	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
5	Link-07	83.00	2667.00	0.00	2665.00	0.00	2.00	2.4100	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
6	Link-08	244.00	2665.00	0.00	2652.00	0.00	13.00	5.3300	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
7	Link-10	232.00	2652.00	0.00	2645.00	0.00	7.00	3.0200	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
8	Link-13	102.00	2628.00	0.00	2615.50	0.00	12.50	12.2500	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
9	Link-15	130.00	2633.00	1.00	2585.00	0.00	48.00	36.9200	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
10	Link-20	150.00	2634.00	0.00	2632.00	0.00	2.00	1.3300	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
11	Link-22	40.85	2605.50	-10.00	2605.00	-10.00	0.50	1.2200	CIRCULAR	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
12	Link-23	80.00	2645.00	0.00	2644.00	0.00	1.00	1.2500	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
13	Link-29	128.00	2641.00	0.00	2606.00	2.00	35.00	27.3400	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
14	Link-30	163.89	2635.00	0.00	2628.00	0.00	7.00	4.2700	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
15	Link-32	275.57	2625.00	0.00	2605.00	0.00	20.00	7.2600	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
16	Link-33	303.56	2645.00	0.00	2625.00	0.00	20.00	6.5900	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
17	Link-34	200.00	2667.00	0.00	2653.00	0.00	14.00	7.0000	CIRCULAR	12.000	12.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
18	Link-35	103.86	2641.00	0.00	2634.00	0.00	7.00	6.7400	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
19	Link-38	30.00	2644.00	0.00	2643.00	0.00	1.00	3.3300	CIRCULAR	15.000	15.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Link-03	13.01	0 04:50	12.50	1.04	8.22	0.43	1.36	0.91	0.00		> CAPACITY
2	Link-04	9.94	0 04:49	16.04	0.62	9.56	0.28	0.85	0.57	0.00		Calculated
3	Link-05	7.41	0 04:48	12.87	0.58	7.54	0.33	0.81	0.54	0.00		Calculated
4	Link-06	3.60	0 04:48	4.87	0.74	6.82	0.39	0.64	0.64	0.00		Calculated
5	Link-07	1.66	0 04:47	4.79	0.35	5.55	0.25	0.40	0.41	0.00		Calculated
6	Link-08	1.66	0 04:47	7.13	0.23	7.40	0.55	0.33	0.33	0.00		Calculated
7	Link-10	1.66	0 04:48	5.36	0.31	6.04	0.64	0.38	0.38	0.00		Calculated
8	Link-13	6.44	0 04:48	31.87	0.20	14.12	0.12	0.46	0.31	0.00		Calculated
9	Link-15	15.99	0 04:51	119.14	0.13	26.42	0.08	0.49	0.25	0.00		Calculated
10	Link-20	15.05	0 04:51	22.64	0.66	7.73	0.32	1.18	0.59	0.00		Calculated
11	Link-22	6.44	0 04:48	21.69	0.30	6.02	0.11	0.74	0.37	0.00		Calculated
12	Link-23	5.47	0 04:48	10.18	0.54	5.86	0.23	0.78	0.52	0.00		Calculated
13	Link-29	9.82	0 04:49	47.60	0.21	21.21	0.10	0.46	0.31	0.00		Calculated
14	Link-30	1.07	0 04:48	18.81	0.06	5.79	0.47	0.24	0.16	0.00		Calculated
15	Link-32	2.63	0 04:48	8.32	0.32	9.39	0.49	0.39	0.39	0.00		Calculated
16	Link-33	2.63	0 04:48	7.93	0.33	9.07	0.56	0.40	0.40	0.00		Calculated
17	Link-34	1.46	0 04:48	8.17	0.18	7.86	0.42	0.29	0.29	0.00		Calculated
18	Link-35	12.87	0 04:50	23.63	0.54	13.68	0.13	0.78	0.53	0.00		Calculated
19	Link-38	8.66	0 04:49	10.22	0.85	9.34	0.05	0.88	0.71	0.00		Calculated

Storage Nodes

Storage Node : Stor-02

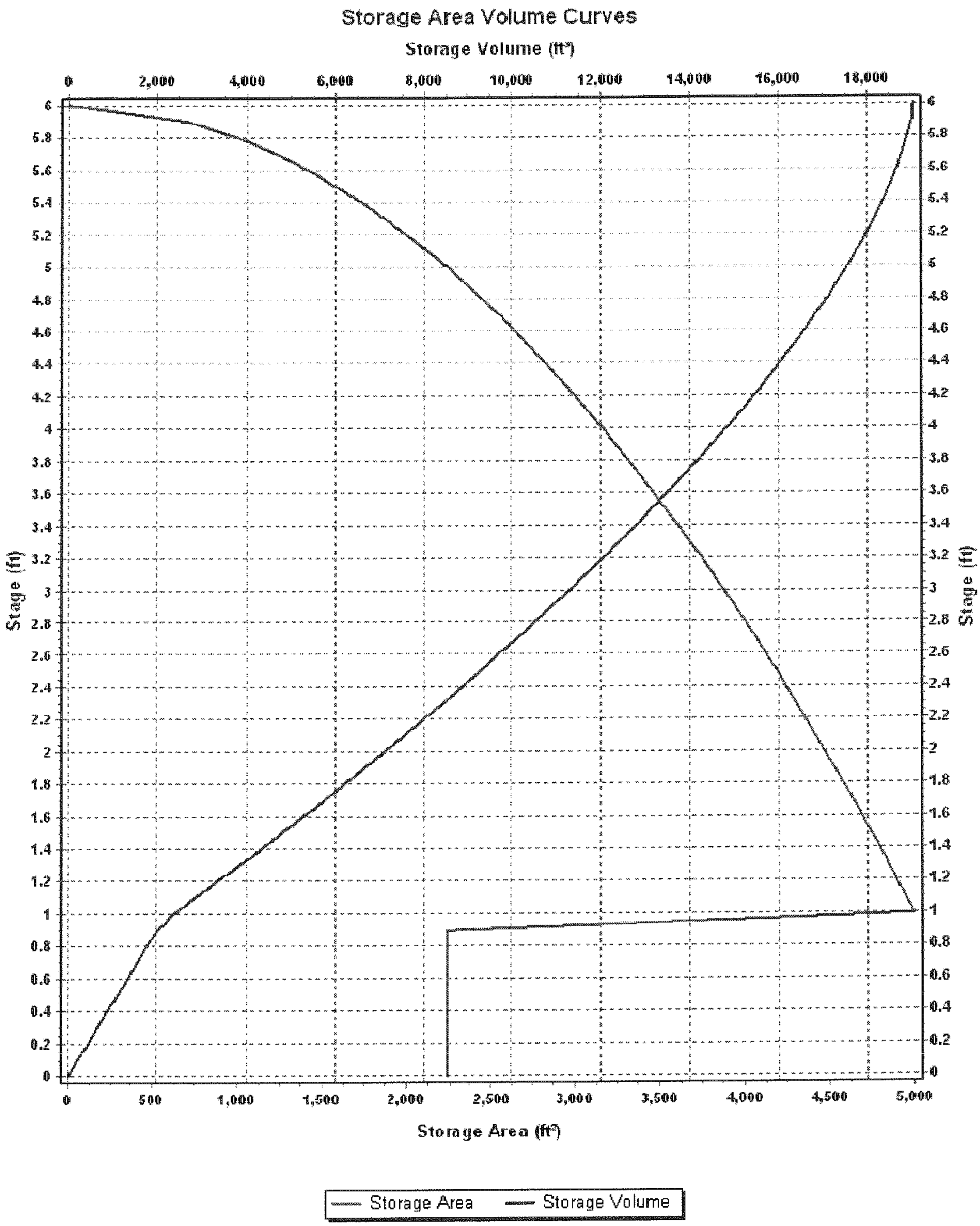
Input Data

Invert Elevation (ft) 2615.00
Max (Rim) Elevation (ft) 2620.00
Max (Rim) Offset (ft) 5.00
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -2615.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Southeast storage

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	2239.9999	0.000
0.1	2239.9999	224.00
0.2	2239.9999	448.00
0.3	2239.9999	672.00
0.4	2239.9999	896.00
0.5	2239.9999	1120.00
0.6	2239.9999	1344.00
0.7	2239.9999	1568.00
0.8	2239.9999	1792.00
0.9	2239.9999	2016.00
1	4999.9998	2378.00
1.2	4898.9793	3367.90
1.3	4847.6797	3855.23
1.4	4795.8313	4337.41
1.5	4743.4163	4814.37
1.6	4690.4156	5286.06
1.7	4636.8091	5752.42
1.8	4582.5755	6213.39
1.9	4527.6924	6668.90
2	4472.1358	7118.89
2.1	4415.8803	7563.29
2.2	4358.8988	8002.03
2.3	4301.1625	8435.03
2.4	4242.6405	8862.22
2.5	4183.3000	9283.52
2.6	4123.1055	9698.84
2.7	4062.0190	10108.10
2.8	3999.9998	10511.20
2.9	3937.0038	10908.05
3	3872.9832	11298.55
3.1	3807.8864	11682.59
3.2	3741.6572	12060.07
3.3	3674.2345	12430.86
3.4	3605.5511	12794.85
3.5	3535.5338	13151.90
3.6	3464.1015	13501.88
3.7	3391.1649	13844.64
3.8	3316.6247	14180.03
3.9	3240.3702	14507.88
4	3162.2775	14828.01
4.1	3082.2069	15140.23
4.2	2999.9999	15444.34
4.3	2915.4758	15740.11
4.4	2828.4270	16027.31
4.5	2738.6127	16305.66
4.6	2645.7512	16574.88
4.7	2549.5097	16834.64
4.8	2449.4896	17084.59
4.9	2345.2078	17324.32
5	2236.0679	17553.38
5.1	2121.3203	17771.25
5.2	1999.9999	17977.32
5.3	1870.8286	18170.86
5.4	1732.0507	18351.00
5.5	1581.1388	18516.66
5.6	1414.2135	18666.43
5.7	1224.7448	18798.38
5.8	1000.0000	18909.62
5.9	707.1068	18994.98
6	0.0000	19030.34


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
Stage (ft)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6
3.8
4
4.2
4.4
4.6
4.8
5
5.2
5.4
5.6
5.8
6
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Stor-02 (continued)

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Orifice-04	Side	CIRCULAR	No	5.00			2605.00	0.61

Output Summary Results

Peak Inflow (cfs) 6.44
Peak Lateral Inflow (cfs) 0.00
Peak Outflow (cfs) 1.41
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 2619.62
Max HGL Depth Attained (ft) 4.62
Average HGL Elevation Attained (ft) 2615.86
Average HGL Depth Attained (ft) 0.86
Time of Max HGL Occurrence (days hh:mm) 0 06:06
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : Stor-06

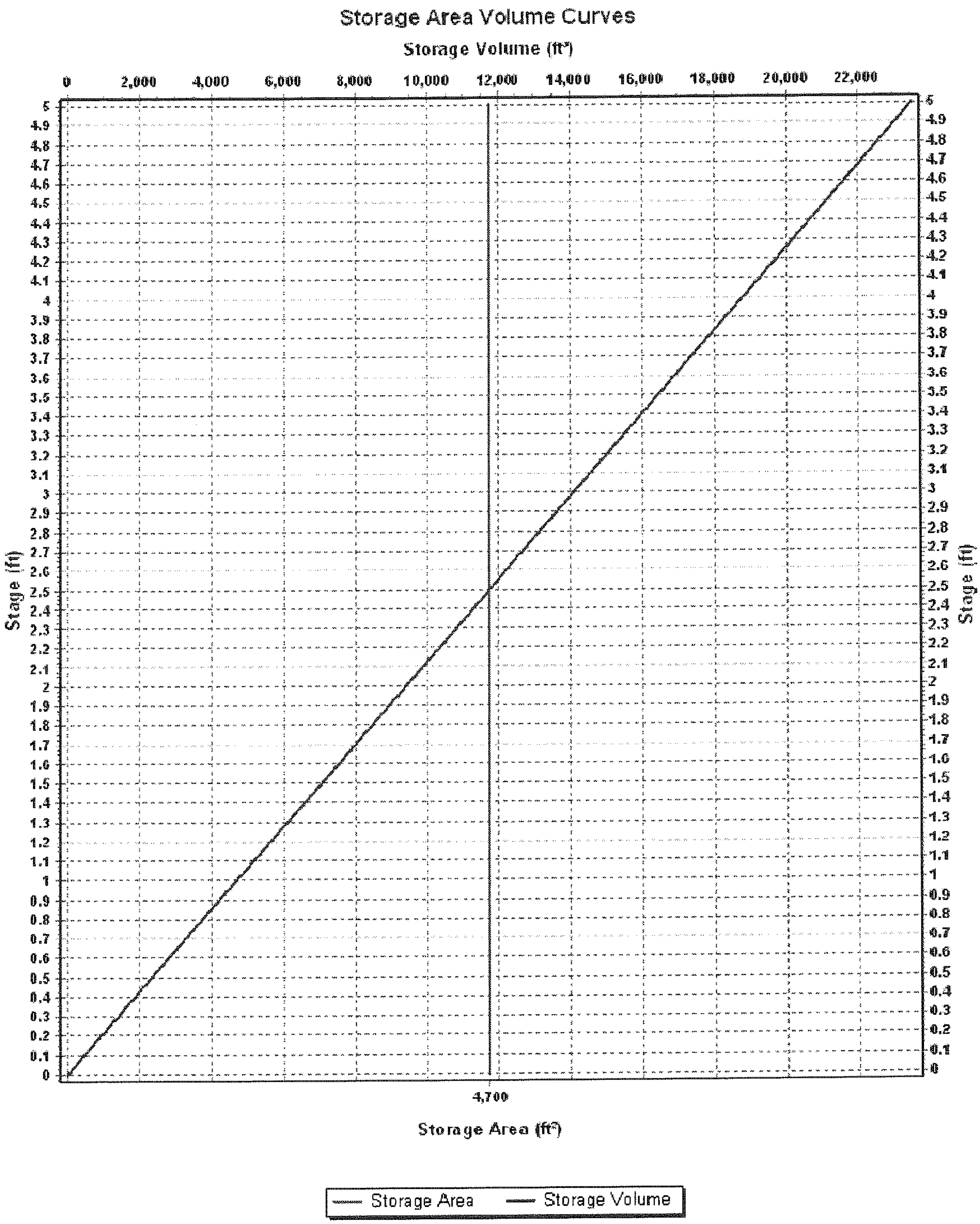
Input Data

Invert Elevation (ft) 2604.00
Max (Rim) Elevation (ft) 2609.00
Max (Rim) Offset (ft) 5.00
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -2604.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : 4700 area

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	4700	0.000
5	4700	23500.00



Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
Stage (ft)
Stage (ft)
4,700
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Stor-06 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-01	Rectangular	No	2608.00	4.00	30.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs) 9.82
Peak Lateral Inflow (cfs) 0.00
Peak Outflow (cfs) 9.81
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 2608.21
Max HGL Depth Attained (ft) 4.21
Average HGL Elevation Attained (ft) 2607.81
Average HGL Depth Attained (ft) 3.81
Time of Max HGL Occurrence (days hh:mm) 0 04:50
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : Stor-07

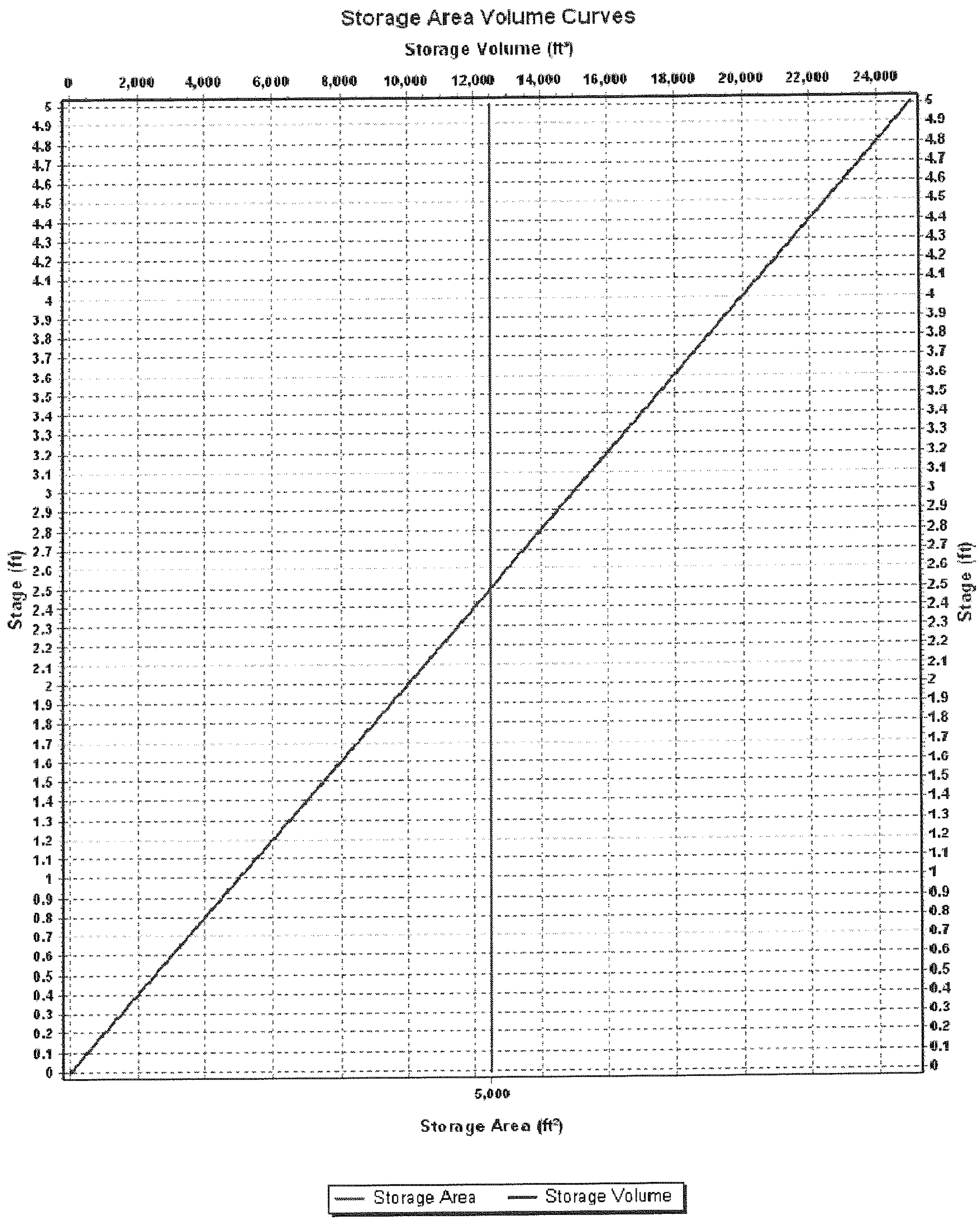
Input Data

Invert Elevation (ft) 2588.00
Max (Rim) Elevation (ft) 2593.00
Max (Rim) Offset (ft) 5.00
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -2588.00
Ponded Area (ft^2) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : 5000 area

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	5000	0.000
5	5000	25000.00


Storage Area Volume Curves
Storage Volume (ft³)
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
3.4
3.5
3.6
3.7
3.8
3.9
4
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5
5,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Stor-07 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-02	Rectangular	No	2592.00	4.00	40.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs) 9.81
Peak Lateral Inflow (cfs) 0.00
Peak Outflow (cfs) 3.85
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 2592.09
Max HGL Depth Attained (ft) 4.09
Average HGL Elevation Attained (ft) 2591.62
Average HGL Depth Attained (ft) 3.62
Time of Max HGL Occurrence (days hh:mm) 0 05:14
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : Stor-08

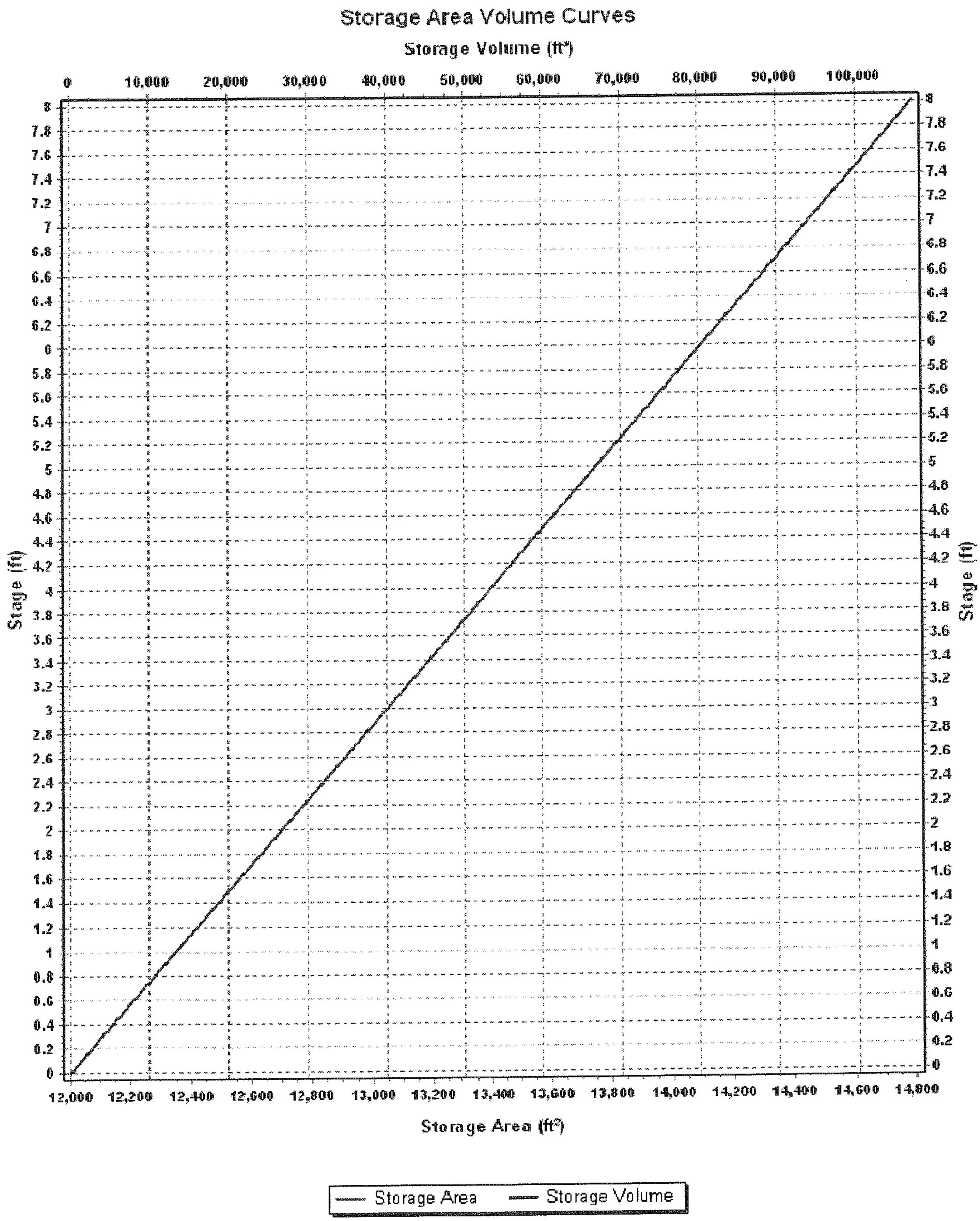
Input Data

Invert Elevation (ft) 2574.00
Max (Rim) Elevation (ft) 2582.00
Max (Rim) Offset (ft) 8.00
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -2574.00
Ponded Area (ft^2) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : 12000 area

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	12000	0.000
8	14800	107200.00



Storage Area Volume Curves
Storage Volume (ft³)
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000
100,000
Stage (ft)
Stage (ft)
12,000
12,200
12,400
12,600
12,800
13,000
13,200
13,400
13,600
13,800
14,000
14,200
14,400
14,600
14,800
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Stor-08 (continued)

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Orifice-05	Side	CIRCULAR	No	8.00			2574.00	0.61

Output Summary Results

Peak Inflow (cfs) 15.16
Peak Lateral Inflow (cfs) 3.77
Peak Outflow (cfs) 3.59
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 2578.68
Max HGL Depth Attained (ft) 4.68
Average HGL Elevation Attained (ft) 2575.16
Average HGL Depth Attained (ft) 1.16
Time of Max HGL Occurrence (days hh:mm) 0 11:03
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Storage Node : Stor-09

Input Data

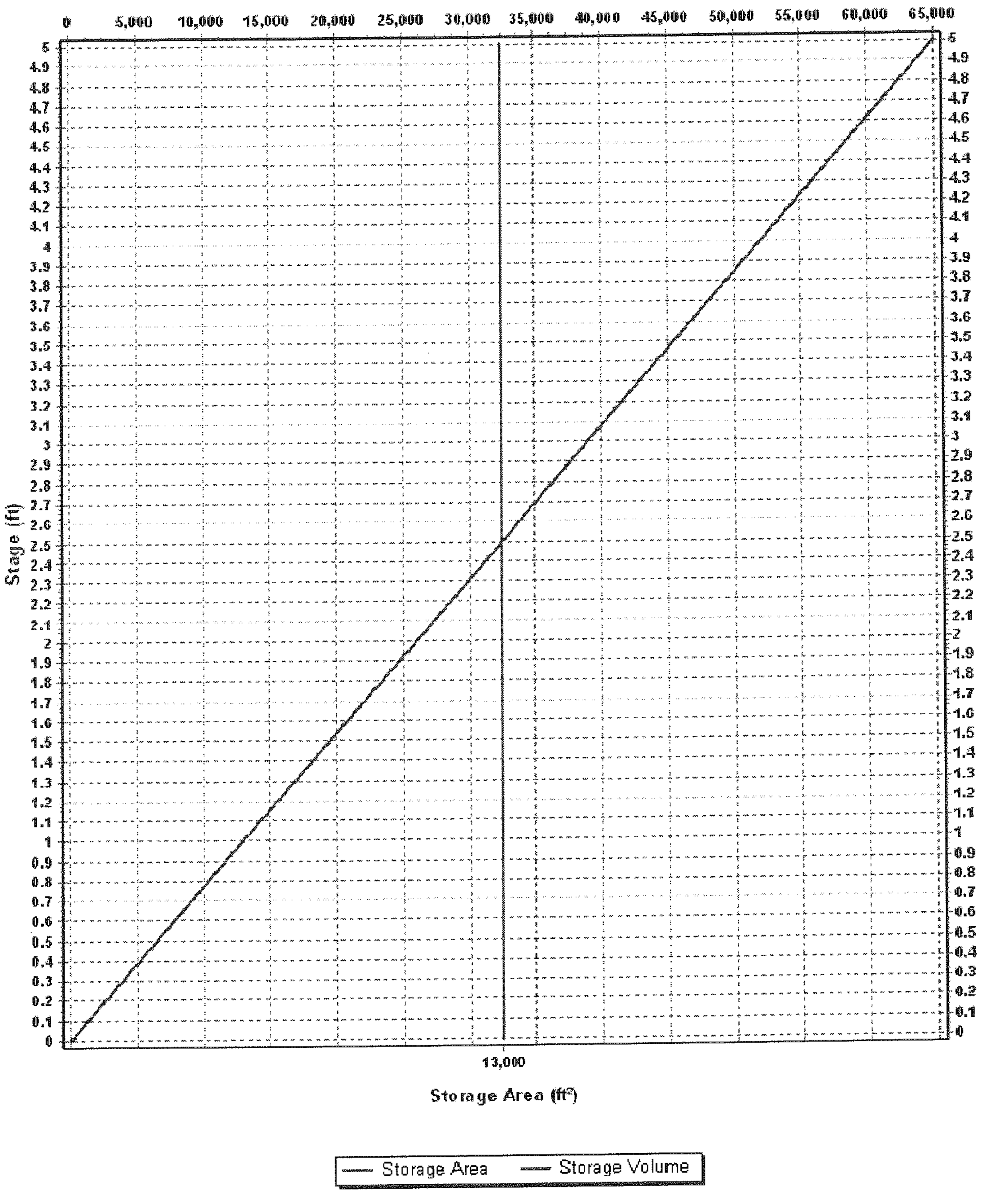
Invert Elevation (ft) 2585.00
Max (Rim) Elevation (ft) 2590.00
Max (Rim) Offset (ft) 5.00
Initial Water Elevation (ft) 0.00
Initial Water Depth (ft) .... -2585.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : 13000 area

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	13000	0.000
5	13000	65000.00

Storage Area Volume Curves



Storage Node : Stor-09 (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Weir-03	Rectangular	No	2589.00	4.00	40.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs) 15.99
Peak Lateral Inflow (cfs) 0.00
Peak Outflow (cfs) 12.27
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 2589.20
Max HGL Depth Attained (ft) 4.2
Average HGL Elevation Attained (ft) 2588.73
Average HGL Depth Attained (ft) 3.73
Time of Max HGL Occurrence (days hh:mm) 0 04:58
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

APPENDIX L

Sewer Flow Assessment

Dorsey Marketplace Project
Technical Memorandum No. 1

Sewer Capacity Assessment

Prepared for:
DUDEK

Prepared by:
Stantec Consulting Services, Inc.

October 21, 2016

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Prepared by ______________________________
(signature)

Breanna Webb, EIT

Reviewed by ______________________________
(signature)

Dave Price, P.E.

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TM1 Sewer Capacity Assessment

Prepared By: Breanna Webb, EIT

Reviewed By: Dave Price, PE

Date: October 21, 2016

1.0 PURPOSE

Stantec has completed a sewer capacity assessment to evaluate specific impacts of the proposed Dorsey Marketplace development on the City's existing wastewater collection system. The purpose of this memo is to present the results and findings of the sewer capacity assessment.

The R. Jeter Family Trust has proposed a development located at the southeast corner of Dorsey Drive and Highway 49 within the City of Grass Valley (City), known as the Dorsey Marketplace Project (Proposed Project). The development will have two entrances, one on Dorsey Drive and the other on Springhill Drive. The proposed utility plan routes wastewater by gravity through an 8" sewer collector in Springhill Drive which connects to an 18" trunk sewer in Idaho Maryland Road. The Idaho Maryland Trunk sewer connects to the City's Main Trunk sewer where Idaho Maryland Road intersects East Main Street. The Main Trunk is aligned roughly parallel to Highway 49 and conveys flow to the City's wastewater treatment plant (WWTP).

1.1 BACKGROUND

1.1.1 Dorsey Marketplace Project

The Proposed Project is of a 26.9 acre former mine site, located on the south side of Dorsey Drive just east of the northbound off ramp of State Route 20/49 within the City of Grass Valley. The Proposed Project location is shown in **Figure 1**. It will consist of an integrated mixed use, infill retail commercial and residential project. The parcel was rezoned to reflect 21.2 acres of Commercial and 5.7 acres of Residential Urban High Density land use. The Proposed Project, consists of approximately 181,900 square feet of retail, service, and community uses, as well as a 90-unit apartment complex.

The Proposed Project is currently completing the entitlement process, which includes preparation of a CEQA document which is to identify all potential impacts resulting from the development of the project and any mitigation measures proposed to reduce those impacts to a less than significant level.

This report was required by the City of Grass Valley to assess the impact of the Proposed Project on the City's collection system. In addition to this report, which is specific to the potential project impacts on the City's sewer collection system, Genesis Engineering has prepared an overall capacity evaluation of the Springhill Drive sewer collector, which was also required by the City. This evaluation can be found in **Exhibit A**.

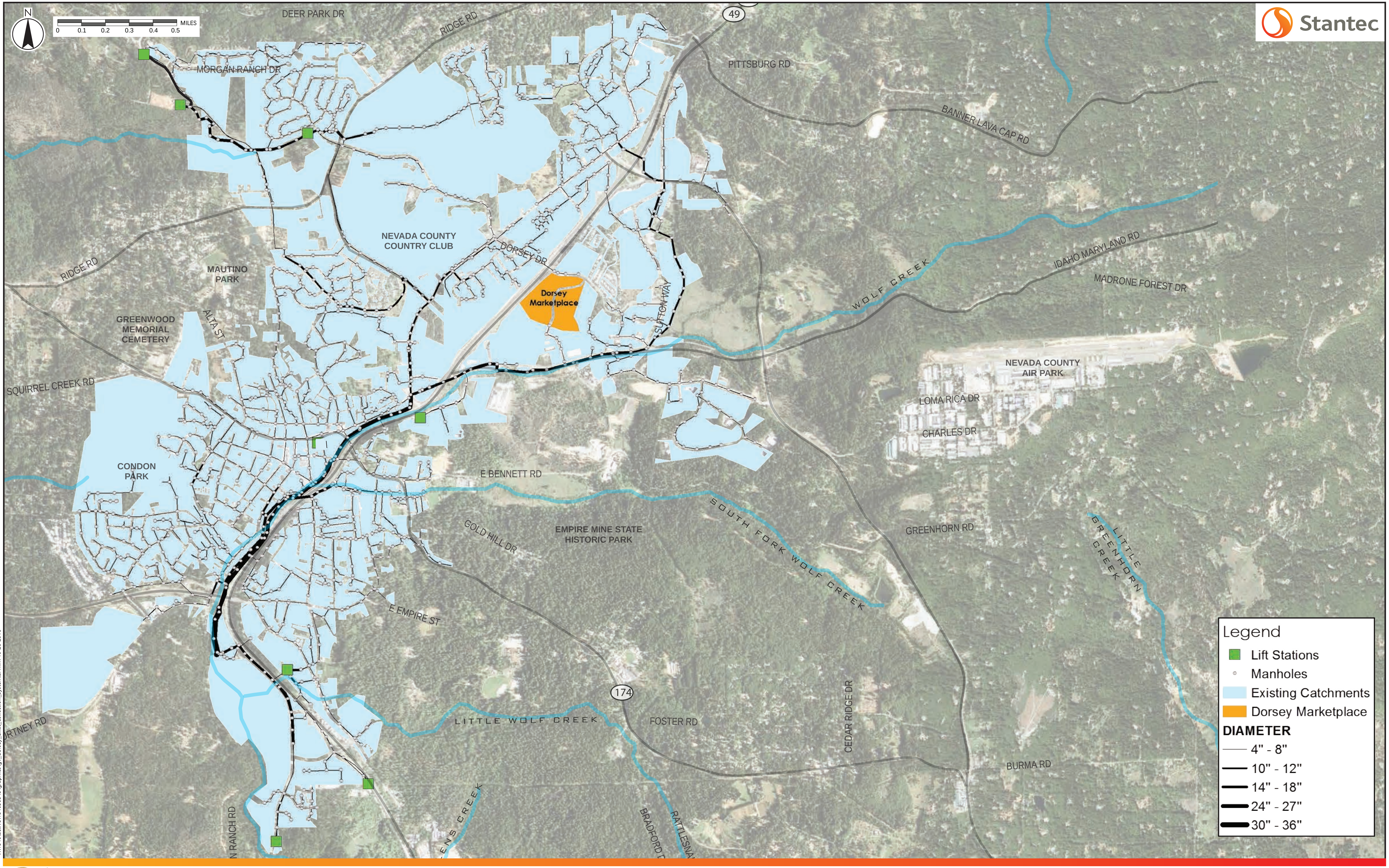
1.1.2 Wastewater System Master Plan

The City's Wastewater System Master Plan (Master Plan) was completed by Stantec in August of 2016. The Master Plan is intended to provide guidance to the City on the management of their existing WWTP, collection system and associated appurtenances by providing assessments of the existing collection system and WWTP condition and capacity, as well as options for providing additional capacity for planned future development. A skeletonized hydraulic model of the City's existing collection system trunk network was developed for use in the development of the Master Plan. This model was updated and used to provide a basis for the sewer capacity evaluation for the Proposed Project.

The Master Plan evaluated the following growth scenarios for the City:

- Existing
- Existing + Development of Vacant Parcels
- Near Term Development
- Long Term Development
- Build Out Growth

The future growth scenarios simulated for the Master Plan address serving build out of 1) the existing City service area, 2) the 2020 General Plan Spheres of Influence, 3) Special Development Areas and 4) Areas of Concern also identified in the General Plan. The projected growth areas are shown in **Figure 2**. The future flow projections were based on current general plan land use information and unit factors for flow developed and presented in the Master Plan. Peak wet weather flows (PWWF) were projected using the hydraulic model with a 10-year 24-hour design storm and were used to assess potential impacts to the City's collection system, for the five (5) growth scenarios identified above.



City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure 1
City of Grass Valley Existing Sewer Service Area

2.0 PROJECT CHARACTERISTICS

2.1 PROJECT LOCATION

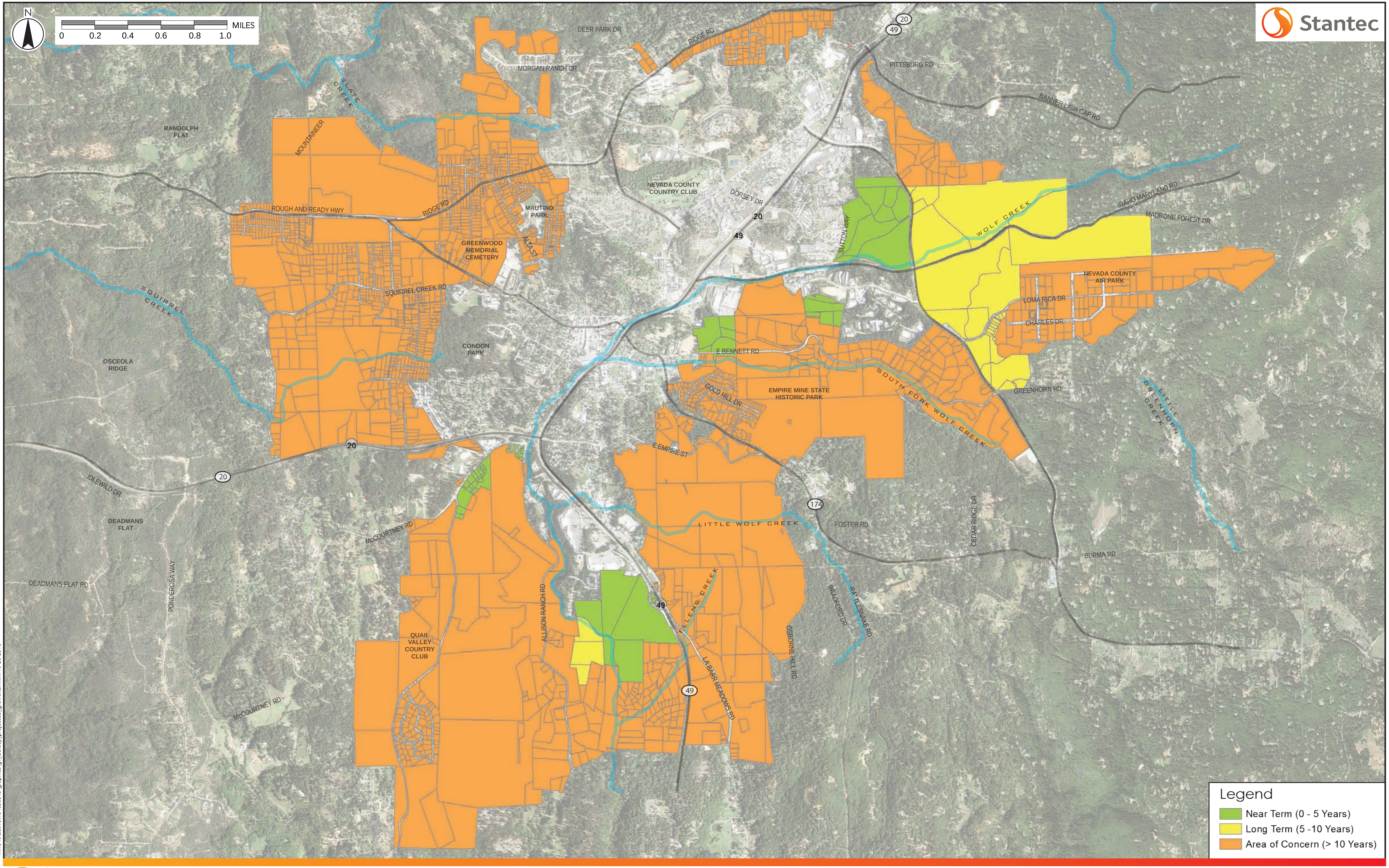
The study area is defined as the wastewater subcatchments that contribute flows to the WWTP serviced by the Idaho Maryland trunk. **Figure 1** shows the location of the proposed Dorsey Marketplace development in relation to the City's wastewater collection system. The Proposed Project is located east of Highway 49 on a vacant parcel within the existing sewershed.

The portion of the service area that discharged into the Idaho Maryland trunk covers an area of approximately 700 acres. The wastewater generated by these users is collected and conveyed to the City's WWTP via a network of gravity trunk mains, force mains and lift stations. The Idaho Maryland trunk generally follows Idaho Maryland Road west from Sutton Way across Highway 49 to E. Main Street, where it merges with the E. Main Street trunk sewer. The Idaho Maryland trunk collects flows from the northeast portion of the City, which includes commercial, industrial, and residential developments. To account for the foothill terrain in the service area, lift stations convey flow from lower areas to system gravity collectors.

2.2 FUTURE WASTEWATER FLOWS

The flow projections for the Proposed Project used in this analysis were provided by Genesis Engineering based on the City of Grass Valley Engineering Standards (Design Standards) and can be found in **Exhibit A**. Based on calculations from Genesis Engineering the developable site consists of 26.42 acres, 22.59 acres will be used for commercial design and the remaining 4.15 acres will be multi-family residential with 90 dwelling units (EDUs). The City Design Standards present wastewater generation rates of 850 gpd/acre for commercial development and 135 gpd for each high density residential dwelling unit, resulting in a total average dry weather flow (ADWF) of 31,352 gpd from the Proposed Project. The Design Standards also call for the use of a factor of safety of 2, and a peaking factor which varies relative to flow rate. Based on a factored ADWF of 0.063 MGD (2 x 31,352 gpd, rounded), the peaking factor used was 4.8. The resulting total peak flow was estimated to be 0.301 MGD.

These projections are reasonable, and the peaking factor and safety factor correspond to a total peaking factor close to those seen in inflow and infiltration (I/I) investigations presented in the Master Plan. The peak flow was added to the model as a steady state inflow, meaning there is no additional I/I added (as there would be if it was entered as an ADWF).



V:\1840\active\184030545\graphics\gv_dorsey_projected_growth.ai mlm 10-20-2016

City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure 2
Projected Growth

3.0 HYDRAULIC MODEL

A skeletonized hydraulic model of the City's existing collection system trunk network was developed as part of the City's Wastewater Master Plan. This model was used and updated to provide the basis for this sewer capacity evaluation. The wastewater collection system capacity was evaluated using a hydrodynamic routing software package, PCSWMM 2016 (SWMM5), by Computational Hydraulics Int. (CHI). This software package has been developed using the EPA SWMM 5.0 engine as its basis. The software has the ability to meet the following objectives:

- To determine the hydraulic capacity of the collection system and its components
- To identify system limitations such as bottlenecks and infrastructure incapable of accommodating future growth

3.1.1 Design Storms

Design storms are usually simulated in the hydraulic model to assess the capacity of the sewer system being studied under wet weather conditions. This is typically done with the goal of assessing potential risk of surcharging the system, which may result in sanitary sewer overflows (SSOs). A 1:10 year return period storm, with a 24-hour duration following the Huff design storm distribution was selected to assess system capacity under wet weather conditions with the addition of the Proposed Project. For reference the storm hyetograph is shown in **Figure 3.**

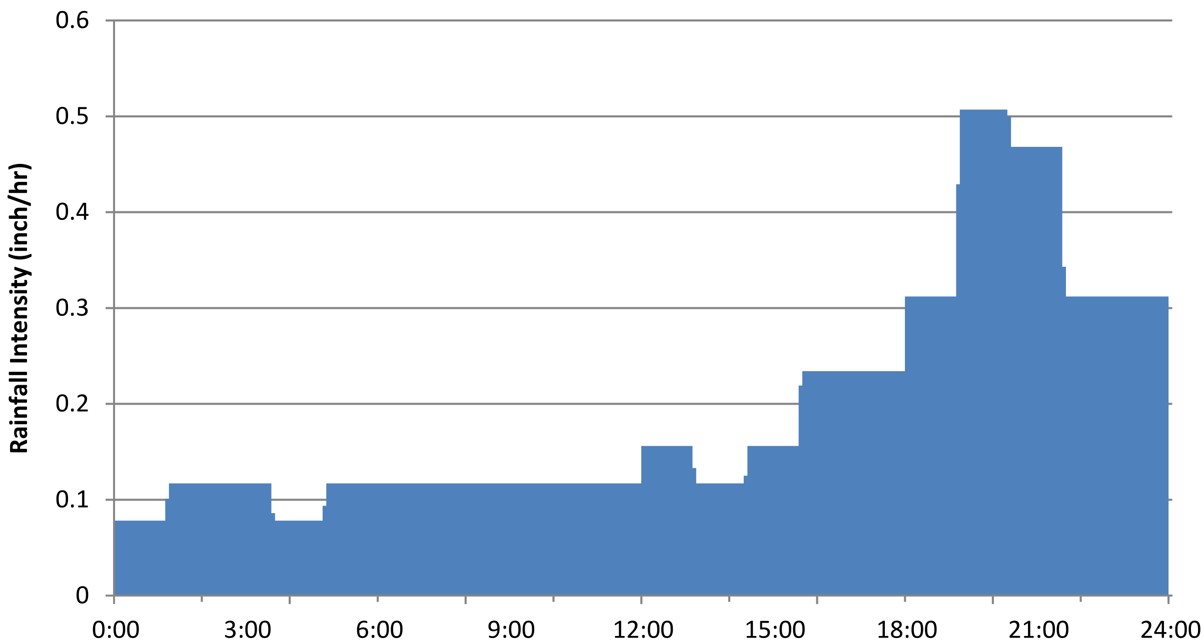


Figure 3 Rainfall Hyetograph for 1:10 Year, 24-hour Huff Design Rainfall

3.1.2 Model Updates

The Springhill Drive sewer collector was added to the model using elevation data provided by Genesis Engineering. The model developed for the Master Plan only features trunk sewers in the collection system greater than 12 inches in diameter. The survey provided by Genesis Engineering also included updated rim and invert elevations for manholes on Idaho Maryland Road from Springhill Drive to Railroad Avenue. These rim and invert elevations were updated in the Model. The manhole elevations gathered by Genesis Engineering as part of this analysis for the Proposed Project are presented in **Exhibit B**.

Flow from parcels along Springhill Drive was redistributed to respective manholes with the addition of the Springhill Drive sewer collector. The Springhill collector was not of sufficient size or overall system criticality to warrant its inclusion in the Master Plan trunk analysis.

All five scenarios presented in the Master Plan were updated and evaluated to include the changes due to the Dorsey Marketplace Project. A sixth scenario (Existing + Dorsey Marketplace) evaluating the existing system including the Proposed Project was also developed and simulated. The scenarios considered in this analysis include the following:

- Existing
- Existing + Dorsey Marketplace
- Existing + Development of Vacant Parcels + Dorsey Marketplace

- Near Term Development + Dorsey Marketplace
- Long Term Development + Dorsey Marketplace
- Build Out Growth + Dorsey Marketplace

It should be noted that the parcels on which the Dorsey Marketplace project is proposed were included in the hydraulic analysis for the Master Plan. The scenarios above referencing "plus Dorsey Marketplace" differ from the Master Plan analysis in the projection of peak flow. In the Master Plan analysis, the parcels on which the Proposed Project is located were estimated to generate wastewater flows using unit factors presented in the Master Plan developed on a gallon per day per acre basis and using the City's General Plan land use designations assigned to those parcels. For this analysis the flows generated by the Proposed Project were based on estimates provided by Genesis Engineering, consistent with the City's Design Standards for system sizing and flow estimation.

4.0 SEWER CAPACITY ASSESSMENT CRITERIA

This section describes the criteria used to perform the sewer capacity assessment and evaluate the model results of the updated hydraulic model described in the sections above. The 1:10 year, 24-hour design rainfall event was applied to the PCSWMM Model after modifications had been made. The hydraulic model results were evaluated based on the City's level of service (LOS) performance criteria for the collection system, and are presented using various wastewater flow metrics to illustrate the capacity constraints of the system.

4.1 WASTEWATER FLOW METRICS

The results of the hydraulic model are assessed using four wastewater flow metrics:

- The peak flow at specific locations within each sewer under design storm conditions.
- The hydraulic surcharging at specific locations within each sewer under design storm conditions.
- Hydraulic loading ratio within each sewer under design storm conditions. Hydraulic loading ratios are commonly used as a metric to evaluate the performance of a collection system. The hydraulic loading ratio (HLR) is mathematically defined as the peak modeled flow divided by the full pipe capacity (calculated using Manning's equation), and is denoted "Max/Full Flow" in the results tab of the PCSWMM Sewer model.
- Residual capacity within each sewer when subjected to the peak flows of the design storm conditions. This result is the difference between full pipe capacity and the peak flow. This performance indicator is useful in illustrating the relative remaining capacity throughout the study area.

4.2 ALLOWABLE SURCHARGE CRITERIA

The City's LOS criteria for the collection system are based on the allowable surcharge within the gravity portion of the collection system. The maximum allowable surcharge in the gravity portion of the sanitary sewer system is assessed using the estimated hydraulic grade line (HGL) elevation of the fluid flow in the pipes. The HGL must remain at least 8 feet from the ground surface (i.e. at least 8 feet of freeboard required) during a design storm scenario. This is the criteria established by the City in the Master Plan analysis. Existing sewers with depths greater than 8 feet have been said to be within LOS criteria if the peak surcharge elevation results in a freeboard of greater than 8 feet with less than one (1) foot of HGL surcharging above the pipe crown. Any sewers identified with freeboard less than 8 feet are considered deficient should any surcharging above the pipe crown result. Thus, the identified deficiencies are generally based upon the criteria below:

- Minimum freeboard of 8 feet (HGL depth below rim)
- Surcharging less than 1 foot above pipe crown (with freeboard of 8 feet or greater)
- No Surcharging (with freeboard of less than 8 feet)

5.0 MODEL RESULTS

A summary of relevant model results from the Master Plan, as well as the results of the new scenarios assessed in this analysis are presented in the following sections. Results from the Master Plan, in the form of HGL profiles are shown in **Exhibit C**. HGL profiles 1 and 5, presented in the Master Plan, have specific relevance to the Dorsey Marketplace analysis.

To help identify the extent of surcharging within the existing network, profile figures from Dorsey Marketplace to the WWTP that show the peak HGL elevation along each profile section have been included in Exhibit D. The location of the HGL profiles can be identified by a plan-view key presented within **Exhibit D**. Note that these profiles include the results for each growth scenario. **Exhibit E** presents plan view figures for each scenario depicting minimum freeboard (depth below rim) in manholes and surcharging in pipes (whether or not they are deficient based on LOS criteria).

5.1 MASTER PLAN SUMMARY OF EXISTING CONDITIONS

The City's Master Plan identifies capacity issues within the City's existing collection system under design storm conditions. The HGL profiles in **Exhibit C** show the results of the capacity evaluation done as part of the City's Master Plan. The portions of the previous analysis that are specifically relevant to the Proposed Project include the assessment of the Idaho Maryland trunk, and the main trunk from its connection to the Idaho Maryland trunk to the WWTP. These results do not reflect the addition of the Springhill drive collector, the updated manhole elevations in the hydraulic model, or the updated flow generation estimates from the Proposed Project.

5.1.1 Idaho Maryland Trunk:

Master Plan HGL Profile 1, shown in **Figure C-1** of **Exhibit C,** presents HGLs for the Idaho Maryland trunk that extends along Idaho Maryland Road to the East Main Street trunk (Main trunk). Manholes in which the HGL did not meet LOS criteria were found in the Idaho Maryland trunk sewer upstream of the location where the Springhill Drive sewer collector discharges to the trunk. No surcharging was found to occur in the Idaho Maryland trunk downstream of the Springhill Drive sewer collector.

5.1.2 East Main Street Trunk:

Master Plan HGL Profile 5, shown in **Figure C-2** of **Exhibit C**, represents a section of the E. Main Street Trunk from the discharge of the City Hall Outfall to the WWTP. Very minor surcharging (<1 foot) was found to occur in manhole (MH) I17-7 (66 feet south of French Ave) as a result of the Master Plan analysis. This surcharging is a result of insufficient capacity in the twin 18-inch sewers crossing underneath Highway 20. There was predicted to be a minimum freeboard of greater than 20 feet under existing conditions, therefore still meeting LOS criteria. It was noted that this information for MH I17-7 was based upon a degree of upstream throttling due to capacity constraints, and this surcharging would likely worsen as those constraints are eliminated (i.e. flow is allowed to reach the twin 18-inch sewers at a higher rate).

5.2 EXISTING LEVEL OF DEVELOPMENT (EXISTING)

This scenario assesses the impact of the design storm on the existing wastewater collection system. These results include the model updates to the collector on Springhill Drive and the updated manhole elevations on Idaho Maryland Road, summarized in **Exhibit B**, but don't consider the additional flow from the Dorsey Marketplace development.

Very little difference in the model results are evident with the addition of the Springhill Drive sewer collector to the model construction when compared to those presented in the Master Plan, other than relative changes in HGLs caused by updated invert elevation. It is predicted that the WWTP will experience a peak flow of 13.5 MGD under design storm conditions. A plan view of model simulation results for the existing system during peak wastewater flow conditions are presented in **Figure E-1**.

The following provides a summary of surcharging in the existing system under design storm conditions and the corresponding peak HGL profiles which are presented in **Figures D-2** through **D-5**.

5.2.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

There were no other significant differences within the results reported for this scenario and the existing scenario in the City's Master Plan in the Idaho Maryland Trunk. No surcharging was predicted to occur in manholes on Idaho Maryland Road under existing conditions. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.2.2 Main Trunk (from Idaho Maryland Road to WWTP):

MH I17-7, located on the Main Trunk, was predicted to be surcharged approximately 0.34 feet above the highest connected pipe crown; however, freeboard remained greater than 20 feet, therefore meeting LOS criteria. This surcharging is a result of limited capacity in twin 18" sewers crossing under Highway 20. This result is only slightly different from the results reported in the Master Plan. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.2.3 Springhill Drive (Dorsey Marketplace to Idaho Maryland Road):

The Springhill Drive collector was found to have excess capacity under the existing scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.2.4 LOS Deficiencies:

There are not expected to be any LOS failures under this scenario.

5.3 EXISTING + DORSEY MARKETPLACE DEVELOPMENT

This scenario assesses the impact of the design storm on the existing wastewater collection system with the addition of flows from the Proposed Project. For this scenario, it is predicted that the WWTP will experience a peak flow of 13.7 MGD. The inclusion of the Proposed Project is not predicted to cause any additional sewer segments to become surcharged; rather the additional loading will slightly increase the existing surcharging. A plan view of model simulation results relative to this scenario during peak wet weather flow conditions are shown in **Figure E-2**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to peak HGL profiles presented in **Figures D-2** through **D-5**:

5.3.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Under this design scenario there is expected to be no surcharging in this profile. The maximum predicted increase in the HGL for all of the sewers is 0.09 (MH N13-10) feet with the inclusion of the Dorsey Marketplace development relative to the "Existing" scenario. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

The most notable increase in HGL in the Idaho Maryland trunk was predicted in MH N13-10, the last manhole before the trunk meets the Main trunk at the intersection of Idaho Maryland Road and East Main Street, with an increase of approximately 0.09 feet.

The problems upstream of the Springhill Drive collector on Idaho Maryland trunk are not predicted to worsen with the addition of the Dorsey Marketplace development under this scenario.

5.3.2 Main Trunk (from Idaho Maryland Road to WWTP):

Model results predict there to be no additional sewers surcharged in this profile when compared to the previous scenario. The HGL of the surcharged sewer is expected to increase by a maximum of 0.28 feet (MH I17-7) with the inclusion of the Dorsey Marketplace development respective to the "Existing" scenario. The surcharged sewer still falls within the City's LOS criteria. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.3.3 Springhill Drive:

There are not expected to be any sewers surcharged in this profile. The Springhill Drive sewer collector is predicted to have remaining capacity after the addition of the development. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.3.4 LOS Deficiencies:

There are not expected to be any LOS failures under this scenario.

5.4 EXISTING + DEVELOPMENT OF VACANT PARCELS + DORSEY MARKETPLACE

This scenario (Existing +Vacant + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of the remaining vacant parcels within the current City limits, including the addition of the Proposed Project.

It is predicted that under this scenario the WWTP would experience a peak wastewater flow of 15.2 MGD under design storm conditions with no capacity improvements made to the collection system. The inclusion of the vacant parcels, using the City's proposed land use designations, is predicted to cause some capacity constraints and deficiencies. A plan view of the model simulation results of this scenario during peak wastewater flow conditions are shown in **Figure E-3**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to peak HGL profiles presented in **Figures D-2** through **D-5**:

5.4.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Minor surcharging (<1 foot) was predicted to occur in MH N13-10, the first manhole upstream of the connection between the Idaho Maryland Trunk and Main Trunk at the intersection of Idaho Maryland Road and East Main Street. Minimum freeboard is 9.25 feet and surcharge depth is predicted to be 0.88 feet, therefore meeting the City's LOS criteria. This surcharging is primarily due to a capacity constraint at the junction of the Idaho Maryland Trunk and the Main Trunk. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.4.2 Main Trunk (from Idaho Maryland Road to WWTP):

Model results predict there to be no additional sewers surcharged in this profile under the Existing plus Vacant Scenario. The HGL of the surcharged sewer may increase by 0.96 feet (MH I17-7) with the inclusion of vacant parcel development respective to the (Existing, + Dorsey Marketplace) scenario. The predicted surcharging in MH I17-7 is greater than 1 foot (1.59 feet) above the pipe crown and therefore no longer meets the City's LOS criteria. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.4.3 Springhill Drive:

As there are no additional vacant parcels or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, the results are the same as those presented for the previous scenario (Existing + Dorsey Marketplace). The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.4.4 LOS Deficiencies:

Due to a surcharge depth greater than 1 foot above the pipe crown, as shown in **Table 1**, manhole I17-7 fails to meet LOS criteria under the Existing + Vacant + Dorsey Marketplace scenario.

Table 1 LOS Deficiencies for Existing +Vacant + Dorsey

MODELED RESULTS	
Manhole	I17-7
Depth (feet)	22.76
Freeboard (feet)	19.18
Surcharge Depth (feet)	1.59

5.5 NEAR TERM DEVELOPMENT + DORSEY MARKETPLACE

This scenario (Near Term + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of areas identified within the Near Term development scenario as designated in the City's Master Plan. This scenario also includes the changes attributed to the Proposed Project. The Near Term growth scenario (~5-year) includes a portion of the "Loma Rica Special Development Area"(lands west of Brunswick Road, north of Idaho Maryland Road and east of Sutton Way), and a portion of the Berriman Ranch & Adjacent Property Area.

For this scenario, it is predicted that the WWTP will experience a peak flow of 16.5 MGD with no capacity improvements made to the existing collection system (with improvements to collection system capacity constraints, peak flows could increase). The inclusion of flow from Near Term developments is not predicted to cause any additional sewer segments to become surcharged under this scenario; rather the additional loading will cause the existing surcharging to worsen. A plan view of model simulation results are presented in **Figure E-4**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to the peak HGL profiles presented in **Figures D-2** through **D-5**:

5.5.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Model results predict there to be no additional sewers surcharged in this profile. The HGL of the surcharged sewer is predicted to increase with the inclusion of Near Term development respective to the (Existing + Vacant + Dorsey Marketplace) scenario. Minimum freeboard is 9.20 feet in surcharged manhole N13-10, and surcharge depth is predicted to be 0.93 feet, therefore meeting the City's LOS criteria. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.5.2 Main Trunk (from Idaho Maryland Road to WWTP):

There is predicted to be no additional sewers surcharged in this profile. The HGL of the surcharged sewer is estimated to increase by 0.73 feet (MH I17-7) with the inclusion of the Near Term development flows respective to the Existing + Vacant + Dorsey Marketplace scenario. The predicted surcharging in manhole I17-7 is greater than 1 foot (2.32 feet) above the pipe crown and therefore does not meet the City's LOS criteria. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.5.3 Springhill Drive:

As there are no additional planned developments or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, the results are the same as those presented for the Existing + Dorsey Marketplace scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.5.4 LOS Deficiencies:

Due to a surcharge depth greater than 1 foot as shown in **Table 2**, manhole I17-7 fails to meet LOS criteria under the Existing + Vacant + Dorsey Marketplace scenario.

Table 2 LOS Deficiencies for Near Term + Dorsey Marketplace

MODELED RESULTS	
Manhole	I17-7
Depth (feet)	22.76
Freeboard (feet)	18.44
Surcharge Depth (feet)	2.32

5.6 LONG TERM DEVELOPMENT + DORSEY MARKETPLACE

This scenario (Long Term + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of the areas identified within the Near Term and Long Term scenarios presented in the City's Master Plan. This scenario also includes the changes attributed to the Proposed Project. The Long Term growth scenario (~10-year) includes build out of the "Loma Rica Special Development Area".

Under this scenario, it is predicted that the WWTP will experience a peak flow of 17.2 MGD without capacity improvements made to the existing collection system. The inclusion of flow from Long Term developments is predicted to cause capacity constraints and deficiencies in both the Idaho Maryland and Main Trunk sewers. A plan view of model simulation results are presented in **Figure E-5**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to the peak HGL profiles presented in **Figures D-2** through **D-5**:

5.6.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Surcharging in manholes near the intersection of Idaho Maryland Road and East Main Street is predicted to worsen under the Long Term + Dorsey Marketplace scenario. MH N13-3 directly upstream of MH N13-10 is predicted to have a surcharge depth of 0.93 feet, and a minimum freeboard of 8.97 feet, which meets the City's LOS criteria. Surcharging in MH N13-10 is predicted to increase to a depth of 1.48, therefore failing to meet the LOS criteria. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.6.2 Main Trunk (from Idaho Maryland Road to WWTP):

Moderate surcharging is predicted to occur under the Long Term + Dorsey Marketplace scenario as a result of limited capacity in twin 18" sewers crossing Highway 20. The surcharge depth of MH I17-7 is expected to increase to 3.06 feet under this scenario, therefore failing to meet the LOS criteria. Minimum freeboard is predicted to be 17.71 feet, which is still well above the recommended value of 8 feet. Upstream manhole I17-3 is expected to surcharge to a depth of 1.27 feet, therefore failing to meet the City's LOS criteria, despite having a minimum freeboard of 13.41 feet. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.6.3 Springhill Drive:

As there are no additional planned developments or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, the results are the same as those presented for the Existing + Dorsey Marketplace scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.6.4 LOS Deficiencies:

The Manholes identified in **Table 3** fail to meet the LOS criteria under the Long Term + Dorsey Marketplace scenario.

Table 3 LOS Deficiencies for Long Term + Dorsey Marketplace

MODELED RESULTS			
Manhole	I17-7	I17-3	N13-10
Depth (feet)	22.76	16.68	11.38
Freeboard (feet)	17.71	13.41	8.65
Surcharge Depth (feet)	3.06	1.27	1.49

5.7 BUILD OUT DEVELOPMENT + DORSEY MARKETPLACE

This scenario (Build Out + Dorsey Marketplace) assesses the impact of the design storm on the existing wastewater collection system with development of remaining vacant parcels, the areas identified within the Near Term and Long Term Spheres of Influence, and Build Out of the Areas of Concern identified in the City's 2020 General Plan. This scenario also includes the changes attributed to the Proposed Project. The Build Out growth scenario includes all additional lands identified by the 2020 General Plan including the Special Development Areas of North Star Ranch, Kenny Ranch, the balance of the Berriman Ranch and Adjacent Properties, as well as all additional Areas of Concern.

For this scenario, it is predicted that the WWTP will experience a peak flow of 25.8 MGD with no capacity improvements made to the existing collection system. The inclusion of flow from Build Out growth is predicted to worsen capacity constraints and deficiencies on the Idaho Maryland and Main Trunk sewers. A plan view of model simulation results are presented in **Figure E-6**.

The following provides a summary of surcharging in the system under design storm conditions for this scenario corresponding to the peak HGL profiles presented in **Figures D-2** through **D-5**:

5.7.1 Idaho Maryland Trunk (from Springhill Drive to E. Main Street):

Surcharging in manholes near the intersection of Idaho Maryland Road and East Main Street is predicted to worsen. MH N12-3 directly upstream of MH N13-3 is predicted to have a surcharge depth of 2.38 feet, therefore failing to meet the LOS criteria. Surcharging in MH N13-3 and MH N13-10 is predicted to increase to depths of 1.69 feet and 1.49 feet respectively, therefore failing to meet the LOS criteria. The peak HGL profile for the Idaho Maryland trunk is shown in **Figure D-2**.

5.7.2 Main Trunk (from Idaho Maryland Road to WWTP):

Surcharging is expected to worsen as a result of higher flows and limited capacity in the twin 18" sewers crossing Highway 20. The surcharge depths of MH I17-7 and MH I17-3 are expected to increase to 4.13 feet and 2.76 feet respectively. MH J16-19, directly upstream of MH I17-7 and MH I17-3, is expected to surcharge to a depth of 1.75 feet, having a minimum freeboard of 7.20 feet, and therefore failing to meet the City's LOS criteria. Upstream of MH J16-19, is MH J16-16 which also fails to meet LOS criteria under this scenario. MH J16-16 is predicted to have a surcharge depth of 1.91 feet, and minimum freeboard of 7.44 feet. The peak HGL profile for the Main trunk is shown in **Figure D-3** and **Figure D-4**.

5.7.3 Springhill Drive:

As there are no additional planned developments or wastewater catchments that would connect to the Springhill Sewer collector under this scenario, results are the same as those presented for the Existing + Dorsey Marketplace scenario. The peak HGL profile for the Springhill Drive collector is shown in **Figure D-5**.

5.7.4 LOS Deficiencies:

The Manholes identified in **Table 4** fail to meet the LOS criteria under the Build Out + Dorsey Marketplace scenario.

Table 4 LOS Deficiencies for Build Out + Dorsey Marketplace

MODELED RESULTS							
Manhole	I17-7	I17-3	J16-19	J16-16	N13-10	N13-3	N12-3
Depth (feet)	22.76	16.68	10.96	11.35	11.38	11.15	13.29
Freeboard (feet)	17.08	11.93	7.20	7.44	8.65	8.21	9.67
Surcharge Depth (feet)	4.13	2.76	1.75	1.91	1.49	1.69	2.38

6.0 SEWER CAPACITY ASSESSMENT SUMMARY

Based on the model results presented above, there are two major areas of concern in the City's wastewater collection system related to the Dorsey Marketplace Project assessment. The twin 18-inch sewers on the Main Trunk crossing Highway 20 have insufficient capacity and cause LOS failures at development scenarios beyond Existing conditions. Where the Idaho Maryland Trunk meets the Main Trunk at the intersection of Idaho Maryland Road and East Main Street throttling occurs and causes LOS failures under the Long Term growth scenarios and beyond. The results of the sewer capacity assessment in these areas are presented using the wastewater flow metrics defined in this report.

A discussion of capacity improvements to fix the LOS failures for the Existing + Vacant + Dorsey Marketplace and the Near Term + Dorsey Marketplace scenarios is presented below. These improvements only address the capacity constraints for MH I17-7 and do not address capacity improvements for growth scenarios beyond the Near Term. The modeling completed for this capacity assessment does not address changes in capacity due to future collection system improvements. If capacity constraints are removed upstream of the limits of this capacity assessment, peak flows in the study area will likely increase. Although capacity improvement solutions for further development scenarios are not presented in this analysis, an estimate of the percentage of peak flow contributed by the Proposed Project to the LOS failures is presented for both Near Term and Long Term growth scenarios.

6.1 TWIN 18-INCH SEWERS

The hydraulic model results identify failure of the LOS criteria in the Main trunk under all but the existing condition scenarios. Surcharging in this area is a result of insufficient capacity in the twin 18-inch sewers crossing underneath Highway 20. **Table 5** presents the wastewater flow metrics for the manholes failing the LOS criteria in the Main trunk.

Table 5 Sewer Capacity Flow Metrics for LOS Failures in the Main Trunk

Level of Development	MH	Peak Flow (MGD)	Peak Surcharge (feet)	Loading Ratio	Residual capacity
Existing +Vacant + Dorsey	I17-7	14.28	1.59	1.19	-1.20
Near Term + Dorsey	I17-7	15.14	2.32	1.25	-1.58
Long Term + Dorsey	I17-7	15.63	3.06	1.29	-1.83
Long Term + Dorsey	I17-3	13.17	1.27	0.76	4.16
Build Out + Dorsey	I17-7	17.08	4.13	1.43	-2.49
Build Out + Dorsey	I17-3	13.97	2.76	0.8	3.49
Build Out + Dorsey	J16-19	14.31	1.75	0.85	2.47
Build Out + Dorsey	J16-16	13.65	1.91	1.06	-0.79

The affected manholes include MH I17-7, MH I17-3, J16-16 and MH J16-19. All of these manholes become surcharged under the Build Out scenario. MH I17-7 has a depth of 22.8 feet, and meets LOS criteria until its surcharge depth becomes greater than 1 foot in the Existing + Vacant + Dorsey Marketplace scenario. MH I17-3 has a depth of 16.7 feet, and meets LOS criteria until its surcharge depth becomes greater than 1 foot in the Long Term + Dorsey Marketplace scenario. MH J16-9 has a depth of 11.0 feet and fails to meet the LOS criteria under the Build Out scenario, when surcharge depth becomes greater than 1 foot. It should be noted that this information is based upon a degree of upstream throttling due to capacity constraints within the system, and this surcharging will worsen as those capacity constraints are eliminated.

6.2 IDAHO MARYLAND AND EAST MAIN STREET INTERSECTION

The hydraulic model results identify failures of the LOS criteria in the Idaho Maryland Trunk under the Long Term and Build Out development scenarios. Surcharging in this area is due to lack of capacity at the intersection of two large trunks. **Table 6** presents the wastewater flow metrics for the manholes failing the LOS criteria in the Idaho Maryland Trunk.

Table 6 Sewer Capacity Flow Metrics for LOS Failures in the Idaho Maryland Trunk

Level of Development	MH	Peak Flow (MGD)	Peak Surcharge (feet)	Loading Ratio	Residual Capacity
Long Term + Dorsey	N13-10	5.09	1.48	1.51	-1.72
Build Out + Dorsey	N13-10	5.23	1.6	1.55	-1.86
Build Out + Dorsey	N13-3	5.23	1.69	0.99	0.05
Build Out + Dorsey	N12-2	5.23	2.38	1.04	-0.2

The affected manholes are MH N13-10, MH N13-3, and MH N12-3, which all become surcharged under the Build Out scenario. MH N13-10 has a depth of 11.4 feet and becomes surcharged under the Existing + Vacant + Dorsey Marketplace scenario, but is still within LOS criteria with greater than 8 feet of freeboard and surcharging less than 1 foot. MH N13-10 meets LOS criteria until its surcharge depth becomes greater than 1 foot under the Long Term + Dorsey Marketplace scenario. MH N13-3, doesn't become surcharged until the Long Term + Dorsey Marketplace scenario and fails to meet the LOS criteria when its surcharge depth becomes greater than 1 foot under the Build Out + Dorsey Marketplace scenario. MH N12-3 only becomes surcharged under the Build Out + Dorsey Marketplace scenario, where it fails to meet the LOS criteria.

It should be noted that capacity constraints upstream of Springhill Drive are throttling flow, resulting in lower peak flows downstream. Should these constraints be eliminated, the capacity in this area will be significantly impacted and it may not be sufficient to convey the full flow, in accordance with City LOS criteria.

6.3 CAPACITY IMPROVEMENTS

Capacity constraints identified for the Existing + Vacant + Dorsey and the Near Term + Dorsey scenarios are primarily caused by limitations of the 18 inch twin sewers that pass under Highway 20. In order to address the capacity constraints identified at MH I17-7 for these scenarios one of the 18 inch lines will need to be upsized to 24 inches or an additional line will need to be added. This improvement is also identified in the City's Master Plan.

6.4 PERCENT RESPONSIBLE

To quantify the contribution to hydraulic loading from the Proposed Project, the percentage of the peak flow attributable to the Project that contributes to surcharging, above existing peak flow conditions, was calculated for Near Term and Long Term Conditions. This quantity can be called percent responsible and was calculated using peak flows in the portions of the system that convey flows from the Proposed Project and also fail the City's LOS criteria.

As described in the Model results above, MH I17-7 is the only manhole that conveys Dorsey Marketplace flows and fails the LOS criteria under Near Term conditions. The percent of peak flow attributable to the Proposed Project has been calculated as 12.6%. The percent responsible was calculated by determining the amount of peak flow in the manhole due to Dorsey Marketplace only, and dividing that by the peak flow being contributed by all Near Term development (including Dorsey Marketplace but excluding all existing flows). The calculations determining the percent responsible for MH I17-7 under Near Term conditions are shown below:

15.14 MGD – 12.76 MGD = 2.38 MGD additional peak flow in I17-7 contributed by Near Term development

15.14 MGD – 14.84 MGD = 0.3 MGD difference between peak flow in I17-7 with and without Dorsey Market Place

0.3/2.38 = 0.126 = 12.6% percent of flow contribution from the Dorsey Marketplace Project over and above existing flows.

Under the Long Term development scenario, MH I17-7, MH I17-3, and MH N13-10 are predicted to fail the LOS criteria. The percent contribution to peak flow from the Dorsey Marketplace Project has been calculated for each of these manholes. The peak flows and percent responsible for all three manholes are presented in **Table 7**.

Table 7 Percent Responsible

Level of Development	Peak Flow (MGD)	Dorsey Marketplace Contribution to Peak Flow (MGD)	% Responsible
Manhole I17-7			
Existing	12.76	-	-
Near Term	15.14	0.3	12.6%
Long Term	15.63	0.34	11.8%
Manhole I17-3			
Existing	10.41	-	-
Long Term	13.17	0.31	11.2%
N13-10			
Existing	3.03	-	-
Long Term	5.09	0.32	15.5%

EXHIBITS

Exhibit A FLOW PROJECTIONS BY GENESIS ENGINEERING

SANITARY SEWER PIPE SIZING

SCOPE:

Provide calculations for sewer pipe sizing based on the City of Grass Valley Engineering Standards for Dorsey Drive.

SITE:

The site will consist of a total of 26.42 acres. 22.59 acres will be used for commercial design and the remaining 4.15 acres will be used for multi-family residential design. It is proposed to have 90 dwelling units for the residential.

CALCULATIONS:

From Table 8-1 of Section 8 of the City of Grass Valley Design Standards

LAND USE DESIGNATION	UNITS	WASTEWATER GENERATION FACTOR (GPD/UNIT)
Commercial/Industrial	Acre	850
Residential Multi Family	Dwelling	135

Per the City of Grass Valley Design Standards a Factor of Safety of 2 is required along with a Peaking Factor.

Commercial Average Dry Weather Flow:	22.59acres x 850 = 19,202 gpd	
Residential Average Dry Weather Flow:	90 units x 135 = 12,150 gpd	
TOTAL:		31,352 gpd
Factor of Safety of 2:		62,704 gpd = 0.06 MGD
Peaking Factor per Figure 1:	4.8	
TOTAL:		300,979 gpd = 0.30 MGD
GRAND TOTAL:		**0.30 MGD**

CONCLUSION:

Based on the calculations and the City of Grass Valley Design Standards an 8" pipe with a minimum slope of 0.0035 will be required to handle the sewer flows for Dorsey Drive.

Exhibit B SURVEY DATA

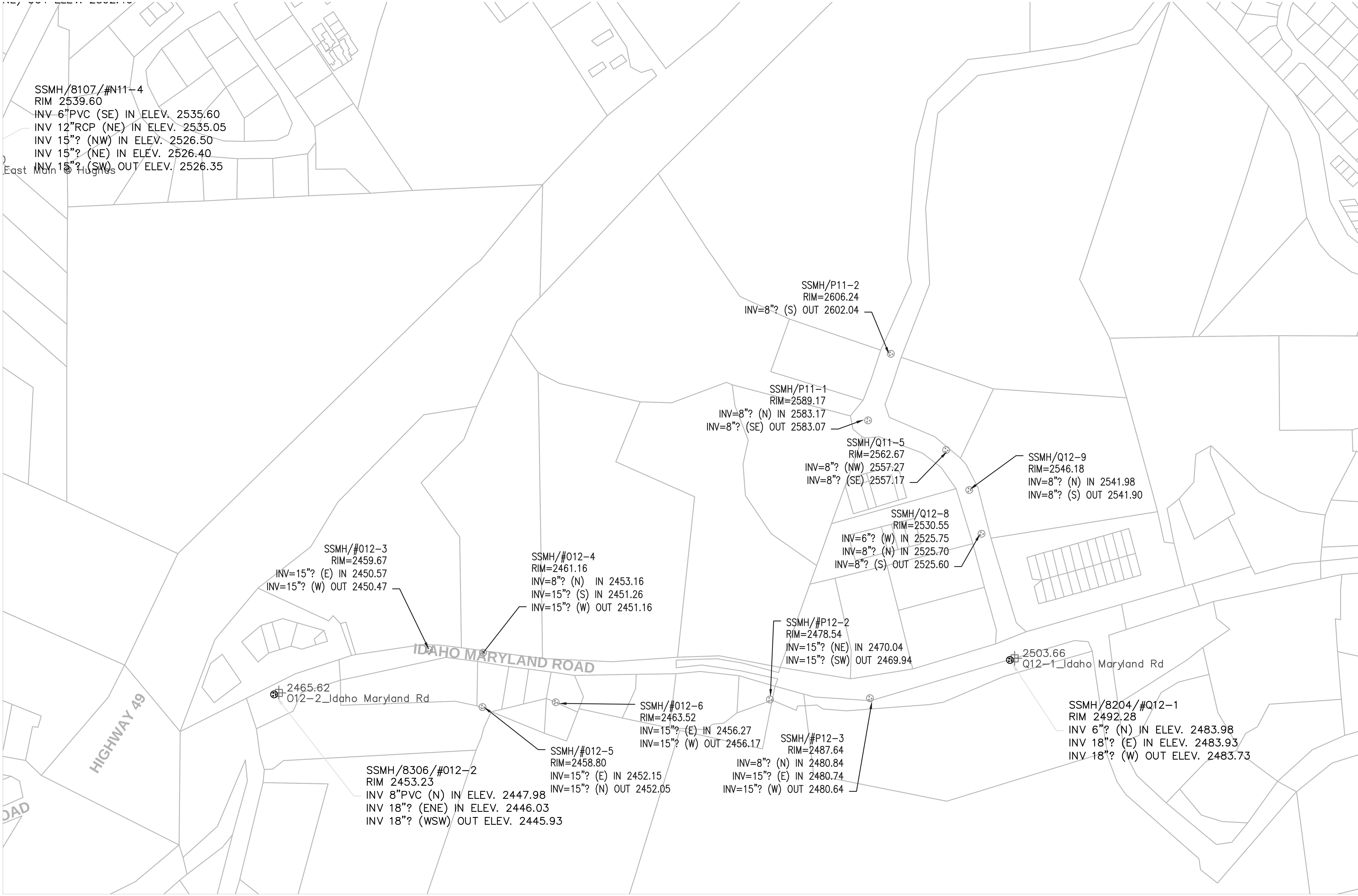
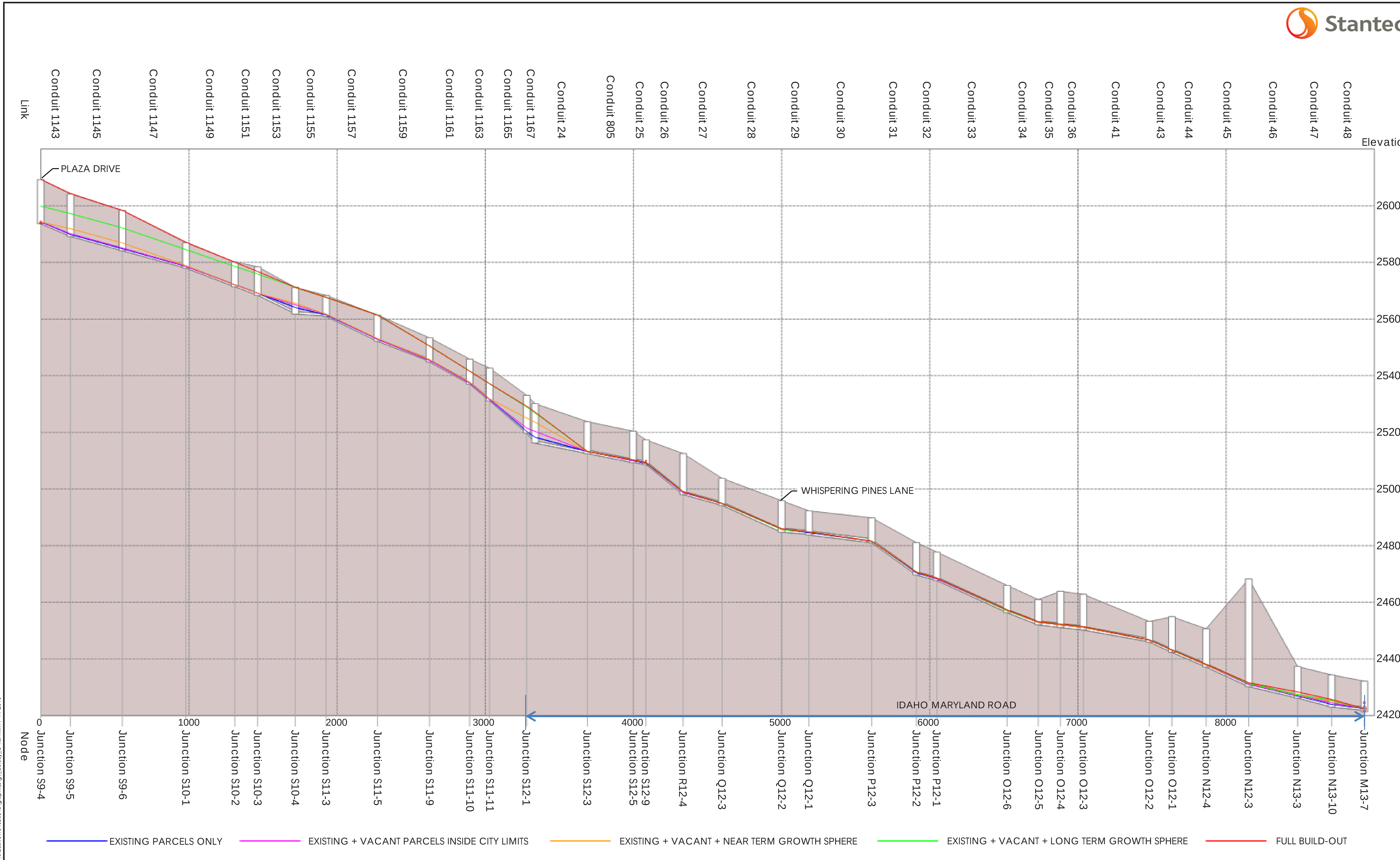

SSMH/8107/#N11-4
RIM 2539.60
INV 6"PVC (SE) IN ELEV. 2535.60
INV 12"RCP (NE) IN ELEV. 2535.05
INV 15"? (NW) IN ELEV. 2526.50
INV 15"? (NE) IN ELEV. 2526.40
INV 15"? (SW) OUT ELEV. 2526.35
East Main @ Hughes
SSMH/P11-2
RIM=2606.24
INV=8"? (S) OUT 2602.04
SSMH/P11-1
RIM=2589.17
INV=8"? (N) IN 2583.17
INV=8"? (SE) OUT 2583.07
SSMH/Q11-5
RIM=2562.67
INV=8"? (NW) 2557.27
INV=8"? (SE) 2557.17
SSMH/Q12-9
RIM=2546.18
INV=8"? (N) IN 2541.98
INV=8"? (S) OUT 2541.90
SSMH/Q12-8
RIM=2530.55
INV=6"? (W) IN 2525.75
INV=8"? (N) IN 2525.70
INV=8"? (S) OUT 2525.60
SSMH/#012-3
RIM=2459.67
INV=15"? (E) IN 2450.57
INV=15"? (W) OUT 2450.47
SSMH/#012-4
RIM=2461.16
INV=8"? (N) IN 2453.16
INV=15"? (S) IN 2451.26
INV=15"? (W) OUT 2451.16
SSMH/#P12-2
RIM=2478.54
INV=15"? (NE) IN 2470.04
INV=15"? (SW) OUT 2469.94
IDAHO MARYLAND ROAD
2503.66
Q12-1_Idaho Maryland Rd
2465.62
O12-2_Idaho Maryland Rd
SSMH/#012-6
RIM=2463.52
INV=15"? (E) IN 2456.27
INV=15"? (W) OUT 2456.17
SSMH/8204/#Q12-1
RIM 2492.28
INV 6"? (N) IN ELEV. 2483.98
INV 18"? (E) IN ELEV. 2483.93
INV 18"? (W) OUT ELEV. 2483.73
HIGHWAY 49
SSMH/#012-5
RIM=2458.80
INV=15"? (E) IN 2452.15
INV=15"? (N) OUT 2452.05
SSMH/#P12-3
RIM=2487.64
INV=8"? (N) IN 2480.84
INV=15"? (E) IN 2480.74
INV=15"? (W) OUT 2480.64
SSMH/8306/#012-2
RIM 2453.23
INV 8"PVC (N) IN ELEV. 2447.98
INV 18"? (ENE) IN ELEV. 2446.03
INV 18"? (WSW) OUT ELEV. 2445.93
OAD

Exhibit C CITY OF GRASS VALLEY WASTEWATER SYSTEM MASTER PLAN HGL PROFILES



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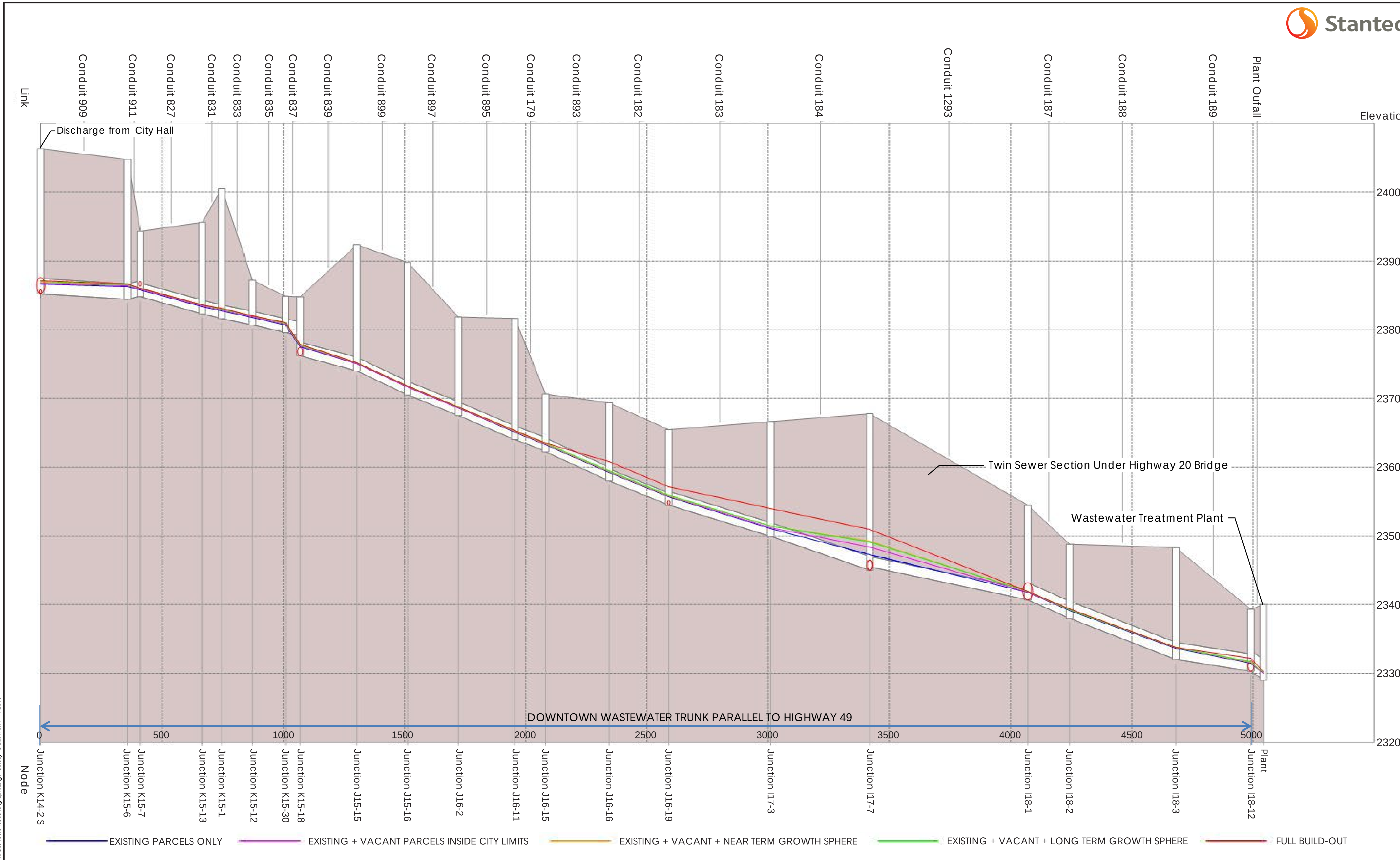
City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure C-1
Existing System Pre-Improvement Results - 1:10 Tear Design Rainfall HGL Profile 1



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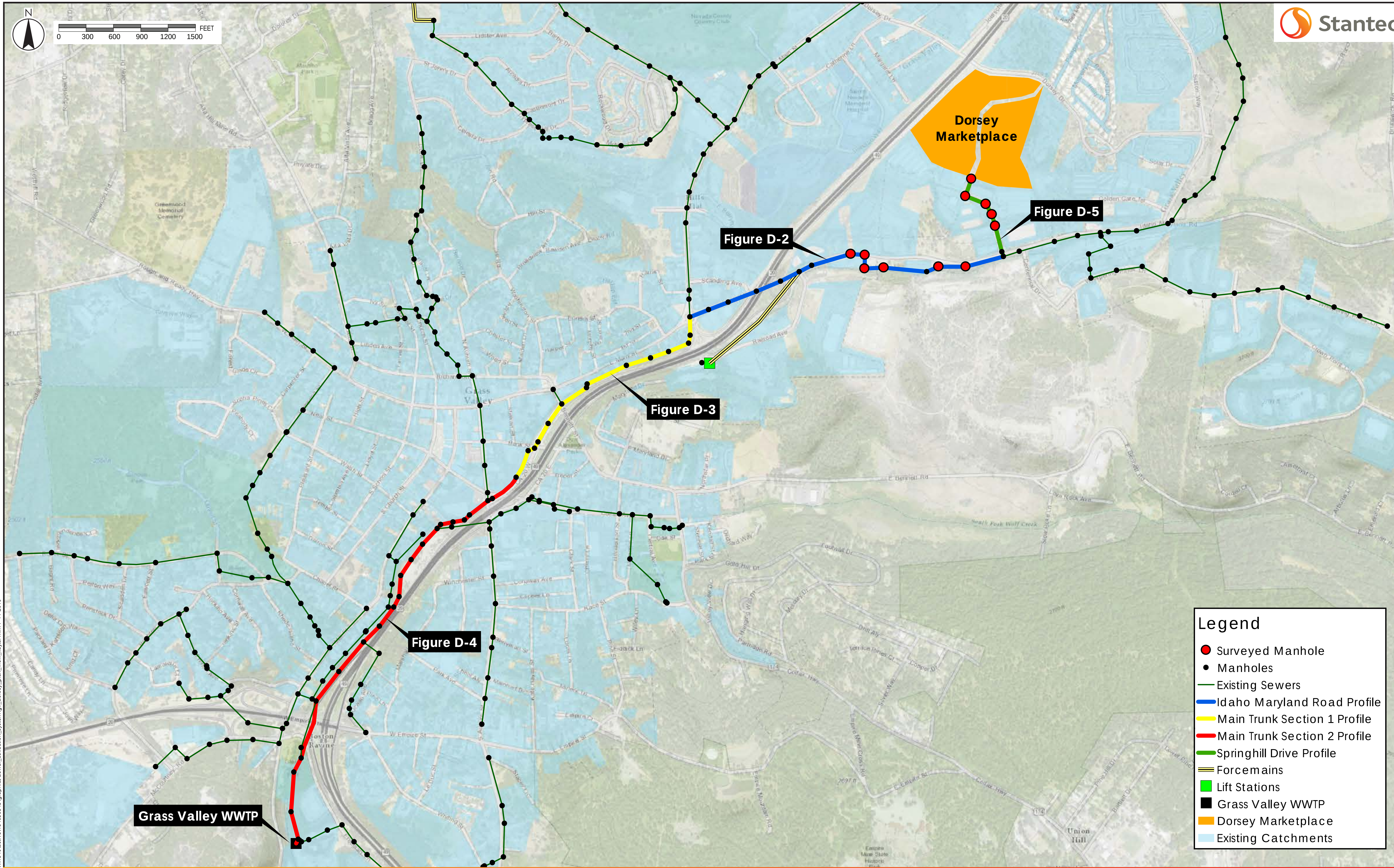
City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure C-2
Existing System Pre-Improvement Results - 1:10 Tear Design Rainfall HGL Profile 5

Exhibit D HGL PROFILES

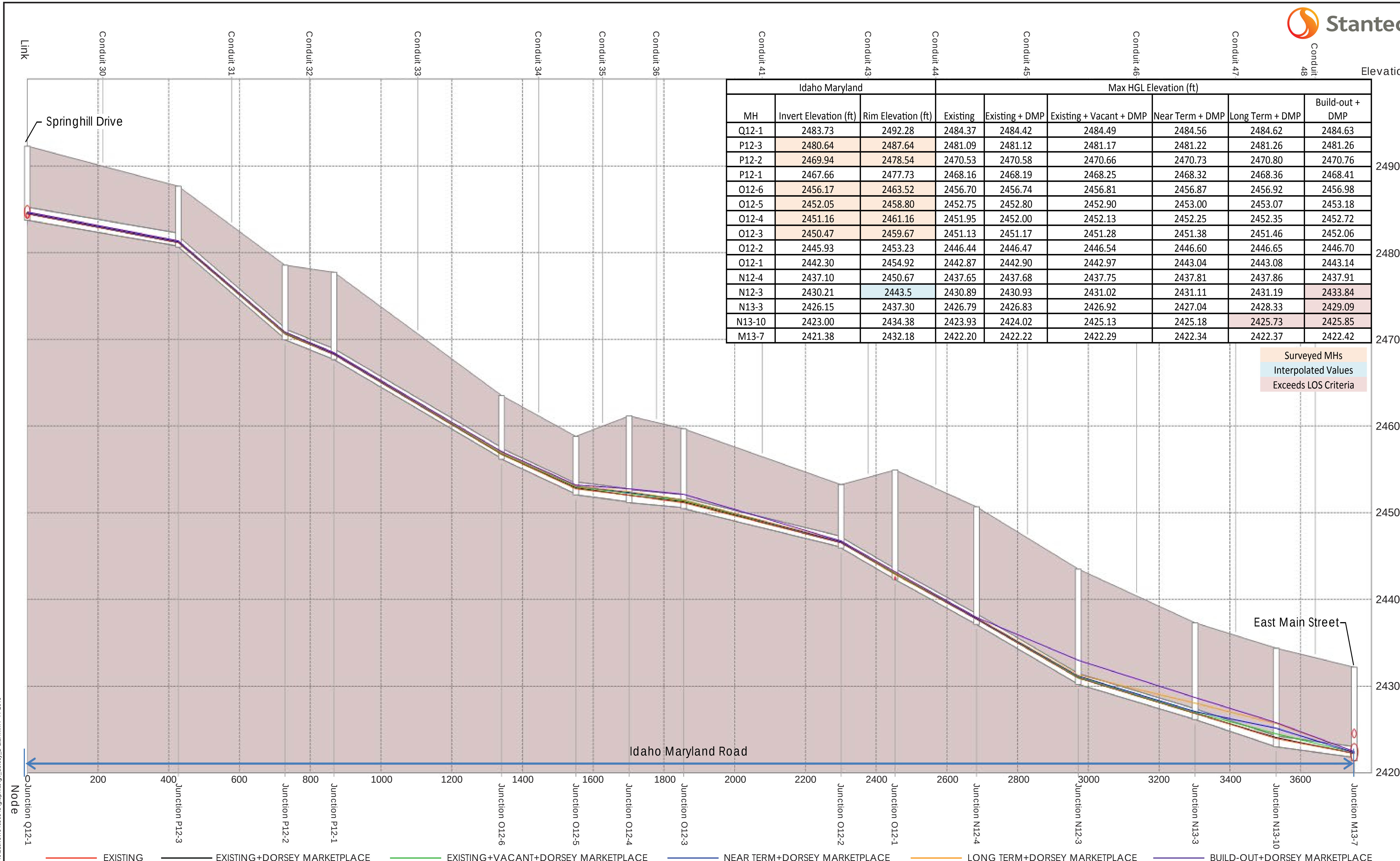


City of Grass Valley

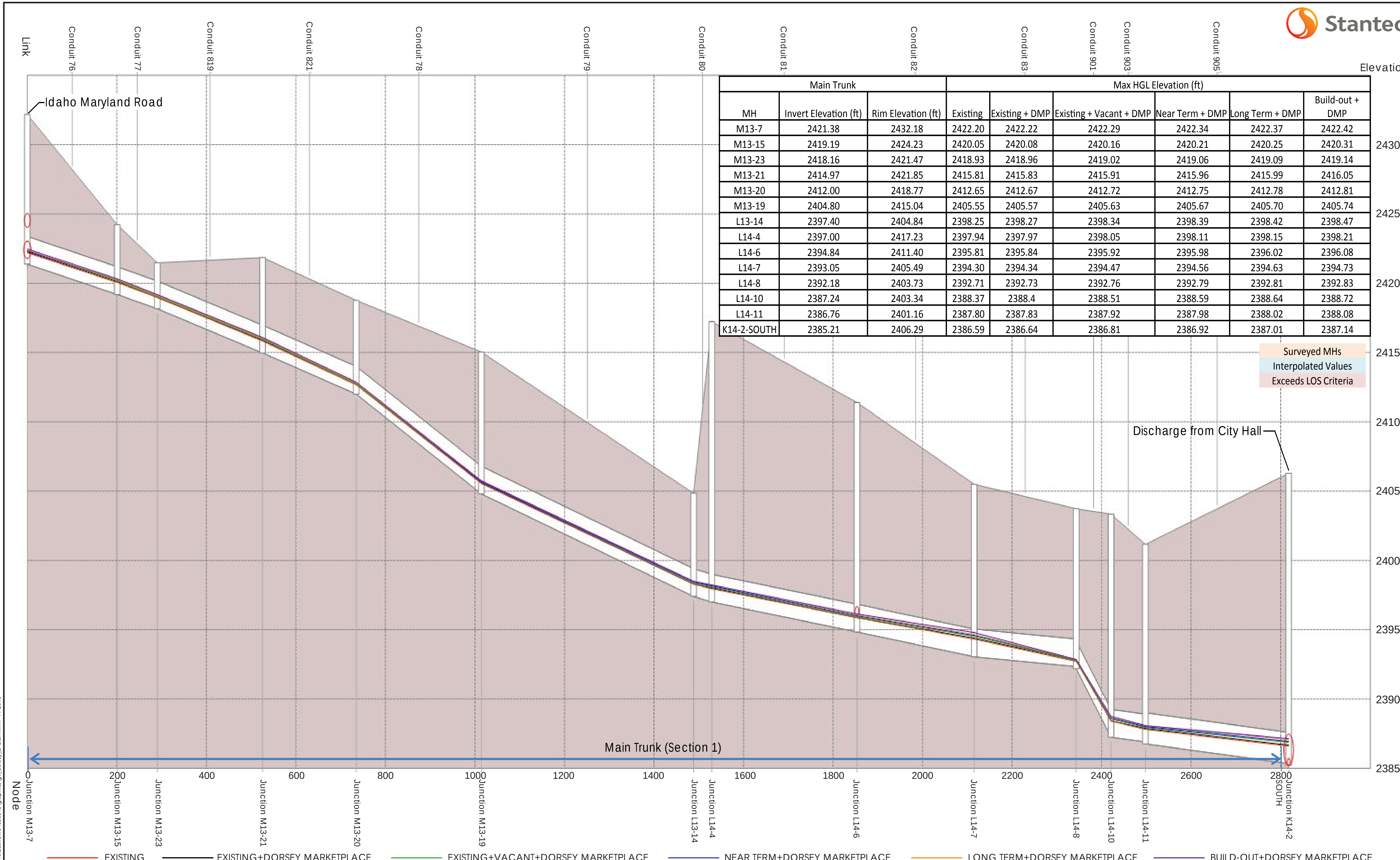
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure D-1

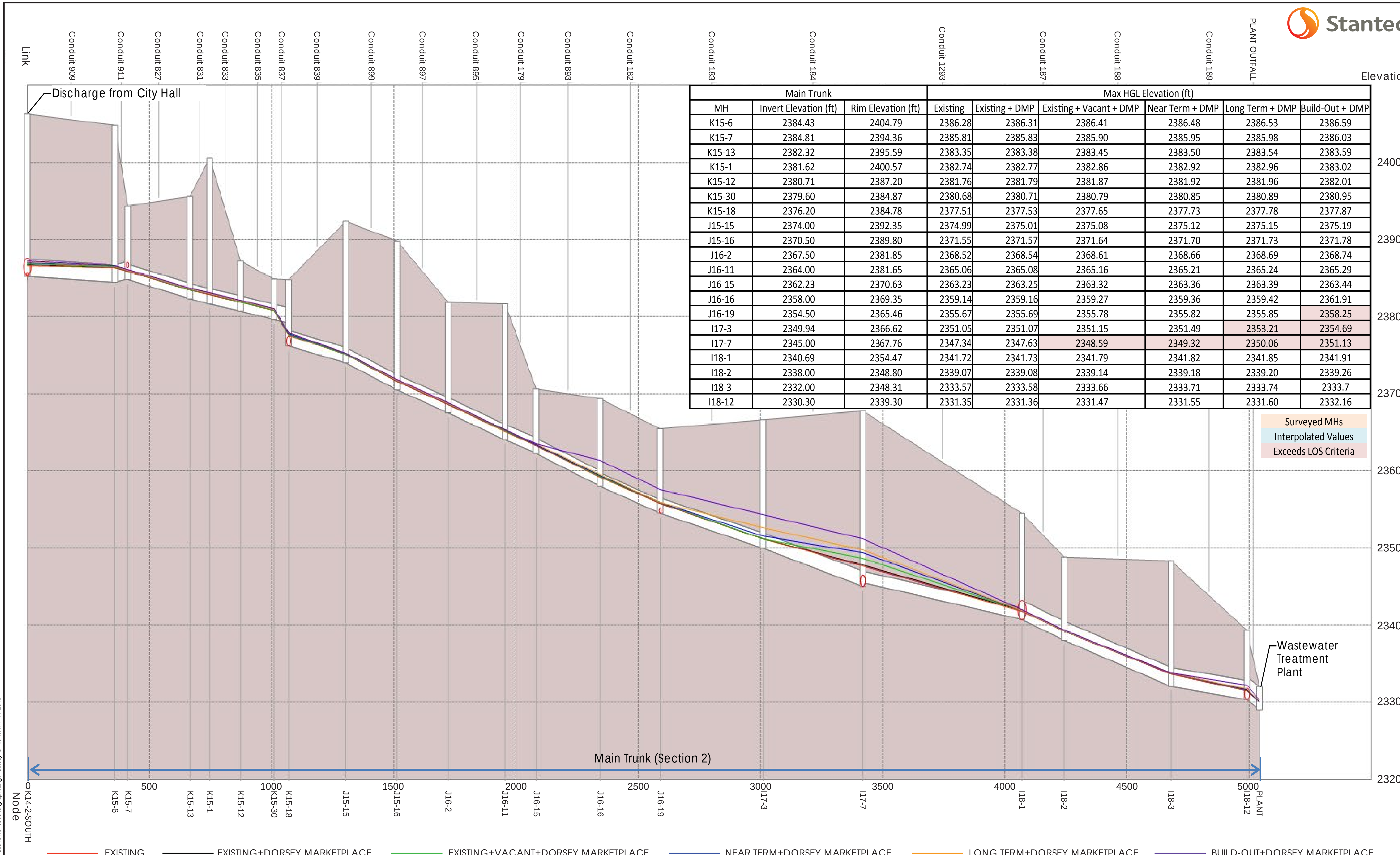
Plan View Key for HGL Profiles



Idaho Maryland			Max HGL Elevation (ft)					
MH	Invert Elevation (ft)	Rim Elevation (ft)	Existing	Existing + DMP	Existing + Vacant + DMP	Near Term + DMP	Long Term + DMP	Build-out + DMP
Q12-1	2483.73	2492.28	2484.37	2484.42	2484.49	2484.56	2484.62	2484.63
P12-3	2480.64	2487.64	2481.09	2481.12	2481.17	2481.22	2481.26	2481.26
P12-2	2469.94	2478.54	2470.53	2470.58	2470.66	2470.73	2470.80	2470.76
P12-1	2467.66	2477.73	2468.16	2468.19	2468.25	2468.32	2468.36	2468.41
O12-6	2456.17	2463.52	2456.70	2456.74	2456.81	2456.87	2456.92	2456.98
O12-5	2452.05	2458.80	2452.75	2452.80	2452.90	2453.00	2453.07	2453.18
O12-4	2451.16	2461.16	2451.95	2452.00	2452.13	2452.25	2452.35	2452.72
O12-3	2450.47	2459.67	2451.13	2451.17	2451.28	2451.38	2451.46	2452.06
O12-2	2445.93	2453.23	2446.44	2446.47	2446.54	2446.60	2446.65	2446.70
O12-1	2442.30	2454.92	2442.87	2442.90	2442.97	2443.04	2443.08	2443.14
N12-4	2437.10	2450.67	2437.65	2437.68	2437.75	2437.81	2437.86	2437.91
N12-3	2430.21	2443.5	2430.89	2430.93	2431.02	2431.11	2431.19	2433.84
N13-3	2426.15	2437.30	2426.79	2426.83	2426.92	2427.04	2428.33	2429.09
N13-10	2423.00	2434.38	2423.93	2424.02	2425.13	2425.18	2425.73	2425.85
M13-7	2421.38	2432.18	2422.20	2422.22	2422.29	2422.34	2422.37	2422.42



Main Trunk			Max HGL Elevation (ft)					
MH	Invert Elevation (ft)	Rim Elevation (ft)	Existing	Existing + DMP	Existing + Vacant + DMP	Near Term + DMP	Long Term + DMP	Build-out + DMP
M13-7	2421.38	2432.18	2422.20	2422.22	2422.29	2422.34	2422.37	2422.42
M13-15	2419.19	2424.23	2420.05	2420.08	2420.16	2420.21	2420.25	2420.31
M13-23	2418.16	2421.47	2418.93	2418.96	2419.02	2419.06	2419.09	2419.14
M13-21	2414.97	2421.85	2415.81	2415.83	2415.91	2415.96	2415.99	2416.05
M13-20	2412.00	2418.77	2412.65	2412.67	2412.72	2412.75	2412.78	2412.81
M13-19	2404.80	2415.04	2405.55	2405.57	2405.63	2405.67	2405.70	2405.74
L13-14	2397.40	2404.84	2398.25	2398.27	2398.34	2398.39	2398.42	2398.47
L14-4	2397.00	2417.23	2397.94	2397.97	2398.05	2398.11	2398.15	2398.21
L14-6	2394.84	2411.40	2395.81	2395.84	2395.92	2395.98	2396.02	2396.08
L14-7	2393.05	2405.49	2394.30	2394.34	2394.47	2394.56	2394.63	2394.73
L14-8	2392.18	2403.73	2392.71	2392.73	2392.76	2392.79	2392.81	2392.83
L14-10	2387.24	2403.34	2388.37	2388.4	2388.51	2388.59	2388.64	2388.72
L14-11	2386.76	2401.16	2387.80	2387.83	2387.92	2387.98	2388.02	2388.08
K14-2-SOUTH	2385.21	2406.29	2386.59	2386.64	2386.81	2386.92	2387.01	2387.14



Main Trunk			Max HGL Elevation (ft)					
MH	Invert Elevation (ft)	Rim Elevation (ft)	Existing	Existing + DMP	Existing + Vacant + DMP	Near Term + DMP	Long Term + DMP	Build-Out + DMP
K15-6	2384.43	2404.79	2386.28	2386.31	2386.41	2386.48	2386.53	2386.59
K15-7	2384.81	2394.36	2385.81	2385.83	2385.90	2385.95	2385.98	2386.03
K15-13	2382.32	2395.59	2383.35	2383.38	2383.45	2383.50	2383.54	2383.59
K15-1	2381.62	2400.57	2382.74	2382.77	2382.86	2382.92	2382.96	2383.02
K15-12	2380.71	2387.20	2381.76	2381.79	2381.87	2381.92	2381.96	2382.01
K15-30	2379.60	2384.87	2380.68	2380.71	2380.79	2380.85	2380.89	2380.95
K15-18	2376.20	2384.78	2377.51	2377.53	2377.65	2377.73	2377.78	2377.87
J15-15	2374.00	2392.35	2374.99	2375.01	2375.08	2375.12	2375.15	2375.19
J15-16	2370.50	2389.80	2371.55	2371.57	2371.64	2371.70	2371.73	2371.78
J16-2	2367.50	2381.85	2368.52	2368.54	2368.61	2368.66	2368.69	2368.74
J16-11	2364.00	2381.65	2365.06	2365.08	2365.16	2365.21	2365.24	2365.29
J16-15	2362.23	2370.63	2363.23	2363.25	2363.32	2363.36	2363.39	2363.44
J16-16	2358.00	2369.35	2359.14	2359.16	2359.27	2359.36	2359.42	2361.91
J16-19	2354.50	2365.46	2355.67	2355.69	2355.78	2355.82	2355.85	2358.25
I17-3	2349.94	2366.62	2351.05	2351.07	2351.15	2351.49	2353.21	2354.69
I17-7	2345.00	2367.76	2347.34	2347.63	2348.59	2349.32	2350.06	2351.13
I18-1	2340.69	2354.47	2341.72	2341.73	2341.79	2341.82	2341.85	2341.91
I18-2	2338.00	2348.80	2339.07	2339.08	2339.14	2339.18	2339.20	2339.26
I18-3	2332.00	2348.31	2333.57	2333.58	2333.66	2333.71	2333.74	2333.7
I18-12	2330.30	2339.30	2331.35	2331.36	2331.47	2331.55	2331.60	2332.16

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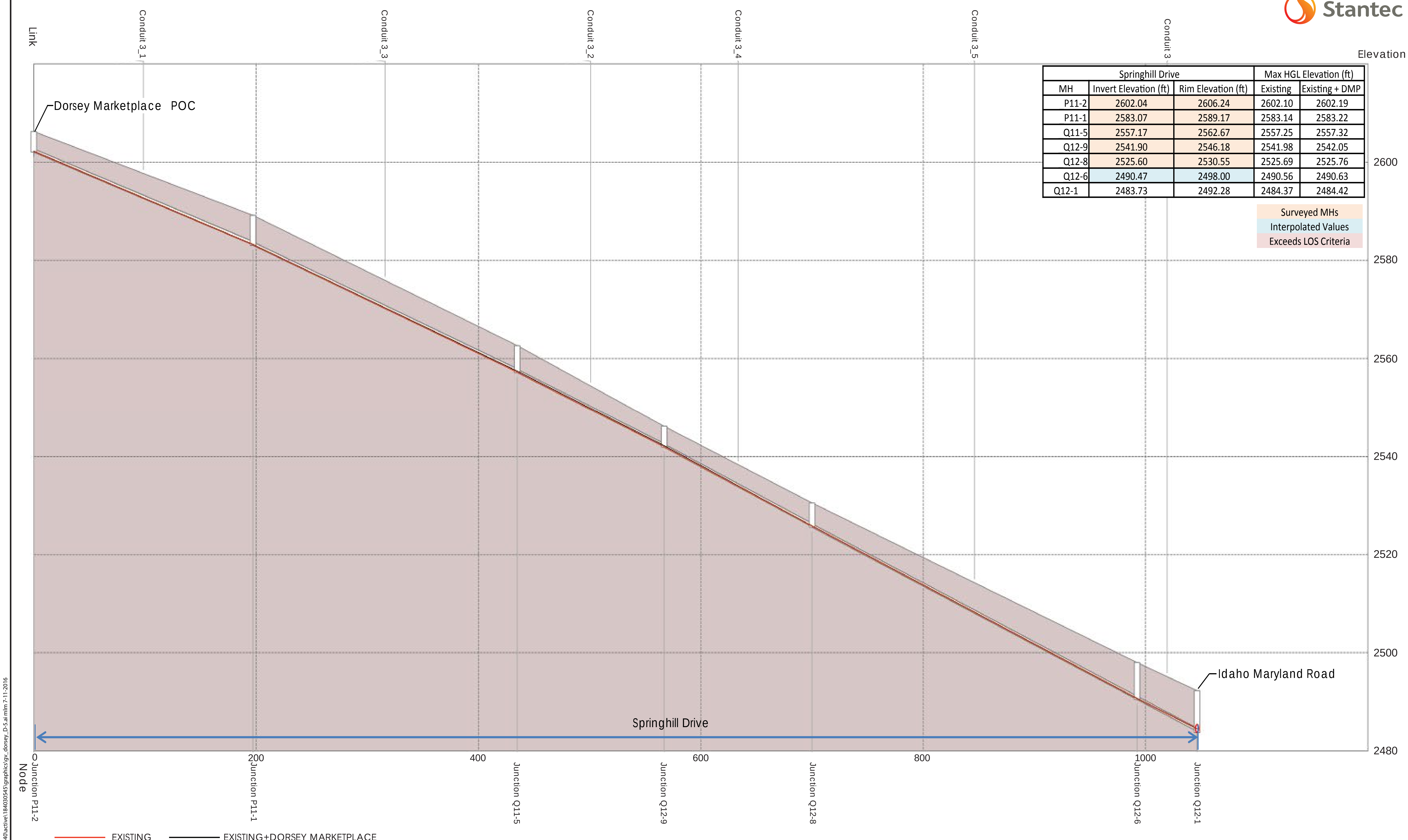
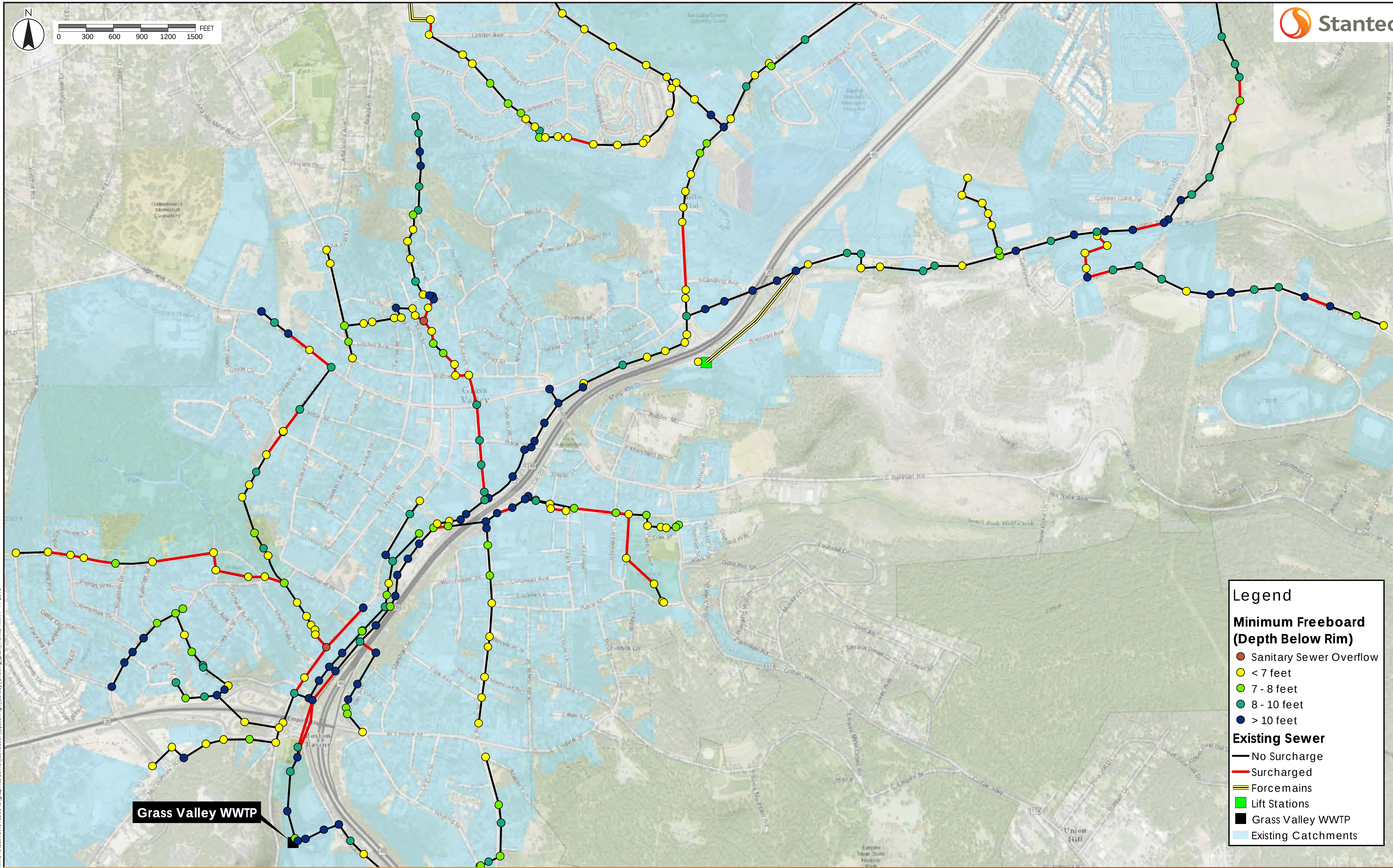


Springhill Drive			Max HGL Elevation (ft)	
MH	Invert Elevation (ft)	Rim Elevation (ft)	Existing	Existing + DMP
P11-2	2602.04	2606.24	2602.10	2602.19
P11-1	2583.07	2589.17	2583.14	2583.22
Q11-5	2557.17	2562.67	2557.25	2557.32
Q12-9	2541.90	2546.18	2541.98	2542.05
Q12-8	2525.60	2530.55	2525.69	2525.76
Q12-6	2490.47	2498.00	2490.56	2490.63
Q12-1	2483.73	2492.28	2484.37	2484.42

Surveyed MHs
Interpolated Values
Exceeds LOS Criteria

Stantec

Exhibit E PLAN VIEW FIGURES



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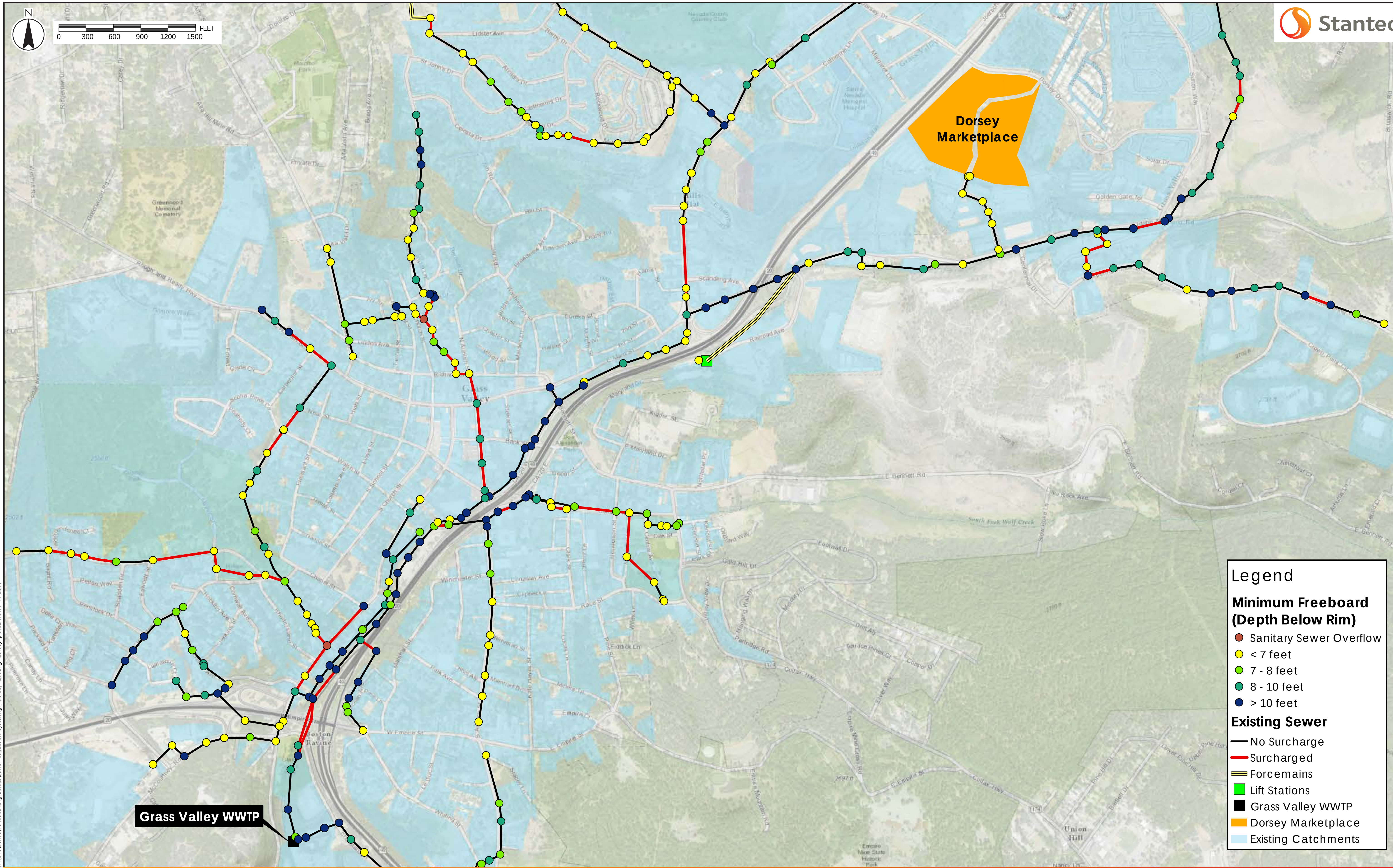
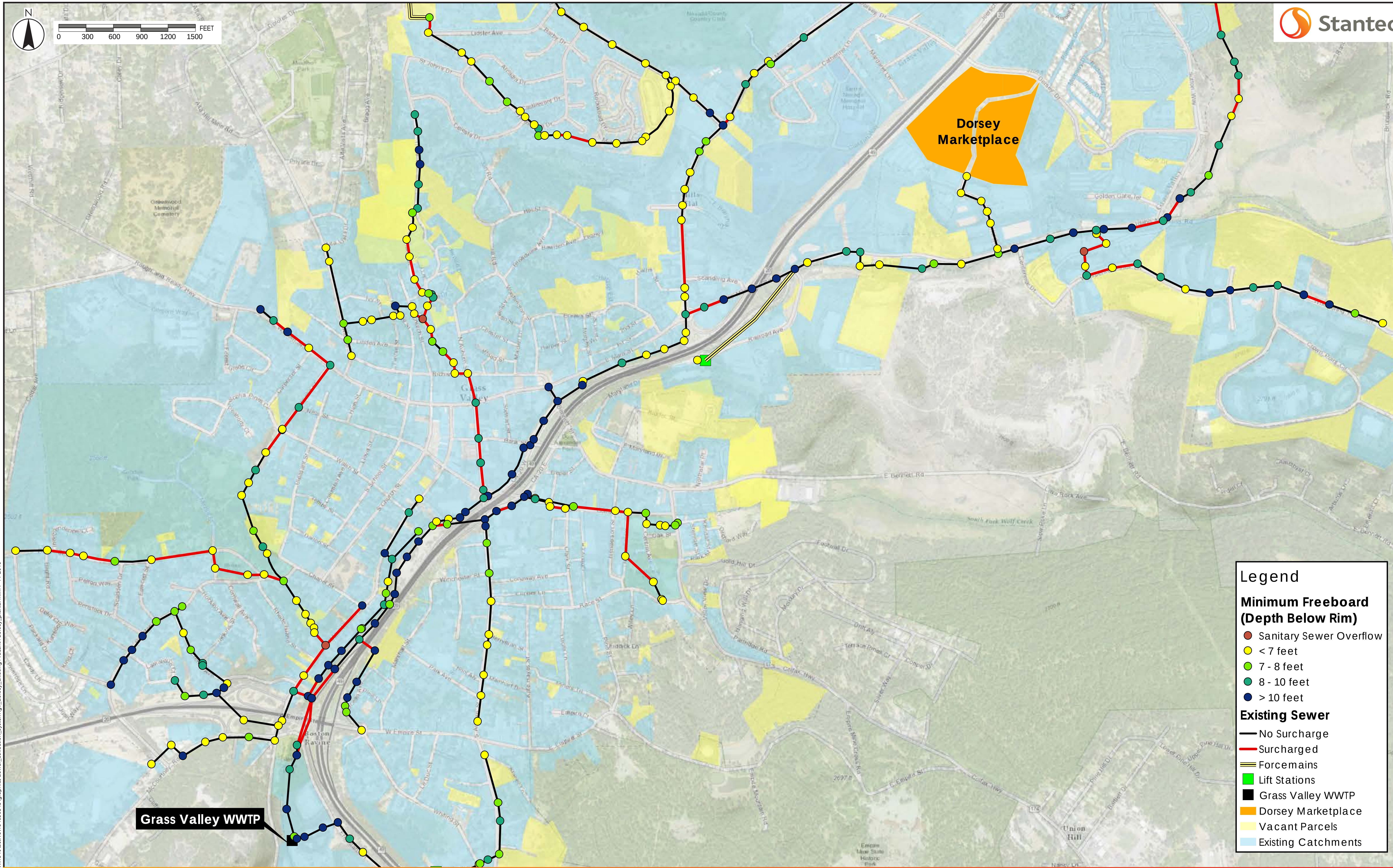
City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure E-1
Existing HGL Freeboard


N
0 300 600 900 1200 1500 FEET
Stantec
Dorsey Marketplace
Grass Valley WWTP
Legend
Minimum Freeboard (Depth Below Rim)
Sanitary Sewer Overflow
< 7 feet
7 - 8 feet
8 - 10 feet
> 10 feet
Existing Sewer
No Surcharge
Surcharged
Forcemains
Lift Stations
Grass Valley WWTP
Dorsey Marketplace
Existing Catchments



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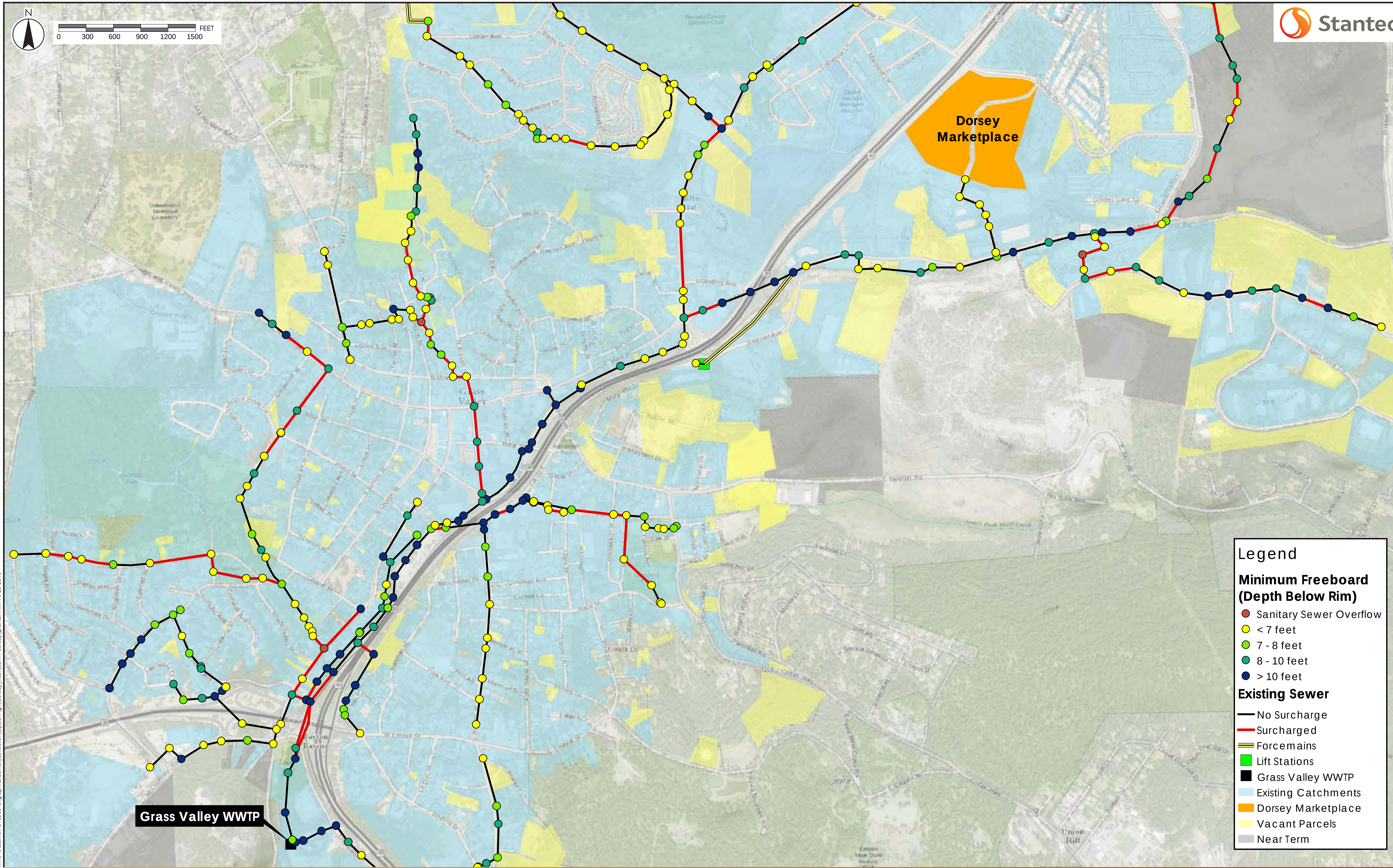
City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure E-3
Existing + Vacant + Dorsey Marketplace HGL Freeboard

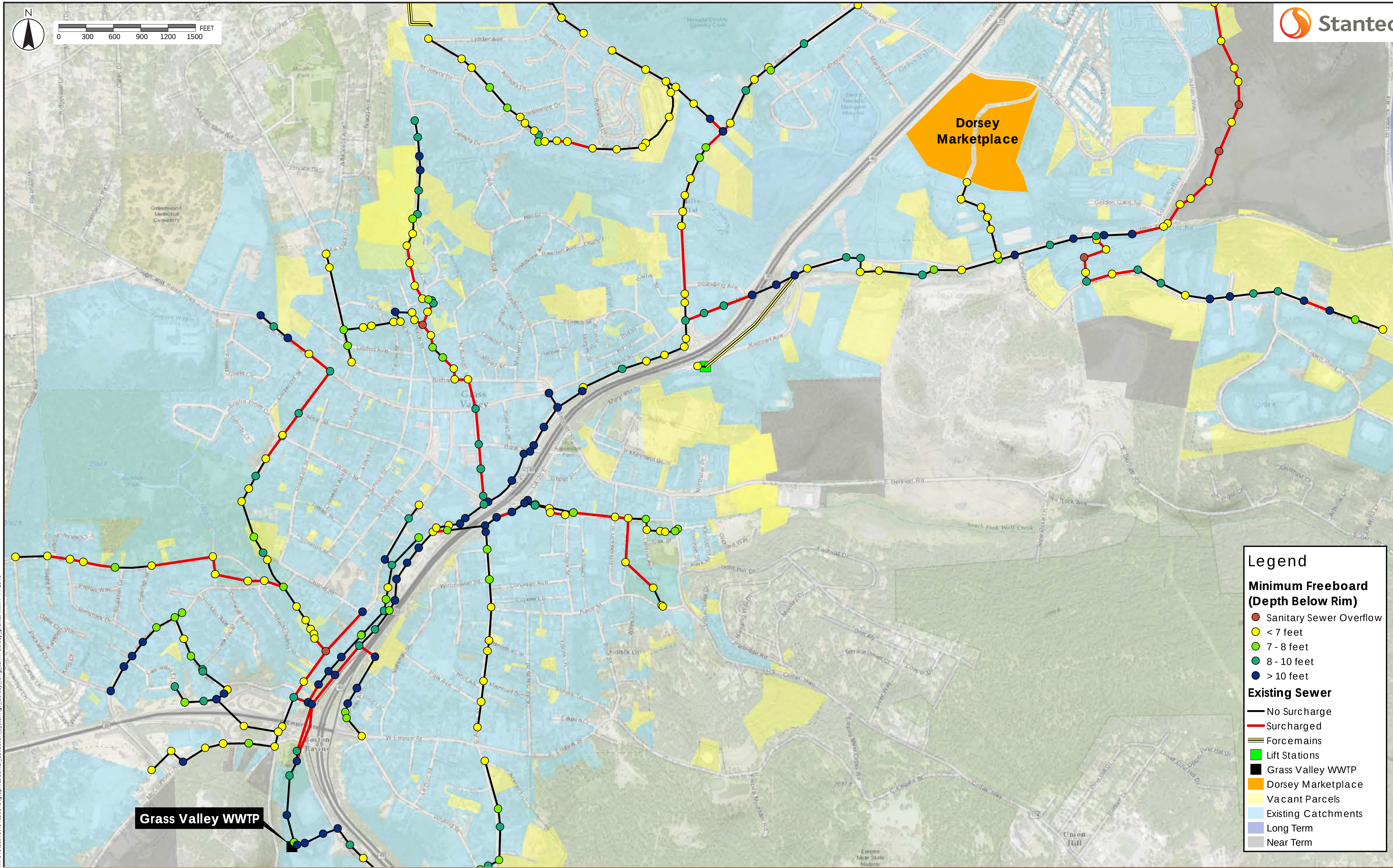


City of Grass Valley

Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

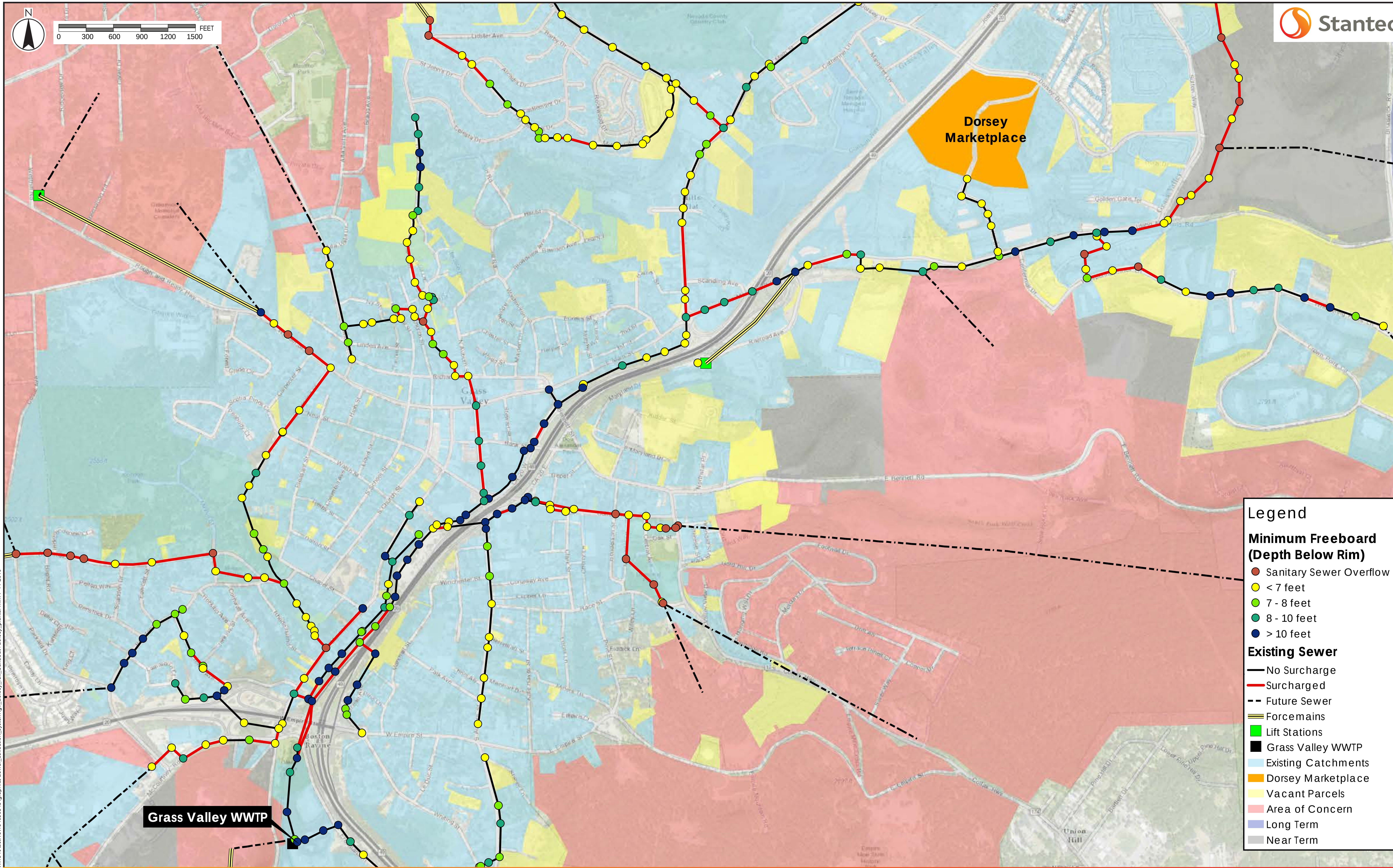
Figure E-4

Near Term Development + Dorsey Marketplace HGL Freeboard



City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure E-5
Long Term Development + Dorsey Marketplace HGL Freeboard



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City of Grass Valley
Sewer Capacity Assessment for the Proposed Dorsey Marketplace Project

Figure E-6
Full Build-out + Dorsey Marketplace HGL Freeboard

Stantec

Memo

To:	Katherine Waugh Dudek 853 Lincoln Way, Suite 208 Auburn, CA 95603	From:	Breanna Webb Stantec Consulting Services, Inc. 101 Providence Mine Road, Suite 202 Nevada City, CA 95959
File:	184030545	Date:	October 5, 2018

Technical Memorandum No. 2: Dorsey Marketplace Project – Sewer Capacity Assessment Update

Stantec completed a sewer capacity assessment to evaluate the specific impacts of the proposed Dorsey Marketplace development (Project) on the wastewater collection system of the City of Grass Valley (City). The results of this evaluation were presented within the Technical Memorandum (TM) titled *Dorsey Marketplace Project Technical Memorandum No. 1 – Sewer Capacity Assessment* (TM No.1), prepared by Stantec in October of 2016. Since the preparation of TM No. 1, the Dorsey Marketplace has developed an alternative site plan, to the one considered in TM No. 1. The original site plan, used to develop TM No.1, will be referred to herein as Alternative A, while the revised site plan will be referenced as Alternative B. The Alternative B site plan features expanded residential areas, a reduced commercial area, and added office space. The purpose of this technical memo is to provide an additional sewer capacity impact assessment of the development under the conditions presented in the Alternative B site plan. TM No. 1, the assessment of the capacity impacts to the collection system of the original site plan (Alternative A), is attached to the TM as **Attachment 1**.

This TM is divided into the following sections:

1. Background – TM No. 1
2. Alternative B – Dorsey Marketplace Alternative Site Plan
3. Wastewater Flow Projections
4. Sewer Capacity Assessment
5. Summary of Alternatives & Sewer Capacity Impacts

1.0 BACKGROUND – TM NO. 1

The purpose of this section is to summarize the project background and results presented in the original capacity assessment for the Dorsey Marketplace project presented in Dorsey Marketplace Project Technical Memorandum No. 1 – Sewer Capacity Assessment (Attachment 1). Only a summary of the project background and assessment results are presented here. The full TM can be referenced for additional details in Attachment 1. The proposed Dorsey Marketplace consists of a new, integrated, mixed-use, infill, retail, commercial and residential development project. The proposed Dorsey Marketplace development is located at the southeast corn of Dorsey Drive and Highway 49 within the City of Grass Valley, California. The proposed project location is shown in **Figure 1**. The project is located on a 26.9-acre former mine site, on the south side of Dorsey Drive. The development will have two entrances, one on Dorsey Drive and the other on Springhill Drive. It is assumed that wastewater from either site plan will be routed in the same way to the City's wastewater collection system. The current utility plan routes wastewater by gravity through an existing 8-inch sewer collector in Springhill Drive, which connects to an 18-inch trunk sewer in Idaho Maryland Road. The Idaho Maryland Trunk sewer connects to the City's Main Trunk sewer, which conveys wastewater to the City's wastewater treatment plant (WWTP).

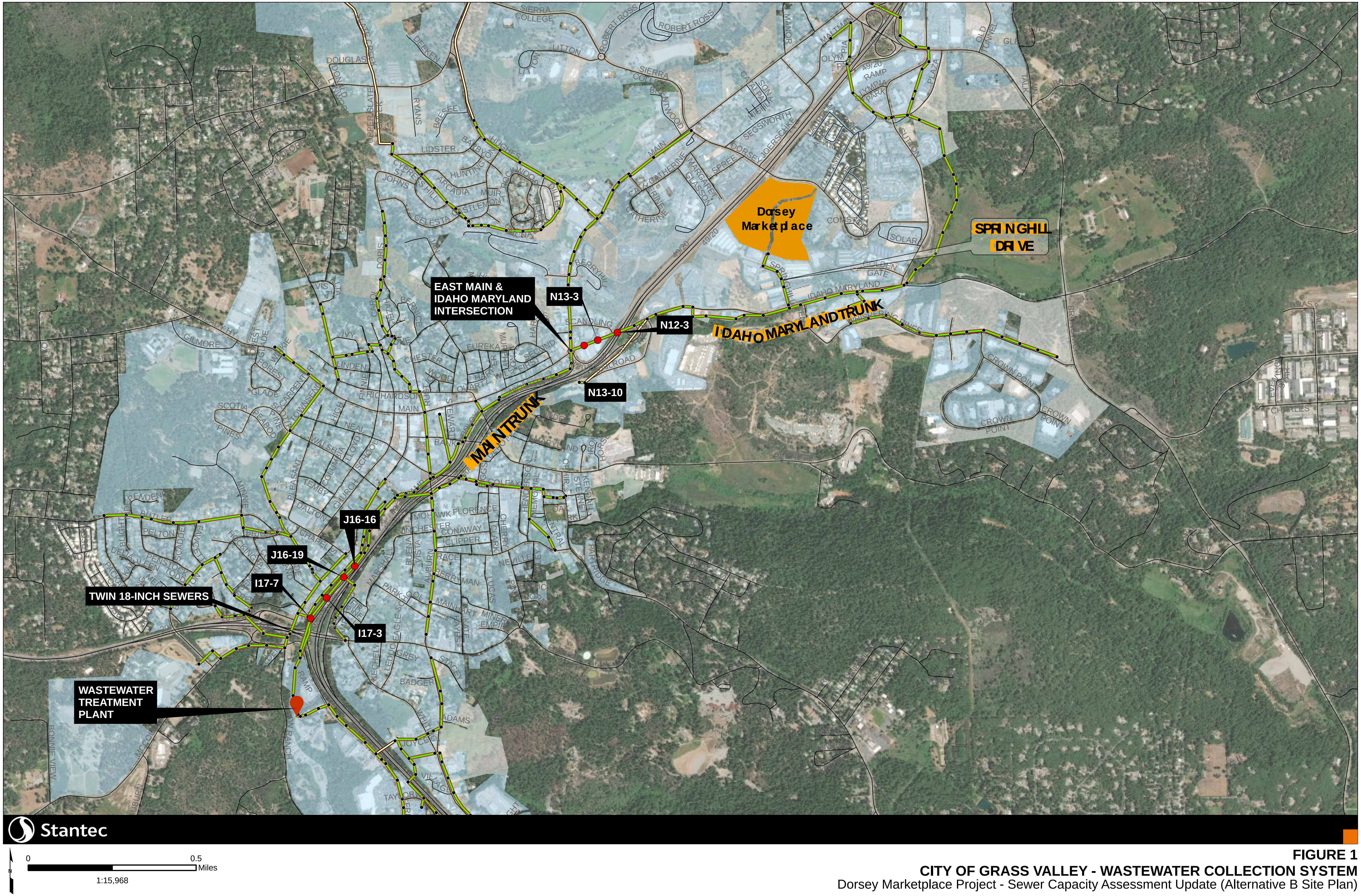

FIGURE 1

CITY OF GRASS VALLEY - WASTEWATER COLLECTION SYSTEM

Dorsey Marketplace Project - Sewer Capacity Assessment Update (Alternative B Site Plan)

TM No. 1 was developed to provide the City of Grass Valley with an assessment of the impacts the Proposed Project would have on the City wastewater collection system, under the Alternative A site plan. An estimate of wastewater flow from the development was approximated using the City's Design Standards. The wastewater collection capacity assessment was performed using the hydraulic model of the City's wastewater collection system. The hydraulic model of the City's wastewater collection system was modified to include segments of sewer connecting the new development to the existing system. As part of the model update survey data was collected for the wastewater sewer in Springhill Drive. A new model with updated wastewater flow estimates and survey information was run for each development scenario considered within the City's Wastewater System Master Plan (Master Plan). These model scenarios include:

- Existing Conditions
- Existing + Development of Vacant Parcels
- Near Term Development
- Long term Development
- Build Out Growth

The results of the model simulations were compared to those presented in the Master Plan. TM No. 1 concludes that there are two major areas of concern in the City's wastewater collection system downstream of the Dorsey Marketplace development. The twin 18-inch sewers on the Main Trunk crossing Highway 20 have insufficient capacity at development scenarios beyond the Existing condition. Where the Idaho Maryland Trunk meets the Main Trunk, at the intersection of Idaho Maryland Road and East Main Street throttling occurs under Long-Term development conditions and beyond. The flows from the Alternative A site plan are expected to exacerbate these capacity limitations.

2.0 ALTERNATIVE B – DORSEY MARKETPLACE ALTERNATE SITE PLAN

The purpose of this section is to provide a description of the Alternative B site plan for the Dorsey Marketplace development. The Alternative A site plan designated the land use of the parcel as 22.6 acres of commercial area, with approximately 180,000 square feet (SF) of retail space and 5.7 acres of "urban high density" residential area, with 90 equivalent dwelling units (EDUs). Alternative B proposes a new site configuration with a slightly modified distribution of land uses as compared to Alternative A. **Table 1** presents the site plan land use configurations for both alternatives. The Alternative B site plan expands the southern residential area to the west, adding approximately 81 EDUs to the original configuration. There are a total of 171 EDUs proposed in the Alternative B site plan. Approximately 8,500 SF of office space is also integrated into the site as a buffer between residential and commercial areas. The commercial area is reduced to approximately 14.2 acres[1] and 105,000 SF of retail space.

[1] Acreages of non-residential area was not provided for use in this analysis, only square footage of commercial and office building space was available. Therefore, the ratio of non-residential square footage to non-residential acreage from Alternative A was used to determine equivalent non-residential acreages for the Alternative B site plan. [22.6 acres/180,000 SF x (105,000 SF + 8,500 SF) = 14.2 acres]

Table 1 Land Uses of Site Plan Alternatives

Land Use	Alternative A	Alternative B
Commercial Building Space (SF)	180,000	105,000
Office Building Space (SF)		8,500
Total Non-Residential Building Space (SF)	180,000	113,500
Residential (EDU)	90	171
Total Non- Residential (Acres) [(a)]	22.6	14.2

(a) Total non-residential acres include the total commercial and office portion of the development, including drainages, parking lots, and other features outside of building space.

3.0 WASTEWATER FLOW PROJECTIONS

Wastewater flow projections for the Dorsey Marketplace development were calculated to assess the impact of the developments added wastewater flow on the City's collection system. The purpose of this section is to present the projected wastewater flows for each of the Dorsey Marketplace site plan alternatives and provide a description of the methods used for their development. Flow projections used for the analysis of the Alternative A site plan presented in TM No. 1, and the Alternative B site plan, were provided and checked with the City of Grass Valley Engineering Standards (Design Standards). The City's Design Standards present wastewater generation rates for residential and non-residential land use types. Commercial and office land uses are assigned 850 gallons per day (gpd)/acre and wastewater estimates for residential land use are quantified by EDU, equating to 135 gpd/EDU (high density EDU). These wastewater generation rates are used to develop the Average Dry Weather Flow (ADWF) estimate for the development using the land use data from each site plan. Wastewater flow estimates for both Alternatives can be found in **Table 2**.

To assess the full impact of the development on the wastewater collection system, Peak Wet Weather Flow (PWWF) estimates must be determined. The PWWF is the peak wastewater flow value consisting of base flow, groundwater infiltration, and Rainfall Dependent Inflow and Infiltration (RDII). Base flow is wastewater contributed directly from the development. Groundwater infiltration is caused by shallow groundwater entering the cracks and imperfections of the wastewater collection system and RDII is considered stormwater that enters the wastewater collection system directly (inflow) or indirectly (infiltration). Inflow into the wastewater collection system causes the peak wastewater flow to occur during or subsequently after the peak rainfall intensity during a storm event. Inflow can enter the collection system through improperly connected roof leaders, open or cracked manhole covers, or other direct flow paths into system.

The City's Design Standards outline the methods for determining PWWF. A safety factor of two (2) is applied to the ADWF estimate developed from the developments land uses. An additional Peaking Factor (PF) is then applied to this value to determine the approximate PWWF. The peaking factor described in the Design Standards is dependent on the ADWF estimate. Additional information and the City's Design Standards can be found in TM No. 1 (Attachment 1). The PWWF for both Alternatives is presented in **Table 2**.

The Alternative A site plan produced a PWWF estimate of approximately 0.301 MGD, as presented in TM No. 1. An approximate PWWF was developed for the Alternative B site plan using the same method, as described in the City's Design Standards. The total non-residential square footage of the Alterative B site plan was estimated using the ratio of the Building Space to Non-Residential Area presented for Alternative A. A total of to 14.2 acres of commercial and office area was used to develop the Alternative B wastewater flow estimate as shown in **Table 1**.

The added residential area and reduced commercial space increases the projected PWWF estimate from 0.301 MGD to 0.325 MGD for Alternative B. The total ADWF for Alternative B equates to approximately 70,400 gpd after applying the factor of safety. A PF of 4.6 is required to determine PWWF at this ADWF.

Table 2 Wastewater Flow Estimates for Alternative Site Plans

Flow Parameter	Alternative A	Alternative B
Non-Residential Wastewater Flow (gpd) – *850 gpd/acre*	19,210	12,070
Residential Wastewater Flow (gpd) – *135 gpd/EDU*	12,150	23,085
Total ADWF (gpd)	31,360	35,155
Factored ADWF (gpd) – *Safety Factor of 2*	62,720	70,310
PF	4.8	4.6
PWWF (gpd)	301,056	323,062
Rounded PWWF (MGD)	**0.300**	**0.325**

4.0 SEWER CAPACITY ASSESSMENT

The purpose of this section is to describe the methods used to determine the results of the sewer capacity assessment for the Dorsey Marketplace development, including the City's hydraulic models, assessment criteria, and level of service requirements.

4.1 SEWER CAPACITY ASSESSMENT CRITERION

A hydraulic model of the City of Grass Valley wastewater collection system was developed as part of the City's Wastewater Master Plan. This model was modified for use in this assessment and the preceding assessment (TM No. 1) to determine the impacts of the Dorsey Marketplace development on the City's collection system. The hydraulic models developed to assess the impact of the Alternative A site plan (described in TM No. 1) were copied and modified to assess the PWWF estimate developed for the Alternative B site plan. The models were used to evaluate the capacity of the collection system and identify limitations, such as bottlenecks and infrastructure unable to accommodate projected flow. The ability for a sewer to accommodate future development is defined by the City's Level of Service (LOS) performance criteria. The criteria define whether or not collection system components are operating effectively based on quantifiable metrics which can be extracted from model simulation results.

The results of each model simulation are assessed using four wastewater flow metrics:

1. **Peak Flow** – Evaluated at specific locations within the collection system under PWWF conditions.
2. **Minimum Freeboard** – Freeboard in the collection system is defined as the depth between the grade or rim elevation and the hydraulic grade line (HGL).
3. **Hydraulic Loading Ratio (HLR)** – The hydraulic loading ratio within each sewer under peak flow conditions is a commonly used as a metric to evaluate the performance of open channel flow sewers. The HLR is mathematically defined as the peak flow divided by the full pipe capacity (calculated using Manning's Equation), and it is denoted as "Max/Full Flow" in the simulation results.
4. **Residual Capacity** – The residual capacity within each sewer when subjected to peak flows equates to the difference between full pipe capacity and the peak flow. This performance indicator is useful in illustrating the relative remaining capacity throughout the system.

The City's LOS criteria for the collection system are based on the allowable surcharge (or minimum freeboard) within the gravity portion of the collection system. The maximum allowable surcharge in the gravity portion of the sanitary sewer system is assessed using the estimated HGL elevation of wastewater in the pipelines. The HGL must remain at least 8-feet from the ground surface during peak flow conditions (i.e. at least 8-feet of minimum freeboard is required).

This is the criteria established within the City's Wastewater Master Plan. Existing sewers with depths greater than 8-feet have been said to be within LOS criteria if the peak surcharge elevation results in a freeboard of greater than 8-feet with less than one foot of HGL surcharging above the pipe crown. Any sewers identified with freeboard less than 8-feet are considered deficient should any surcharging above the pipe crown result.

Thus, the identified deficiencies are generally based upon the following criteria:

1. Minimum freeboard of 8-feet (HGL depth below grade/rim)
2. Surcharging less than 1-foot above the pipe crown (with freeboard of 8-feet or greater)
3. No surcharging (with freeboard of less than 8-feet)

4.2 PREVIOUS MODEL RESULTS

The sewer capacity assessments are performed using the simulated results from modeled scenarios and the City's LOS criteria. A summary of relevant model results and capacity constraints identified in the Master Plan and the two Project Alternatives are described herein. HGL profiles that are relative to the Dorsey Marketplace and the downstream collection system were provided in TM No. 1.

4.2.1 Wastewater System Master Plan & TM No. 1: Results Summary

City of Grass Valley Wastewater System Master Plan

A summary of relevant model results from the Master Plan have been presented in TM No. 1. The HGL profiles of specific relevance to the Dorsey Marketplace project are shown in Exhibit C of TM No. 1 (Attachment 1). The City's Master Plan identifies capacity issues within the City's collection system under design storm (peak flow) conditions. The portions of the collection system that are specifically relevant to the Dorsey Marketplace development include the assessment of the Idaho Maryland Trunk and the portion of the Main Trunk between the Idaho Maryland Trunk and the City's WWTP. The Springhill Drive sewer collector was not considered within the Master Plan and was added to the model and considered with the assessment of Alternative A and Alternative B.

The Idaho Maryland Trunk extends along Idaho Maryland Road to East Main Street, where it connects to the City's Main Trunk sewer. The Master Plan identifies manholes in which the HGL failed to meet the City's LOS criteria. The location of these capacity constraints is upstream of the point of connection of the Springhill sewer collector, which is proposed to convey flow from the Dorsey Marketplace development. Sanitary Sewer Overflows (SSO) are predicted to occur in this upstream reach of the system with the addition of flow from long-term growth. Despite being upstream of the portion of the collection system considered as part of this assessment, eliminating these capacity constraints will increase peak flows in the downstream collection system. Collection system capacity improvements along the Idaho Maryland Trunk upstream of Springhill Drive would allow a higher rate of flow from portions of the system where flow is currently attenuated flow and impact the portion of the trunk considered in this assessment. In addition to the upstream capacity issues, there is also a constraint where the Idaho Maryland Trunk meets the Main Trunk.

The Master Plan also identifies capacity constraints along the City's Main Trunk, specifically in the twin 18-inch sewers crossing underneath Highway 20. There was predicted to be a minimum freeboard of greater than 20 feet under existing conditions. It is noted that this capacity constraint will only worsen as capacity improvements and expansions occur in the upstream system.

Dorsey Marketplace Project TM No. 1 – Sewer Capacity Assessment

TM No. 1 identified two major areas of concern within the collection system, downstream of the Dorsey Marketplace development.

1. The twin 18-inch sewers crossing underneath Highway 20 identified in the Master Plan have insufficient capacity and cause LOS failures at development scenarios beyond existing conditions.

2. Where the Idaho Maryland Trunk meets the Main Trunk at the intersection of Idaho Maryland Road and East Main Street capacity limitations cause backwater effects along both trunks, including LOS failures under development scenarios under the long-term growth scenario and beyond.

4.3 ALTERNATIVE B SITE PLAN MODEL RESULTS

The hydraulic models of the City's collection system were adjusted to reflect the conditions of the Alternative B site plan. The Alternative B site plan adds approximately 25,000 gpd to the wastewater flow estimate generated for the Alternative A site plan.

4.3.1 Existing + Dorsey Marketplace Development (Alternative B)

This modeled scenario assesses the impact of a design storm event (10-year, 24-hour) on the existing collection system with the addition of flows from the proposed development. The peak flow experienced at the WWTP is the same as that of Alternative A, 13.7 MGD. The additional flow associated with the Alternative B site plan is attenuated in the upstream system, exacerbating upstream deficiencies.

The following provides a summary of surcharging in the system under design storm conditions for this scenario.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

In this scenario there is expected to be no surcharging along the Idaho Maryland Trunk, as was predicted in the original assessment of Alternative A

Main Trunk (from Idaho Maryland Road to the WWTP)

Model results predict that there will be no additional sewer surcharged in this profile when compared to the results presented for Alternative A. Surcharging in manhole I17-7 increases by only 0.01 feet.

Springhill Drive

There are not expected to be any sewers surcharge in this profile. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

There are not expected to be any LOS failures under this scenario.

4.3.2 Existing + Development of Vacant Parcels + Dorsey Marketplace (Alternative B)

This scenario simulates the impact of a design storm on the existing collection system when all remaining vacant parcels within City Limits are developed, in addition to the Dorsey Marketplace (Alternative B). It is predicted that under these conditions a peak flow of 15.26 MGD would be experienced at the WWTP. Increasing by 0.025 MGD when compared to that of Alternative A, the amount of additional flow proposed by the alternative.

The following provides a summary of surcharging in the system under design storm conditions for this scenario.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

In this scenario there is expected to be minor surcharging along the Idaho Maryland Trunk, as was predicted in the original assessment of Alternative A. Surcharging is predicted to reach 0.39 feet at manhole N13-10, the first manhole upstream of the confluence of the Idaho Maryland and Main Trunk sewers. Surcharging increases by 0.02 feet when compared to that of Alternative A. The sewer remains within the City's LOS criteria having a minimum freeboard of 9.73 feet and a surcharge depth of less than 1-foot.

Main Trunk (from Idaho Maryland Road to the WWTP)

Model results predict that surcharging in manhole I17-7 will reach 1.60 feet with the addition of flow from vacant parcels and that of the proposed development. The surcharge depth exceeds the LOS limit of 1-foot in this scenario, as was predicted under Alternative A. Surcharge depth is predicted to increase by 0.01 feet when compared to the results for Alternative A. Freeboard

Springhill Drive

There are not expected to be any sewers surcharge in this profile, under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 3**.

Table 3 LOS Deficiencies Existing + Vacant + Dorsey Marketplace

Model Results	Alternative A	Alternative B
Manhole	I17-7	I17-7
Depth (feet)	22.76	22.76
Freeboard (feet)	19.18	19.16
Surcharge Depth (feet)	1.59	1.60

4.3.3 Near-term Development + Dorsey Marketplace (Alternative B)

This scenario simulates the impact of a design storm on the existing collection system upon development of areas identified as near-term growth in the City's Wastewater System Master Plan. This scenario also includes modifications attributed to the Dorsey Marketplace development. The near-term growth scenario (~5-years) includes a portion of the "Loma Rica Special Development Area", lands west of Brunswick Road, north of Idaho Maryland and east of Sutton Way. It also includes a portion of the Berriman Ranch and adjacent properties.

Under these conditions, it is predicted that the WWTP will experience a peak flow of 16.5 MGD, assuming no capacity improvements are made within the existing collection system. This peak flow was also predicted to occur under Alternative A conditions when rounded. Increasing from 16.48 to 16.52 MGD from Alternative A to Alternative B. The inclusion of additional flow from Alternative B is not predicted to cause any additional sewer segments to become surcharged when compared to results predicted for Alternative A. The following provides a summary of surcharging in the system under near-term growth and design storm conditions.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

Model results for Alternative B predict surcharging will occur in manhole N13-10, reaching a depth of 0.95 feet. This scenario increases surcharge depth by 0.02 feet when compared to the results of Alternative A. This manhole remains within LOS criteria with minimum freeboard of 9.18 feet.

Main Trunk (from Idaho Maryland Road to the WWTP)

Surcharging in manhole I17-7 is further exacerbated with the inclusion of flow from near-term development. The surcharge depth is estimated to reach 2.35 feet above the pipe crown. The Alternative B site plan increases the surcharge depth at this manhole by 0.03 feet when compared to the results of Alternative A. Although the minimum freeboard is predicted to be 18.41 feet, this manhole fails to meet the City's LOS criteria due to the surcharge depth.

Springhill Drive

There are not expected to be any sewers surcharge in this profile under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 4**.

Table 4 LOS Deficiencies Near-term Development + Dorsey Marketplace

Model Results	Alternative A	Alternative B
Manhole	I17-7	I17-7
Depth (feet)	22.76	22.76
Freeboard (feet)	18.44	18.41
Surcharge Depth (feet)	2.32	2.35

4.3.4 Long-term Development + Dorsey Marketplace (Alternative B)

This scenario simulates the impact of a design storm on the existing collection system upon development of areas identified as long-term growth in the City's Wastewater System Master Plan. This scenario also includes modifications attributed to the Dorsey Marketplace development. The long-term growth scenario (~10-years) includes full development of the "Loma-Rica Special Development Area".

Under these conditions, it is predicted that the WWTP will experience a peak flow of 17.3 MGD, assuming no capacity improvements are made within the existing collection system. The peak flow was predicted to be 17.2 MGD under Alternative A conditions, when rounded. The inclusion of additional flow from Alternative B is predicted to cause surcharge depth to exceed 1-foot at one additional manhole on the Idaho Maryland Trunk when compared to results predicted for Alternative A. The following provides a summary of surcharging in the system under long-term growth and design storm conditions.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

Model results predict surcharging will occur in manholes N13-10 and N13-3, reaching depths of 1.54 and 1.08 feet. This scenario increases surcharge depth in manhole N13-10 by 0.05 feet when compared to the results of Alternative A. Surcharge depth in manhole N13-3 is predicted to increase by 0.15 feet causing the surcharge depth to exceed the LOS threshold of 1.0 foot of allowable surcharge, when compared to the results of Alternative A. The minimum freeboard exceeds 8-feet in both manholes.

Main Trunk (from Idaho Maryland Road to the WWTP)

The most notable surcharging in the collection system downstream of Springhill Drive exists in the parallel 18-inch sewers crossing Highway 20. Surcharge depth is predicted to reach 3.08 feet in manhole I17-7, with a minimum freeboard of 18.44 feet. Alternative B increases surcharge depth by 0.02 feet at this manhole. The manhole immediately upstream of manhole I17-7 also fails to meet LOS criteria under the conditions of this development scenario. Surcharge depth in manhole I17-3 reaches 1.30 feet, increasing from 1.27 feet predicted for Alternative A. The minimum freeboard exceeds 14 feet in both manholes.

Springhill Drive

There are not expected to be any sewers surcharge in this profile under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 5**.

Table 5 LOS Deficiencies Long-term Development + Dorsey Marketplace

Manhole ID	N13-10		N13-3		I17-7		I17-3	
Model Results	A	B	A	B	A	B	A	B
Depth (feet)	11.38	11.38	11.15	11.15	22.76	22.76	16.68	16.68
Freeboard (feet)	8.66	8.61	8.99	8.83	18.46	18.44	14.17	14.15
Surcharge Depth (feet)	1.48	1.53	0.93	1.08	3.06	3.08	1.27	1.30

4.3.5 Build-out Development + Dorsey Marketplace (Alternative B)

This scenario simulates the impact of a design storm on the existing collection system upon development of all remaining vacant parcels, the areas identified within the near-term and long-term sphere of influence, and "build-out areas of concern" identified in the City's Wastewater System Master Plan. This scenario also includes modifications attributed to the Dorsey Marketplace development. The build-out growth scenario includes all additional lands identified within the City of Grass Valley 2020 General Plan, including the special development areas of North Star Ranch, Kenny Ranch, the balance of Berriman Ranch and adjacent properties, as well as all "areas of concern".

Under these conditions, it is predicted that the WWTP will experience a peak flow of 25.9 MGD, assuming no capacity improvements are made within the existing collection system. The peak flow was predicted to be 25.8 MGD under Alternative A conditions, when rounded. The inclusion of additional flow from Alternative B is predicted to cause surcharge depth to exceed 1-foot at one additional manhole on the Idaho Maryland Trunk when compared to results predicted for Alternative A. The following provides a summary of surcharging in the system under long-term growth and design storm conditions.

Idaho Maryland Trunk (from Springhill Drive to E. Main Street)

Model results predict surcharging will increase under buildout development conditions in manholes N13-10 and N13-3, reaching depths of 1.56 and 1.78 feet. This scenario increases surcharge depth in manhole N13-10 by 0.07 feet when compared to the results of Alternative A. Surcharge depth in manhole N13-3 is predicted to increase by 0.09 feet, when compared to the results of Alternative A. The minimum freeboard exceeds 8-feet in both manholes. Manhole N12-3 also fails to meet LOS criteria under buildout conditions, as predicted in the Alternative A assessment. Surcharge depth reaches 2.55 feet above the pipe crown, 0.17 feet higher than what was predicted for Alternative A. It should also be noted that further upstream, east of Highway 20, manholes O12-3 and O12-4 are predicted to just meet LOS criteria. Manhole O12-3 has a depth of 9.2 feet and less than 8-feet of available freeboard. Any additional flow would cause surcharging this this manhole and would cause it to fail to meet LOS criteria. It should also be noted that the Idaho Maryland Trunk and tributary sewers upstream of Springhill Drive has severe capacity constraints. The model predicts that under buildout conditions approximately 1.26 MG will overflow from this portion of the sewer system during design storm conditions. Should these capacity constraints be resolved, more flow will be allowed to enter the downstream portion of the Idaho Maryland Trunk being considered in this TM, further exacerbating existing capacity constraints.

Main Trunk (from Idaho Maryland Road to the WWTP)

Surcharging is expected to worsen as a result of higher flows and limited capacity in the twin 18-inch sewers crossing Highway 20. The surcharge depths of manhole I17-7 and I17-3 are expected to increase to 4.16 feet and 2.81 feet respectively, increasing by 0.03 and 0.05 feet when compared to the results of Alternative A. Manhole J16-19, directly upstream of I17-7 and I17-3, is also predicted to fail LOS criteria under these conditions. In the assessment of Alternative A, manhole J16-19 was predicted to reach a surcharge depth of 1.75 feet. Surcharge depth increased to depth of 1.80 feet in the assessment of Alternative B. The manhole upstream of J16-19 is also predicted to fail LOS criteria under buildout conditions. Manhole J16-16 is predicted to have a surcharge depth of 1.98 feet under Alternative B, and 1.91 feet under Alternative A. As noted for the Idaho Maryland Trunk, upstream capacity restrictions cause sewer system overflows under buildout conditions. Improvements to these areas will cause higher flow rates to enter the downstream collection system considered in this TM.

Springhill Drive

There are not expected to be any sewers surcharge in this profile under these development conditions. There are not predicted to be any capacity constraints within the Springhill Drive sewer collector with the addition of either of the Dorsey Marketplace site plans.

LOS Deficiencies

The LOS deficiencies predicted in this scenario are summarized in **Table 6** and **Table 7**.

Table 6 Idaho Maryland Trunk LOS Deficiencies Build-out + Dorsey Marketplace

Manhole	N13-10		N13-3		N12-3	
Model Results	**A**	**B**	**A**	**B**	**A**	**B**
Depth (feet)	11.38	11.38	11.15	11.15	13.29	13.29
Freeboard (feet)	8.64	8.57	8.21	8.12	9.66	9.49
Surcharge Depth (feet)	1.49	1.56	1.69	1.78	2.38	2.55

Table 7 Main Trunk LOS Deficiencies Build-out + Dorsey Marketplace

Manhole	I17-7		I17-3		J16-19		J16-16	
Model Results	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Depth (feet)	22.76	22.76	16.68	16.68	10.96	10.96	11.35	11.35
Freeboard (feet)	16.63	16.60	11.92	11.88	7.21	7.16	7.44	7.37
Surcharge Depth (feet)	4.13	4.16	2.76	2.81	1.75	1.80	1.91	1.98

5.0 SUMMARY OF ALTERNATIVES & SEWER CAPACITY IMPACTS

The purpose of this section is to present a summary of the sewer capacity assessment results presented in the previous section of this TM in comparison to those presented in TM No. 1 for the original Dorsey Marketplace site plan (Alternative A).

There are two major areas of concern in the City's wastewater collection system downstream of the proposed Dorsey Marketplace development, the twin 18-inch sewers crossing under Highway 20 and the confluence of the Idaho Maryland Trunk and the Main Trunk. The twin 18-inch sewers have insufficient capacity and cause LOS failures at development scenarios beyond existing conditions. Where the Idaho Maryland and Main Trunk sewers meet, throttling occurs and causes LOS failures under the long-term growth scenario and beyond.

TM No. 1 defines the "percent responsible" to quantify the contribution of hydraulic loading from the Dorsey Marketplace development. The percentage of the peak flow attributable to the development above existing peak flow conditions (presented in the Master Plan), was calculated for the near-term and long-term scenarios. Manhole I17-7 is the only manhole that conveys Dorsey Marketplace flow and fails the City's LOS criteria under near-term development conditions, as predicted for the evaluation of Alternative A. The percent of peak flow attributable to the development was calculated as 12.6% in TM No. 1 for the Alternative A site plan. The Alternative B site plan adds an additional 0.25 MGD of flow to the Dorsey Marketplace wastewater flow estimate and increases this percent responsible to 13.7%.

The percent responsible is calculated by determining the amount of peak flow in the manhole that can be attributed to the Dorsey Marketplace. This value is then divided by the peak flow that can be attributed to near-term development.

Under the long-term development scenario, manholes I17-7, I17-3, and N13-10 failed to meet the City's LOS criteria, as presented in TM No. 1. The Alternative B site plan causes an additional LOS failure along the Idaho Maryland Trunk, when surcharge depth exceeds i-foot in manhole N13-3. The percent responsible in each of these manholes is presented in **Table 8**.

Table 8 Percent Responsible - Long Term Conditions

Manhole	Percent Responsible Long Term	
	Alternative A	Alternative B
I17-7	11.8%	12.7%
I17-3	11.2%	12.1%
N13-10	15.5%	16.7%
N13-3	-	16.7%

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Attachment: Attachment

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