The City of San Diego	**PRIORITY DEVELOPMENT PROJECT (PDP) STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) FOR**

Pacific Village
PTS# 470158
DWG#

ENGINEER OF WORK:

Giovanni Posillico, RCE 6632

PREPARED FOR:

Lennar Homes of California, Inc.
25 Enterprise, Suite 300
Aliso Viejo, CA 92656
(949) 349-8000

PREPARED BY:

Latitude 33 Planning & Engineering
9968 Hibert Street Second Floor
San Diego, CA 92131
(858) 751-0633

DATE:
September 2016

Approved by: City of San Diego Date

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TABLE OF CONTENTS

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ACRONYMS

APN	Assessor's Parcel Number
ASBS	Area of Special Biological Significance
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CGP	Construction General Permit
DCV	Design Capture Volume
DMA	Drainage Management Areas
ESA	Environmentally Sensitive Area
GLU	Geomorphic Landscape Unit
GW	Ground Water
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
HU	Harvest and Use
INF	Infiltration
LID	Low Impact Development
LUP	Linear Underground/Overhead Projects
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
POC	Pollutant of Concern
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWPPP	Stormwater Pollutant Protection Plan
SWQMP	Storm Water Quality Management Plan
TMDL	Total Maximum Daily Load
WMAA	Watershed Management Area Analysis
WPCP	Water Pollution Control Program
WQIP	Water Quality Improvement Plan

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CERTIFICATION PAGE

Project Name: Pacific Village
Permit Application Number:

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the Storm Water Standards, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Storm Water Standards. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

____

Engineer of Work's Signature, PE Number & Expiration Date

Giovanni Posillico

Print Name

Latitude 33 Planning & Engineering

Company

Date

Engineer's Stamp

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SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In last column indicate changes that have been made or indicate if response to plan check comments is included. When applicable, insert response to plan check comments.

Submittal Number	Date	Project Status	Changes
1	02/05/2016	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Initial Submittal
2	05/12/2016	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Second Submittal
3	09/23/2016	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Third Submittal
4		☐ Preliminary Design/Planning/CEQA ☐ Final Design	

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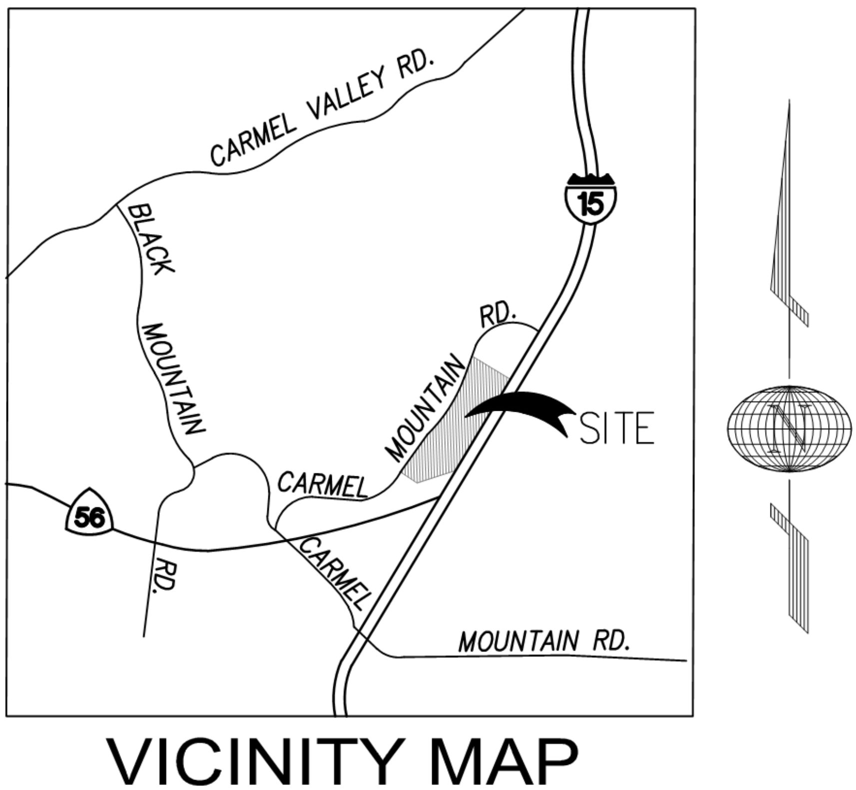
PROJECT VICINITY MAP

Project Name: Pacific Village
Permit Application Number: VTM 1669785



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STORM WATER REQUIREMENTS APPLICABILITY CHECKLIST

Complete and attach DS-560 Form included in Appendix A.1

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THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Storm Water Requirements Applicability Checklist**	FORM **DS-560** January 2016

Project Address: 10955 Carmel Mountain Road, San Diego, CA 92129-1643	Project Number *(for the City Use Only)*:

SECTION 1. Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the Storm Water Standards Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP)[1], which is administrated by the State Water Resources Control Board.

For all projects complete PART A: If project is required to submit a SWPPP or WPCP, continue to PART B.

PART A: Determine Construction Phase Storm Water Requirements.

1. Is the project subject to California's statewide General NPDES permit for Storm Water Discharges Associated with construction activities, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

   ☒ Yes; SWPPP required, skip questions 2-4 ☐ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity that results in ground disturbance and contact with storm water runoff?

   ☐ Yes; WPCP required, skip questions 3-4 ☐ No; next question

3. Does the project propose routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (projects such as pipeline/utility replacement)

   ☐ Yes; WPCP required, skip question 4 ☐ No; next question

4. Does the project only include the following Permit types listed below?
   - Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit, Right of Way Permit for pot holing.
   - Individual Right of Way Permits that exclusively include one of the following activities and associated curb/ sidewalk repair: water services, sewer lateral, storm drain lateral, or dry utility service.
   - Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, curb and gutter replacement, and retaining wall encroachments.

   ☐ Yes; no document required

Check one of the boxes to the right, and continue to PART B:

☒ If you checked "Yes" for question 1,
a SWPPP is REQUIRED. Continue to PART B

☐ If you checked "No" for question 1, and checked "Yes" for question 2 or 3,
a WPCP is REQUIRED. If the project processes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to PART B.**

☐ If you checked "No" for all question 1-3, and checked "Yes" for question 4
PART B **does not apply and no document is required. Continue to Section 2.**

[1]More information on the City's construction BMP requirements as well as CGP requirements can be found at: www.sandiego.gov/stormwater/regulations/swguide/constructing.shtml

PART B: Determine Construction Site Priority.
This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a "high threat to water quality." The City has aligned the local definition of "high threat to water quality" to the risk. Determination approach of the State Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **NOTE:** The construction priority does **NOT** change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by city staff.

Complete PART B and continued to Section 2

1. ☐ **ASBS**
   a. Projects located in the ASBS watershed. A map of the ASBS watershed can he found here *<placeholder for ASBS map link>*

2. ☒ **High Priority**
   a. Projects 1 acre or more determined to be Risk Level 2 or Risk Level 3 per the Construction General Permit and not located in the ASBS watershed.
   b. Projects 1 acre or more determined to be LUP Type 2 or LUP Type 3 per the Construction General Permit and not located in the ASBS watershed.

3. ☐ **Medium Priority**
   a. Projects 1 acre or more but not subject to an ASBS or high priority designation.
   b. Projects determined to be Risk Level 1 or LUP Type 1 per the Construction General Permit and not located in the ASBS watershed.

4. ☐ **Low Priority**
   a. Projects not subject to ASBS, high or medium priority designation.

SECTION 2. Permanent Storm Water BMP Requirements.

Additional information for determining the requirements is found in the Storm Water Standards Manual.

PART C: Determine if Not Subject to Permanent Storm Water Requirements.
Projects that are considered maintenance, or otherwise not categorized as "new development projects" or "redevelopment projects" according to the Storm Water Standards Manual are not subject to Permanent Storm Water BMPs.

If "yes" is checked for any number in Part C, proceed to Part F and check "Not Subject to Permanent Storm Water BMP Requirements".

If "no" is checked for all of the numbers in Part C continue to Part D.

1.	Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact storm water?	☐ Yes ☒ No
2.	Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?	☐ Yes ☒ No
3.	Does the project fall under routine maintenance? Examples include, but are not limited to: roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay, and pothole repair).	☐ Yes ☒ No

PART D: PDP Exempt Requirements.

PDP Exempt projects are required to implement site design and source control BMPs.

If "yes" was checked for any questions in Part D, continue to Part F and check the box labeled "PDP Exempt."
If "no" was checked for all questions in Part D, continue to Part E.

1. Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:

   • Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   • Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;
   • Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Storm Water Standards manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Storm Water Standards Manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; project not exempt. PDP requirements apply

PART E: Determine if Project is a Priority Development Project (PDP). Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

If "yes" is checked for any number in PART E, continue to PART F and check the box labeled "Priority Development Project".
If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Project".

1. **New Development that creates 10,000 square feet or more of impervious Surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☐ Yes ☒ No
2. **Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☒ Yes ☐ No
3. **New development or redevelopment of a restaurant.** Facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC 5812), and where the land development creates and/or replace 5,000 square feet or more of impervious surface.	☐ Yes ☒ No
4. **New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater.	☐ Yes ☒ No

5.	**New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).**	☐ Yes ☒ No
6.	**New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervio us surface (collectively over the project site).	☒ Yes ☐ No
7.	**New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging- directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).	☐ Yes ☒ No
8.	**New development regardless of size or redevelopment projects that create and/or replace 5,000 square feet of impervious surface of a retail gasoline outlet.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic of 100 or more vehicles per day.	☐ Yes ☒ No
9.	**New development regardless of size or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface of an automotive repair shops.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.	☐ Yes ☒ No
10.	**Other Pollutant Generating Project.** The project is not covered in the categories above, results in the disturbance of one or more acres of land and is expected to generate pollutants post construction, such as fertilizers and pesticides. This does not include projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces of if they sheet flow to surrounding pervious surfaces.	☐ Yes ☒ No

PART F: Select the appropriate category based on the outcomes of PART C through PART E.

1.	The project is **NOT SUBJECT TO PERMANENT STORM WATER REQUIREMENTS.**	☐
2.	The project is a **STANDARD PROJECT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance.	☐
3.	The project is **PDP EXEMPT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance.	☐
4.	The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control, and structural pollutant control BMP requirements apply. See the Storm Water Standards Manual for guidance on determining if project requires hydromodification management.	☒

Name of Owner or Agent *(Please Print)*: Jonathan J. Green	Title: Senior Project Engineer
Signature: [signature]	Date: 5/03/16

<table>
<tr><td colspan="2">Applicability of Permanent, Post-Construction Storm Water BMP Requirements</td><td>Form I-1</td></tr>
<tr><td colspan="3">Project Identification</td></tr>
<tr><td colspan="3">Project Name: Pacific Village</td></tr>
<tr><td colspan="2">Permit Application Number: VTM 1669785</td><td>Date: 05/12/2016</td></tr>
<tr><td colspan="3">Determination of Requirements</td></tr>
<tr><td colspan="3">The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short <u>summary</u> of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements.

Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop".
Refer to Part 1 of Storm Water Standards sections and/or separate forms referenced in each step below.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Answer</th><th>Progression</th></tr>
<tr><td rowspan="2">Step 1: Is the project a "development project"?
See Section 1.3 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.</td><td>☒ Yes</td><td>Go to Step 2.</td></tr>
<tr><td>☐ No</td><td>Stop.
Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.</td></tr>
<tr><td colspan="3">Discussion / justification if the project is <u>not</u> a "development project" (e.g., the project includes <u>only</u> interior remodels within an existing building):</td></tr>
<tr><td rowspan="3">Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions?
To answer this item, see Section 1.4 of the BMP Design Manual (Part 1 of Storm Water Standards) <u>in its entirety</u> for guidance, AND complete Storm Water Requirements Applicability Checklist.</td><td>☐ Standard Project</td><td>Stop.
Standard Project requirements apply.</td></tr>
<tr><td>☒ PDP</td><td>PDP requirements apply, including PDP SWQMP.
Go to Step 3.</td></tr>
<tr><td>☐ PDP Exempt</td><td>Stop.
Standard Project requirements apply.
Provide discussion and list any additional requirements below.</td></tr>
<tr><td colspan="3">Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:</td></tr>
</table>

Form I-1 Page 2		
Step	Answer	Progression
Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval? See Section 1.10 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Consult the City Engineer to determine requirements. Provide discussion and identify requirements below. Go to Step 4.
	☒ No	BMP Design Manual PDP requirements apply. Go to Step 4.
Discussion / justification of prior lawful approval, and identify requirements (<u>not required if prior lawful approval does not apply</u>):		
Step 4. Do hydromodification control requirements apply? See Section 1.6 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☒ Yes	PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6). Go to Step 5.
	☐ No	Stop. PDP structural BMPs required for pollutant control (Chapter 5) only. Provide brief discussion of exemption to hydromodification control below.
Discussion / justification if hydromodification control requirements do <u>not</u> apply:		
Step 5. Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☒ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.
Discussion / justification if protection of critical coarse sediment yield areas does <u>not</u> apply: According to the 2015 Regional Potential Critical Coarse Sediment Yield Area Map there are no CCSYAs onsite or upstream of the project site.		

Site Information Checklist For PDPs	**Form I-3B**
Project Summary Information	
Project Name	Pacific Village
Project Address	10955 Carmel Mountain Road, San Diego, CA 92129-1643
Assessor's Parcel Number(s) (APN(s))	313-030-15-00
Permit Application Number	VTM 1669785
Project Watershed	Select One: ☐ San Dieguito River ☒ Penasquitos ☐ Mission Bay ☐ San Diego River ☐ San Diego Bay ☐ Tijuana River
Hydrologic subarea name with Numeric Identifier up to two decimal places (9XX.XX)	Poway 906.20
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	41.45 Acres (1805289 Square Feet)
Area to be disturbed by the project (Project Footprint)	40.74 Acres (1774768 Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	27.27 Acres (1187876 Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	13.47 Acres (586892 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Project Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition.	51% Increase

Form I-3B Page 2 of 11
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☒ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Description / Additional Information:
Existing Land Cover Includes (select all that apply): ☒ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☒ Impervious Areas Description / Additional Information: The existing site is a developed residential location with natural grasses and tress spaced out through the community
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☒ NRCS Type D
Approximate Depth to Groundwater (GW): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☒ 10 feet < GW Depth < 20 feet (Ground water was not encountered in any of the nine exploratory borings which extended approximately 15 feet below existing ground). ☐ GW Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☐ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☒ None Description / Additional Information:

Form I-3B Page 3 of 11
Description of Existing Site Topography and Drainage:
How is storm water runoff conveyed from the site? At a minimum, this description should answer: 1. Whether existing drainage conveyance is natural or urban; 2. If runoff from offsite is conveyed through the site? If yes, quantification of all offsite drainage areas, design flows, and locations where offsite flows enter the project site and summarize how such flows are conveyed through the site; 3. Provide details regarding existing project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, and natural and constructed channels; 4. Identify all discharge locations from the existing project along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.
Description / Additional Information:
The project area is approximately 41 acres of developed land consisting of relatively spread out single story multi-dwelling residential homes. The existing site is comprised of rolling hills with gentle slopes no larger than 2:1 and as mild as 30:1. Although the overall surface flow pattern tends to drain to the southeast, there are two major basins at Pacific Village. There exists a ridge running east roughly in the middle of the site that divides the project into northern and southern basins. Within each basin there exists 36-in storm drains which begin outside the project limits from the west and aid with the capture of onsite flows. These flows are then transferred east under Interstate 15 and travel south eventually meeting up with Los Penasquitos Creek.

Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:

The post project developed site at Pacific Village will have a 99 cluster homes, 102 triplexes, 128 row townhomes and 240 apartments. The storm water run-off from the project site will be treated by biofiltration basins onsite and will follow the same flow pattern as the existing condition utilizing the two existing 36-in storm drains. The drainage areas have been designed to maintain the overall drainage areas tributary to the existing storm drains.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):

Project impervious features include:

- Cluster Homes, Triplexes, Townhomes, and Apartment Complexes
- Asphalt roadway
- Concrete sidewalks
- Asphalt Parking Spaces

List/describe proposed pervious features of the project (e.g., landscape areas):

Project pervious features include:

- Biofiltration basins
- Yards
- Parks
- Dog Parks

Does the project include grading and changes to site topography?

☒ Yes

☐ No

Description / Additional Information:

Proposed construction activities for Pacific Village will involve demolishing of existing structures and roadway features, clearing, grubbing, and rough grading. This will be followed by precise grading and then construction of the subdivision's proposed single- and multi-family residences, pavement, curb, gutter, sidewalk, additional infrastructure (storm drain, sewer, water, etc.), and landscaping.

Form I-3B Page 5 of 11
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? ☒ Yes ☐ No If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural and constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre and post-proj ect drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations. Description / Additional Information: Based on grading limitations and flow patterns biofiltration basins will be placed strategically throughout the project site to treat surface runoff. The runoff will either be captured by spillways, directly discharging to the basin, or will be collected by catch basins placed along the roadway and conveyed by pipe to the basin for treatment. After treated the water will be stored in underground storage units and with the implementation of low flow orifices the runoff will be discharged at a rate that meets the hydro modification requirements.

Form I-3B Page 6 of 11
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply): ☒ On-site storm drain inlets ☐ Interior floor drains and elevator shaft sump pumps ☒ Interior parking garages ☒ Need for future indoor & structural pest control ☒ Landscape/Outdoor Pesticide Use ☒ Pools, spas, ponds, decorative fountains, and other water features ☐ Food service ☒ Refuse areas ☐ Industrial processes ☒ Outdoor storage of equipment or materials ☐ Vehicle and Equipment Cleaning ☐ Vehicle/Equipment Repair and Maintenance ☐ Fuel Dispensing Areas ☒ Loading Docks ☐ Fire Sprinkler Test Water ☐ Miscellaneous Drain or Wash Water ☒ Plazas, sidewalks, and parking lots ☐ Large Trash Generating Facilities ☒ Animal Facilities ☐ Plant Nurseries and Garden Centers ☐ Automotive-related Uses Description / Additional Information:

Form I-3B Page 7 of 11

Identification and Narrative of Receiving Water

Narrative describing flow path from discharge location(s), through urban storm conveyance system, to receiving creeks, rivers, and lagoons and ultimate discharge location to Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable)

The storm drain systems that capture the project runoff discharge into Caltrans systems which convey them across Interstate 15 to Chicarita Creek that flows adjacent to Carmel Mountain Ranch Country Club golf course. This creek flows approximately 2 miles south and eventually joins Los Penasquitos Creek. Los Penasquitos Creek flows over 10 miles to the Pacific Ocean.

Provide a summary of all beneficial uses of receiving waters downstream of the project discharge locations.

● Existing Beneficial Use
○ Potential Beneficial Use
+ Except from Municipal Use

Receiving Water (Hydrologic Unit Code)	**Beneficial Use**														
	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
906.20	+	●	○					●	●		●		●		

Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations.

No areas of ASBS have been identified for this project.

Provide distance from project outfall location to impaired or sensitive receiving waters.

Los Penasquitos Creek lies approximately 2 miles downstream of the project discharge point.

Summarize information regarding the proximity of the permanent, post-construction storm water BMPs to the City's Multi-Habitat Planning Area and environmentally sensitive lands

There are no existing MHPA and open space areas within the project area. The nearest MHPA is approximately 900 ft to the West of the site. The nearest environmentally sensitive land is located approximately 2 miles downstream to the South.

Form I-3B Page 8 of 11		
Identification of Receiving Water Pollutants of Concern		
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:		
303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs/ WQIP Highest Priority Pollutant
Los Penasquitos Creek 90610000	Enterococcus	*848 tons
	Fecal Coliform	
	Selenium	
	Total Dissolved Solids	
	Total Nitrogen as N	
	Toxicity	
Los Penasquitos Lagoon 90610000	Sediment	

Identification of Project Site Pollutants*			
*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated) Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see BMP Design Manual (Part 1 of Storm Water Standards) Appendix B.6):			
Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment		X	X
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris		X	
Oxygen Demanding Substances		X	X
Oil & Grease		X	
Bacteria & Viruses		X	X
Pesticides		X	

**TMDLs are based on the final City of San Diego jurisdictional sediment goals for Los Penasquitos WMA, Table H-3, of the revised Final Penasquitos Watershed Management Area (WMA) Water Quality Improvement Plan, accepted by the San Diego Region Water Quality Board February 12, 2016*

Form I-3B Page 9 of 11
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)? ☒ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above):
Critical Coarse Sediment Yield Areas* *This Section only required if hydromodification management requirements apply
Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint? ☐ Yes ☒ No Discussion / Additional Information: There are no existing Course Sediment Yield Areas (CCYAs) on the project footprint or in the upstream area draining through the project footprint.

Form I-3B Page 10 of 11

Flow Control for Post-Project Runoff*

*This Section only required if hydromodification management requirements apply

List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.

There are two Points Of Compliance (POC) at Pacific Village, POC North and POC South. The POC's are separated into the North and South Basins as described in the Drainage Report (see Attachment 5). The First, POC North, is located where an existing 36" RCP leaves the project boundary on the eastside of the site. The other point of compliance, POC South, is also located on the eastside of the project along its boundary where the other existing 36" RCP leaves the site. Both of these existing drainage systems continue under freeway I-15 and discharge into the Chicarita Creek.

Has a geomorphic assessment been performed for the receiving channel(s)?

☐ No, the low flow threshold is 0.1Q2 (default low flow threshold)
☐ Yes, the result is the low flow threshold is 0.1Q2
☐ Yes, the result is the low flow threshold is 0.3Q2
☒ Yes, the result is the low flow threshold is 0.5Q2

If a geomorphic assessment has been performed, provide title, date, and preparer:

HYDROMODIFICATION SCREENING FOR PACIFIC VILLAGE
SEPTEMBER 19, 2016
Chang Consultants

Discussion / Additional Information: (optional)

Form I-3B Page 11 of 11
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

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Source Control BMP Checklist for All Development Projects			Form I-4
Source Control BMPs			
All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of the Storm Water Standards) for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.			
Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-3 not implemented:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-4 not implemented: The proposed project does not include outdoor work area.			
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			

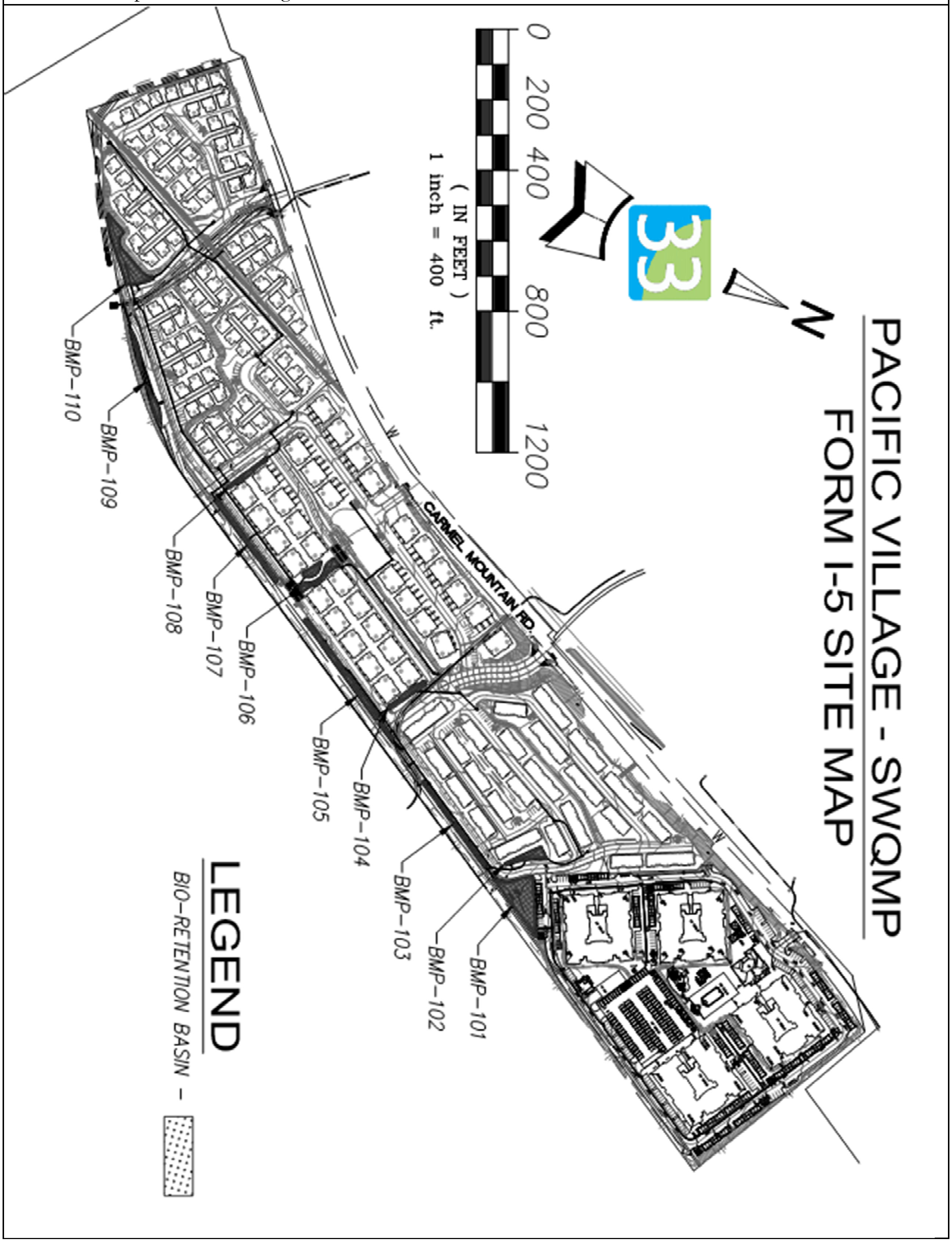
Form I-4 Page 2 of 2			
Source Control Requirement	**Applied?**		
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
On-site storm drain inlets	☒ Yes	☐ No	☐ N/A
Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☐ N/A
Interior parking garages	☒ Yes	☐ No	☐ N/A
Need for future indoor & structural pest control	☒ Yes	☐ No	☐ N/A
Landscape/Outdoor Pesticide Use	☒ Yes	☐ No	☐ N/A
Pools, spas, ponds, decorative fountains, and other water features	☒ Yes	☐ No	☐ N/A
Food service	☐ Yes	☐ No	☒ N/A
Refuse areas	☒ Yes	☐ No	☐ N/A
Industrial processes	☐ Yes	☐ No	☒ N/A
Outdoor storage of equipment or materials	☐ Yes	☐ No	☒ N/A
Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	☒ N/A
Fuel Dispensing Areas	☐ Yes	☐ No	☒ N/A
Loading Docks	☒ Yes	☐ No	☐ N/A
Fire Sprinkler Test Water	☐ Yes	☐ No	☒ N/A
Miscellaneous Drain or Wash Water	☐ Yes	☐ No	☒ N/A
Plazas, sidewalks, and parking lots	☒ Yes	☐ No	☐ N/A
SC-6A: Large Trash Generating Facilities	☐ Yes	☐ No	☒ N/A
SC-6B: Animal Facilities	☒ Yes	☐ No	☐ N/A
SC-6C: Plant Nurseries and Garden Centers	☐ Yes	☐ No	☒ N/A
SC-6D: Automotive-related Uses	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Source Control BMP Checklist for All Development Projects	Form I-5		
Site Design BMPs			
All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of Storm Water Standards) for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided. A site map with implemented site design BMPs must be included at the end of this checklist.			
Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-1 not implemented:			
1-1 Are existing natural drainage pathways and hydrologic features mapped on the site map?	☒ Yes	☐ No	
1-2 Are trees implemented? If yes, are they shown on the site map?	☒ Yes	☐ No	
1-3 Implemented trees meet the design criteria in SD-1 Fact Sheet (e.g. soil volume, maximum credit, etc.)?	☐ Yes	☒ No	
1-4 Is tree credit volume calculated using Appendix B.2.2.1 and SD-1 Fact Sheet in Appendix E?	☐ Yes	☒ No	
SD-2 Have natural areas, soils and vegetation been conserved?	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-2 not implemented: Effort has been made to preserve existing trees located along the projects boundary along Carmel Mountain Road, other than that area this project is a redevelopment project upon which no natural areas exist to conserve.			
Form I-5 Page 1 of 4			

Site Design Requirement	Applied?		
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented:			
SD-4 Minimize Soil Compaction	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-4 not implemented: The proposed project site has been previously developed.			
SD-5 Impervious Area Dispersion	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-5 not implemented: Grading limitations prevent the implementation of such areas			
5-1 Is the pervious area receiving runon from impervious area identified on the site map?	☐ Yes	☒ No	
5-2 Does the pervious area satisfy the design criteria in SD-5 Fact Sheet in Appendix E (e.g. maximum slope, minimum length, etc.)	☐ Yes	☒ No	
5-3 Is impervious area dispersion credit volume calculated using Appendix B.2.1.1 and SD-5 Fact Sheet in Appendix E?	☐ Yes	☒ No	

Form I-5 Page 3 of 4			
Site Design Requirement	Applied?		
SD-6 Runoff Collection	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented: Landscape areas, catch basins, and biofiltration basins have been interspersed throughout the project site to reduce the transportation of pollutants to receiving waters.			
6a-1 Are green roofs implemented in accordance with design criteria in SD-6A Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☒ No	
6a-2 Is green roof credit volume calculated using Appendix B.2.1.2 and SD-6A Fact Sheet in Appendix E?	☐ Yes	☒ No	
6b-1 Are permeable pavements implemented in accordance with design criteria in SD-6B Fact Sheet? If yes, are they shown on the site	☐ Yes	☒ No	
6b-2 Is permeable pavement credit volume calculated using Appendix B.2.1.3 and SD-6B Fact Sheet in Appendix E?	☐ Yes	☒ No	
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Discussion / justification I f SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-8 not implemented:			
8-1 Are rain barrels implemented in accordance with design criteria in SD-8 Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☒ No	
8-2 Is rain barrel credit volume calculated using Appendix B.2.2.2 and SD-8 Fact Sheet in Appendix E?	☐ Yes	☒ No	

Insert Site Map with all site design BMPs identified:



Summary of PDP Structural BMPs	Form I-6

PDP Structural BMPs

All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual, Part 1 of Storm Water Standards). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s).

PDP structural BMPs must be verified by the City at the completion of construction. This includes requiring the project owner or project owner's representative to certify construction of the structural BMPs (complete Form DS-563). PDP structural BMPs must be maintained into perpetuity (see Chapter 7 of the BMP Design Manual).

Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

Step 1: Sites were located for water pollutant control BMPs and DMA's were delineated and DCV's calculated. Based on land use, Runoff Factors were calculated and the percent of each land use contributing to the DCV was determined. Self-mitigating DMA's have been identified and are shown on the DMA Map.

Step 2: Per the included Harvest and Use feasibility screening the proposed project is considered to be infeasible for harvest and use.

Step 3: Per the included Form I-8 "Categorization of Infiltration Feasibility Condition", the site is not recommended for "full infiltration" of site storm water, however "partial infiltration" is feasible. At this stage of design, a minimum infiltration rate of 0.01 in/hr has been implemented to model the water quality device using BMP fact sheet PR-1 "Bio-filtration with Partial Retention". Final design infiltration rates may change if field infiltration testing is performed and the rates differ from 0.01 in/hr.

Step 4: Taking into account the site design and constraints 10 bio-filtration basins have been placed strategically throughout the project site. The DRAFT version of section B.5, "Biofiltration BMPs", of the City of San Diego BMP Design Manual, June 2016 Edition was used in the analysis of the bio-filtration BMP sizing. "Calculation of Alternative Minimum Footprint Sizing Factor", Worksheet B.5-3 was implemented and the, "Sizing Method for Pollutant Removal Criteria", Worksheet B.5-1 was used to determine the bio-filtration footprint required. It is important to note that the minimum footprint for every bio-filtration basin was governed by the minimum footprint sizing factor. This result indicates that each bio-filtration basin satisfies both options 1 & 2 as outlined in Section B.5 as sizing methods.

(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)

(Continued from page 1)

Step 5: After using Worksheet B.5-1 to find the required bio-filtration footprint for water quality, an actual bio-filtration footprint of greater value was provided in the design sheets (See the DMA exhibits and/or the DMA & Biofiltration Summary Table in Attachment 1 for the required areas calculated versus the area provided). Using this provide footprint area, volume retention was verified with the implementation of Worksheet B.5-2, "Sizing Method for Volume Retention Criteria". This procedure and technical background for this method can be found in the DRAFT version of section B.5 of Appendix B of the City of San Diego BMP Design Manual, June 2016 Edition.

Step 6: Volumes for the flow control structural BMPs are based on the sizing factor method identified in Chapter 6.3.5.1 of the City of San Diego's Storm Water Standards BMP Design Manual, dated January 2016. In order to size these storage facilities, the BMP Sizing Spreadsheet that was developed by the County of San Diego was implemented. Based on the HYDROMODIFICATION SCREENING FOR PACIFIC VILLAGE, dated SEPTEMBER 19, 2016 by Chang Consultants a low flow threshold of 0.5Q2 was used. This spread sheet was also used to determine the orifice size for the detention facility.

Step 7: Based on the site constraints and water quality footprint and taking into account a 6-inch preferred freeboard from the basin outside rim the ponding surface area of each basin was determined. Next the bottom surface area of each basin was identified and considering that each basin has a 1-foot depth (except for basin 101 which has a 1.5-foot depth) the ponding storage volume for each basin was calculated.

Step 8: A perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with an impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for each DMA (except for self-mitigating areas where a 48-inch perforated CMP is used with the same configuration). For each DMA the ponding storage volume from Step 6 was then subtracted from the total required storage volume identified in step 5. This remaining volume was used to determine the length of gravel backfill and 96-inch pipe section. A summary table labeled, "Storage Pipe Sizing Calculations", has been provided in Attachment 2.

Form I-6 Page 3 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 101	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 4 of 50
Structural BMP ID No. 101
Construction Plan Sheet No. TBD
Discussion (as needed):

Form I-6 Page 5 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 102	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 6 of 50
Structural BMP ID No. 102
Construction Plan Sheet No. TBD
Discussion (as needed):

Form I-6 Page 7 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 103	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 8 of 50
Structural BMP ID No. 103
Construction Plan Sheet No. TBD
Discussion (as needed):

Form I-6 Page 9 of 50

Structural BMP Summary Information	
Structural BMP ID No. 104	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 10 of 50
Structural BMP ID No. 104
Construction Plan Sheet No. TBD
Discussion (as needed):

Form I-6 Page 11 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 105	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 12 of 50
Structural BMP ID No. 105
Construction Plan Sheet No. TBD
Discussion (as needed):

Form I-6 Page 13 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 106	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 14 of 50
Structural BMP ID No. 106
Construction Plan Sheet No. TBD
Discussion (as needed):

Form I-6 Page 15 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 107	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 16 of 50
Structural BMP ID No. 107
Construction Plan Sheet No. TBD
Discussion (as needed):

Structural BMP Summary Information	
Structural BMP ID No. 108	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 18 of 50
Structural BMP ID No. 108
Construction Plan Sheet No. TBD
Discussion (as needed):

Structural BMP Summary Information	
Structural BMP ID No. 109	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

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Form I-6 Page 20 of 50
Structural BMP ID No. 109
Construction Plan Sheet No. TBD
Discussion (as needed):

Structural BMP Summary Information	
Structural BMP ID No. 110	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☒ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 22 of 50
Structural BMP ID No. 110
Construction Plan Sheet No. TBD
Discussion (as needed):

Structural BMP Summary Information	
Structural BMP ID No. 101 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 24 of 50
Structural BMP ID No. 101 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 424 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 101. A 4.28-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 102 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 26 of 50
Structural BMP ID No. 102 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 90 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 102. A 1.91-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 103 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 28 of 50
Structural BMP ID No. 103 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 85 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 103. A 1.80-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 104 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 30 of 50
Structural BMP ID No. 104 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 84 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 104. A 1.70-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Form I-6 Page 31 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 105 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 32 of 50
Structural BMP ID No. 105 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 51 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 105. A 1.76-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 106 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 34 of 50
Structural BMP ID No. 106 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 148 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 10106. A 2.60-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Form I-6 Page 35 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 107 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

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Form I-6 Page 36 of 50
Structural BMP ID No. 107 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 129 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 107. A 2.20-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Form I-6 Page 37 of 50	
Structural BMP Summary Information	
Structural BMP ID No. 108 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 38 of 50
Structural BMP ID No. 108 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 59 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 108. A 1.66-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 109 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 40 of 50
Structural BMP ID No. 109 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 76 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 109. A 1.81-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 110 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 42 of 50
Structural BMP ID No. 110 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 290 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner (see cross section detail on Sheet 3 of plans) has been implemented as the detention facility for DMA 110. A 3.49-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 111 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 44 of 50
Structural BMP ID No. 111 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 19 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner has been implemented as the detention facility for DMA 111. A 1.47-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 112 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 46 of 50
Structural BMP ID No. 112 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 20 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner has been implemented as the detention facility for DMA 112. A 1.48-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 113 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 48 of 50
Structural BMP ID No. 113 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 4 feet of perforated 96-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner has been implemented as the detention facility for DMA 113. A 0.68-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

Structural BMP Summary Information	
Structural BMP ID No. 114 HMP	
Construction Plan Sheet No. TBD	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (Provide BMP type / Description in discussion section below ☐ Flow-thru treatment control included as pre-treatment / forebay for an onsite retention or biofiltration BMP (provide BMP type / description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type / description in discussion section below ☐ Detention pond of vault for hydromodification management ☒ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☒ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Giovanni Posillico Latitude 33 Planning & Engineering 9968 Hibert Street 2nd Floor, San Diego, CA 92131 gio.posillico@latitude33.com
Who will be the final owner of this BMP?	California Properties Village
Who will maintain this BMP into perpetuity?	California Properties Village
What is the funding mechanism for maintenance?	California Properties Village

Form I-6 Page 50 of 50
Structural BMP ID No. 114 HMP
Construction Plan Sheet No. TBD
Discussion (as needed): 2 feet of perforated 48-inch CMP surrounded by a foot and a half of Class II permeable gravel on all sides with impermeable liner has been implemented as the detention facility for DMA 114. A 0.43-inch orifice will regulate the discharge of the flow down to 50% of the 2-year storm.

City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Permanent BMP Construction** **Self Certification Form**	FORM DS-563 January 2016

THE CITY OF SAN DIEGO

Date Prepared:	Project No.:
Project Applicant:	Phone:
Project Address:	
Project Engineer:	Phone:

The purpose of this form is to verify that the site improvements for the project, identified above, have been constructed in conformance with the approved Storm Water Quality Management Plan (SWQMP) documents and drawings.

This form must be completed by the engineer and submitted prior to final inspection of the construction permit. Completion and submittal of this form is required for all new development and redevelopment projects in order to comply with the City's Storm Water ordinances and NDPES Permit Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100. Final inspection for occupancy and/or release of grading or public improvement bonds may be delayed if this form is not submitted and approved by the City of San Diego.

CERTIFICATION:
As the professional in responsible charge for the design of the above project, I certify that I have inspected all constructed Low Impact Development (LID) site design, source control and structural BMP's required per the approved SWQMP and Construction Permit No.________________________; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 of the San Diego Regional Water Quality Control Board.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

Signature: ______________________________

Date of Signature: ______________________________

Printed Name: ______________________________

Title: ______________________________

Phone No. ______________________________

Engineer's Stamp

DS-563 (01-16)

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ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

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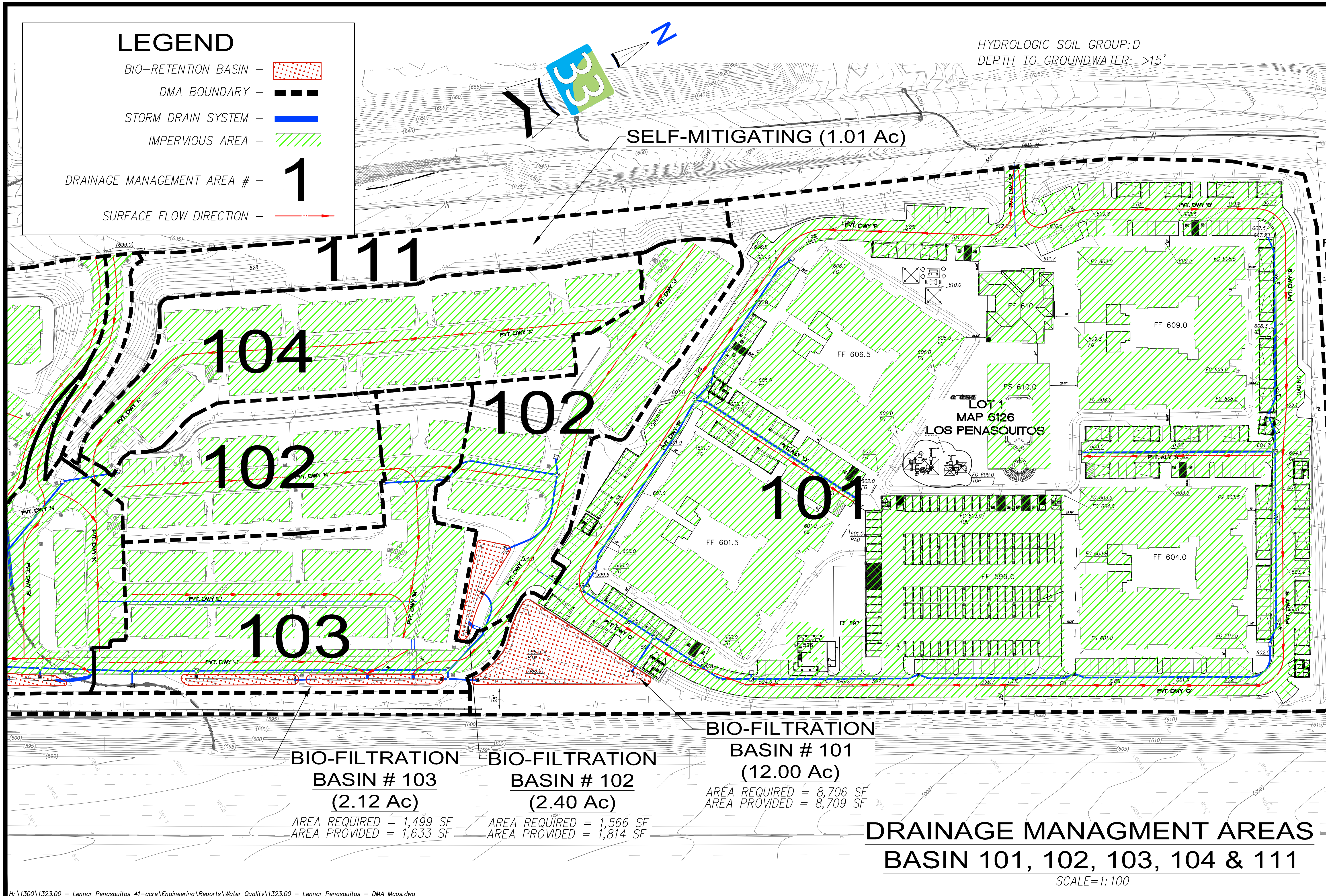
Indicate which Items are Included:

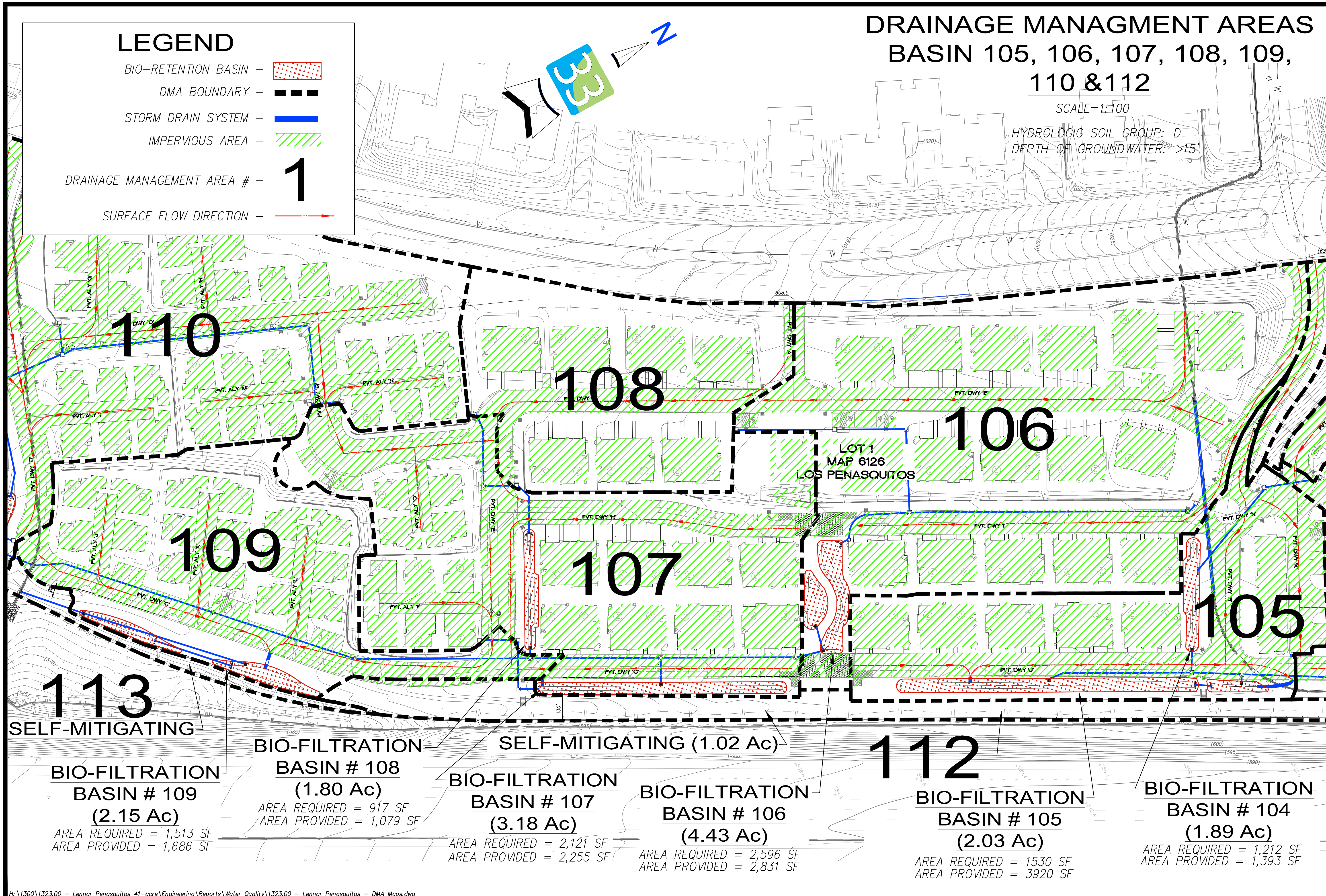
Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist.	☒ Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☐ Included on DMA Exhibit in Attachment 1a ☒ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☒ Included ☐ Not included because the entire project will use infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	☒ Included ☐ Not included because the entire project will use harvest and use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines and site design credit calculations	☒ Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

- ☒ Underlying hydrologic soil group
- ☒ Approximate depth to groundwater
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands) N/A
- ☐ Critical coarse sediment yield areas to be protected N/A
- ☒ Existing topography and impervious areas
- ☒ Existing and proposed site drainage network and connections to drainage offsite
- ☒ Proposed grading
- ☒ Proposed impervious features
- ☐ Proposed design features and surface treatments used to minimize imperviousness N/A
- ☒ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
- ☐ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B) N/A
- ☒ Structural BMPs (identify location, type of BMP, and size/detail)


LEGEND
BIO-RETENTION BASIN –
DMA BOUNDARY –
STORM DRAIN SYSTEM –
IMPERVIOUS AREA –
DRAINAGE MANAGEMENT AREA # – 1
SURFACE FLOW DIRECTION –
HYDROLOGIC SOIL GROUP: D
DEPTH TO GROUNDWATER: >15'
SELF-MITIGATING (1.01 Ac)
111
104
102
102
103
101
LOT 1
MAP 6126
LOS PENASQUITOS
FF 606.5
FF 610
FF 609.0
FS 610.0
FF 601.5
FF 599.0
FF 604.0
FF 597
BIO-FILTRATION
BASIN # 103
(2.12 Ac)
AREA REQUIRED = 1,499 SF
AREA PROVIDED = 1,633 SF
BIO-FILTRATION
BASIN # 102
(2.40 Ac)
AREA REQUIRED = 1,566 SF
AREA PROVIDED = 1,814 SF
BIO-FILTRATION
BASIN # 101
(12.00 Ac)
AREA REQUIRED = 8,706 SF
AREA PROVIDED = 8,709 SF
DRAINAGE MANAGMENT AREAS
BASIN 101, 102, 103, 104 & 111
SCALE=1:100
H:\1300\1323.00 – Lennar Penasquitos 41-acre\Engineering\Reports\Water Quality\1323.00 – Lennar Penasquitos – DMA Maps.dwg


DRAINAGE MANAGMENT AREAS
BASIN 105, 106, 107, 108, 109,
110 &112
SCALE=1:100
HYDROLOGIC SOIL GROUP: D
DEPTH OF GROUNDWATER: >15'
LEGEND
BIO-RETENTION BASIN –
DMA BOUNDARY –
STORM DRAIN SYSTEM –
IMPERVIOUS AREA –
DRAINAGE MANAGEMENT AREA # – 1
SURFACE FLOW DIRECTION –
110
108
106
109
107
105
113
112
LOT 1
MAP 6126
LOS PENASQUITOS
SELF-MITIGATING
BIO-FILTRATION
BASIN # 109
(2.15 Ac)
AREA REQUIRED = 1,513 SF
AREA PROVIDED = 1,686 SF
BIO-FILTRATION
BASIN # 108
(1.80 Ac)
AREA REQUIRED = 917 SF
AREA PROVIDED = 1,079 SF
SELF-MITIGATING (1.02 Ac)
BIO-FILTRATION
BASIN # 107
(3.18 Ac)
AREA REQUIRED = 2,121 SF
AREA PROVIDED = 2,255 SF
BIO-FILTRATION
BASIN # 106
(4.43 Ac)
AREA REQUIRED = 2,596 SF
AREA PROVIDED = 2,831 SF
BIO-FILTRATION
BASIN # 105
(2.03 Ac)
AREA REQUIRED = 1530 SF
AREA PROVIDED = 3920 SF
BIO-FILTRATION
BASIN # 104
(1.89 Ac)
AREA REQUIRED = 1,212 SF
AREA PROVIDED = 1,393 SF
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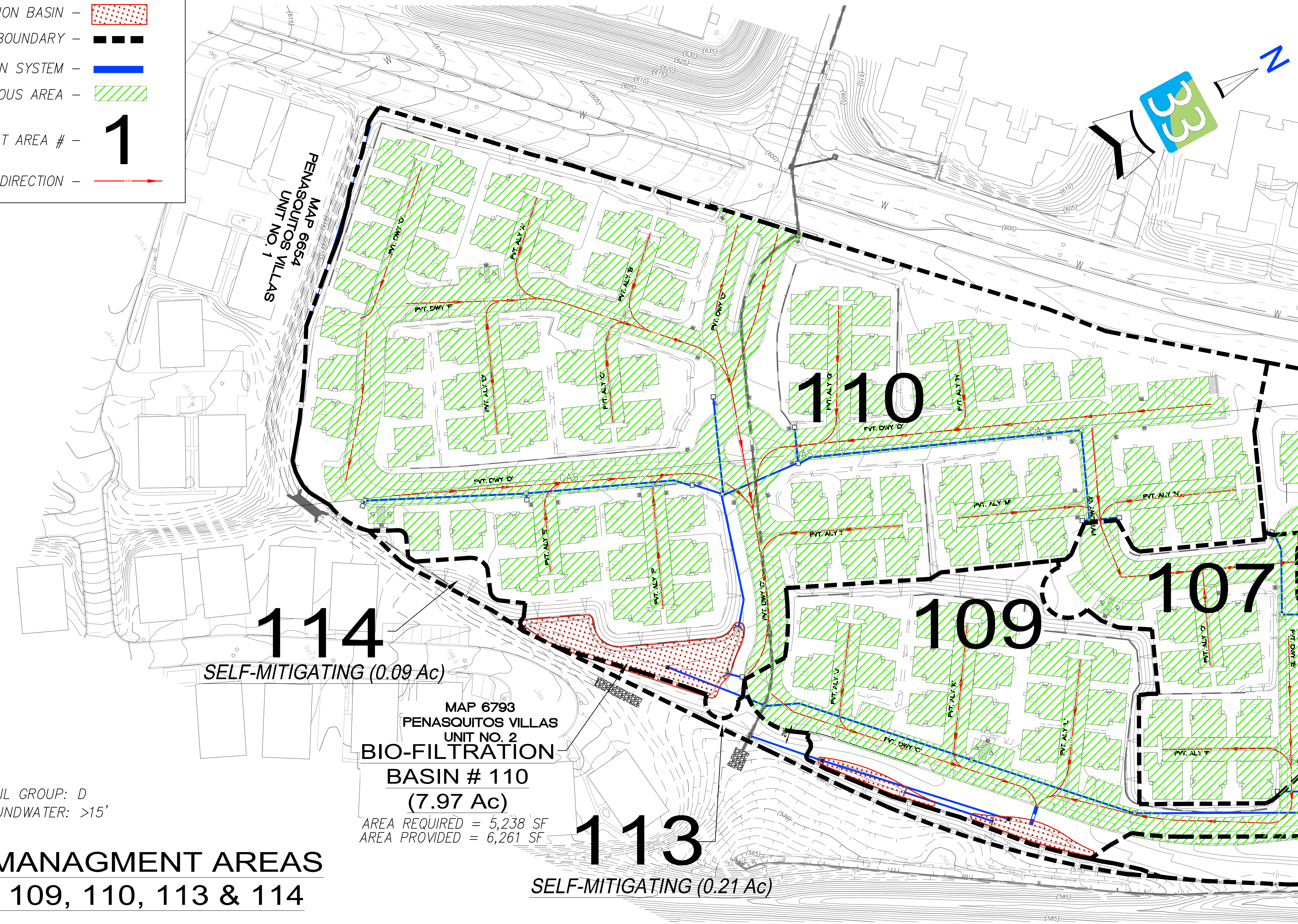
LEGEND

- BIO-RETENTION BASIN –
- DMA BOUNDARY –
- STORM DRAIN SYSTEM –
- IMPERVIOUS AREA –
- DRAINAGE MANAGEMENT AREA # – 1
- SURFACE FLOW DIRECTION –



HYDROLOGIC SOIL GROUP: D
DEPTH OF GROUNDWATER: >15'

DRAINAGE MANAGMENT AREAS
BASIN 107, 109, 110, 113 & 114

SCALE=1:100

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Pacific Village

DMA & Biofiltration Summary Table

Constants

85th Percentile Depth	0.63	inches
Roof Runoff Coefficient	0.9	
Landscape Runoff Coefficient	0.1	
Road Runoff Coefficient	0.9	

DMA & BMP ID	101		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Drains to BMP	Roofs	138030.32		
Structural BMP	Biofiltration Basin	Landscape	151378.55		
Weighted Runoff	0.67	Road	233339.60		
Min Sizing Factor	0.0249	Total Area	522748.47	8706	8709

DMA & BMP ID	102		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Drains to BMP	Roofs	30294.57		
Structural BMP	Biofiltration Basin	Landscape	34202.02		
Weighted Runoff	0.64	Road	40079.20		
Min Sizing Factor	0.0235	Total Area	104575.79	1566	1814

DMA & BMP ID	103		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Drains to BMP	Roofs	26353.88		
Structural BMP	Biofiltration Basin	Landscape	26314.85		
Weighted Runoff	0.67	Road	39848.67		
Min Sizing Factor	0.0241	Total Area	92517.40	1499	1633

DMA & BMP ID	104		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Drains to BMP	Roofs	33017.08		
Structural BMP	Biofiltration Basin	Landscape	17651.73		
Weighted Runoff	0.73	Road	31602.71		
Min Sizing Factor	0.0202	Total Area	82271.52	1212	1393

DMA & BMP ID	105		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Drains to BMP	Roofs	21671.73		
Structural BMP	Biofiltration Basin	Landscape	25202.96		
Weighted Runoff	0.67	Road	41565.09		
Min Sizing Factor	0.0257	Total Area	88439.78	1530	3920

Pacific Village

DMA & Biofiltration Summary Table

DMA & BMP ID	106		Area	Min Area Required	Area Provided
Soil Type	D		(SF)	(SF)	(SF)
DMA Type	Drains to BMP	Roofs	54653.87		
Structural BMP	Biofiltration Basin	Landscape	76088.46		
Weighted Runoff	0.58	Road	62308.30		
Min Sizing Factor	0.0230	Total Area	193050.63	2596	2831

DMA & BMP ID	107		Area	Min Area Required	Area Provided
Soil Type	D		(SF)	(SF)	(SF)
DMA Type	Drains to BMP	Roofs	43496.71		
Structural BMP	Biofiltration Basin	Landscape	39547.66		
Weighted Runoff	0.67	Road	55268.19		
Min Sizing Factor	0.0228	Total Area	138312.56	2121	2255

DMA & BMP ID	108		Area	Min Area Required	Area Provided
Soil Type	D		(SF)	(SF)	(SF)
DMA Type	Drains to BMP	Roofs	23741.96		
Structural BMP	Biofiltration Basin	Landscape	34561.3		
Weighted Runoff	0.55	Road	20070.98		
Min Sizing Factor	0.0214	Total Area	78374.24	917	1079

DMA & BMP ID	109		Area	Min Area Required	Area Provided
Soil Type	D		(SF)	(SF)	(SF)
DMA Type	Drains to BMP	Roofs	21199.59		
Structural BMP	Biofiltration Basin	Landscape	32701.75		
Weighted Runoff	0.62	Road	39651.97		
Min Sizing Factor	0.0261	Total Area	93553.31	1513	1686

DMA & BMP ID	110		Area	Min Area Required	Area Provided
Soil Type	D		(SF)	(SF)	(SF)
DMA Type	Drains to BMP	Roofs	96358.23		
Structural BMP	Biofiltration Basin	Landscape	116673.98		
Weighted Runoff	0.63	Road	134148.26		
Min Sizing Factor	0.0239	Total Area	347180.47	5238	6261

DMA ID	111		Area	Min Area Required	Area Provided
Soil Type	D		(SF)	(SF)	(SF)
DMA Type	Self-Mitigating	Roofs	0.00		
Structural BMP	NA	Landscape	43842.46		
Weighted Runoff	0.10	Road	0.00		
Min Sizing Factor	NA	Total Area	43842.46	NA	NA

Pacific Village

DMA & Biofiltration Summary Table

DMA ID	112		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Self-Mitigating	Roofs	0.00		
Structural BMP	NA	Landscape	44443.72		
Weighted Runoff	0.10	Road	0.00		
Min Sizing Factor	NA	Total Area	44443.72	NA	NA

DMA ID	113		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Self-Mitigating	Roofs	0.00		
Structural BMP	NA	Landscape	9246.05		
Weighted Runoff	0.10	Road	0.00		
Min Sizing Factor	NA	Total Area	9246.05	NA	NA

DMA ID	114		Area (SF)	Min Area Required (SF)	Area Provided (SF)
Soil Type	D				
DMA Type	Self-Mitigating	Roofs	0.00		
Structural BMP	NA	Landscape	3730.22		
Weighted Runoff	0.10	Road	0.00		
Min Sizing Factor	NA	Total Area	3730.22	NA	NA

<table>
<tr><th colspan="2">Harvest and Use Feasibility Screening</th><th>Form I-7</th></tr>
<tr><td colspan="3">1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?
☒ Toilet and urinal flushing
☐ Landscape Irrigation
☐ Other: ______________</td></tr>
<tr><td colspan="3">2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.
Per Table B.3-1, Residential flushes per day amounts to 18.5/3.45 = 5.36 flushes/day. This is a new development which will employ the use of low-flow toilets. So, (5.36 flushes/day)x(1.6 gallons/flush)x(0.5 WEF) = (4.3 gallons/resident-day)*(2063 residents) = (8870.9 gallons/day)
(8870.9 gallons/day)*1.5 = 13,306 gallon 36 hour demand

(13,306 gallons) * (1 cubic foot/7.48 gallons) => 36 Hour Demand = 1,779 Cubic Feet</td></tr>
<tr><td colspan="3">3. Calculate the DCV using worksheet B-2.1.
DCV=52,037 cubic feet > 1,779 cubic feet
0.25 DCV= 13,009 cubic feet > 1,779 cubic feet</td></tr>
<tr><td>3a. Is the 36-hour demand greater than or equal to the DCV?
Yes / No</td><td>3b. Is the 36-hour demand greater than 0.25 DCV but less than the full DCV?
Yes / No</td><td>3c. Is the 36-hour demand less than 0.25DCV?
Yes</td></tr>
<tr><td>Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.</td><td>Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.</td><td>Harvest and use is considered to be infeasible.</td></tr>
<tr><td colspan="3">Is harvest and use feasible based on further evaluation?
☐ Yes, refer to appendix E to select and size harvest and use BMPs
☒ No, select alternate BMPs</td></tr>
</table>

Pacific Village
DMA - 116

DESIGN CAPTURE VOLUME

Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	478178.57	10.98	0.90	9.879723	43.4%
landscape	792274.677	18.18812	0.10	1.819	8.0%
road	535108.753	12.28441	0.90	11.05597	48.6%
TOTAL	**1805562**	**41.45**	**0.548963**	**22.7545**	**100%**

B.1.1 Runoff Factor

Estimate the area weighted runoff factor for the tributary area to the BMP using runoff factor (from Table B.1-1) and area of each surface type in the tributary area and the following equation:

$$C = \frac{\sum C_x A_x}{\sum A_x}$$

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Worksheet B.2-1. DCV

	Design Capture Volume	Worksheet B-2.1		
1	85[th] percentile 24-hr storm depth from Figure B.1-1	d=		inches
2	Area tributary to BMP (s)	A=		acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=		unitless
4	Street trees volume reduction	TCV=		cubic-feet
5	Rain barrels volume reduction	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=		cubic-feet

	Design Capture Volume	Worksheet B-2.1		
1	85TH PERCENTILE 24-HR STORM	D=	0.63	inches
2	AREA TRIBUTARY TO BMP (s)	A=	41.45	acres
3	AREA WEIGHTED RUNOFF FACTOR (ESTIMATE USING APPENDIX B.1.1 AND B.2.1)	C=	0.55	unitless
4	STREET TREES VOLUME REDUCTION	TCV=	-	cubic-feet
5	RAIN BARRELS VOLUME REDUCTION	RCV=	-	cubic-feet
6	CALCULATE DCV=(3630 X C X D X A) - TCV - RCV	**DCV=**	**52,037.27**	**cubic-feet**

Note: Criteria 1, 2, 5 & 6 where answered by LGC Geotechnical while Criteria 3, 4, 7 & 8 where completed by Latitude 33 Planning and Engineering. See Attachment 6 for Geotechnical report and Comment Reponses concerning this form.

<table>
<tr><th colspan="2">Categorization of Infiltration Feasibility Condition</th><th colspan="2">Form I-8</th></tr>
<tr><td colspan="4">Part 1 - Full Infiltration Feasibility Screening Criteria
Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>1</td><td>Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td>☐</td><td>☒</td></tr>
<tr><td colspan="4">Provide basis:

No. Based on Figure C.5-C.5.-1 Soils Exhibit our site soils are categorized as Hydrologic Soils Group C. Per Table G.1-5, Hydrologic Soil Group C has infiltration range from 0 to 0.08 inches per hour. Based on this categorization the associated infiltration rates are below 0.5 inches per hour.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Yes. Based on current information, it is our opinion that infiltration will not increase the risk of geotechnical hazards.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
</table>

Note: Criteria 1, 2, 5 & 6 where answered by LGC Geotechnical while Criteria 3, 4, 7 & 8 where completed by Latitude 33 Planning and Engineering. See Attachment 6 for Geotechnical report and Comment Reponses concerning this form.

<table>
<tr><th colspan="4">Form I-8 Page 2 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>☐</td><td>☒</td></tr>
<tr><td colspan="4">Provide basis:

Site specific infiltration testing will be performed during Final Engineering, at this stage a minimum infiltration rate of 0.01 in/hr has been implemented. Further investigation will reveal if there exists a shallow water table although this characteristic is not anticipated based on the study that has been performed thus far.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>☐</td><td>☒</td></tr>
<tr><td colspan="4">Provide basis:

Site specific infiltration testing will be performed during Final Engineering, at this stage a minimum infiltration rate of 0.01 in/hr has been implemented. There are no existing ephemeral streams that the project is directly discharging into. All water will be treated before being discharge off the project site. Also there are no known contaminate plumes of ground water that would bring concern for discharging to surface waters</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all answers to rows 1 - 4 are “Yes” a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is “No”, infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a “full infiltration” design. Proceed to Part 2</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City Engineer to substantiate findings

Note: Criteria 1, 2, 5 & 6 where answered by LGC Geotechnical while Criteria 3, 4, 7 & 8 where completed by Latitude 33 Planning and Engineering. See Attachment 6 for Geotechnical report and Comment Reponses concerning this form.

<table>
<tr><th colspan="4">Form I-8 Page 3 of 4</th></tr>
<tr><td colspan="4">Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria
Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Yes. As defined by the City of San Diego, an appreciable rate is considered to be 0.01 inches per hour or greater. Additionally, all soils and rock must be assumed to have a minimum infiltration rate of 0.01 inches per hour unless proven otherwise with field infiltration test results. At this time, the site soils and rock are considered to have an “appreciable” infiltration rate.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>6</td><td>Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Yes. Based on current information, it is our opinion that partial infiltration at an appreciable rate will not increase the risk of geotechnical hazards.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
</table>

Note: Criteria 1, 2, 5 & 6 where answered by LGC Geotechnical while Criteria 3, 4, 7 & 8 where completed by Latitude 33 Planning and Engineering. See Attachment 6 for Geotechnical report and Comment Reponses concerning this form.

<table>
<tr><th colspan="4">Form I-8 Page 4 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Site specific infiltration testing will be performed during Final Engineering, at this stage a minimum infiltration rate of 0.01 in/hr has been implemented. Further investigation will reveal if there exists a shallow water table although this characteristic is not anticipated based on the study that has been performed thus far.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Downstream water rights issues are not believed to be a potential issue. The project design is increase the impervious surface of the project location which in turn will increase the runoff but with the implementation of the bio-filtration basins with partial retention the flows leaving the project will be equal to or less than they were in the existing condition. Furthermore, with the infiltration rate being so low the amount of infiltration that will be taken away the surface flows is insignificant.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.
If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City Engineer to substantiate findings

Pacific Village
DMA & BMP 101
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	138030.32	3.16874	0.90	2.851866	35.6%
Landscape	151378.55	3.475173	0.10	0.348	4.3%
Road	233339.60	5.35674	0.90	4.821066	60.1%
TOTAL	**522748.47**	**12.00**	**0.67**	**8.02**	**100%**

Pacific Village
DMA & BMP 101
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			522748.47	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.67	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.601	128	76.94	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.356	14	4.98	
Low Traffic Areas			50	0.00	
Open Space		0.043	216	9.36	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			91.28	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			305699	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			1741	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			8706	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0249**	

Pacific Village
DMA & BMP 101
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	522748	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	18342	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	18	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	30.6	inches
15	Total depth treated [Line 13 + Line 14]	60.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	27512.9	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**5448.1**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	13756.5	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**5394.7**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0249	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**8706**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**8706**	sq-ft

Pacific Village

DMA & BMP 101

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

	Sizing Method for Volume Retention Criteria	Worksheet B.5-2	
1	Area draining to the BMP	522748.47	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	18342	cu. ft.
BMP Parameters			
5	Footprint of the BMP	8709	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	988	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	762.04	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.04	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	3.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	870.9	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.047	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.147	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	14.0	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0983	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-815	cu. ft.

BMP 101: Reference Figures for Worksheet B.5-2

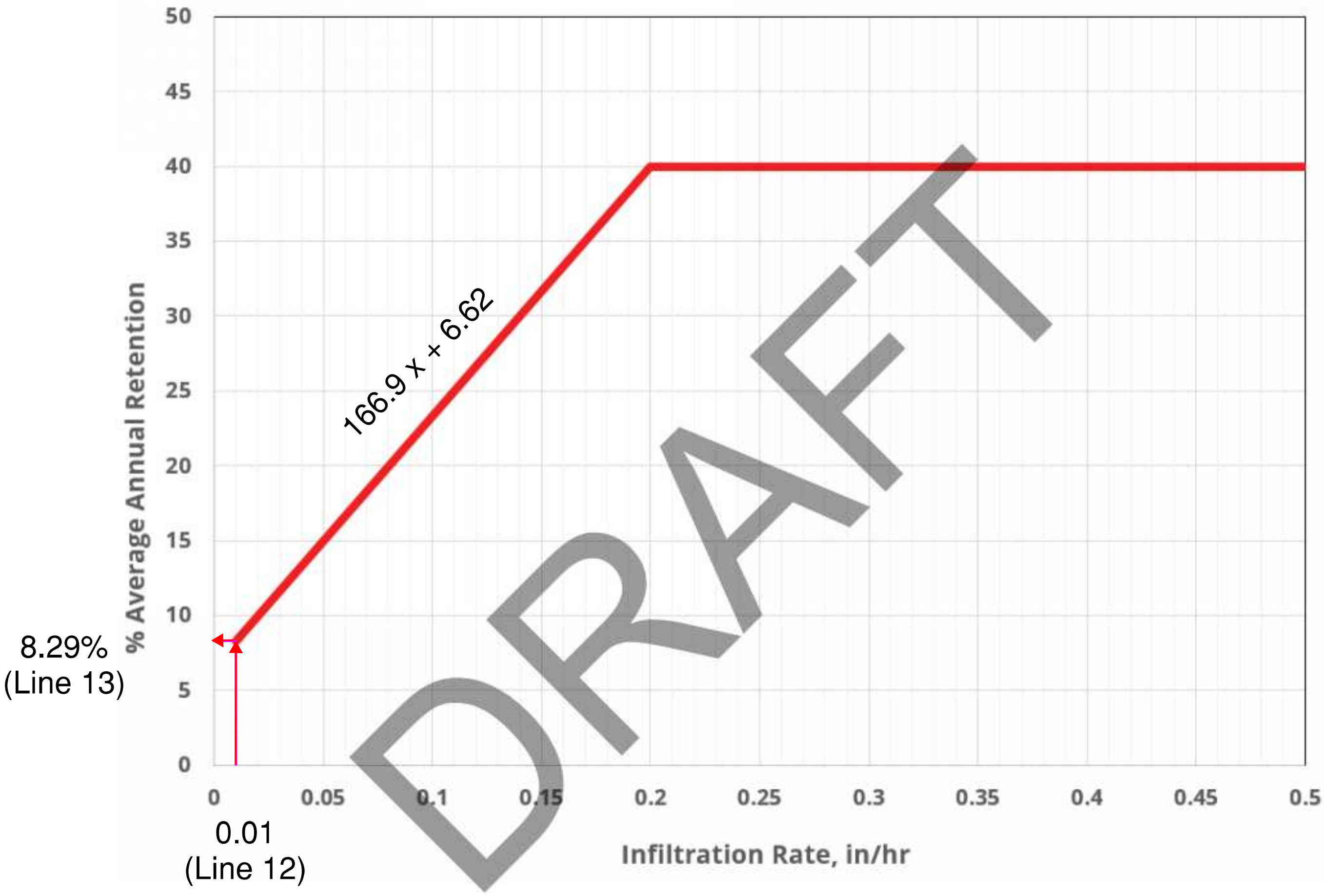


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

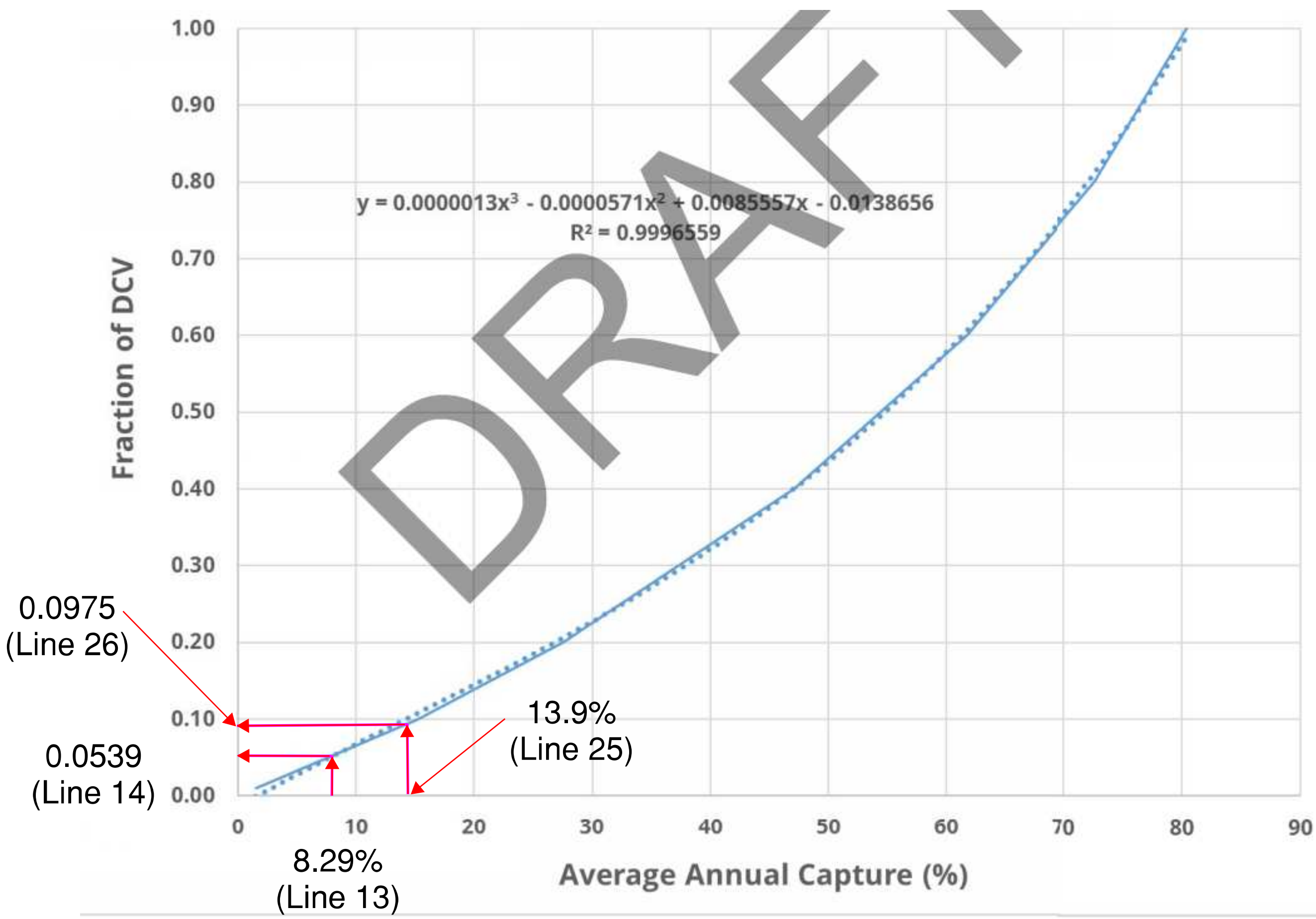


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 101: Reference Figure for Worksheet B.5-2

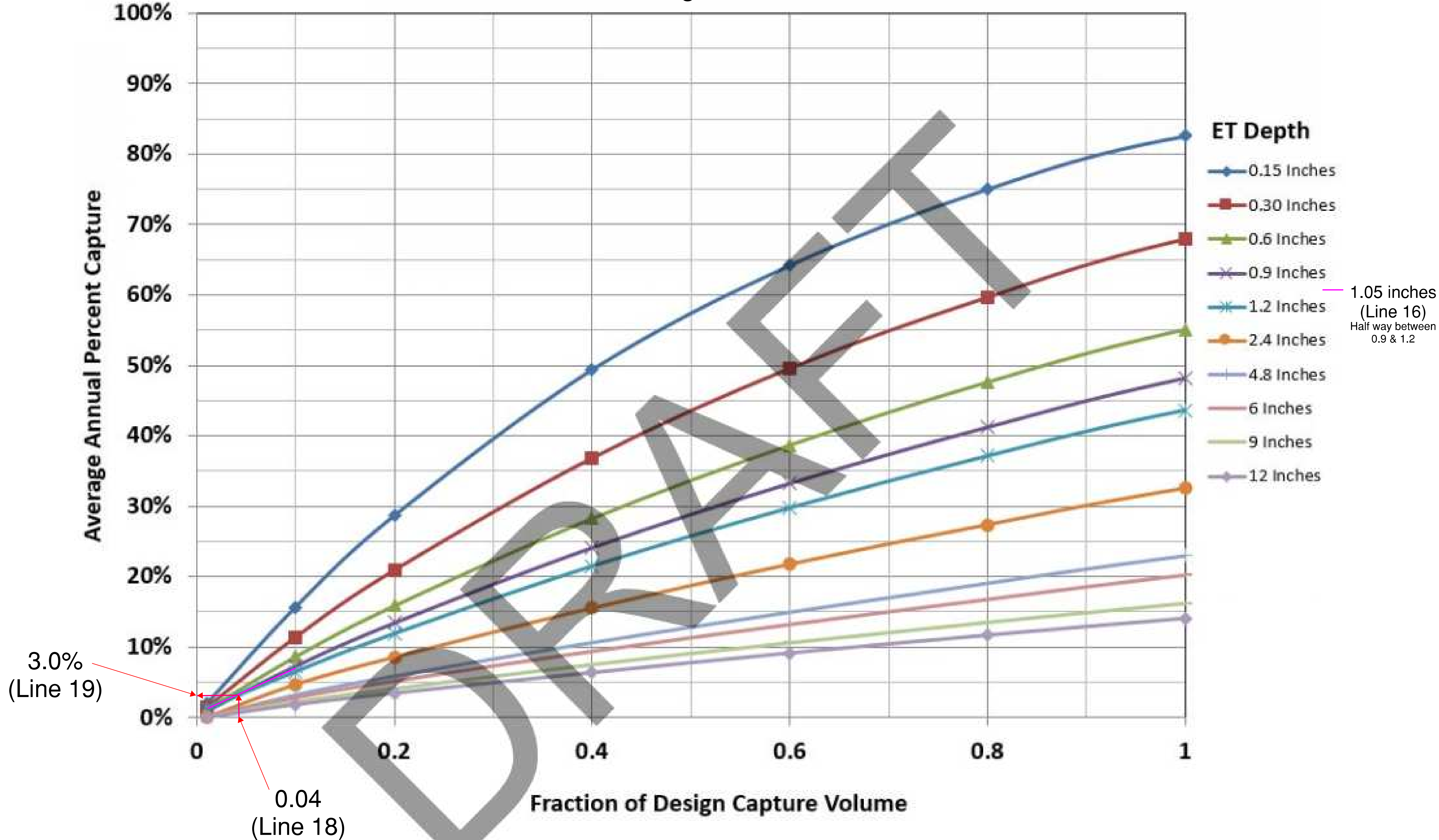
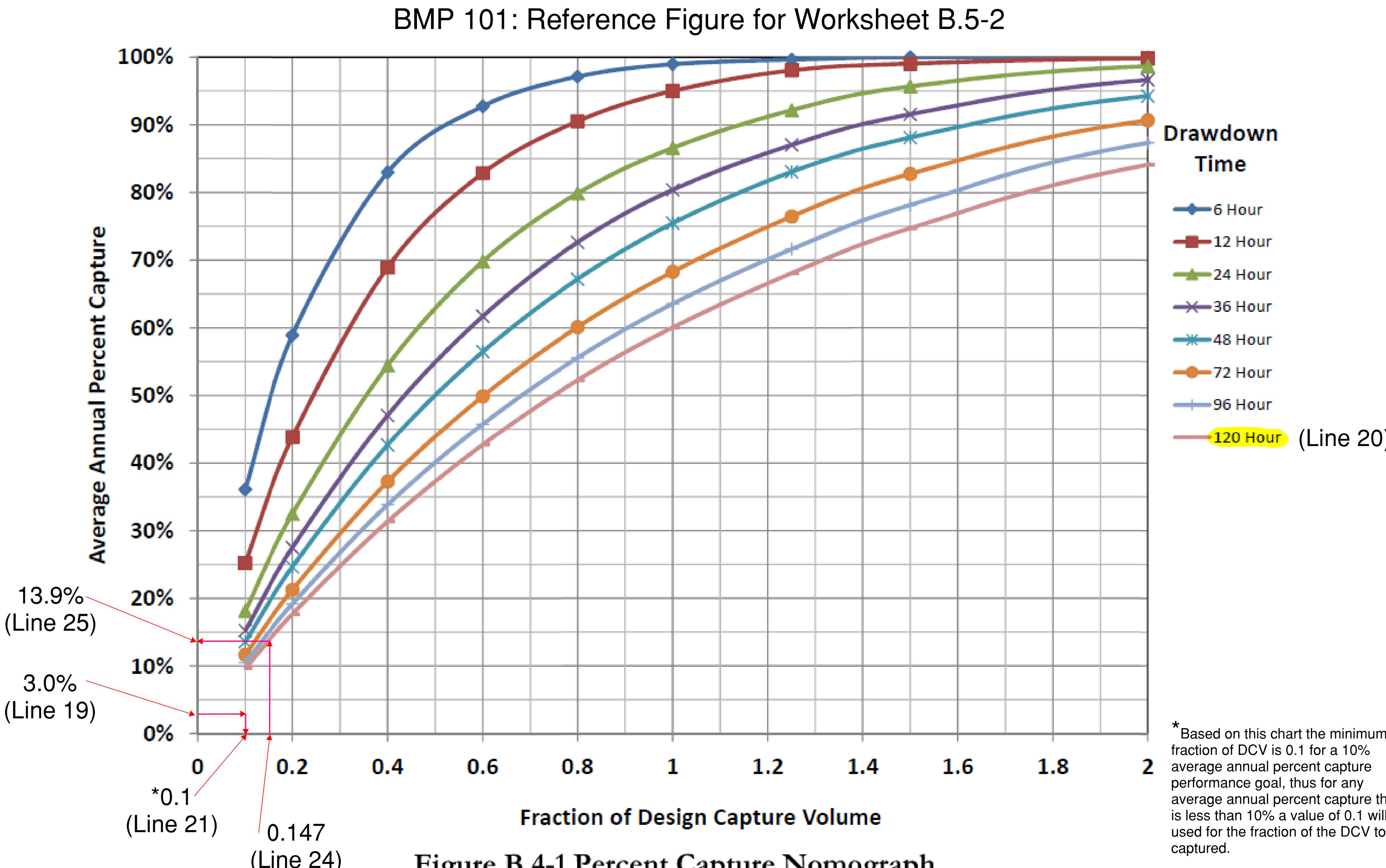


Figure B.5-5. Evapotranspiration Nomographs



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 102
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	30294.57	0.695468	0.90	0.625921	40.8%
Landscape	34202.02	0.78517	0.10	0.079	5.1%
Road	40079.20	0.920092	0.90	0.828083	54.0%
TOTAL	**104575.79**	**2.40**	**0.64**	**1.53**	**100%**

Pacific Village
DMA & BMP 102
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			104575.79	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.64	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.540	128	69.16	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.408	14	5.72	
Low Traffic Areas			50	0.00	
Open Space		0.051	216	11.07	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			85.95	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			58412	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			313	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			1566	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0235**	

Pacific Village
DMA & BMP 102
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	104576	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.64	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3505	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	5257.1	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1155.4**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2628.5	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**1282.2**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0235	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**1566**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**1566**	sq-ft

Pacific Village
DMA & BMP 102
Worksheet B.5-2: Sizing Method for Volume Retention Criteria

Sizing Method for Volume Retention Criteria		Worksheet B.5-2	
1	Area draining to the BMP	104575.79	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.64	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3505	cu. ft.
BMP Parameters			
5	Footprint of the BMP	1814	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	189	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	158.71	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.05	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	4.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	181.387	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.052	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.152	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	14.1	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0991	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-158	cu. ft.

BMP 102: Reference Figures for Worksheet B.5-2

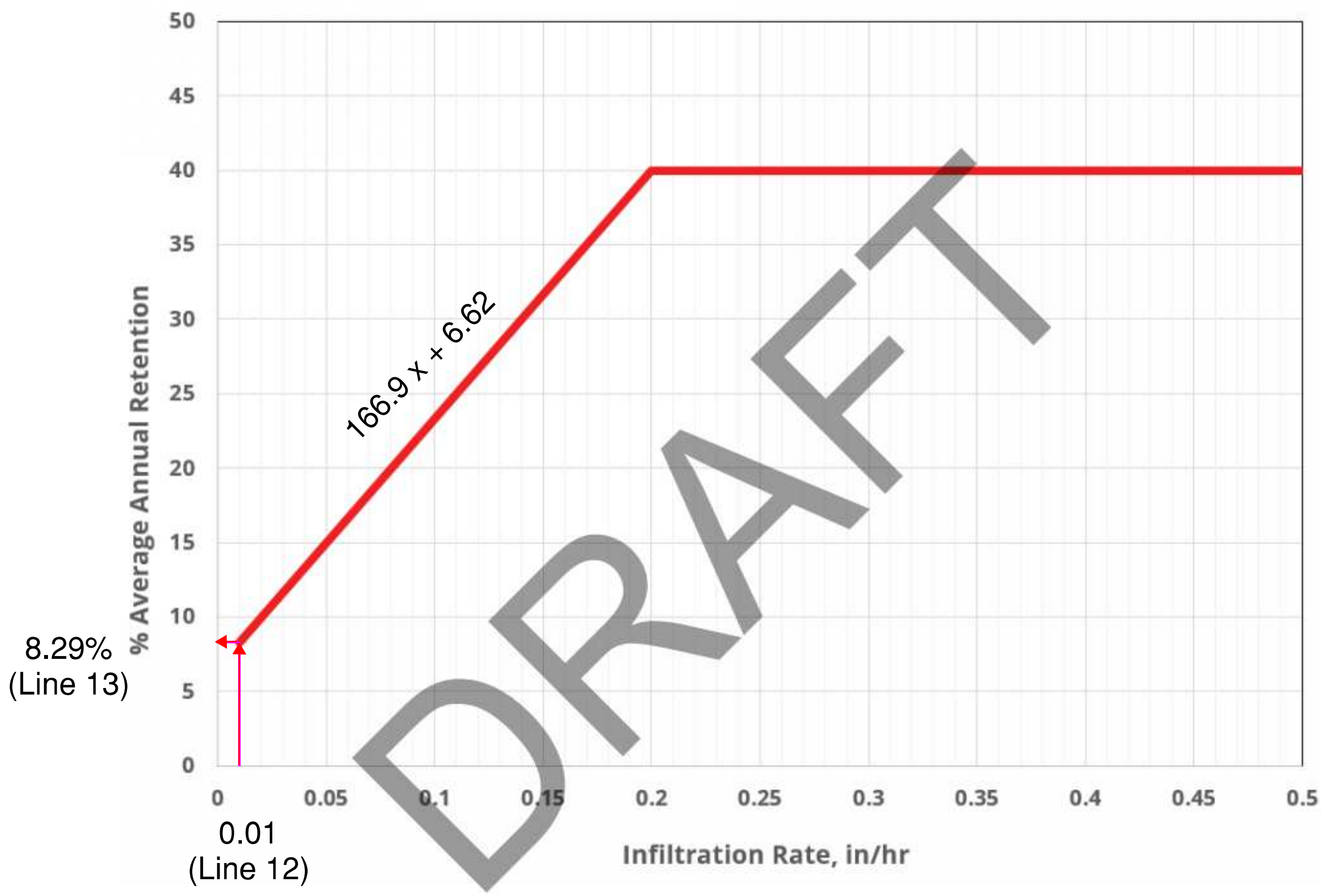


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

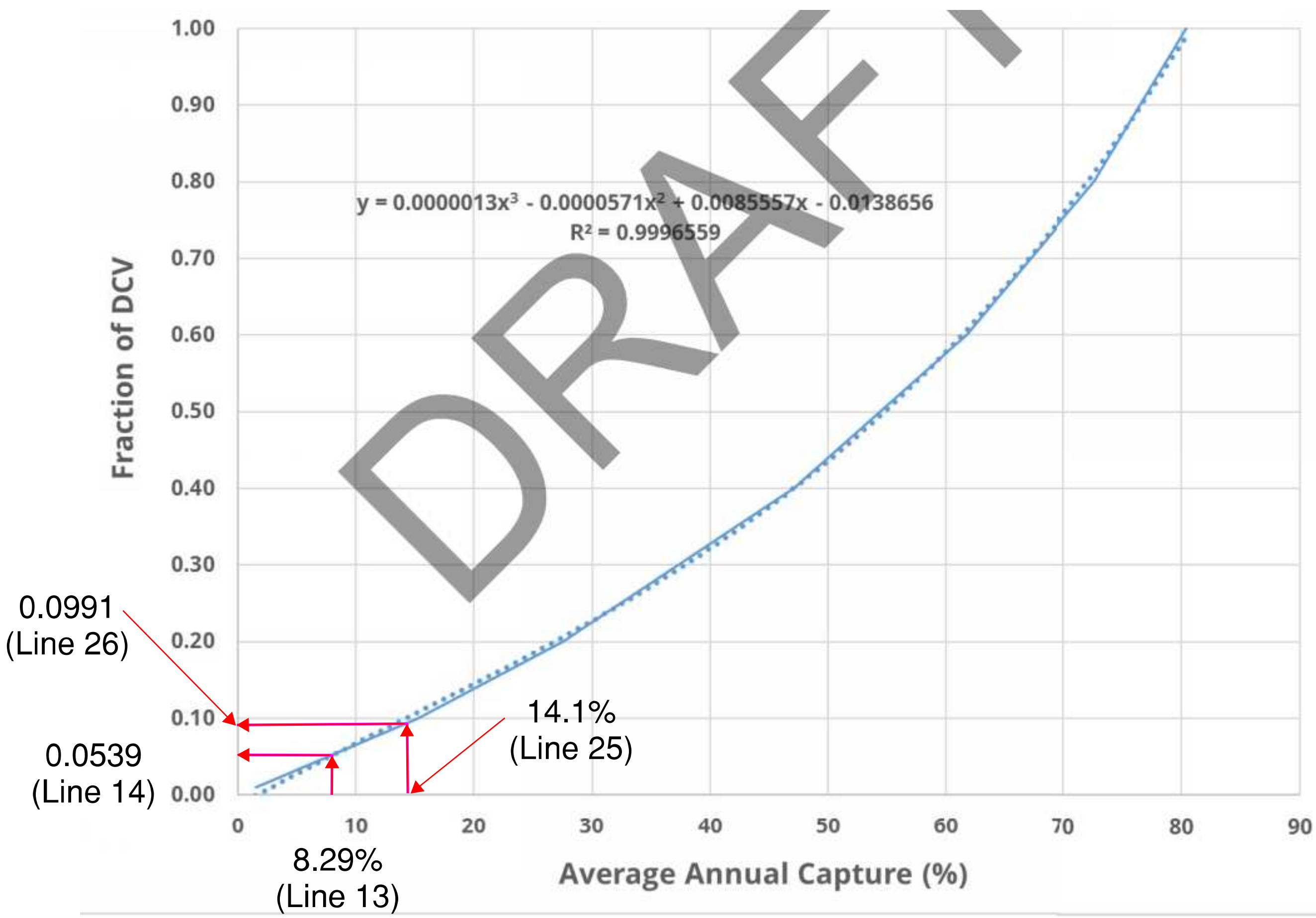


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 102: Reference Figure for Worksheet B.5-2

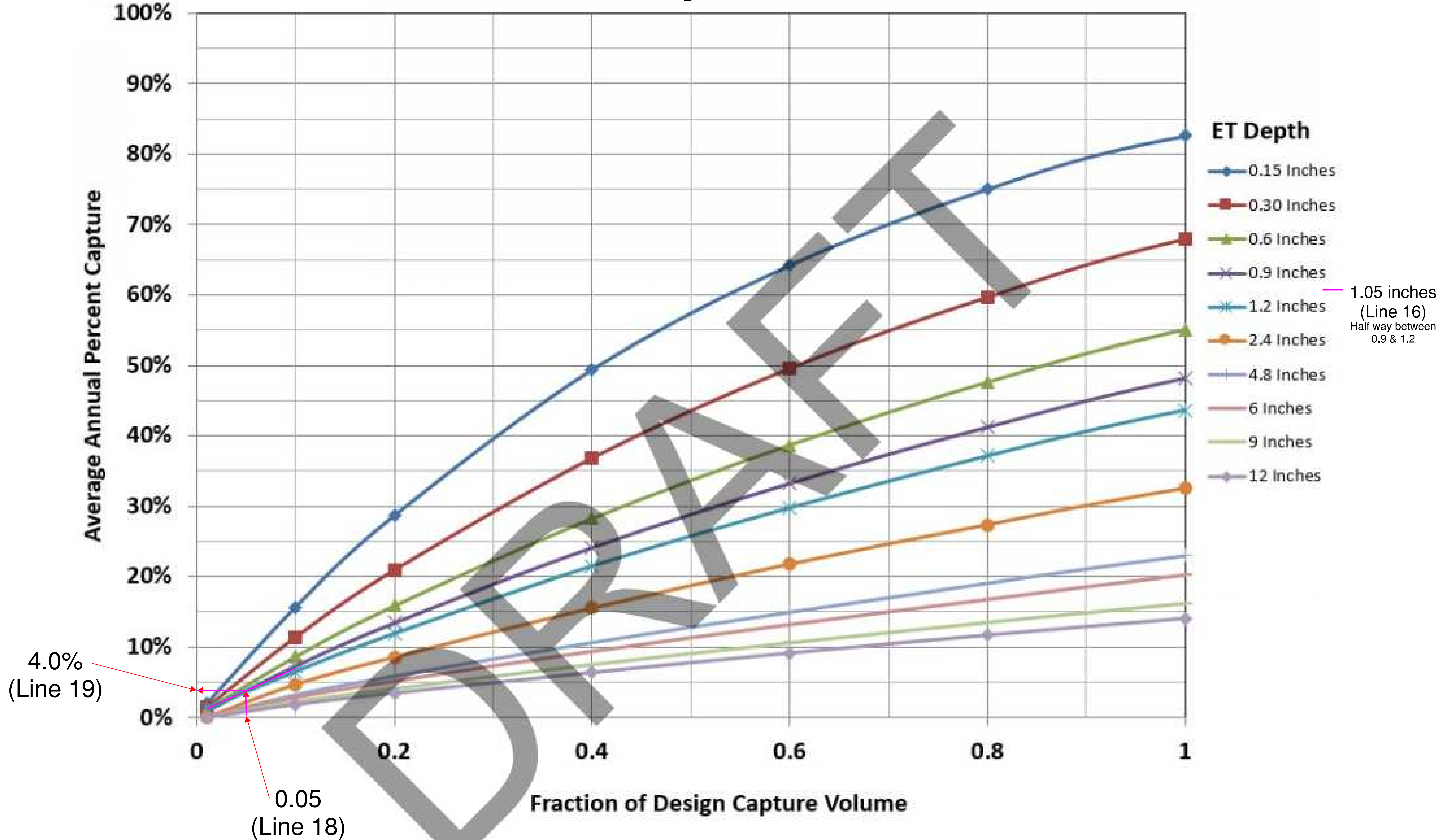


Figure B.5-5. Evapotranspiration Nomographs

BMP 102: Reference Figure for Worksheet B.5-2

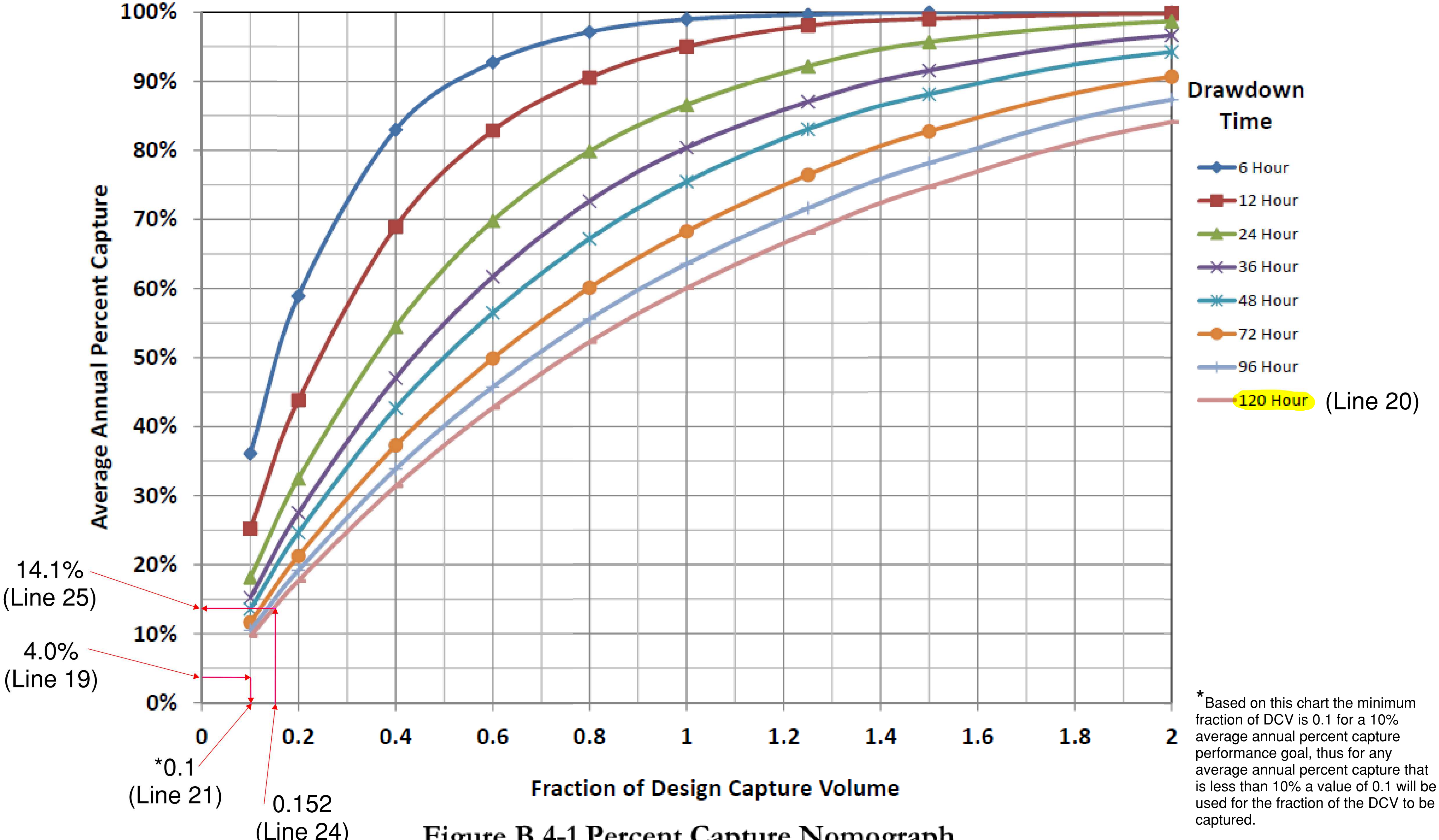


Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 103
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	26353.88	0.605002	0.90	0.544502	38.1%
Landscape	26314.85	0.604106	0.10	0.060	4.2%
Road	39848.67	0.9148	0.90	0.82332	57.6%
TOTAL	**92517.40**	**2.12**	**0.67**	**1.43**	**100%**

Pacific Village
DMA & BMP 103
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			92517.40	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.67	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.576	128	73.79	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.381	14	5.34	
Low Traffic Areas			50	0.00	
Open Space		0.042	216	9.14	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			88.26	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			54437	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			300	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			1499	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0241**	

Pacific Village
DMA & BMP 103
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	92517	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3266	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	4899.3	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1076.8**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2449.7	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**1195.0**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0241	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**1499**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**1499**	sq-ft

Pacific Village

DMA & BMP 103

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

Sizing Method for Volume Retention Criteria		Worksheet B.5-2	
1	Area draining to the BMP	92517.40	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3266	cu. ft.
BMP Parameters			
5	Footprint of the BMP	1633	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	176	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	142.88	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.04	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	3.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	163.295	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.050	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.150	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	14.0	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) $0.0000013 \times \text{Line } 25^3 - 0.000057 \times \text{Line } 25^2 + 0.0086 \times \text{Line } 25 - 0.014$	0.0983	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-145	cu. ft.

BMP 103: Reference Figures for Worksheet B.5-2

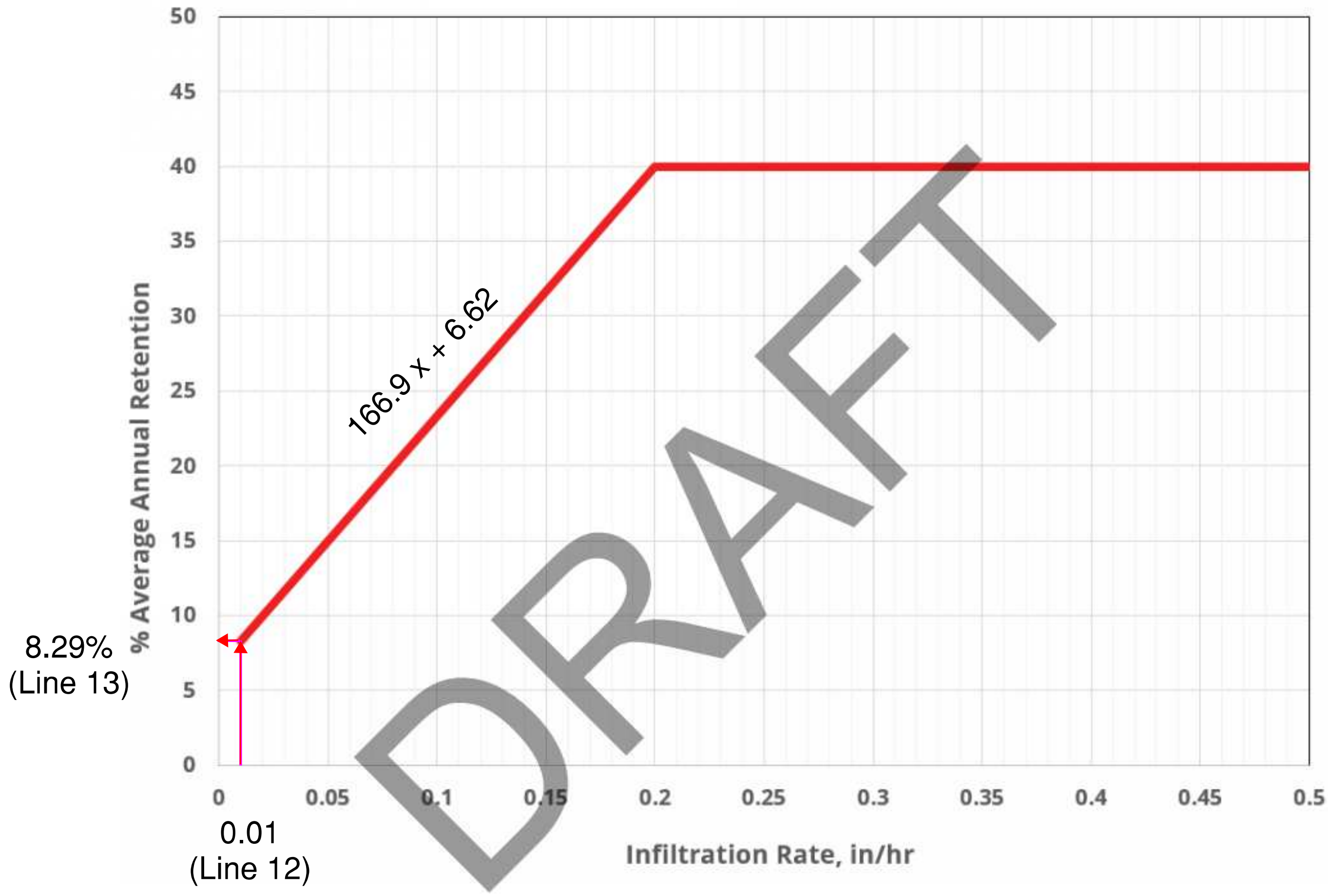


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

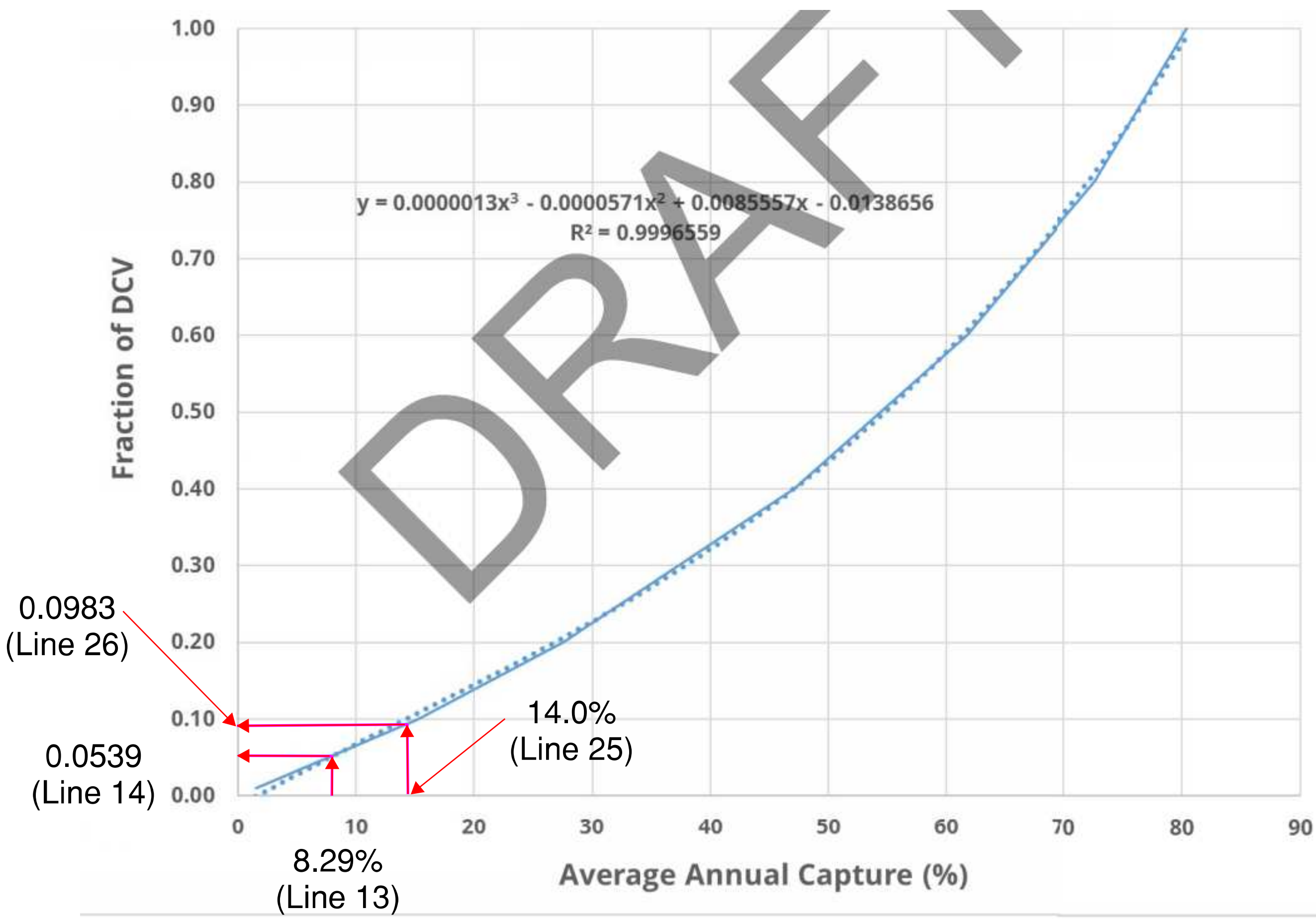


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 103: Reference Figure for Worksheet B.5-2

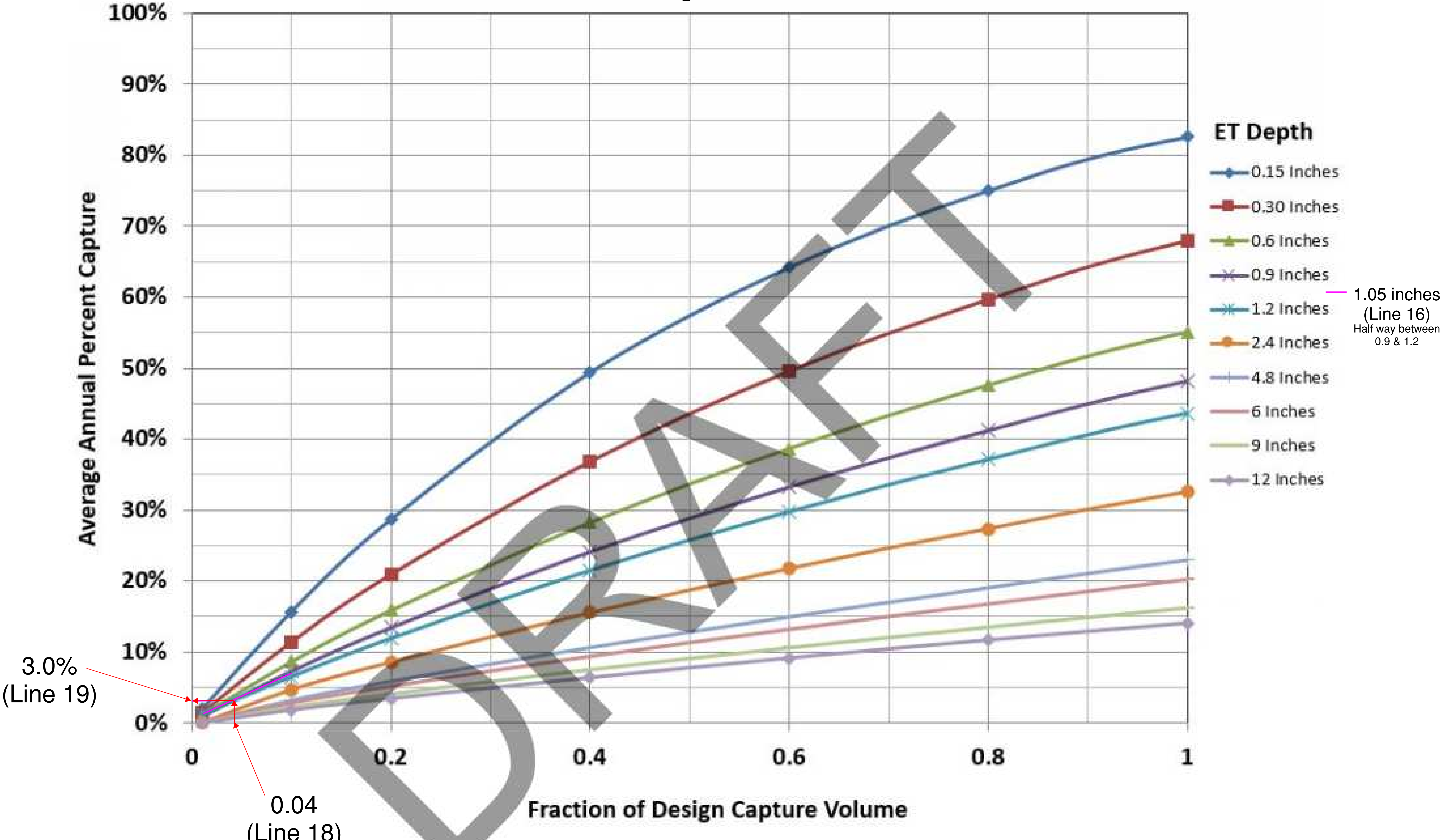
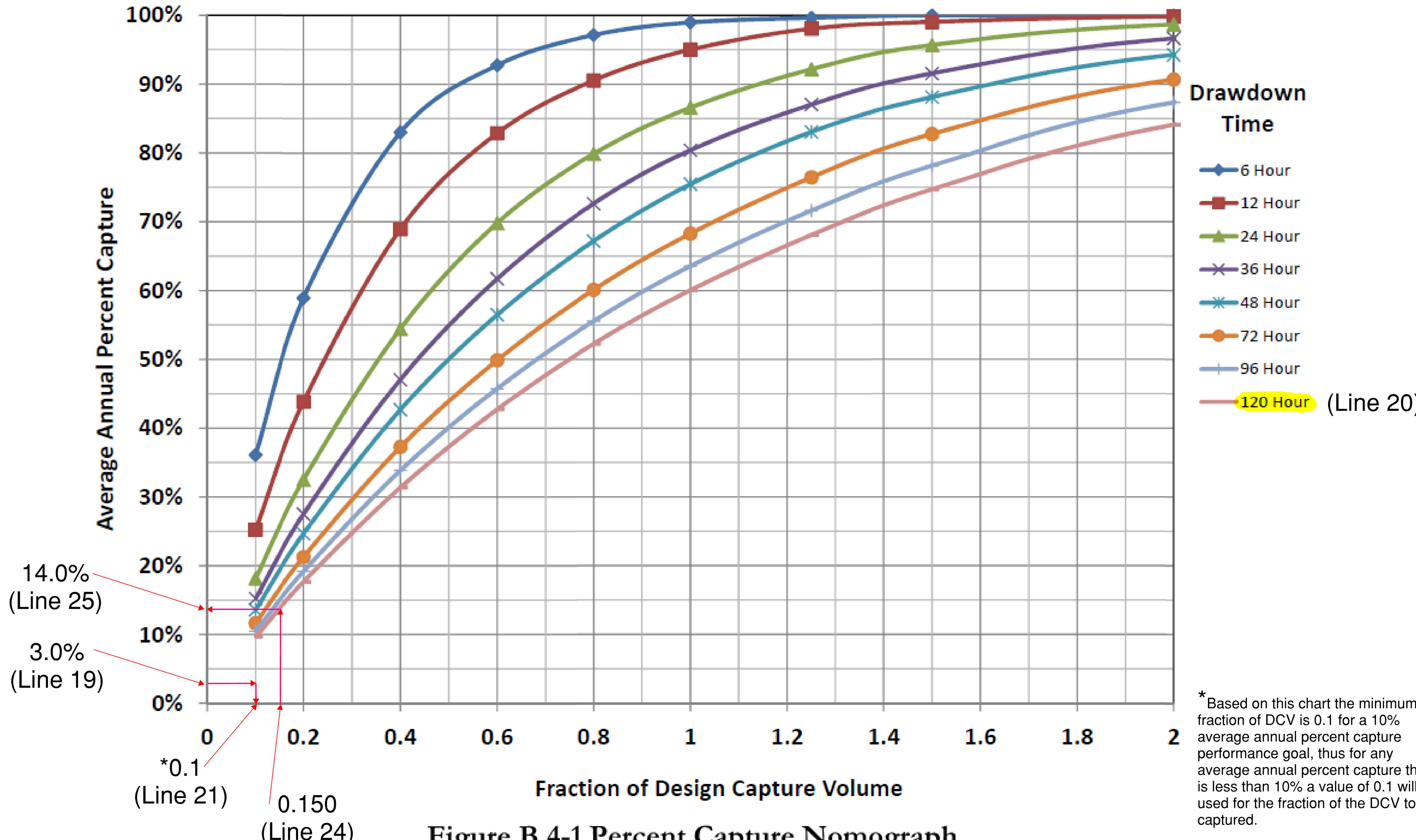


Figure B.5-5. Evapotranspiration Nomographs

BMP 103: Reference Figure for Worksheet B.5-2



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 104
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	33017.08	0.757968	0.90	0.682171	49.6%
Landscape	17651.73	0.405228	0.10	0.041	2.9%
Road	31602.71	0.725498	0.90	0.652949	47.5%
TOTAL	**82271.52**	**1.89**	**0.73**	**1.38**	**100%**

Pacific Village
DMA & BMP 104
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			82271.52	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.73	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.475	128	60.76	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.496	14	6.94	
Low Traffic Areas			50	0.00	
Open Space		0.029	216	6.36	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			74.06	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			52433	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			242	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			1212	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0202**	

Pacific Village
DMA & BMP 104
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	82272	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.73	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3146	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	4718.9	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1037.1**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2359.5	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**1151.0**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0202	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**1212**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**1212**	sq-ft

Pacific Village

DMA & BMP 104

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

	Sizing Method for Volume Retention Criteria	Worksheet B.5-2	
1	Area draining to the BMP	82271.52	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.73	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3146	cu. ft.
BMP Parameters			
5	Footprint of the BMP	1393	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	169	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	121.84	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.04	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	3.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	139.251	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.044	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.144	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	13.7	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0960	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-132	cu. ft.

BMP 104: Reference Figures for Worksheet B.5-2

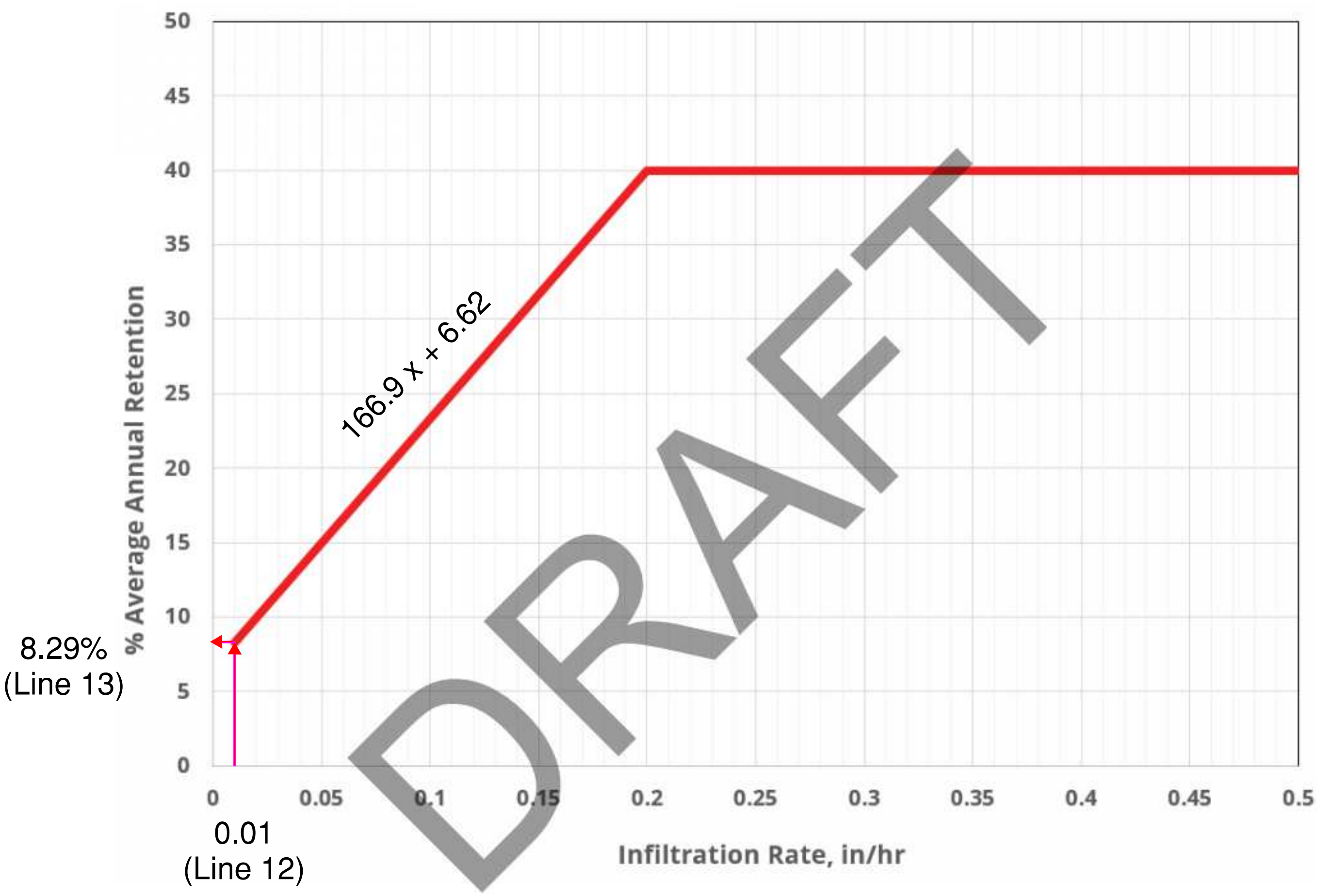


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

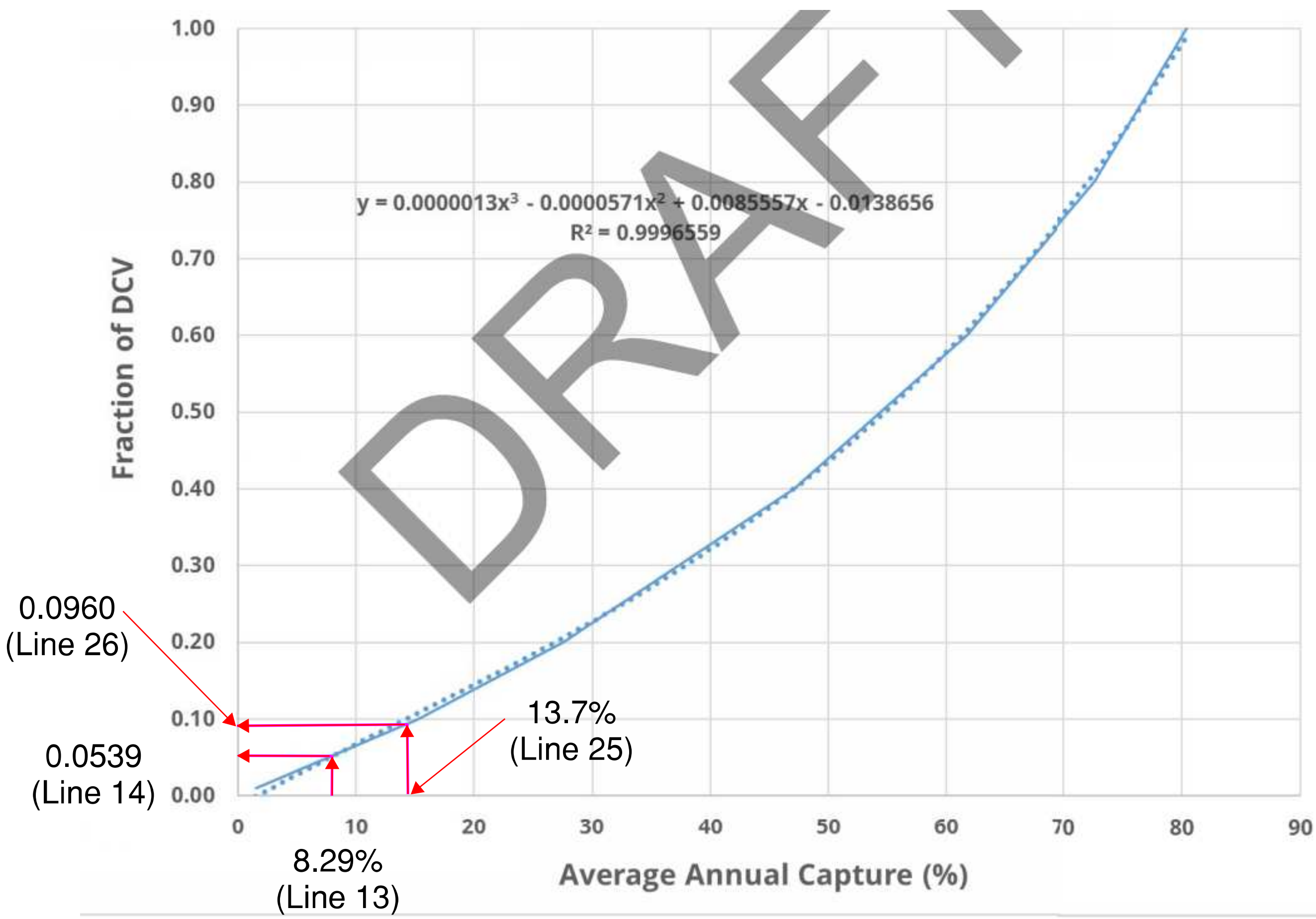


Figure B.5-3. Fraction of DCV versus Average Annual Capture

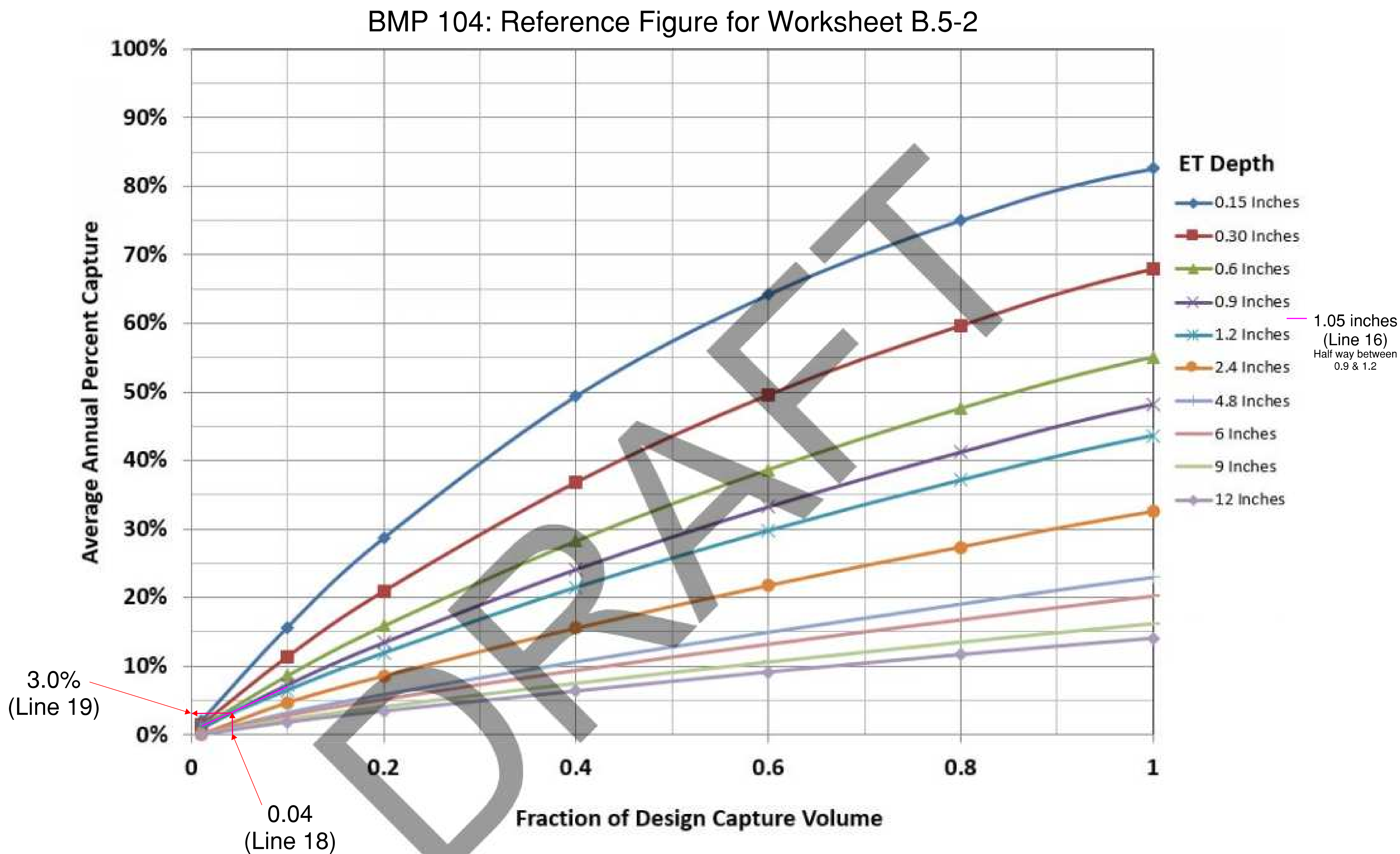


Figure B.5-5. Evapotranspiration Nomographs

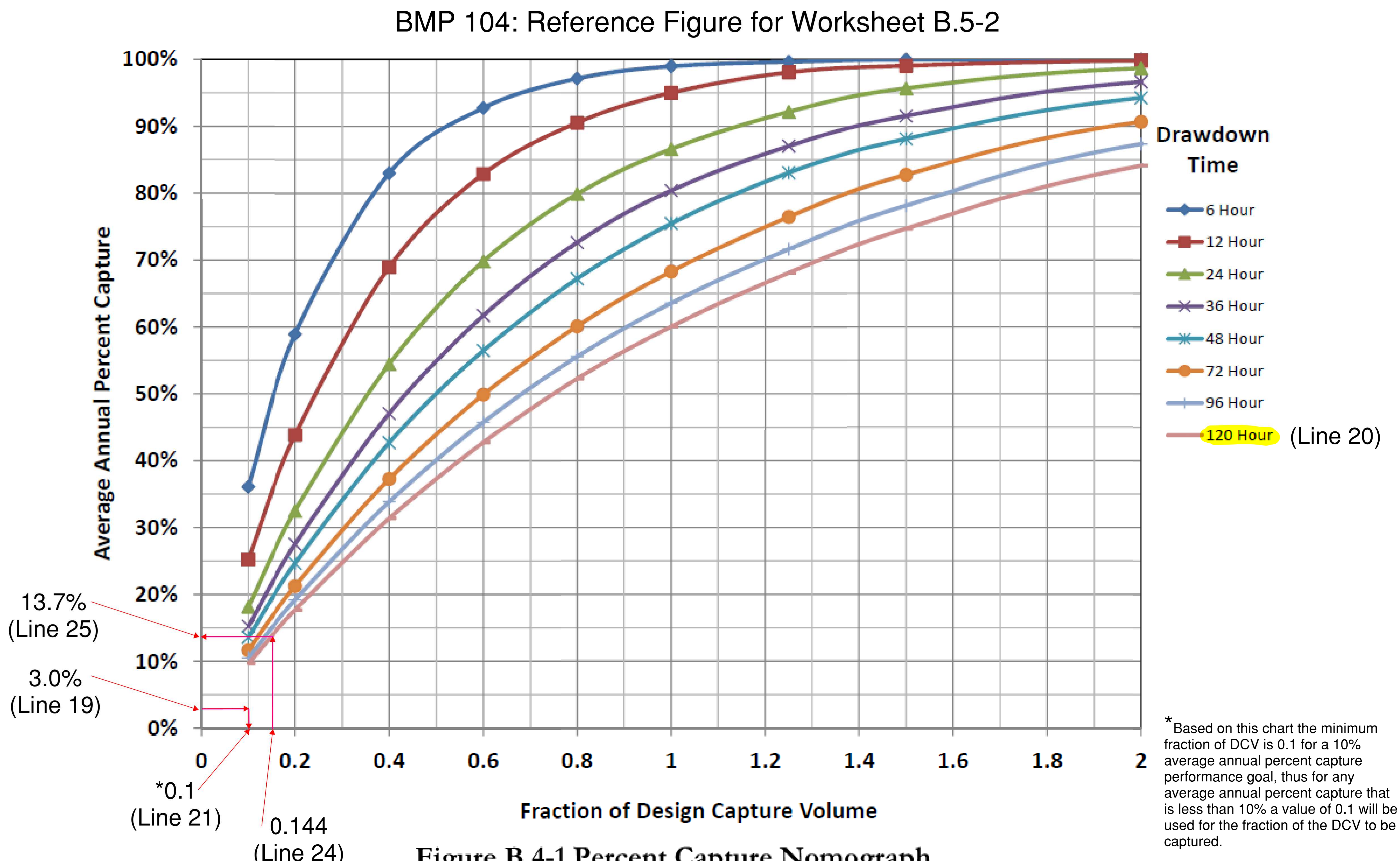


Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 105
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	21671.73	0.497514	0.90	0.447763	32.8%
Landscape	25202.96	0.57858	0.10	0.058	4.2%
Road	41565.09	0.954203	0.90	0.858783	62.9%
TOTAL	**88439.78**	**2.03**	**0.67**	**1.36**	**100%**

Pacific Village
DMA & BMP 105
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			88439.78	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.67	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.629	128	80.57	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.328	14	4.59	
Low Traffic Areas			50	0.00	
Open Space		0.042	216	9.16	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			94.32	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			52004	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			306	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			1530	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0257**	

Pacific Village
DMA & BMP 105
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	88440	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3120	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	4680.4	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1028.7**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2340.2	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**1141.6**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0257	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**1530**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**1530**	sq-ft

Pacific Village

DMA & BMP 105

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

	Sizing Method for Volume Retention Criteria	Worksheet B.5-2	
1	Area draining to the BMP	88439.78	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3120	cu. ft.
BMP Parameters			
5	Footprint of the BMP	3920	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	168	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	343.00	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.11	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	7.5	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	391.996	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.126	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.226	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	21.0	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.1527	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-308	cu. ft.

BMP 105: Reference Figures for Worksheet B.5-2

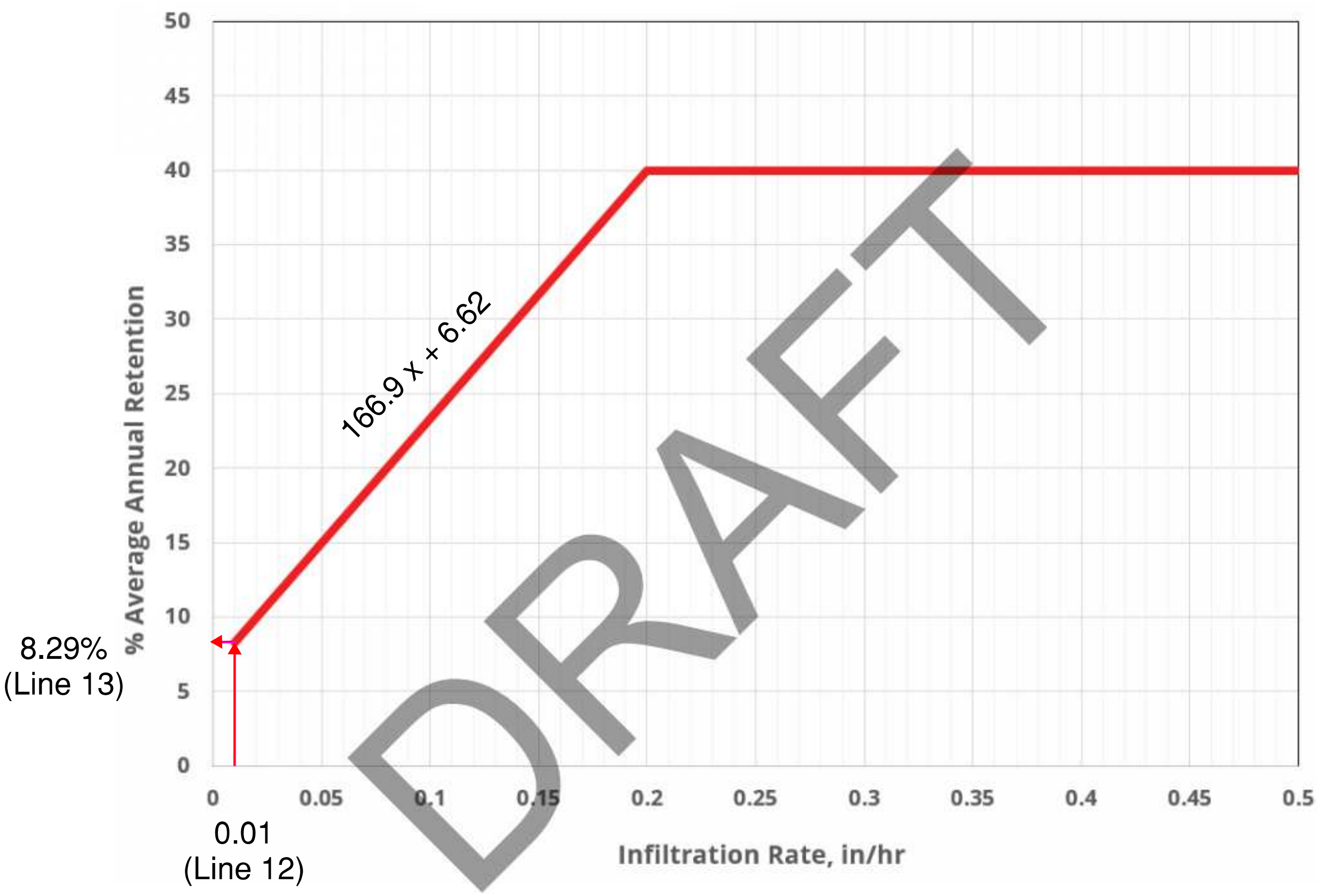


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

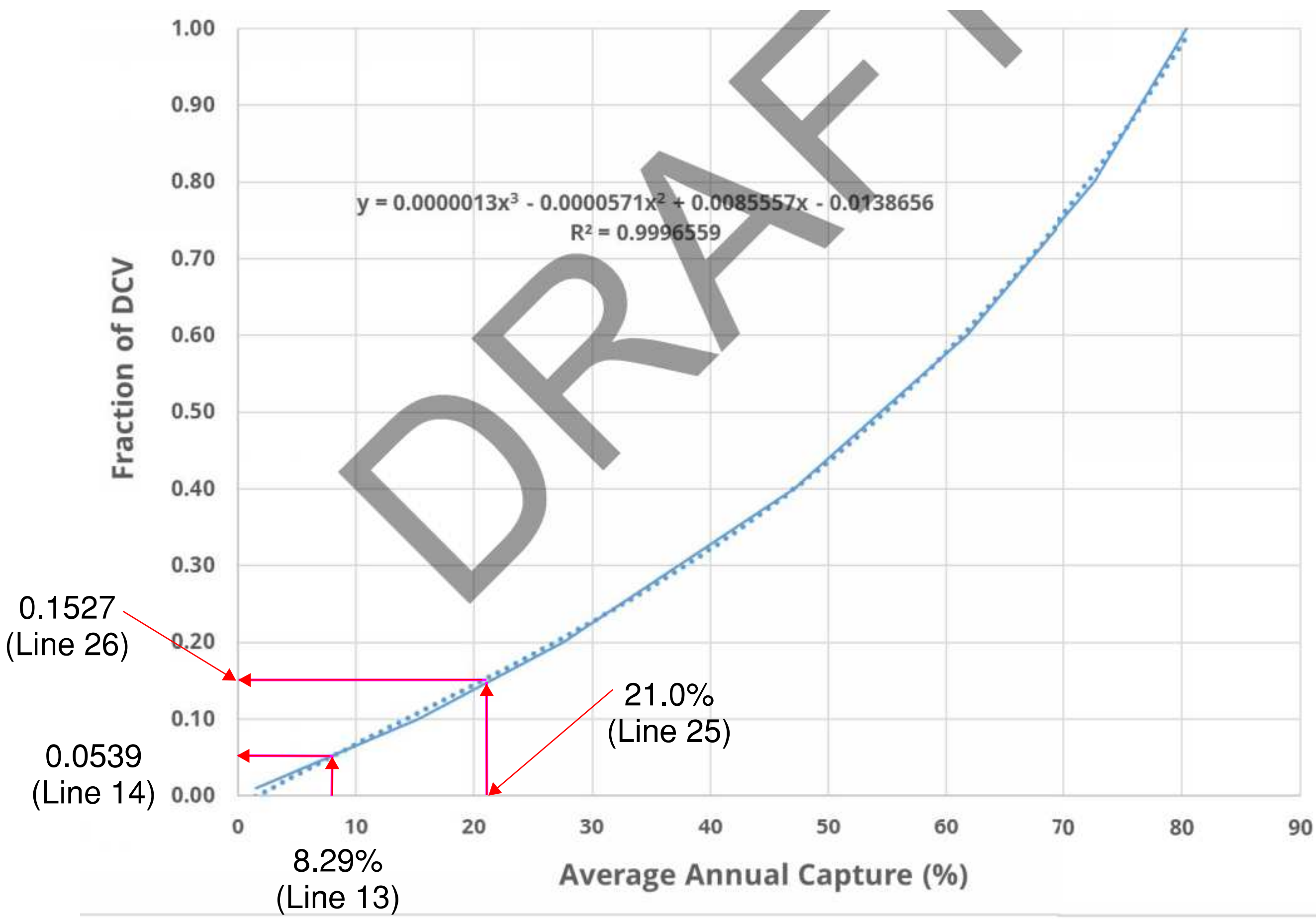


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 105: Reference Figure for Worksheet B.5-2

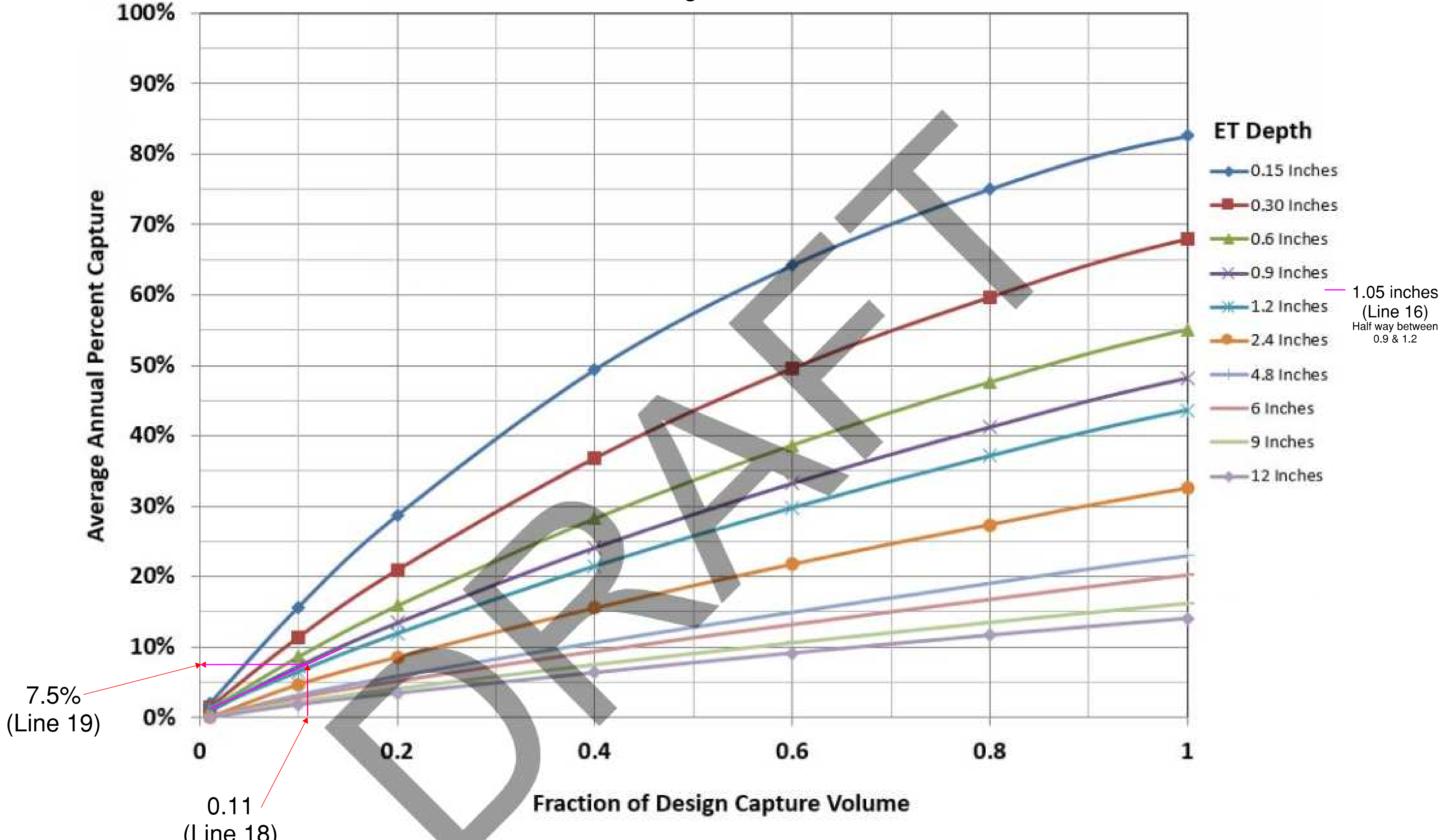
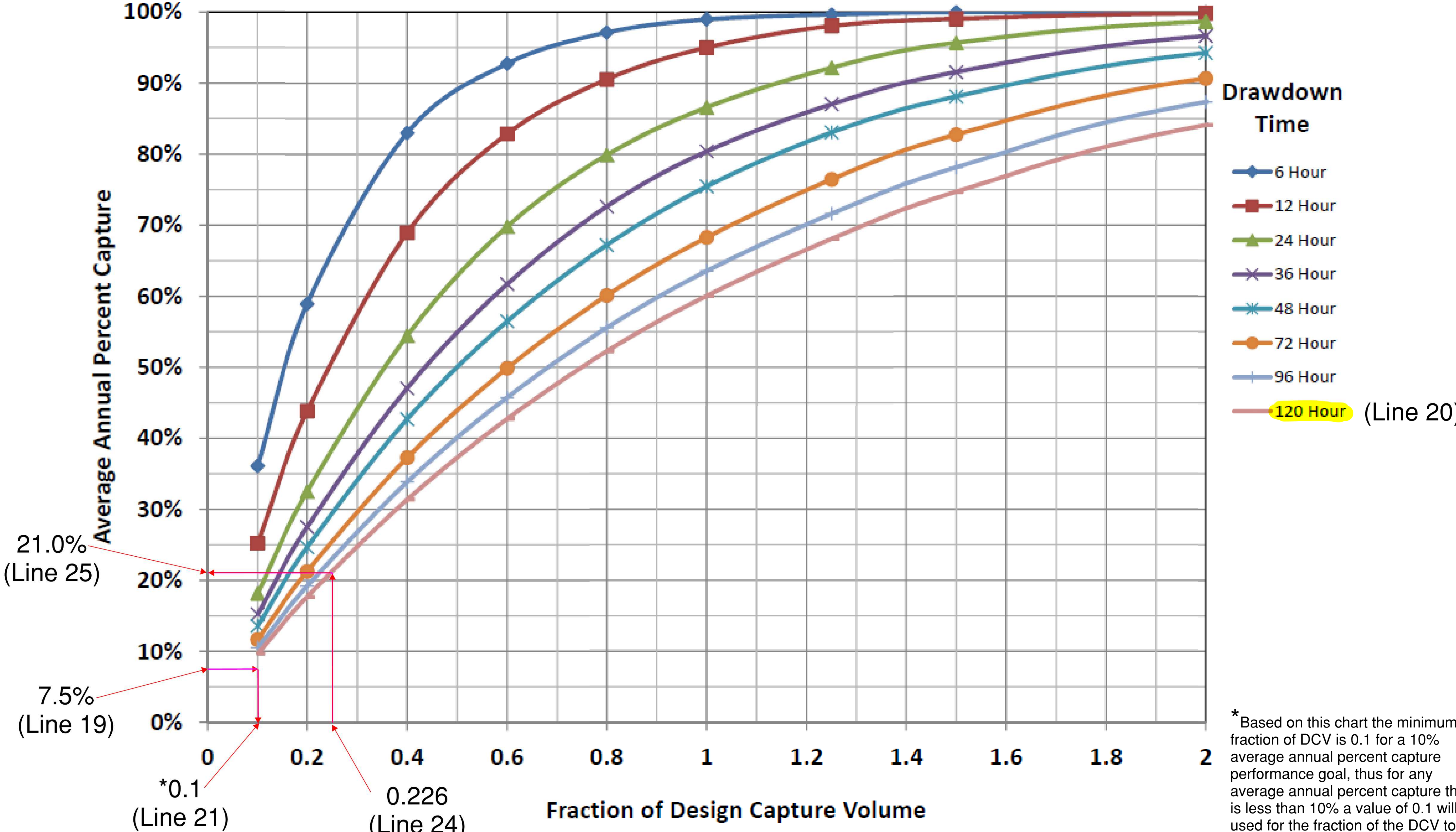


Figure B.5-5. Evapotranspiration Nomographs

BMP 105: Reference Figure for Worksheet B.5-2



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 106
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	54653.87	1.25468	0.90	1.129212	43.6%
Landscape	76088.46	1.746751	0.10	0.175	6.7%
Road	62308.30	1.430402	0.90	1.287362	49.7%
TOTAL	**193050.63**	**4.43**	**0.58**	**2.59**	**100%**

Pacific Village
DMA & BMP 106
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			193050.63	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.58	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.497	128	63.59	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.436	14	6.10	
Low Traffic Areas			50	0.00	
Open Space		0.067	216	14.56	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			84.25	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			98765	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			519	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			2596	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0230**	

Pacific Village
DMA & BMP 106
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	193051	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.58	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	5926	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	8888.9	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1953.6**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	4444.4	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**2168.0**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0230	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**2596**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**2596**	sq-ft

Pacific Village

DMA & BMP 106

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

Sizing Method for Volume Retention Criteria		Worksheet B.5-2	
1	Area draining to the BMP	193050.63	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.58	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	5926	cu. ft.
BMP Parameters			
5	Footprint of the BMP	2845	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	319	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	248.93	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.04	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	3.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	284.495	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.048	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.148	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	13.9	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0975	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-259	cu. ft.

BMP 106: Reference Figures for Worksheet B.5-2

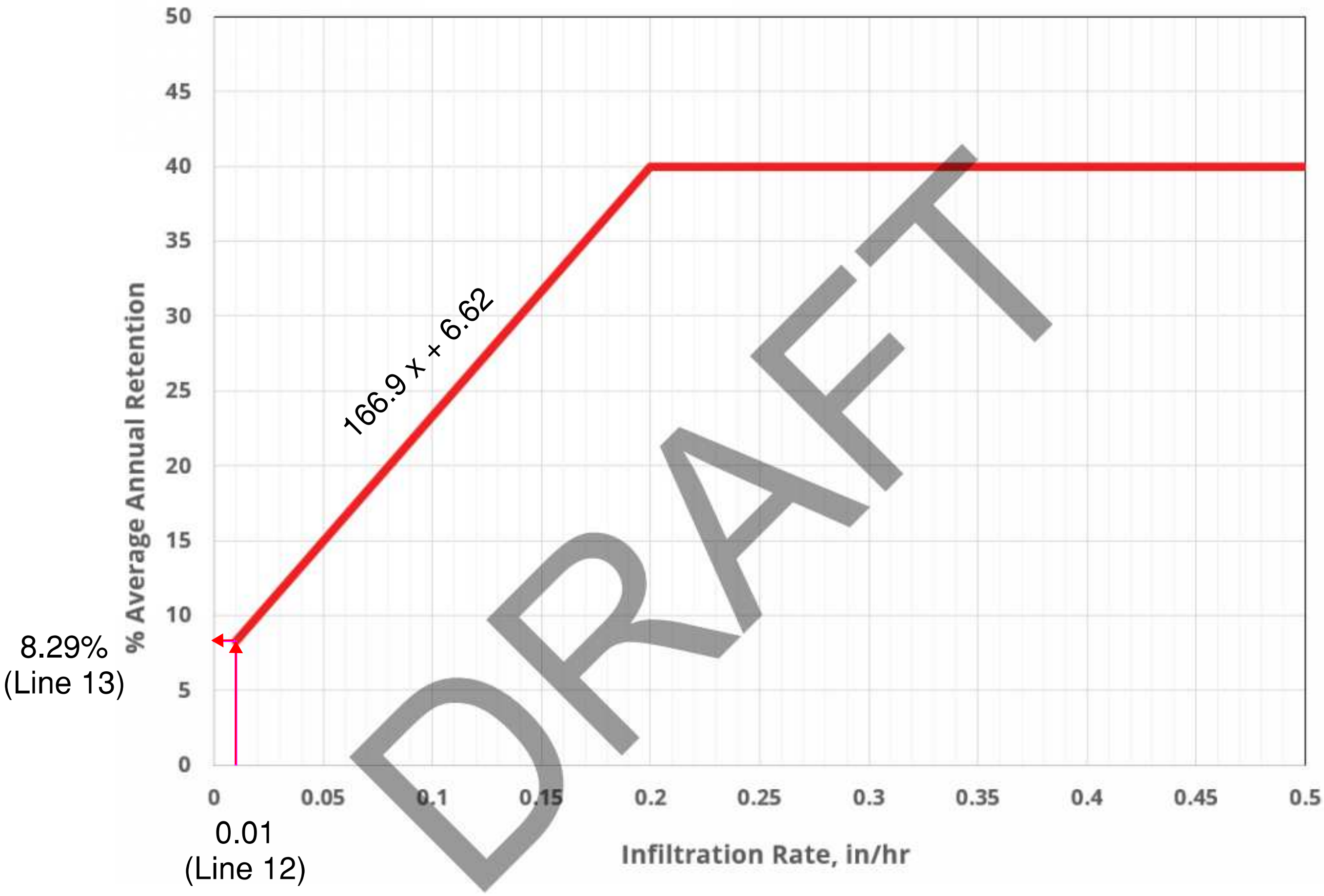


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

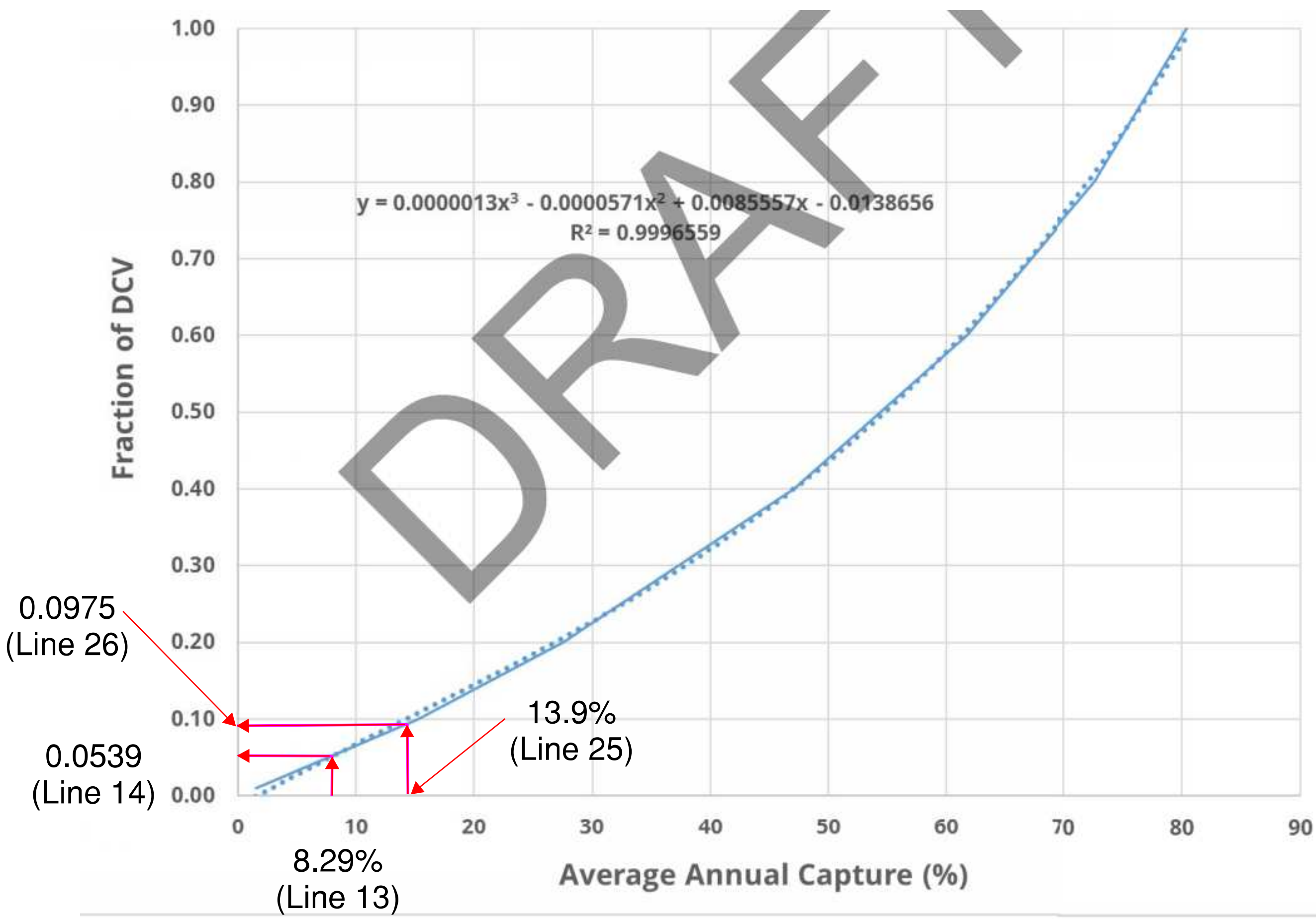


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 106: Reference Figure for Worksheet B.5-2

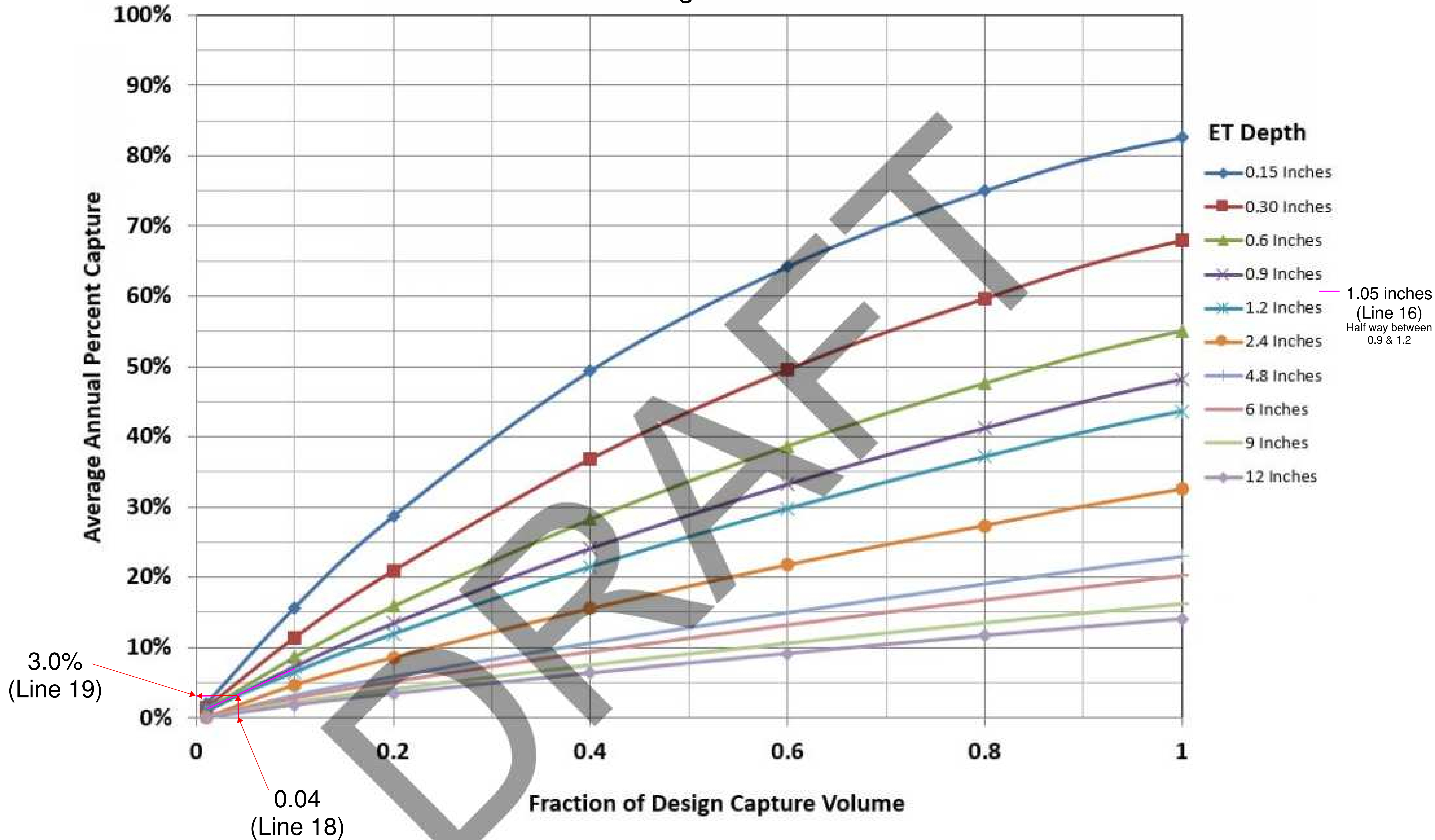


Figure B.5-5. Evapotranspiration Nomographs

BMP 106: Reference Figure for Worksheet B.5-2

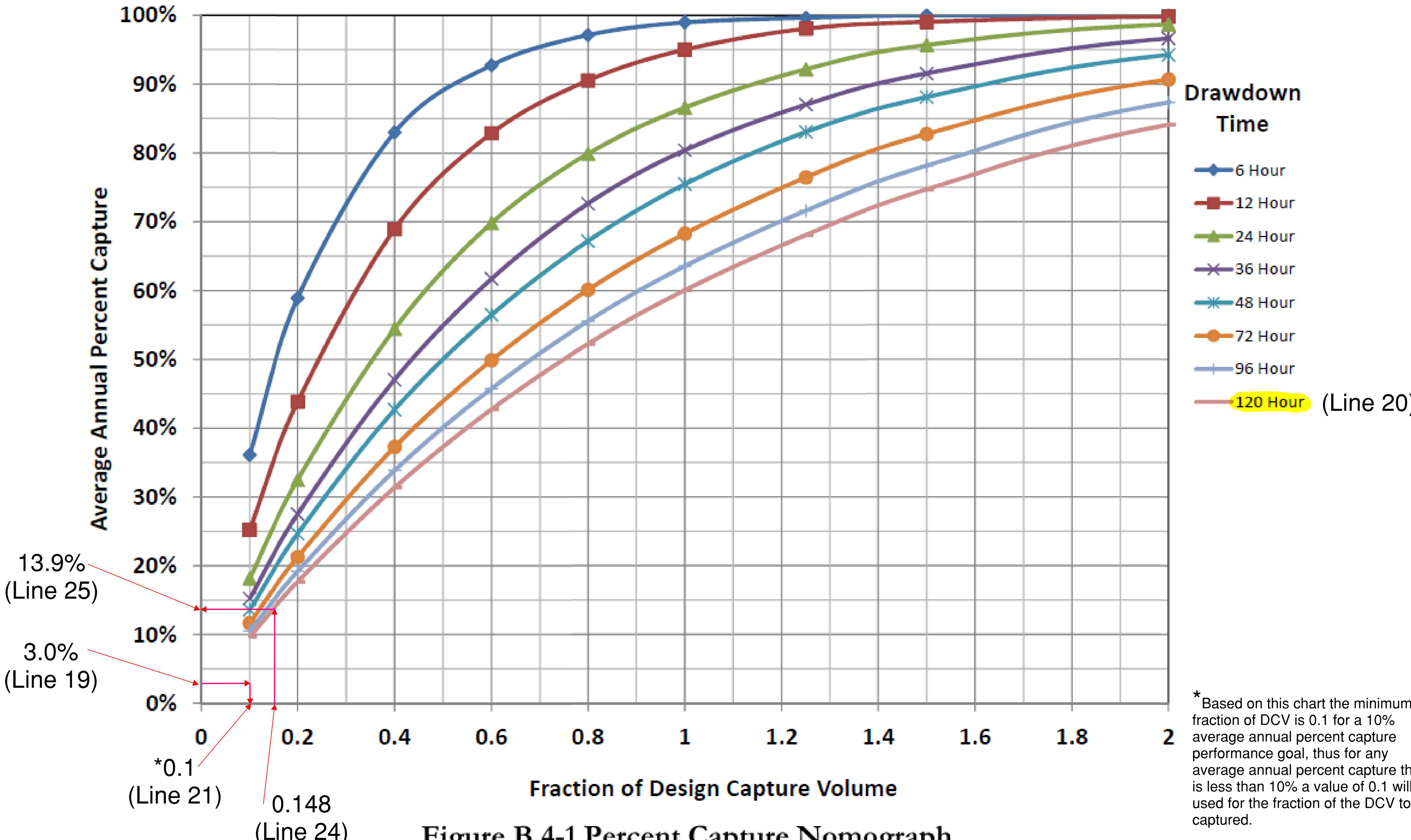


Figure B.4-1 Percent Capture Nomograph

*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Pacific Village
DMA & BMP 107
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	43496.71	0.998547	0.90	0.898692	42.2%
Landscape	39547.66	0.907889	0.10	0.091	4.3%
Road	55268.19	1.268783	0.90	1.141905	53.6%
TOTAL	**138312.56**	**3.18**	**0.67**	**2.13**	**100%**

Pacific Village
DMA & BMP 107
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			138312.56	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.67	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.536	128	68.58	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.422	14	5.90	
Low Traffic Areas			50	0.00	
Open Space		0.043	216	9.20	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			83.68	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			81238	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			424	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			2121	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0228**	

Pacific Village
DMA & BMP 107
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	138313	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	4874	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	7311.4	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1606.9**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	3655.7	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**1783.3**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0228	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**2121**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**2121**	sq-ft

Pacific Village

DMA & BMP 107

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

Sizing Method for Volume Retention Criteria		Worksheet B.5-2	
1	Area draining to the BMP	138312.56	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.67	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	4874	cu. ft.
BMP Parameters			
5	Footprint of the BMP	2255	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	263	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	197.33	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.04	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	3.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	225.524	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.046	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.146	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	13.8	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0967	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-209	cu. ft.

BMP 107: Reference Figures for Worksheet B.5-2

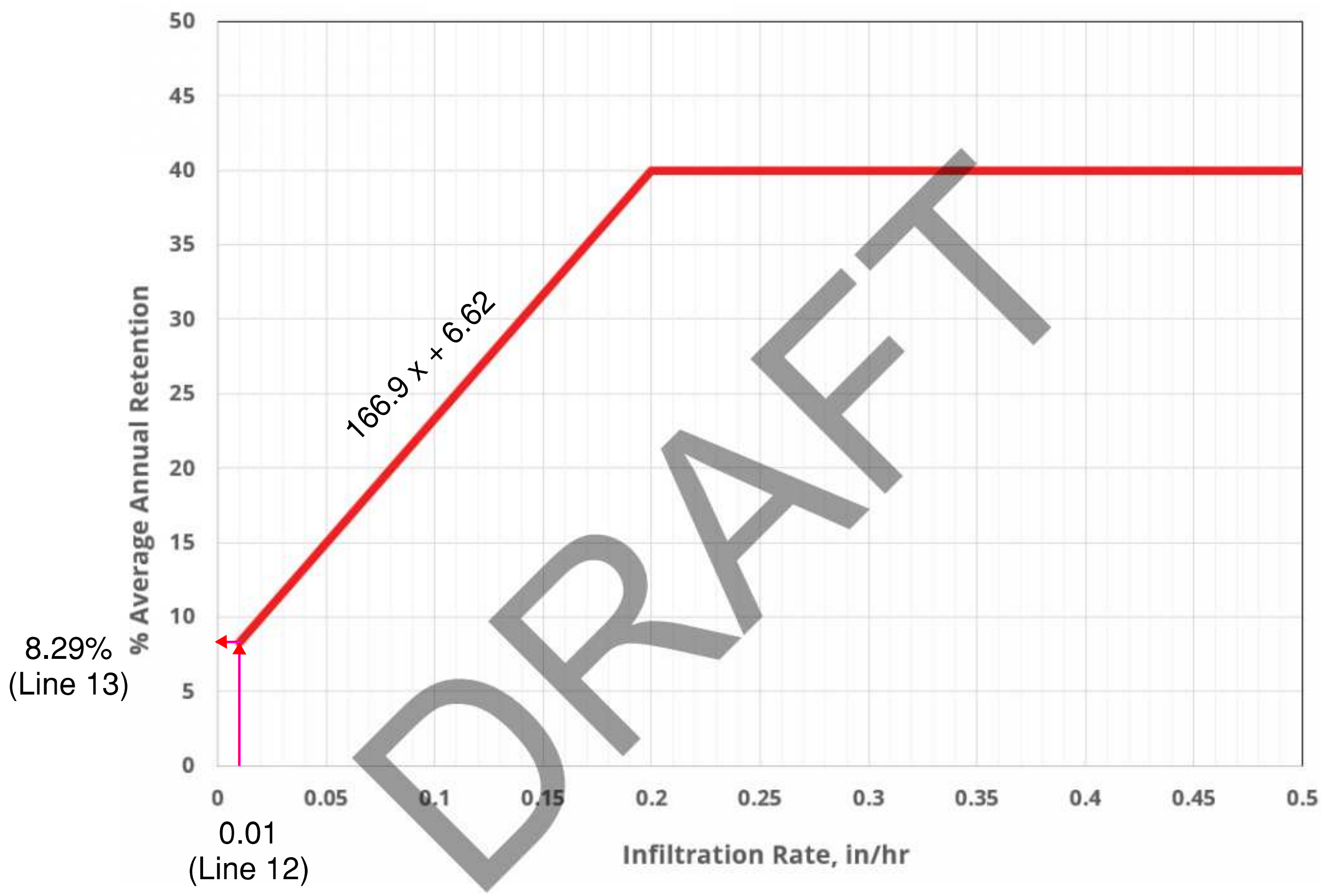


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

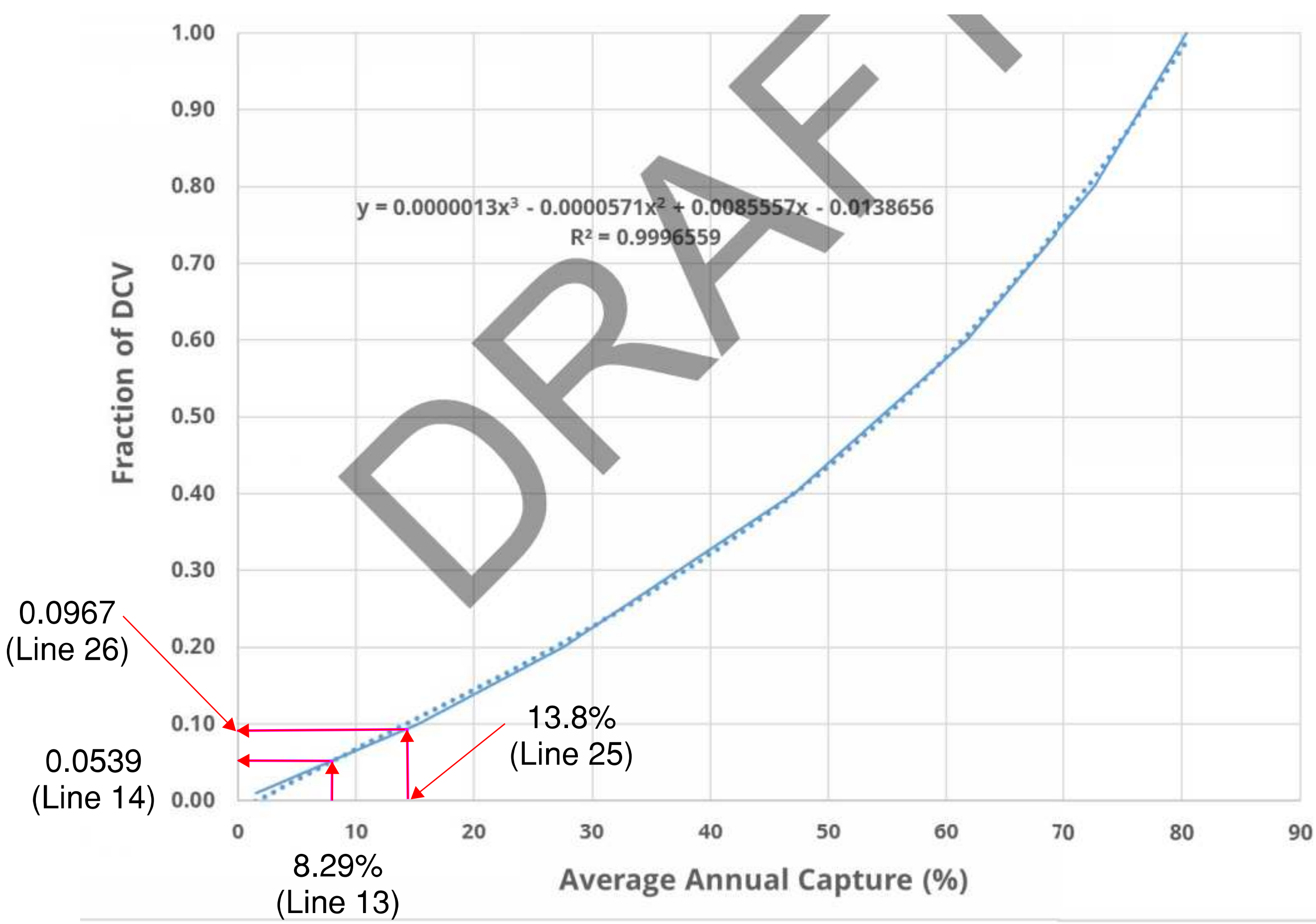


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 107: Reference Figure for Worksheet B.5-2

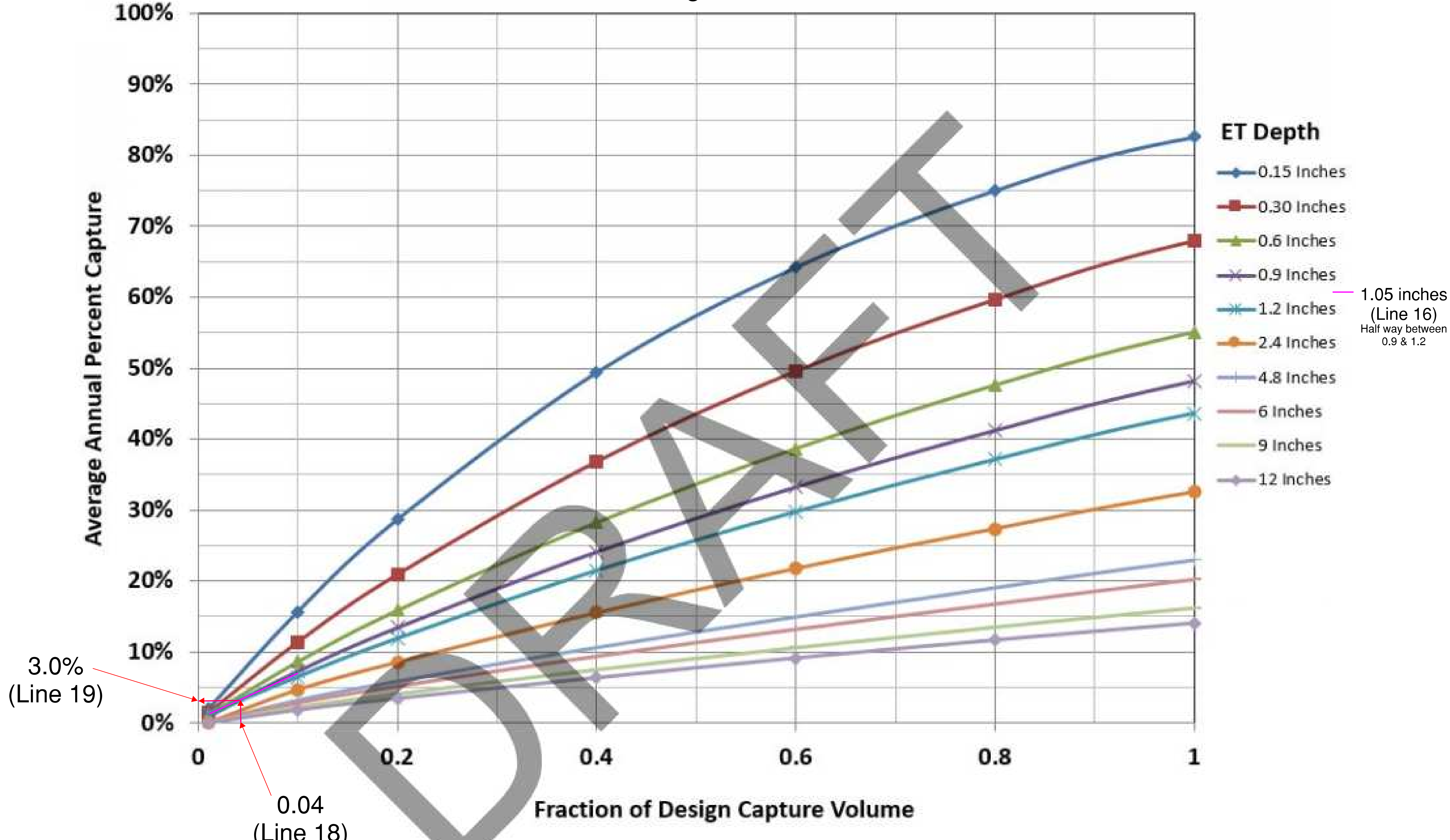
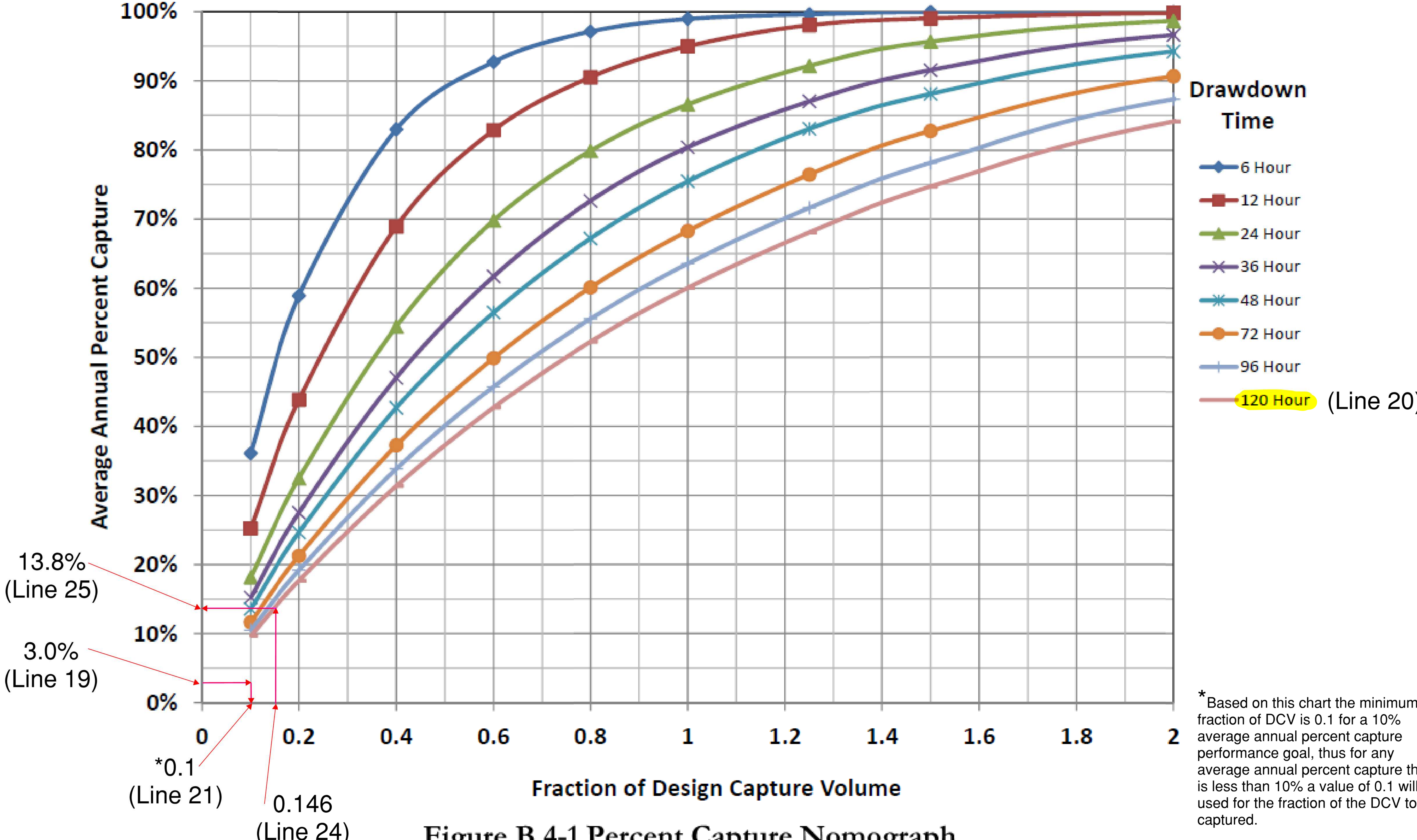


Figure B.5-5. Evapotranspiration Nomographs

BMP 107: Reference Figure for Worksheet B.5-2



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 108
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	23741.96	0.54504	0.90	0.490536	49.8%
Landscape	34561.30	0.793418	0.10	0.079	8.1%
Road	20070.98	0.460766	0.90	0.41469	42.1%
TOTAL	**78374.24**	**1.80**	**0.55**	**0.98**	**100%**

Pacific Village
DMA & BMP 108
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			78374.24	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.55	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.421	128	53.91	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.498	14	6.98	
Low Traffic Areas			50	0.00	
Open Space		0.081	216	17.41	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			78.29	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			37527	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			183	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			917	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0214**	

Pacific Village
DMA & BMP 108
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	78374	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.55	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	2252	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	3377.4	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**742.3**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	1688.7	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**823.8**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0214	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**917**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**917**	sq-ft

Pacific Village

DMA & BMP 108

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

Sizing Method for Volume Retention Criteria		Worksheet B.5-2	
1	Area draining to the BMP	78374.24	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.55	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	2252	cu. ft.
BMP Parameters			
5	Footprint of the BMP	1079	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	121	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	94.37	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.04	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	3.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	107.853	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.048	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.148	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	13.9	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0975	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-98	cu. ft.

BMP 108: Reference Figures for Worksheet B.5-2

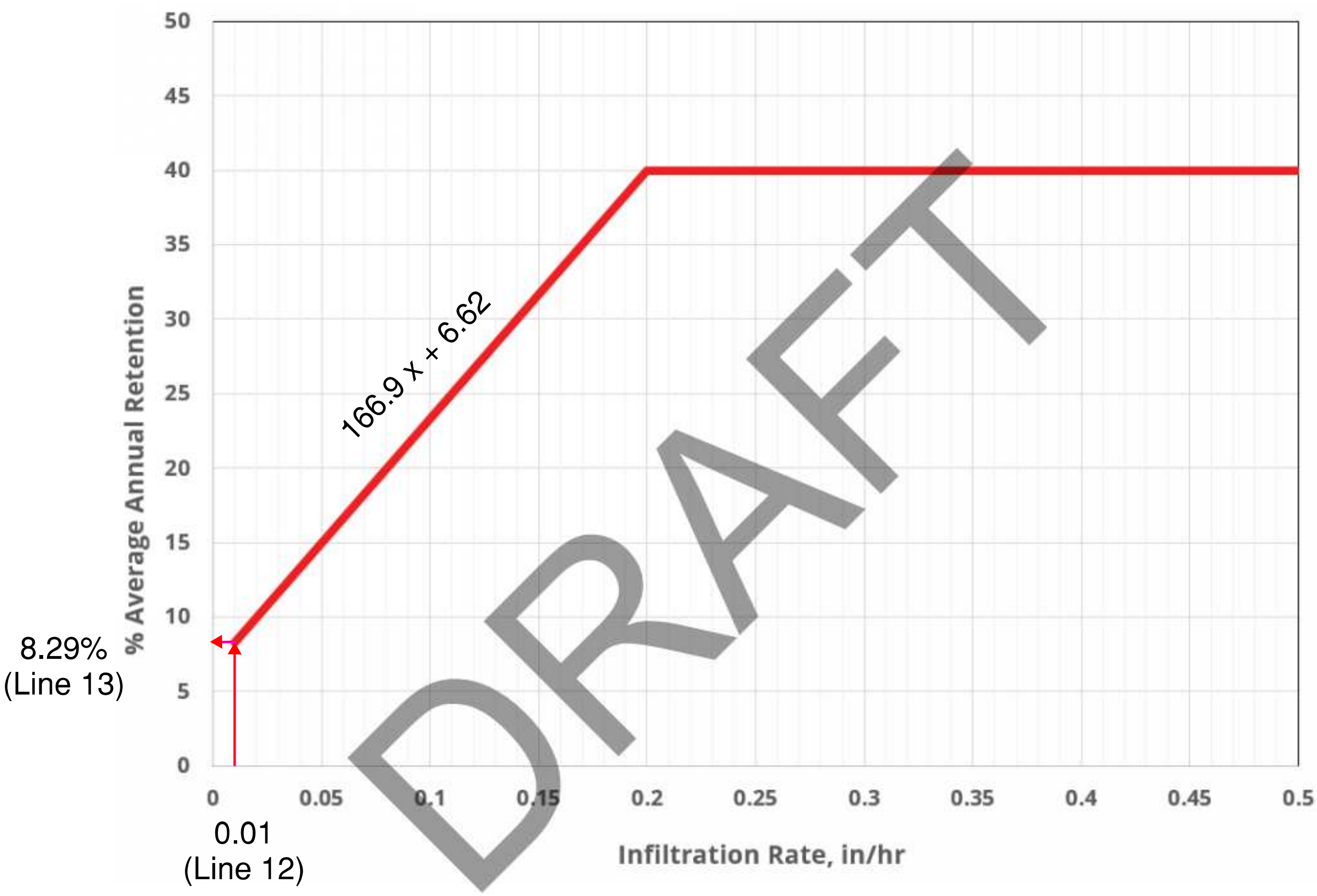


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

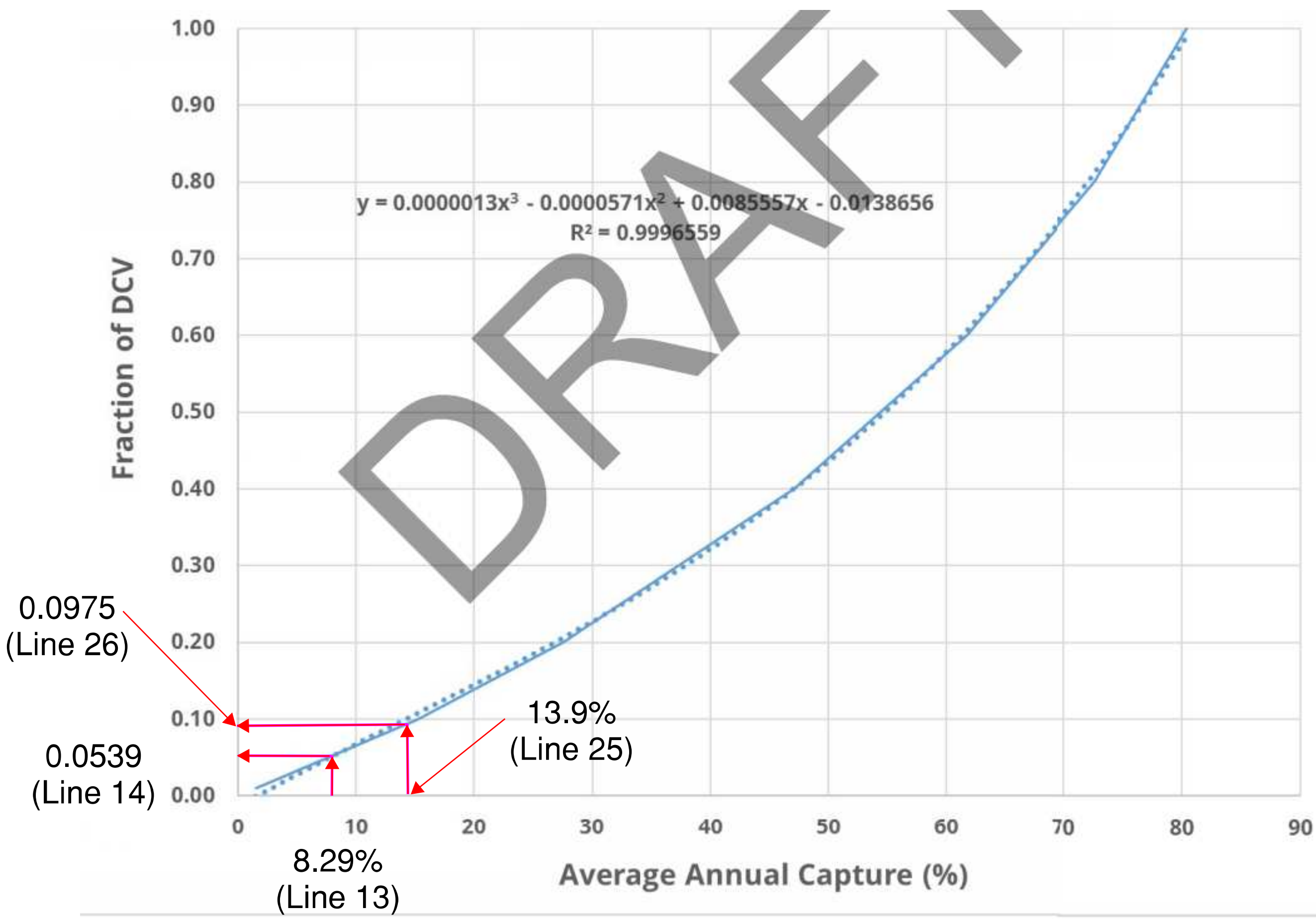


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 108: Reference Figure for Worksheet B.5-2

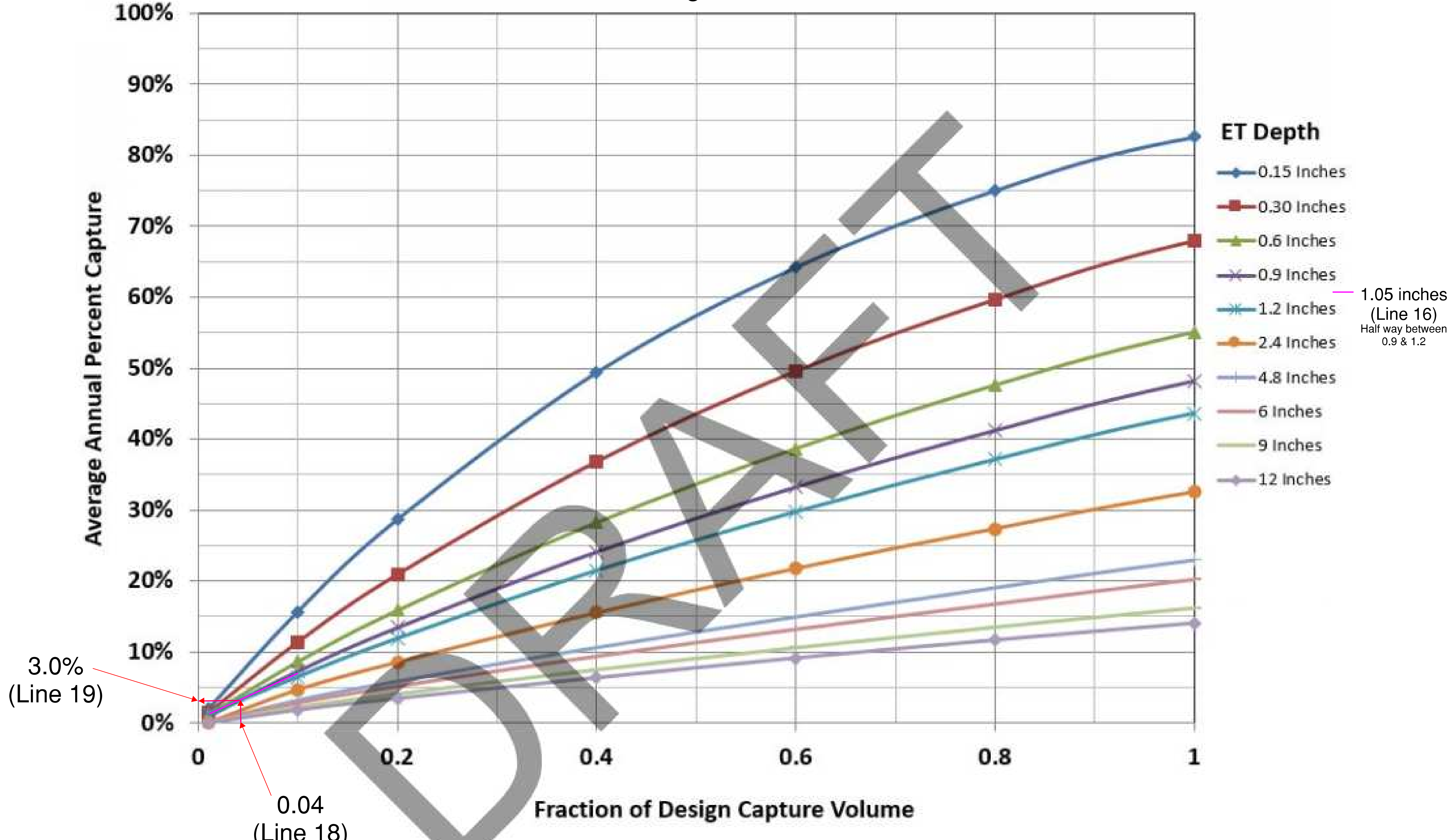
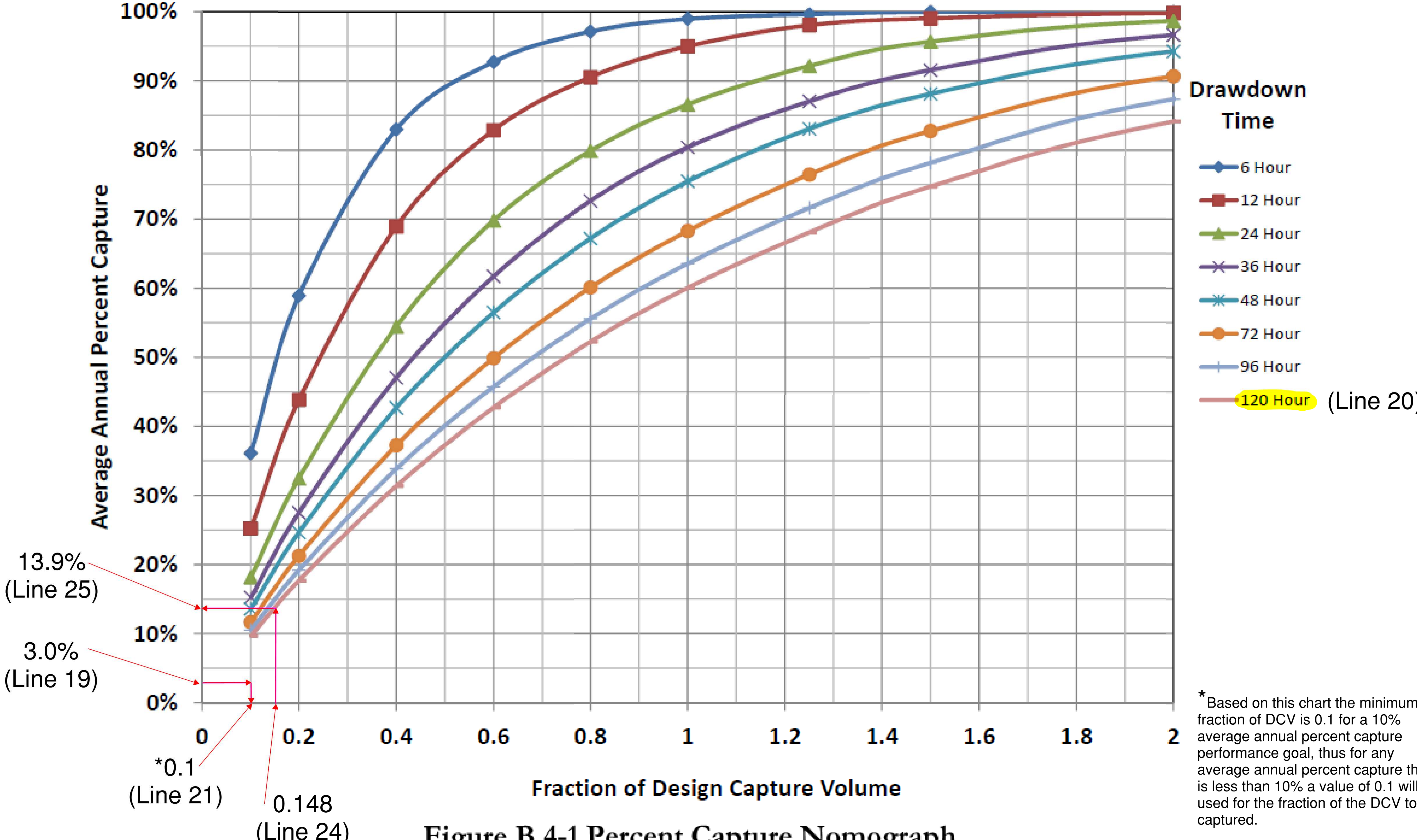


Figure B.5-5. Evapotranspiration Nomographs

BMP 108: Reference Figure for Worksheet B.5-2



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 109
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	21199.59	0.486676	0.90	0.438008	32.9%
Landscape	32701.75	0.750729	0.10	0.075	5.6%
Road	39651.97	0.910284	0.90	0.819256	61.5%
TOTAL	**93553.31**	**2.15**	**0.62**	**1.33**	**100%**

Pacific Village
DMA & BMP 109
Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			93553.31	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.62	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.615	128	78.71	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.329	14	4.60	
Low Traffic Areas			50	0.00	
Open Space		0.056	216	12.17	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			95.48	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			50782	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			303	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			1513	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0261**	

Pacific Village
DMA & BMP 109
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	93553	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.62	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3047	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	4570.4	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**1004.5**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	2285.2	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**1114.7**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0261	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**1513**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**1513**	sq-ft

Pacific Village

DMA & BMP 109

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

	Sizing Method for Volume Retention Criteria	Worksheet B.5-2	
1	Area draining to the BMP	93553.31	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.62	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	3047	cu. ft.
BMP Parameters			
5	Footprint of the BMP	1686	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	164	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	147.50	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.05	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	4.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	168.568	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.055	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.155	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	14.2	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0998	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-140	cu. ft.

BMP 109: Reference Figures for Worksheet B.5-2

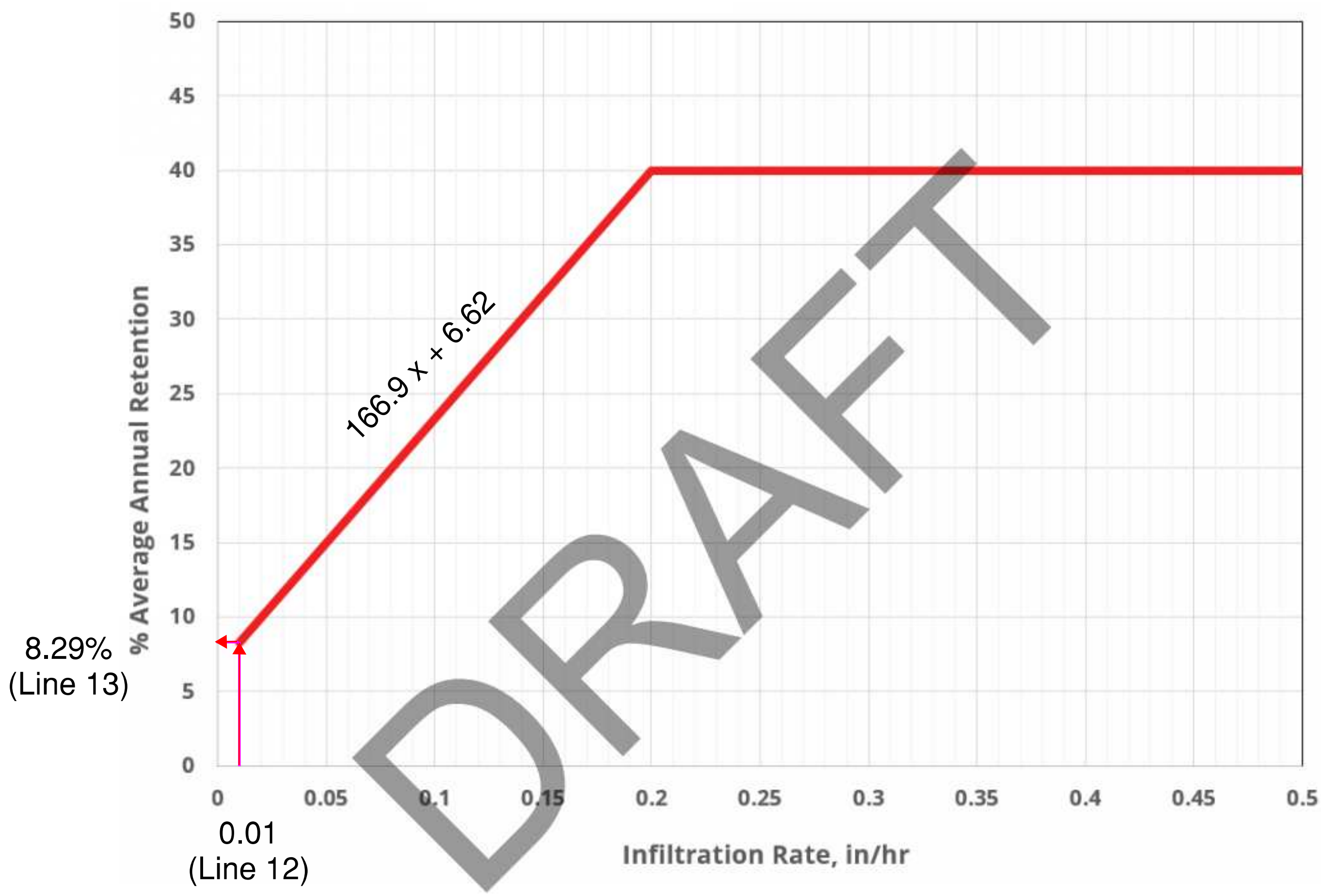


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

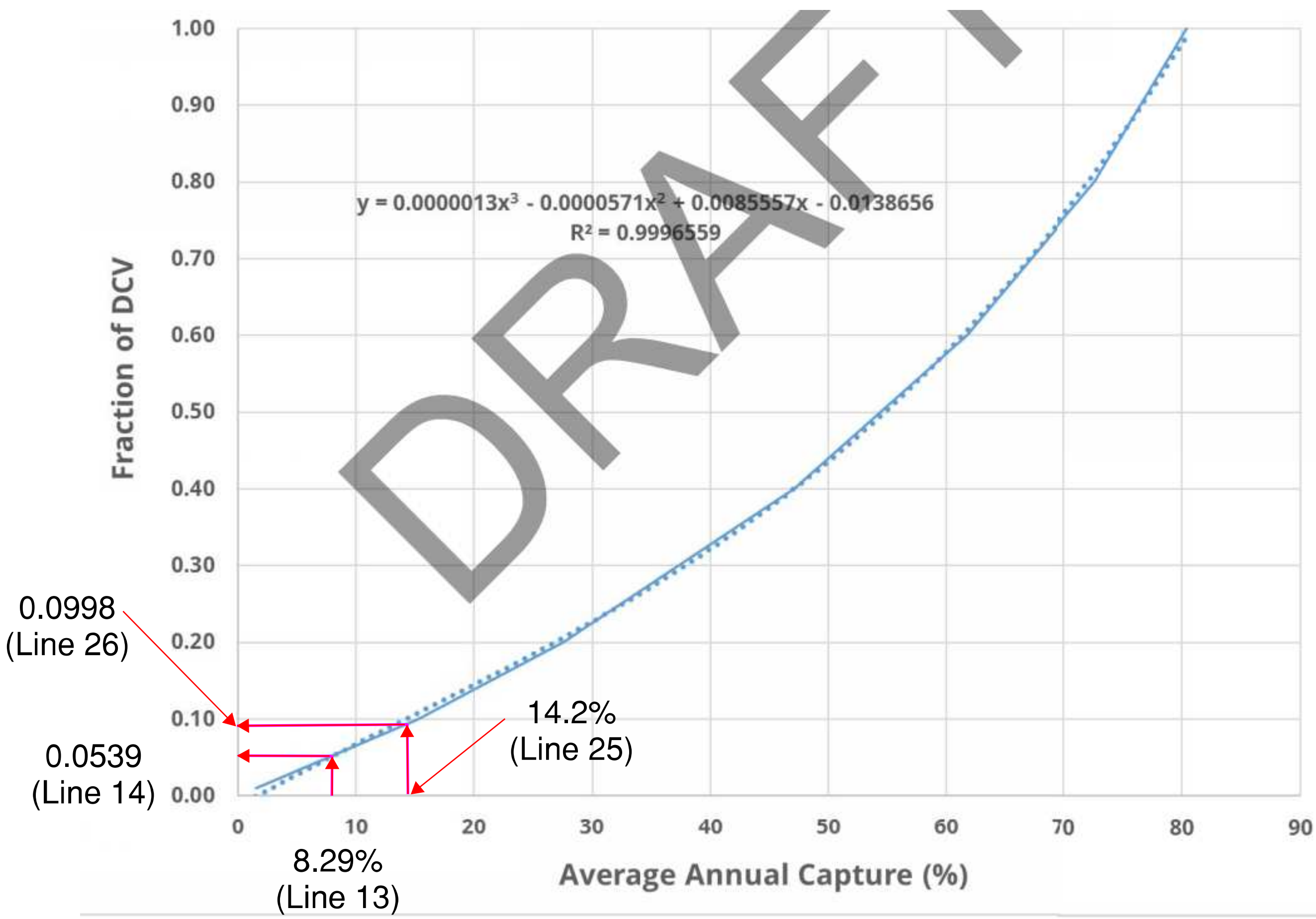


Figure B.5-3. Fraction of DCV versus Average Annual Capture

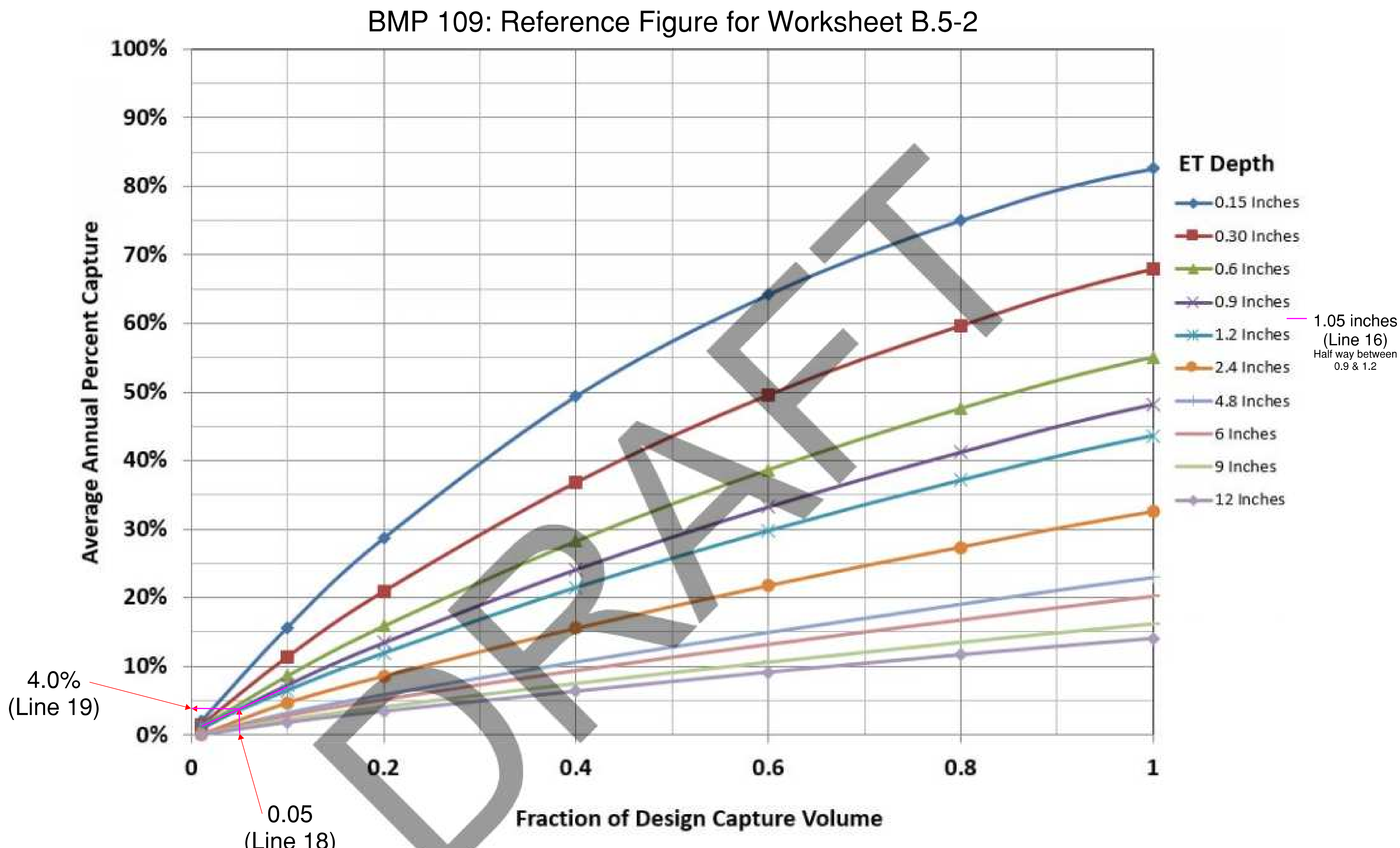
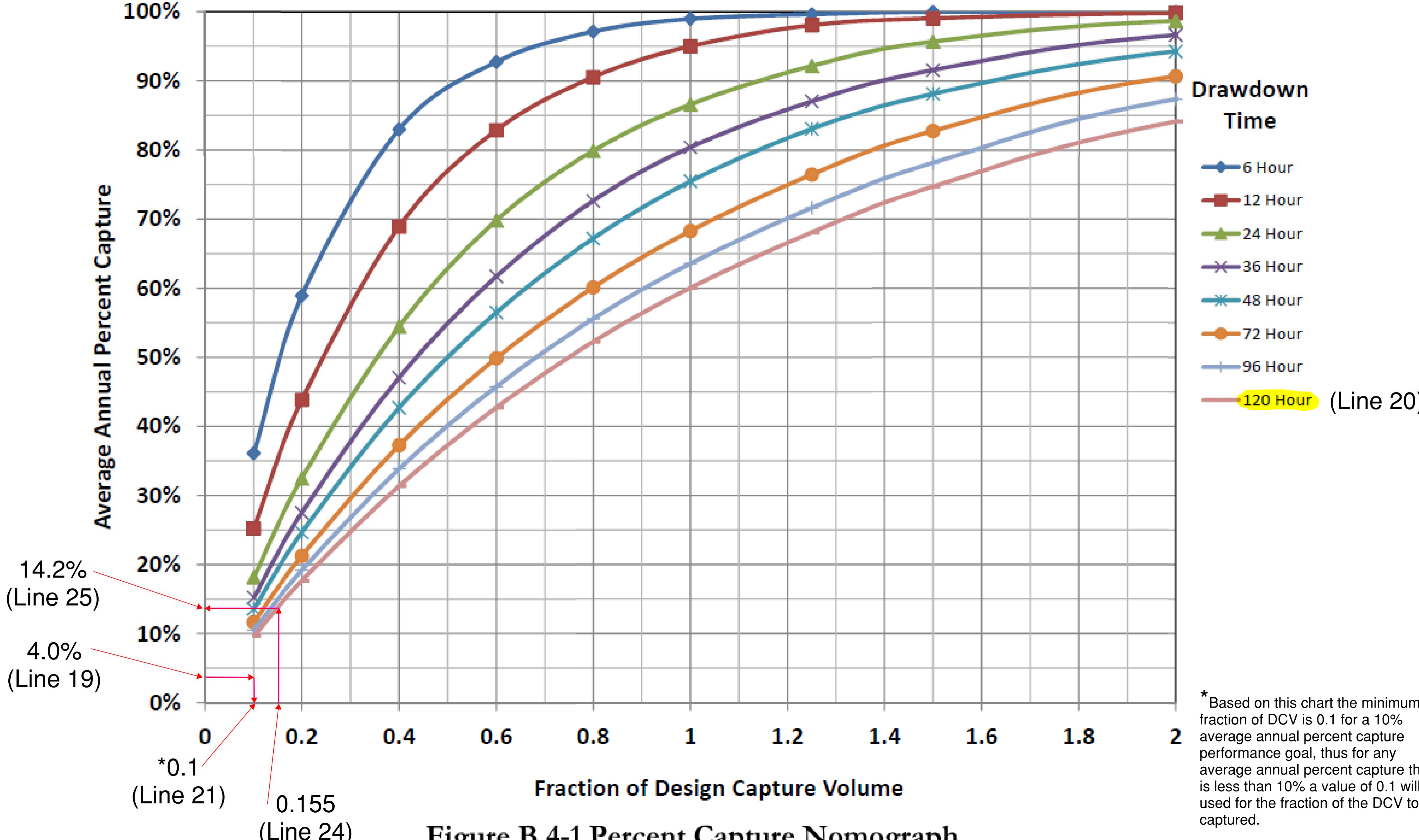


Figure B.5-5. Evapotranspiration Nomographs

BMP 109: Reference Figure for Worksheet B.5-2



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

Pacific Village
DMA & BMP 110
Calculation of Runoff Factor & Fraction of DCV

Land Use	Area (SF)	Area (ac)	C	C·A (ac)	% DCV
Roof	96358.23	2.212081	0.90	1.990873	39.6%
Landscape	116673.98	2.678466	0.10	0.268	5.3%
Road	134148.26	3.07962	0.90	2.771658	55.1%
TOTAL	**347180.47**	**7.97**	**0.63**	**5.03**	**100%**

Pacific Village

DMA & BMP 110

Worksheet B.5-3 : Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor				Worksheet B.5-3	
1	Area Draining to the BMP			347180.47	sq-ft
2	Adjusted Runoff Factor for Drainage Area (Refer to Appendix B.1 and B.2)			0.63	
3	Load to Clog (See table B.5-3 for guidance; L_C)			**2.0**	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)			**10.00**	years
Volume Weighted EMC Calculation					
Land Use		**Fraction of Total DCV**	**TSS EMC (mg/L)**	**Product**	
Single Family Residential			123	0.00	
Commercial		0.551	128	70.53	
Industrial			125	0.00	
Education			132	0.00	
Transportation			78	0.00	
Multi-family Residential			40	0.00	
Roof Runoff		0.396	14	5.54	
Low Traffic Areas			50	0.00	
Open Space		0.053	216	11.50	
Other, Specify:					
Other, Specify:					
5	Volume weighted EMC (sum of all products)			87.57	mg/L
BMP Parameters					
6	Adjustment for pretreatment measures Where: Line 6 = 0 if no pretreatment; Line 6 = 0.25 when pretreatment is included; Line 6 = 0.5 if pretreatment has an active Washington State TAPE approval rating for "pre-treatment."			**0.00**	
7	Average Annual Precipitation			10.5	inches
8	Calculate the Average Annual Runoff (Line 7 x Line 1 /12) x Line 2			191733	cu-ft/yr
9	Calculate Average Annual TSS Load (Line 8 x 62.4 x Line 5 x (1 - Line 6))/10^6			1048	lb/yr
10	Calculate BMP Footprint Needed (Line 9 x Line 4)/Line 3			5238	sq-ft
11	Calculate the Minimum Footprint Sizing Factor for Clogging [Line 10/ (Line 1 x Line 2)]			**0.0239**	

Pacific Village
DMA & BMP 110
Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria

Sizing Method for Pollutant Removal Criteria		Worksheet B.5-1	
1	Area draining to the BMP	347180	sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.63	
3	85th percentile 24 - hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	11504	cu. Ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]	12	inches
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Aggregate storage above underdrain invert (12 inches typical) - use 0 inches if the aggregate is not over the entire bottom surface area	18	inches
8	Aggregate storage below underdrain invert (3 inches minimum) - use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5.0	in/hr
Baseline Calculations			
12	Allowable routing time for sizing	6.0	hours
13	Depth filtered during storm [Line 11 x Line 12]	30	inches
14	Depth of detention storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]	24.6	inches
15	Total depth treated [Line 13 + Line 14]	54.60	inches
Option 1 - Biofilter 1.5 times the DCV			
16	Required bio-filtered volume [1.5 x Line 4]	17256.0	cu-ft
17	Required Footprint [Line 16/ Line 15] x 12	**3792.5**	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]	8628.0	cu-ft
19	Required Footprint [Line 18/ Line 14] x 12	**4208.8**	sq-ft
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-3)	0.0239	
21	Minimum BMP footprint [Line 1 x Line 2 x Line 20]	**5238**	sq-ft
22	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line27)	**5238**	sq-ft

Pacific Village

DMA & BMP 110

Worksheet B.5-2: Sizing Method for Volume Retention Criteria

	Sizing Method for Volume Retention Criteria	Worksheet B.5-2	
1	Area draining to the BMP	347180.47	sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)	0.63	
3	85th percentile 24-hour rainfall depth	0.63	inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]	11504	cu. ft.
BMP Parameters			
5	Footprint of the BMP	6261	sq. ft.
6	Media thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	21	inches
7	Media retained pore space [50% of (FC-WP)]	0.05	in/in
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area	3	inches
9	Porosity of aggregate storage	0.4	in/in
Volume Retention Requirement			
10	Measured infiltration rate in the DMA	0.02	in/hr.
11	Factor of safety	2	
12	Design infiltration rate, for biofiltration BMP sizing [Line 10/ Line 11] Note: This worksheet is not applicable if Line 12 < 0.01 in/hr.	0.01	in/hr.
13	Average annual volume reduction target (Figure B.5-2) When Line 12 ≥ 0.01 in/hr. = Minimum (40, 166.9 x Line 12 +6.62)	8.29	%
14	Fraction of DCV to be retained (Figure B.5-3) 0.0000013 x Line 133 - 0.000057 x Line 132 + 0.0086 x Line 13 - 0.014	0.0539	
15	Target volume retention [Line 14 x Line 4]	620	cu. ft.
Evapotranspiration: Average Annual Volume Retention			
16	Effective evapotranspiration depth [Line 6 x Line 7]	1.05	inches
17	Retained pore volume [(Line 16 x Line 5)/12]	547.79	cu. ft.
18	Fraction of DCV retained in pore spaces [Line 17/Line 4]	0.05	
19	Evapotranspiration average annual capture [use ET Nomographs in Figure B.5-5, Refer to Appendix B.5.4]	4.0	%
Infiltration: Average Annual Volume Retention			
20	Drawdown for infiltration storage [(Line 8 x Line 9)/Line 12]	120.00	hours
21	Equivalent DCV fraction from evapotranspiration (use Line 19 and Line 20 in Figure B.4-1; Refer to Appendix B.4.2.2)	0.1	
22	Infiltration volume storage [(Line 5 x Line 8 x Line 9)/12]	626.05	cu. ft.
23	Infiltration storage: Fraction of DCV [Line 22/Line 4]	0.054	
24	Total Equivalent Fraction of DCV [Line 21 + Line 23]	0.154	
25	Biofiltration BMP average annual capture [use Line 24 and 20 in Figure B.4-1]	14.2	%
Volume retention required from site design and other BMPs			
26	Fraction of DCV retained (Figure B.5-3) 0.0000013 x Line 25^3 - 0.000057 x Line 25^2 + 0.0086 x Line 25- 0.014	0.0998	
27	Remaining target DCV retention [(Line 14 – Line 26) x Line 4] Note: If Line 27 is equal to or smaller than 0 then the BMP meets the volume retention performance standard. If Line 27 is greater than 0, the applicant must implement site design and/or other BMPs within the DMA that will retain DCV equivalent to or greater than Line 27 to meet the volume retention performance standard	-529	cu. ft.

BMP 109: Reference Figures for Worksheet B.5-2

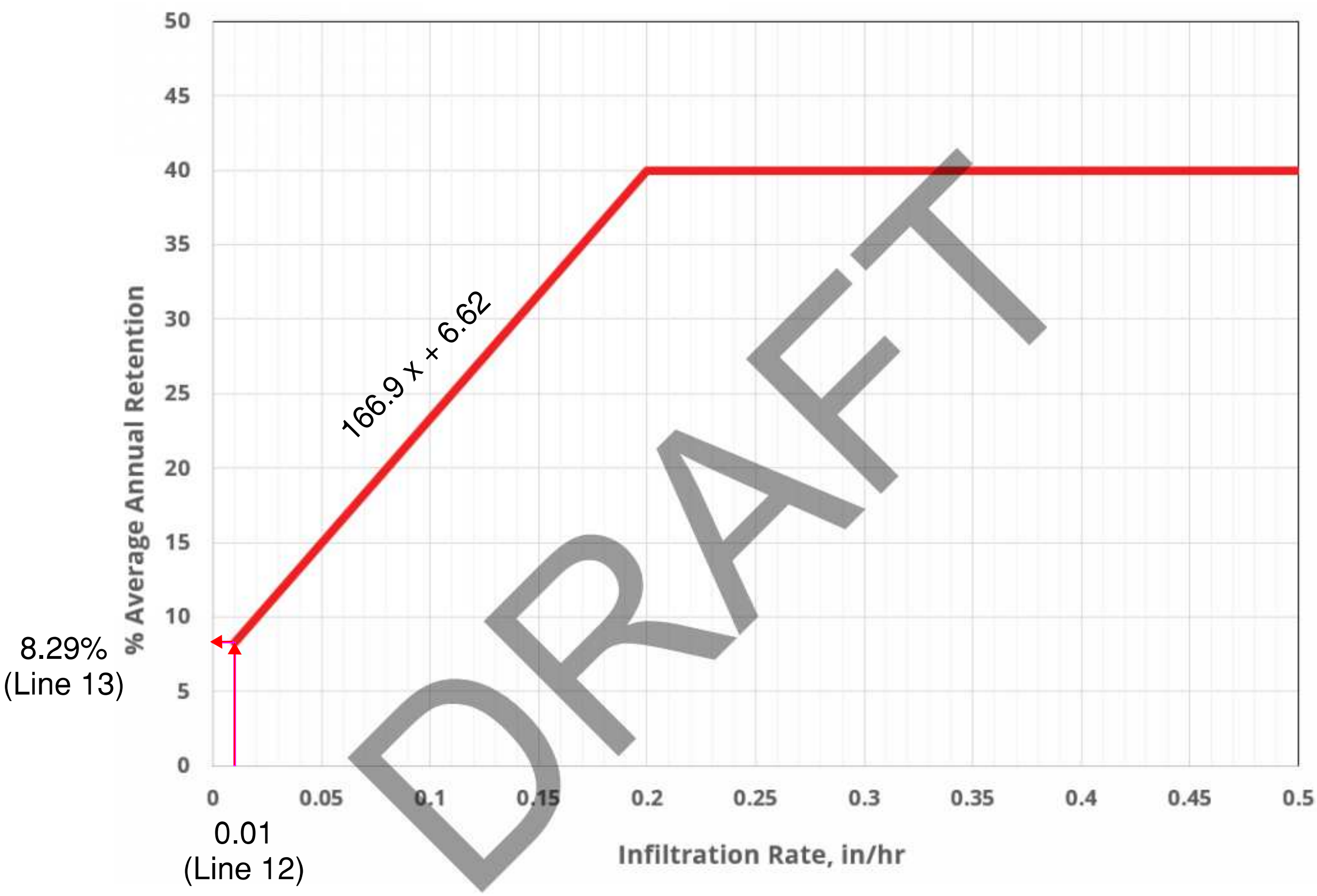


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

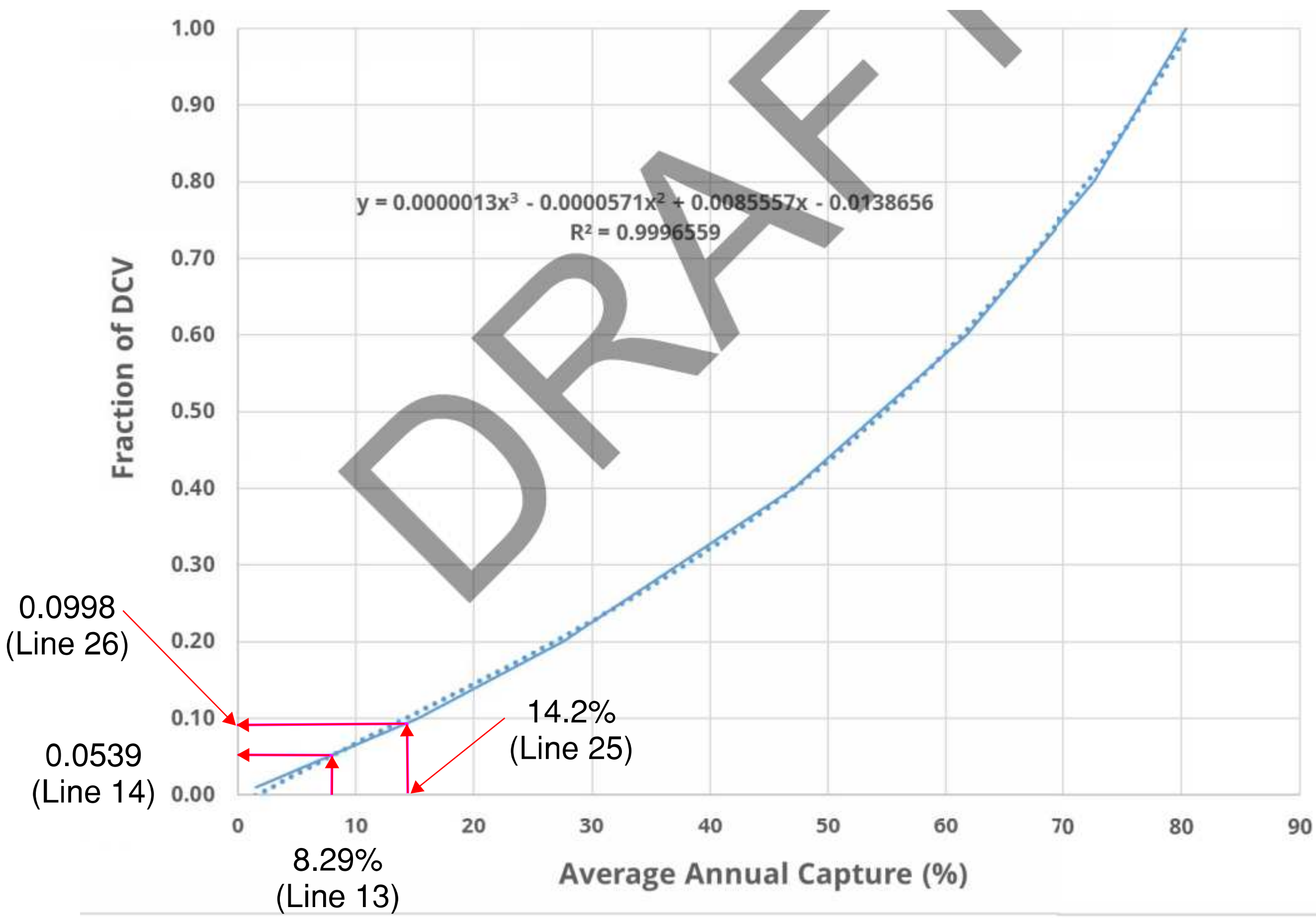


Figure B.5-3. Fraction of DCV versus Average Annual Capture

BMP 109: Reference Figure for Worksheet B.5-2

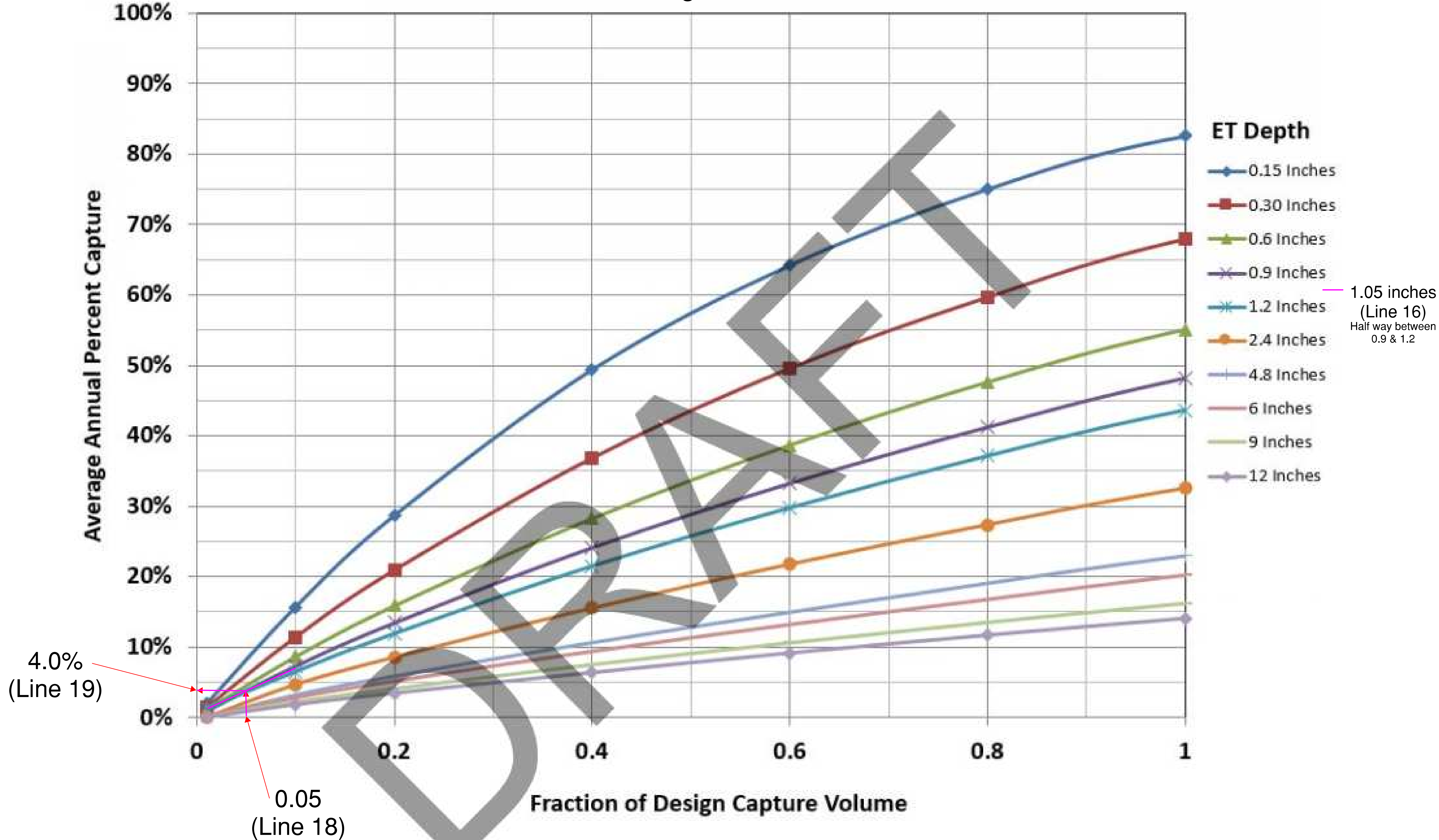
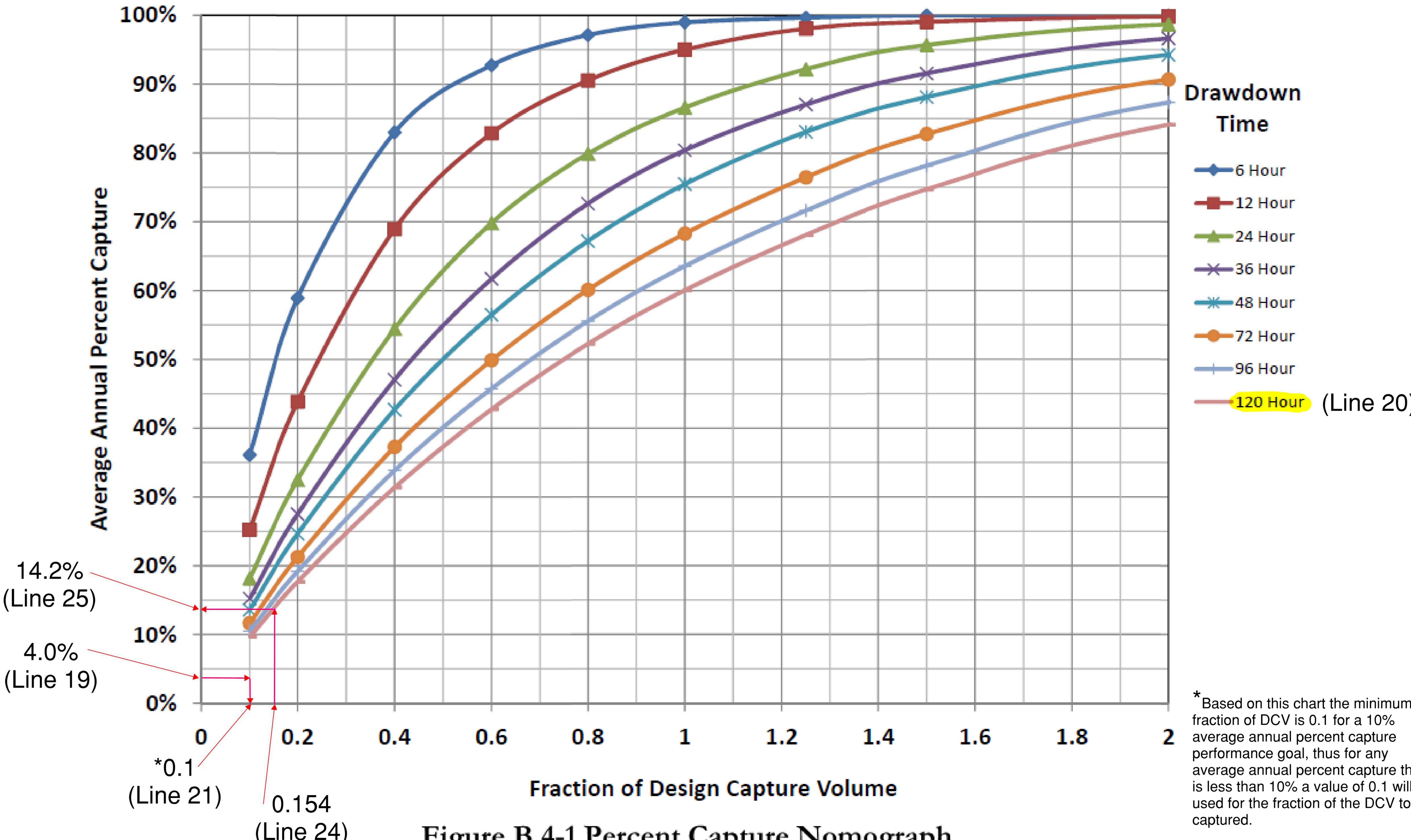


Figure B.5-5. Evapotranspiration Nomographs

BMP 109: Reference Figure for Worksheet B.5-2



*Based on this chart the minimum fraction of DCV is 0.1 for a 10% average annual percent capture performance goal, thus for any average annual percent capture that is less than 10% a value of 0.1 will be used for the fraction of the DCV to be captured.

Figure B.4-1 Percent Capture Nomograph

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

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Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 2a	Hydromodification Management Exhibit (Required)	☒ Included See Hydromodification Management Exhibit Checklist
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required; additional analyses are optional) See Section 6.2 of the BMP Design Manual.	☒ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☐ Not Performed ☒ Included ☐ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each structural BMP (Not included with this submittal) See Chapter 6 and Appendix G of the	☒ Included ☐ Submitted as separate stand-alone document
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	☐ Included ☒ Not required because BMPs will drain in less than 96 hours

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

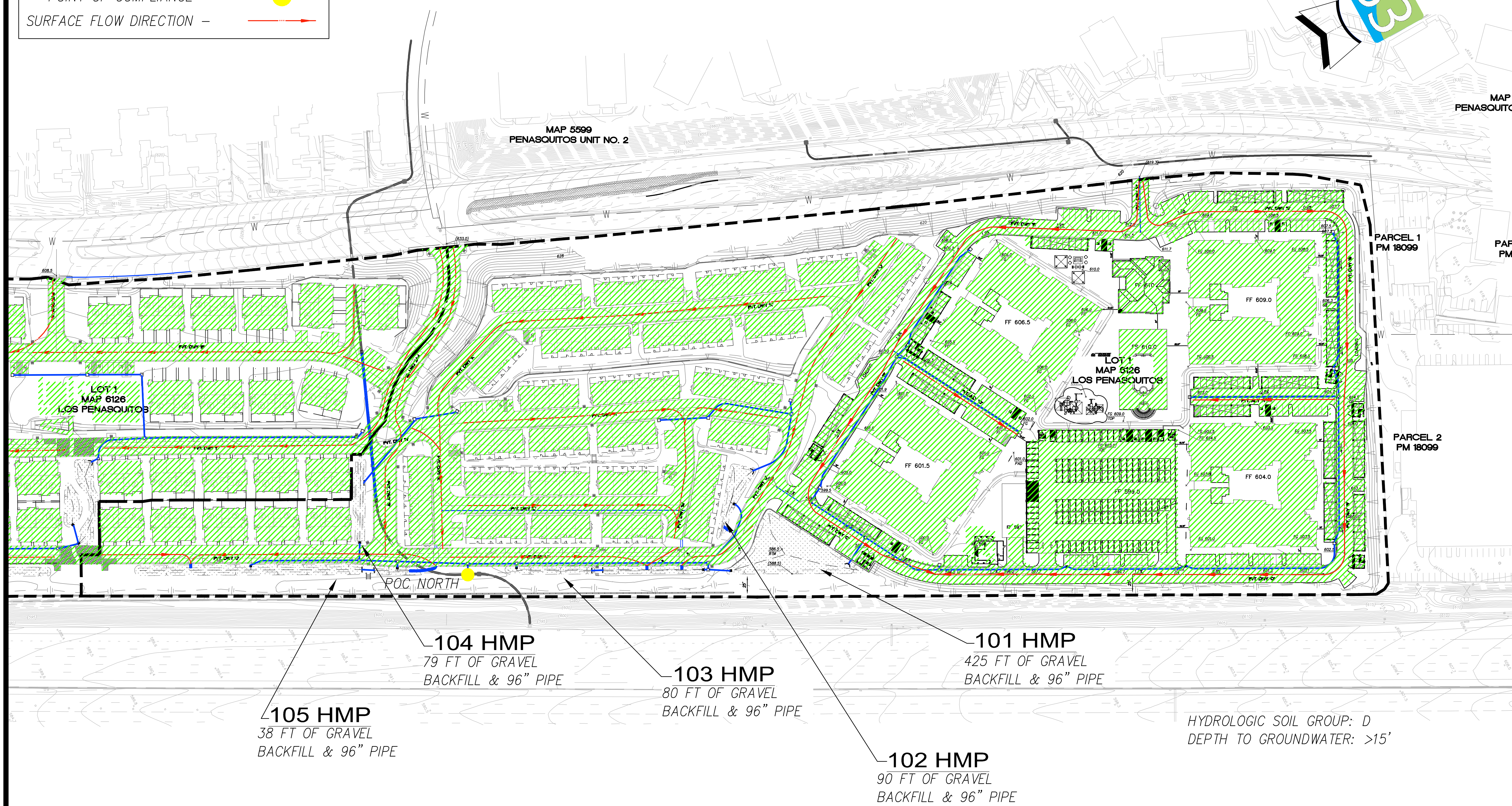
☒ Underlying hydrologic soil group
☒ Approximate depth to groundwater
☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands) N/A
☐ Critical coarse sediment yield areas to be protected N/A
☒ Existing topography
☒ Existing and proposed site drainage network and connections to drainage offsite
☒ Proposed grading
☒ Proposed impervious features
☐ Proposed design features and surface treatments used to minimize imperviousness N/A
☒ Point(s) of Compliance (POC) for Hydromodification Management
☒ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☒ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

PACIFIC VILLAGE
HYDROMODIFICATION MANAGEMENT EXHIBIT
NORTH BASIN

SCALE=1:150

LEGEND

- IMPERVIOUS AREA –
- PROPOSED BASIN LIMITS –
- STORM DRAIN SYSTEM –
- POINT OF COMPLIANCE –
- SURFACE FLOW DIRECTION –



HYDROLOGIC SOIL GROUP: D
DEPTH TO GROUNDWATER: >15'

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PACIFIC VILLAGE
HYDROMODIFICATION MANAGEMENT EXHIBIT
SOUTH BASIN

SCALE=1:150

LEGEND

IMPERVIOUS AREA –
PROPOSED BASIN LIMITS –
STORM DRAIN SYSTEM –
POINT OF COMPLIANCE –
SURFACE FLOW DIRECTION –

HYDROLOGIC SOIL GROUP: D
DEPTH TO GROUNDWATER: >15'

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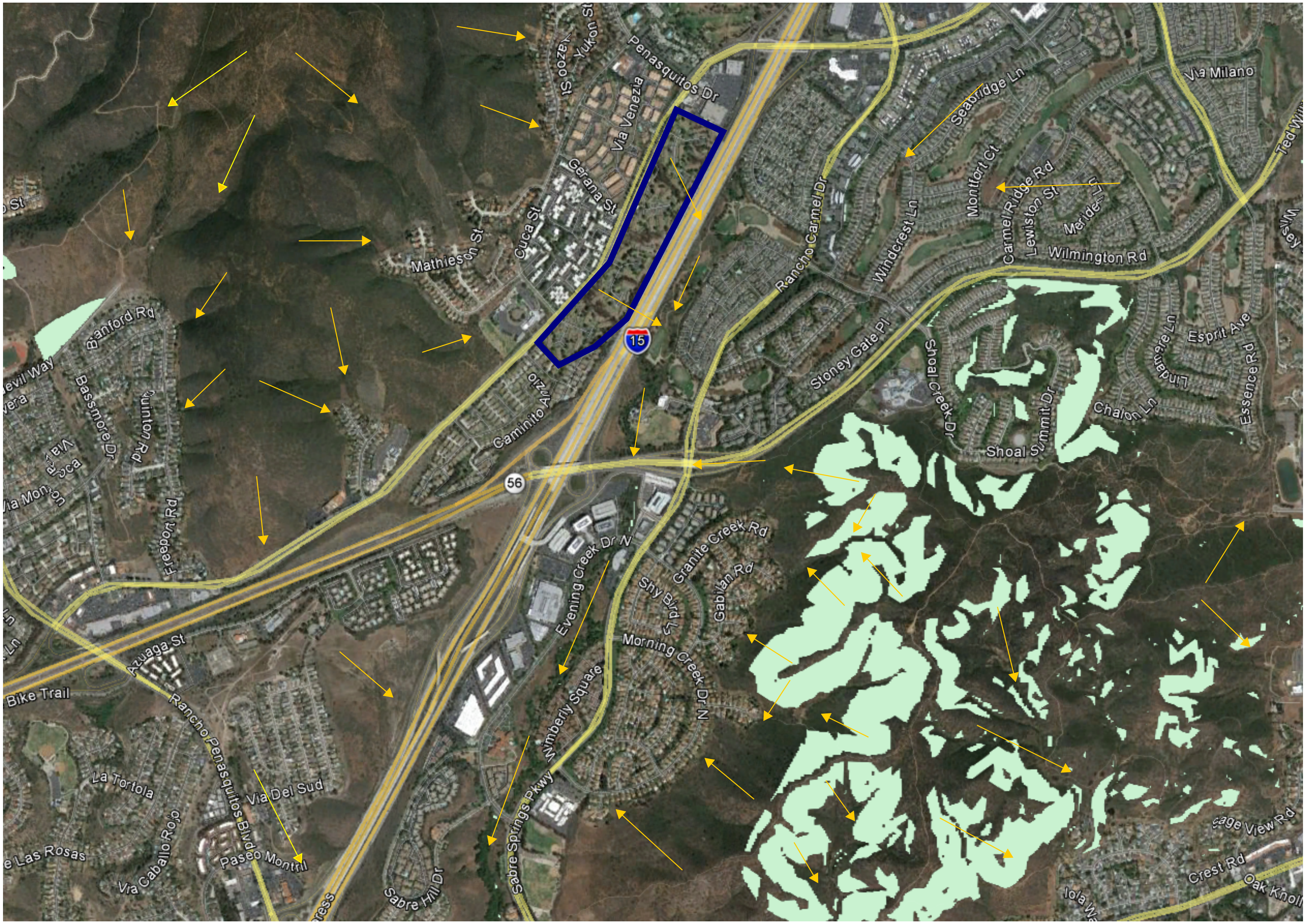
PACIFIC VILLAGE - WMMA CRITICAL COARSE SEDIMENT YEILD AREA MAP



CRITICAL COARSE SEDIMENT YEILD AREAS

PROJECT BOUNDARY

SURFACE FLOW DIRECTION

HYDROMODIFICATION SCREENING
FOR
PACIFIC VILLAGE

(I.O. No. 24006477, PTS No. 470158)

September 19, 2016

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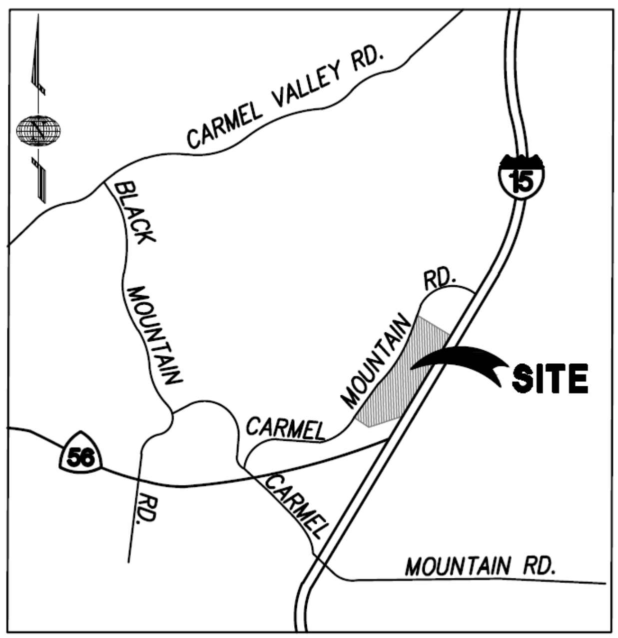
FOR REVIEW ONLY

-TABLE OF CONTENTS -

APPENDICES

INTRODUCTION

The City of San Diego's January 2016 Edition, *Storm Water Standards,* outline low flow thresholds for hydromodification analyses. The thresholds are based on a percentage of the pre-project 2-year flow (Q_2), i.e., $0.1Q_2$ (low flow threshold and high susceptibility to erosion), $0.3Q_2$ (medium flow threshold and medium susceptibility to erosion), or $0.5Q_2$ (high flow threshold and low susceptibility to erosion). A flow threshold of $0.1Q_2$ represents a natural downstream receiving conveyance system with a high susceptibility to bed and/or bank erosion. This is the default value used for hydromodification analyses and will result in the most conservative (largest) on-site facility sizing. A flow threshold of $0.3Q_2$ or $0.5Q_2$ represents downstream receiving conveyance systems with a medium or low susceptibility to erosion, respectively. In order to qualify for a medium or low erosion susceptibility rating, a project must perform a channel screening analysis based on the March 2010, *Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility,* developed by the Southern California Coastal Water Research Project (SCCWRP). The SCCWRP results are compared with the critical shear stress calculator results from the County of San Diego's Critical Flow Calculator spreadsheet to establish the appropriate erosion susceptibility threshold of low, medium, or high.



Vicinity Map

This report provides a hydromodification screening analysis for the Pacific Village project (Tentative Map No. 1669785) located in the Rancho Penasquitos community of the city of San Diego (see the Vicinity Map). The site is bounded by Carmel Mountain Road to the west and Interstate 15 to the east. The site is on 41 acres and currently contains single-story, multi-dwelling residential homes. The project will demolish the existing development and replace it with 99 cluster homes, 102 triplexes, 128 row townhomes and 240 apartments. The project is being designed by Latitude 33.

Under pre-project conditions, storm runoff generally flows to the southeast within two major drainage basins. An east-west ridge aligned generally through the middle of the site divides the project into northern and southern drainage basins. Each basin contains an existing 36-inch storm drain that begins beyond the project limits to the west and captures on-site runoff. The flows are ultimately conveyed east under Interstate 15 to Chicarita Creek, which flows south to Los Penasquitos Creek.

Under post-project conditions, storm water run-off from the project site will be treated by on-site biofiltration basins and will follow a similar flow pattern as existing conditions utilizing the two existing 36-inch storm drains. The project has been designed to maintain the overall drainage areas tributary to the existing storm drains.

The SCCWRP screening tool requires both office and field work to establish the vertical and lateral susceptibility of a natural downstream receiving channel to erosion. The vertical and lateral assessments are performed independently of each other although the lateral results can be affected by the vertical rating. A screening analysis was performed to assess the low flow threshold for the project's points of compliance, which are the first locations downstream of the site containing a natural drainage course with the potential for erosion. In this case, there is a point of compliance associated with each of the two major drainage basins. The northerly drainage basin flow is conveyed by a storm drain system that crosses under Interstate 15, and then outlets into a natural channel on the east side of freeway (see the Study Area Exhibit in Appendix A and Figure 1). The outlet into the natural channel is the northerly point of compliance. The southerly drainage basin flow is conveyed to a natural channel immediately below the southerly 36-inch storm drain outlet (see Figure 7). This natural channel is just west of Interstate 15. The outlet into the natural channel is the southerly point of compliance.

The initial step in performing the SCCWRP screening analysis is to establish the domain of analysis and the study reaches within the domain. This is followed by office and field components of the screening tool along with the associated analyses and results. The following sections cover these procedures in sequence.

DOMAIN OF ANALYSIS

SCCWRP defines an upstream and downstream domain of analysis, which establish the study limits. The County of San Diego's HMP specifies the downstream domain of analysis based on the SCCWRP criteria. The HMP indicates that the downstream domain is the first point where one of these is reached:

- at least one reach downstream of the first grade control point (or to the second grade control)
- tidal backwater/lentic waterbody
- equal order tributary
- accumulation of 50 percent drainage area for stream systems or 100 percent drainage area for urban conveyance systems (storm drains, hardened channels, etc.)

The upstream limit is defined as:

- proceed upstream for 20 channel top widths or to the first grade control point, whichever comes first. Identify hard points that can check headward migration and evidence of active headcutting.

SCCWRP defines the maximum spatial unit, or reach (a reach is circa 20 channel widths), for assigning a susceptibility rating within the domain of analysis to be 200 meters (656 feet). If the domain of analysis is greater than 200 meters, the study area should be subdivided into smaller reaches of less than 200 meters for analysis. Most of the units in the HMP's SCCWRP analysis are metric. Metric units are used in this report only where given so in the HMP. Otherwise English units are used.

Downstream Domain of Analysis

The downstream domain of analysis location for the study area has been determined by assessing and comparing the four bullet items above. As discussed in the Introduction, the project runoff will be conveyed by a northerly storm drain system to a natural channel east of Interstate 15, and by a southerly storm drain system to a natural channel west of Interstate 15. The storm drain outlets into the natural drainage channels are the two points of compliance (POC) for the project. A downstream domain of analysis location is selected below each POC. The northerly POC is labeled POC 1 and the southerly POC is labeled POC 2.

Per the first bullet item, the first permanent grade control below each POC was located. Runoff below POC 1 continues for 42 feet before entering an HDPE culvert under an earthen access road (see Figure 4). The culvert is a grade control because it will maintain the grade of the upstream channel bed. Runoff below POC 2 continues for 124 feet before entering a Caltrans reinforced concrete box culvert under Interstate 15 (see Figure 10). The reinforced concrete box culvert is also a grade control. Therefore, the first grade control below the northerly and southerly POCs are at the HDPE culvert and box culvert, respectively.

The second bullet item is the tidal backwater or lentic (standing or still water such as ponds, pools, marshes, lakes, etc.) waterbody location. Storm runoff from both POCs is conveyed to Chicarita Creek, which flows in a southerly direction on the east side of Interstate 15. Chicarita Creek confluences with Los Penasquitos Creek on the south side of Poway Road approximately 1.5 miles south of the site. Los Penasquitos Creek then flows west over 8 miles to Los Penasquitos Lagoon and the Pacific Ocean. The nearest lentic waterbody downstream of the site occurs where Chicarita Creek confluences with Los Penasquitos Lagoon. A small reservoir is located in Chicarita Creek at the confluence. This lentic waterbody is downstream of the each POC's permanent grade control, so the second bullet item will not govern over the first bullet item in establishing the downstream domain of analysis location.

The third bullet item is met when the natural drainage course below a POC confluences with a stream with an equal order or larger tributary area. As mentioned above, the runoff from each POC enters Chicarita Creek. The Chicarita Creek headwaters initiate approximately 1 mile north of the site. Therefore, the Chicarita Creek tributary area is larger than the tributary area for the natural channels below each POC. Based on this, the confluence with Chicarita Creek meets the third bullet item criteria for both POCs. Chicarita Creek is further downstream from each POC than their grade controls. Therefore, the third bullet item will not govern over the first bullet item in establishing the downstream domain of analysis location because it is further away from each POC.

The fourth bullet item was assessed by reviewing the natural drainage channels below each POC to determine where an additional 100 percent drainage area is accumulated. The 100 percent rather than 50 percent criteria applies because the drainage channel below the POC is an urban conveyance system. The grade controls are so close to each POC that a 100 percent drainage area will not be accumulated before each grade control. In fact, a 100 percent drainage area will not be accumulated until the confluence with Chicarita Creek. Therefore, the fourth bullet item will not govern over the first bullet item in establishing the downstream domain of analysis location because it is further away from each POC.

From the above assessment, the downstream domain of analysis location for the northerly and southerly POC is based on the first bullet item, i.e., the permanent grade control criteria. This is the location closest to each POC from the four bullet criteria.

Upstream Domain of Analysis
The storm drain outlets at the northerly and southerly POCs discharge into the uppermost end of their natural drainage channels. Since the natural drainage channels do not extend upstream of the outlets, the upstream domain of analysis location for each POC is at the POC.

Study Reaches within Domain of Analysis
After the upstream and downstream domain of analysis locations are established for each POC, the study reaches are identified (see the Study Area Exhibit in Appendix A). One or more study reaches can occur below each POC. The following describes the study reaches associated with each POC.

Reach 1 is the study reach immediately below northerly POC 1. Reach 1 extends over 42 feet from the upstream domain of analysis location at the POC 1 storm drain outlet to the permanent grade control at the HDPE culvert. Since the downstream domain of analysis for POC 1 is based on the first bullet item criteria, a second study reach, Reach 2, needs to be analyzed below the grade control. Per the SCCWRP criteria, Reach 2 is based on 20 channel top widths below the grade control. The channel top width is estimated at 60 feet, so 20 channel top widths is 1,200 feet. In this case, the Chicarita Creek confluence occurs before 1,200 feet, so the confluence establishes the lower end of Reach 2 rather than 20 channel top widths. Therefore, Reach 2 extends over 183 feet from the HDPE culvert to the confluence with Chicarita Creek.

Reach 3 is the study reach immediately below southerly POC 2. Reach 3 extends over 124 feet from the upstream domain of analysis location at the POC 2 storm drain outlet to the permanent grade control at the Caltrans box culvert. The channel top width along Reach 3 is approximately 15 feet, so 20 channel top widths is 300 feet. The non-erodible box culvert is over 300 feet long, so an additional study reach is does not need to be analyzed below the box culvert.

INITIAL DESKTOP ANALYSIS

After the domain of analysis is established, SCCWRP requires an "initial desktop analysis" that involves office work. The initial desktop analysis establishes the watershed area, mean annual precipitation, valley slope, and valley width. These terms are defined in Form 1, which is included in Appendix A. SCCWRP recommends the use of National Elevation Data (NED) to determine the watershed area, valley slope, and valley width. The NED data is similar to USGS quadrangle mapping.

The watershed areas associated with POC 1 and POC 2 were delineated from USGS quadrangle mapping and refined using the off-site storm drain system layout. The drainage basin boundary within the middle of the project site reflects Latitude 33's proposed condition hydrology study. The Watershed Exhibit in Appendix A includes the watershed tributary to the POC 1 and 2 study reaches. The watershed area tributary to Reach 2 was used for Reach 1 since these areas are similar in size. Using the slightly larger area for Reach 1 will yield slightly conservative results, i.e., more potential for erosion.

The mean annual precipitation was obtained from the rain gages closest to the site. These are the Western Regional Climate Center's Hodges Dam gage and their Poway Valley gage (see Appendix A). The average annual rainfall measured at the Hodges Dam gage for the period of record from 1940 to 1962 is 13.94 inches and at Poway Valley from 1893 to 2016 is 13.24 inches. These values are almost equivalent. The 13.94 inches was chosen for the analyses because it is slightly higher so will predict greater erosion susceptibility.

The valley slope and valley width were obtained from SANGIS' 2014 2-foot contour interval topographic mapping. NED data was not used because it is not very accurate for these parameters. The valley slope is the longitudinal slope of the channel bed along the flow line, so it is determined by dividing the elevation difference within a study reach by the length of the flow line. The valley width is the valley bottom width dictated by breaks in the hillslope. The valley slope and valley width within each reach along with the area are included in Table 1.

Reach	Tributary Drainage Area, sq. mi. (acres)	Valley Slope, m/m	Valley Width, m
1	0.163 (104.27)	0.0152	3.05
2	0.163 (104.27)	0.0311	4.88
3	0.482 (308.59)	0.0323	1.83

Table 1. Summary of Drainage Area, Valley Slope, and Valley Width

The above described values were input to a spreadsheet to calculate the simulated peak flow, screening index, and valley width index outlined in Form 1. The input data and results are tabulated in Appendix A. This completes the initial desktop analysis.

FIELD SCREENING

After the initial desktop analysis is complete, a field assessment must be performed. The field assessment is used to establish a natural channel's vertical and lateral susceptibility to erosion. SCCWRP states that although they are admittedly linked, vertical and lateral susceptibility are assessed separately for several reasons. First, vertical and lateral responses are primarily controlled by different types of resistance, which, when assessed separately, may improve ease of use and lead to increased repeatability compared to an integrated, cross-dimensional assessment. Second, the mechanistic differences between vertical and lateral responses point to different modeling tools and potentially different management strategies. Having separate screening ratings may better direct users and managers to the most appropriate tools for subsequent analyses.

The field screening tool uses combinations of decision trees and checklists. Decision trees are typically used when a question can be answered fairly definitively and/or quantitatively (e.g., $d_{50} < 16$ mm). Checklists are used where answers are relatively qualitative (e.g., the condition of a grade control). Low, medium, high, and very high ratings are applied separately to the vertical and lateral analyses. When the vertical and lateral analyses return divergent values, the most conservative value shall be selected as the flow threshold for the hydromodification analyses.

Vertical Stability

The purpose of the vertical stability decision tree (Figure 6-4 in the County of San Diego HMP) is to assess the state of the channel bed with a particular focus on the risk of incision (i.e., down cutting). The decision tree is included in Figure 14. The first step is to assess the channel bed resistance. There are three categories defined as follows:

1. Labile Bed – sand-dominated bed, little resistant substrate.

2. Transitional/Intermediate Bed – bed typically characterized by gravel/small cobble, Intermediate level of resistance of the substrate and uncertain potential for armoring.

3. Threshold Bed (Coarse/Armored Bed) – armored with large cobbles or larger bed material or highly-resistant bed substrate (i.e., bedrock).

Figures 11, 12, and 13 contain photographs of the typical channel material within Reach 1, 2, and 3, respectively. A gravelometer is included in each figure for reference. Each square on the gravelometer indicates grain size in millimeters (the squares range from 2 mm to 180 mm). Based on Figures 11 through 13, the channel photographs in the other figures, mature vegetation in some areas, and a site investigation, the bed material and resistance is generally within the transitional/intermediate bed to threshold bed categories.

In addition to the material size and compaction, there are several factors that establish the erodibility of a channel such as the flow rate (i.e., size of the tributary area), grade controls, channel slope, vegetative cover, channel planform, etc. The Introduction of the SCCWRP Hydromodification Screening Tools: Field Manual identifies several of these factors. When multiple factors influence erodibility, it is appropriate to perform the more detailed SCCWRP analysis, which is to analyze a channel according to SCCWRP's transitional/intermediate bed procedure. This requires the most rigorous steps and will generate appropriate results given the range of factors that define erodibility. The transitional/intermediate bed procedure takes into account that bed material may fall within the labile category (the bed material size is used in SCCWRP's Form 3 Figure 4), but other factors may trend towards a less erodible condition. Dr. Eric Stein from SCCWRP, who co-authored the Hydromodification Screening Tools: Field Manual in the Final Hydromodification Management Plan (HMP), indicated that it would be appropriate to analyze channels with multiple factors that impact erodibility using the transitional/intermediate bed procedure. Consequently, this procedure was used to produce more accurate results.

Transitional/intermediate beds cover a wide susceptibility/potential response range and need to be assessed in greater detail to develop a weight of evidence for the appropriate screening rating. The three primary risk factors used to assess vertical susceptibility for channels with transitional/intermediate bed materials are:

1. Armoring potential – three states (Checklist 1)

2. Grade control – three states (Checklist 2)

3. Proximity to regionally-calibrated incision/braiding threshold (Mobility Index Threshold – Probability Diagram)

These three risk factors are assessed using checklists and a diagram (see Appendix B), and the results of each are combined to provide a final vertical susceptibility rating for the intermediate/transitional bed-material group. Each checklist and diagram contains a Category A, B, or C rating. Category A is the most resistant to vertical changes while Category C is the most susceptible.

Checklist 1 determines armoring potential of the channel bed. The channel beds along Reach 1, 2 and 3 are within Category B, which represents intermediate bed material of unknown resistance or unknown armoring potential. The soil was probed and penetration was relatively difficult through the underlying layer, but the resistance is unknown without a soils investigation.

Checklist 2 determines grade control characteristics of the channel bed. This is reliant on the spacing of the grade controls. The three categories for Checklist 2 are related to a grade control spacing of $2/S_v$ and $4/S_v$, where S_v is the valley slope from Appendix A. The $2/S_v$ and $4/S_v$ results are in meters, so a factor is applied to convert to feet. A reach is in Category A if it has a grade control spacing of less than $2/S_v$ and in Category B if its spacing is between $2/S_v$ and $4/S_v$. The $2/S_v$ values for Reach 1, 2, and 3 are 433, 211, and 203 feet, respectively. In comparison, the lengths of the three reaches are 42, 183, and 124 feet, respectively. Since the lengths of Reach 1, 2, and 3, are less than their $2/S_v$ values, all three reaches are within Category A on Checklist 2.

The Screening Index Threshold is a probability diagram that depicts the risk of incising or braiding based on the potential stream power of the valley relative to the median particle diameter. The threshold is based on regional data from Dr. Howard Chang of Chang Consultants and others. The probability diagram is based on d_{50} as well as the screening index value determined in the initial desktop analysis (see Appendix A). The d_{50} value is the particle size in which 50 percent of the particles are smaller and 50 percent are larger. The pebble count results for Reach 1, 2, and 3 are included in Appendix B. The results show a d_{50} of 8, 16, and 32 millimeters, respectively. The screening index for Reach 1, 2, and 3 are tabulated in Appendix A. Plotting the d_{50} and screening index values on the Mobility Index Threshold diagram shows all three reaches have a less than 50 percent probability of incising or braiding, which falls within Category A.

The overall vertical rating is determined from the Checklist 1, Checklist 2, and Screening Index Threshold results. The scoring is based on the following values:

Category A = 3, Category B = 6, Category C = 9

The vertical rating score for each reach is based on these values and the equation (the equation values are the same for Reach 1, 2, and 3):

$$\begin{aligned}\text{Vertical Rating} &= [(\text{armoring} \times \text{grade control})^{1/2} \times \text{screening index score}]^{1/2} \\ &= [(6 \times 3)^{1/2} \times 3]^{1/2} \\ &= 3.6\end{aligned}$$

Since the vertical rating is less than 4.5, Reach 1 has a low threshold for vertical susceptibility.

Lateral Stability

The purpose of the lateral decision tree (Figure 6-5 from County of San Diego HMP is included in Figure 15) is to assess the state of the channel banks with a focus on the risk of widening. Channels can widen from either bank failure or through fluvial processes such as chute cutoffs, avulsions, and braiding. Widening through fluvial avulsions/active braiding is a relatively straightforward observation. If braiding is not already occurring, the next logical step is to assess the condition of the banks. Banks fail through a variety of mechanisms; however, one of the most important distinctions is whether they fail in mass (as many particles) or by fluvial detachment of individual particles. Although much research is dedicated to the combined effects of weakening, fluvial erosion, and mass failure, SCCWRP found it valuable to segregate bank types based on the inference of the dominant failure mechanism (as the management approach may vary based on the dominant failure mechanism). A decision tree (Form 4 in Appendix B) is used in conducting the lateral susceptibility assessment. Definitions and photographic examples are also provided below for terms used in the lateral susceptibility assessment.

The first step in the decision tree is to determine if lateral adjustments are occurring. The adjustments can take the form of extensive mass wasting (greater than 50 percent of the banks are exhibiting planar, slab, or rotational failures and/or scalloping, undermining, and/or tension cracks). The adjustments can also involve extensive fluvial erosion (significant and frequent bank cuts on over 50 percent of the banks). Neither mass wasting nor extensive fluvial erosion was evident within Reach 1, 2, or 3 during a field investigation (see Figures 2, 3, 5, 6, 8, and 9).

The next step in the Form 4 decision tree is to assess the consolidation of the bank material. The banks in Reach 1, 2, and 3 are moderate to well-consolidated. This determination was made because the ground surface was difficult to penetrate with a probe. In addition, the banks showed no evidence of crumbling, were composed of relatively well-packed particles, and supported mature vegetation.

Form 6 (see Appendix B) is used to assess the probability of mass wasting. Form 6 identifies a 10, 50, and 90 percent probability based on the bank angle and bank height. From the site investigation and SANGIS' 2014 2-foot contour interval topographic mapping, the average bank angle in each reach is 2:1 (26 degrees) or flatter. Form 6 shows that the probably of mass wasting and bank failure has less than 10 percent risk for a 26 degree bank angle or less regardless of the bank height.

The final two steps in the Form 4 decision tree are based on the braiding risk determined from the vertical rating as well as the Valley Width Index (VWI) calculated in Appendix A. If the vertical rating is high, the braiding risk is considered to be greater than 50 percent. Excessive braiding can lead to lateral bank failure. For Reach 1, 2, and 3 the vertical rating is low, so the braiding risk is less than 50 percent. Furthermore, a VWI greater than 2 represents channels unconfined by bedrock or hillslope and, hence, subject to lateral migration. The VWI calculation in the spreadsheet in Appendix A shows that the VWI values for Reach 1, 2, and 3 are less than 2.

From the above steps, the lateral susceptibility rating is low for Reach 1, 2, and 3 (colored circles are included on the Form 4: Lateral Susceptibility Field Sheet decision tree in Appendix B showing the decision path).

CONCLUSION

The SCCWRP channel screening tools were used to assess the downstream channel susceptibility for the Pacific Village redevelopment project being designed by Latitude 33. The project runoff will be collected, treated, and then conveyed by storm drain systems that discharge at two locations into unnamed natural drainage channels east of the site. A downstream channel assessment for POC 1 and POC 2 at the beginning of the natural channels was performed based on office analyses and field work. The results indicate a low threshold for vertical and lateral susceptibility for the entire study area.

The HMP requires that these results be compared with the critical flow calculator results outlined in the County of San Diego HMP. The critical flow calculator results are included in Appendix B for Reach 1, 2, and 3 using the spreadsheet provided by the County. The channel dimensions were estimated from the topographic mapping. Based on these values, the critical flow results returned a low threshold. Therefore, the SCCWRP analyses and critical flow calculator demonstrate that the project can be designed assuming a low susceptibility to erosion, i.e., 0.5Q2.

Figure 1. Caltrans Culvert Outlet at POC 1 (Headwall Slightly Visible in Center)

Figure 2. Looking Downstream at Reach 1 from Upper End near POC 1

Figure 3. Looking Upstream at Reach 1 from Lower End at Grade Control

Figure 4. HDPE Pipe and Access Road Grade Control between Reach 1 and 2

Figure 5. Looking Downstream at Reach 2 from Upper End at Grade Control

Figure 6. Looking Upstream at Reach 2 from Lower End (Chicarita Creek at Bottom)

Figure 7. 36-inch RCP Outlet at POC 3

Figure 8. Looking Downstream at Reach 3 from Upper End at POC 3

Figure 9. Looking Upstream at Reach 3 from Lower End

Figure 10. Caltrans Box Culvert at Lower End of Reach 3

Figure 11. Gravelometer along Reach 1

Figure 12. Gravelometer along Reach 2

Figure 13. Gravelometer along Reach 3

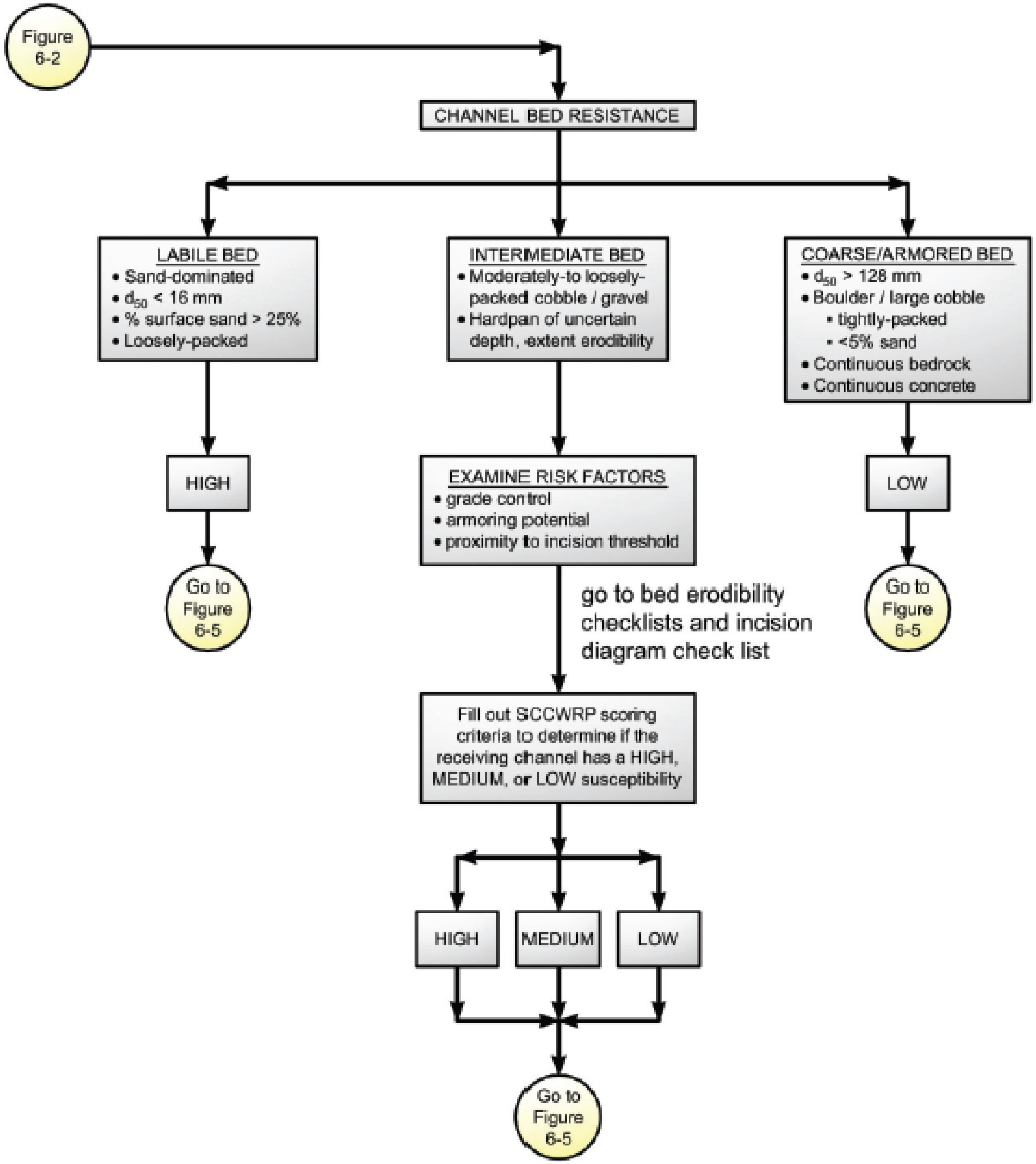


Figure 6-4. SCCWRP Vertical Susceptibility

Figure 14. SCCWRP Vertical Channel Susceptibility Matrix

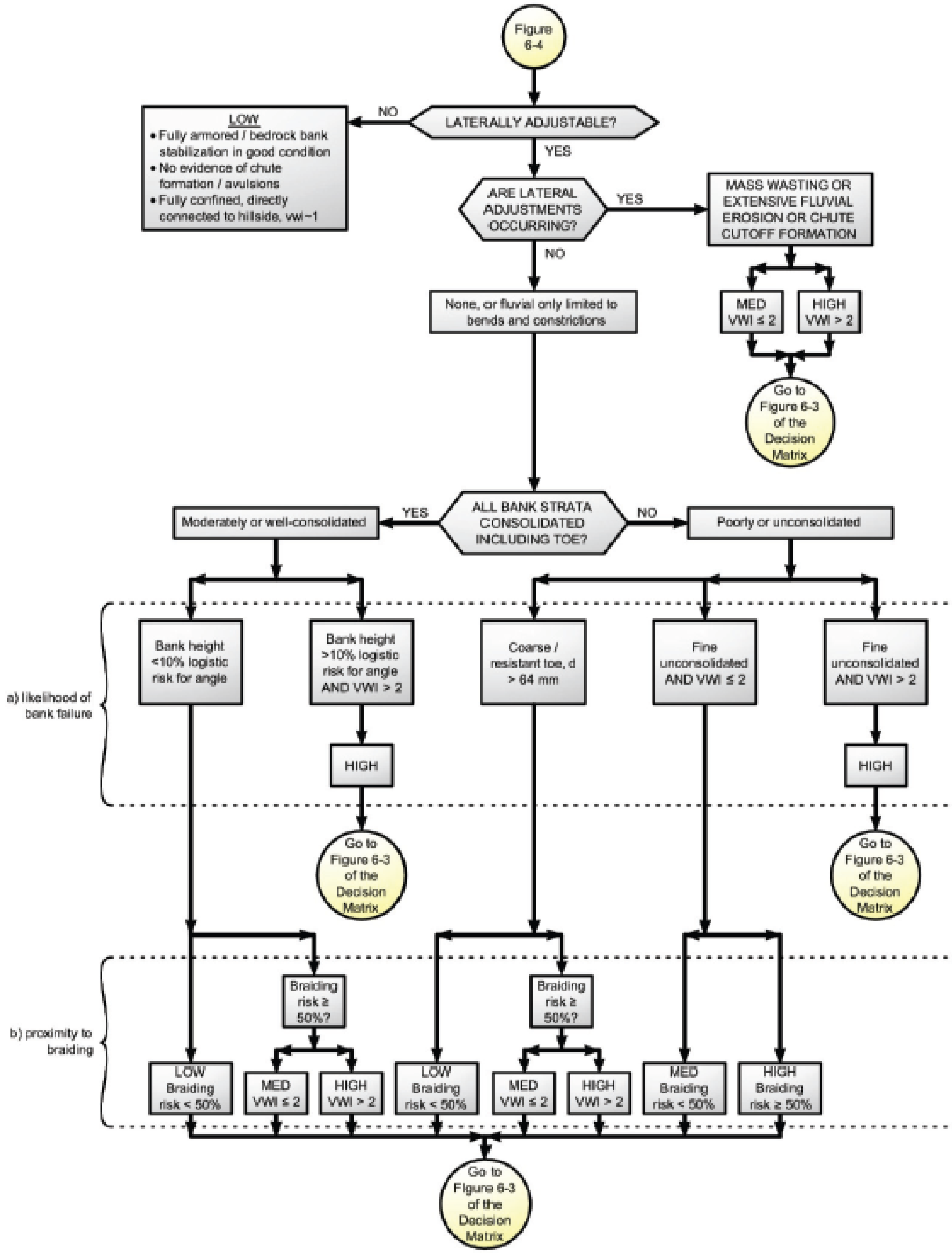
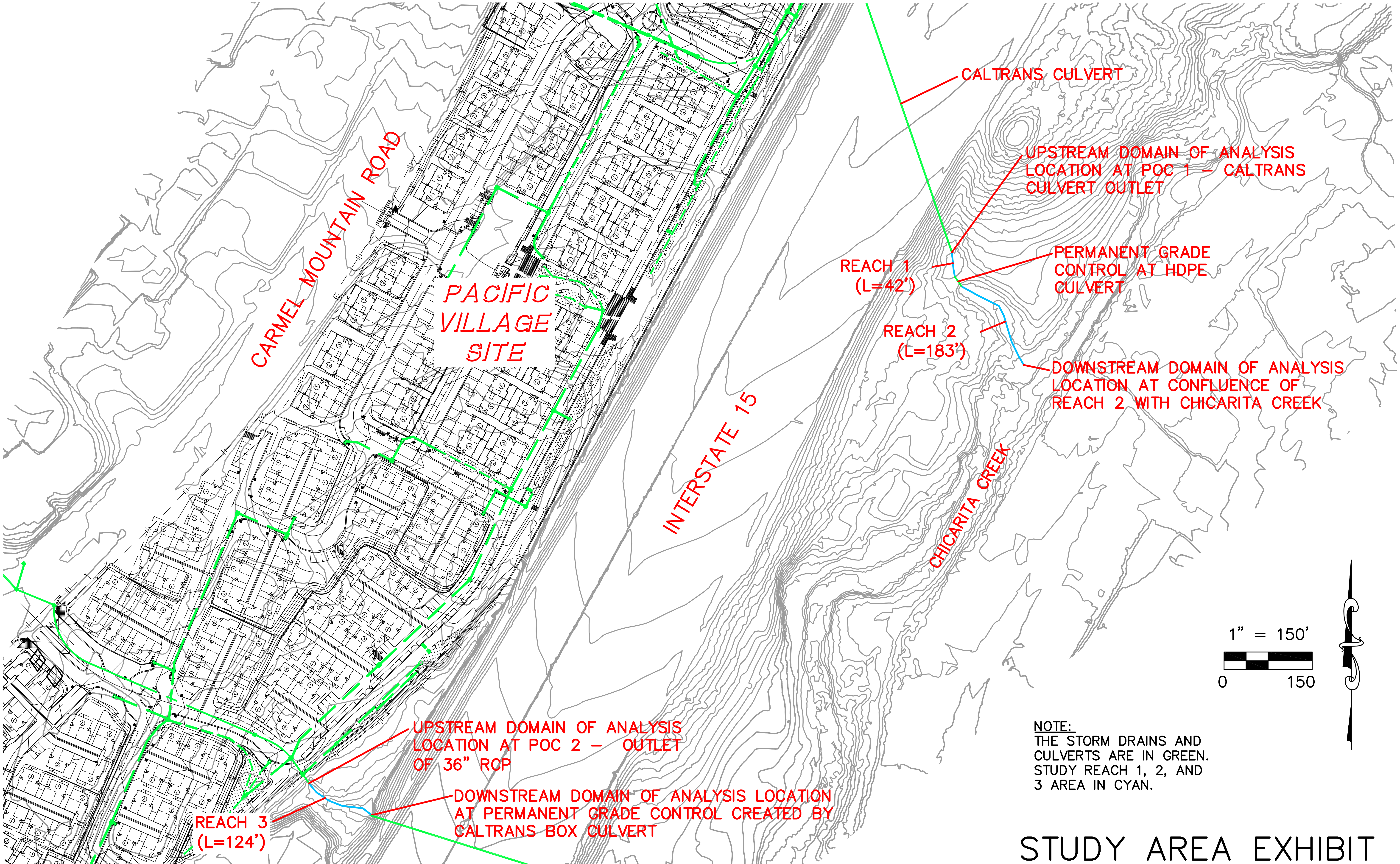


Figure 6-5. Lateral Channel Susceptibility

Figure 15. SCCWRP Lateral Channel Susceptibility Matrix

APPENDIX A

SCCWRP INITIAL DESKTOP ANALYSIS



NOTE:
THE STORM DRAINS AND CULVERTS ARE IN GREEN. STUDY REACH 1, 2, AND 3 AREA IN CYAN.

STUDY AREA EXHIBIT

FORM 1: INITIAL DESKTOP ANALYSIS

Complete all shaded sections.

IF required at multiple locations, circle one of the following site types:

Applicant Site / **Upstream Extent** / **Downstream Extent**

Location: Latitude: 32.9730 Longitude: -117.0919

Description (river name, crossing streets, etc.): Pacific Village - West of Interstate 15 and Eat of Carmel Mountain Road

GIS Parameters: The International System of Units (SI) is used throughout the assessment as the field standard and for consistency with the broader scientific community. However, as the singular exception, US Customary units are used for contributing drainage area (A) and mean annual precipitation (P) to apply regional flow equations after the USGS. See SCCWRP Technical Report 607 for example measurements and "Screening Tool Data Entry.xls" for automated calculations.

Note: Lat/Long obtained from Google Earth near middle of study reach.

Form 1 Table 1. Initial desktop analysis in GIS.

	Symbol	Variable	Description and Source	Value
Watershed properties (English units)	**A**	Area (mi^2)	Contributing drainage area to screening location via published Hydrologic Unit Codes (HUCs) and/or ≤ 30 m National Elevation Data (NED), USGS seamless server	See attached Form 1 table on next page for calculated values for each reach.
	P	Mean annual precipitation (in)	Area-weighted annual precipitation via USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)	
Site properties (SI units)	S_v	Valley slope (m/m)	Valley slope at site via NED, measured over a relatively homogenous valley segment as dictated by hillslope configuration, tributary confluences, etc., over a distance of up to ~500 m or 10% of the main-channel length from site to drainage divide	
	W_v	Valley width (m)	Valley bottom width at site between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachment, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI is >> 2, as defined in lateral decision tree)	

Form 1 Tabl e 2. Simplif ied peak flo w, screening index, and valley width index. Values for this table should be calculated in the sequence shown in this table, using values from Form 1 Table 1.

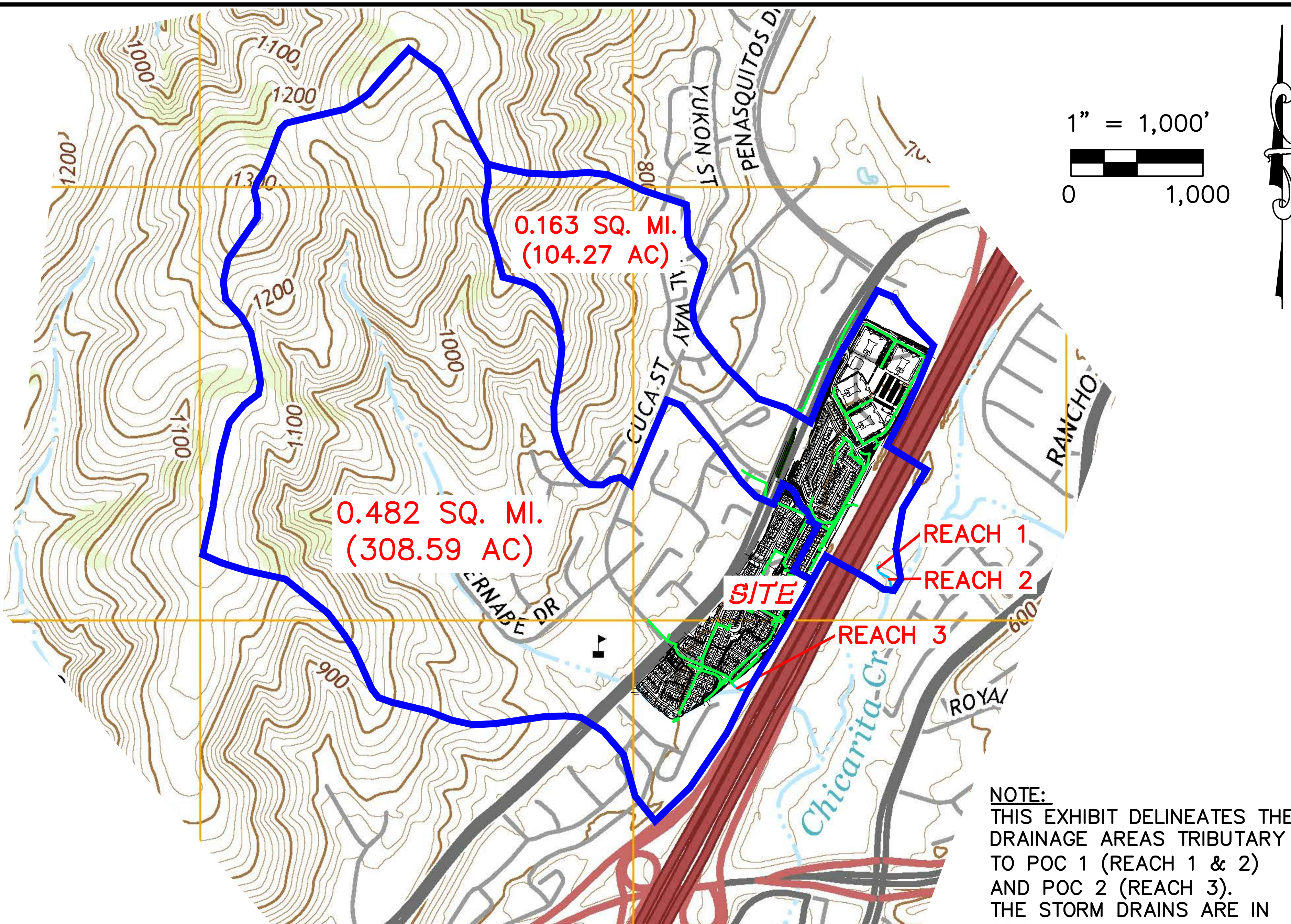
Symbol	Dependent Variable	Equation	Required Units	Value
Q_{10cfs}	10-yr peak flow (ft^3/s)	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$	A (mi^2) P (in)	See attached Form 1 table on next page for calculated values for each reach.
Q_{10}	10-yr peak flow (m^3/s)	$Q_{10} = 0.0283 * Q_{10cfs}$	Q_{10cfs} (ft^3/s)	
INDEX	10-yr screening index ($m^{1.5}/s^{0.5}$)	$INDEX = S_v * Q_{10}^{0.5}$	Sv (m/m) Q_{10} (m^3/s)	
W_{ref}	Reference width (m)	$W_{ref} = 6.99 * Q_{10}^{0.438}$	Q_{10} (m^3/s)	
VWI	Valley width index (m/m)	$VWI = W_v/W_{ref}$	W_v (m) W_{ref} (m)	

(Sheet 1 of 1)

SCCWRP FORM 1 ANALYSES

Reach	Area A, sq. mi.	Mean Annual Precip. P, inches	Valley Slope Sv, m/m	Valley Width Wv, m	10-Year Flow Q10cfs, cfs	10-Year Flow Q10, cms
1	0.163	13.94	0.0238	3.05	29	0.8
2	0.163	13.94	0.0311	4.88	29	0.8
3	0.482	13.94	0.0323	1.83	73	2.1

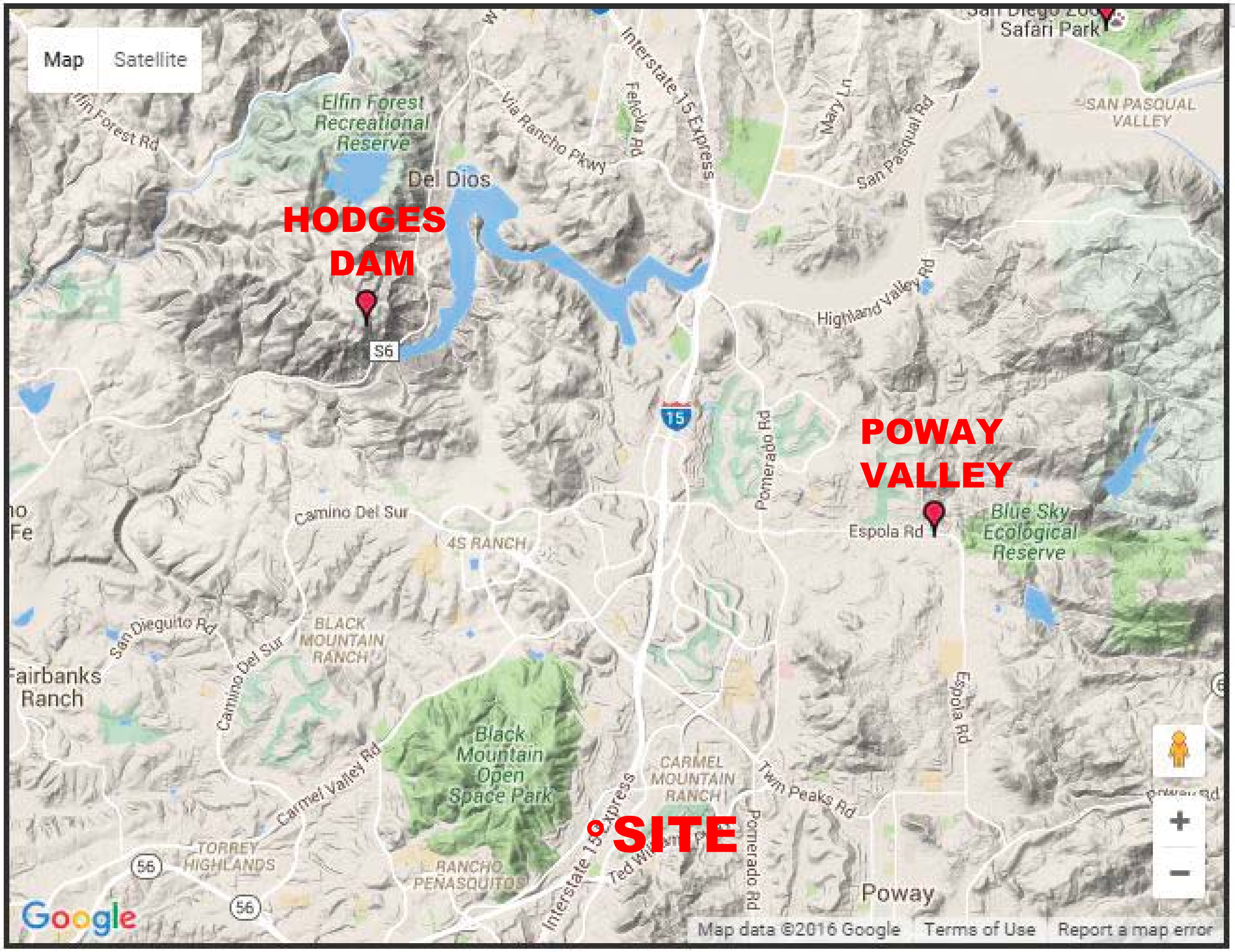
Reach	10-Year Screening Index INDEX	Reference Width Wref, m	Valley Width Index VWI, m/m
1	0.021	6.4	0.48
2	0.028	6.4	0.77



WATERSHED EXHIBIT

NOTE:
THIS EXHIBIT DELINEATES THE DRAINAGE AREAS TRIBUTARY TO POC 1 (REACH 1 & 2) AND POC 2 (REACH 3).
THE STORM DRAINS ARE IN GREEN.

US COOP Station Map



RAIN GAGE LOCATIONS

HODGES DAM, CALIFORNIA (044014)

Period of Record Monthly Climate Summary

Period of Record : 09/12/1940 to 05/31/1962

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)					Insuff	icient	Data						
Average Min. Temperature (F)					Insuff	icient	Data						
Average Total Precipitation (in.)	2.91	2.15	2.60	1.24	0.39	0.05	0.01	0.15	0.08	0.55	1.36	2.46	13.94
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 0% Min. Temp.: 0% Precipitation: 99.2% Snowfall: 99.2% Snow Depth: 99.2%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

POWAY VALLEY, CALIFORNIA (047111)

Period of Record Monthly Climate Summary

Period of Record : 01/01/1893 to 05/21/2016

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	66.6	66.0	67.4	72.1	74.2	80.9	85.6	86.4	84.4	79.2	71.7	67.3	75.1
Average Min. Temperature (F)	40.6	42.9	43.7	48.3	54.4	56.2	60.1	62.2	58.1	50.2	43.2	38.6	49.9
Average Total Precipitation (in.)	2.80	2.70	2.30	0.95	0.37	0.08	0.04	0.07	0.19	0.52	1.36	1.87	13.24
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 0.8% Min. Temp.: 0.8% Precipitation: 92.9% Snowfall: 93.3% Snow Depth: 92.9%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

APPENDIX B

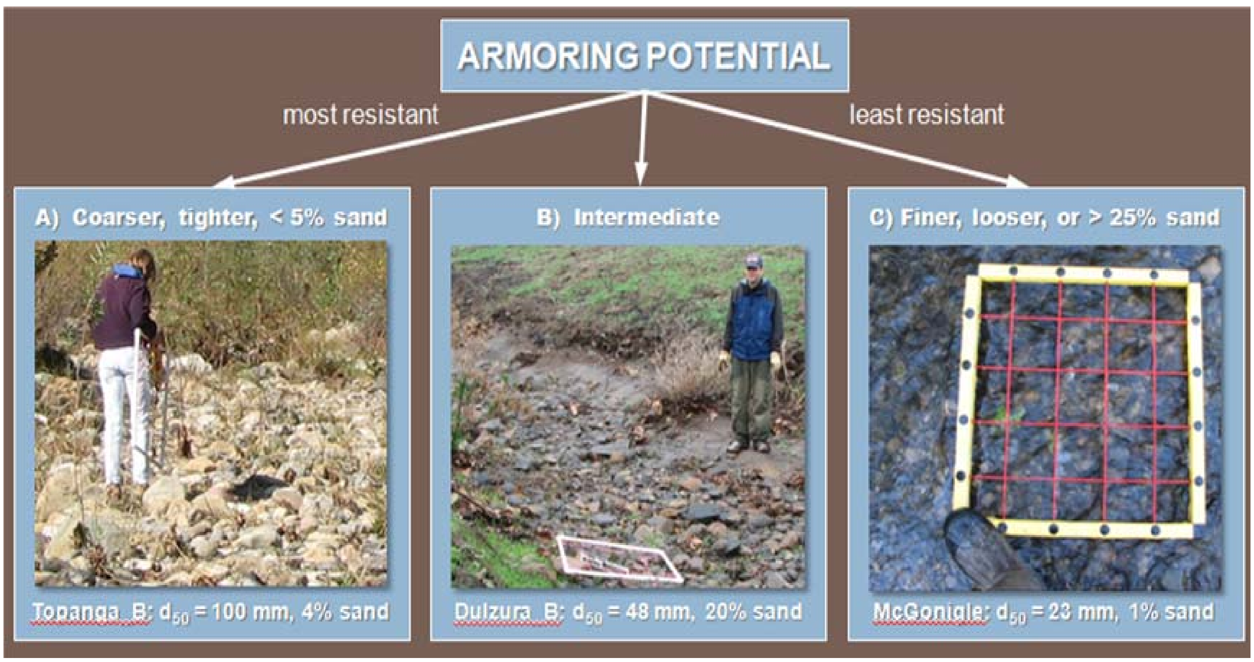
SCCWRP FIELD SCREENING DATA

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

□	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
X	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
□	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used i**n conjunction with Form 3 Checklist 1.**

(Sheet 2 of 4)

RESULT FOR ALL STUDY REACHES

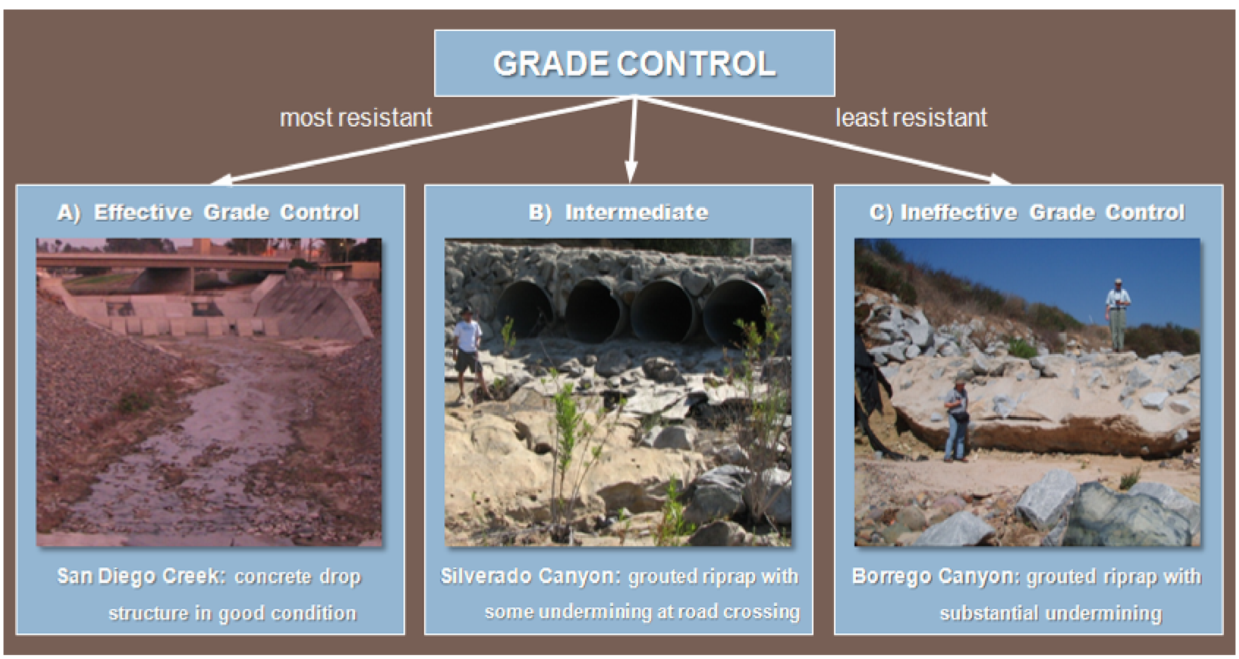
Form 3 Checklist 2: Grade Control

x A Grade control is present with spacing <50 m or 2/S_v m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

□ B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

□ C Grade control absent, spaced >100 m or >4/S_v m, or clear evidence of ineffectiveness



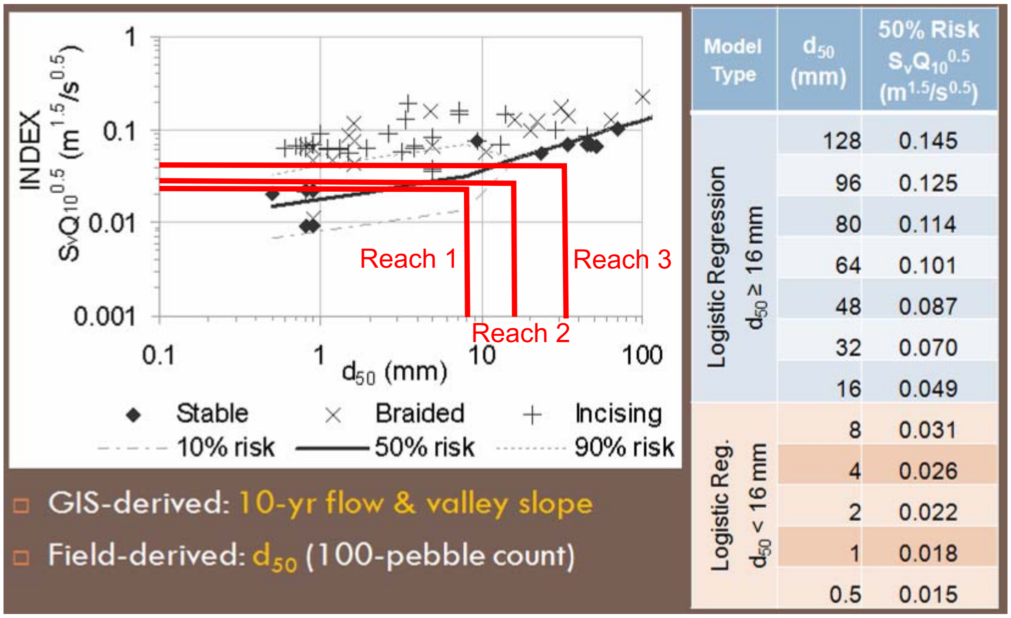
Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

(Sheet 3 of 4)

RESULT FOR ALL STUDY REACHES

Regionally-Calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = $\geq$50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	**S_v*$Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)** *From Form 1*	**S_v*$Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)** *50% risk of incising/braiding from table in Form 3 Figure 3 above*	**Screening Index Score (A, B, C)**

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring * grade\ control}) * screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

RESULT FOR ALL STUDY REACHES

PEBBLE COUNT

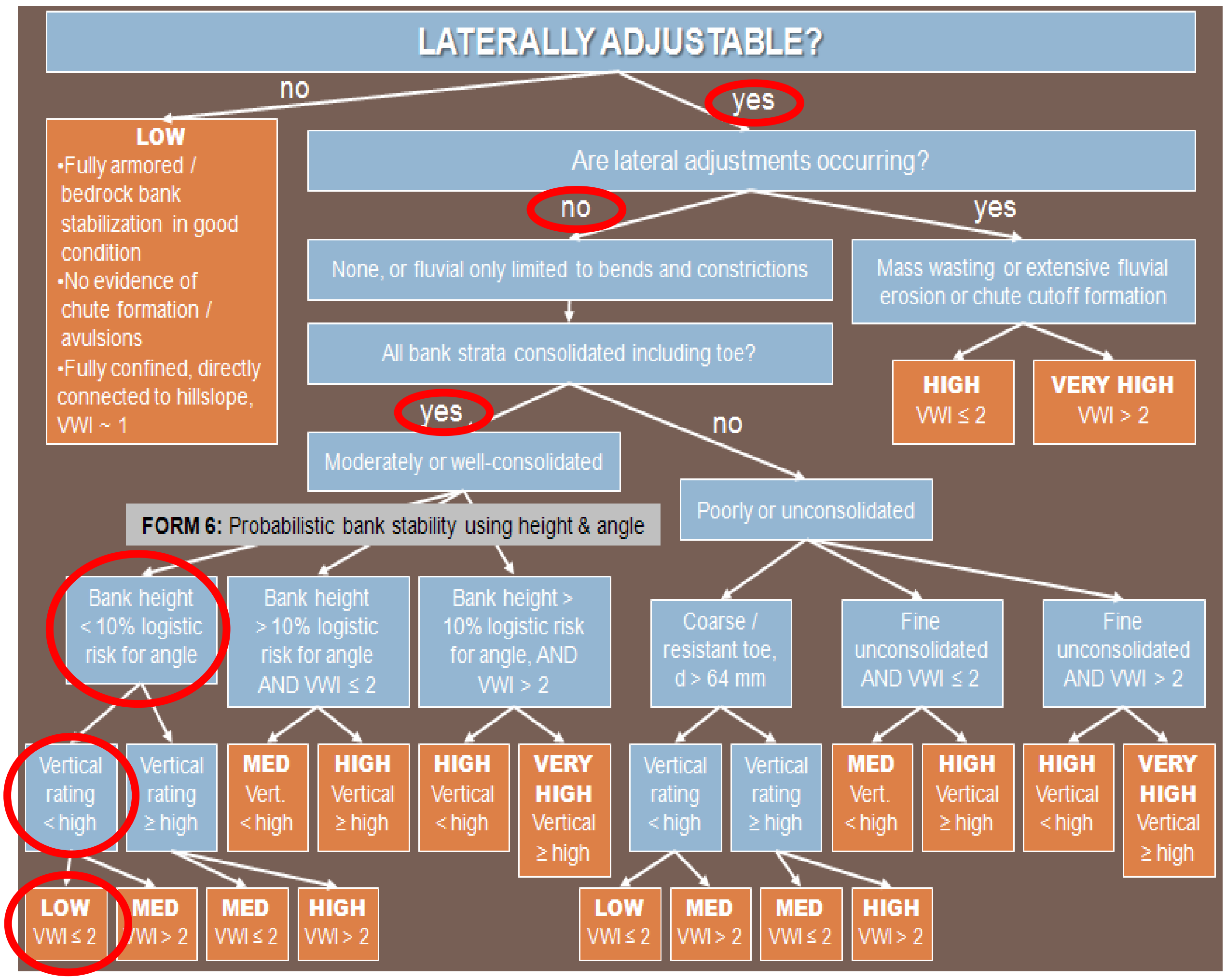
#	Reach 1 Diameter, mm	Reach 2 Diameter, mm	Reach 3 Diameter, mm
1	2	2	5.6
2	2	2	5.6
3	2	2	8
4	2	2	8
5	2	2.8	8
6	2.8	2.8	8
7	2.8	2.8	8
8	2.8	2.8	8
9	2.8	2.8	8
10	2.8	4	8
11	2.8	4	8
12	2.8	4	8
13	2.8	4	11
14	2.8	4	11
15	4	4	11
16	4	4	11
17	4	4	11
18	4	4	11
19	4	5.6	11
20	4	5.6	11
21	4	5.6	11
22	4	5.6	11
23	4	5.6	11
24	4	5.6	16
25	4	5.6	16
26	4	5.6	16
27	5.6	5.6	16
28	5.6	8	16
29	5.6	8	16
30	5.6	8	16
31	5.6	8	16
32	5.6	8	16
33	5.6	8	16
34	5.6	8	22.6
35	5.6	8	22.6
36	5.6	8	22.6
37	5.6	16	22.6
38	5.6	16	22.6
39	5.6	16	22.6
40	5.6	16	22.6
41	5.6	16	22.6
42	5.6	16	22.6
43	5.6	16	22.6

#	Reach 1 Diameter, mm	Reach 2 Diameter, mm	Reach 3 Diameter, mm	
44	8	16	22.6	
45	8	16	32	
46	8	16	32	
47	8	16	32	
48	8	16	32	
49	8	16	32	
50	8	16	32	**D50**
51	8	16	32	
52	8	16	32	
53	8	16	32	
54	8	16	32	
55	8	16	32	
56	8	22.6	32	
57	8	22.6	45	
58	8	22.6	45	
59	8	22.6	45	
60	8	22.6	45	
61	8	22.6	45	
62	11	22.6	45	
63	11	22.6	45	
64	11	22.6	45	
65	11	22.6	45	
66	11	22.6	45	
67	11	22.6	45	
68	11	32	45	
69	11	32	64	
70	11	32	64	
71	11	32	64	
72	11	32	64	
73	11	32	64	
74	11	32	64	
75	16	32	64	
76	16	32	64	
77	16	32	64	
78	16	32	64	
79	16	32	64	
80	16	32	90	
81	16	45	90	
82	16	45	90	
83	16	45	90	
84	16	45	90	
85	16	45	90	
86	16	45	90	
87	16	45	90	
88	16	45	90	

#	Reach 1 Diameter, mm	Reach 2 Diameter, mm	Reach 3 Diameter, mm
89	22.6	45	90
90	22.6	45	90
91	22.6	45	90
92	22.6	45	90
93	22.6	64	128
94	22.6	64	128
95	22.6	64	128
96	32	64	128
97	32	64	128
98	32	64	128
99	32	64	128
100	45	64	128

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site OR use sequence of questions provided in Form 5.



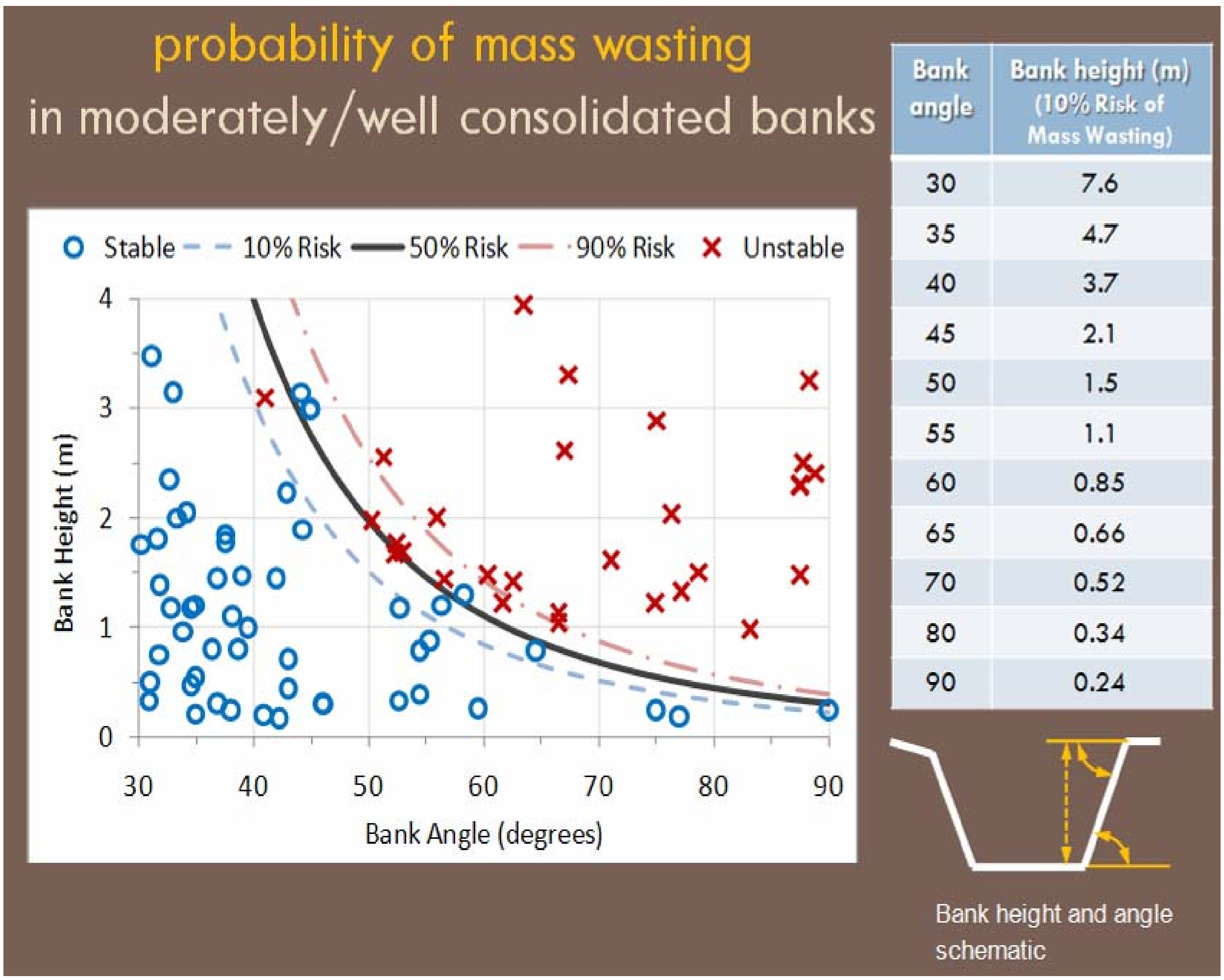
(Sheet 1 of 1)

RESULT FOR ALL STUDY REACHES

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	<22.6 (2:1)	---	---	<10%
Right Bank	<22.6 (2:1)	---	---	<10%



Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

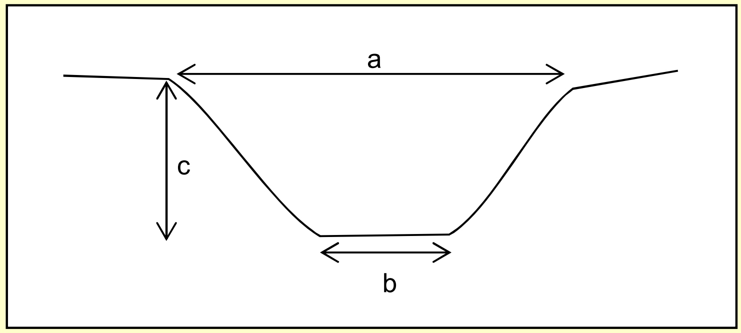
(Sheet 1 of 1)

RESULT FOR ALL STUDY REACHES

Critical Flow Calculator

Reach 1

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	50.0
b) Channel width at bed (ft)	10.0
c) Bank height at top of bank (ft)	4.0
Channel gradient (ft/ft)	0.0238
Receiving channel roughness	Same as above, but more stones and weeds n=0.035

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	13.94	Receiving water watershed area at PoC (sq mi)	0.163
Project watershed annual precipitation (inches)	13.94	Project watershed area draining to PoC (sq mi)	0.163

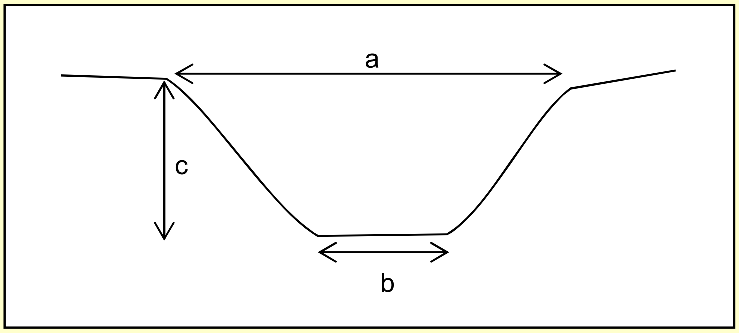
Outputs - Flow control range

Receiving water Q2	2.7	**Point of Compliance low flow rate (cfs)**	**1.4**
Project site Q2	2.7	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

Critical Flow Calculator

Reach 2

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	45.0
b) Channel width at bed (ft)	16.0
c) Bank height at top of bank (ft)	4.0
Channel gradient (ft/ft)	0.0311

Receiving channel roughness: Same as above, but more stones and weeds n=0.035

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	13.94	Receiving water watershed area at PoC (sq mi)	0.163
Project watershed annual precipitation (inches)	13.94	Project watershed area draining to PoC (sq mi)	0.163

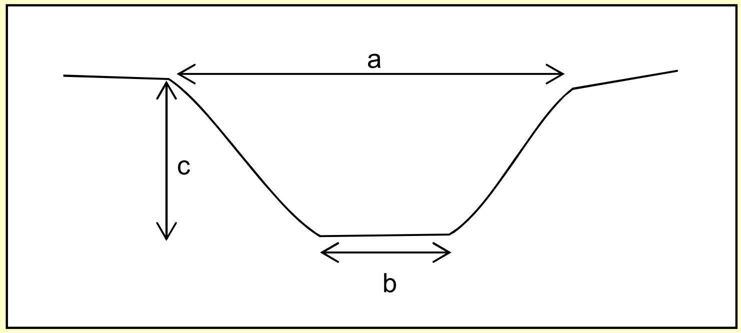
Outputs - Flow control range

Receiving water Q2	2.7	**Point of Compliance low flow rate (cfs)**	**1.4**
Project site Q2	2.7	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

Critical Flow Calculator

Reach 3

enter all values in green cells
and drop down boxes



Inputs

a) Receiving channel width at top of bank (ft) - see figure on right	20.0
b) Channel width at bed (ft)	6.0
c) Bank height at top of bank (ft)	2.0
Channel gradient (ft/ft)	0.0323
Receiving channel roughness	Same as above, but more stones and weeds n=0.035

Channel materials (use weakest of bed or banks). If materials are varied use weakest material covering more than 20% of channel.

- unconsolidated sandy loam 0.035 lb/sq ft
- alluvial silt (non coloidal) 0.045 lb/sq ft
- medium gravel 0.12 lb/sq ft
- alluvial silt/clay 0.26 lb/sq ft
- 2.5 inch cobble 1.1 lb/sq ft
- enter own d50 (variable)
- vegetation (bed and banks) 0.6 lb/sq ft

Select method of calculating Q2

- Input own Q2
- Calculate Q2 using USGS regression

Receiving water watershed annual precip (inches)	13.94	Receiving water watershed area at PoC (sq mi)	0.482
Project watershed annual precipitation (inches)	13.94	Project watershed area draining to PoC (sq mi)	0.482

Outputs - Flow control range

Receiving water Q2	5.9	**Point of Compliance low flow rate (cfs)**	**3.0**
Project site Q2	5.9	**Low flow class**	**0.5Q2**
		Channel vulnerability	**Low**

BMP Sizing Spreadsheet V1.04

Project Name:	Pacific Village
Project Applicant:	Lennar Homes
Jurisdiction:	San Diego
Parcel (APN):	313-030-15
Hydrologic Unit:	Los Penasquitos
Rain Gauge:	Oceanside
Total Project Area (sf):	1805562
Channel Susceptibility:	Low

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	101	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	138030.32	D	Moderate		1.0	0.04	0.12	N/A	5521	16564	N/A
LANDSCAPE	151378.55	D	Moderate		0.1	0.04	0.12	N/A	606	1817	N/A
ROAD	233339.6	D	Moderate		1.0	0.04	0.12	N/A	9334	28001	N/A
Total BMP Area	522748.47							Minimum BMP Size	15460.311	46381	
								Proposed BMP Size*	8709	N/A	N/A

		in
Minimum Cistern Depth	N/A	in
Maximum Cistern Depth	N/A	in
Selected Cistern Depth	96.00	in
Selected Cistern Volume	46381	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	101	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	3.169	0.336	**3.80**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	3.475	0.368	**4.16**
ROAD	Oceanside	D	Scrub	Moderate	0.212	5.357	0.568	**6.42**

1.272	**14.38**	**4.28**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

1.361	**14.39**	**4.28**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	18.9

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	102	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	30294.57	D	Moderate		1.0	0.04	0.12	N/A	1212	3635	N/A
LANDSCAPE	34202.02	D	Moderate		0.1	0.04	0.12	N/A	137	410	N/A
ROAD	40079.2	D	Moderate		1.0	0.04	0.12	N/A	1603	4810	N/A
Total BMP Area	104575.79							Minimum BMP Size	2951.75888	8855	
								Proposed BMP Size*	1814	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		8855	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

This Sizing Calculator has been developed in compliance with the Countywide Model SUSMP. For questions or concerns please contact the jurisdiction in which your project is located.

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	102	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.695	0.074	**0.83**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.785	0.083	**0.94**
ROAD	Oceanside	D	Scrub	Moderate	0.212	0.920	0.098	**1.10**

0.254	**2.88**	**1.91**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.271	**2.87**	**1.91**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	18.2

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	103	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	26353.88	D	Moderate		1.0	0.04	0.12	N/A	1054	3162	N/A
LANDSCAPE	26314.85	D	Moderate		0.1	0.04	0.12	N/A	105	316	N/A
ROAD	39848.67	D	Moderate		1.0	0.04	0.12	N/A	1594	4782	N/A
Total BMP Area	92517.4							Minimum BMP Size	2753.3614	8260	
								Proposed BMP Size*	1633	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		8260	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	103	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.605	0.064	**0.72**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.604	0.064	**0.72**
ROAD	Oceanside	D	Scrub	Moderate	0.212	0.915	0.097	**1.10**

0.225	**2.54**	**1.80**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.241	**2.54**	**1.80**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	19.1

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	104	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	33017.08	D	Moderate		1.0	0.04	0.12	N/A	1321	3962	N/A
LANDSCAPE	17651.73	D	Moderate		0.1	0.04	0.12	N/A	71	212	N/A
ROAD	31602.71	D	Moderate		1.0	0.04	0.12	N/A	1264	3792	N/A
Total BMP Area	82271.52										
								Minimum BMP Size	2655.39852	7966	
								Proposed BMP Size*	1393	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		7966	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	104	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.758	0.080	**0.91**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.405	0.043	**0.49**
ROAD	Oceanside	D	Scrub	Moderate	0.212	0.725	0.077	**0.87**

0.200	**2.26**	**1.70**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.215	**2.27**	**1.70**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	20.6

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	105	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	21671.73	D	Moderate		1.0	0.04	0.12	N/A	867	2601	N/A
LANDSCAPE	25202.96	D	Moderate		0.1	0.04	0.12	N/A	101	302	N/A
ROAD	41565.09	D	Moderate		1.0	0.04	0.12	N/A	1663	4988	N/A
Total BMP Area	88439.78										

Minimum BMP Size	2630.28464	7891	
Proposed BMP Size*	3920	N/A	N/A
			in
Minimum Cistern Depth		N/A	in
Maximum Cistern Depth		N/A	in
Selected Cistern Depth		96.00	in
Selected Cistern Volume		7891	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	105	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.498	0.053	**0.60**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.579	0.061	**0.69**
ROAD	Oceanside	D	Scrub	Moderate	0.212	0.954	0.101	**1.14**

0.215	**2.43**	**1.76**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.230	**2.43**	**1.76**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	19.1

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	106	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	54653.87	D	Moderate		1.0	0.04	0.12	N/A	2186	6558	N/A
LANDSCAPE	76088.46	D	Moderate		0.1	0.04	0.12	N/A	304	913	N/A
ROAD	62308.3	D	Moderate		1.0	0.04	0.12	N/A	2492	7477	N/A
Total BMP Area	193050.63							Minimum BMP Size	4982.84064	14949	
								Proposed BMP Size*	2845	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		14949	cubic feet

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	106	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	1.255	0.133	**1.50**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	1.747	0.185	**2.09**
ROAD	Oceanside	D	Scrub	Moderate	0.212	1.430	0.152	**1.71**

0.470	**5.31**	**2.60**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.502	**5.31**	**2.60**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	16.5

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	107	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	43496.71	D	Moderate		1.0	0.04	0.12	N/A	1740	5220	N/A
LANDSCAPE	39547.66	D	Moderate		0.1	0.04	0.12	N/A	158	475	N/A
ROAD	55268.19	D	Moderate		1.0	0.04	0.12	N/A	2211	6632	N/A
Total BMP Area	138312.56							Minimum BMP Size	4108.78664	12326	
								Proposed BMP Size*	2255	N/A	N/A

		in
Minimum Cistern Depth	N/A	in
Maximum Cistern Depth	N/A	in
Selected Cistern Depth	96.00	in
Selected Cistern Volume	12326	cubic feet

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	107	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.999	0.106	**1.20**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.908	0.096	**1.09**
ROAD	Oceanside	D	Scrub	Moderate	0.212	1.269	0.134	**1.52**

0.337	**3.80**	**2.20**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.360	**3.80**	**2.20**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	19.0

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	108	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	23741.96	D	Moderate		1.0	0.04	0.12	N/A	950	2849	N/A
LANDSCAPE	34561.3	D	Moderate		0.1	0.04	0.12	N/A	138	415	N/A
ROAD	20070.98	D	Moderate		1.0	0.04	0.12	N/A	803	2409	N/A
Total BMP Area	78374.24							Minimum BMP Size	1890.7628	5672	
								Proposed BMP Size*	1079	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		5672	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	108	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.545	0.058	**0.65**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.793	0.084	**0.95**
ROAD	Oceanside	D	Scrub	Moderate	0.212	0.461	0.049	**0.55**

0.191	**2.16**	**1.66**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.205	**2.16**	**1.66**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	15.4

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	109	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	21199.59	D	Moderate		1.0	0.04	0.12	N/A	848	2544	N/A
LANDSCAPE	32701.75	D	Moderate		0.1	0.04	0.12	N/A	131	392	N/A
ROAD	39651.97	D	Moderate		1.0	0.04	0.12	N/A	1586	4758	N/A
Total BMP Area	93553.31							Minimum BMP Size	2564.8694	7695	
								Proposed BMP Size*	1686	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		7695	cubic feet

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	109	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	0.487	0.052	**0.58**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.751	0.080	**0.90**
ROAD	Oceanside	D	Scrub	Moderate	0.212	0.910	0.096	**1.09**

0.228	**2.57**	**1.81**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.243	**2.57**	**1.81**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	17.6

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	110	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF	96358.23	D	Moderate		1.0	0.04	0.12	N/A	3854	11563	N/A
LANDSCAPE	116673.98	D	Moderate		0.1	0.04	0.12	N/A	467	1400	N/A
ROAD	134148.26	D	Moderate		1.0	0.04	0.12	N/A	5366	16098	N/A
Total BMP Area	347180.47							Minimum BMP Size	9686.95552	29061	
								Proposed BMP Size*	6261	N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		96.00	in
								Selected Cistern Volume		29061	cubic feet

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	110	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF	Oceanside	D	Scrub	Moderate	0.212	2.212	0.234	**2.65**
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	2.678	0.284	**3.21**
ROAD	Oceanside	D	Scrub	Moderate	0.212	3.080	0.326	**3.69**

0.845	**9.55**	**3.49**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.905	**9.57**	**3.49**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	17.8

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	111	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF		D	Moderate		1.0	0.04	0.12	N/A			N/A
LANDSCAPE	43842.46	D	Moderate		0.1	0.04	0.12	N/A	175	526	N/A
ROAD		D	Moderate		1.0	0.04	0.12	N/A			N/A
Total BMP Area	43842.46							Minimum BMP Size	175.36984	526	
								Proposed BMP Size*		N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		48.00	in
								Selected Cistern Volume		526	cubic feet

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	111	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF		D	Scrub	Moderate				
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	1.006	0.107	**1.71**
ROAD		D	Scrub	Moderate				

0.107	**1.71**	**1.47**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.113	**1.70**	**1.47**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	2.6

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	112	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF		D	Moderate		1.0	0.04	0.12	N/A			N/A
LANDSCAPE	44443.72	D	Moderate		0.1	0.04	0.12	N/A	178	533	N/A
ROAD		D	Moderate		1.0	0.04	0.12	N/A			N/A
Total BMP Area	44443.72							Minimum BMP Size	177.77488	533	
								Proposed BMP Size*		N/A	N/A

		in
Minimum Cistern Depth	N/A	in
Maximum Cistern Depth	N/A	in
Selected Cistern Depth	48.00	in
Selected Cistern Volume	533	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	112	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF		D	Scrub	Moderate				
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	1.020	0.108	**1.73**
ROAD		D	Scrub	Moderate				

0.108	**1.73**	**1.48**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.115	**1.72**	**1.48**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	2.6

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	113	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF		D	Moderate		1.0	0.04	0.12	N/A			N/A
LANDSCAPE	9246.05	D	Moderate		0.1	0.04	0.12	N/A	37	111	N/A
ROAD		D	Moderate		1.0	0.04	0.12	N/A			N/A
Total BMP Area	9246.05							Minimum BMP Size	36.9842	111	
								Proposed BMP Size*		N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		48.00	in
								Selected Cistern Volume		111	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	113	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - $\%Q_2$ (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF		D	Scrub	Moderate				
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.212	0.022	**0.36**
ROAD		D	Scrub	Moderate				

0.022	**0.36**	**0.68**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.024	**0.36**	**0.68**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	2.5

BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name:	114	BMP Type:	Bioretention Plus Cistern
BMP Native Soil Type:	N/A - Impervious Liner	BMP Infiltration Rate (in/hr):	N/A

Areas Draining to BMP						HMP Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Slope	Post Project Surface Type	Runoff Factor (Table 4-2)	Bioretention Surface Area	Cistern Volume	N/A	Bioretention Surface Area (sf)	Cistern Volume (cf)	N/A
ROOF		D	Moderate		1.0	0.04	0.12	N/A			N/A
LANDSCAPE	3730.22	D	Moderate		0.1	0.04	0.12	N/A	15	45	N/A
ROAD		D	Moderate		1.0	0.04	0.12	N/A			N/A
Total BMP Area	3730.22							Minimum BMP Size	14.92088	45	
								Proposed BMP Size*		N/A	N/A
											in
								Minimum Cistern Depth		N/A	in
								Maximum Cistern Depth		N/A	in
								Selected Cistern Depth		48.00	in
								Selected Cistern Volume		45	cubic feet

Describe the BMP's in sufficient detail in your SWMP to demonstrate the area, volume, and other criteria can be met within the constraints of the site.

BMP's must be adapted and applied to the conditions specific to the development project such as unstable slopes or the lack of available head.
Designated Staff have final review and approval authority over the project design.

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BMP Sizing Spreadsheet V1.04			
Project Name:	Pacific Village	Hydrologic Unit:	Los Penasquitos
Project Applicant:	Lennar Homes	Rain Gauge:	Oceanside
Jurisdiction:	San Diego	Total Project Area:	1805562
Parcel (APN):	313-030-15	Low Flow Threshold:	0.5Q2
BMP Name	114	BMP Type:	Bioretention Plus Cistern

DMA Name	Rain Gauge	Existing Condition			Q2 Sizing Factor (cfs/ac)	DMA Area (ac)	Orifice Flow - %Q_2 (cfs)	**Orifice Area (in2)**
		Soil Type	Cover	Slope				
ROOF		D	Scrub	Moderate				
LANDSCAPE	Oceanside	D	Scrub	Moderate	0.212	0.086	0.009	**0.15**
ROAD		D	Scrub	Moderate				

0.009	**0.15**	**0.43**
Tot. Allowable Orifice Flow (cfs)	**Tot. Allowable Orifice Area (in2)**	**Max Orifice Diameter (in)**

0.010	**0.15**	**0.43**
Actual Orifice Flow (cfs)	Actual Orifice Area (in2)	Selected Orifice Diameter (in)

Drawdown (Hrs)	2.6

Table G.2-7: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	0.3900	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	0.2000	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.5Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	0.1900	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	0.1000	N/A
$0.5Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	0.2100	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	0.2000	N/A
$0.5Q_2$	B	Steep	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	0.5900	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	0.3600	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	0.1800	N/A

Table G.2-2: Unit Runoff Ratios for Sizing Factor Method

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil Group	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	A	Scrub	Low	0.136	0.369
Lake Wohlford	A	Scrub	Moderate	0.207	0.416
Lake Wohlford	A	Scrub	Steep	0.244	0.47
Lake Wohlford	B	Scrub	Low	0.208	0.414
Lake Wohlford	B	Scrub	Moderate	0.227	0.448
Lake Wohlford	B	Scrub	Steep	0.253	0.482
Lake Wohlford	C	Scrub	Low	0.245	0.458
Lake Wohlford	C	Scrub	Moderate	0.253	0.481
Lake Wohlford	C	Scrub	Steep	0.302	0.517
Lake Wohlford	D	Scrub	Low	0.253	0.48
Lake Wohlford	D	Scrub	Moderate	0.292	0.516
Lake Wohlford	D	Scrub	Steep	0.351	0.538
Oceanside	A	Scrub	Low	0.035	0.32
Oceanside	A	Scrub	Moderate	0.093	0.367
Oceanside	A	Scrub	Steep	0.163	0.42
Oceanside	B	Scrub	Low	0.08	0.365
Oceanside	B	Scrub	Moderate	0.134	0.4
Oceanside	B	Scrub	Steep	0.181	0.433
Oceanside	C	Scrub	Low	0.146	0.411
Oceanside	C	Scrub	Moderate	0.185	0.433
Oceanside	C	Scrub	Steep	0.217	0.458
Oceanside	D	Scrub	Low	0.175	0.434
Oceanside	D	Scrub	Moderate	0.212	0.455
Oceanside	D	Scrub	Steep	0.244	0.571
Lindbergh	A	Scrub	Low	0.003	0.081
Lindbergh	A	Scrub	Moderate	0.018	0.137
Lindbergh	A	Scrub	Steep	0.061	0.211
Lindbergh	B	Scrub	Low	0.011	0.134
Lindbergh	B	Scrub	Moderate	0.033	0.174
Lindbergh	B	Scrub	Steep	0.077	0.23
Lindbergh	C	Scrub	Low	0.028	0.19
Lindbergh	C	Scrub	Moderate	0.075	0.232
Lindbergh	C	Scrub	Steep	0.108	0.274
Lindbergh	D	Scrub	Low	0.05	0.228
Lindbergh	D	Scrub	Moderate	0.104	0.266
Lindbergh	D	Scrub	Steep	0.143	0.319

Pacific Village

Storage Pipe Sizing Calculations

Constants

Sizing Factor	0.12	inches
Roof Runoff Coefficient	1.0	
Landscape Runoff Coefficient	0.1	
Road Runoff Coefficient	1.0	

					Basin Ponding Storage Volume		
DMA	101		Area	Volume Required			Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	9811.942	96 " Pipe
Slope	Moderate	Roofs	138030.32		Bot Area (SF)	7650.229	(FT)
Structural BMP	Cistern	Landscape	151378.55		Ponding Depth (FT)	1.5	
Rain Gage	Oceanside	Road	233339.60				
Orifice Size (inches)	4.28			46381	Basin Volume (CF)	13063	424

					Basin Ponding Storage Volume		
DMA	102		Area	Volume Required			Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	2215.876	96 " Pipe
Slope	Moderate	Roofs	30294.57		Bot Area (SF)	1425.994	(FT)
Structural BMP	Cistern	Landscape	34202.02		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	40079.20				
Orifice Size (inches)	1.91			8855	Basin Volume (CF)	1806	90

					Basin Ponding Storage Volume		
DMA	103		Area	Volume Required			Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	2525.63	96 " Pipe
Slope	Moderate	Roofs	26353.88		Bot Area (SF)	768.61	(FT)
Structural BMP	Cistern	Landscape	26314.85		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	39848.67				
Orifice Size (inches)	1.80			8260	Basin Volume (CF)	1563	85

					Basin Ponding Storage Volume		
DMA	104		Area	Volume Required			Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	1802.002	96 " Pipe
Slope	Moderate	Roofs	33017.08		Bot Area (SF)	997.162	(FT)
Structural BMP	Cistern	Landscape	17651.73		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	31602.71				
Orifice Size (inches)	1.70			7966	Basin Volume (CF)	1380	84

Pacific Village

Storage Pipe Sizing Calculations

DMA	105		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	5205.89	96 " Pipe
Slope	Moderate	Roofs	21671.73		Bot Area (SF)	2672.83	(FT)
Structural BMP	Cistern	Landscape	25202.96		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	41565.09				
Orifice Size (inches)	1.76			7891	Basin Volume (CF)	3870	51

DMA	106		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	3530.02	96 " Pipe
Slope	Moderate	Roofs	54653.87		Bot Area (SF)	3182.89	(FT)
Structural BMP	Cistern	Landscape	76088.46		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	62308.30				
Orifice Size (inches)	2.60			14949	Basin Volume (CF)	3355	148

DMA	107		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	3142.68	96 " Pipe
Slope	Moderate	Roofs	43496.71		Bot Area (SF)	1381.96	(FT)
Structural BMP	Cistern	Landscape	39547.66		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	55268.19				
Orifice Size (inches)	2.20			12326	Basin Volume (CF)	2203	129

DMA	108		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	1508.46	96 " Pipe
Slope	Moderate	Roofs	23741.96		Bot Area (SF)	663.81	(FT)
Structural BMP	Cistern	Landscape	34561.3		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	20070.98				
Orifice Size (inches)	1.66			5672	Basin Volume (CF)	1058	59

DMA	109		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	2441.57	96 " Pipe
Slope	Moderate	Roofs	21199.59		Bot Area (SF)	1043.19	(FT)
Structural BMP	Cistern	Landscape	32701.75		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	39651.97				
Orifice Size (inches)	1.81			7695	Basin Volume (CF)	1694	76

Pacific Village

Storage Pipe Sizing Calculations

DMA	110		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	7062.02	96 " Pipe
Slope	Moderate	Roofs	96358.23		Bot Area (SF)	5477.75	(FT)
Structural BMP	Cistern	Landscape	116673.98		Ponding Depth (FT)	1	
Rain Gage	Oceanside	Road	134148.26				
Orifice Size (inches)	3.49			29061	Basin Volume (CF)	6253	290

DMA	111		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	0	48 " Pipe
Slope	Moderate	Roofs	0		Bot Area (SF)	0	(FT)
Structural BMP	Cistern	Landscape	43842.46		Ponding Depth (FT)	0	
Rain Gage	Oceanside	Road	0				
Orifice Size (inches)	1.47			526	Basin Volume (CF)	0	19

DMA	112		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	0	48 " Pipe
Slope	Moderate	Roofs	0		Bot Area (SF)	0	(FT)
Structural BMP	Cistern	Landscape	44443.72		Ponding Depth (FT)	0	
Rain Gage	Oceanside	Road	0				
Orifice Size (inches)	1.48			533	Basin Volume (CF)	0	20

DMA	113		Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
Soil Type	D		(SF)	(CF)	Top Area (SF)	0	48 " Pipe
Slope	Moderate	Roofs	0		Bot Area (SF)	0	(FT)
Structural BMP	Cistern	Landscape	9246.05		Ponding Depth (FT)	0	
Rain Gage	Oceanside	Road	0				
Orifice Size (inches)	0.68			111	Basin Volume (CF)	0	4

Pacific Village

Storage Pipe Sizing Calculations

			Area	Volume Required	Basin Ponding Storage Volume		Length of Gravel Backfill &
DMA	114		(SF)	(CF)	Top Area (SF)	0	48 " Pipe
Soil Type	D						(FT)
Slope	Moderate	Roofs	0		Bot Area (SF)	0	
Structural BMP	Cistern	Landscape	3730.22		Ponding Depth (FT)	0	
Rain Gage	Oceanside	Road	0				
Orifice Size (inches)	0.43			45	Basin Volume (CF)	0	2

Total Required Volume **150271** CF

Total 96" Pipe	424	Apartments
Total 96" Pipe	310	Town Houses
Total 96" Pipe	335	Triplexes
Total 96" Pipe	367	Single Family
Total 96" Pipe	**1436**	**Entire Site**
Total 48" Pipe	**45**	**Entire Site**

Volume Required

Vr = Ponding Volume + Gravel Backfill + Storage Pipe

Ponding Volume = (h/3) x (B1 + SQRT(B1 x B2) + B2)

Where:

h = depth of pond (FT)

B1 = Surface Area of the Bottom of the Basin (SF)

B2 = Surface Area of the Water Surface in the Basin (Top Area) (SF)

Gravel Backfill = 0.40 x L x [W x H - (Pi x r^2)]

Where:

0.40 = Aggregate Pore Space

L = Length of Pipe and Gravel Section (FT)

W = Width of Gravel Section (FT)

H = Height of Gravel Section (FT)

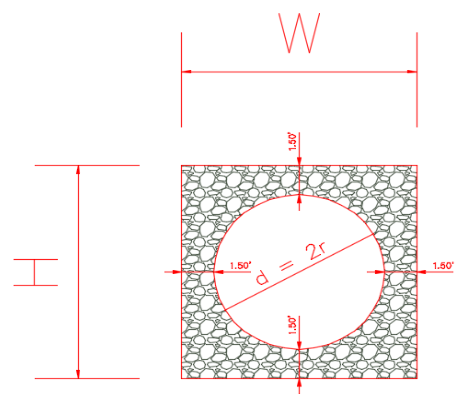
r = Storage Pipe Radius (FT)

Storage Pipe = L x Pi x r^2

Where:

L = Length of Pipe and Gravel Section (FT)

r = Storage Pipe Radius (FT)



Gravel Backfill and Storage Pipe Section

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE INFORMATION

This is the cover sheet for Attachment 3.

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Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	☒ Included See Structural BMP Maintenance Information Checklist.
Attachment 3b	Maintenance Agreement (Form DS-3247) (when applicable)	☐ Included ☒ Not Applicable

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Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Preliminary Design / Planning / CEQA level submittal:

- Attachment 3a must identify:
  - ☒ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual
- Attachment 3b is not required for preliminary design / planning / CEQA level submittal.

Final Design level submittal:

Attachment 3a must identify:

- ☐ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ When applicable, frequency of bioretention soil media replacement.
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

Attachment 3b: For private entity operation and maintenance, Attachment 3b must include a Storm Water Management and Discharge Control Maintenance Agreement (Form DS-3247). The following information must be included in the exhibits attached to the maintenance agreement:

- ☐ Vicinity map
- ☐ Site design BMPs for which DCV reduction is claimed for meeting the pollutant control obligations.
- ☐ BMP and HMP location and dimensions
- ☐ BMP and HMP specifications/cross section/model
- ☐ Maintenance recommendations and frequency
- ☐ LID features such as (permeable paver and LS location, dim, SF).

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation per original plans when applicable (e.g. a vegetated swale may require a minimum vegetation height).
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in vegetated swales	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, loosening or replacing top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

Typical Maintenance Indicator(s) for Non-Vegetated Infiltration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris in infiltration basin, pre-treatment device, or on permeable pavement surface	Remove and properly dispose accumulated materials.
Standing water in infiltration basin without subsurface infiltration gallery for longer than 96 hours following a storm event	Remove and replace clogged surface soils.
Standing water in subsurface infiltration gallery for longer than 96 hours following a storm event	This condition requires investigation of why infiltration is not occurring. If feasible, corrective action shall be taken to restore infiltration (e.g. flush fine sediment or remove and replace clogged soils). BMP may require retrofit if infiltration cannot be restored. If retrofit is necessary, the City Engineer shall be contacted prior to any repairs or reconstruction.
Standing water in permeable paving area	Flush fine sediment from paving and subsurface gravel. Provide routine vacuuming of permeable paving areas to prevent clogging.
Damage to permeable paving surface	Repair or replace damaged surface as appropriate.
Note: When inspection or maintenance indicates sediment is accumulating in an infiltration BMP, the DMA draining to the infiltration BMP should be examined to determine the source of the sediment, and corrective measures should be made as applicable to minimize the sediment supply.	

Typical Maintenance Indicator(s) for Filtration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.
Clogged filter media	Remove and properly dispose filter media, and replace with fresh media.
Damage to components of the filtration system	Repair or replace as applicable.
Note: For proprietary media filters, refer to the manufacturer's maintenance guide.	

Typical Maintenance Indicator(s) for Detention Basins	Maintenance Actions
Poor vegetation establishment	Re-seed, re-establish vegetation.
Overgrown vegetation	Mow or trim as appropriate.
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or re-grading where necessary.
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials.
Standing water	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, or minor re-grading for proper drainage.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.

ATTACHMENT 4
COPY OF PLAN SHEETS SHOWING PERMANENT STORM WATER BMPS

This is the cover sheet for Attachment 4.

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Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

- ☐ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- ☐ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- ☐ Details and specifications for construction of structural BMP(s)
- ☐ Signage indicating the location and boundary of structural BMP(s) as required by the City Engineer
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- ☐ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
- ☐ All BMPs must be fully dimensioned on the plans
- ☐ When proprietary BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Boucher photocopies are not allowed.

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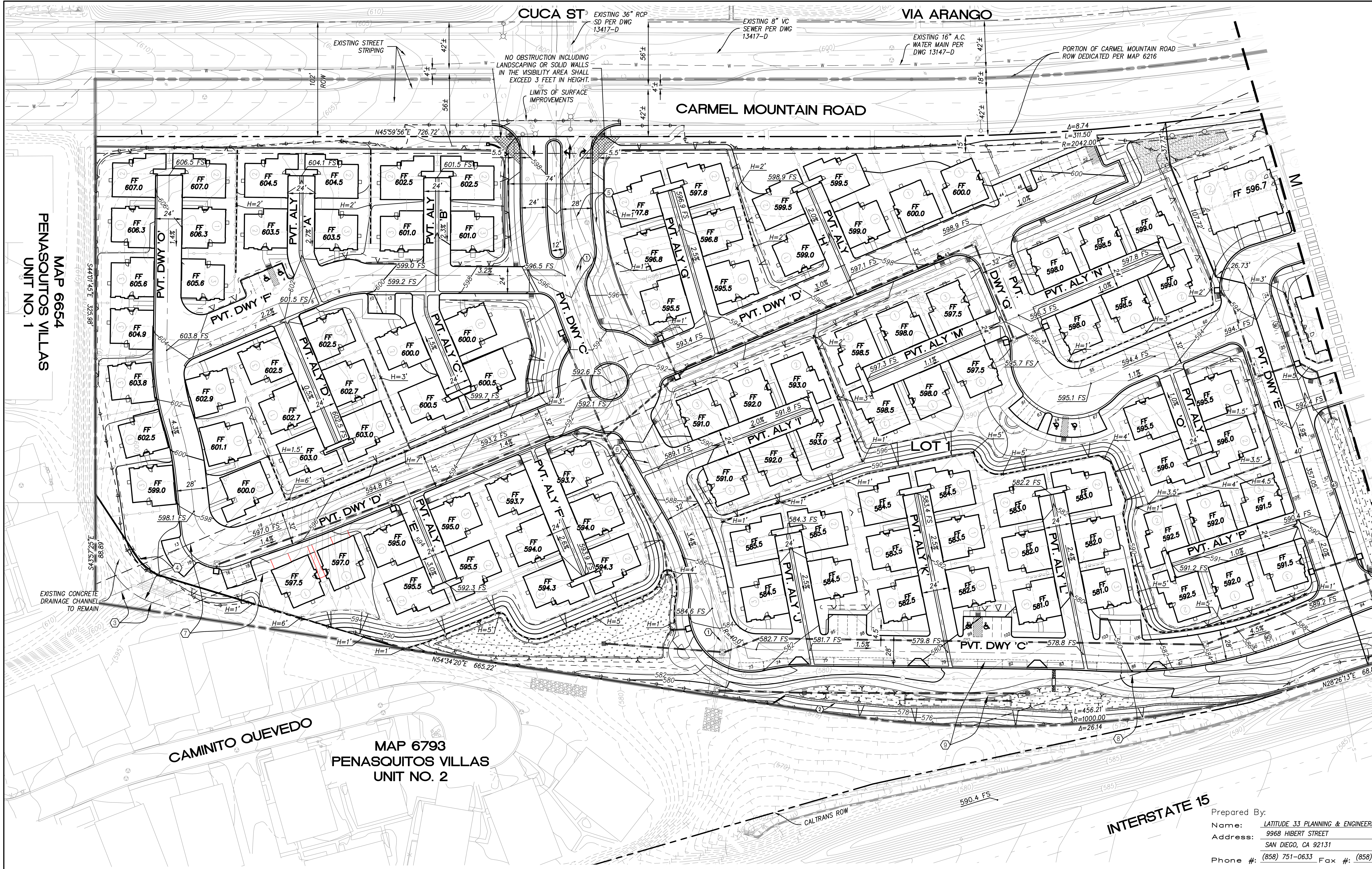

LEGEND

- PROJECT BOUNDARY
- SLOPES 2:1 MAX. (TYP.)
- DAYLIGHT LINE
- EXISTING LOT LINE
- PROPOSED LOT LINE
- PROPOSED RETAINING WALL
- FINISHED FLOOR ELEVATION — FF 660.0
- EX. STORM DRAIN
- EX. SEWER
- EX. WATER
- EX. CONTOUR
- EX. RIP RAP
- EX. RETAINING WALL
- EX. CURB & GUTTER
- PROPOSED HDPE STORM DRAIN
- PROPOSED STREET SLOPE — 1.0%
- PROPOSED CURB & GUTTER
- PROPOSED CURB INLET
- PROPOSED HEADWALL
- PROPOSED A-4 CLEANOUT
- PROPOSED 24" X 24" GRATE INLET
- BIO-FILTRATION BASIN (SEE DETAIL SHEET 3)
- PROPOSED FINISHED SURFACE ELEVATION — 660.0 FS
- FENCE PER LANDSCAPE ARCHITECTURE PLANS
- PROPOSED SIDEWALK UNDERDRAIN & RIP RAP OUTLET
- RETAINING WALL HEIGHT — H=1'
- PARKING SPOTS
- VISIBILITY TRIANGLES
- SOUNDWALL SEE SHEET 2 FOR DETAIL
- MODIFIED ADA RAMP
- PROPOSED BROW DITCH
- MOTORCYCLE 5' X 3' SPOTS (NUMBER INDICATES SPOTS PER CLUSTER)
- PROPOSED TRASH ENCLOSURE
- LOADING AREA 35' X 12' — LOADING

DRAINAGE NOTES

1. ALL STORM DRAIN PIPES SHOWN ON PLAN ARE PRIVATE HDPE TO BE SIZED DURING CONSTRUCTION DRAWINGS.
2. AT THE STORM WATER DISCHARGE LOCATIONS WITHIN THE PROJECT SITE, SUITABLE ENERGY DISSIPATERS ARE TO BE INSTALLED TO REDUCE THE DISCHARGE TO NON-ERODIBLE VELOCITIES.

NOTES

① EXISTING STORM DRAIN TO REMAIN.
② PROPOSED 12' SOUNDWALL. SEE DETAIL SHEET 3.
③ INDICATES 20' SDG&E CO EASEMENT PER BOOK 3221, PAGE 10 O.R.
④ INDICATES 25' DRAINAGE EASEMENT PER MAP 6126
⑤ INDICATES PROPOSED 15' SEWER EASEMENT
⑥ INDICATES PROPOSED 15' DRAINAGE EASEMENT
⑦ EXISTING 15' SETBACK FROM SDG&E EASEMENT
⑧ 50' SETBACK PER MAP 6126
⑨ INDICATES PROPOSED 30' SEWER EASEMENT

0 40 80 120
(IN FEET)
1 inch = 40 ft.

REGISTERED PROFESSIONAL ENGINEER GIOVANNI POSILLICO No. 66332 Exp. 06-2016 CIVIL STATE OF CALIFORNIA

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Tel 858.751.0633

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Phone #: (858) 751-0633 Fax #: (858) 751-0634

Project Address:
10955 CARMEL MOUNTAIN ROAD, SAN DIEGO,
CALIFORNIA 92129

Project Name:
PACIFIC VILLAGE
VESTING TENTATIVE MAP
PLANNED DEVELOPMENT PERMIT
SITE DEVELOPMENT PERMIT
NEIGHBORHOOD USE PERMIT

Sheet Title:
GRADING AND DRAINAGE PLAN

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Revision 13:	
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Revision 2:	9-28-2016
Revision 1:	5-24-2016
Original Date:	2-3-2016

Sheet 7 of 95

PTS # 470158

I.O. # 24006477

1932-6299 CCS83 COORDINATES — 292-1739 LAMBERT COORDINATES

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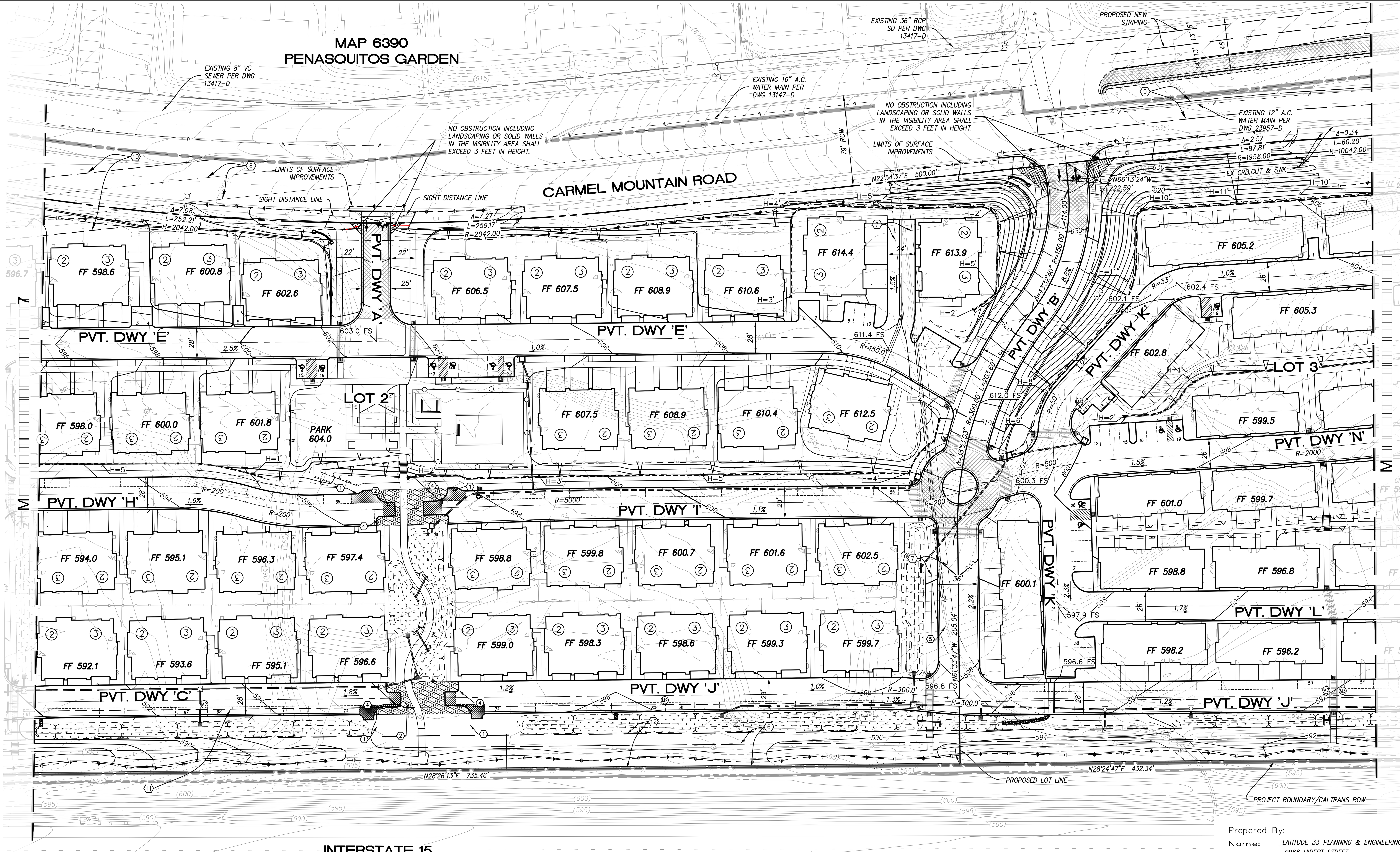

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NOTES

1. VEHICLE TURN AROUND STRIPED TO PROHIBIT PARKING
2. GRASS CRETE FIRE ACCESS
3. REMOVABLE BOLLARDS
4. MOUNTABLE CURB ALONG FIRE ACCESS FRONTAGE
5. EXISTING STORM DRAIN TO REMAIN
6. INDICATES 20' SEWER EASEMENT PER CITY DWG 11942-2D, FILE NO. 116206, SERIES 6, BOOK 1965, O.R.
7. INDICATES PROPOSED 15' WIDE DRAINAGE EASEMENT
8. INDICATES 20' SDG&E CO EASEMENT PER BOOK 3221, PAGE 10 O.R.
9. INDICATES WATER EASEMENT PER DOC NO. 116207 RECORDED JUNE 29, 1965
10. EXISTING 15' SETBACK FROM SDG&E EASEMENT
11. 50' SETBACK PER MAP 6126
12. INDICATES PROPOSED 30' SEWER EASEMENT

DRAINAGE NOTES

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Sheet 8 of 95

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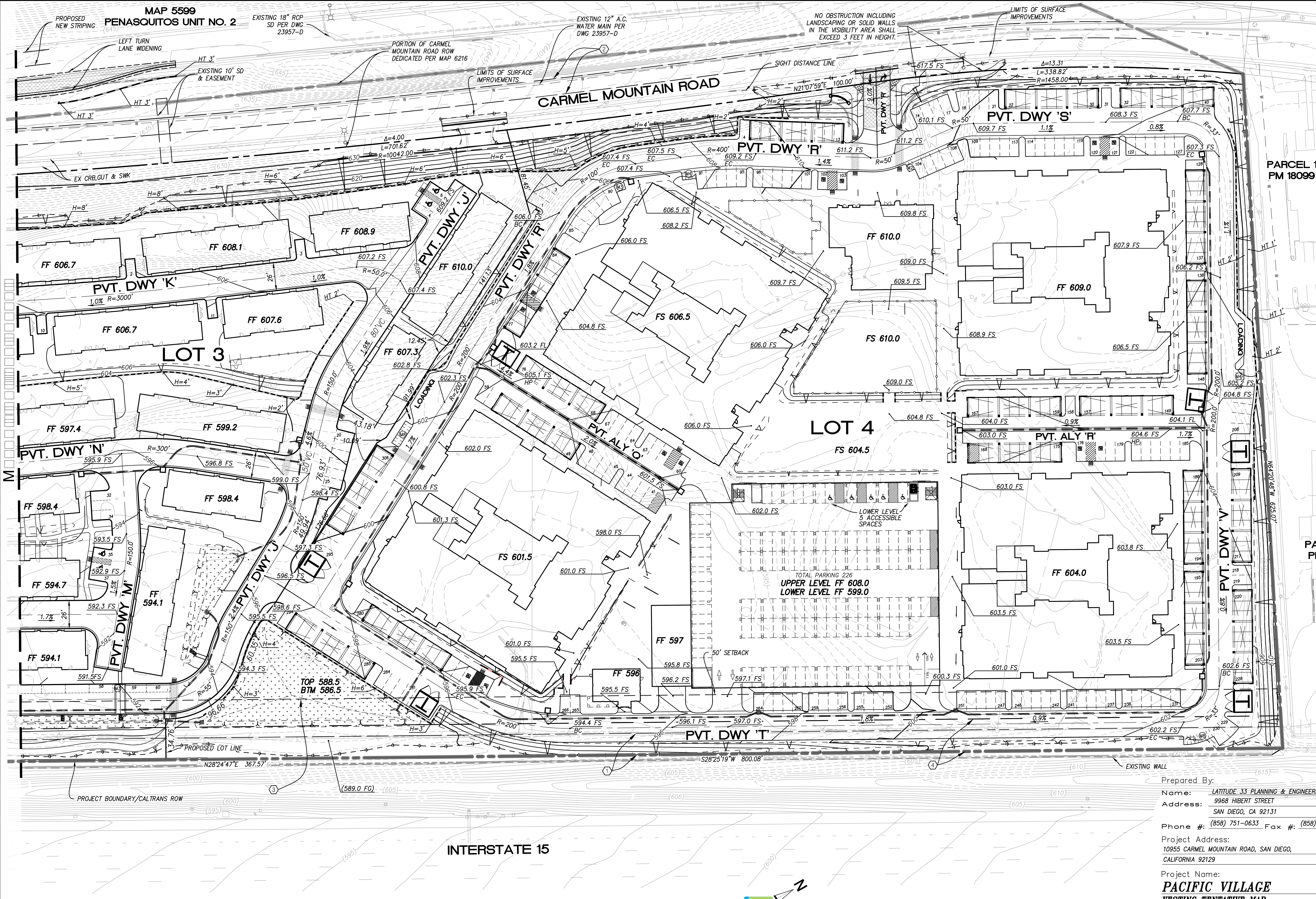

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REGISTERED PROFESSIONAL ENGINEER
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Sheet 9 of 95

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ATTACHMENT 5
DRAINAGE REPORT

Attach project's drainage report. Refer to Drainage Design Manual to determine the reporting requirements.

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DRAINAGE STUDY FOR:

PACIFIC VILLAGE
TENTATIVE MAP N0. 1669785

CITY OF SAN DIEGO, CALIFORNIA

PTS NO. 470158

Prepared for:

Lennar Homes of California, Inc.

25 Enterprise, Suite 300

Aliso Viejo, CA 92656

(949) 349-8000

Prepared by:

Latitude 33 Planning and Engineering

9968 Hibert Street, 2nd Floor

San Diego, California 92131

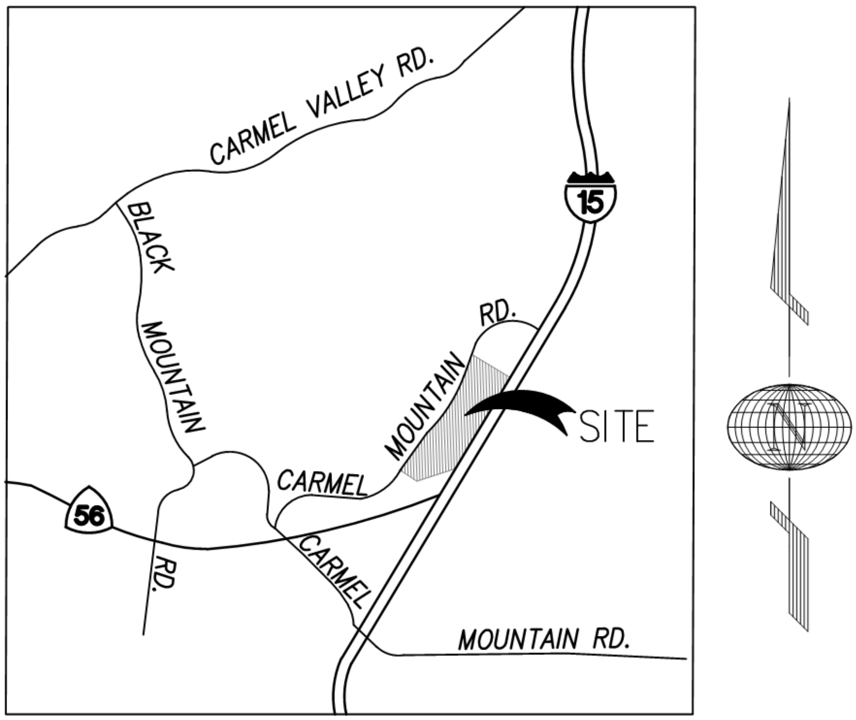
(858) 751-0633

Giovanni Posillico RCE 66332

TABLE OF CONTENTS

I. PROJECT DESCRIPTION

Latitude 33 is developing a tentative map for the Pacific Village project located in Ranchos Penasquitos just west of Interstate 15 along Carmel Mountain Road, see vicinity map below. As part of this development there is a mix of 2-story single family detached cluster homes, triplexes, 3-story row townhomes and apartments. This report has been prepared to document the analysis of the existing and proposed drainage condition associated with Pacific Village.



VICINITY MAP

II. EXISTING SITE CONDITION

The project area is approximately 41 acres of developed land consisting of relatively spread out single story multidwelling residential homes. The existing site is comprised of rolling hills with gentle slopes no larger than 2:1 and as mild as 30:1. Although the overall surface flow pattern tends to drain to the southeast, there are two major basins at Pacific Village. There exists a ridge running east roughly in the middle of the site that divides the project into northern and southern basins. Within each basin there exists 36-in storm drains which begin outside the project limits from the west and aid with the capture of onsite flows. These flows are then transferred east under Interstate 15 and travel south eventually meeting up with Los Penasquitos Creek.

III. DEVELOPED SITE CONDITION

The post project developed site at Pacific Village will have a 99 cluster homes, 102 triplexes, 128 row townhomes and 240 apartments. The storm water run-off from the project site will be treated by biofiltration basins onsite and will follow a similar flow pattern as the existing condition utilizing the two existing 36-in storm drains. The drainage areas have been designed to maintain the overall drainage areas tributary to the existing storm drains.

The two existing 36-in storm drains collecting runoff from the project site cross through and also drain a portion of Interstate 15. Caltrans requires a design storm of 25-yrs for conventional, high volume, multilane highways with speeds over 45 mph while design storms for this project are much less. According to the City of San Diego's Storm Water Standards, BMP Design Manual, dated January 2016, the flow control performance requirements for the proposed developed site states that we need to reduce the discharge leaving the site to a fraction of the 2-yr storm event. Based on the geomorphic assessment performed by Chang Consultants titled, Hydromodification Screening for Pacific Village, dated May 10, 2016 the low flow threshold for this project is half of the discharge for the 2-yr storm ($0.5Q_2$).

The manual specifically states that, "For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-development 2year runoff event (0.1Q2, 0.3Q2, or 0.5Q2) to the pre-development 10-year runoff event (Q10), the post-project discharge rates and durations must not exceed the pre-development rates and durations by more than 10 percent…", (pg. 6-4 of the City of San Diego's Storm Water Standards, BMP Design Manual, dated January 2016). This requirement is beyond the scope of this study but fortunately the manual also allows the low flow orifices used as flow control for the storage facilities to be determined using the BMP Sizing Spreadsheet that was developed by the County of San Diego, which is a much more conservative approach.

These orifices are sized to discharge 50 percent of the predevelopment two year storm. In the existing condition there has been no reports of flooding or backwater effects from the contribution of the current projects site's runoff onto Caltrans property. Also, currently there are no hydromodification structural BMPs in place to regulate flows onto Caltrans right-of-way. With the new flow control BMPs proposed, the flows leaving the project will be less than what they are currently today due to the simple fact that we a reducing the flows to predevelopment conditions, meaning much less impervious area and thus less flow and this flow is half of the 2-year storm event. Please see the Storm Water Quality Management Plan (SWQMP) for details of Water Quality and hydromodification compliance calculations.

For some developed site conditions there exist jurisdictional waters on the project site that the government, both federal and state, wish to protect. Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material in water of the United States. Section 401 of the Clean Water Act requires that any applicant for a section 404 permit also obtain a Water Quality Certification from the State. The purpose of the certificate is to confirm that the discharge of fill materials will be in compliance with the State's applicable Water Quality Standards. This project does not have any jurisdictional waters onsite. There is no proposal to dredge or fill in Waters of the U.S. or of the State and thus is not required to obtain approval from the Regional Water Quality Control Board under the Federal Clean Water Act (CWA) section 401 and 404.

IV. HYDROLOGIC METHODOLOGY

This report is intended to support preliminary engineering design, as well as demonstrate compliance with applicable design standards. Specifically this report will address:

1. Flow rates for the pre-development and post project conditions.
2. Note, a separate Storm Water Quality Management Plan (SWQMP) has been prepared for this project. Refer to the SWQMP for detailed discussion of the following:
    a. Project pollutants of concern and receiving water information.
    b. Water quality treatment.
    c. Hydromodification Management.
    d. Other miscellaneous items required by the June 2015 Model BMP Design Manual, San Diego Region.

Appendix I of the City of San Diego's 1984 *Drainage Design Manual's* rational method procedure was the basis for the pre-developed and post project 100-year and 50-year hydrologic analysis. This study was accomplished through the implementation of the 2015 Autodesk Storm and Sanitary Analysis software, which has the capability to utilize a rational method program based on the City of San Diego storm water design criteria. The input parameters are summarized below and the supporting data is included in Appendix A.

- Intensity-Duration-Frequency: The City's 100-year and 50-year Intensity-Duration-Frequency curve from the *Drainage Design Manual* was used.
- Drainage area: The pre-development drainage basins were delineated from the base topographic mapping prepared for the project. Proposed condition drainage basins were delineated using the proposed grading and the tentative map storm drain plans.
- Manning's Roughness Coefficients: Table 1-104.14A was used to determine appropriate values.
- Run-off Coefficient: Taking into consideration the amount of landscaped area for the pre-developed condition a value of 0.55 was used and for the post condition a runoff coefficient of 0.70 was implemented in accordance with Table 2 in Appendix I.
- Flow lengths and elevations: The flow lengths and elevations were obtained from the topographic mapping and grading plans.

V. DISCUSSION AND RESULT

The rational method results (see table below) show that there is an overall growth in flow for both the North and South basins during the 50 and 100 year storm events. For the northern basin there is a decrease in total area but there is also a decrease in time of concentration which results in an overall increase in flow of moderate size. The southern basin gained the area the northern basin lost. This development creates a longer flow path which increases the time of concentration. Although the area increased, the time of concertation also increased so that the resulting flow rise is tolerable. Appendix A shows the rational method calculations from the 2015 Autodesk Storm and Sanitary Analysis software used in this analysis.

Basin	**Exist Area**	**Prop. Area**	**Exist Q50**	**Prop. Q50**	**Exist Q100**	**Prop. Q100**
	(ac)	**(ac)**	**(cfs)**	**(cfs)**	**(cfs)**	**(cfs)**
North	27.43	24.80	37.98	46.91	42.38	51.69
South	16.18	18.81	35.86	42.49	38.58	46.45

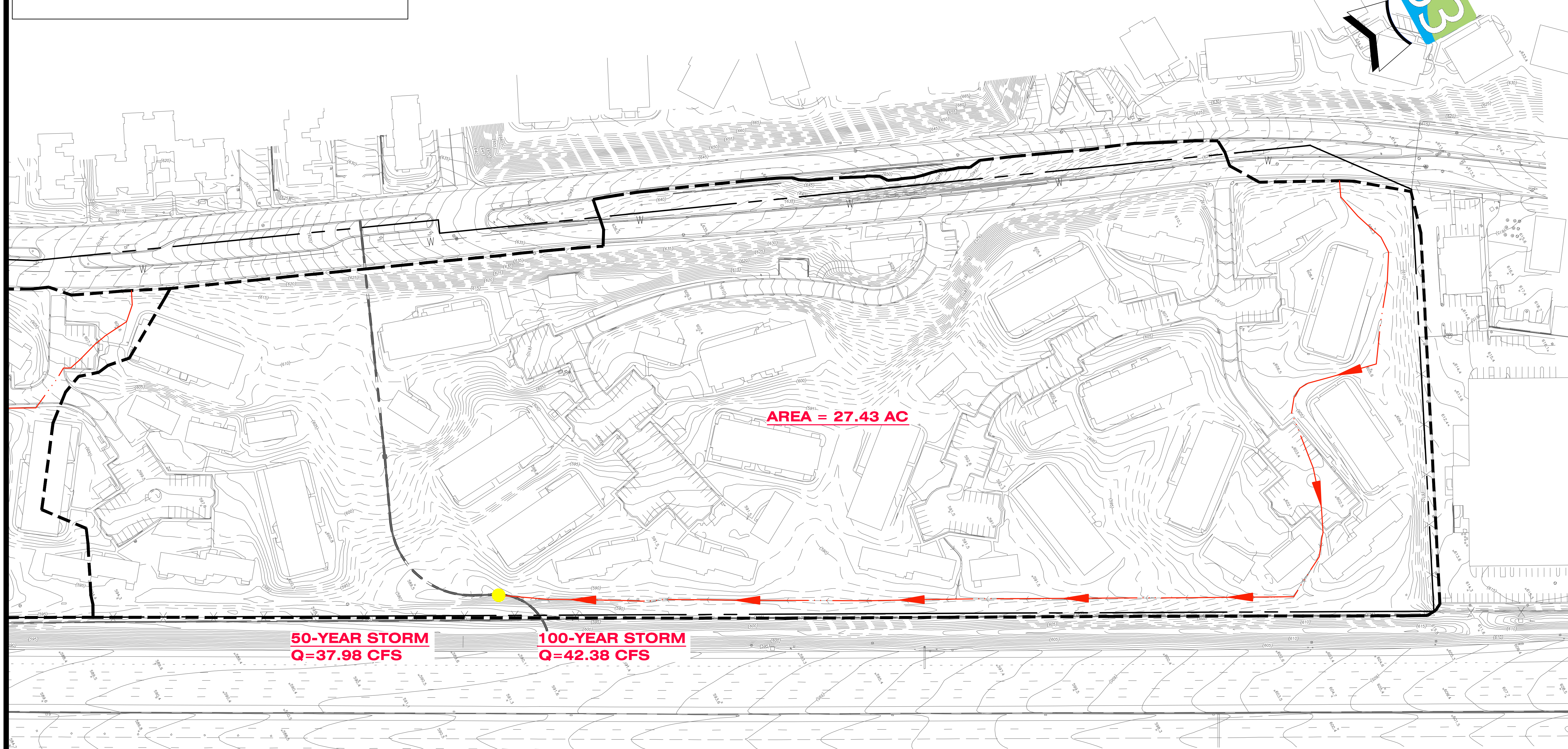
APPENDIX A: EXISTING & PROPOSED HYDROLOGIC CALCULATIONS

PACIFIC VILLAGE
EXISTING CONDITION HYDROLOGY MAP
NORTH BASIN

SCALE=1:150

LEGEND

- PROPOSED BASIN LIMITS –
- BASIN OUTLET LOCATION –
- SURFACE FLOW DIRECTION –



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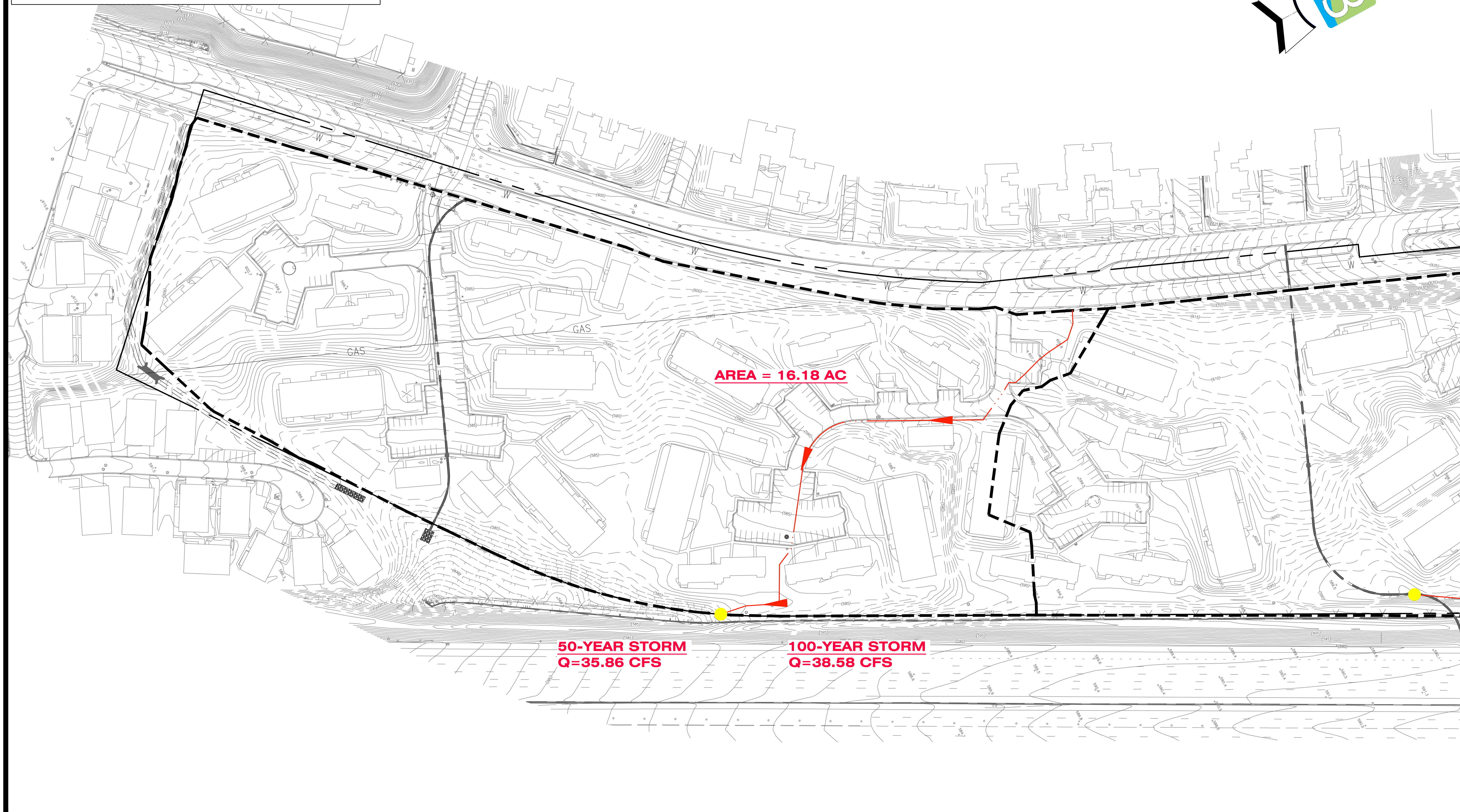
PACIFIC VILLAGE
EXISTING CONDITION HYDROLOGY MAP
SOUTH BASIN

SCALE=1:150

LEGEND

PROPOSED BASIN LIMITS –
BASIN OUTLET LOCATION –
SURFACE FLOW DIRECTION –



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PACIFIC VILLAGE
PROPOSED CONDITION HYDROLOGY MAP
NORTH BASIN

SCALE=1:150

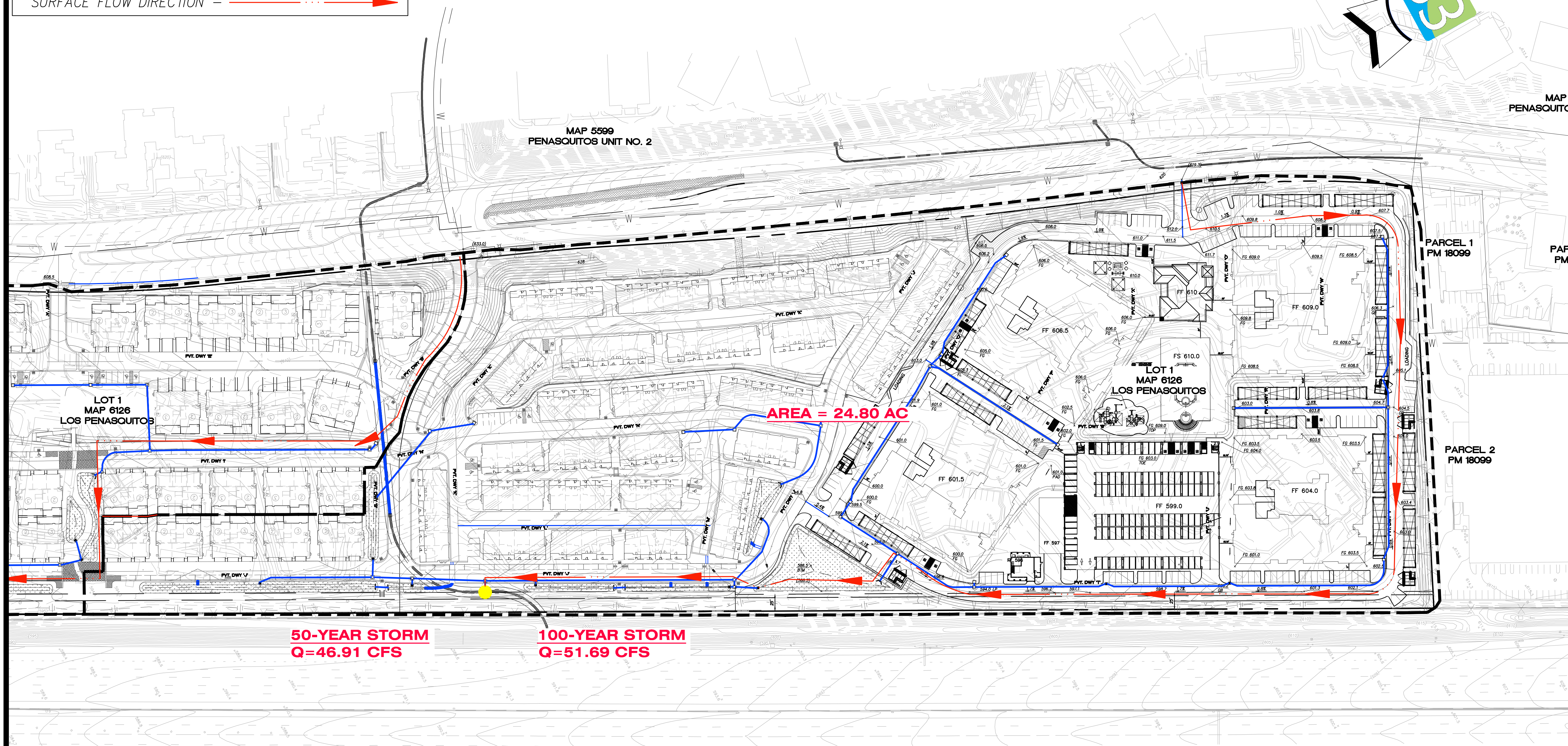
LEGEND

PROPOSED BASIN LIMITS –

STORM DRAIN SYSTEM –

BASIN OUTLET LOCATION –

SURFACE FLOW DIRECTION –



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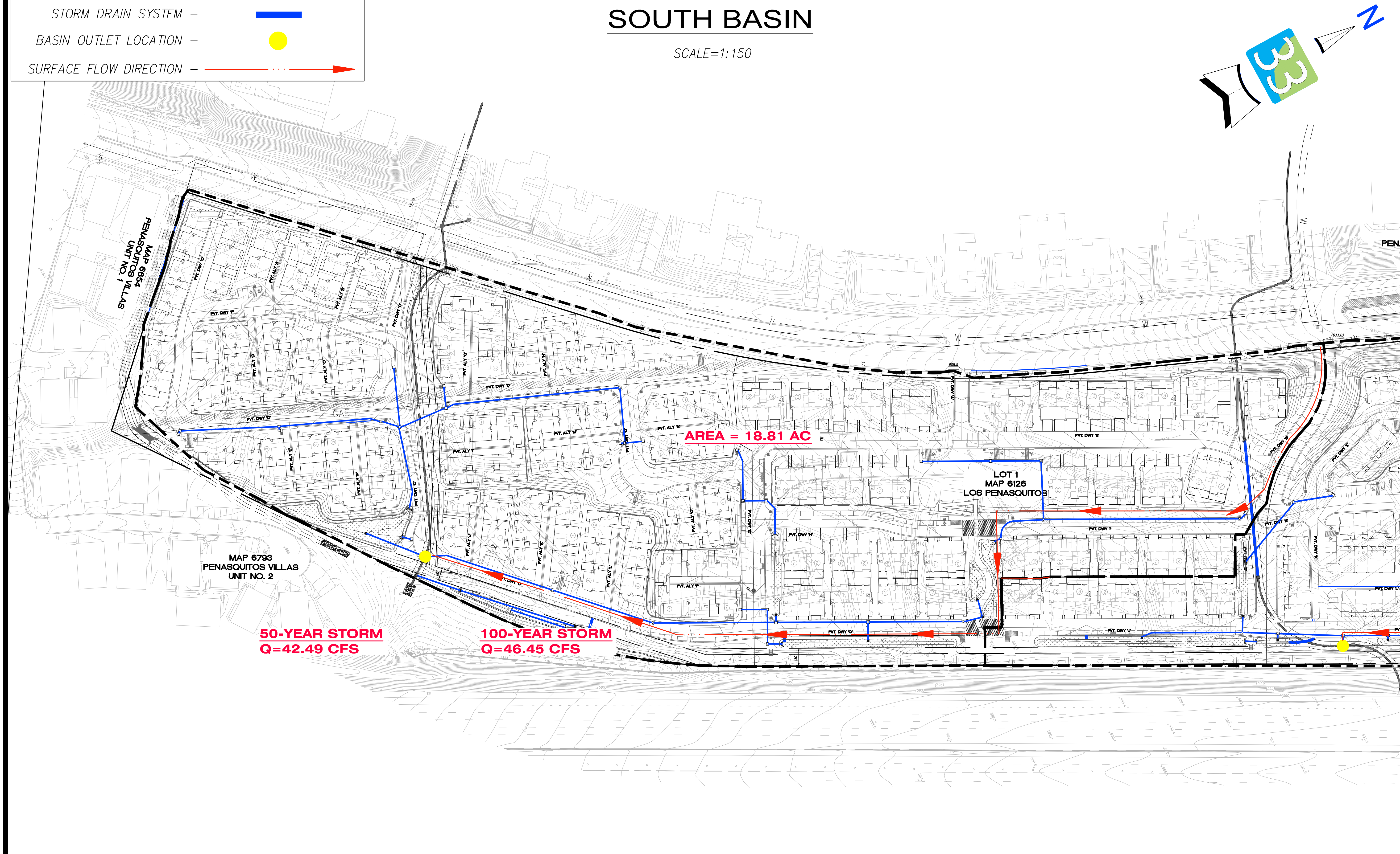
PACIFIC VILLAGE
PROPOSED CONDITION HYDROLOGY MAP
SOUTH BASIN

SCALE=1:150

LEGEND

PROPOSED BASIN LIMITS –
STORM DRAIN SYSTEM –
BASIN OUTLET LOCATION –
SURFACE FLOW DIRECTION –



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Project Description

File Name	Lennar Exisitng Drainage.SPF
Description	
	C:\Users\jgreen\Desktop\Test\1323 C3D SD & EXIST DA.dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 11, 2015	00:00:00
End Analysis On	Dec 11, 2015	02:00:00
Start Reporting On	Dec 11, 2015	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

Rainfall Details

Return Period	50 year(s)

Subbasin Hydrology

Subbasin : {Site 1}.Lenar_Exist_North

Input Data

Area (ac) 27.43
Weighted Runoff Coefficient 0.5500

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	27.43	-	0.55
Composite Area & Weighted Runoff Coeff.	27.43		0.55

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0.00	0.00
Flow Length (ft) :	298.868	0.00	0.00
Slope (%) :	2.449	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	12.04	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	342.641	0.00	0.00
Slope (%) :	1.097	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.69	0.00	0.00
Computed Flow Time (min) :	3.38	0.00	0.00

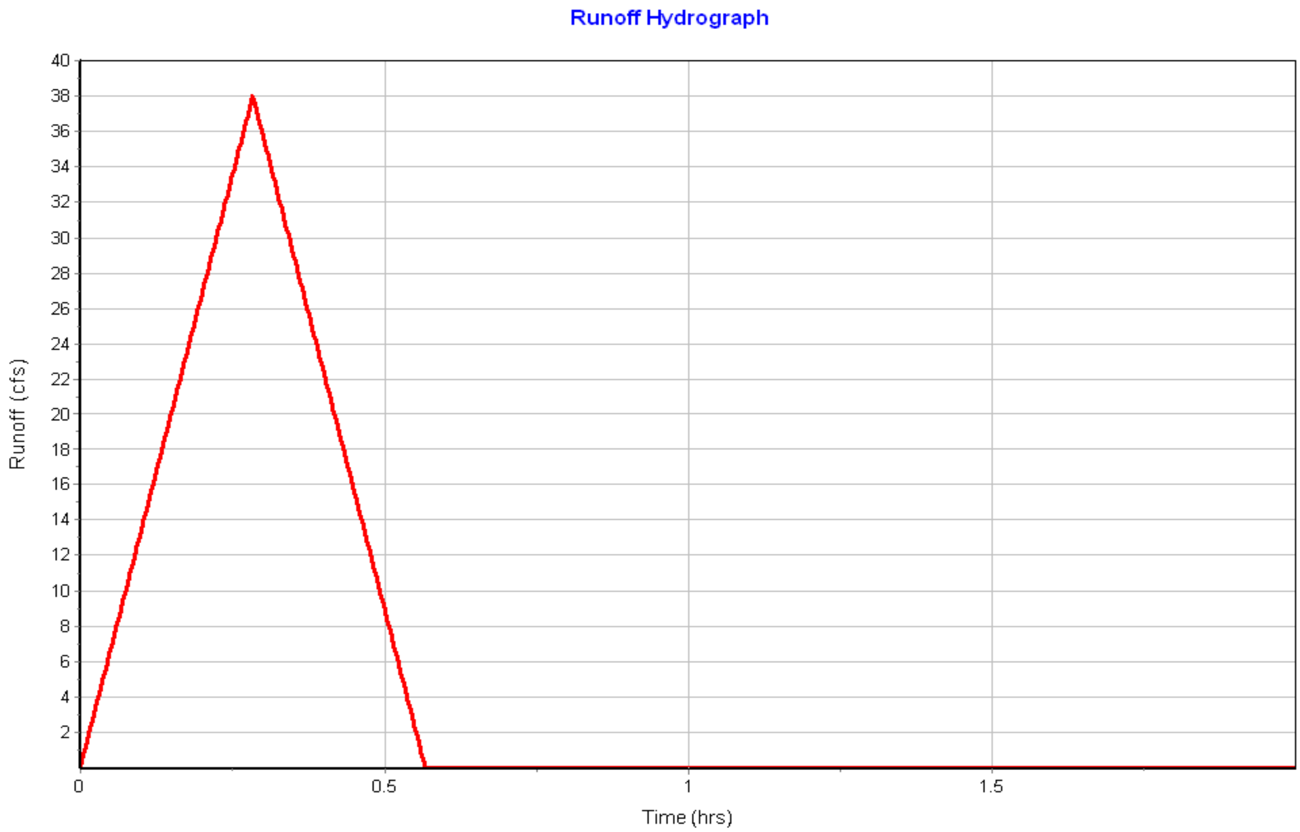
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.00	0.00
Flow Length (ft) :	1282.998	0.00	0.00
Channel Slope (%) :	1.24	0.00	0.00
Cross Section Area (ft^2) :	6.534	0.00	0.00
Wetted Perimeter (ft) :	4.712	0.00	0.00
Velocity (ft/sec) :	13.75	0.00	0.00
Computed Flow Time (min) :	1.55	0.00	0.00

Total TOC (min) 16.97

Subbasin Runoff Results

Total Rainfall (in) 0.71
Total Runoff (in) 0.39
Peak Runoff (cfs) 37.98
Rainfall Intensity 2.517
Weighted Runoff Coefficient 0.5500
Time of Concentration (days hh:mm:ss) 0 00:16:58

Subbasin : {Site 1}.Lenar_Exist_North



Subbasin : {Site 1}.Lennar_Exist_South

Input Data

Area (ac) 16.18
Weighted Runoff Coefficient 0.5500

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	16.18	-	0.55
Composite Area & Weighted Runoff Coeff.	16.18		0.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.018	0.00	0.00
Flow Length (ft) :	237.731	0.00	0.00
Slope (%) :	4.39	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	1.31	0.00	0.00
Computed Flow Time (min) :	3.03	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	449.65	0.00	0.00
Slope (%) :	4.18	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	4.16	0.00	0.00
Computed Flow Time (min) :	1.80	0.00	0.00

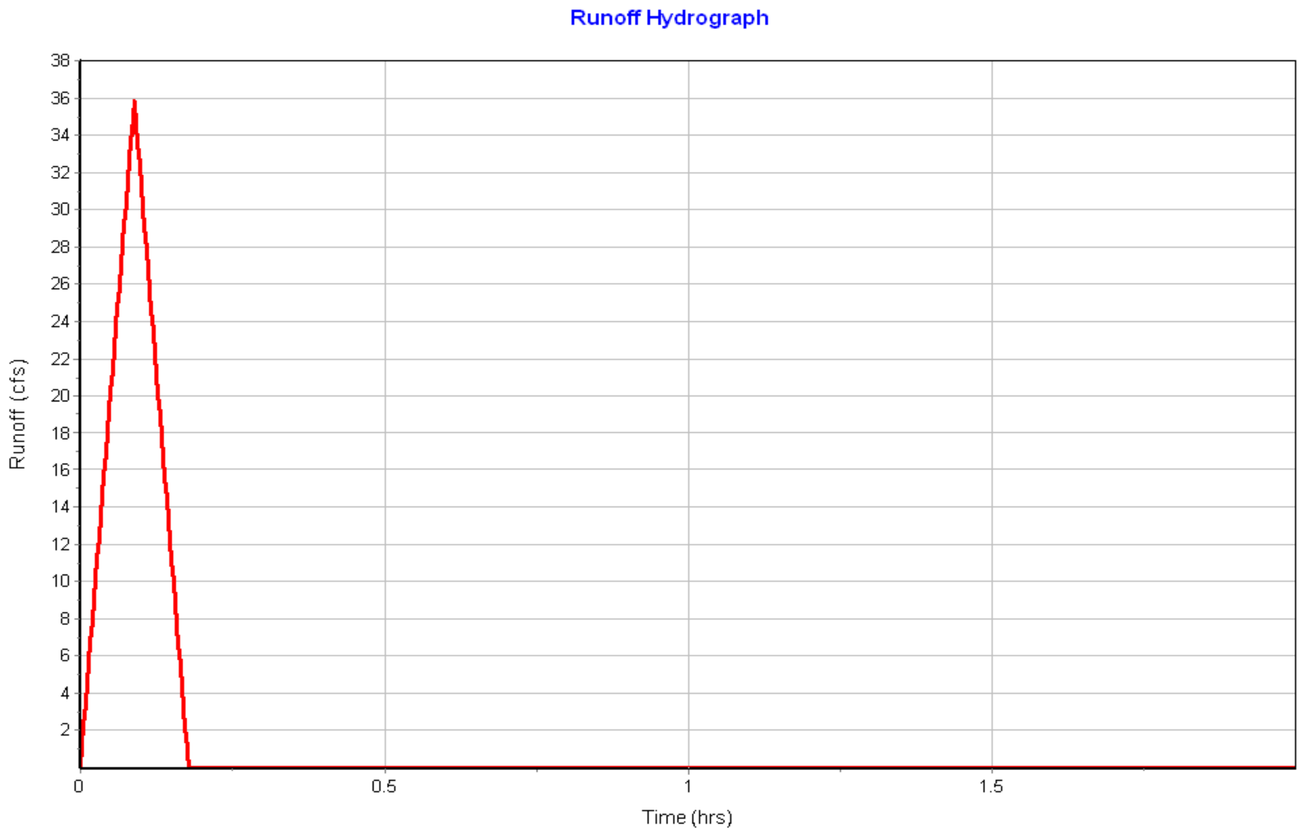
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.05	0.00	0.00
Flow Length (ft) :	192.64	0.00	0.00
Channel Slope (%) :	1.84	0.00	0.00
Cross Section Area (ft²) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	1.57	0.00	0.00
Velocity (ft/sec) :	6.42	0.00	0.00
Computed Flow Time (min) :	0.50	0.00	0.00

Total TOC (min) 5.33

Subbasin Runoff Results

Total Rainfall (in) 0.36
Total Runoff (in) 0.20
Peak Runoff (cfs) 35.86
Rainfall Intensity 4.029
Weighted Runoff Coefficient 0.5500
Time of Concentration (days hh:mm:ss) 0 00:05:20

Subbasin : {Site 1}.Lennar_Exist_South



Project Description

File Name	Lennar Proposed Drainage.SPF
Description	H:\1300\1323.00 - Lennar Penasquitos 41-acre\Engineering\Reports\Drainage\SSA Calcs\1323 C3D PROP DA.dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 17, 2015	00:00:00
End Analysis On	Dec 17, 2015	02:00:00
Start Reporting On	Dec 17, 2015	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

Rainfall Details

Return Period	50 year(s)

Subbasin Hydrology

Subbasin : {Site 1}.Lennar_Proposed_North

Input Data

Area (ac) 24.80
Weighted Runoff Coefficient 0.7000

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	24.80	-	0.70
Composite Area & Weighted Runoff Coeff.	24.80		0.70

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.060	0.00	0.00
Flow Length (ft) :	127.732	0.00	0.00
Slope (%) :	3.184	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	0.39	0.00	0.00
Computed Flow Time (min) :	5.49	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1180.914	0.00	0.00
Slope (%) :	1.331	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.35	0.00	0.00
Computed Flow Time (min) :	8.38	0.00	0.00

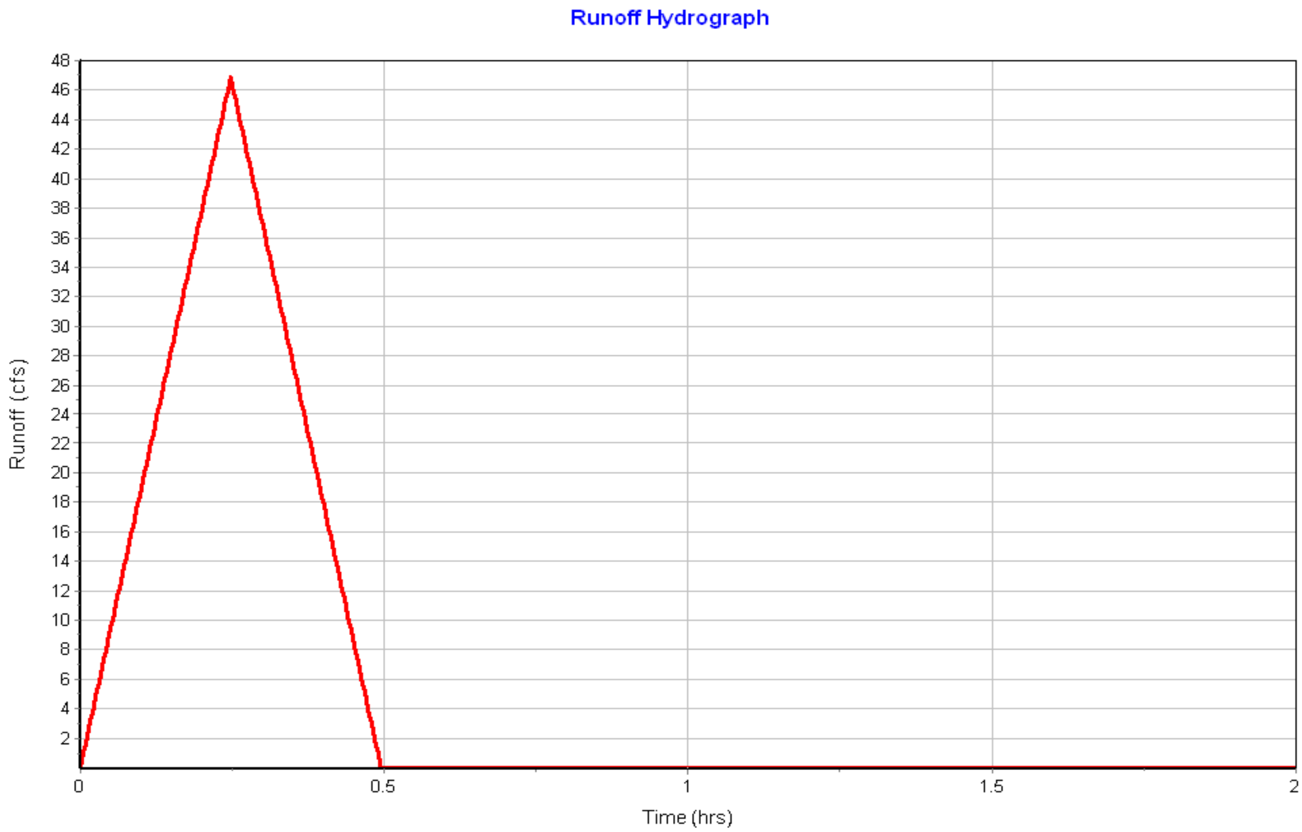
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.012	0.00	0.00
Flow Length (ft) :	593.649	0.00	0.00
Channel Slope (%) :	1.788	0.00	0.00
Cross Section Area (ft^2) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	6.28	0.00	0.00
Velocity (ft/sec) :	10.46	0.00	0.00
Computed Flow Time (min) :	0.95	0.00	0.00

Total TOC (min) 14.81

Subbasin Runoff Results

Total Rainfall (in) 0.67
Total Runoff (in) 0.47
Peak Runoff (cfs) 46.91
Rainfall Intensity 2.702
Weighted Runoff Coefficient 0.7000
Time of Concentration (days hh:mm:ss) 0 00:14:49

Subbasin : {Site 1}.Lennar_Proposed_North



Subbasin : {Site 1}.Lennar_Proposed_South

Input Data

Area (ac) 18.81
Weighted Runoff Coefficient 0.7000

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	18.81	-	0.70
Composite Area & Weighted Runoff Coeff.	18.81		0.70

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0.00	0.00
Flow Length (ft) :	93.345	0.00	0.00
Slope (%) :	4.057	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	0.40	0.00	0.00
Computed Flow Time (min) :	3.88	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	432.559	0.00	0.00
Slope (%) :	1.820	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.74	0.00	0.00
Computed Flow Time (min) :	2.63	0.00	0.00

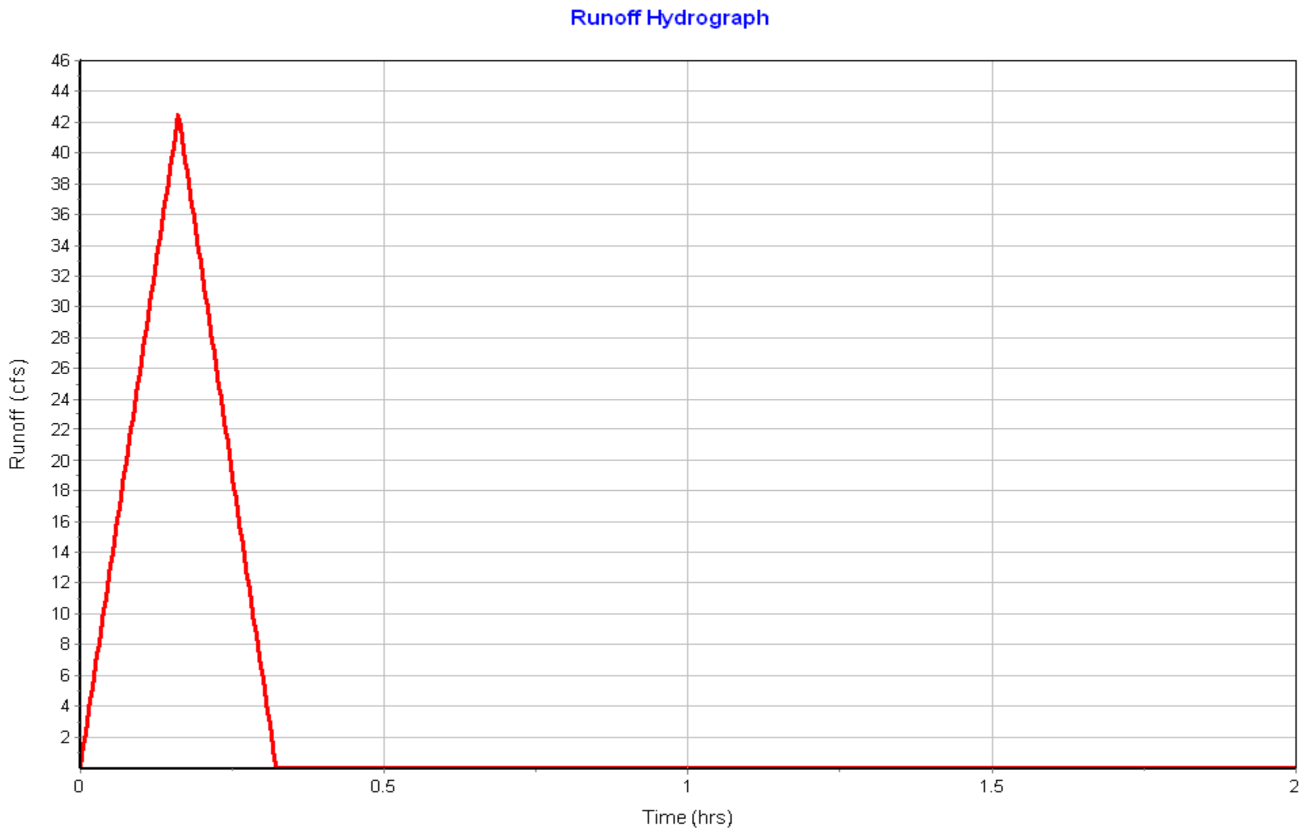
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.012	0.00	0.00
Flow Length (ft) :	1505.761	0.00	0.00
Channel Slope (%) :	1.0	0.00	0.00
Cross Section Area (ft^2) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	6.28	0.00	0.00
Velocity (ft/sec) :	7.82	0.00	0.00
Computed Flow Time (min) :	3.21	0.00	0.00

Total TOC (min) 9.72

Subbasin Runoff Results

Total Rainfall (in) 0.52
Total Runoff (in) 0.36
Peak Runoff (cfs) 42.49
Rainfall Intensity 3.227
Weighted Runoff Coefficient 0.7000
Time of Concentration (days hh:mm:ss) 0 00:09:43

Subbasin : {Site 1}.Lennar_Proposed_South



Project Description

File Name	Lennar Exisitng Drainage.SPF
Description	
	C:\Users\jgreen\Desktop\Test\1323 C3D SD & EXIST DA.dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 11, 2015	00:00:00
End Analysis On	Dec 11, 2015	02:00:00
Start Reporting On	Dec 11, 2015	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

Rainfall Details

Return Period..	100 year(s)

Subbasin Hydrology

Subbasin : {Site 1}.Lenar_Exist_North

Input Data

Area (ac) 27.43
Weighted Runoff Coefficient 0.5500

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	27.43	-	0.55
Composite Area & Weighted Runoff Coeff.	27.43		0.55

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0.00	0.00
Flow Length (ft) :	298.868	0.00	0.00
Slope (%) :	2.449	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	0.41	0.00	0.00
Computed Flow Time (min) :	12.04	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	342.641	0.00	0.00
Slope (%) :	1.097	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.69	0.00	0.00
Computed Flow Time (min) :	3.38	0.00	0.00

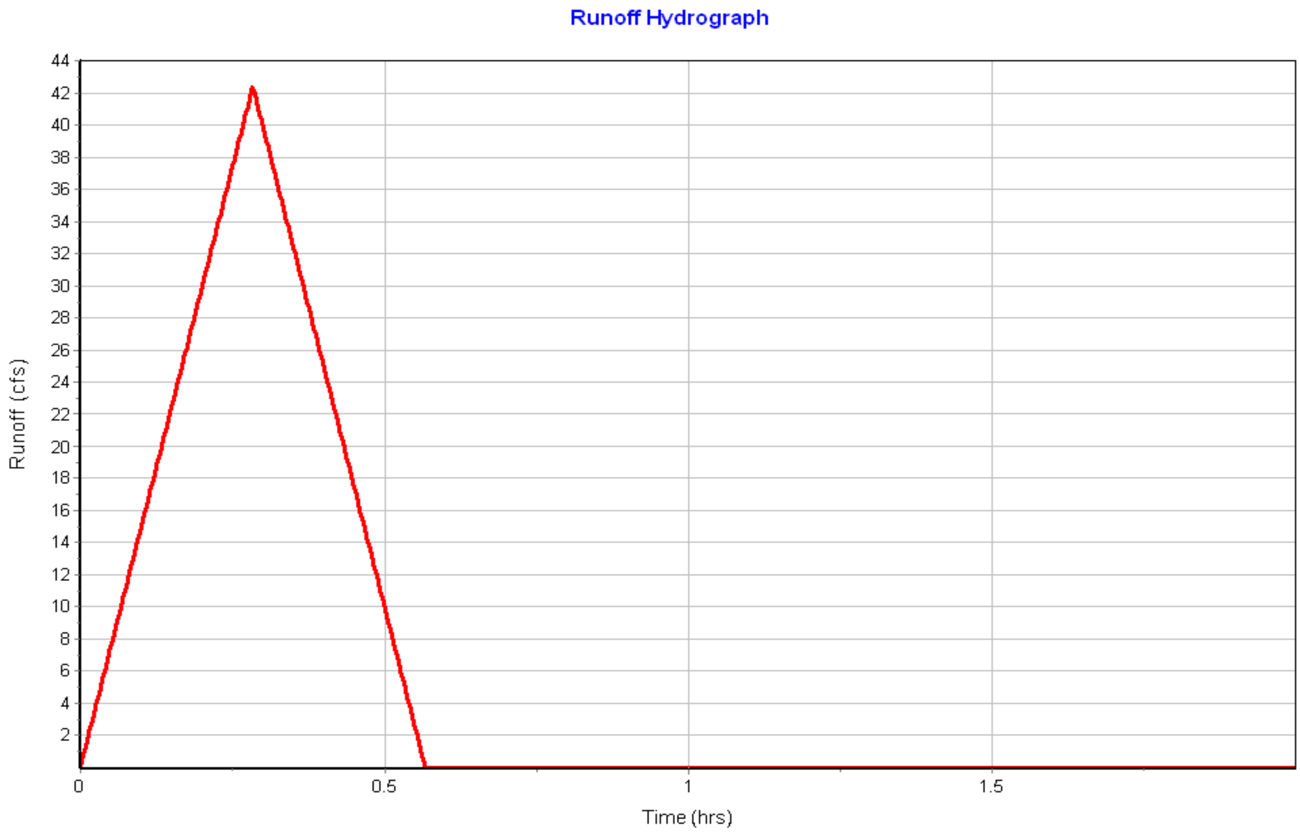
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.00	0.00
Flow Length (ft) :	1282.998	0.00	0.00
Channel Slope (%) :	1.24	0.00	0.00
Cross Section Area (ft^2) :	6.534	0.00	0.00
Wetted Perimeter (ft) :	4.712	0.00	0.00
Velocity (ft/sec) :	13.75	0.00	0.00
Computed Flow Time (min) :	1.55	0.00	0.00

Total TOC (min) 16.97

Subbasin Runoff Results

Total Rainfall (in) 0.80
Total Runoff (in) 0.44
Peak Runoff (cfs) 42.38
Rainfall Intensity 2.809
Weighted Runoff Coefficient 0.5500
Time of Concentration (days hh:mm:ss) 0 00:16:58

Subbasin : {Site 1}.Lenar_Exist_North



Subbasin : {Site 1}.Lennar_Exist_South

Input Data

Area (ac) 16.18
Weighted Runoff Coefficient 0.5500

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	16.18	-	0.55
Composite Area & Weighted Runoff Coeff.	16.18		0.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.018	0.00	0.00
Flow Length (ft) :	237.731	0.00	0.00
Slope (%) :	4.39	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	1.31	0.00	0.00
Computed Flow Time (min) :	3.03	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	449.65	0.00	0.00
Slope (%) :	4.18	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	4.16	0.00	0.00
Computed Flow Time (min) :	1.80	0.00	0.00

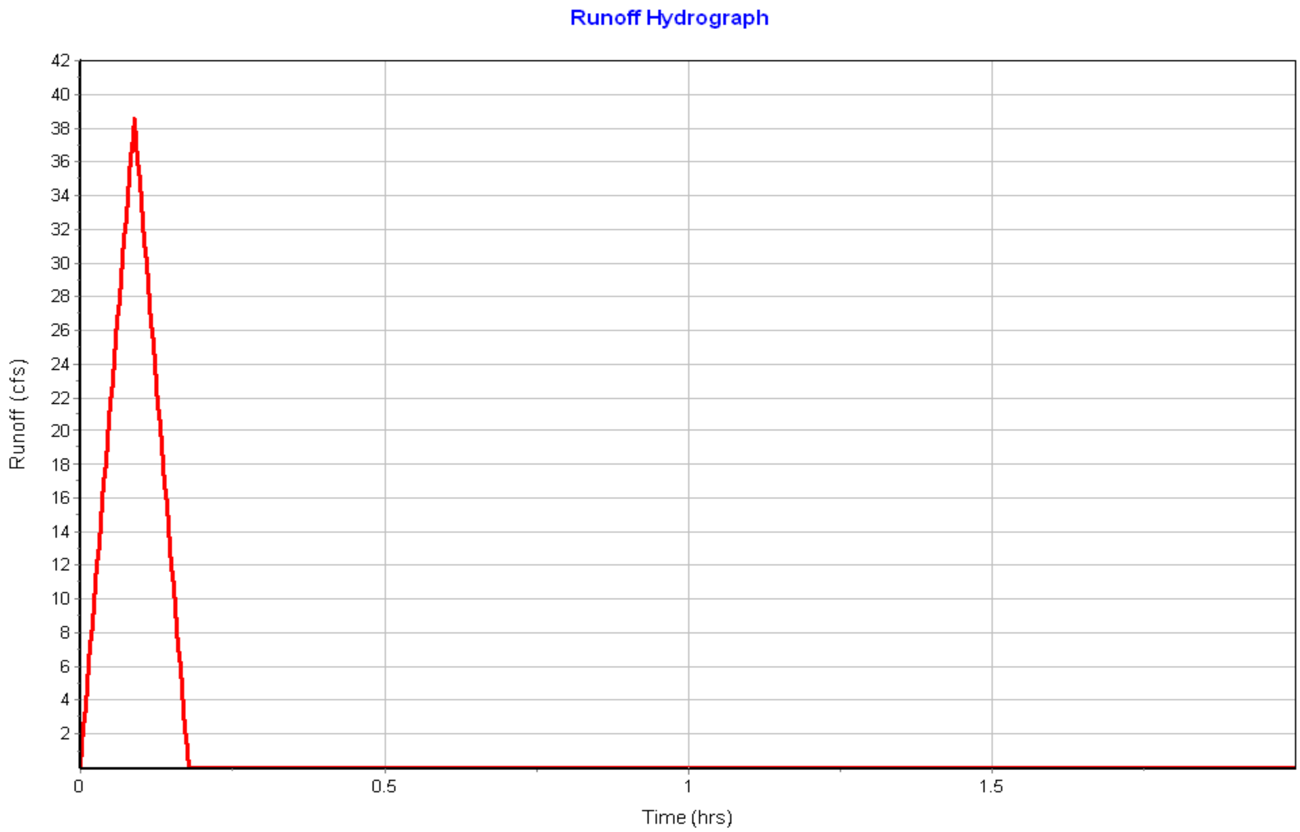
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.05	0.00	0.00
Flow Length (ft) :	192.64	0.00	0.00
Channel Slope (%) :	1.84	0.00	0.00
Cross Section Area (ft²) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	1.57	0.00	0.00
Velocity (ft/sec) :	6.42	0.00	0.00
Computed Flow Time (min) :	0.50	0.00	0.00

Total TOC (min) 5.33

Subbasin Runoff Results

Total Rainfall (in) 0.39
Total Runoff (in) 0.21
Peak Runoff (cfs) 38.58
Rainfall Intensity 4.334
Weighted Runoff Coefficient 0.5500
Time of Concentration (days hh:mm:ss) 0 00:05:20

Subbasin : {Site 1}.Lennar_Exist_South



Project Description

File Name	Lennar Proposed Drainage.SPF
Description	H:\1300\1323.00 - Lennar Penasquitos 41-acre\Engineering\Reports\Drainage\SSA Calcs\1323 C3D PROP DA.dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 17, 2015	00:00:00
End Analysis On	Dec 17, 2015	02:00:00
Start Reporting On	Dec 17, 2015	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

Rainfall Details

Return Period	100 year(s)

Subbasin Hydrology

Subbasin : {Site 1}.Lennar_Proposed_North

Input Data

Area (ac) 24.80
Weighted Runoff Coefficient 0.7000

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	24.80	-	0.70
Composite Area & Weighted Runoff Coeff.	24.80		0.70

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.060	0.00	0.00
Flow Length (ft) :	127.732	0.00	0.00
Slope (%) :	3.184	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	0.39	0.00	0.00
Computed Flow Time (min) :	5.49	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1180.914	0.00	0.00
Slope (%) :	1.331	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.35	0.00	0.00
Computed Flow Time (min) :	8.38	0.00	0.00

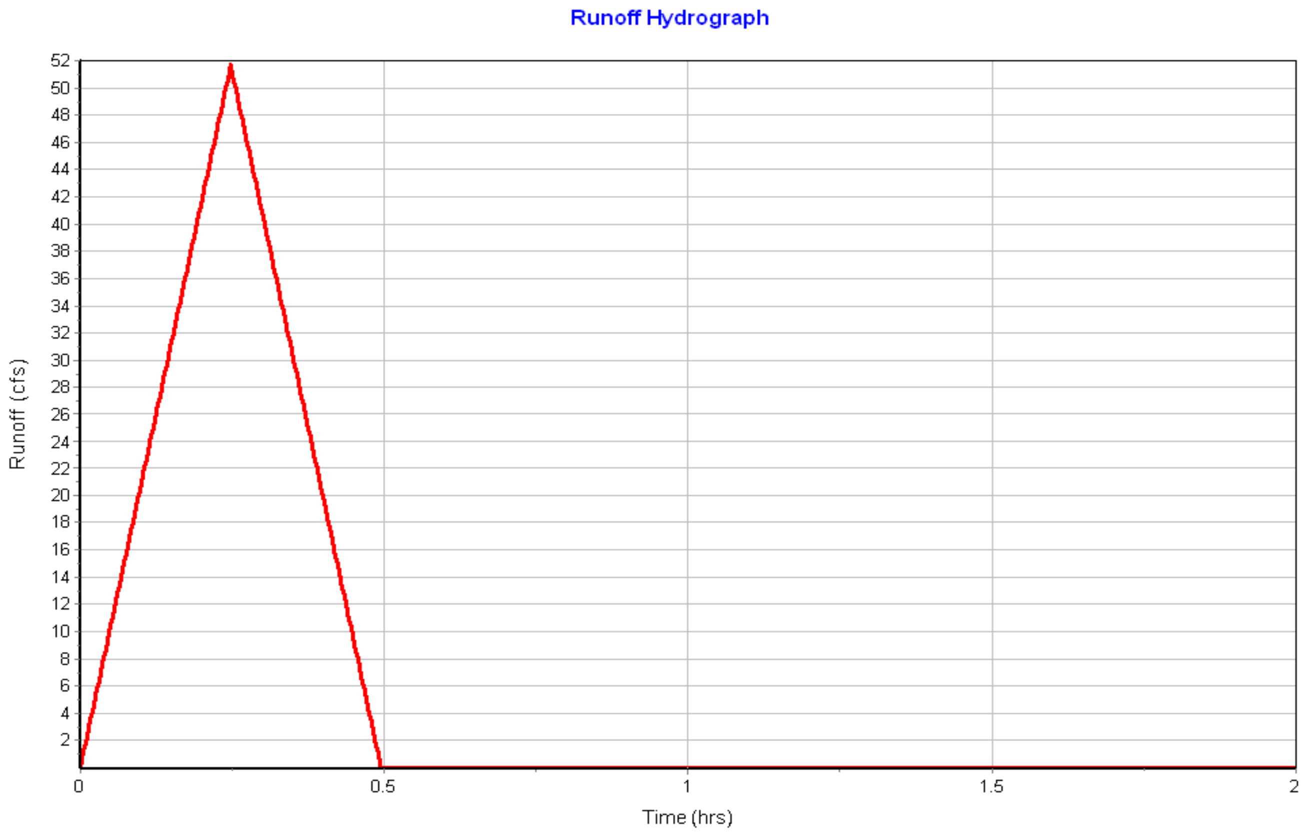
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.012	0.00	0.00
Flow Length (ft) :	593.649	0.00	0.00
Channel Slope (%) :	1.788	0.00	0.00
Cross Section Area (ft^2) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	6.28	0.00	0.00
Velocity (ft/sec) :	10.46	0.00	0.00
Computed Flow Time (min) :	0.95	0.00	0.00

Total TOC (min) 14.81

Subbasin Runoff Results

Total Rainfall (in) 0.74
Total Runoff (in) 0.52
Peak Runoff (cfs) 51.69
Rainfall Intensity 2.978
Weighted Runoff Coefficient 0.7000
Time of Concentration (days hh:mm:ss) 0 00:14:49

Subbasin : {Site 1}.Lennar_Proposed_North



Subbasin : {Site 1}.Lennar_Proposed_South

Input Data

Area (ac) 18.81
Weighted Runoff Coefficient 0.7000

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	18.81	-	0.70
Composite Area & Weighted Runoff Coeff.	18.81		0.70

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.06	0.00	0.00
Flow Length (ft) :	93.345	0.00	0.00
Slope (%) :	4.057	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.40	0.00	0.00
Velocity (ft/sec) :	0.40	0.00	0.00
Computed Flow Time (min) :	3.88	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	432.559	0.00	0.00
Slope (%) :	1.820	0.00	0.00
Surface Type :	Paved	Unpaved	Unpaved
Velocity (ft/sec) :	2.74	0.00	0.00
Computed Flow Time (min) :	2.63	0.00	0.00

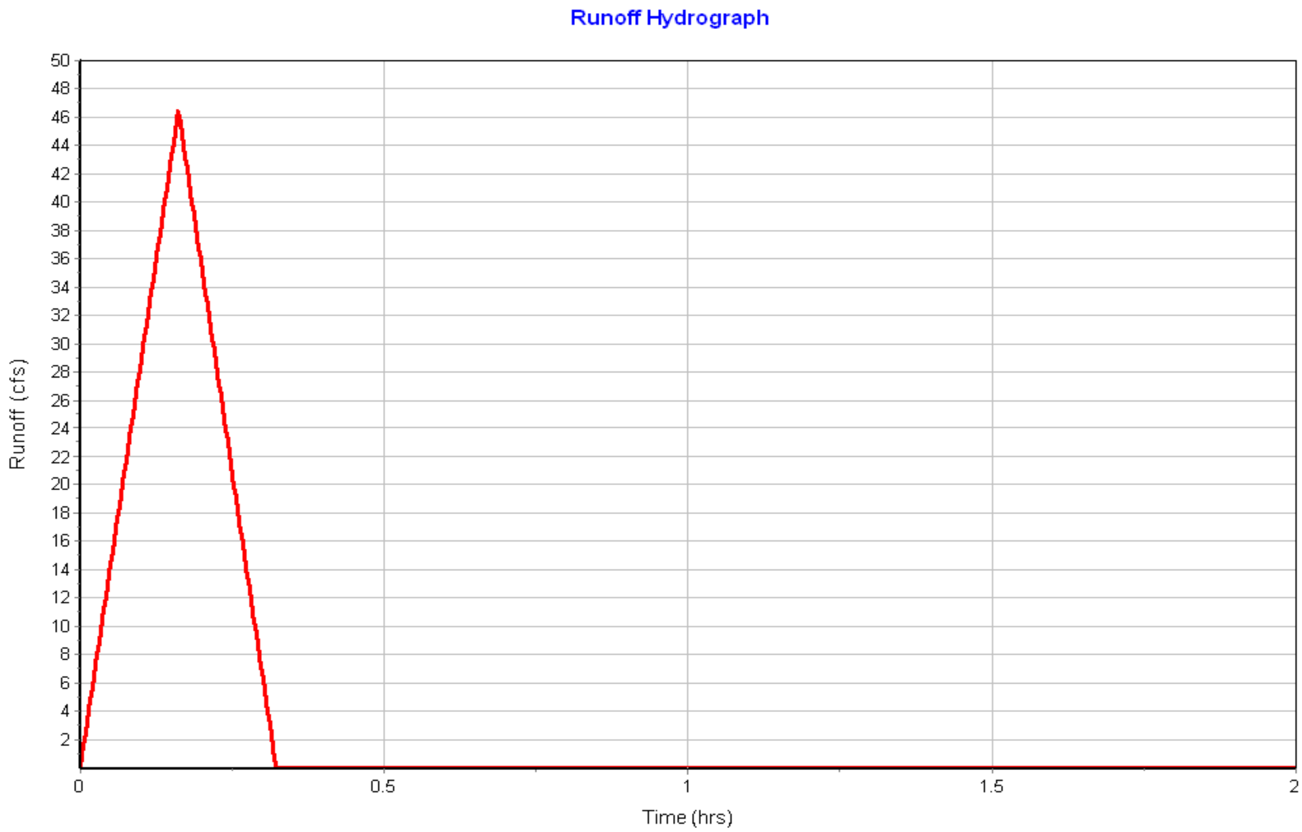
Channel Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.012	0.00	0.00
Flow Length (ft) :	1505.761	0.00	0.00
Channel Slope (%) :	1.0	0.00	0.00
Cross Section Area (ft²) :	3.14	0.00	0.00
Wetted Perimeter (ft) :	6.28	0.00	0.00
Velocity (ft/sec) :	7.82	0.00	0.00
Computed Flow Time (min) :	3.21	0.00	0.00

Total TOC (min) 9.72

Subbasin Runoff Results

Total Rainfall (in) 0.57
Total Runoff (in) 0.40
Peak Runoff (cfs) 46.45
Rainfall Intensity 3.527
Weighted Runoff Coefficient 0.7000
Time of Concentration (days hh:mm:ss) 0 00:09:43

Subbasin : {Site 1}.Lennar_Proposed_South



ATTACHMENT 6
GEOTECHNICAL AND GROUNDWATER INVESTIGATION REPORT

Attach project's geotechnical and groundwater investigation report. Refer to Appendix C.4 to determine the reporting requirements.

Geotechnical, Inc.

January 18, 2016

Project No. 15198-01

Mr. Andrew Han
Lennar Homes
25 Enterprise, Suite 250
Aliso Viejo, California 92656

Subject: ***Geotechnical 40-Scale Rough Grading Plan Review, "Pacific Village", City of San Diego, California***

In accordance with your request, LGC Geotechnical, Inc. (LGC) has performed a geotechnical 40-scale grading plan review for the proposed development of "Pacific Village", currently known as "Rancho Penasquitos", in the City of San Diego, California. Our scope of services included review of the project geotechnical documents and reports, the project development plans, and a site visit to observe the current site conditions. The findings, conclusions, and recommendations of our study are presented herein in accordance with the current 2013 California Building Code (CBC) and in conformance with the current standard of practice in the industry. Recommendations presented herein should be considered preliminary and must be confirmed during grading under the observation and testing services of LGC Geotechnical. This report should be considered a comprehensive geotechnical report for the grading and development of the subject site.

It is our opinion that the proposed residential development is suitable from a geotechnical standpoint provided the recommendations contained in this report are incorporated into the appropriate design documents.

Should you have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully,

LGC Geotechnical, Inc.

REGISTERED PROFESSIONAL ENGINEER
BLAKE J. ELLIOTT
No. 70705
EXP. 6/30/17
CIVIL
STATE OF CALIFORNIA

Blake J. Elliott, RCE 70705
Project Engineer

REGISTERED GEOLOGIST
KEVIN DYEKMAN
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CERTIFIED ENGINEERING GEOLOGIST
EXP. 5/31/17
STATE OF CALIFORNIA

Kevin Dyekman, CEG 2595
Project Geologist

BJE/KTM/DJB/aca

Distribution: (4) Addressee (3 wet signed and 1 electronic copy)
(1) Latitude 33 Planning and Engineering (electronic copy)
Attention: Ms. Melissa Krause

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS, TABLES, AND APPENDICES

Figures

Tables

Appendices

Sheets

1.0 INTRODUCTION

LGC Geotechnical, Inc. has reviewed the feasibility/due-diligence report prepared by Petra Geosciences (Petra, 2015) for the subject site and is in general agreement with the findings presented therein. Data collected from their field evaluation has been included in this report. LGC Geotechnical, Inc. accepts the role of geotechnical consultant of record for the subject residential development.

1.1 Purpose and Scope of Services

This report presents the results of our geotechnical evaluation and review of the proposed grading plan for "Pacific Village" by Latitude 33 Planning & Engineering. The referenced plan (Latitude 33, 2016) was utilized as a base map for our Geotechnical Map, (Sheet 1).

The purpose of our review was to evaluate the proposed plan and to provide preliminary geotechnical design criteria relative to the proposed development of the site. As part of this grading plan review, we have: 1) reviewed the available previous geotechnical reports and geologic maps pertinent to the site (Appendix A); 2) prepared an updated geotechnical map of the site incorporating available geotechnical information to date; 4) performed geotechnical analysis utilizing the available and acquired data; and 5) prepared this report presenting our preliminary findings, conclusions, and geotechnical recommendations specific to the proposed development plan. The findings, conclusions, and recommendations presented herein should be considered preliminary and will need to be confirmed by LGC Geotechnical during site grading.

This report considers, incorporates, and reiterates (where appropriate) the findings provided in the feasibility/due-diligence report (Petra, 2015). This report should be considered a comprehensive geotechnical report for the grading and development of the subject site.

1.2 Project Description

The site consists of approximately 41 acres of currently developed land located in the City of San Diego, California. The current development consists of over 50 apartment buildings and associated improvements. The site is irregular in shape, bounded by Carmel Mountain Road to the northwest, existing commercial development to the northeast, existing residential development to the southwest and the Interstate 15 freeway to the southeast (see Site Location Map, Figure 1). Other existing improvements include a 16-inch high priority gas line, and associated easement, belonging to San Diego Gas & Electric (SDG&E) that extends through the southern portion of the site trending in a southwest direction. In addition, a sewer line easement is located along the eastern boundary of the property adjacent to and paralleling the Interstate 15 Freeway.

The proposed development will include demolition of the existing structures and improvements, grading and construction of 324 "for-sale" and 240 "for-rent" residential structures and associated improvements. It is our understanding that the postgrading construction of the "for-rent" structures and improvements will be performed by others.

1.3 Background

The site was previously rough graded under the observation and testing of Woodward-Clyde & Associates, between approximately April 8 to May 24 of 1968. Rough grading included the removal of potentially expansive materials existing within 2 feet of finish grade elevations in the proposed building areas and extended approximately 5 feet outside of the proposed building limits. Observation and testing indicated that artificial fill materials were compacted to a minimum 90 percent relative compaction (Woodward-Clyde, 1968). At the completion of rough grading the compaction test results were report and provided for City records.

1.4 Geotechnical Investigation

As discussed above, Petra performed a geotechnical investigation and prepared a feasibility/due-diligence report for the subject site (Appendix A). For completeness, the boring logs, cone penetrometer sounding (CPT) logs and laboratory data from the referenced report have been included as appendices to this report. This data was considered in our analysis and evaluation of the proposed grading.

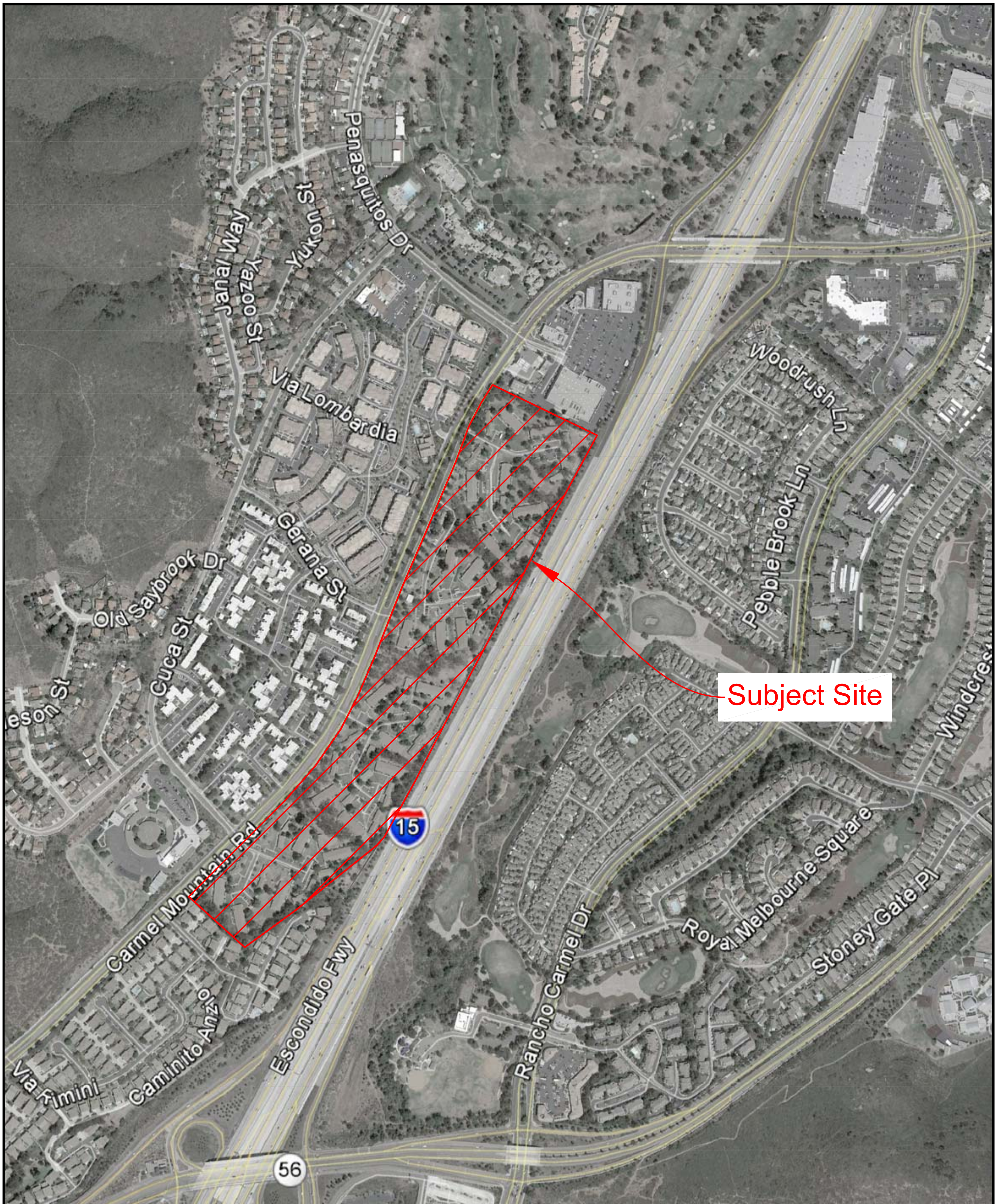
The approximate locations of the borings and CPT's within the area of proposed grading are depicted on the Geotechnical Map (Sheet 1). This includes 9 hollow-stem auger borings and 4 CPT's excavated to evaluate the general engineering characteristics of the onsite soils and the geologic structure of the materials in the area of the proposed grading. The excavations were sampled and logged from the surface under the supervision of a field representative.

1.5 Laboratory Testing

Representative bulk and driven (relatively undisturbed) samples were retained for laboratory testing during the field investigation for the subject site (Petra, 2015) Laboratory testing included in-situ moisture content and in-situ unit weight (depicted on boring logs), maximum dry density and optimum moisture content (laboratory compaction), expansion index, plasticity index and corrosion potential.

- Laboratory compaction (maximum dry density and optimum moisture content) tests were performed for on bulk samples obtained from various representative boring locations. The maximum dry densities ranged from 126.5 to 136.5 with optimum moisture contents of 11.5 and 8.5, respectively.
- The results of expansion potential tests for samples from the site and adjacent site locations indicate an expansion index range from approximately 40 "Low" to 61 "Medium" (per ASTM D4289.
- One Atterberg Limits (liquid limit and plastic limit) tests was performed. Results indicated a Plasticity Index (PI) value of 15.
- Corrosion testing of three representative samples of the site soils indicated sulfate concentrations ranging from 24 to 506 parts per million (ppm), chloride concentrations ranging from 96 to 141 parts per million (ppm), pH values from 7.5 to 8.0, and resistivity values from 850 to 1,600 ohm-cm.

The moisture and density test results are presented on the boring logs in Appendix B and the lab test results are presented in Appendix C.



LGC Geotechnical, Inc.

FIGURE 1
Site Location Map

PROJECT NAME	Lennar - Ranch Penasquitos
PROJECT NO.	15198-01
ENG. / GEOL.	BJE / KAD
SCALE	Not to Scale
DATE	January 2016

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

Regionally, the site is located within the coastal sub-province of the Peninsular Ranges Geomorphic Province, near the western edge of the Southern California batholith. The topography at the edge of the batholith changes from the rugged landforms developed on the batholith to the more subdued landforms, which typify the softer sedimentary formations of the coastal plain. Tertiary and Quaternary rocks are generally comprised of marine and non-marine sediments consisting of sandstone, mudstones, conglomerates, and occasional volcanic units. Erosion and regional tectonic uplift created the valleys and ridges of the area. More specifically the subject site lies within the San Diego Embayment, which is a down dropped structural block that encompasses the western portion of San Diego County.

2.2 Site-Specific Geology

According to the Geologic Map of the Poway Quadrangle (CDMG, 1975) the site is underlain by Santiago Peak Volcanics and a minor amount of Quaternary Alluvium associated with adjacent valley. In the previous due diligence/feasibility study performed by Petra (2015) the materials underlying the site were described as Cretaceous aged granitic bedrock and Quaternary Old Alluvial Deposits. In order to provide uniformity, we have adopted the nomenclature provided by Petra (2015) for this report.

In general, subject site is underlain by Cretaceous granitic bedrock materials which are overlain by old artificial fill soils and old alluvial deposits. A brief description of these geologic units is presented below (from youngest to oldest).

2.2.1 Artificial Fill – Older (Map Symbol - Afo)

Old artificial fill soils placed during original grading are present throughout the subject site. These soils were placed under the observation and testing of Woodward-Clyde (1968). In general, the soils consisted of clayey sands, clay, clayey silt, sandy silt and silty sands that were light to dark brown, light gray and reddish brown. In addition, the soils were generally dry to moist and stiff/dense to very dense.

2.2.2 Old Alluvial Deposits (Map Symbol - Qoal)

Old Alluvial Deposits encountered in borings B-2, B-3, and B-4 generally consisted of fine to coarse grained silty sand, clayey sand, and silty clay with varying gravel content. In general, the deposits were light brown, orange brown, and light gray brown, dry to moist, with densities ranging from medium dense to very dense and stiff to hard.

2.2.3 *Cretaceous Granitic Bedrock (Map Symbol – Kgr)*

In general, the Cretaceous aged granitic bedrock encountered during boring excavation was light to medium brown, reddish brown, orange brown and dark gray. In addition, the bedrock tended to be weathered with local friable and moderately hard areas.

2.3 *Landslides*

Our research and field observations do not indicate the presence of landslides on the site or in the immediate vicinity. Review of the City of San Diego, Seismic Safety Study, Geologic Hazards and Faults (City, 2008) indicates that the site is not located within a mapped area considered to include known or suspected landslides, nor is the bedrock considered to be slide-prone.

2.4 *Groundwater*

Groundwater was not encountered in any of the nine exploratory borings which extended approximately 15 feet below existing ground. However, a small amount of seepage associated with a silty clay layer within the Old Alluvial Deposits was encountered in boring B-4. Groundwater is not considered to be an issue in regards to the proposed site development.

Seasonal fluctuations of groundwater elevations should be expected over time. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present due to local seepage caused by irrigation and/or recent precipitation. Local perched groundwater conditions or surface seepage may develop once site development is completed.

2.5 *Seismicity*

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2013 California Building Code (CBC). Representative site coordinates of latitude 32.9763 degrees north and longitude -117.0899 degrees west, were utilized in our analyses. Please note that these coordinates are considered generally considered representative of the site, however their applicability should be verified with respect to a desired specific location within the site. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class C are provided in Table 1 below.

TABLE 1

Seismic Design Parameters

Selected Parameters from 2013 CBC, Section 1613 - Earthquake Loads	**Seismic Design Values**
Site Class per Chapter 20 of ASCE 7	C
Risk-Targeted Spectral Acceleration for Short Periods (S_S)*	0.915g
Risk-Targeted Spectral Accelerations for 1-Second Periods (S_1)*	0.358g
Site Coefficient F_a per Table 1613.3.3(1)	1.034
Site Coefficient F_v per Table 1613.3.3(2)	1.442
Site Modified Spectral Acceleration for Short Periods (S_{MS}) for Site Class C [Note: $S_{MS} = F_aS_S$]	0.946g
Site Modified Spectral Acceleration for 1-Second Periods (S_{M1}) for Site Class C [Note: $S_{M1} = F_vS_1$]	0.516g
Design Spectral Acceleration for Short Periods (S_{DS}) for Site Class C [Note: $S_{DS} = (^2/_3)S_{MS}$]	0.631g
Design Spectral Acceleration for 1-Second Periods (S_{D1}) for Site Class C [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.344g
Mapped Risk Coefficient at 0.2 sec Spectral Response Period, C_{RS} (per ASCE 7)	1.028
Mapped Risk Coefficient at 1 sec Spectral Response Period, C_{R1} (per ASCE 7)	1.084

* From USGS, 2015

Section 1803.5.12 of the 2013 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for liquefaction potential. The PGA_M for the site is equal to 0.362g.

A deaggregation of the PGA based on a 2,475-year average return period indicates that an earthquake magnitude of 6.32 at a distance of approximately 17.9 km (11.1 miles) from the site would contribute the most to this ground motion (USGS, 2008).

2.6 <u>Faulting</u>

California is located on the boundary between the Pacific and North American Lithospheric Plates. The average motion along this boundary is on the order of 50-mm/yr in a right-lateral sense. The majority of the motion is expressed at the surface along the northwest trending San Andreas Fault Zone with lesser amounts of motion accommodated by sub parallel faults located predominantly west of the San Andreas Fault including the Elsinore, Newport-Inglewood, Rose Canyon, and Coronado Bank Faults. Within Southern California, a large bend in the San Andreas Fault north of the San Gabriel Mountains has resulted in a transfer of a portion of the right-lateral motion between the plates into left-lateral displacement and vertical uplift. Compression south and west of the bend has resulted in folding, left-lateral reverse thrust faulting, and regional uplift creating the east-west trending Transverse Ranges and several east-west trending faults. Further south within the Los Angeles Basin, “blind thrust” faults are believed to have developed below the surface; also as a result of this compression, which have resulted in earthquakes such as the 1994 Northridge event along faults with little to no surface expression.

Prompted by damaging earthquakes in Northern and Southern California, State legislation and policies concerning the classification and land-use criteria associated with faults have been developed. Their purpose was to prevent the construction of urban developments across the trace of active faults. The result is the Alquist-Priolo Earthquake Fault Zoning Act, which was most recently revised in 2007 (CGS, 2007). According to the State Geologist, an active fault is defined as one which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). A potentially active fault is defined as any fault which has had surface displacement during Quaternary time (last 1,600,000 years), but not within the Holocene. Earthquake Fault Zones have been delineated along the traces of active faults within California. Where developments for human occupation are proposed within these zones, the state requires detailed fault evaluations be performed so that engineering-geologists can mitigate the hazards associated with active faulting by identifying the location of active faults and allowing for a setback from the zone of previous ground rupture

The subject site is not located within a State of California Fault Rupture Hazard Zone (CGS, 2007) nor is it located in a fault zone of the City of San Diego Seismic Safety Study (City, 2008). There are no known active or potentially active faults mapped on the site. The possibility of damage due to ground rupture, as a result of faulting, is considered very low since active faults are not known to cross the site.

The subject site is not located within an Earthquake Fault Zone (aka Alquist-Priolo Special Studies Zone) and no faults were identified on the site during our site evaluation (CDMG, 2000). The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site. The closest major active fault is the Rose Canyon Fault Zone located approximately 12 miles (19 kilometers) to the southwest.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching and shallow ground rupture, soil liquefaction, and dynamic settlement. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependant on the distance between the site and causative fault and the onsite geology.

2.6.1 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that loose, saturated, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction, depending on their plasticity and moisture content (Bray & Sancio, 2006). Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Dynamic settlement of dry sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

Per the City of San Diego Seismic Safety Study (City, 2008), the site is in an area considered to have a "low potential" for liquefaction. Based on the proposed plans and remedial grading, the site will consist of compacted fill over dense/hard native materials. Therefore, the potential for post construction liquefaction and liquefaction-induced dynamic settlement is considered low.

2.6.2 Lateral Spreading

Lateral spreading is a type of liquefaction induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

Due to the very low potential for liquefaction, the potential for lateral spreading is also considered extremely low.

2.7 Rippability

In general, the old artificial fill and old alluvial deposits are anticipated to be rippable with conventional heavy-duty equipment (CAT D-9). However, moderate to very difficult ripping utilizing heavy-duty excavation equipment should be anticipated for site granitic bedrock. Blasting may be necessary in order to facilitate excavation in areas of deep cuts and/or shallow bedrock. The borings logs indicate that granitic bedrock is shallowest in the northern portion of the subject site with depths ranging from approximately 1 to 3 feet below existing grades. In addition, excavation difficulties may be encountered utilizing light-duty construction equipment for the excavations for utilities, foundations, or other improvements in areas of shallow bedrock.

Ultimately, the rippability conditions will only be known during grading and may be variable across the site. These conditions will also vary with the methods and techniques of different contractors. Ultimately, the grading contractors should evaluate the data provided themselves and draw their own conclusions, as it will be their equipment making the excavations and their judgment as to what they consider to be rippable at a reasonable production rate.

2.8 Oversized Material

Oversized material (material larger than 8 inches in maximum dimension) is likely to be generated during site grading. In general, it is likely that the deeper excavations will generate more oversized material than the shallow ones, especially in the areas where granitic bedrock materials are encountered. With considerable effort, some of the oversized material excavated may break down to material of workable size. However, the deeper the excavation, the less weathered the material becomes. As a result, joints and other planes of weakness become less common and the size and frequency of "core stones" may increase. Recommendations are provided for appropriate handling of oversized materials in Appendix D.

2.9 Expansive Soil Characteristics

Laboratory testing of representative samples of the onsite materials indicated expansion potentials ranging from "Low" to "Medium." During grading, the less prevalent medium expansive soils may be diluted by mixing with the less expansive soils, which comprise the majority of the site. However, this must be confirmed at the completion of grading.

2.10 Corrosion Potential

Corrosion suites (soluble sulfate, chloride content, pH and minimum resistivity) were performed on samples from the subject site. The result of the soluble sulfate content tests ranged from 24 ppm to 506 ppm, less than 0.10 percent. Chloride content ranged from 96 to 141 parts-per-million (ppm), pH values ranged from 7.5 to 8.0 and the resistivity tests ranged from a minimum resistivity value of 850 ohm-centimeters to 1,600 ohm-centimeters. Caltrans defines a corrosive area where any of the following conditions exist: the soil contains more than 500 ppm of chlorides, more than 2,000 ppm (0.2 percent) of sulfates, or a pH of 5.5 or less (Caltrans, 2012).

3.0 CONCLUSIONS

Based on the results of our geotechnical evaluation and geotechnical review of the proposed rough grading plans, it is our opinion that the proposed development is feasible from a geotechnical standpoint, provided that the recommendations contained in the following sections are incorporated during site grading and construction. A summary of our geotechnical conclusions are as follows:

- In general, subject site is underlain by Cretaceous granitic bedrock materials which is overlain by old artificial fill soils and old alluvial deposits.
- A static groundwater table was not encountered in any of the nine exploratory borings which extended approximately 15 feet below existing ground. Groundwater is not considered to be an issue in regards to the proposed site development.
- Based on our review of the City of San Diego Seismic Safety Study the site is not located within a “landslide” zone or a “slide-prone formation” zone. The site is relatively flat with relatively short slopes of engineered fill proposed.
- Based on the proposed finish grades, depth of compacted fill, and implementation of the remedial recommendations provided herein, the potential for post construction liquefaction and liquefaction-induced settlement is considered low.
- The subject site is not located within an Earthquake Fault Zone (aka Alquist-Priolo Special Studies Zone) and no faults were identified on the site during our site evaluation (CDMG, 2000). The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site.
- Based on the results of our evaluation and review, the onsite materials appear to be rippable to marginally rippable with heavy-duty construction equipment to the proposed depths of grading. Blasting may be necessary in order to facilitate excavation in areas of deep cuts and/or shallow bedrock.
- Design fill slopes are anticipated to be both grossly and surficially stable as designed, as long as they are constructed in accordance with these recommendations and our General Earthwork and Grading Specifications (Appendix D) and are properly landscaped and maintained.
- Based on the results of limited laboratory testing, site soils are anticipated to have a “Low” to “Medium” expansion potential. However, this should be confirmed at the completion of grading.
- Based on chloride test results, site contains soils that are not considered “corrosive” based on Caltrans guidelines.
- From a geotechnical perspective, the existing onsite soils appear to be suitable material for use as fill provided they are relatively free from rocks (larger than 8 inches in maximum dimension), construction debris, and organic material. Oversize rocks will need to be crushed down to the maximum allowed size or removed from the site.

4.0 <u>PRELIMINARY RECOMMENDATIONS</u>

The following recommendations are to be considered preliminary, and should be confirmed upon completion of grading and earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, or the owner.

It should be noted that the following geotechnical recommendations are intended to provide sufficient information to develop the site in general accordance with the 2013 CBC requirements. With regard to the possible occurrence of potentially catastrophic geotechnical hazards such as seismic shaking, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level." The "acceptable level" of risk is defined by the California Code of Regulations as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed improvements may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development such as expansive soils, fill settlement, groundwater seepage, etc, the recommendations contained herein are intended as a reasonable protection against potential damaging effects. It should be understood, however, that our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions, but cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

4.1 <u>Site Earthwork</u>

We anticipate that earthwork at the site will consist of completion of rough and precise grading operations followed by wall construction, utility construction, foundation construction, asphalt paving of the interior streets and drives and paving of associated concrete flatwork. We recommend that earthwork onsite be performed in accordance with the following recommendations, the City of San Diego Grading Requirements, 2013 CBC requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix D. In case of conflict, the following recommendations shall supersede all previous recommendations and those included as part of Appendix D. The following recommendations should be considered preliminary and may be revised based on the actual conditions encountered during site grading by the geotechnical consultant.

4.1.1 <u>Site Preparation</u>

Prior to grading of areas to receive structural fill or engineered structures, the areas should be cleared of surface obstructions and potentially compressible material (such as undocumented fill, weathered engineered fill, and topsoil). Vegetation and debris should be removed and properly disposed of offsite. Holes resulting from the removal of buried obstructions, which extend below proposed removal bottoms, should be replaced with suitable compacted fill material.

4.1.2 Removal and Recompaction

All unsuitable and potentially compressible materials not removed by design cuts should be excavated to competent material and replaced with compacted fill soils within areas of the proposed buildings. In general, existing weathered artificial fill and topsoil should be removed to competent bedrock or dense older alluvial deposits. The depths of removals are estimated to be approximately 4 feet below the existing ground surface and should extend laterally approximately 5 feet beyond the proposed building footprint. Deeper removals on the order of 5 feet to 10 feet below the existing ground surface should be anticipated in localized areas.

The actual depth and lateral extents of the remedial removals should be determined by the geotechnical consultant, based on subsurface conditions encountered during grading.

4.1.3 Over-excavation of Design Cut or Cut/Fill Transition Pads and Streets

Due to the presence of hard granitic bedrock, we recommend design cut or cut/fill transition pads be undercut 4 feet below finished pad grade, or a minimum of 2 feet below planned footings, whichever is greater. A maximum 3:1 differential fill thickness underneath individual lots should be maintained in order to reduce the potential for future differential settlement. Over-excavation should extend laterally a minimum of 5 feet beyond proposed building footprints.

The over-excavation bottoms should be graded with a minimum 2 percent tilt towards deeper fill areas (preferably the street) in order to reduce the potential for ponding of water. Over-excavations/undercuts must be confirmed and mapped by the geotechnical consultant prior to subsequent fill placement.

Additionally, if areas of granitic bedrock are encountered close to finish grade, it may be desirable to over-excavate the street areas rather than facing potentially difficult excavation during underground utility placement with lighter construction equipment. If streets are to be over-excavated for ease of future utility installation, we recommend streets be over-excavated to at least 1-foot below the deepest utilities.

4.1.4 Temporary Excavations

We anticipate temporary slopes required for removals, over-excavations and haul roads to be grossly stable at 1.5:1 (horizontal: vertical) or flatter; however, excavations must be made in accordance with Cal OSHA and OSHA requirements. Vehicular traffic, stockpiles, and equipment storage should be set back from the perimeter of the excavations a minimum distance equivalent to a 1:1 projection from the bottom of the excavation.

The contractor must request observation of temporary excavations by a representative of LGC Geotechnical, not only to confirm the geotechnical conditions, but to also help provide early warning of potential failures. Based on observed conditions, flatter inclinations may be required. The majority of site soils are anticipated to be OSHA Type “B” soils. The contractor will be responsible for providing the “competent person” required by Cal/OSHA standards to evaluate soil conditions. Close coordination with the geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Excavation safety is the sole responsibility of the contractor.

Once an excavation has been initiated, it should be backfilled as soon as practical. Prolonged exposure of temporary excavations may result in some localized instability. Excavations should be planned so that they are not initiated without sufficient time to shore/fill them prior to weekends, holidays, or forecasted rain.

4.1.5 Subgrade Preparation Prior to Fill Placement

In general, removal bottom areas and areas to receive compacted fill should be scarified to a minimum depth of 6 to 8 inches, brought to a near-optimum moisture condition, and re-compacted per project recommendations.

Removal bottoms and areas to receive fill should be observed and accepted by the geotechnical consultant prior to subsequent fill placement.

4.1.6 Material for Fill

From a geotechnical perspective, the onsite soils are generally considered suitable for use as general compacted fill, provided they are relatively free of organic materials and construction debris. Any encountered oversized material (material larger than 8 inches in maximum dimension) must be appropriately handled as outlined in Appendix D.

Conventional (masonry) retaining wall backfill should consist of sandy soils with a minimum Sand Equivalent (SE) of 30 per California Test Method (CTM) 217 and a "Very Low" expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris, and any material greater than 3 inches in maximum dimension. The site contains soils that are not suitable for retaining wall backfill due to their fines content and expansion potential, import and/or select grading and stockpiling of approved onsite soils will be required by the contractor for obtaining suitable retaining wall backfill soil.

If any import is required for general fill (i.e., not retaining wall backfill), it should consist of clean, relatively granular soils of Very Low to Low expansion potential (expansion index 50 or less based on ASTM D4829) and no particles larger than 3 inches in greatest dimension. Source samples should be provided to the geotechnical consultant for laboratory testing a minimum of 3 working days prior to any planned importation.

Aggregate base (crushed aggregate base or crushed miscellaneous base) should conform to the latest requirements of Section 200-2 of the Standard Specifications for Public Works Construction ("Greenbook") for untreated base materials (except processed miscellaneous base) or Caltrans Class 2 aggregate base.

4.1.7 Fill Placement and Compaction

Material to be placed as fill should be brought to near optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and compacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances and under the observation and testing performed by the geotechnical consultant. Any oversized material, as previously defined, encountered must be appropriately handled (Appendix E). It should be noted that there might not be many fill areas with sufficient depth (greater than 10 feet) for placement of oversize material. Other options for dealing with oversized material include crushing or exporting.

Fill placed on any slopes greater than 5:1 (horizontal to vertical) should be properly keyed and benched into firm and competent soils as it is placed in lifts. During backfill of excavations, the fill should be properly benched into firm and competent soils of temporary backcut slopes as it is placed in lifts. All benching must be performed behind the design backcuts. Every bench must be a minimum of 4 feet high.

Slope face compaction should be achieved by the contractor by overfilling the slope face a minimum of 2 feet and cutting back to design finish grades, or by another acceptable method.

Aggregate base material (crushed aggregate base and crushed miscellaneous base) should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction at or slightly above optimum moisture content per ASTM D1557.

4.1.8 Trench and Retaining Wall Backfill and Compaction

The onsite soils may generally be suitable as trench backfill, provided the soils are screened of rocks and other material greater than 6 inches in diameter and organic matter. If trenches are shallow or the use of conventional equipment may result in damage to the utilities, sand having a sand equivalent (SE) of 30 or greater (per CTM 217) may be used to bed and shade the pipes. Sand backfill within the pipe bedding zone may be densified by jetting or flooding and then tamped to ensure adequate compaction. Subsequent trench backfill should be compacted in uniform thin lifts by mechanical means to at least the recommended minimum relative compaction (per ASTM D1557).

Retaining wall backfill should consist of sandy soils as outlined in the previous Section 4.1.6. The limits of select sandy backfill should extend a minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater, refer to Figure 2 (rear of text). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

A representative from LGC Geotechnical should observe and test the backfill to verify compliance with the project recommendations.

4.1.10 Shrinkage and Bulking

Volumetric changes in earth quantities will occur when excavated onsite earth materials are replaced as properly compacted fill. The following is an estimate of shrinkage and bulking factors for the various geologic units found onsite. These estimates are based on in-place densities of the various materials and on the estimated average degree of relative compaction achieved during grading. Allowance in the earthwork volumes budget should be made for an estimated 0 to 5 percent reduction in volume of the topsoil and old fill. Bulking on the order of approximately 15 to 20 percent should be anticipated for granite rock.

It should be stressed that these values are only estimates and that actual shrinkage and bulking factors are extremely difficult to predetermine. The effective shrinkage/bulkage of onsite soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor. The above shrinkage and bulking estimates are intended as an aid for project engineers in determining preliminary earthwork quantities. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during grading. Shrinkage and bulking are also expected to vary with variations in survey accuracy before and during rough grading.

4.2 Slopes

All interior slopes, both proposed and existing, should be constructed as fill slopes to facilitate planting of the finished slope. Design fill slopes at the site are anticipated to be both grossly surficially stable as designed, as long as they are constructed in accordance with the Standard Earthwork and Grading Specifications included in Appendix D. Fill slopes should be constructed with a maximum slope ratio of 2:1 (horizontal to vertical). Slope faces should also be compacted to minimum project specifications. This may require overbuilding of the slope face and trimming back to design grades. To improve surficial stability, vegetation specified by the landscape architect should be established on the slope face as soon as it is practical.

Stabilization fills should be constructed on proposed cut slopes over 10 feet in height, in accordance with the detail provided in Appendix D. Keyway widths should be a minimum of one-half of the total height of the slope or no less than 15 feet-wide, whichever is greater. Keyways should be a minimum of 5 feet deep, determined from the lowest toe-of-slope elevation, and tilt back to the heel a minimum of 1-foot or 2 percent (whichever is greater). Stabilization fill backcuts should be excavated so that at least a minimum 15-foot-wide fill width is maintained for the entire height of the stability fill slope. In general, backcuts should be excavated at 2:1 (horizontal to vertical) inclinations. If grading limits do not allow sufficient room for maintaining 15-foot widths at 2:1 backcut inclinations, then portions of the backcut may be cut steeper to accommodate the stability fill slopes at the appropriate widths at the discretion of the geotechnical consultant. Properly outletted back drains should be constructed along stabilization fill backcuts.

In general, to reduce the potential for backcut failures, we recommend the keyway backcuts be planned to minimize the time the backcut is left exposed. The backcuts should not be initiated prior to forecasted rain or where they will be left open for extended periods such as weekends.

Backcuts and key excavations should be geologically mapped by the geotechnical consultant during excavation to confirm the anticipated conditions. If adverse joints, fractures, and/or bedding are exposed, additional analysis and/or remediation measures may be required. The grading contractor must trim the backcuts with a slope board to remove loose material to allow for confirmational mapping.

Located along the southwestern property line, on the adjacent property, is an existing ascending slope. The slope is approximately 10 feet high and portions of the slope contain pipe and board construction. Erosion rills are present in the slope and eroded sediment has accumulated in the concrete drainage channel at the toe of the slope. The concrete drainage channel is cracked and broken in many pieces. Although the slope and concrete drainage channel are on the adjacent property, improper maintenance of them could result in water and sediment coming onto the subject property.

4.3 Provisional Foundation Recommendations

Given that the expansion index exceeds 20, the foundation system shall be designed for effects of expansive soil. Generally, post-tensioned foundations are preferred over conventionally reinforced foundations when expansive soils are present at a site. The geotechnical parameters provided herein may be used for post-tensioned slab foundations with a deepened perimeter footing or a post-tensioned mat slab. These parameters have been determined in general accordance with the Post-Tensioning Institute (PTI) Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils, referenced in Chapter 18 of the 2013 CBC. In utilizing these parameters, the foundation engineer should design the foundation system in accordance with the allowable deflection criteria of applicable codes and the requirements of the structural designer/architect. Other types of stiff slabs may be used in place of the CBC post-tensioned slab design provided that, in the opinion of the foundation structural designer, the alternative type of slab is at least as stiff and strong as that designed by the CBC/PTI method.

Our design parameters are based on our experience with similar projects, test results performed by others, and the anticipated nature of the soil (with respect to expansion potential). Please note that implementation of our recommendations will not eliminate foundation movement (and related distress) should the moisture content of the subgrade soils fluctuate. It is the intent of these recommendations to help maintain the integrity of the proposed structures and reduce (not eliminate) movement, based upon the anticipated site soil conditions. Should future owners and/or property maintenance personnel not properly maintain the areas surrounding the foundation, for example by overwatering, then we anticipate for highly expansive soils the maximum differential movement of the perimeter of the foundation to the center of the foundation to be on the order of a couple of inches. Soils of lower expansion potential are anticipated to show less movement.

The following section summarizes our recommendations for each alternative type of foundation component for expansion potentials in the Low and Medium categories. Recommendations for other expansion potential soils will be provided if determined appropriate based on the final graded conditions.

TABLE 2A

Provisional Geotechnical Foundation Design Parameters for Low Expansion Potential

Parameter	PT Slab with Perimeter Footing	PT Mat with Thickened Edge
Expansion Index	Low[1]	Low[1]
Thornthwaite Moisture Index	-20	-20
Constant Soil Suction	PF 3.9	PF 3.9
Center Lift Edge moisture variation distance, e_m Center lift, y_m	 9.0 feet 0.25 inch	 9.0 feet 0.30 inch
Edge Lift Edge moisture variation distance, e_m Edge lift, y_m	 5.5 feet 0.55 inch	 5.5 feet 0.66 inch
Modulus of Subgrade Reaction, k (assuming presoaking as indicated below)	200 pci	200 pci
Minimum perimeter footing/thickened edge embedment below finish grade	15 inches	6 inches

1. Assumed for provisional design purposes. Further evaluation is needed at the completion of grading.
2. Recommendations for foundation reinforcement and slab thickness are ultimately the purview of the foundation engineer/structural engineer based upon geotechnical criteria and structural engineering considerations.
3. Recommendations for sand below slabs have traditionally been included with geotechnical foundation recommendations, although they are not the purview of the geotechnical consultant. The sand layer requirements are the purview of the foundation engineer/structural engineer, and should be provided in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction".
4. Recommendations for vapor retarders below slabs are also the purview of the foundation engineer/structural engineer and should be provided in accordance with applicable code requirements.
5. Moisture condition to 100 % of optimum moisture content to a depth of 12 inches prior to trenching.

TABLE 2B

Provisional Geotechnical Foundation Design Parameters for Medium Expansion Potential

Parameter	PT Slab with Perimeter Footing	PT Mat with Thickened Edge
Expansion Index	Medium[1]	Medium[1]
Thornthwaite Moisture Index	-20	-20
Constant Soil Suction	PF 3.9	PF 3.9
Center Lift Edge moisture variation distance, e_m Center lift, y_m	 9.0 feet 0.50 inch	 9.0 feet 0.60 inch
Edge Lift Edge moisture variation distance, e_m Edge lift, y_m	 4.7 feet 1.1 inch	 4.7 feet 1.3 inch
Modulus of Subgrade Reaction, k (assuming presoaking as indicated below)	150 pci	150 pci
Minimum perimeter footing/thickened edge embedment below finish grade	18 inches	6 inches

1. Assumed for provisional design purposes. Further evaluation is needed at the completion of grading.
2. Recommendations for foundation reinforcement and slab thickness are ultimately the purview of the foundation engineer/structural engineer based upon geotechnical criteria and structural engineering considerations.
3. Recommendations for sand below slabs have traditionally been included with geotechnical foundation recommendations, although they are not the purview of the geotechnical consultant. The sand layer requirements are the purview of the foundation engineer/structural engineer, and should be provided in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction".
4. Recommendations for vapor retarders below slabs are also the purview of the foundation engineer/structural engineer and should be provided in accordance with applicable code requirements.
5. Moisture condition to 120 % of optimum moisture content to a depth of 18 inches prior to trenching.

4.4 Post-Tensioned Foundation Subgrade Preparation and Maintenance

Moisture conditioning of the subgrade soils is recommended prior to trenching the foundation. The recommendations, specific to anticipated site soil conditions, are presented in Tables 2A and 2B. The subgrade moisture condition of the building pad soils should be maintained at the recommended moisture content up to the time of concrete placement. This moisture content should be maintained around the immediate perimeter of the slab during construction and up to occupancy of the building structures.

The geotechnical parameters provided in Tables 2A and 2B assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage and adequately maintained so that ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Plants should only be provided with sufficient irrigation for life and not overwatered to saturate subgrade soils. Sunken planters placed adjacent to the foundation should either be designed with an efficient drainage system or liners to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters.

In addition to the factors mentioned above, future owners/property management personnel should be made aware of the potential negative influences of trees and/or other large vegetation. Roots that extend near the vicinity of foundations can cause distress to foundations. Future owners (and the owner's landscape architect) should not plant trees/large shrubs closer to the foundations than a distance equal to half the mature height of the tree or 20 feet, whichever is more conservative, unless specifically provided with root barriers to prevent root growth below the building foundation.

It is the homeowner's/property management personnel's responsibility to perform periodic maintenance during hot and dry periods to ensure that adequate watering has been provided to keep soil from separating or pulling back from the foundation. Future owners and property management personnel should be informed and educated regarding the importance of maintaining a constant level of soil-moisture. The owners should be made aware of the potential negative consequences of both excessive watering, as well as allowing potentially expansive soils to become too dry. Expansive soils can undergo shrinkage during drying, and swelling during the rainy winter season, or when irrigation is resumed. This can result in distress to building structures and hardscape improvements. The builder should provide these recommendations to future homeowners and property management personnel.

4.4.1 Slab Underlayment Guidelines

The following is for informational purposes only since slab underlayment (e.g., moisture retarder, sand or gravel layers for concrete curing and/or capillary break) is unrelated to the geotechnical performance of the foundation and thereby not the purview of the geotechnical consultant. Post-construction moisture migration should be expected below the foundation. The foundation engineer/architect should determine whether the use of a capillary break (sand or gravel layer), in conjunction with the vapor retarder, is necessary or required by code. Sand layer thickness and location (above and/or below vapor retarder) should also be determined by the foundation engineer/architect.

4.5 Foundation Setback from Top of Slope and Bottom of Slope

Foundations should have adequate setback from top and bottom of slopes. Per the 2013 CBC, the minimum top-of-slope setback is H/3, with a maximum required setback of 40 feet, where H is the total height of the slope. This distance is measured horizontally from the outside bottom edge of the footing to the slope face. The minimum bottom-of-slope setback is H/2, with a maximum required setback of 15 feet. Refer to Chapter 18 of the 2013 CBC. Foundation setbacks should be further analyzed during the precise grading plan review when building footprints are finalized.

4.6 Soil Bearing and Lateral Resistance

An allowable soil bearing pressure of 1,500 pounds per square foot (psf) may be used for the design of footings having a minimum width of 12 inches and minimum embedment of 12 inches below lowest adjacent ground surface. This value may be increased by 300 psf for each additional foot of embedment of 100 psf for each additional foot of foundation width to a maximum value of 2,500 psf. An allowable soil bearing pressure of 1,200 psf may be used for a mat post-tensioned slab a minimum of 6 inches below lowest adjacent grade. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. Bearing values indicated above are for total dead loads and frequently applied live loads. The above vertical bearing may be increased by one-third for short durations of loading which will include the effect of wind or seismic forces.

In utilizing the above-mentioned allowable bearing capacity and provided our earthwork recommendations are implemented, foundation settlement due to structural loads is anticipated to be 1-inch or less. Differential settlement may be taken as half of the total settlement (i.e., ½-inch over a horizontal span of 40 feet).

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.35 may be assumed with dead-load forces. An allowable passive lateral earth pressure of 300 psf per foot of depth (or pcf) to a maximum of 2,500 psf may be used for the sides of footings poured against properly compacted fill. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. The passive pressure may be increased by one-third due to wind or seismic forces. We recommend that the upper foot of passive resistance be neglected if finished grade will not be covered with concrete or asphalt. Frictional resistance and passive pressure may be used in combination without reduction. The provided allowable passive pressures are based on a factor of safety of 1.5 and may be increased by one-third for short duration seismic loading conditions.

4.7 Lateral Earth Pressures and Retaining Wall Design Considerations

Lateral earth pressures are provided as equivalent fluid unit weights, in pound per square foot (psf) per foot of depth or pcf. These values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of soil over the wall footing.

The following lateral earth pressures are presented on Table 3 for approved select sandy soils having a minimum sand equivalent of 30 and an EI of 20 or less. The retaining wall designer should clearly indicate on the retaining wall plans the required sandy soil backfill criteria.

TABLE 3

Lateral Earth Pressures – Select Sand Backfill

Condition	Equivalent Fluid Weight (pcf) Level Backfill Approved Backfill Material	Equivalent Fluid Weight (pcf) 2:1 Sloping Backfill Approved Backfill Material
Active	35	55
At Rest	55	80

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. This would include 90-degree corners of retaining walls. Such walls should be designed for "at-rest." The equivalent fluid pressure values assume free-draining conditions and a drainage system will be installed and maintained to prevent the build-up of hydrostatic pressures. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer.

Surcharge loading effects from any adjacent structures should be evaluated by the retaining wall designer. In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed retaining wall footing will surcharge the proposed retaining structure. Uniform surcharges may be estimated using the applicable coefficient of lateral earth pressure using a rectangular distribution. A factor of 0.5 and 0.33 may be used for at-rest and active conditions, respectively. The retaining wall designer should contact the geotechnical engineer for any required geotechnical input in estimating any applicable surcharge loads.

If required, the retaining wall designer may use a seismic lateral earth pressure increment of 5 pcf for retaining walls up to a maximum of 10 feet in height. This increment should be applied in addition to the applicable static lateral earth pressure using a triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). For the restrained, at-rest condition, the seismic increment may be added to the applicable active lateral earth pressure (in lieu of the at-rest lateral earth pressure) when analyzing short duration seismic loading. Per Section 1803.5.12 of the 2013 CBC, the seismic lateral earth pressure is applicable to structures assigned to Seismic Design Category D through F for retaining wall structures supporting more than 6 feet of backfill height. This seismic lateral earth pressure is estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010). The provided seismic lateral earth pressure is for a maximum of 10 feet in height. If a retaining wall greater than 10 feet in height is proposed, the retaining wall designer should contact the geotechnical engineer for specific seismic lateral earth pressure increments based on the configuration of the planned retaining wall structures.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. To reduce, but not eliminate, saturation of near surface (upper approximate 1-foot) soils in front of the retaining walls, the perforated subdrain pipe should be located as low as possible behind the retaining wall. The outlet pipe should be sloped to drain to a suitable outlet. In general, we do not recommend retaining wall outlet pipes be connected to area drains. If subdrains are connected to area drains, special care and information should be provided to homeowners to maintain these drains. Typical retaining wall drainage is illustrated in Figure 2 (rear of text). It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water containing soluble salts migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Lateral resistance (friction coefficient and passive resistance) is provided in Section 4.6. Earthwork considerations (temporary backcuts, backfill, compaction, etc.) for retaining walls are provided in Section 4.1 (Site Earthwork) and the subsequent earthwork related sub-sections.

4.8 Control of Surface Water and Drainage Control

From a geotechnical perspective, positive drainage of surface water away from structures is very important. Water should not be allowed to pond adjacent to buildings or to flow freely down a graded slope. Per the 2013 CBC, positive drainage may be accomplished by providing drainage away from buildings at a gradient of at least 5 percent for earthen surfaces for a distance of at least 10 feet away from the face of building. If a distance of 10 feet cannot be achieved, an alternative of a gradient of at least 5 percent to an area drain or swale having a gradient of 2 percent is acceptable. Where necessary, drainage paths may be shortened by use of area drains and collector pipes. Eave gutters are recommended and should reduce water infiltration into the subgrade soils if the downspouts are properly connected to appropriate outlets. Ultimately surface drainage and code compliance is the purview of the Project Civil Engineer.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.9 Preliminary Pavement Recommendations

Based on an assumed R-value of 25 and the City of San Diego “Pavement Design Standard”, we recommend the following provisional minimum street sections for a range of Traffic Indices between 5.0 and 6.0. These recommendations must be confirmed with R-value testing of representative near-surface soils at the completion of grading and after underground utilities have been installed and backfilled. Final street sections should be confirmed by the project civil engineer and/or traffic engineer based upon the design Traffic Index.

Assumed Traffic Index	5.0	5.5	6.0
R-Value Subgrade	25	25	25
AC Thickness	3.0 inches	3.0 inches	3.0 inches
Base Thickness	5.5 inches	7.0 inches	8.0 inches

The thicknesses shown are for <u>minimum</u> thicknesses. Increasing the thickness of any or all of the above layers will reduce the likelihood of the pavement experiencing distress during its service life. The above recommendations are based on the assumption that proper maintenance and irrigation of the areas adjacent to the roadway will occur through the design life of the pavement. Failure to maintain a proper maintenance and/or irrigation program may jeopardize the integrity of the pavement.

Earthwork recommendations regarding aggregate base and subgrade are provided in Section 4.1 (Site Earthwork) and the related sub-sections of this report.

4.10 Soil Corrosivity

Although not corrosion engineers (LGC Geotechnical is not a corrosion consultant), several governing agencies in Southern California require the geotechnical consultant to determine the corrosion potential of soils to buried concrete and metal facilities. We therefore present the corrosion test results for the use of the client and other consultants, as they determine necessary.

The result of the soluble sulfate content tests ranged from 24 ppm to 506 ppm, less than 0.10 percent. Chloride content ranged from 96 to 141 parts-per-million (ppm), pH values ranged from 7.5 to 8.0 and the resistivity tests ranged from a minimum resistivity value of 850 ohm-centimeters to 1,600 ohm-centimeters. Caltrans defines a corrosive area where any of the following conditions exist: the soil contains more than 500 ppm of chlorides, more than 2,000 ppm (0.2 percent) of sulfates, or a pH of 5.5 or less (Caltrans, 2012). Thereby, based on chloride test results, the site contains soils that are considered "corrosive" based on Caltrans guidelines.

Based on preliminary laboratory sulfate test results, the near-surface soils have an exposure class of "S0" per ACI 318-14, Table 19.3.1.1 with respect to sulfates. This must be verified based on as-graded conditions.

4.11 Nonstructural Concrete Flatwork

Nonstructural concrete flatwork (such as walkways, bicycle trails, etc.) has a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the minimum guidelines outlined in Table 4. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints, but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 4

Nonstructural Concrete Flatwork for Medium Expansion Potential

	Homeowner Sidewalks	Private Drives	Patios/Entryways	City Sidewalk Curb and Gutters
Minimum Thickness (in.)	4 (nominal)	5 (full)	5 (full)	City/Agency Standard
Presoaking	Wet down prior to placing	Presoak to 12 inches	Presoak to 12 inches	City/Agency Standard
Reinforcement	—	No. 3 at 24 inches on centers	No. 3 at 24 inches on centers	City/Agency Standard
Thickened Edge (in.)	—	8 x 8	—	City/Agency Standard
Crack Control Joints	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	City/Agency Standard
Maximum Joint Spacing	5 feet	10 feet or quarter cut whichever is closer	6 feet	City/Agency Standard
Aggregate Base Thickness (in.)	—	—	2	City/Agency Standard

To reduce the potential for driveways to separate from the garage slab, the builder may elect to install dowels to tie these two elements together. Similarly, future homeowners should consider the use of dowels to connect flatwork to the foundation.

4.12 Subsurface Water Infiltration

Recent regulatory changes mandate that storm water be infiltrated rather than discharged via conventional storm drainage systems. It should be noted that intentionally infiltrating storm water conflicts with the geotechnical engineering objective of directing surface water away from structures and improvements. The geotechnical stability and integrity of the project site is reliant upon appropriately handling surface water.

In general, the vast majority of geotechnical distress issues are directly related to improper drainage. Distress in the form of movement of foundations and other improvements could occur as a result of soil saturation and loss of soil support of foundations and pavements, settlement, collapse, internal soil erosion, and/or expansion. Additionally, off-site properties and improvements may be subjected to seeps, springs, slope instability, movements of foundations or other impacts as a result of water infiltration and migration. Infiltrated water may enter underground utility pipe zones and migrate along the pipe backfill, potentially impacting other improvements located far away from the point of infiltration.

Given the shallow depth to impermeable bedrock, per the City of San Diego "Storm Water Standards", the site is "infeasible for infiltration and infiltration-based facilities should not be constructed.

4.13 Swimming Pools and Spas

Swimming pools and spas should not be constructed over a cut/fill transition and should comply with current CBC requirements for slope setback. Lot-specific geotechnical recommendations based on as-graded conditions should be obtained for any proposed swimming pools and spas.

4.14 Geotechnical Plan Review

When available, any updated rough, precise grading, retaining wall, and foundation plans should be reviewed by LGC Geotechnical in order to verify our geotechnical recommendations are implemented. Updated recommendations and/or additional field work may be necessary.

4.15 Geotechnical Observation and Testing During Construction

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC Geotechnical. Geotechnical observation and testing is required per Section 1705 of the 2013 California Building Code (CBC).

Geotechnical observation and/or testing should be performed by LGC Geotechnical at the following stages:

- During rough grading (removal/over-excavation bottoms, fill placement, etc.);
- Part-time geologic mapping of removal bottoms and temporary backcuts;
- During retaining wall backfill and compaction;
- During utility trench backfill and compaction;
- During precise grading;
- After presoaking building pads and other concrete-flatwork subgrades, and prior to placement of aggregate base or concrete;
- Preparation of pavement subgrade and placement of aggregate base;
- After building and wall footing excavation and prior to placement of steel reinforcement and/or concrete; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

5.0 LIMITATIONS

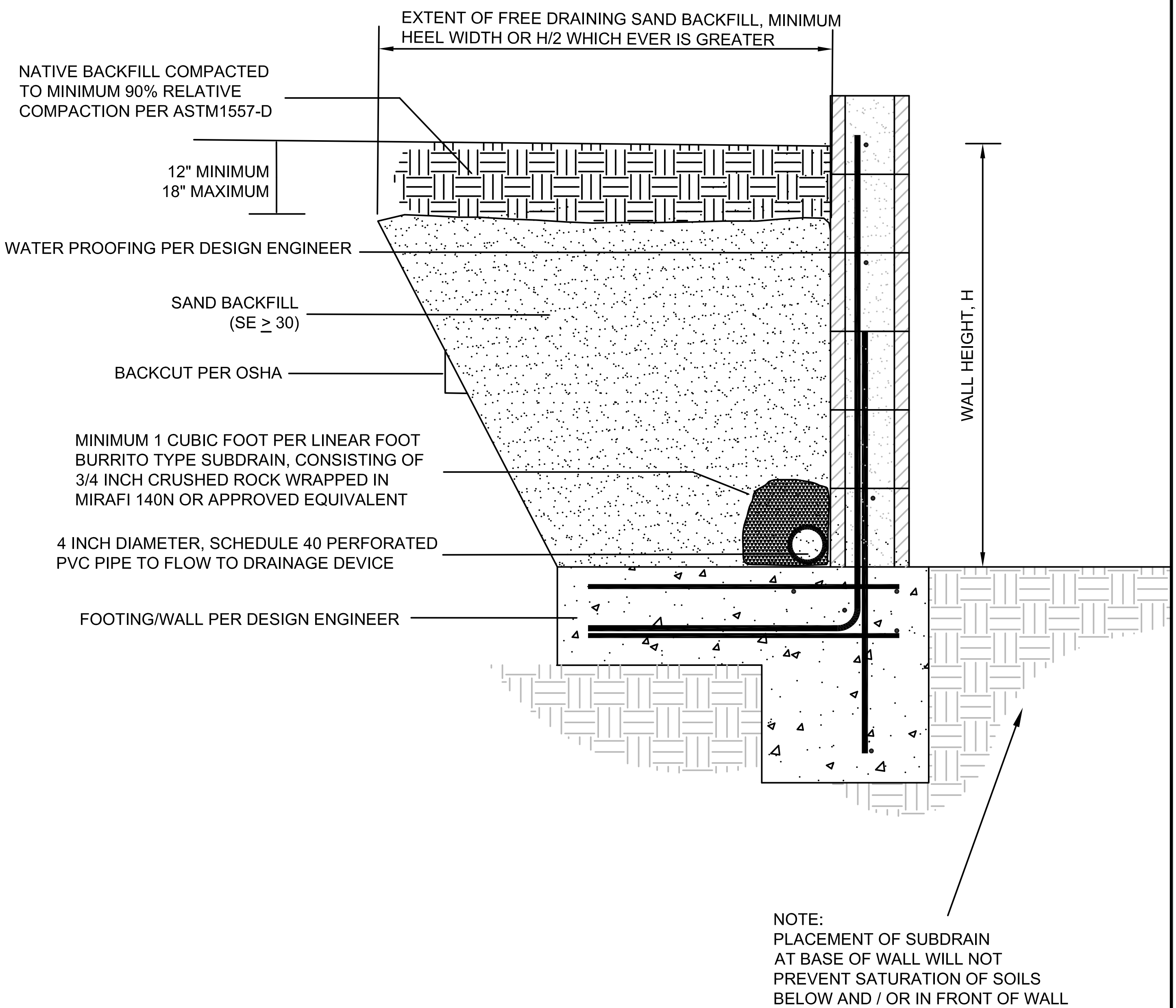
Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical investigation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the other consultants (at a minimum the civil engineer, structural engineer, landscape architect) and incorporated into their plans. The contractor should properly implement the recommendations during construction and notify the owner if they consider any of the recommendations presented herein to be unsafe, or unsuitable.

The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings, conclusions, and recommendations presented in this report can be relied upon only if LGC has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party’s sole risk.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.



LGC Geotechnical, Inc.

FIGURE 2
Retaining Wall Backfill Detail

PROJECT NAME	*Lennar - Rancho Penasquitos*
PROJECT NO.	*15198-01*
ENG. / GEOL.	*BJE / KAD*
SCALE	*Not to Scale*
DATE	*January 2016*

Appendix A
References

APPENDIX A

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Appendix B
Logs of Exploratory Excavations by Others

EXPLORATION LOG

Project: **Rancho Penasquitos**		Boring No.: **B-1**	
Location: **Carmel Mountain Road**		Elevation: **595(±)**	
Job No.: **15-261**	Client: **Lennar Homes**	Date: **6/25/15**	
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By: **EL**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Clayey SAND (SC): medium brown to reddish brown, slightly moist, dense; with gravel, grass on surface, roots.							
		UNDOCUMENTED FILL (Uaf) Clayey SAND (SC): medium brown to reddish brown, slightly moist, dense; with gravel.		44			9.2	108.5	
5		Clayey SILT (ML): dark brown to black, moist, stiff; with gravel.		24			13.5	112.7	
		CLAY (CL): orange to reddish brown, moist, stiff; with gravel.		24			16.0	91.9	
		CLayey SAND/SAND (SC/SP): medium brown, moist, dense; minor relict granitic fragments.		44			11.0	114.4	
10		**BEDROCK - Granitics (Kgr)** Granitic Bedrock (Kgr): reddish brown, moderatelly hard; weathered.							
		Total Depth 14 Feet Practical Refusal No Groundwater Hole Backfilled with Bentonite and Soil.							

EXPLORATION LOG - V2 15-261.GPJ PETRA.GDT 7/15/15

PLATE A-1

Petra Geotechnical, Inc.

EXPLORATION LOG

Project:	Rancho Penasquitos	Boring No.:	B-2
Location:	Carmel Mountain Road	Elevation:	598(±)
Job No.: 15-261	Client: Lennar Homes	Date:	6/25/15
Drill Method: 4" Solid Stem	Driving Weight: 140 lbs / 30 in	Logged By:	EL

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Silty SAND(SM): light brown, dry, dense; occasional small gravel, grass on surface, roots.							
		UNDOCUMENTED FILL (Uaf) Silty SAND(SM): light brown, dry, dense; occasional small gravel.							
		Clayey SAND (SC): light brown, dry, dense; gravel.		42			8.4		
5		**OLDER ALLUVIUM (Qoal)** Silty SAND (SM): light brown, dry, very dense; with minor clay, fine to coarse grain, no obvious porosity.		50-5"			9.1	119.2	
				30 50-1"			7.7	109.7	
		BEDROCK - Granitics (Kgr) Granitic Bedrock (Kgr): reddish brown, moderatelly hard; weathered. Total Depth 9.5 Feet Practiacl Refusal No Groundwater Hole Backfilled with Bentonite and Soil.		50-5"			6.8	106.1	

PLATE A-2

EXPLORATION LOG

Project: Rancho Penasquitos		Boring No.: B-3
Location: Carmel Mountain Road		Elevation: 600(±)
Job No.: 15-261	Client: Lennar Homes	Date: 6/25/15
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: EL

Depth (Feet)	Lithology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Silty SAND(SM): light brown, dry, dense; occasional small gravel, grass on surface, roots.							
		OLDER ALLUVIUM (Qoal) Silty CLAY (CL): mottled, light grey brown and orange brown, dry, hard; brittle.		50-3"			12.2	110.7	
		Sandy CLAY (CL): orange brown-light gray to brown, slightly moist, hard; occasionally smal gravel, no visible porosity.		50-5"			16.3	114.3	
5				83			8.5	119.6	MAX, EI, COR
				23 50-5"			12.0	117.6	
10		Increase gravel content at 9'.							
15		**BEDROCK - Granitics (Kgr)** Granitic Bedrock (Kgr): reddish brown, moderatelly hard; weathered. Total Depth 15 Feet Practical Refusal No Groundwater Hole Backfilled with Bentonite and Soil.					6.6	102.0	

PLATE A-3

EXPLORATION LOG - V2 15-261.GPJ PETRA.GDT 7/14/15

EXPLORATION LOG

Project: **Rancho Penasquitos**		Boring No.: **B-4**	
Location: **Carmel Mountain Road**		Elevation: **587(±)**	
Job No.: **15-261**	Client: **Lennar Homes**	Date: **6/25/15**	
Drill Method: **4" Solid Stem**	Driving Weight: **140 lbs / 30 in**	Logged By: **EL**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Clayey SAND/Silty SAND (SC/SM): light brown and orange brown, slightly moist, medium dense; with small gravel,grass on surface, roots.							
		UNDOCUMENTED FILL (Uaf) Clayey SAND/Silty SAND (SC/SM): light brown and orange brown, slightly moist, dense; with small gravel.		46			7.9	114.7	
		OLDER ALLUVIUM (Qoal) Silty CLAY (CL): brown and black, wet, stiff; pliable, local sand layer.		18			22.7	100.8	
5		Minor seepage at 5 feet.							
		Clayey SILT/Silty SAND (ML/SM): medium brown, orange and light gray, moist, hard; occasionally small gravel, oxidized.		55			15.1	113.8	
				52			15.1	113.6	
10		Silty SAND (SM): brown with orange mottling, moist, very dense; fine to coarse-grain with gravel.		57			11.7	119.9	
		BEDROCK - Granitics (Kgr) Granitic Bedrock (Kgr): reddish brown, moderatelly hard; weathered.							

Total Depth 12.5 Feet
Practical Refusal
Water Seepage 5 feet
Hole Backfilled with Bentonite and Soil.

PLATE A-4

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: Rancho Penasquitos		Boring No.: B-5
Location: Carmel Mountain Road		Elevation: 610(±)
Job No.: 15-261	Client: Lennar Homes	Date: 6/26/15
Drill Method: 4" Solid Stem	Driving Weight: 140 lbs / 30 in	Logged By: EL

Depth (Feet)	Lithology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Sandy GRAVEL (GS): light brown and light gray, loose, dry; grass on surface, roots.							
		UNDOCUMENTED FILL (Uaf) Sandy GRAVEL (GS): light brown and light gray, loose, dry;.		37			11.9	122.1	
		BEDROCK - Granitics (Kgr) Granitic Bedrock (Kgr): reddish brown, slightly moist, moderatelly hard; highly weathered, small mica or gypsum crystals.		13 50-5"			8.8	122.4	
5		Orange brown, slightly moist, hard; mafic.		44 50-3"			6.0	129.3	
		Total Depth 6.5 Feet No Ground water Hole Backfilled with Bentonite and Soil.							

EXPLORATION LOG - V2 15-261.GPJ PETRA.GDT 7/14/15

PLATE A-5

Petra Geotechnical, Inc.

EXPLORATION LOG

Project:	Rancho Penasquitos			Boring No.:	B-6
Location:	Carmel Mountain Road			Elevation:	604(±)
Job No.:	15-261	Client:	Lennar Homes	Date:	7/2/15
Drill Method:	Hollow-Stem Auger	Driving Weight:	140 lbs / 30 in	Logged By:	EL

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Clayey SAND/Silty SAND (SC/SM): light brown and orange brown, slightly moist, medium dense; with small gravel,grass on surface, roots.							
		BEDROCK - Granitics (Kgr) Granitic Bedrock (Kgr): orange brown, slightly moist, moderatelly hard; highly weathered, decomposed.		48			10.6	108.4	MAX, EI, COR
		Orange brown, gray and black, slightly moist, hard.		50			12.4	110.5	
5		Gray brown.		27' 50-5			9.0	116.9	
		Total Depth 6 Feet No Groundwater Hole Backfilled with Bentonite and Soil.							

PLATE A-6

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: Rancho Penasquitos		Boring No.: B-7
Location: Carmel Mountain Road		Elevation: 595(±)
Job No.: 15-261	Client: Lennar Homes	Date: 7/2/15
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: EL

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Silty SAND (SM): brown , slightly moist, dense; grass on surface, roots.		50-5"			6.2	125.4	
		UNDOCUMENTED FILL (Uaf) Silty SAND (SM): brown , slightly moist, dense.							
		BEDROCK - Granitics (Kgr) Granitic Bedrock (Kgr): orange brown, slightly moist, moderatelly hard; highly weathered, friable.		0.5					
		Total Depth 3.5 Feet Practical Refusal No Groundwater Hole Backfilled with Bentonite and Soil.							

EXPLORATION LOG - V2 15-261.GPJ PETRA.GDT 7/14/15

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: Rancho Penasquitos		Boring No.: B-8
Location: Carmel Mountain Road		Elevation: 606(±)
Job No.: 15-261	Client: Lennar Homes	Date: 7/2/15
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: EL

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		TOPSOIL Silty SAND (SM): brown , slightly moist, dense; grass on surface, roots.							
		BEDROCK - Granitics (Kgr) Granitic Bedrock (Kgr): medium to light brown, slightly moist, moderatelly hard; highly weathered, friable.		39 50-3"			6.4	116.3	
		Total Depth 3 Feet Practical Refusal No Groundwater Hole Backfilled with Bentonite and Soil.							

EXPLORATION LOG - V2 15-261.GPJ PETRA.GDT 7/14/15

Petra Geotechnical, Inc.

EXPLORATION LOG

Project: **Rancho Penasquitos**		Boring No.:	**B-9**
Location: **Carmel Mountain Road**		Elevation:	**599(±)**
Job No.: **15-261**	Client: **Lennar Homes**	Date:	**7/2/15**
Drill Method: **Hollow-Stem Auger**	Driving Weight: **140 lbs / 30 in**	Logged By:	**EL**

Depth (Feet)	Material Description	Water	Blows Per Foot	Moisture Content (%)	Dry Density (pcf)	Other Lab Tests
0	**TOPSOIL** Clayey SAND (SC): medium brown to reddish brown, slightly moist, loose; with gravel, grass on surface, roots.					
	UNDOCUMENTED FILL (Uaf) Clayey SAND (SC): brown, slighty moist, medium dense.		47	3.9	113.3	MAX. EI, COR
			30	4.8	114.7	
4	Sandy SILT/Silty SAND (ML/SM): brown, slightly moist, very stiff; ocassional small gravel, fine mica or gypsum.					
5			45	9.0	108.9	
7.5	**BEDROCK - Granitics (Kgr)** Granitic Bedrock (Kgr): brown, dark gray and black, dry to slightly moist, moderatelly hard; highly weathered, friable.		22 / 50-3"	4.8	123.6	
10			50-5"	3.7	111.7	

Total Depth 10.5 Feet
Practical Refusal
No Groundwater
Hole Backfilled with Bentonite and Soil.

EXPLORATION LOG - V2 15-261.GPJ PETRA.GDT 7/14/15

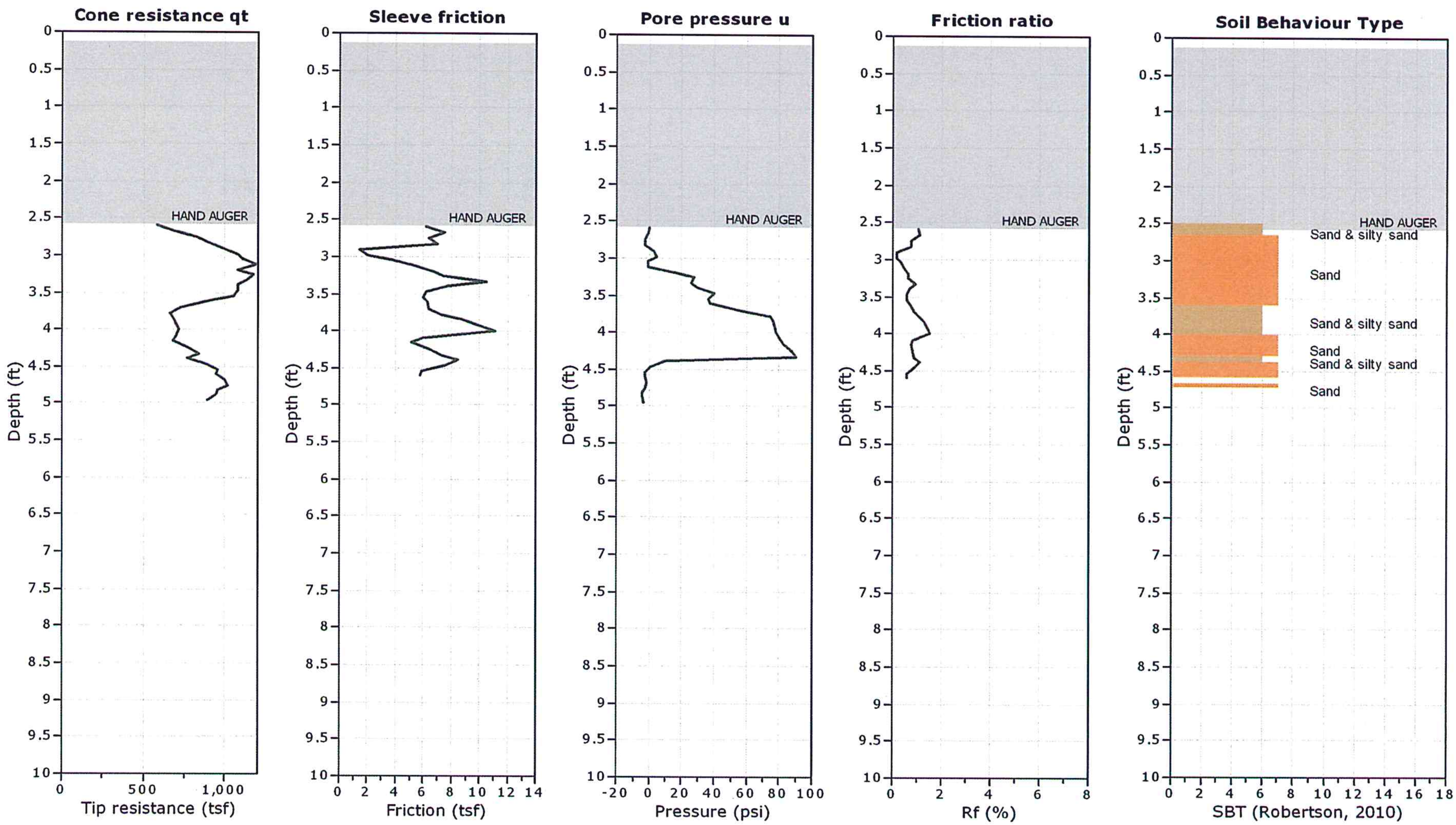
PLATE A-9

Petra Geotechnical, Inc.

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

Project: Petra Geotechnical, Inc.
Location: Caminata Taugus San Diego, CA

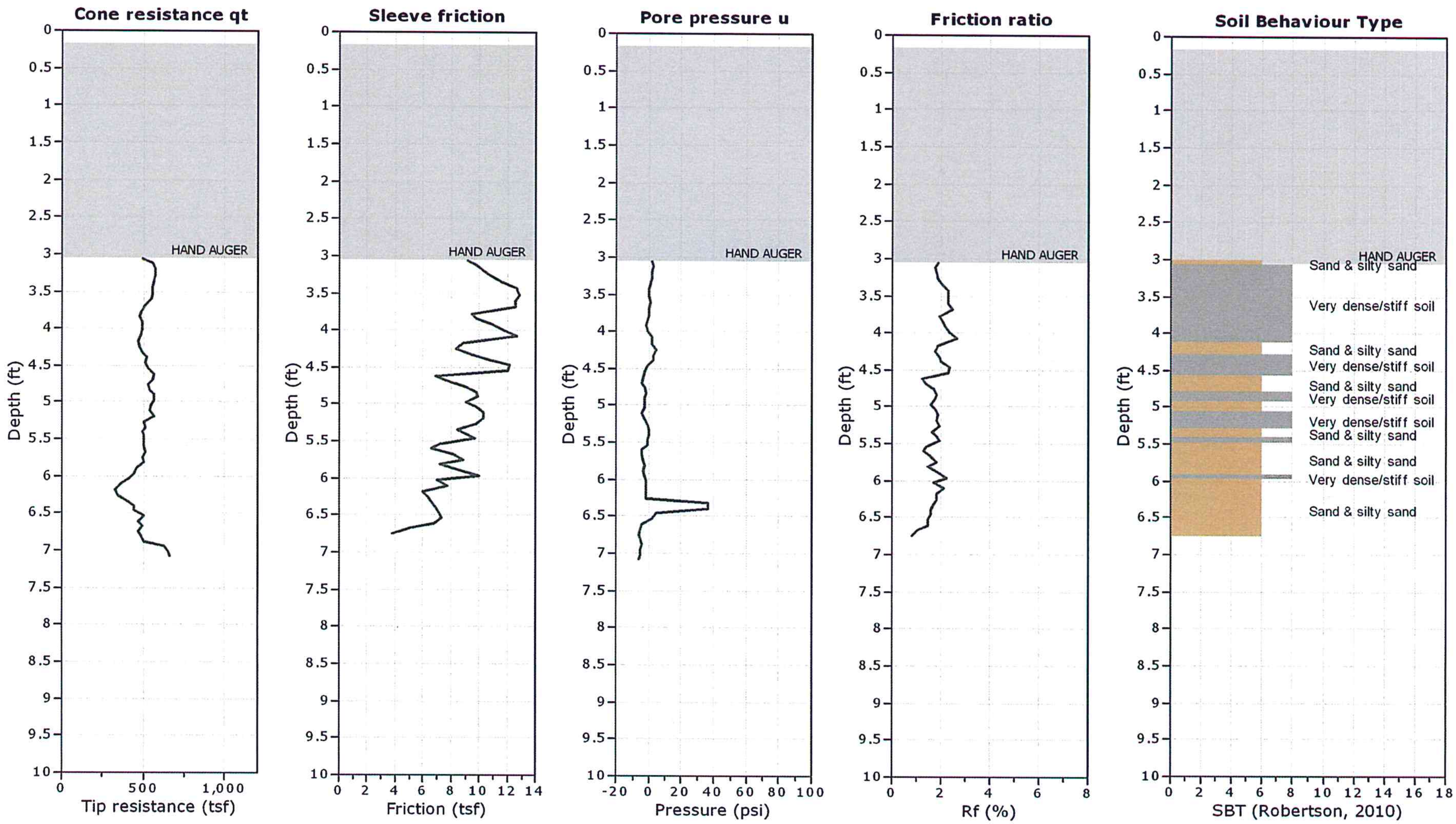
CPT: CPT-1
Total depth: 4.95 ft, Date: 6/17/2015
Cone Type: Vertek



Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

Project: Petra Geotechnical, Inc.
Location: Caminata Taugus San Diego, CA

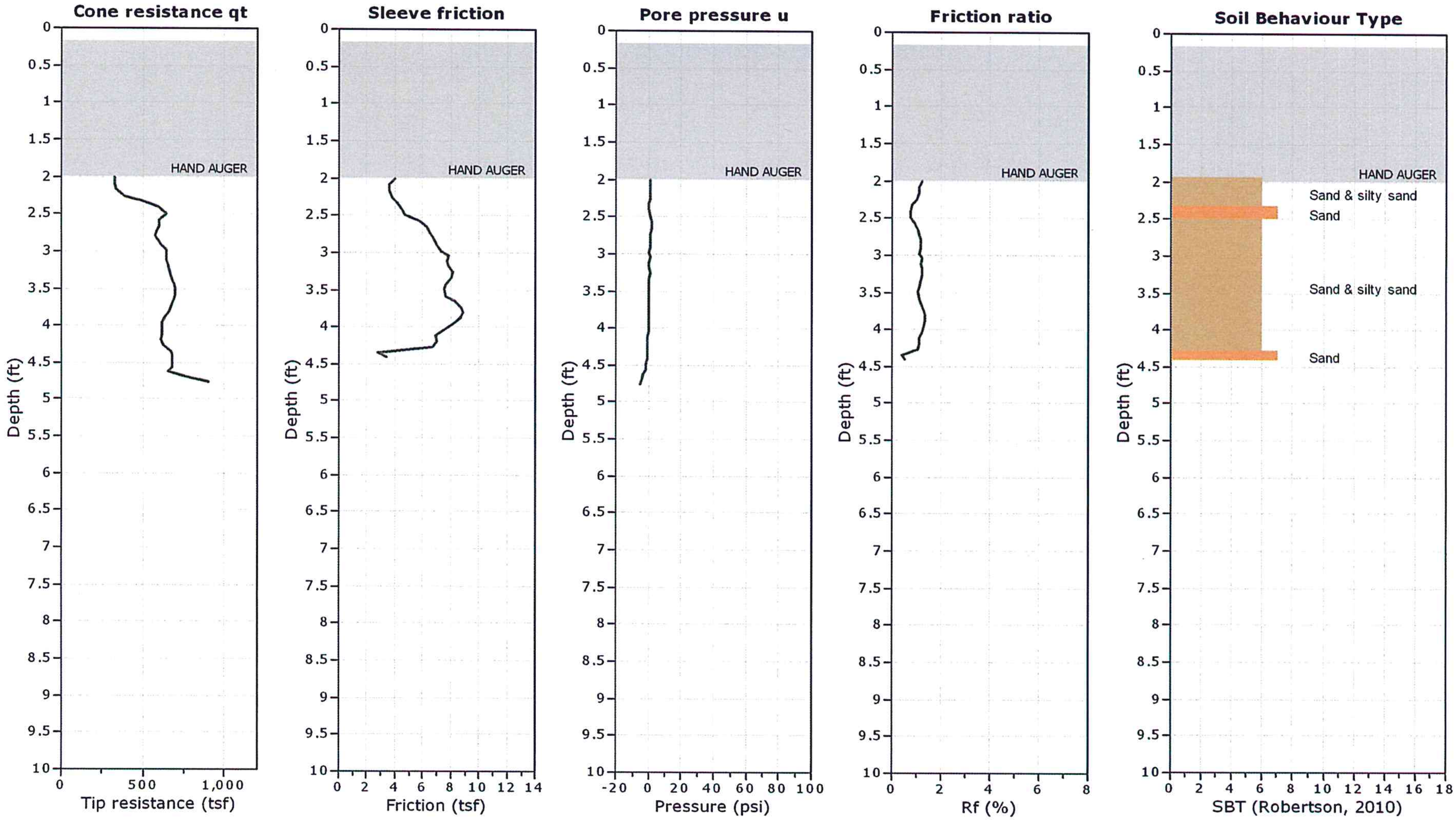
CPT: CPT-1A
Total depth: 7.08 ft, Date: 6/17/2015
Cone Type: Vertek



Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

Project: Petra Geotechnical, Inc.
Location: Caminata Taugus San Diego, CA

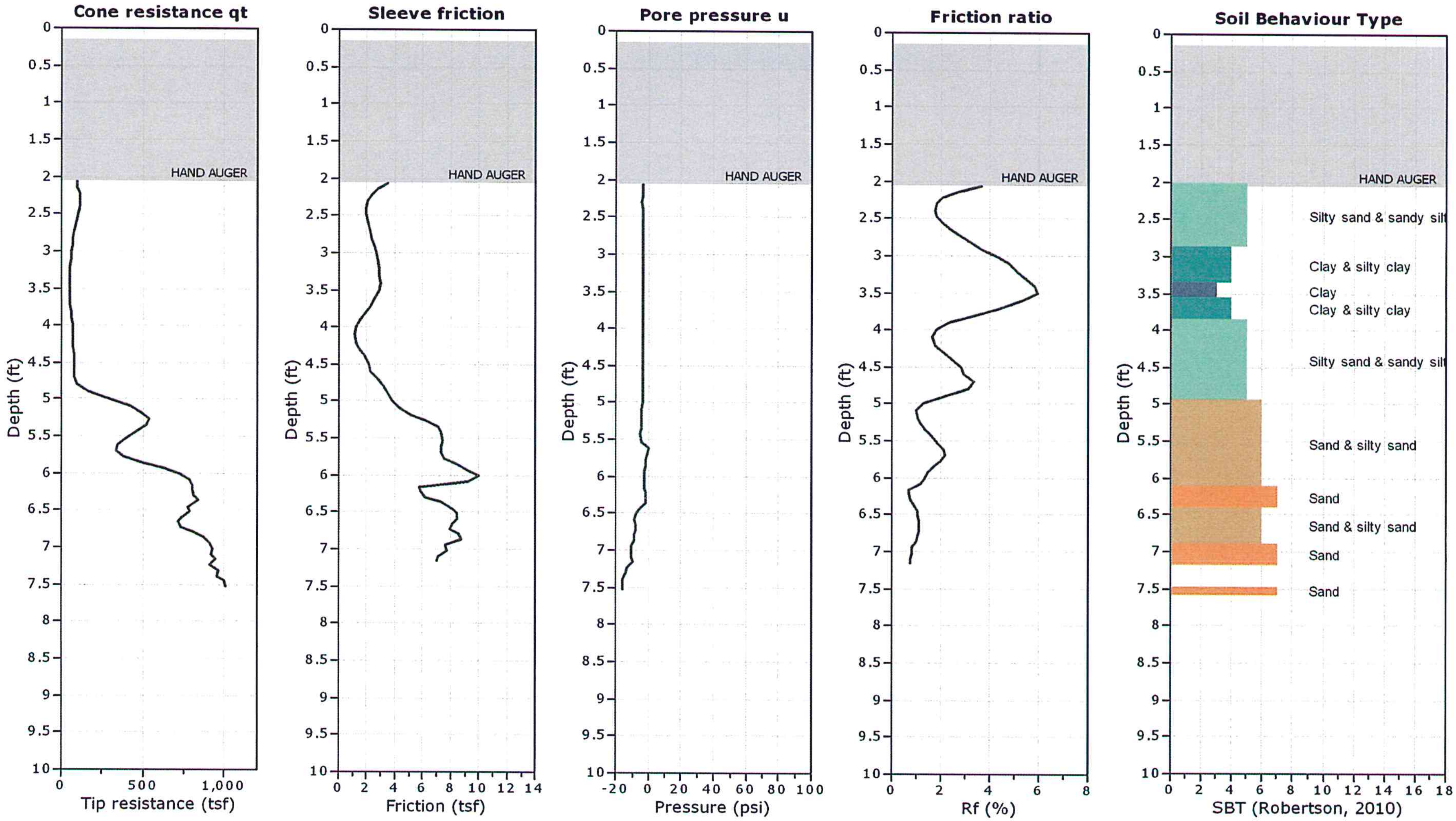
CPT: CPT-2
Total depth: 4.76 ft, Date: 6/17/2015
Cone Type: Vertek



Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

Project: Petra Geotechnical, Inc.
Location: Caminata Taugus San Diego, CA

CPT: CPT-3
Total depth: 7.52 ft, Date: 6/17/2015
Cone Type: Vertek



Appendix C
Laboratory Test Results by Others

APPENDIX B

Laboratory Test Criteria

Soil Classification
Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D2488). The samples were re-examined in the laboratory and the classifications reviewed and then revised where appropriate. The assigned group symbols are presented in the Boring Logs (Appendix A).

In-Situ Moisture and Density
Moisture content and unit dry density of in-place soils were determined in representative strata. Test data are summarized in the Boring Logs (Appendix A).

Maximum Dry Density and Optimum Moisture Content
The maximum dry density and optimum moisture content of the on-site soils were determined for selected bulk samples in accordance with current version of ASTM D 1557. The results of these tests are presented in the following table.

Expansion Index
The expansion index of onsite soils was determined per ASTM D4829. The expansion index and expansion potential are presented in the following table.

Grain Size Distribution
Grain size analysis was performed on bulk samples of onsite soils in accordance with the current versions of Test Method ASTM D 136 and/or Test Method ASTM D 422. The test result is graphically presented on Plates B-1 thru B-3.

Atterberg Limits
Atterberg Limit tests (Liquid Limit and Plastic Limit) were performed on selected samples to verify visual classifications. These tests were performed in accordance with ASTM D4318. Test results are presented in the following table.

Soil Corrosivity
Chemical analyses were performed on a selected sample to determine concentrations of soluble sulfate and chloride, as well as pH and resistivity. These tests were performed in accordance with California Test Method Nos. 417 (sulfate), 422 (chloride) and 643 (pH and resistivity). Test results are presented in the following table.

MAXIMUM DRY DENSITY

Boring/Depth (feet)	Soil Type	Optimum Moisture[1] (%)	Maximum Dry Density[1] (pcf)
B-3 @ 5-15	Sandy Clay (CL)	11.5	126.5
B-6 @ 0-5	Sandy Clay (CL)	10.5	128.5
B-9 @ 0-5	Clayey SAND (SC)	8.5	136.5

EXPANSION INDEX

Boring/Depth (feet)	Soil Type	Expansion[2] Index	Expansion[3] Potential
B-3 @ 5-15	Sandy Clay (CL)	42	Low
B-6 @ 0-5	Sandy Clay (CL)	61	Medium
B-9 @ 0-5	Clayey SAND (SC)	40	Low

ATTERBERG LIMITS

Boring/Depth (feet)	Soil Type	Liquid[4] Limit	Plastic[4] Limit	Plasticity Index[4]
B-6 @ 0-5	Sandy Clay (CL)	34	19	15

CORROSIVITY

Boring/Depth (feet)	Sulfate[5] (%)	Chloride[6] (ppm)	pH[7]	Resistivity[7] (ohm-cm)	Corrosivity Potential
B-3 @ 5-15	0.0156	126	7.5	1,000	concrete: not applicable steel: severely corrosive
B-6 @ 0-5	0.0506	141	8.0	850	concrete: not applicable steel: severely corrosive
B-9 @ 0-5	0.0024	96	7.8	1,600	concrete: not applicable steel: corrosive

(1) PER ASTM D1557
(2) PER ASTM D4829
(3) PER 2010 CBC SECTION 1802.3.2
(4) PER ASTM D4318
(5) PER CALIFORNIA TEST METHOD NO. 417
(6) PER CALIFORNIA TEST METHOD NO. 422
(7) PER CALIFORNIA TEST METHOD NO. 643

Appendix D
General Earthwork and Grading Specifications for Grading

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of “equipment” of work and the estimated quantities of daily earthwork

contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the
Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 *Preparation of Areas to be Filled*

2.1 *Clearing and Grubbing*

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 *Processing*

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be over-excavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Over-excavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 *Import*

If importing of fill material is required for grading, proposed import material shall meet the requirements of the geotechnical consultant. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 *Fill Placement and Compaction*

4.1 *Fill Layers*

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 *Fill Moisture Conditioning*

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 *Compaction of Fill*

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 *Compaction of Fill Slopes*

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 *Compaction Testing*

Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

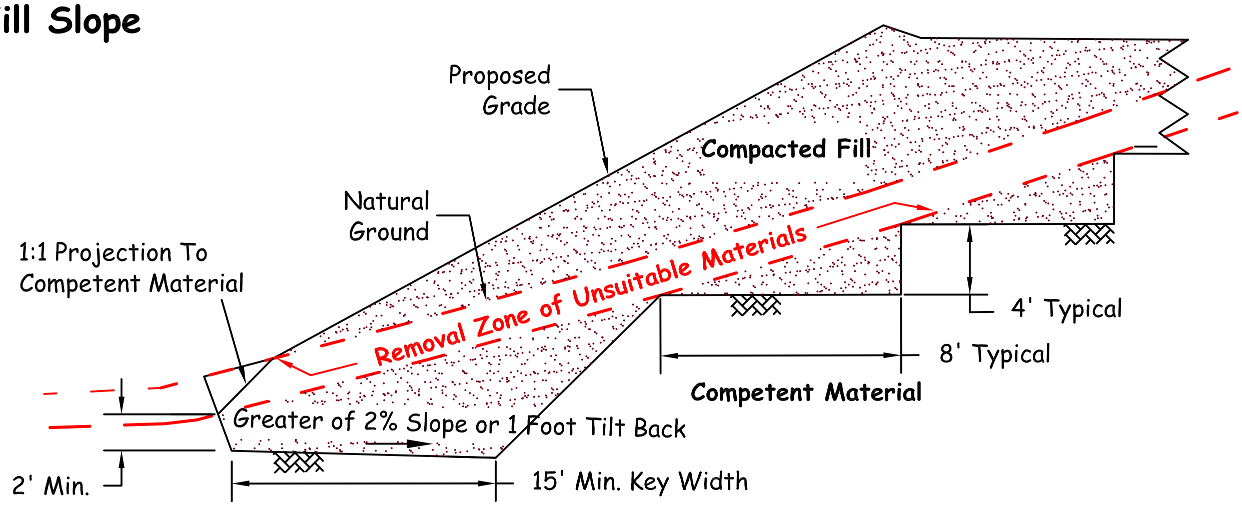
7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

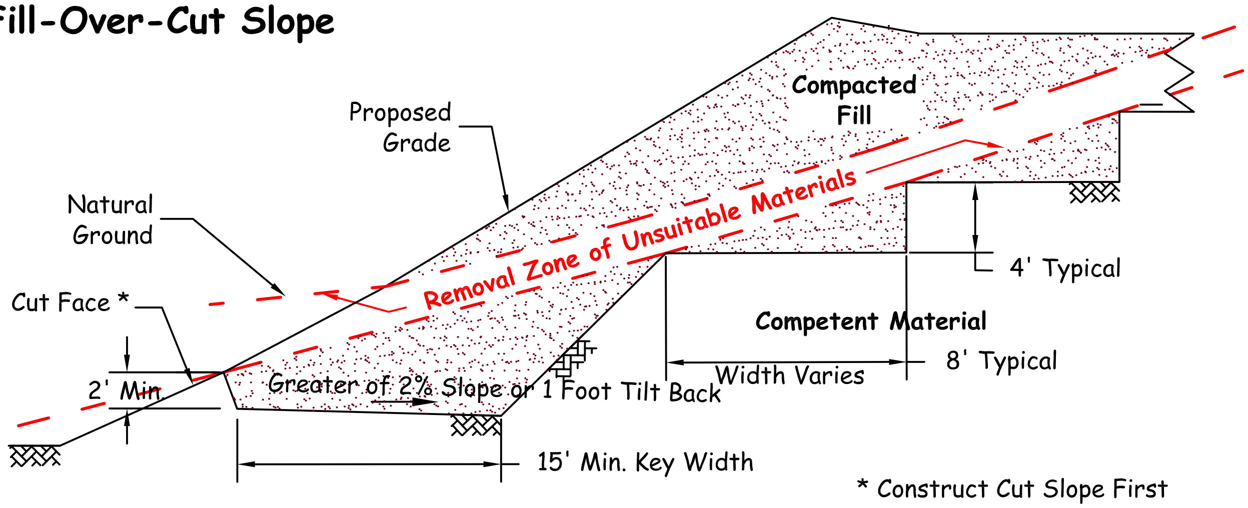
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

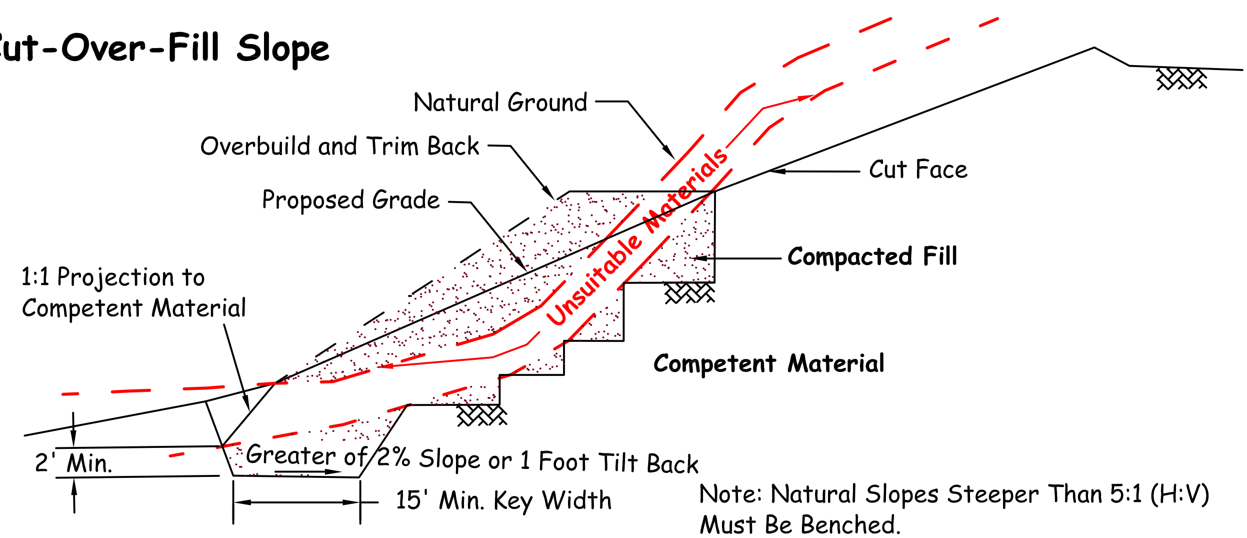
Fill Slope



Fill-Over-Cut Slope

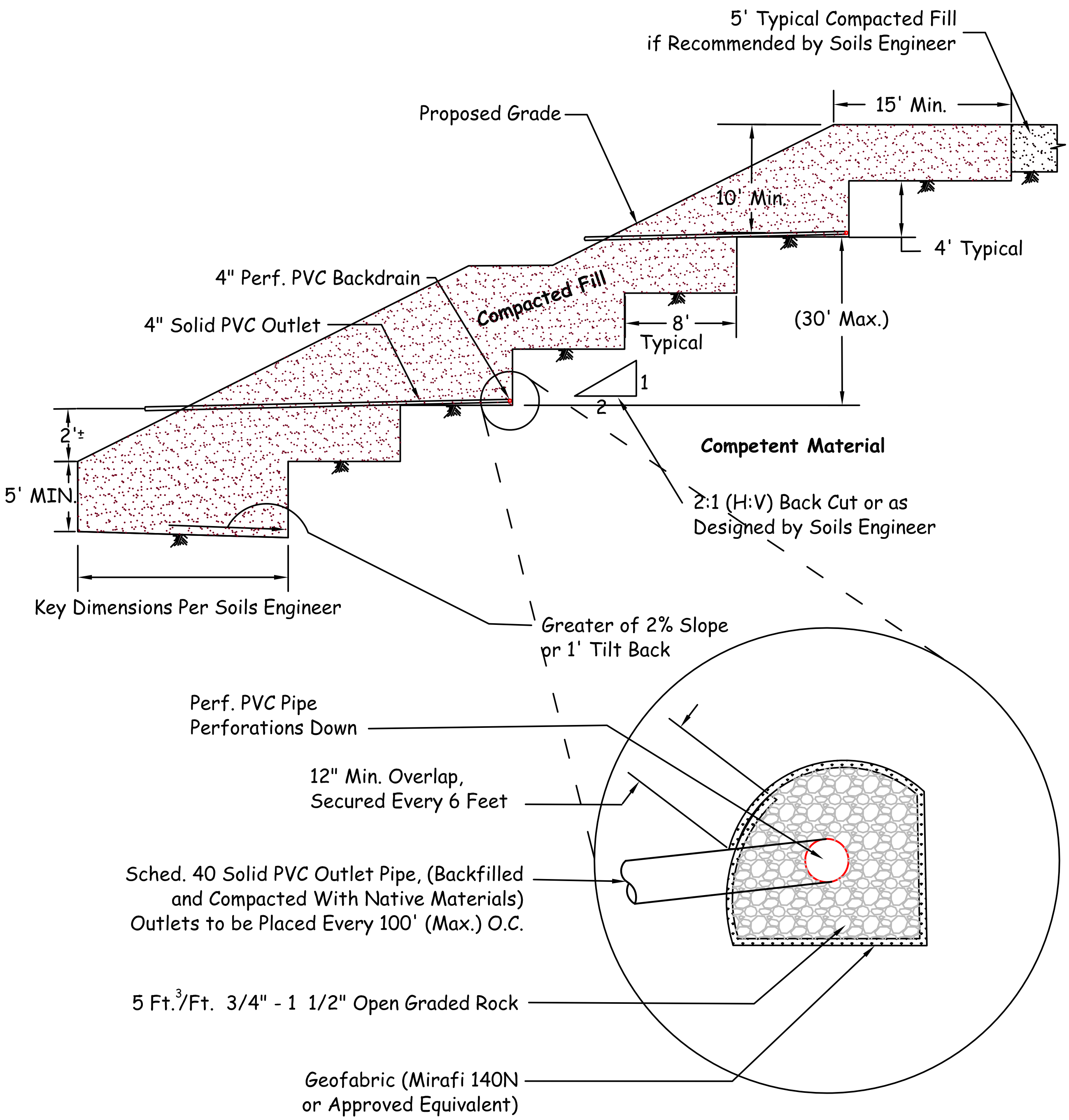


Cut-Over-Fill Slope



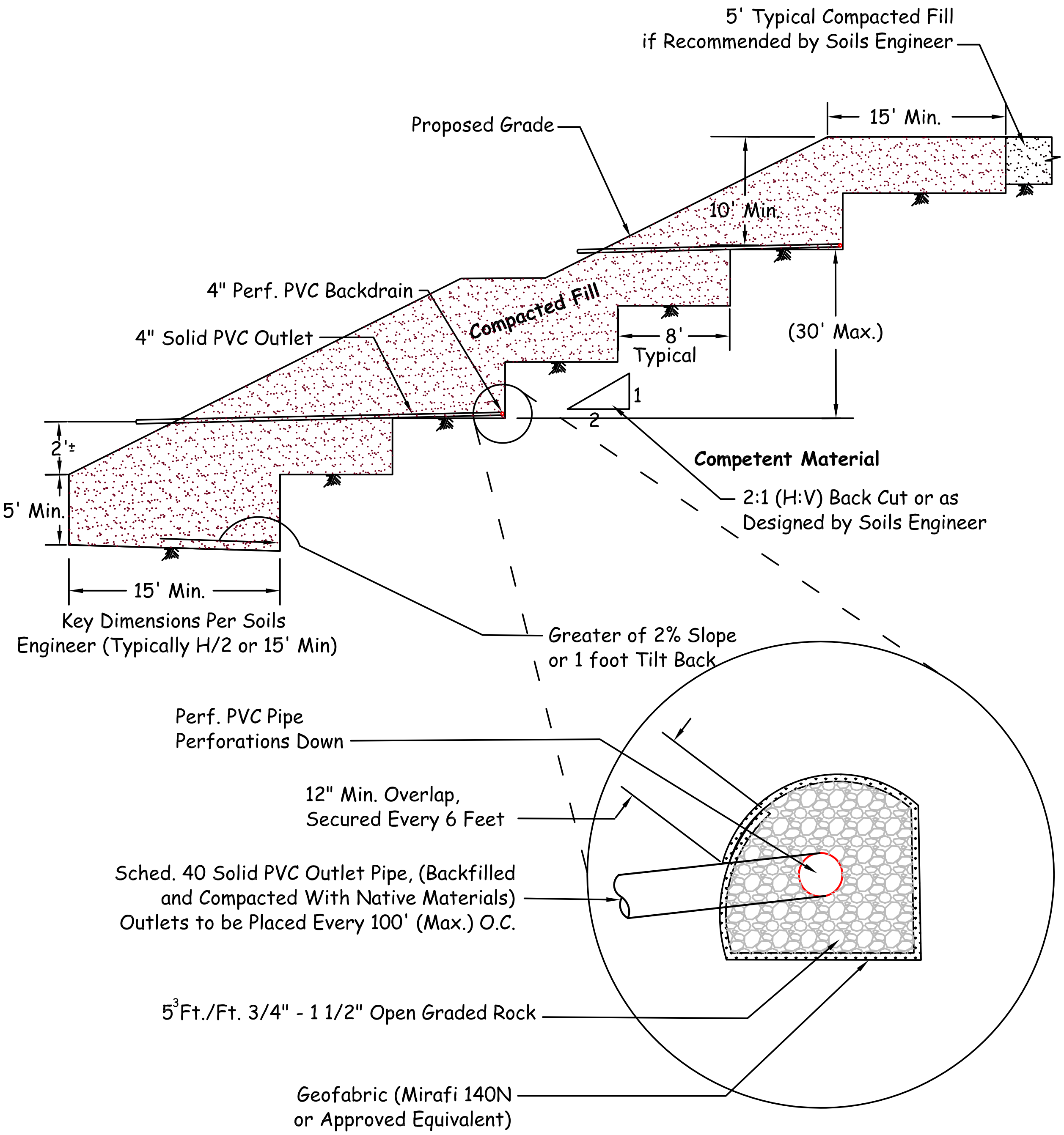
LGC Geotechnical, Inc.

KEYING AND BENCHING



LGC Geotechnical, Inc.

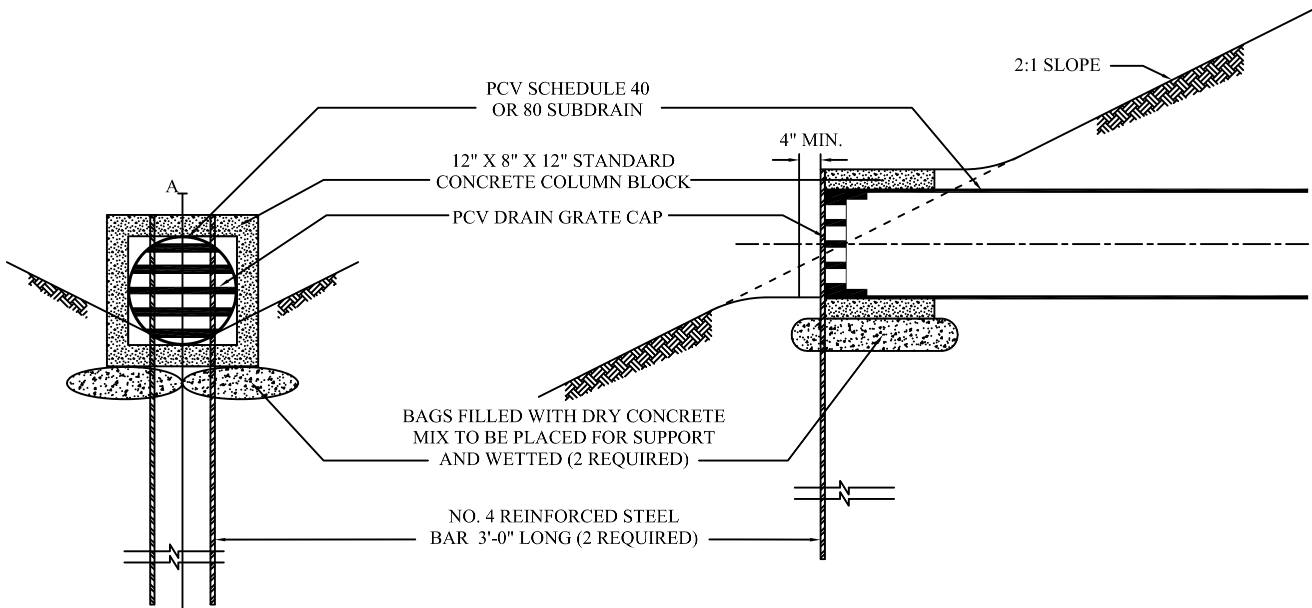
TYPICAL BUTTRESS DETAIL



LGC Geotechnical, Inc.

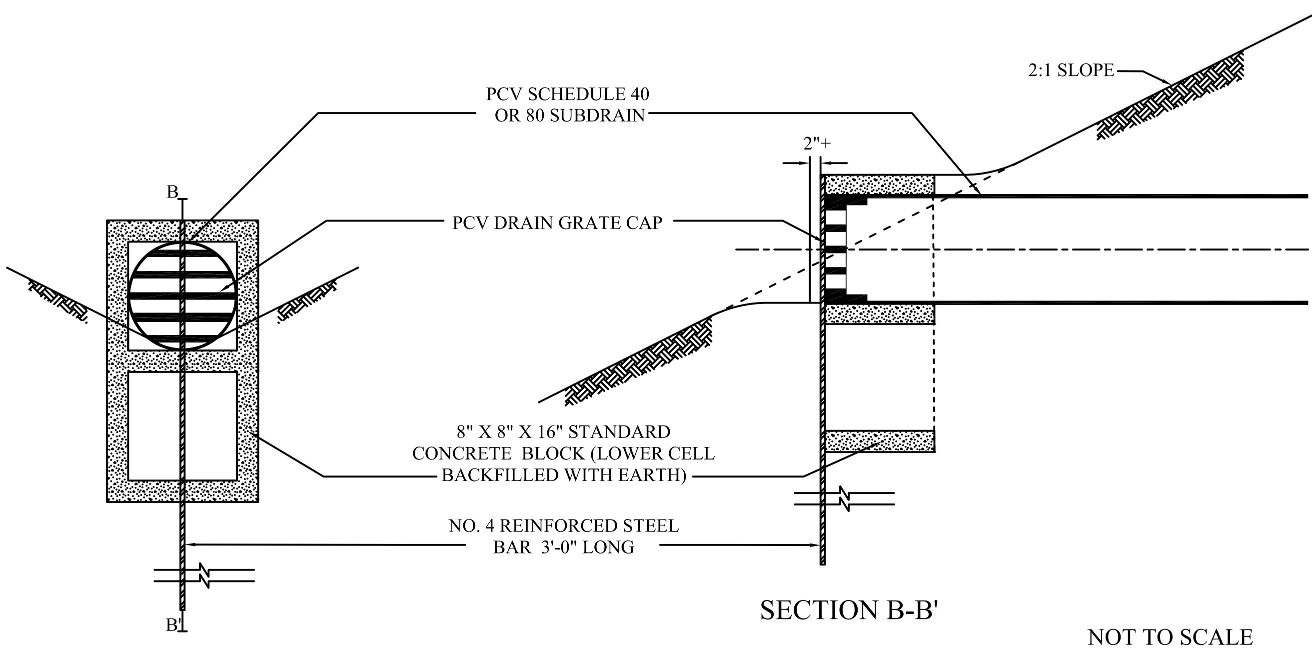
TYPICAL STABILIZATION FILL DETAIL

SUBDRAIN OUTLET MARKER -6" & 8" PIPE



SECTION A-A'

SUBDRAIN OUTLET MARKER -4" PIPE



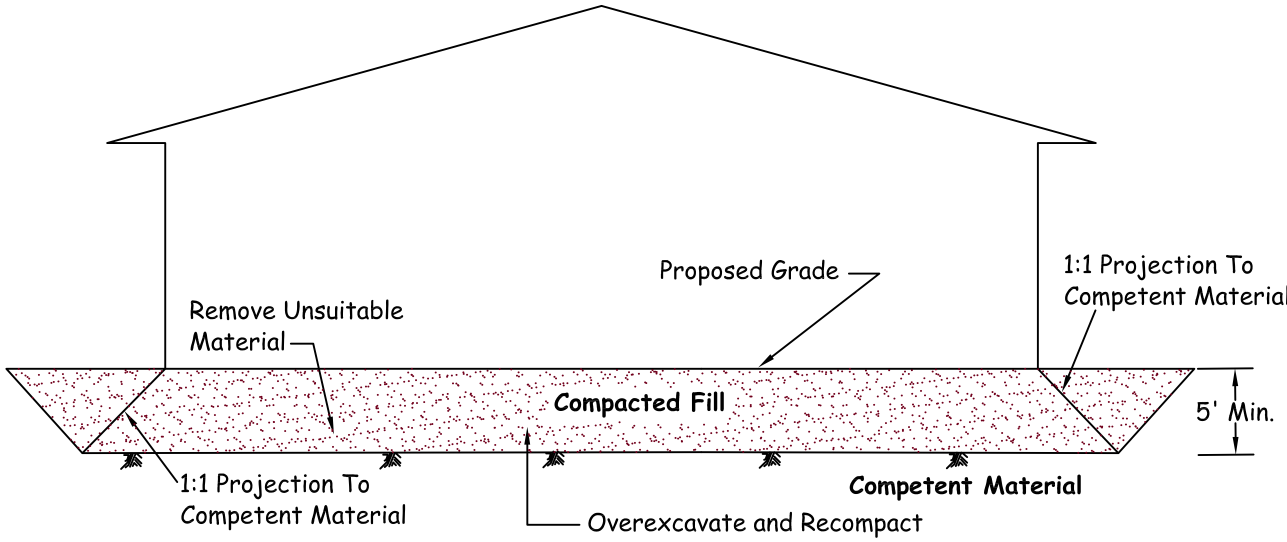
SECTION B-B'

NOT TO SCALE

LGC Geotechnical, Inc.

SUBDRAIN OUTLET MARKER DETAIL

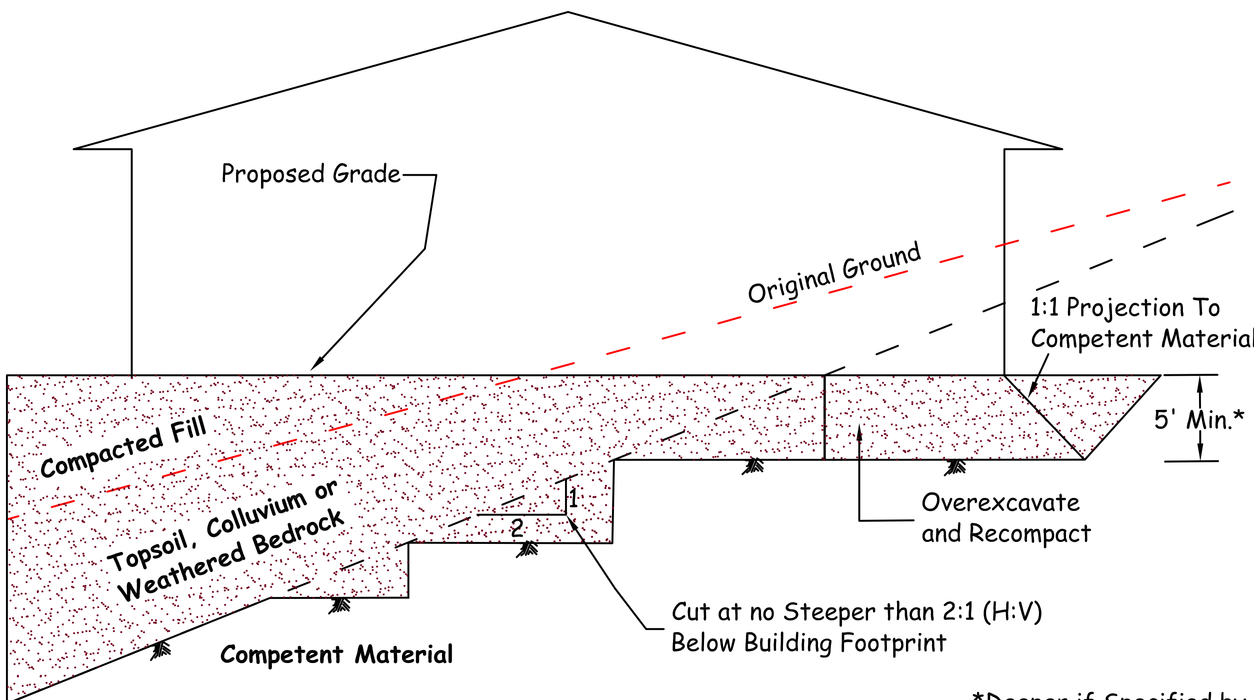
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

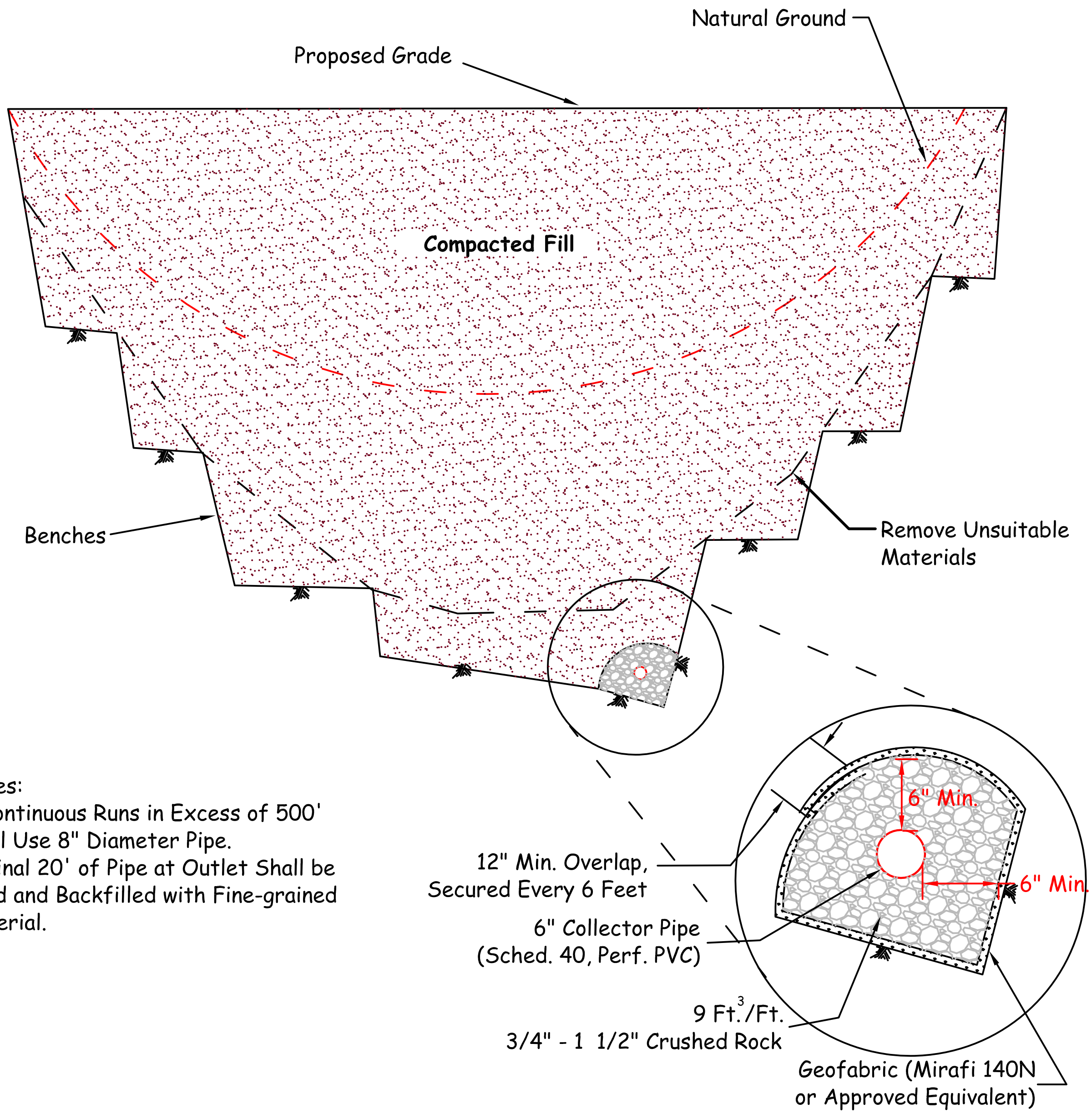
Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

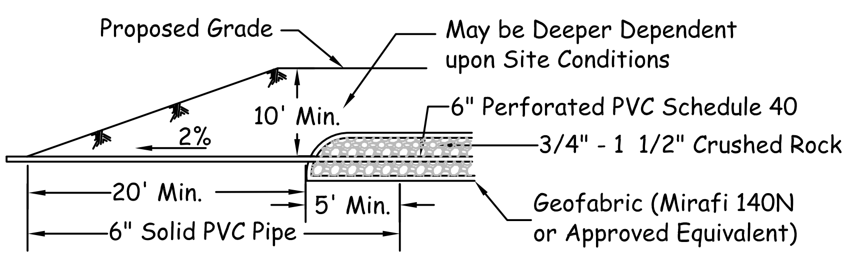
LGC Geotechnical, Inc.

CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



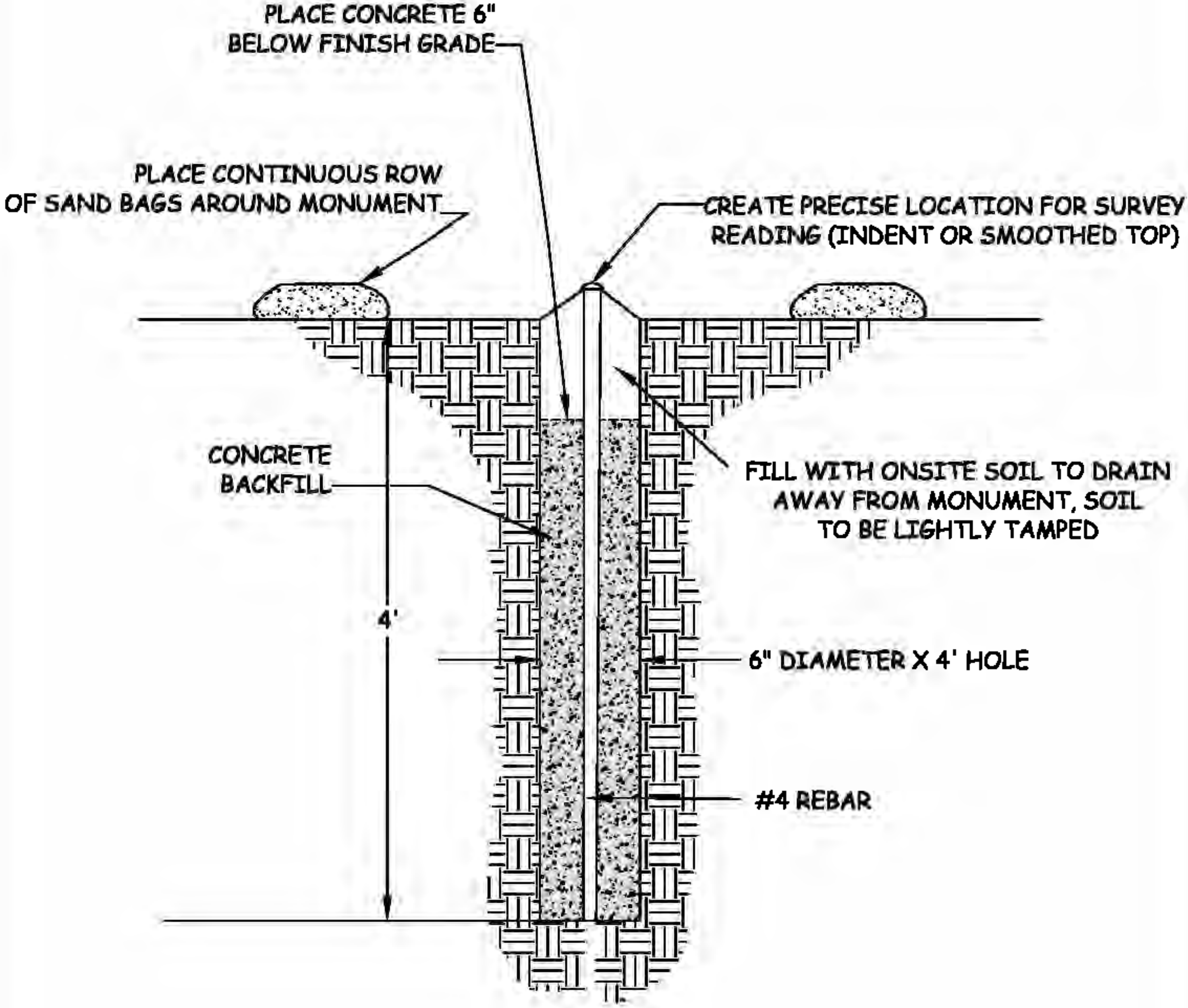
Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



LGC Geotechnical, Inc.

CANYON SUBDRAINS

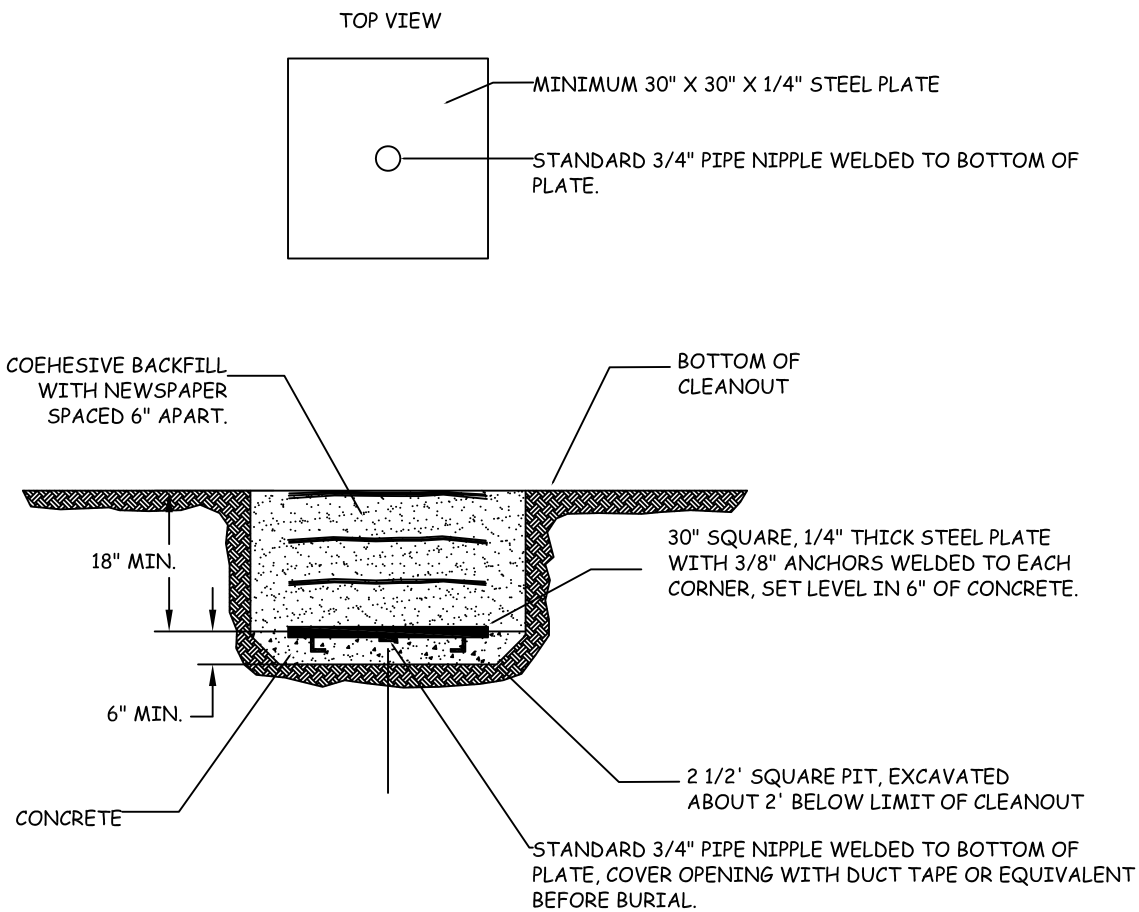


NO CONSTRUCTION EQUIPMENT WITHIN 25 FEET
OF ANY INSTALLED SETTLEMENT MONUMENTS

Revised 11/15

LGC Geotechnical, Inc.

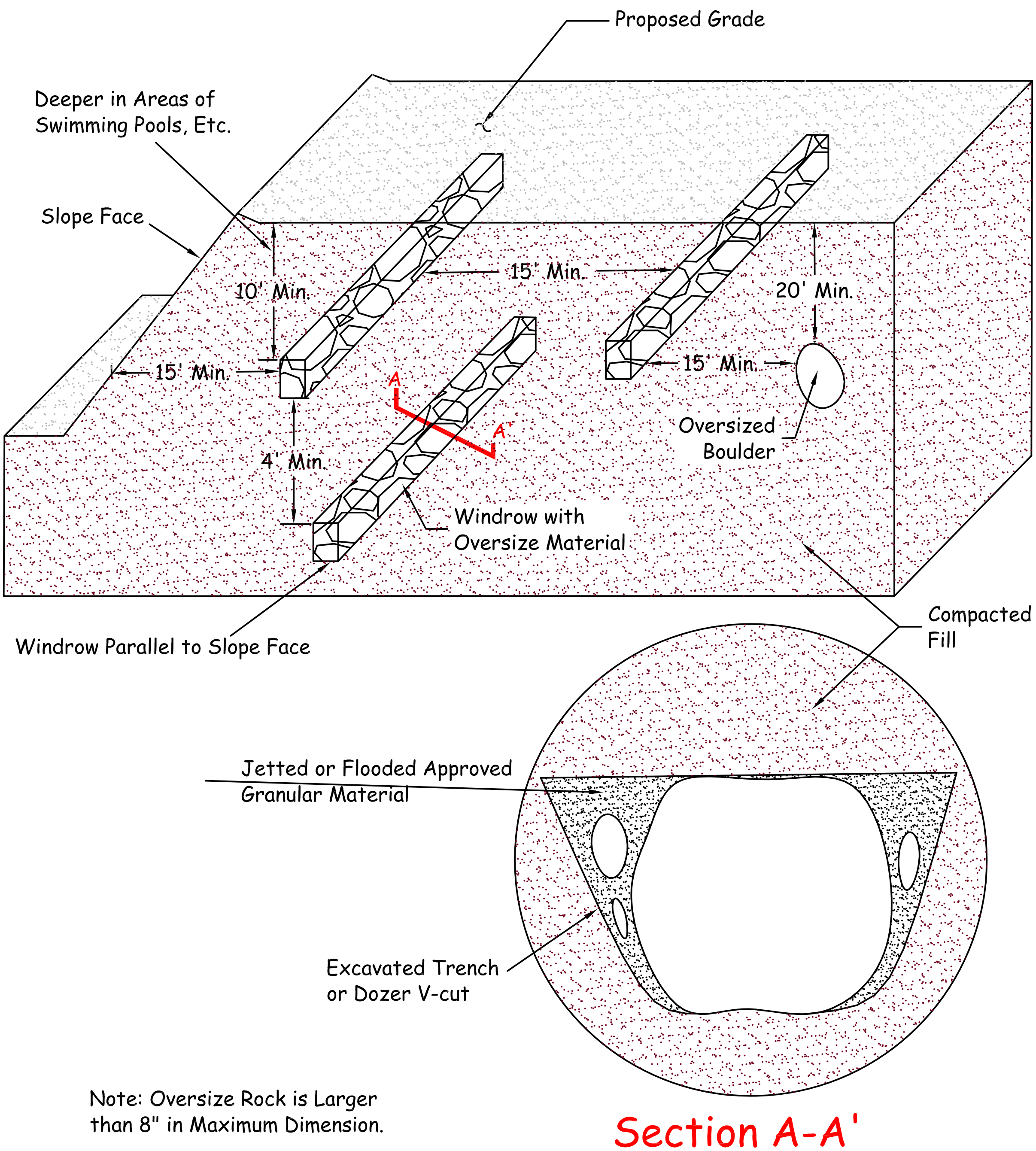
TYPICAL SURFACE SETTLEMENT MONUMENT



1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

LGC Geotechnical, Inc.

TYPICAL SETTLEMENT PLATE AND RISER



Note: Oversize Rock is Larger than 8" in Maximum Dimension.

LGC Geotechnical, Inc.

OVERSIZE ROCK DISPOSAL DETAIL

LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

Geotechnical Map

PROJECT NAME	Lennar - Rancho Penasquitos
PROJECT NO.	15198-01
ENG. / GEOL.	BJE / KAD
SCALE	1" = 100'
DATE	January 2016

SHEET 1 of 1

September 29, 2016 Project No. 15198-01

Mr. Andrew Han
Lennar Homes
25 Enterprise, Suite 250
Aliso Viejo, CA 92656

Subject: ***Geotechnical Response to Report Review Checklist for the Proposed Site Development, "Pacific Village", City of San Diego, California***

Introduction

In accordance with your request, LGC Geotechnical, Inc. has prepared this geotechnical response-report to the City of San Diego review checklist dated July 15, 2016 (City, 2016c) for the proposed site development of "Pacific Village" in the City of San Diego, California. This response-report has been prepared after a meeting with members of the City of San Diego in which they provided clarification of subjective language within the 2016 Storm Water Design Manual and additional information not present in the current manual that is being enforced and will be incorporated in a forthcoming document.

This response-report should be considered as part of the project design documents in conjunction with our previous geotechnical reports (LGC Geotechnical, 2016a and b). In the case of conflict, the recommendations contained herein should supersede those provided in our previous report. The remaining recommendations provided in our previous geotechnical reports remain valid and applicable.

GEOTECHNICAL REVIEW DATED July 15, 2016

For your convenience, the pertinent geotechnical review comments and questions that request further information have been repeated below along with our responses.

Comment No.10 (Page 24)

"The project's geotechnical consultant had indicated in Criteria 1 (Form I-8) that the site is not feasible for implementing storm water infiltration systems. The project's geotechnical consultant must address the specific geologic or geotechnical hazard associated with any amount of storm water infiltration that cannot be mitigated to an acceptable level for each proposed storm water BMP at the site. Note that a geotechnical condition created by the proposed (after the fact) grading may not be considered a valid geotechnical hazard.

Response to Comment No. 10 (Page 24)

The I-8 Form has been updated based on information presented by the City at our recent meeting. Please see the attached I-8 Form.

Comment No. 11 (Page 24)

"If geologic or geotechnical hazards can be demonstrated for each site that cannot be mitigated to an acceptable level, the project's geotechnical consultant should clarify if, in their professional opinion and based on their site specific investigation, there are no areas of the site where any amount of storm water infiltration is feasible."

Response to Comment No. 11 (Page 24)

As mentioned in "Response to Comment No. 10, the I-8 Form has been updated and is attached to this response-report.

Comment No. 12 (Page 24)

"Infiltration testing will be necessary if there are no geologic or geotechnical constraints that will preclude any amount of infiltration. The infiltration testing should conform to the design phase testing methods listed in Table D.3-1 of Appendix D of the Storm Water Standards."

Response to Comment No. 12 (Page 24)

Based on our discussions with the members of the City of San Diego at our meeting on September 27, 2016, at this stage of the project ("Planning Stage") the storm water infiltration systems can be designed for partial infiltration utilizing a 0.01 inch/hour infiltration rate. This BMP will consist of filter media underlain with open graded rock wrapped in a filter fabric, including a perforated pipe. The sides will be lined with an impermeable liner, however, the bottom will be unlined and likely underlain by compacted fill or granite bedrock materials. During the "design stage" the owner (Lennar Homes) may elect to perform field infiltration testing, to determine the infiltration rate in selected drainage management areas. Should the calculated infiltration rate be less than 0.01 inches/hr, the owner may elect to place an impermeable liner on the bottom of the BMP, as infiltration will be deemed infeasible. If performed, this information will be presented to the City for review.

Limitations

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

It should be understood that LGC Geotechnical has relied on the accuracy of documents, verbal information, and other material and information provided by the City of San Diego and other associated parties in preparation of this report. LGC Geotechnical makes no warranties or guarantees as to the accuracy or completeness of information obtained from or compiled by others.

Should you have any questions regarding this report, please do not hesitate to contact this office.

Sincerely,

LGC Geotechnical, Inc.

Blake J. Elliott, RCE 70705 Project Engineer	Kevin Dyekman, CEG 2595 Project Geologist

BJE/KAD/aca

Attachments: References
Form I-8 Categorization of Infiltration Feasibility Conditions
City of San Diego, 2016, Cycle Issues, L64A-003A, dated July 15, 2016

Distribution: (4) Addressee (3 wet-signed copies for City submittal and 1 electronic copy)

References

City of San Diego, 2016a, Storm Water Standards, Part 1: BMP Design Manual – Appendices, January 2016 Edition

_____, 2016b, Cycle Issues, L64A-003A, dated April 4, 2016

_____, 2016c, Cycle Issues, L64A-003A, dated July 15, 2016

Petra Geotechnical, Inc., Feasibility/Due-Diligence Geotechnical Assessment Report, Rancho Penasquitos Project Site at Southwest Intersection of Freeway 15 and Carmel Mountain Road, San Diego, California, J.N. 15-261, dated July 15, 2015.

LGC Geotechnical, Inc., 2016a, Geotechnical 40-Scale Rough Grading Plan Review, "Pacific Village", City of San Diego, California, Project No. 15198-01, dated January 18, 2016.

_____, 2016b, Geotechnical Response to Report Review Checklist for the Proposed Site Development, "Pacific Village", City of San Diego, California, Project No. 15198-01, dated April 12, 2106.

<table>
<tr><th colspan="3">Categorization of Infiltration Feasibility Condition</th><th colspan="2">Form I-8</th></tr>
<tr><td colspan="5">Part 1 - Full Infiltration Feasibility Screening Criteria
Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td colspan="2">Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>1</td><td colspan="2">Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td>☐</td><td>☒</td></tr>
<tr><td colspan="5">Provide basis:

No. Based on Figure C.5-C.5.-1 Soils Exhibit our site soils are categorized as Hydrologic Soils Group C. Per Table G.1-5, Hydrologic Soil Group C has an infiltration range from 0 to 0.08 inches per hour. Based on this categorization the associated infiltration rates are below 0.5 inches per hour.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td colspan="2">Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="5">Provide basis:

Yes. Based on current information, it is our opinion that infiltration will not increase the risk of geotechnical hazards.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
</table>

<table>
<tr><th colspan="4">Form I-8 Page 2 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>☐</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Consideration to Criteria 3 was not performed by LGC Geotechnical as groundwater contamination is not the purview of the geotechnical consultant.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>☐</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Consideration to Criteria 4 was not performed by LGC Geotechnical as water balance issues are not the purview of the geotechnical consultant.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City Engineer to substantiate findings

<table>
<tr><th colspan="4">Form I-8 Page 3 of 4</th></tr>
<tr><td colspan="4">Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria
Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Yes. As defined by the City of San Diego, an appreciable rate is considered to be 0.01 inches per hour or greater. Additionally, all soils and rock must be assumed to have a minimum infiltration rate of 0.01 inches per hour unless proven otherwise with field infiltration test results. At this time, the site soils and rock are considered to have an “appreciable” infiltration rate.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>6</td><td>Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="4">Provide basis:

Yes. Based on current information, it is our opinion that partial infiltration at an appreciable rate will not increase the risk of geotechnical hazards.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
</table>

Form I-8 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	☐	☐
Provide basis: Consideration to Criteria 7 was not performed by LGC Geotechnical as the described groundwater related concerns are not the purview of the geotechnical consultant. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	☐	☐
Provide basis: Consideration to Criteria 8 was not performed by LGC Geotechnical as water rights are not the purview of the geotechnical consultant. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration. If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City Engineer to substantiate findings

Review Information

Cycle Type:	8 Submitted (Multi-Discipline)	**Submitted:**	05/24/2016	Deemed Complete on 05/24/2016
Reviewing Discipline:	LDR-Geology	**Cycle Distributed:**	05/24/2016	
Reviewer:	**Washburn, Jacobe**	**Assigned:**	05/24/2016	
	(619) 446-5075	**Started:**	05/25/2016	
	jwashburn@sandiego.gov	**Review Due:**	06/15/2016	
Hours of Review:	2.50	**Completed:**	06/15/2016	**COMPLETED ON TIME**
Next Review Method:	Submitted (Multi-Discipline)	**Closed:**	07/15/2016	

. The review due date was changed to 07/21/2016 from 06/27/2016 per agreement with customer.
. The reviewer has indicated they want to review this project again. Reason chosen by the reviewer: New Document Required.
. We request a 3rd complete submittal for LDR-Geology on this project as: Submitted (Multi-Discipline).
. The reviewer has requested more documents be submitted.
. Your project still has 6 outstanding review issues with LDR-Geology (6 of which are new issues).
. Last month LDR-Geology performed 79 reviews, 97.5% were on-time, and 64.7% were on projects at less than < 3 complete submittals.

470158-1 (3/10/2016)

References

Cleared?	Issue Num	Issue Text
☒	1	Geotechnical 40-scale Rough Grading Plan Review, "Pacific Village", City of San Diego, California, prepared by LGC Geotechnical, Inc., dated January 18, 2016 (their project no. 15198-01). (From Cycle 1)
☒	2	Pacific Village, Vesting Tentative Map, Planned Development Permit, Site Development Permit, prepared by Latitude 33 Planning & Engineering, original date February 3, 2016. (From Cycle 1)

Comments

Cleared?	Issue Num	Issue Text
☒	3	Submit an addendum geotechnical report or update letter that specifically addresses the proposed development for the purposes of environmental review and the following: (From Cycle 1)
☒	4	If it is the intent of the geotechnical consultant to use the geotechnical investigation and test data prepared by Petra Geosciences (2015), the geotechnical consultant should clarify that they agree with the data, findings, and conclusions contained in that report. (From Cycle 1)
☒	5	Provide a complete copy of the geotechnical report prepared by Petra Geosciences (2015) referenced the submitted geotechnical report prepared by LGC Geotechnical, Inc. (From Cycle 1)
☒	6	The project's geotechnical consultant should provide a conclusion regarding if the proposed development will destabilize or result in settlement of adjacent properties or the city Right-of-Way. (From Cycle 1)

470158-8 (6/15/2016)

References

Cleared?	Issue Num	Issue Text
☐	7	Geotechnical 40-scale Rough Grading Plan Review, "Pacific Village", City of San Diego, California, prepared by LGC Geotechnical, Inc., dated January 18, 2016 (their project no. 15198-01). Geotechnical Response to Report Review Checklist for the Proposed Site Development, "Pacific Village", City of San Diego, California, prepared by LGC Geotechnical, Inc., dated April 12, 2016 (their project no. 15198-01). (New Issue)

Cleared?	Issue Num	Issue Text
☐	8	Pacific Village, Vesting Tentative Map, Planned Development Permit, Site Development Permit, prepared by Latitude 33 Planning & Engineering, original date February 3, 2016. (New Issue)

Comments

Cleared?	Issue Num	Issue Text
☐	9	Submit an addendum geotechnical report or update letter that specifically addresses the proposed development for the purposes of environmental review and the following: (New Issue)
☐	10	The project's geotechnical consultant has indicated in Criteria 1 (Form I-8) that the site is not feasible for implementing storm water infiltration systems. The project's geotechnical consultant must address the specific geologic or geotechnical hazard associated with any amount of storm water infiltration that cannot be mitigated to an acceptable level for each proposed storm water BMP at the site. Note that a geotechnical condition created by the proposed (after the fact) grading may not be considered a valid geotechnical hazard. (New Issue)
☐	11	If geologic or geotechnical hazards can be demonstrated for each site that cannot be mitigated to an acceptable level, the project's geotechnical consultant should clarify if, in their professional opinion and based on their site specific investigation, there are no areas of the site where any amount of storm water infiltration is feasible. (New Issue)
☐	12	Infiltration testing will be necessary if there are no geologic or geotechnical constraints that will preclude any amount of infiltration. The infiltration testing should conform to the design phase testing methods listed in Table D.3-1 of Appendix D of the Storm Water Standards. (New Issue)

LINSCOTT LAW & GREENSPAN engineers

TRANSPORTATION IMPACT ANALYSIS

PACIFIC VILLAGE

(REDEVELOPMENT OF PEÑASQUITOS VILLAGE)

San Diego, California
January 27, 2017

LLG Ref. 3-15-2472

Linscott, Law & Greenspan, Engineers
4542 Ruffner Street
Suite 100
San Diego, CA 92111
858.300.8800 T
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EXECUTIVE SUMMARY

Linscott, Law & Greenspan, Engineers (LLG) has been retained to assess the traffic impacts associated with the Pacific Village redevelopment (hereby referred to as the proposed "Project"). The site is immediately west of Interstate 15 (I-15), east of Carmel Mountain Road, south of the Peñasquitos Drive Shopping Center, and north of the multi-family development, Peñasquitos Villas, within the Community of Rancho Peñasquitos in the City of San Diego.

The existing use of the property is a 332-unit, one and two bedroom, single-story apartment community that was built in 1970. The Project proposes the redevelopment of an existing 41-acre rental complex currently known as Peñasquitos Village. Three (3) distinct housing types are proposed. The "for sale" component proposes 99 single-family cluster homes, 105 multi-family tri-plex units, and 120 row towns, for a total of 324 units. In addition, the northern portion of the site will be entitled for 277 apartments ("for rent" component). As such the total redevelopment assessed in this study account for all 601 dwelling units. The Project requires a Vesting Tentative Map, Planned Development Permit, and Site Development Permit.

The existing development currently generates 2,656 ADT with 212 AM peak hour trips and 266 PM peak hour trips. The Project is anticipated to generate 4,452 ADT with 356 AM peak hour trips and 429 PM peak hour trips. Trip generation credits have been taken for the existing occupied residential units. Therefore, the net increase in traffic with the Project is 1,796 ADT with 144 AM peak hour trips and 163 PM peak hour trips.

Based on the City of San Diego significance criteria, **one (1) direct and cumulative significant impact** was calculated with the addition of Project traffic. Therefore, mitigation measures are recommended at the end of this report. The location impacted is the proposed access point termed "Access B" that will be realigned to intersect with the existing Gerana Street tee-intersection. A traffic signal is needed to improve operations and is shown to meet warrants. Full details on the Access B realignment are provided in *Section 15.0* of this report.

TABLE OF CONTENTS

TABLE OF CONTENTS *(CONTINUED)*

SECTION	PAGE

APPENDICES

APPENDIX

List of Figures

LIST OF TABLES

TRANSPORTATION IMPACT ANALYSIS
PACIFIC VILLAGE
(REDEVELOPMENT OF PEÑASQUITOS VILLAGE)
San Diego, California
January 27, 2017

1.0 INTRODUCTION

The following traffic study has been prepared to determine and evaluate the traffic impacts on the local circulation system due to the redevelopment of the existing Peñasquitos Village Apartment property with the proposed Pacific Village Project (proposed "Project") in the Community of Rancho Peñasquitos, west of Interstate 15 in the City of San Diego. The purpose of this study is to assess the potential impacts to the local circulation system as a result of the Project.

Included in this traffic study are the following:

- Project Description
- Existing Conditions Discussion
- Study Area, Analysis Approach & Methodology
- Significance Criteria
- Analysis of Existing Conditions
- Trip Generation, Distribution & Assignment
- Analysis of Existing + Project Scenario
- Near-Term Cumulative Conditions Discussion
- Analysis of Near-Term Scenarios
- Year 2035 Long-Term Conditions Discussion
- Analysis of Year 2035 Long-Term Scenarios
- Other Transportation Modes
- Parking Discussion
- Access Assessment
- Significance of Impacts, and Mitigation Measures

2.0 PROJECT DESCRIPTION

2.1 Project Location

The Project is located immediately west of Interstate 15 (I-15), east of Carmel Mountain Road, south of the Peñasquitos Drive Shopping Center, and north of the multi-family development, Peñasquitos Villas, within the Community of Rancho Peñasquitos in the City of San Diego.

Figure 2–1 shows the vicinity map. ***Figure 2–2*** shows a more detailed Project area map.

2.2 Project Description

The Project proposes the redevelopment of an existing 41-acre rental complex currently known as Peñasquitos Village. Three (3) distinct housing types are proposed. The “for sale” component proposes 99 single-family cluster homes, 105 multi-family tri-plex units, and 120 row towns, for a total of 324 units. In addition, the northern portion of the site will be entitled for 277 apartments (“for rent” component). As such the total redevelopment assessed in this study account for all 601 dwelling units. The Project requires a Vesting Tentative Map, Planned Development Permit, and Site Development Permit.

The existing use of the property is a 332-unit, one and two bedroom, single-story apartment community that was built in 1970 named Peñasquitos Village. The current use of the site includes a mix a market rate rentals and Section 8 rent controlled units. However, there are no legal obligations of the property to remain rent controlled and they could be leased at market rates at any time. The Project proposes to increase the number of residences by 269 units. Access to the existing site is currently provided via four (4) driveways to Carmel Mountain Road. With the proposed Project, there will continue to be four (4) access points, however, the second-most northern driveway will be relocated to intersect with Gerana Street to complete a four-way signalized intersection.

Existing site access for Peñasquitos Village is provided via four (4) driveways on Carmel Mountain Road. The Project proposes to maintain four (4) driveways with the exception of realigning Access “B” from its current location to complete the fourth leg of the Carmel Mountain Road/ Gerana Street intersection. The access locations are listed below from north to south.

Access ID	Existing Street Name	Existing Configuration	Proposed Configuration
Access A	Caminata Duoro	Right-in/Right-out Only (unsignalized)	No change
Access B	Caminata Soleado	Right-in/Right-out Only (unsignalized)	Realigned to Gerana Street, full access, signalized
Access C	Caminata Ebro	Full access (unsignalized)	No change
Access D	Caminata Deluz	Full access (signalized)	No change

A more detailed discussion on Project access is included in *Section 15.0* of this report. ***Figure 2–3*** shows the conceptual site plan.

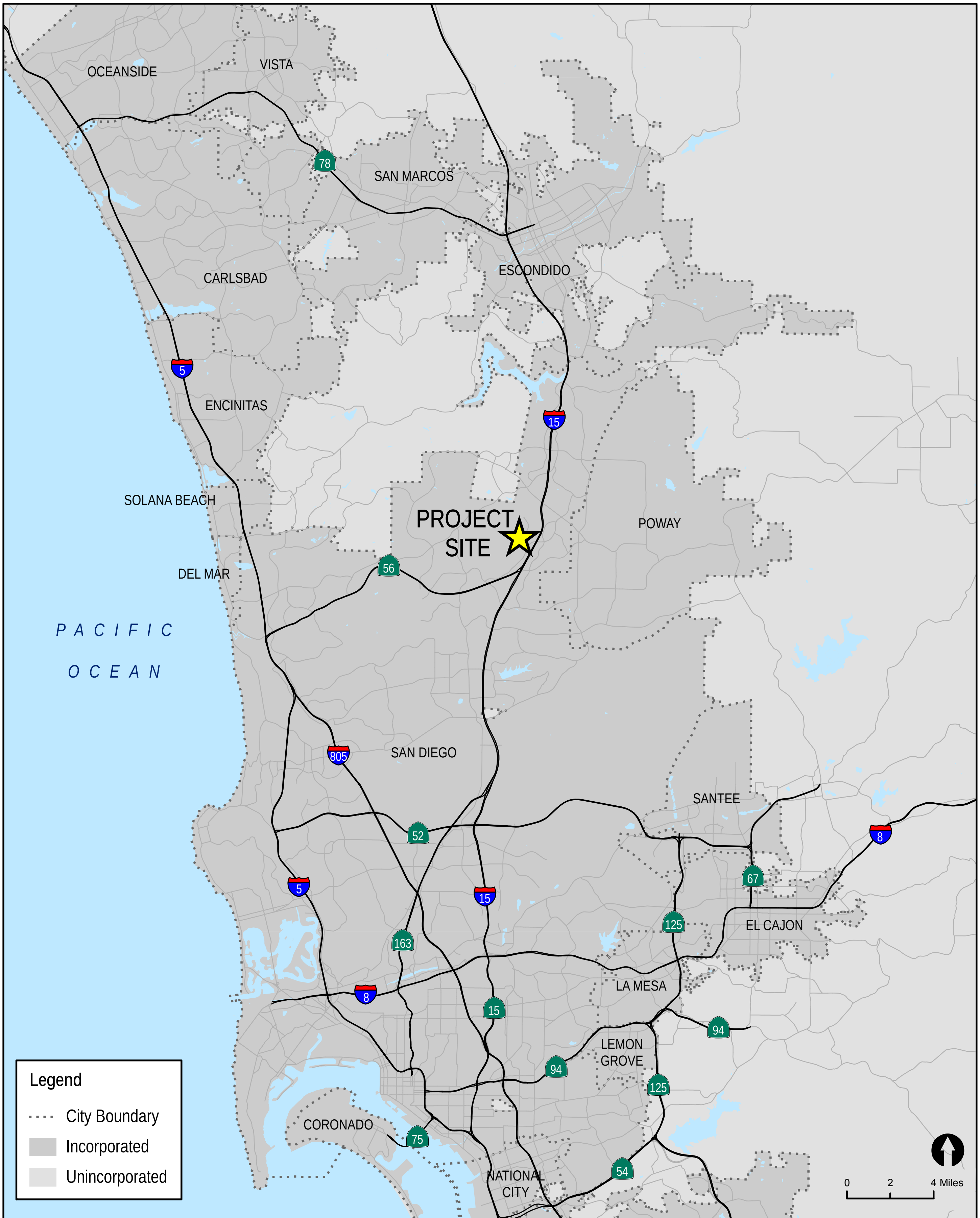

Figure 2-1

Vicinity Map

PACIFIC VILLAGE

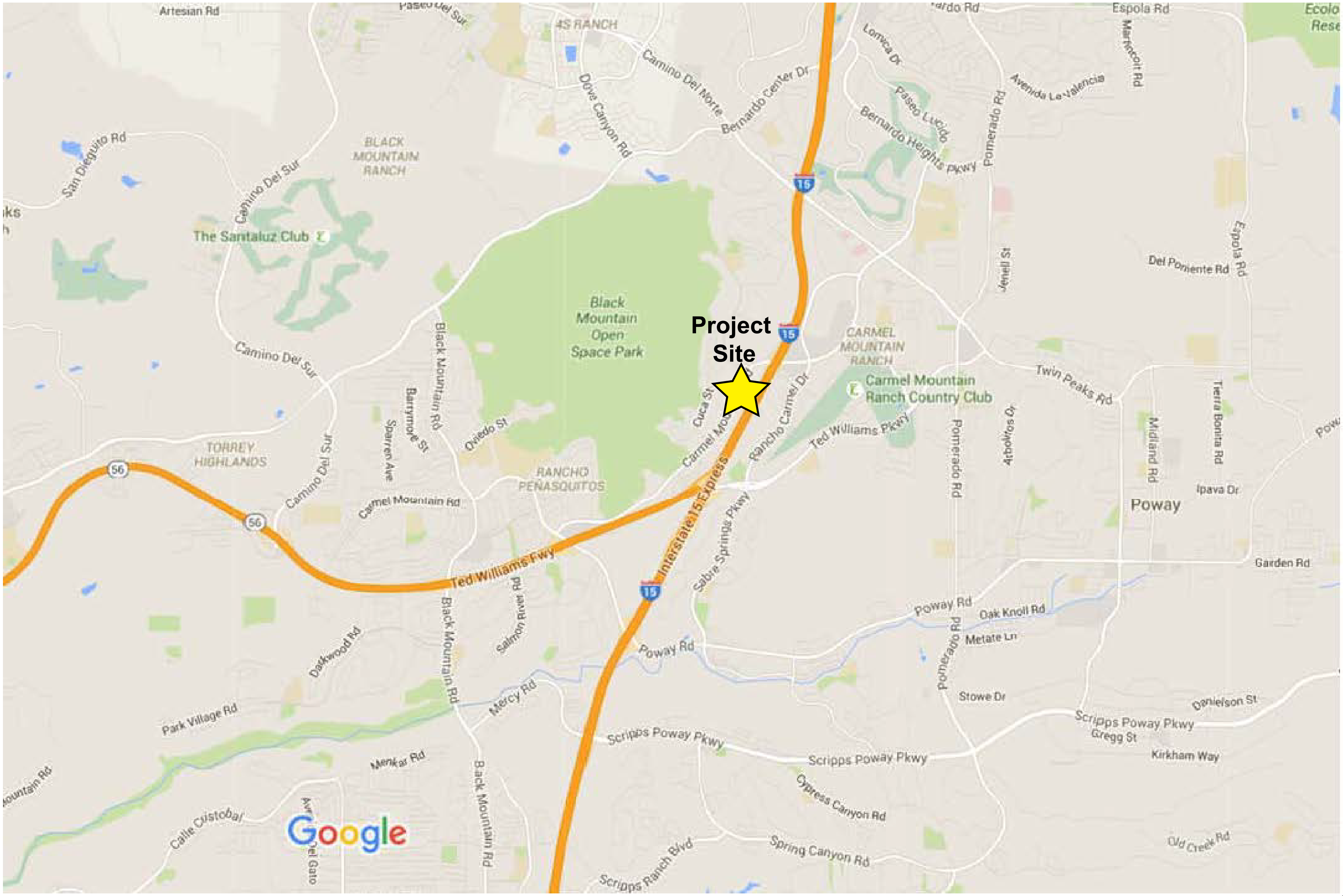

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Figure 2-2

Project Area Map

PACIFIC VILLAGE

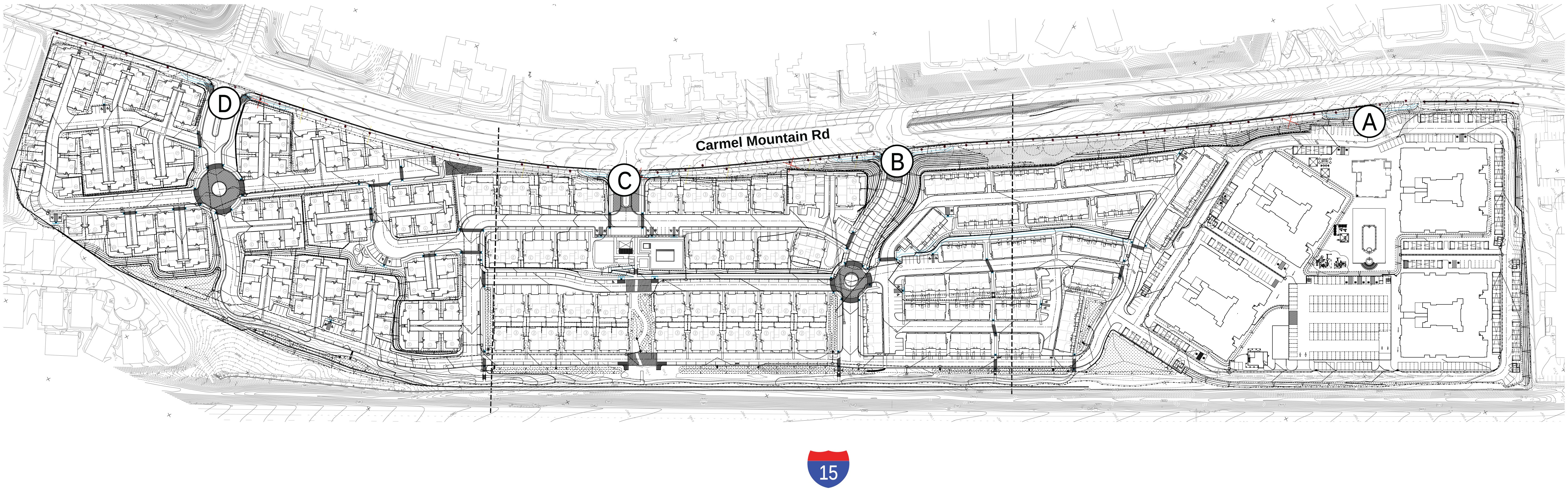

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Figure 2-3

Conceptual Site Plan

PACIFIC VILLAGE

3.0 EXISTING CONDITIONS

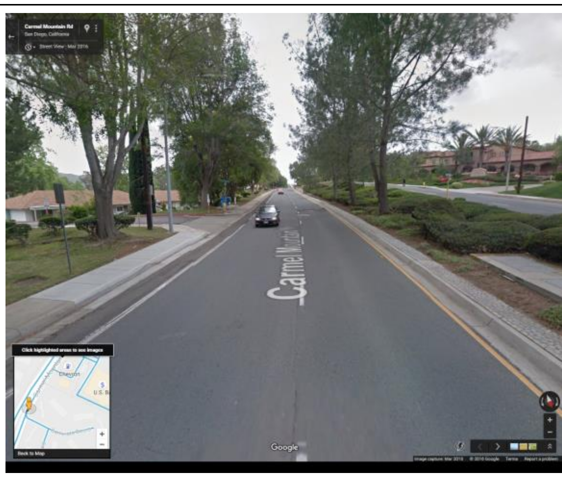
3.1 Existing Street System

The following provides a brief description of the street system in the Project area. ***Figure 3–1*** illustrates existing conditions in terms of traffic lanes and intersection controls.

Interstate 15 (I-5) is a north/south twelve-lane freeway (plus four high-occupancy vehicle – HOV lanes) regionally connecting San Diego County with Riverside County.

State Route 56 (SR 56) is an east/west four-lane freeway between Interstate 5 and Interstate 15 providing two travel lanes in each direction. SR 56 is planned to be widened to six lanes in the future, however, funding is not yet identified for this improvement and the widening is not programmed in the SANDAG Regional Transportation Plan until Year 2040.

Carmel Mountain Road is classified as a Six-Lane Major roadway on the *Rancho Peñasquitos Community Plan Circulation Element* from I-15 to Peñasquitos Drive and currently built as a five lane divided roadway with three (3) northbound travel lanes and two (2) southbound. From Peñasquitos Drive to Rancho Peñasquitos Boulevard it is classified as a Four-Lane Major roadway. Between Peñasquitos Drive and Gerana Street and between Cuca Street to Rancho Peñasquitos Boulevard, it is also built to Four-Lane Major standards. Beginning at Peñasquitos Drive for about a ¼-mile distance to Gerana Street, a grade differential divides Carmel Mountain Road. The southbound travel lanes sit at a higher elevation that the northbound lanes; about a 10-15 foot change in elevation. The exhibits below visual illustrate the elevation change between the northbound and southbound lanes along this ¼-mile segment of the roadway.

	
Northbound Carmel Mountain Road, looking South. Cross-Street: Caminita Duoro	Northbound Carmel Mountain Road, looking North. Cross-Street: Caminata Soleado

	
Northbound Carmel Mountain Road, looking North. Cross-Street: Gerana Street	Northbound Carmel Mountain Road, looking South. Cross-Street: Gerana Street

For the ¼-mile segment between Gerana Street and Cuca Street along the Project frontage, the roadway provides a curb-to-curb paved width (100 feet) and raised median width (20-38 feet) exceeding that of a Four-Lane Major, however, on-street parking is permitted thus providing for a reduced capacity closer to that of a Four-Lane Collector.

From Rancho Peñasquitos Boulevard to Paseo Montalban, it is classified and currently built as a Five Lane Major with three (3) lanes in the southeastern direction and two (2) lanes northwesterly. North of Paseo Montalban, it transitions back and is classified as a Four Lane Major. The posted speed limit is 40 mph. Bus stops are provided intermittently within the study area and curbside parking is permitted along portions of the roadway.

Peñasquitos Drive is classified as a Four-Lane Major roadway on the *Rancho Peñasquitos Community Plan Circulation Element* from Carmel Mountain Road to Cuca Street and a Four-Lane Collector roadway from Cuca Street to its terminus at Almazon Street. It is currently built as a three lane roadway with one (1) northbound travel lane and two (2) southbound divided by a two-way left-turn lane (TWLTL). North of Cuca Street, it is built as a two-lane divided roadway separated by a raised median. The posted speed limit is 35 mph. Bus stops are not provided and curbside parking is prohibited.

3.2 Existing Bicycle Network

Based on a review of the City of San Diego *Bicycle Master Plan*, *Rancho Peñasquitos Community Plan* and field observations, there are existing Class II bike lanes provided along Carmel Mountain Road and Peñasquitos Drive within the study area. From Cuca Street to Caminata Soleado and between Rancho Peñasquitos Boulevard to Paseo Montalban, curbside parking is permitted along Carmel Mountain Road, disconnecting sections of the Class II bike lanes. These Class II bike lanes are planned to be maintained as Class II bike lanes based on a review of these planning documents. Further details on the proposed Project improvements to connect the Class II bike lane are provided later on in *Section 13.2* of this report.

3.3 Existing Transit Conditions

Based on the most recent information on the San Diego Metropolitan Transit System (MTS) website, the following transit conditions are noted.

Bus stops served by Route 20 are provided along Carmel Mountain Road at the following locations:

- Peñasquitos Drive
- Caminata Soleado
- Gerana Street (Future Access B)
- Cuca Street (Access D)
- Caminata Ebro (Access C)
- Via San Marco
- Via Rimini
- Freeport Road
- Paseo Cardiel
- Rancho Peñasquitos Boulevard
- Stoney Creek Road

The locations along Carmel Mountain Road are within very close proximity to the Project site and the stops at Caminata Soleado, Caminata Ebro, Gerana Street and Cuca Street are fronting the Project site. Pedestrian crossings providing protected access to bus stops on both sides of the street are striped at the signalized intersections on Carmel Mountain Road at Peñasquitos Drive and Cuca Street.

Route 20 travels between the Rancho Bernardo Transit Station and Downtown San Diego. Monday through Friday it travels with 15 minute frequencies in the morning and 15-30 minute frequencies in the evening, between 4:55 AM and 11:26 PM. On Saturdays, it travels between 5:07 AM and 9:17 PM with 30 minute frequencies. Sundays it travels between 6:07 AM and 8:36 PM with hour long frequencies.

3.4 Existing Pedestrian Conditions

Based on field observations within the study area, the following pedestrian conditions are noted:

Carmel Mountain Road: Contiguous four-foot sidewalks are provided along both sides of Carmel Mountain Road within the study area. Crosswalks are provided at Peñasquitos Drive and at Cuca Street adjacent to the Project site.

Peñasquitos Drive: Contiguous sidewalks are provided on both sides of Peñasquitos Drive in the study area.

3.5 Existing Traffic Volumes

Existing AM and PM peak hour traffic volumes at key area intersections and 24-hour street segment counts were collected on Tuesday November 17, 2015 while schools were in session. ***Table 3–1*** shows the existing street segment Average Daily Traffic (ADT) volumes in the Project area. ***Figure 3–2*** shows the existing AM/PM peak hour turning movements and ADTs.

Appendix A contains the peak hour intersection and daily segment count sheets.

TABLE 3–1
EXISTING TRAFFIC VOLUMES

Street Segments	ADT [a]
Carmel Mountain Road	
1. I-15 Southbound Ramps to Peñasquitos Drive	28,310
2. Peñasquitos Drive to Gerana Street	14,060
3. Gerana Street to Cuca Street	13,800
4. Cuca Street to Paseo Cardiel	13,025
5. Paseo Cardiel to Rancho Peñasquitos Boulevard	17,180
6. Rancho Peñasquitos Boulevard to Paseo Montalban	23,580
7. Paseo Montalban to Sundevil Way	14,580

Footnotes:

a. Average Daily Traffic Volumes. Data collected by LLG, Engineers on Tuesday November 17, 2015 while schools were in session.

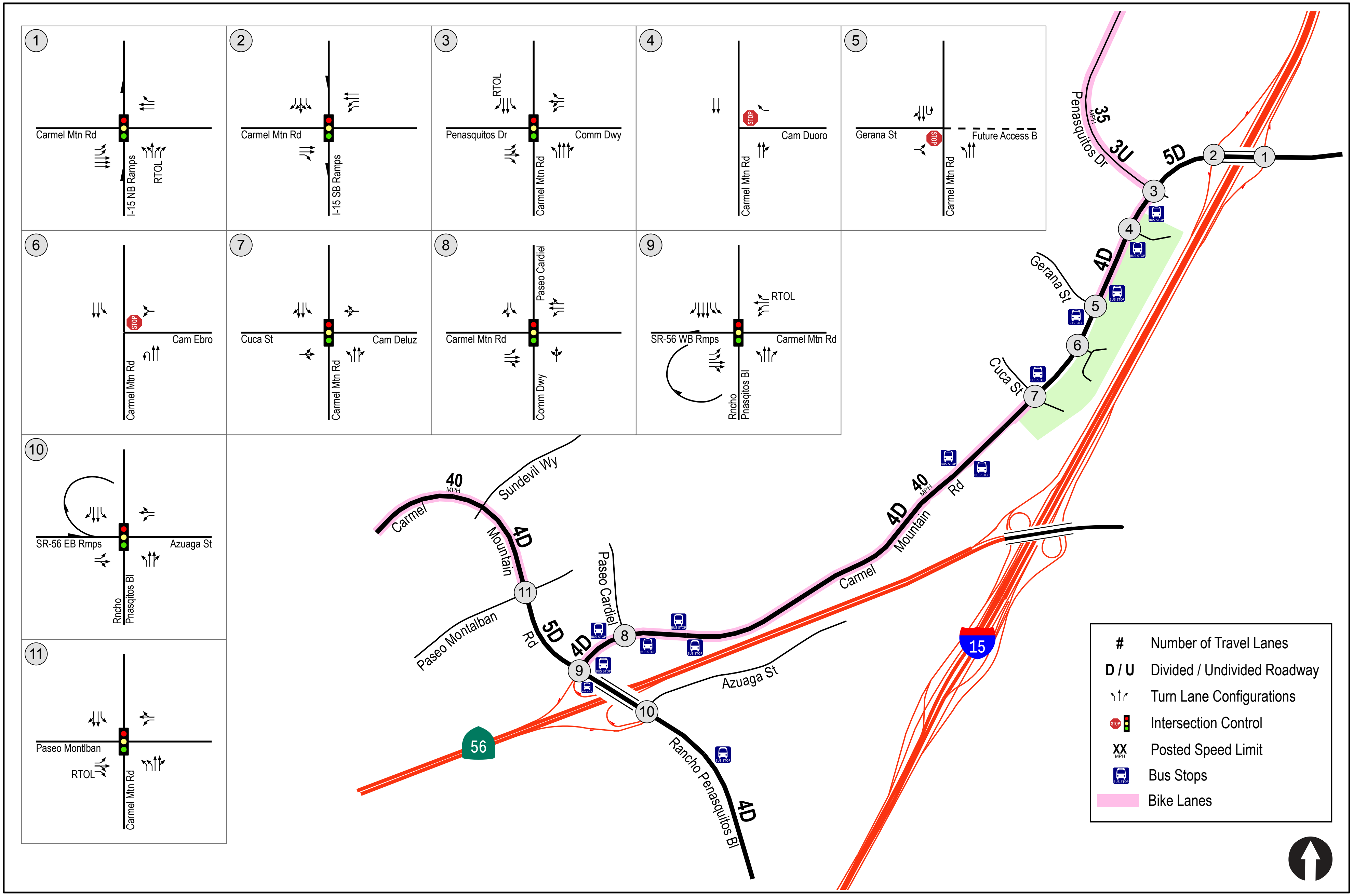


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Figure 3-1

Existing Conditions Diagram

PACIFIC VILLAGE

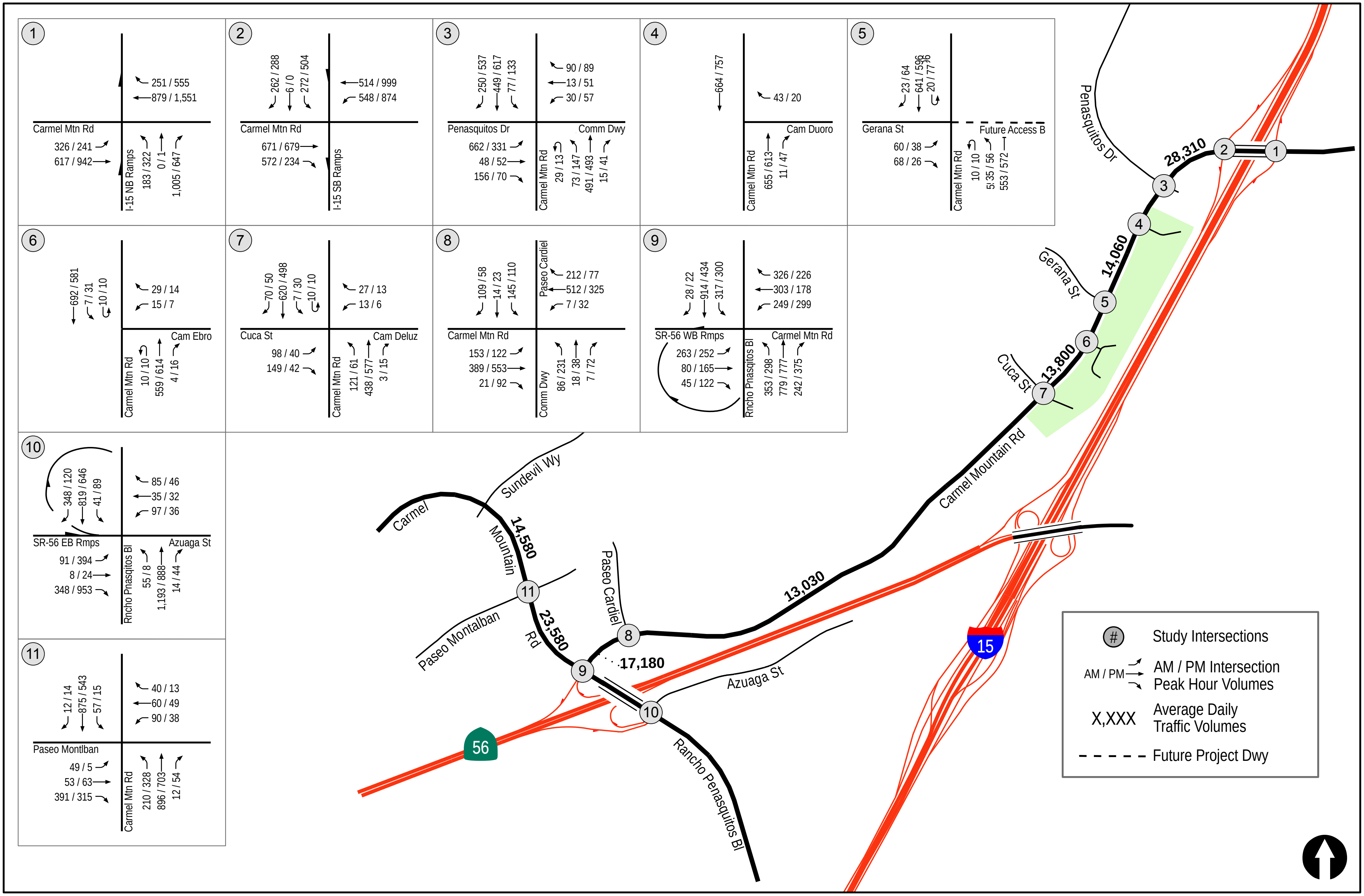

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Figure 3-2

Existing Traffic Volumes

PACIFIC VILLAGE

4.0 STUDY AREA, ANALYSIS APPROACH AND METHODOLOGY

4.1 Study Area

The study area was based on the criteria identified in the City of San Diego *Traffic Impact Study Manual*, July 1998. Based on this criteria, the traffic study shall evaluate all adjacent intersections plus the first major signalized intersection in each direction of the site. Beyond this minimum requirement, all known congested or potentially congested locations that may be impacted by the proposed development should be studied. As stated in the City's guidelines, the study area must include "all regionally significant arterial system segments and intersections, including freeway on/off ramp intersections, where the proposed project will add 50 or more peak hour trips in either direction to the adjacent street traffic. Mainline freeway locations where the project will add 150 or more peak hour trips in either direction [must also be considered]."

Given these criteria, this traffic analysis evaluates the operations of study area intersections and street segments only. Since less than 150 and 50 net peak hour Project trips are added to nearby freeway mainlines and ramp meters, respectively, analysis of these facilities was not included.

The Project study area includes the following locations:

Intersections

1. Carmel Mountain Road/ I-15 Southbound Ramps (signalized)
2. Carmel Mountain Road/ I-15 Northbound Ramps (signalized)
3. Carmel Mountain Road/ Peñasquitos Drive (unsignalized)
4. Carmel Mountain Road/ Access A (unsignalized)
5. Carmel Mountain Road/ Gerana Street/Future Access B (unsignalized)
6. Carmel Mountain Road/ Access C (unsignalized)
7. Carmel Mountain Road/ Cuca Street/ Access D (signalized)
8. Carmel Mountain Road/ Paseo Cardiel (signalized)
9. Carmel Mountain Road/Rancho Peñasquitos Boulevard/ SR 56 Westbound Ramps (signalized)
10. Rancho Peñasquitos Boulevard/ SR 56 Eastbound Ramps (signalized)
11. Carmel Mountain Road/ Paseo Montalban (signalized)

Segments

Carmel Mountain Road

1. I-15 Southbound Ramps to Peñasquitos Drive
2. Peñasquitos Drive to Gerana Street/ Future Access B
3. Gerana Street/Access C to Cuca Street/Access D
4. Cuca Street/Access D to Paseo Cardiel
5. Paseo Cardiel to Rancho Peñasquitos Boulevard/SR 56 Westbound Ramps
6. Rancho Peñasquitos Boulevard/SR 56 Westbound Ramps to Paseo Montalban
7. Paseo Montalban to Sundevil Way

4.2 Analysis Approach

The Project site is currently developed with 332 occupied apartment residential units over 41.5 acres. As such, the site is currently generating traffic. The Project proposes to redevelop the site with a mix of housing types for a net increase of 269 units. Therefore, this analysis was completed analyzing the net increase in traffic with the proposed Project. *Section 7.0* of this report discusses the changes in trip generation in more detail.

Table 4–1 shows the analyses performed for each of the scenarios to determine the potential impacts to the road network.

TABLE 4–1
ANALYSIS SCENARIOS

Scenario	Analysis Performed
Existing & Near-Term Conditions	
▪ Existing ▪ Existing + Project ▪ Existing + Cumulative Projects ▪ Existing + Cumulative Projects + Project	AM/PM Peak Hour Intersection Analysis Street Segment Analysis
Year 2035 Conditions	
▪ Year 2035 Without Project ▪ Year 2035 With Project	AM/PM Peak Hour Intersection Analysis Street Segment Analysis

4.3 Methodology

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment or intersection under various traffic volume loads. It is a qualitative measure used to describe a quantitative analysis taking into account factors such as roadway geometries, signal phasing, speed, travel delay, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level of service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Level of service designation is reported differently for signalized and unsignalized intersections, as well as for roadway segments.

4.3.1 *Intersections*

Signalized intersections were analyzed under weekday 7:00-9:00 AM and 4:00-6:00 PM peak hour conditions. Average vehicle delay was determined utilizing the methodology found in Chapter 18 of the *2010 Highway Capacity Manual (HCM),* with the assistance of the *Synchro* (version 9) computer software. The delay values (represented in seconds) were qualified with a corresponding intersection Level of Service (LOS). City of San Diego and Caltrans location-specific signal timing information such as minimum greens, cycle lengths, phasing, and splits for the freeway interchanges, where available, and real-time peak hour field observations were included in the analysis.

Unsignalized intersections were analyzed under weekday 7:00-9:00 AM and 4:00-6:00 PM peak hour conditions. Average vehicle delay and Levels of Service (LOS) were determined based upon the procedures found in Chapters 19 and 20 of the *2010 HCM,* with the assistance of the *Synchro* (version 9) computer software.

It should be noted that the procedures from the *HCM 2000* were used at intersections where the *HCM 2010* is limited in its analysis capabilities. For example, the *HCM 2010* cannot analyze U-Turn movements, nor can it analyze shared thru/left-turn lanes often observed at split phased intersections.

4.3.2 *Street Segments*

Street segment ultimate classifications were taken from the Rancho Peñasquitos Community Plan Circulation Element. Street segment analysis is based upon the comparison of daily traffic volumes (ADTs) to the City of San Diego's *Roadway Classification, Level of Service, and ADT Table*. This table provides segment capacities for different street classifications, based on traffic volumes and roadway characteristics. Copies of the Community Plan Circulation Element map and the City of San Diego roadway classification table are attached in ***Appendix B.***

5.0 SIGNIFICANCE CRITERIA

According to the City of San Diego's *Significance Determination Thresholds* report dated January 2007, a project is considered to have a significant impact if the new project traffic has decreased the operations of surrounding roadways by a City defined threshold. For projects deemed complete on or after January 1, 2011, the City defined threshold by roadway type or intersection is shown in ***Table 5–1***.

The impact is designated either a "direct" or "cumulative" impact. According to the City's *Significance Determination Thresholds* report,

> *"Direct* traffic impacts are those projected to occur at the time a proposed development becomes operational, including other developments not presently operational but which are anticipated to be operational at that time (near term)."
>
> *"Cumulative* traffic impacts are those projected to occur at some point after a proposed development becomes operational, such as during subsequent phases of a project and when additional proposed developments in the area become operational (short-term cumulative) or when affected community plan area reaches full planned Year 2035 (long-term cumulative)."
>
> "It is possible that a project's near term (direct) impacts may be reduced in the long term, as future projects develop and provide additional roadway improvements (for instance, through implementation of traffic phasing plans). In such a case, the project may have direct impacts but not contribute considerably to a cumulative impact."
>
> "For intersections and roadway segments affected by a project, LOS D or better is considered acceptable under both direct and cumulative conditions."

If the project exceeds the thresholds in *Table 5–1*, then the project may be considered to have a significant "direct" or "cumulative" project impact. A significant impact can also occur if a project causes the LOS to degrade from D to E, even if the allowable increases in *Table 5–1* are not exceeded. A feasible mitigation measure will need to be identified to return the impact within the City thresholds, or the impact will be considered significant and unmitigated.

TABLE 5–1
CITY OF SAN DIEGO
TRAFFIC IMPACT SIGNIFICANT THRESHOLDS

Level of Service with Project [b]	Allowable Increase Due to Project Impacts [a]					
	Freeways		Roadway Segments		Intersections	Ramp Metering [c]
	V/C	Speed (mph)	V/C	Speed (mph)	Delay (sec.)	Delay (min.)
E	0.010	1.0	0.02	1.0	2.0	2.0
F	0.005	0.5	0.01	0.5	1.0	1.0

Footnotes:

a. If a proposed project's traffic causes the values shown in the table to be exceeded, the impacts are determined to be significant. The project applicant shall then identify feasible improvements (within the Traffic Impact Study) that will restore/and maintain the traffic facility at an acceptable LOS. If the LOS with the proposed project becomes unacceptable (see note b), or if the project adds a significant amount of peak-hour trips to cause any traffic queues to exceed on- or off-ramp storage capacities, the project applicant shall be responsible for mitigating the project's direct significant and/or cumulatively considerable traffic impacts.

b. All LOS measurements are based upon Highway Capacity Manual procedures for peak-hour conditions. However, V/C ratios for roadway segments are estimated on an ADT/24-hour traffic volume basis (using Table 2 of the City's Traffic Impact Study Manual). The acceptable LOS for freeways, roadways, and intersections is generally "D" ("C" for undeveloped locations). For metered freeway ramps, LOS does not apply. However, ramp meter delays above 15 minutes are considered excessive.

c. The allowable increase in delay at a ramp meter with more than 15 minutes delay and freeway LOS E is 2 minutes. The allowable increase in delay at a ramp meter with more than 15 minutes delay and freeway LOS F is 1 minute. *No ramp meters were analyzed in this report since none of the study area freeway on-ramps are currently metered.*

General Notes:

1. Delay = Average control delay per vehicle measured in seconds for intersections or minutes for ramp meters
2. LOS = Level of Service
3. V/C = Volume to Capacity ratio
4. Speed = Arterial speed measured in miles per hour

6.0 ANALYSIS OF EXISTING CONDITIONS

The following section presents the analysis of existing study area locations.

6.1 Peak Hour Intersection Operations

Table 6–1 summarizes the existing intersections LOS. As seen in *Table 6–1*, all intersections are calculated to currently operate at LOS D or better except for the following:

- Intersection #1. Carmel Mountain Road / I-15 NB Ramps – LOS E during the PM peak hour
- Intersection #10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps – LOS F during the PM peak hour

Appendix C contains the Existing intersection analysis worksheets.

6.2 Daily Street Segment Operations

Table 6–2 summarizes the existing roadway segment operations. As seen in *Table 6–2*, the study area segments are calculated to currently operate at LOS C or better.

TABLE 6–1
EXISTING INTERSECTION OPERATIONS

Intersection	Control Type	Peak Hour	Existing	
			Delay [a]	LOS [b]
1. Carmel Mountain Rd / I-15 NB Ramps	Signal	AM PM	39.0 74.2	D E
2. Carmel Mountain Rd / I-15 SB Ramps	Signal	AM PM	26.9 37.0	C D
3. Carmel Mountain Rd / Peñasquitos Dr	Signal	AM PM	25.1 25.0	C C
4. Carmel Mountain Rd / Access A *(existing right-in/right-out only movements)*	MSSC [c]	AM PM	11.1 10.8	B B
5. Carmel Mountain Rd / Gerana St/ Future Access B [d]	MSSC	AM PM	26.7 29.2	D D
6. Carmel Mountain Rd / Access C	MSSC	AM PM	15.1 15.1	C C
7. Carmel Mountain Rd / Cuca St/ Access D	Signal	AM PM	17.5 9.5	B A
8. Carmel Mountain Rd / Paseo Cardiel	Signal	AM PM	15.5 18.1	B B
9. Rancho Peñasquitos Blvd/ Carmel Mountain Road / SR 56 WB Ramps	Signal	AM PM	54.3 49.9	D D
10. Rancho Peñasquitos Blvd / SR 56 EB Ramps	Signal	AM PM	43.9 157.5	D F
11. Carmel Mountain Rd / Paseo Montalban	Signal	AM PM	21.3 16.6	C B

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. MSSC = Minor Street Stop-Controlled intersection. Minor street critical movement delay reported.
d. The existing Caminata Soleada right-turn in/right-turn out only driveway for Peñasquitos Village will be realigned with the Project to intersect Gerana Street as "Future Access B".

General Notes:

1. Sig = Significant impact, yes or no.

SIGNALIZED		UNSIGNALIZED	
DELAY/LOS THRESHOLDS		DELAY/LOS THRESHOLDS	
Delay	LOS	Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

TABLE 6–2
EXISTING DAILY STREET SEGMENT OPERATIONS

Street Segment	Currently Built As	Capacity (LOS E) [a]	ADT [b]	LOS [c]	V/C [d]
Carmel Mountain Road					
1. I-15 SB Ramps to Peñasquitos Drive [e]	5-Ln Divided	45,000	28,310	C	0.629
2. Peñasquitos Drive to Gerana Street	4-Ln Divided	40,000	14,060	A	0.352
3. Gerana Street/Access B to Cuca Street	4-Ln Divided	40,000	13,800	A	0.345
4. Cuca Street to Paseo Cardiel	4-Ln Divided	40,000	13,025	A	0.326
5. Paseo Cardiel to Rancho Peñasquitos Boulevard/ SR 56 WB Ramps	4-Ln Divided	40,000	17,180	B	0.430
6. Rancho Peñasquitos Boulevard/ SR 56 WB Ramps to Paseo Montalban [e]	5-Ln Divided	45,000	23,580	B	0.524
7. Paseo Montalban to Sundevil Way	4-Ln Divided	40,000	14,580	A	0.365

Footnotes:

a. Capacities based on City of San Diego Roadway Classification & LOS table (See *Appendix B*).
b. Average Daily Traffic Volumes.
c. Level of Service.
d. Volume to Capacity.
e. Carmel Mountain Road from I-15 SB to Peñasquitos Drive currently provides three lanes in the NB direction and two lanes SB for an increased capacity of 45,000 ADT. From Rancho Peñasquitos Boulevard/SR 56 WB Ramps to just south of Paseo Montalban the roadways has three lanes in the SB direction and two lanes NB for an increased capacity of 45,000 ADT.

7.0 TRIP GENERATION/DISTRIBUTION/ASSIGNMENT

As discussed in *Section 2.2* of this report, the Project proposes to redevelop the existing multi-family 41.5-acre site with 324 mixed housing types, in addition to entitling the northern portion of the property for 277 apartments.

The following is a discussion on the additional traffic expected to be generated with the development of these homes.

7.1 Trip Generation

7.1.1 *Existing Trip Generation*

The existing Peñasquitos Village development is currently occupied by 332 multi-family units. The current use of the site includes a mix a market rate rentals and Section 8 rent controlled units. However, there are no legal obligations of the property to remain rent controlled and they could be leased at market rates at any time. Trip generation for the existing development was calculated using the City of San Diego *Trip Generation Manual, May 2003*. Using the multi-family daily rate of eight (8) trips per dwelling unit based on the site density, the existing land use currently generates 2,656 ADT with 212 trips during the AM peak hour (42 inbound / 170 outbound) and 266 trips during the PM peak hour (186 inbound / 80 outbound).

7.1.2 *Proposed Trip Generation*

The Project proposes to develop three distinct housing types: 99 single-family cluster homes, 105 multi-family tri-plex units, and 120 row towns, for a total of 324 units. In addition, the northern portion of the site will be entitled for 277 apartments. For purposes of this analysis, the trip generation for all 601 units was calculated. Below are the product types, densities and trip rates applied in the calculations.

Product Type	Units	Acres	Density	City Trip Rate
Single-Family Detached Cluster	99	11.8	8.4 du/acre	10 ADT/du *
Multi-Family Tri-Plex	105	9.2	11.4 du/acre	8 ADT/du
Row Towns	120	8.5	14.1 du/acre	8 ADT/du
Apartments (3-stories)	277	12.0	23.1 du/acre	6 ADT/du

*The single-family cluster homes used a 10 ADT/du rate to be conservative based on the "single-family" designation.

To arrive at the net new trips on the street system with the redevelopment, the proposed Project trips were deducted from the existing site trip generation. Using the City of San Diego *Trip Generation Manual, May 2003*, the proposed Project is forecasted to generate a gross total of 4,452 ADT with 356 trips during the AM peak hour (71 inbound / 285 outbound) and 429 trips during the PM peak hour (300 inbound / 129 outbound).

7.1.3 *Net New Trip Generation*

Subtracting the existing site trip generation from the proposed Project, the net new trips expected on the street system with redevelopment of the site is 1,796 net new ADT with 144 net new trips during the AM peak hour (29 inbound / 115 outbound) and 163 net new trips during the PM peak hour (114 inbound / 49 outbound).

Table 7–1 shows the Existing, proposed Project, and Net New traffic generation.

TABLE 7–1
PROJECT TRIP GENERATION

Land Use	Size	Daily Trip Ends (ADTs) [a]		AM Peak Hour					PM Peak Hour				
		Rate [b]	Volume	% of ADT [b]	In:Out Split [b]	Volume			% of ADT [b]	In:Out Split [b]	Volume		
						In	Out	Total			In	Out	Total
EXISTING DEVELOPMENT													
Family Apartments (8 DU per acre)	332 DU	8/DU	2,656	8%	2:8	42	170	212	10%	7:3	186	80	266
Total Existing Trip Generation	**332 DU**	**—**	**2,656**	**—**	**—**	**42**	**170**	**212**	**—**	**—**	**186**	**80**	**266**
PROPOSED PROJECT													
Single-Family Cluster (8.4 DU per acre)	99 DU	10/DU	990	8%	2:8	16	63	79	10%	7:3	69	30	99
Multi-Family Tri-Plex (11.4 DU per acre)	105 DU	8/DU	840	8%	2:8	13	54	67	10%	7:3	59	25	84
Row Towns (14.1 DU per acre)	120 DU	8/DU	960	8%	2:8	15	62	77	10%	7:3	67	29	96
Subtotal Trip Generation	*324 DU*	*—*	*2,790*	*—*	*—*	*44*	*179*	*223*	*—*	*—*	*195*	*84*	*279*
Apartments (23.1 DU per acre)	277 DU	6/DU	1,662	8%	2:8	27	106	133	9%	7:3	105	45	150
Total Proposed Trip Generation	**601 DU**	**—**	**4,452**	**—**	**—**	**71**	**285**	**356**	**—**	**—**	**300**	**129**	**429**
Net New Trip Generation	**269 DU**	**—**	**1,796**	**—**	**—**	**29**	**115**	**144**	**—**	**—**	**114**	**49**	**163**

Footnotes:

a. ADT = Average Daily Traffic.
b. Rates taken from City of San Diego *Trip Generation Manual*, May 2003.

General Notes:

1. DU = dwelling units

7.2 Trip Distribution/Assignment

In order to distribute and assign vehicular trips to the study area street system, a SANDAG Select Zone Assignment Model was run using residential land use inputs. Following a thorough review of the model outputs, minor adjustments to the distribution were made based on site access parameters, proximinty to schools, retail and office uses, roadway system charactersics, and using professional engineering judgement. A copy of the SANDAG model is included in ***Appendix D*** with a full-sized plot also being provided with the report submittal.

As a result of these changes, modifications to the north/south distribution on Carmel Mountain Road were made. Instead of the model-assumed 85%/15% split on Carmel Mountain Road north and south of the Project site, a 66%/34% was utilized in the analysis. This redistribution accounts for the school boundaries for the site being located to the west (which may be incorrectly assumed in the model), along with a substantial amount of retail uses also being located to the west.

Using the above mentioned assumptions, approximately 20% of the Project trips are regionally distributed on I-15 to the north with 25% to the south, with 15% oriented to/from the west on SR 56. The remaining 40% were distributed to the local network. This distribution was applied to both the existing land use and proposed Project land uses, given they are both residential and would likely have the same travel patterns. ***Figure 7–1*** shows the Project Trip Distribution.

Given the land uses for the existing site and proposed Project are the same, the distribution was first applied to the existing development trip generation to assign the existing traffic to the street network assuming the current access scheme. ***Figure 7–2*** depicts the Existing Site traffic assignment.

Then, the Project-generated traffic was then assigned to the study area street system with the redesigned access configurations. ***Figure 7–3*** depicts the Proposed Project traffic assignment.

For arriving at the Existing plus Project traffic volumes, the net increase between the existing and Project trip generation was assigned to the street system for use in the analysis. ***Figure 7–4*** shows the Net New Project Trips on the study area street system.

Figure 7–5 depicts the Existing + Net New Trips Project traffic volumes.

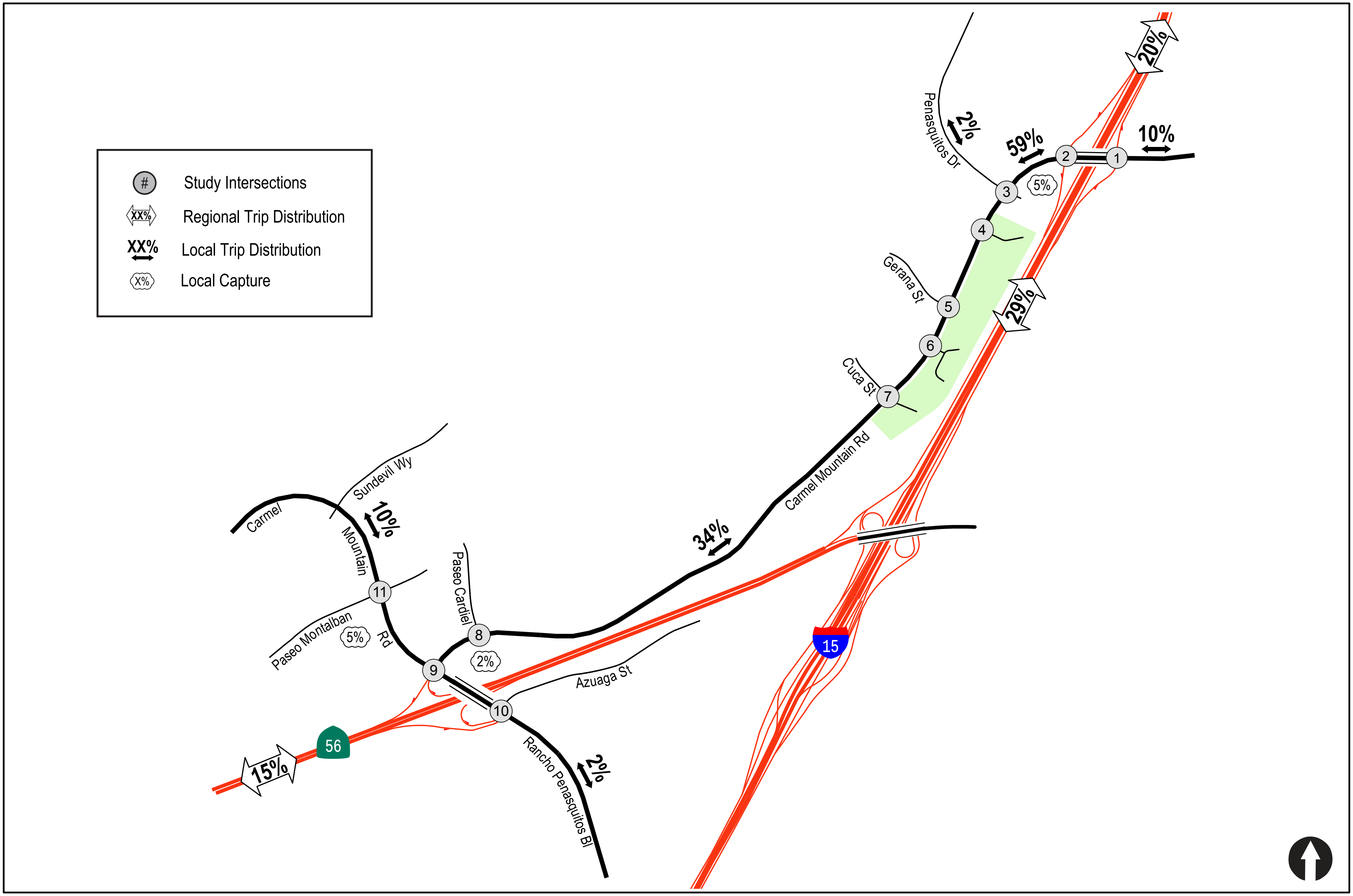

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Figure 7-1

Project Traffic Distribution

PACIFIC VILLAGE

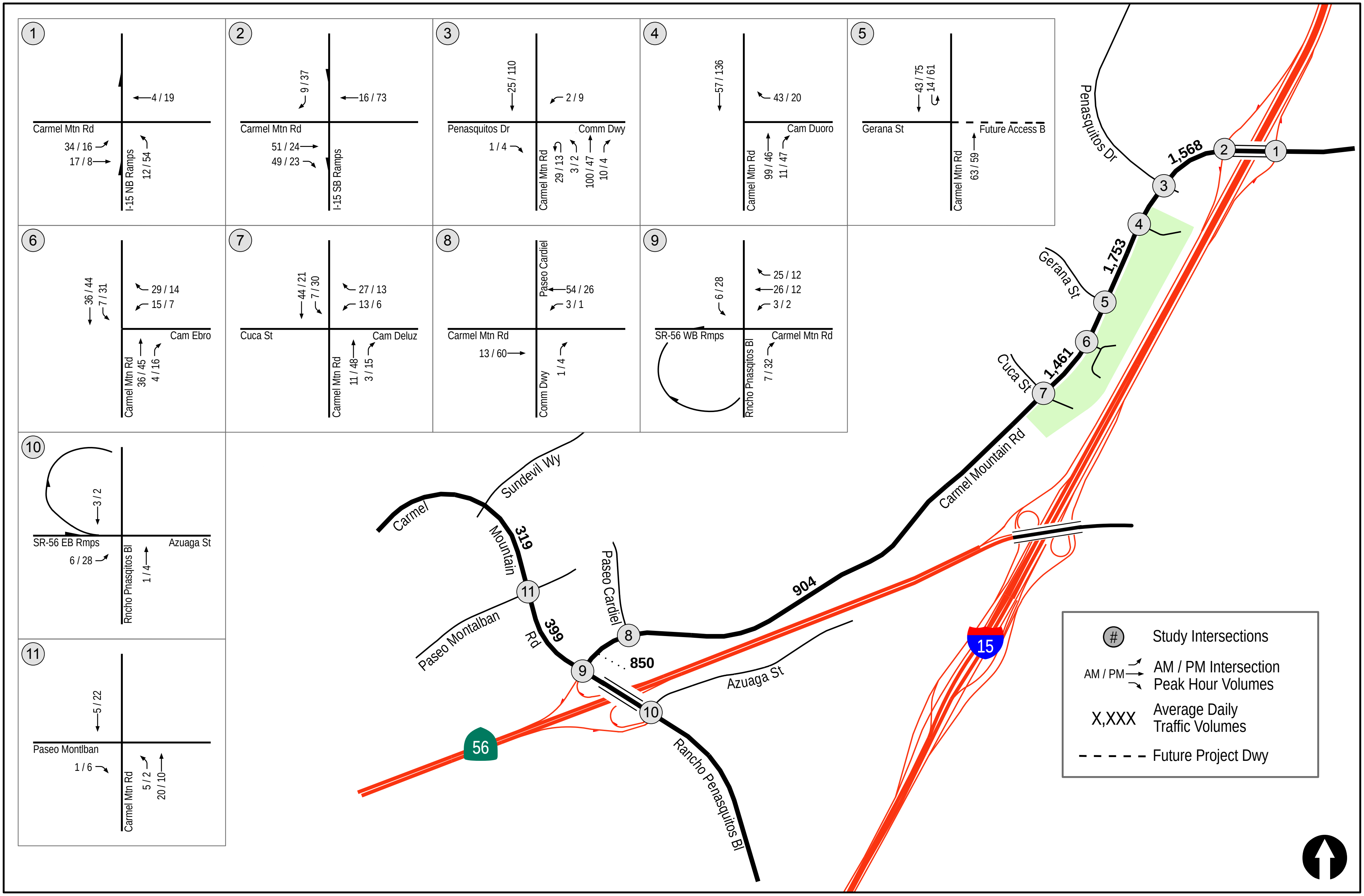

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Figure 7-2

Existing Site Traffic Volumes

PACIFIC VILLAGE

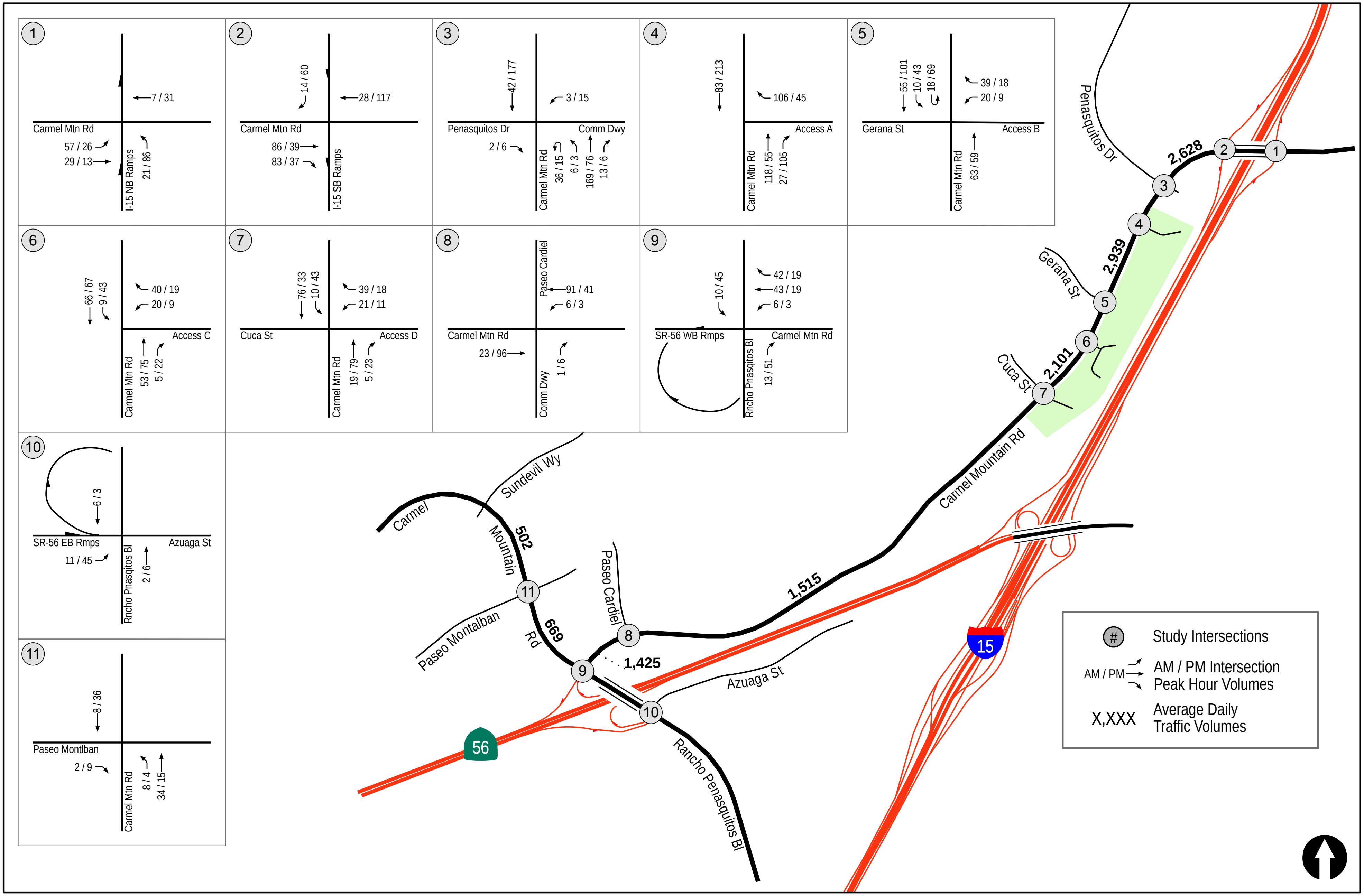

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Figure 7-3

Proposed Project Traffic Volumes

PACIFIC VILLAGE

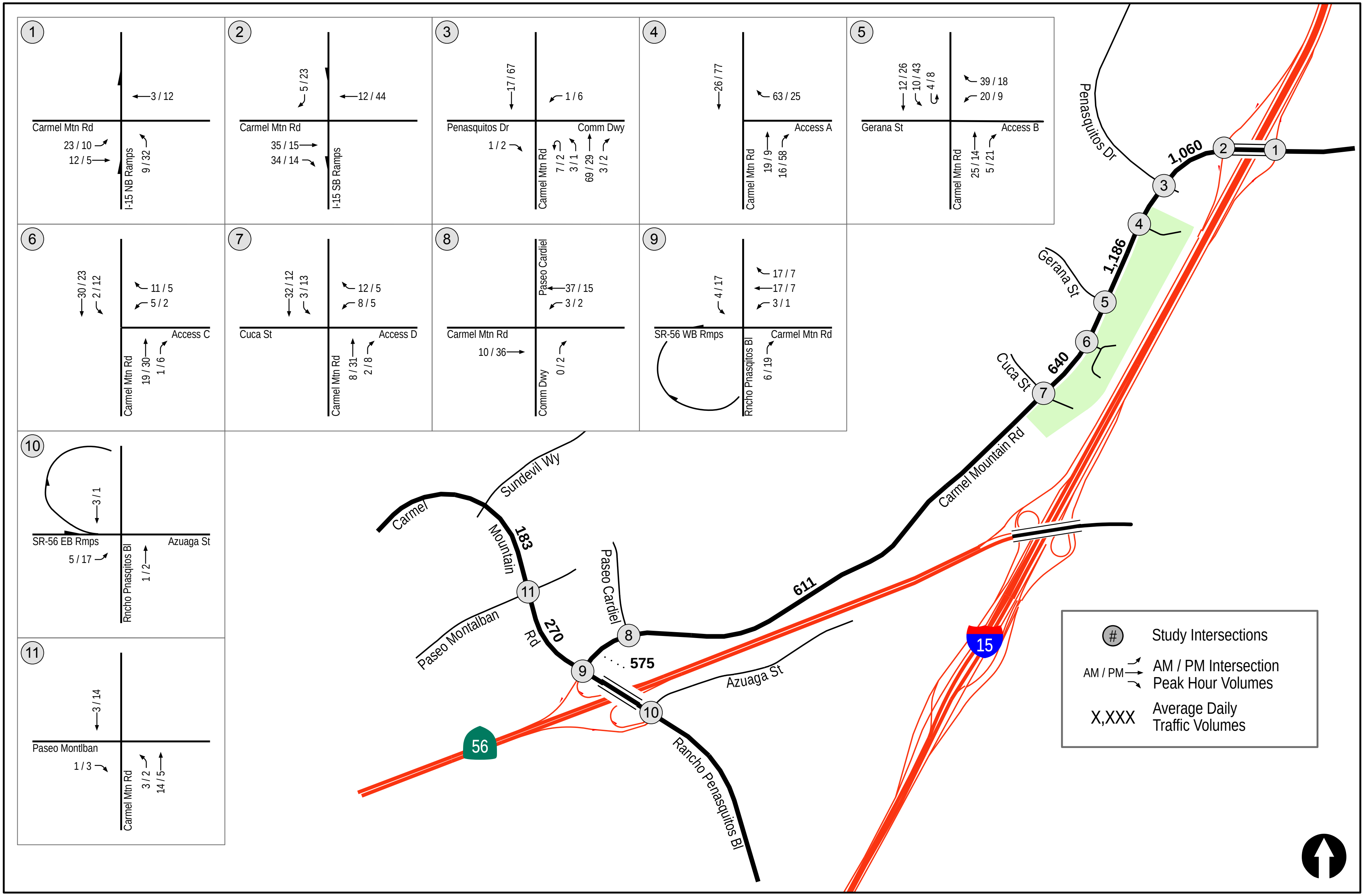

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Figure 7-4

Net New Project Traffic Volumes

PACIFIC VILLAGE

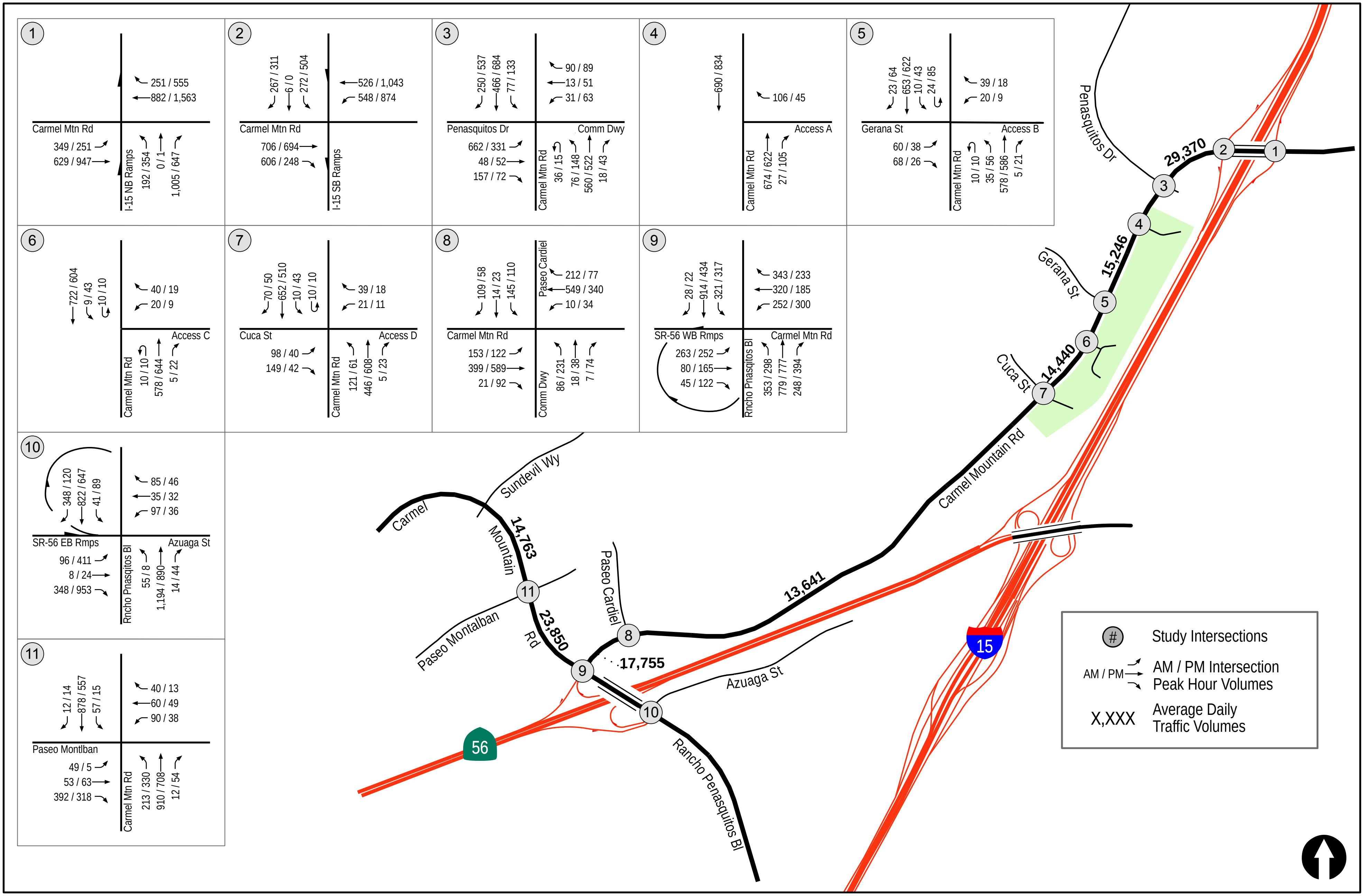

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Figure 7-5

Existing + Net New Project Traffic Volumes

PACIFIC VILLAGE

8.0 ANALYSIS OF EXISTING + PROJECT CONDITIONS

The following section presents the analysis of Existing + Project study area locations. The Existing + Project condition represents the effect of Project traffic on the existing street network, at the time of traffic data collection (November 2015) without assuming either additional cumulative projects or additional road improvements in the baseline condition other than those proposed as part of the Project (realigned Gerana Street access intersection).

8.1 Peak Hour Intersection Operations

Table 8–1 summarizes the existing intersections LOS. As seen in *Table 8–1*, with the addition of Project traffic, all intersections are calculated to continue to operate at LOS D or better except for the following:

- Intersection #1. Carmel Mountain Road/ I-15 NB Ramps – LOS E during the PM peak hour
- **<u>Intersection #5. Carmel Mountain Road/ Gerana Street/ Future Access B – LOS F/F during the AM/PM peak hours</u>**
- Intersection #10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps – LOS F during the PM peak hour

Based on City of San Diego significance criteria, **<u>one (1) significant direct impact</u>** was calculated with the addition of Project traffic at the intersection **bolded** and <u>underlined</u> above, as the increase in delay associated with the Project is greater than the allowable thresholds.

Appendix E contains the Existing + Project intersection analysis worksheets.

8.2 Daily Street Segment Operations

Table 8–2 summarizes the existing roadway segment operations. As seen in *Table 8–2*, with the addition of Project traffic, the study area segments are calculated to continue to operate at LOS C.

Based on City of San Diego significance criteria, **<u>no significant direct impacts</u>** were calculated with the addition of Project traffic on the street segments.

TABLE 8–1
EXISTING + PROJECT INTERSECTION OPERATIONS

Intersection	Control Type	Peak Hour	Existing		Existing + Project		Delay Δ [c]	Sig?
			Delay [a]	LOS [b]	Delay	LOS		
1. Carmel Mountain Rd / I-15 NB Ramps	Signal	AM PM	39.0 74.2	D E	40.4 75.5	D E	1.4 1.3	No
2. Carmel Mountain Rd / I-15 SB Ramps	Signal	AM PM	26.9 37.0	C D	28.8 37.3	C D	1.9 0.3	No
3. Carmel Mountain Rd / Peñasquitos Dr	Signal	AM PM	25.1 25.0	C C	25.5 26.0	C C	0.4 1.0	No
4. Carmel Mountain Rd / Access A *(right-in/right-out only movements)*	MSSC [d]	AM PM	11.1 10.8	B B	12.2 11.5	B B	1.1 0.7	No
5. Carmel Mountain Rd / Gerana St/ Access B [e]	MSSC	AM PM	26.7 29.2	D D	**44.7** **57.1**	**E** **F**	**18.0** **27.9**	**Yes**
6. Carmel Mountain Rd / Access C	MSSC [d]	AM PM	15.1 15.1	C C	16.1 16.1	C C	1.0 1.0	No
7. Carmel Mountain Rd / Cuca St/ Access D	Signal	AM PM	17.5 9.5	B A	17.6 11.4	B B	0.1 1.9	No
8. Carmel Mountain Rd / Paseo Cardiel	Signal	AM PM	15.5 18.1	B B	15.7 18.5	B B	0.2 0.4	No
9. Rancho Peñasquitos Blvd/ Carmel Mountain Road / SR 56 WB Ramps	Signal	AM PM	54.3 49.9	D D	54.8 50.2	D D	0.5 0.3	No
10. Rancho Peñasquitos Blvd / SR 56 EB Ramps	Signal	AM PM	43.9 157.5	D F	44.0 157.6	D F	0.1 0.1	No
11. Carmel Mountain Rd / Paseo Montalban	Signal	AM PM	21.3 16.6	C B	21.5 16.7	C B	0.2 0.1	No

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. Δ denotes the increase in delay due to Project.
d. MSSC = Minor Street Stop-Controlled intersection. Minor street critical movement delay reported.
e. The existing Caminata Soleada right-turn in/right-turn out only driveway for Peñasquitos Village will be realigned with the Project to intersect Gerana Street as "Future Access B". Existing traffic volumes from Caminata Soleadad have been accounted for in the analysis.

General Notes:

1. Sig = Significant impact, yes or no.
2. **Bold** typeface and shading represents a significant direct impact.

SIGNALIZED DELAY/LOS THRESHOLDS		UNSIGNALIZED DELAY/LOS THRESHOLDS	
Delay	LOS	Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

TABLE 8–2
EXISTING + PROJECT STREET SEGMENT OPERATIONS

Street Segment	Existing Capacity (LOS E)[a]	Existing			Existing + Project			Δ [e]	Sig?
		ADT [b]	LOS [c]	V/C [d]	ADT	LOS	V/C		
Carmel Mountain Road									
1. I-15 SB Ramps to Peñasquitos Dr [f]	45,000	28,310	C	0.629	29,370	C	0.653	0.024	No
2. Peñasquitos Dr to Gerana St	40,000	14,060	A	0.352	15,246	B	0.381	0.029	No
3. Gerana St to Cuca St	40,000	13,800	A	0.345	14,440	A	0.361	0.016	No
4. Cuca St to Paseo Cardiel	40,000	13,025	A	0.326	13,641	A	0.341	0.015	No
5. Paseo Cardiel to Rancho Peñasquitos Blvd	40,000	17,180	B	0.430	17,755	B	0.444	0.014	No
6. Rancho Peñasquitos Blvd to Paseo Montalban [f]	45,000	23,580	B	0.524	23,850	B	0.530	0.006	No
7. Paseo Montalban to Sundevil Way	40,000	14,580	A	0.365	14,763	A	0.369	0.004	No

Footnotes:

a. Capacities based on City of San Diego Roadway Classification & LOS table (See *Appendix B*).
b. Average Daily Traffic.
c. Level of Service.
d. Volume to Capacity ratio.
e. Δ denotes a Project-induced increase in the Volume to Capacity ratio.
f. Carmel Mountain Road from I-15 SB to Peñasquitos Drive currently provides three lanes in the NB direction and two lanes SB for an increased capacity of 45,000 ADT. From Rancho Peñasquitos Boulevard/SR 56 WBG Ramps to just south of Paseo Montalban the roadways has three lanes in the SB direction and two lanes NB for an increased capacity of 45,000 ADT.

General Notes:

1. Sig = Significant impact, yes or no.

9.0 NEAR-TERM CUMULATIVE PROJECTS CONDITIONS

Cumulative projects are other projects in the study area that will add traffic to the local circulation system in the near future. LLG reviewed the City's Open DSD website and consulted with City of San Diego staff to identify relevant, pending cumulative projects in the study area that could be constructed and generating traffic in the study area vicinity by completion of the Project. Based on information received from City staff, two (2) cumulative projects are planned nearby that would add to traffic to study area intersections and street segments. Traffic generated by these projects was added to the existing traffic volumes to develop the Existing + Cumulative Projects near-term condition. Project traffic was added to the near-term traffic volumes to arrive at the Existing + Cumulative Projects + Project condition. The following is a brief description of each of the cumulative projects. ***Table 9–1*** provides a summary of the cumulative project trip generation summary.

9.1 Description of Cumulative Projects

1. **Merge 56** proposes to develop 525,000 square feet of commercial, office, theater and hotel uses, and 242 residential dwelling units. The residential units would include a mix of housing types including multi-family (approximately 47 affordable units), townhomes (approximately 111 units), and single family (approximately 84 units). The project includes the construction of Camino Del Sur south of Torrey Santa Fe Road to its current terminus north of Dormouse Road and the realignment and construction of Carmel Mountain Road from Via Las Lenas to Camino Del Sur. The project requires a Community Plan Amendment and currently has a discretionary permit application into the City (PTS#360009). The proposed Merge 56 project was included in both the near-term and long-term analyses. The project is calculated to generate approximately 19,468 ADT with 806 inbound and 386 outbound trips in the AM peak hour, and 929 inbound and 1,166 outbound trips in the PM peak hour. *Trip distribution and assignment taken from a SANDAG Series 12 Year 2035 Select Zone Assignment prepared for a custom zone assigned to Merge 56 used in the City approved LLG traffic study dated January 14, 2016.*

2. **The Preserve at Torrey Highlands (Community Plan Amendment request previously referred to as the "Kilroy Development")** proposes to develop 450,000 SF of commercial office space with parking structures south of Torrey Santa Fe Road and west of future Camino Del Sur. The property is currently approved to construct a 1,200-seat church with a Kindergarten through eighth grade school. The project requires a Community Plan Amendment and currently has a discretionary permit application into the City (PTS#442880). The proposed Preserve project was included in both the near-term and long-term analysis. The project is calculated to generate approximately 5,264 ADT with 616 inbound and 68 outbound trips in the AM peak hour, and 147 inbound and 589 outbound trips in the PM peak hour. *Trip distribution and assignment taken from a SANDAG Series 12 Year 2035 Select Zone Assignment prepared for a custom zone assigned to The Preserve used in the most current LLG traffic study dated March 29, 2016.*

TABLE 9–1
CUMULATIVE DEVELOPMENT PROJECTS SUMMARY

No.	Name	Project	ADT [a]	AM		PM		Status
				In	Out	In	Out	
1	Merge 56	525 KSF Commercial/ Office + 242 Residential Units	19,468	806	386	929	1,166	Under Review PTS# 360009
2	The Preserve at Torrey Highlands	450 KSF Commercial Office	5,260	616	68	147	589	Under Review PTS# 442880
Total Cumulative Projects			**24,728**	**1,422**	**472**	**1,076**	**1,755**	–

Footnotes:

a. Average daily traffic.

Figure 9–1 shows the locations of the cumulative projects and ***Figure 9–2*** depicts the cumulative projects traffic volumes. ***Figure 9–3*** depicts the Existing + Cumulative Projects traffic volumes and ***Figure 9–4*** depicts the Existing + Cumulative Projects + Project traffic volumes.

Appendix F contains the cumulative projects assignment sheets.

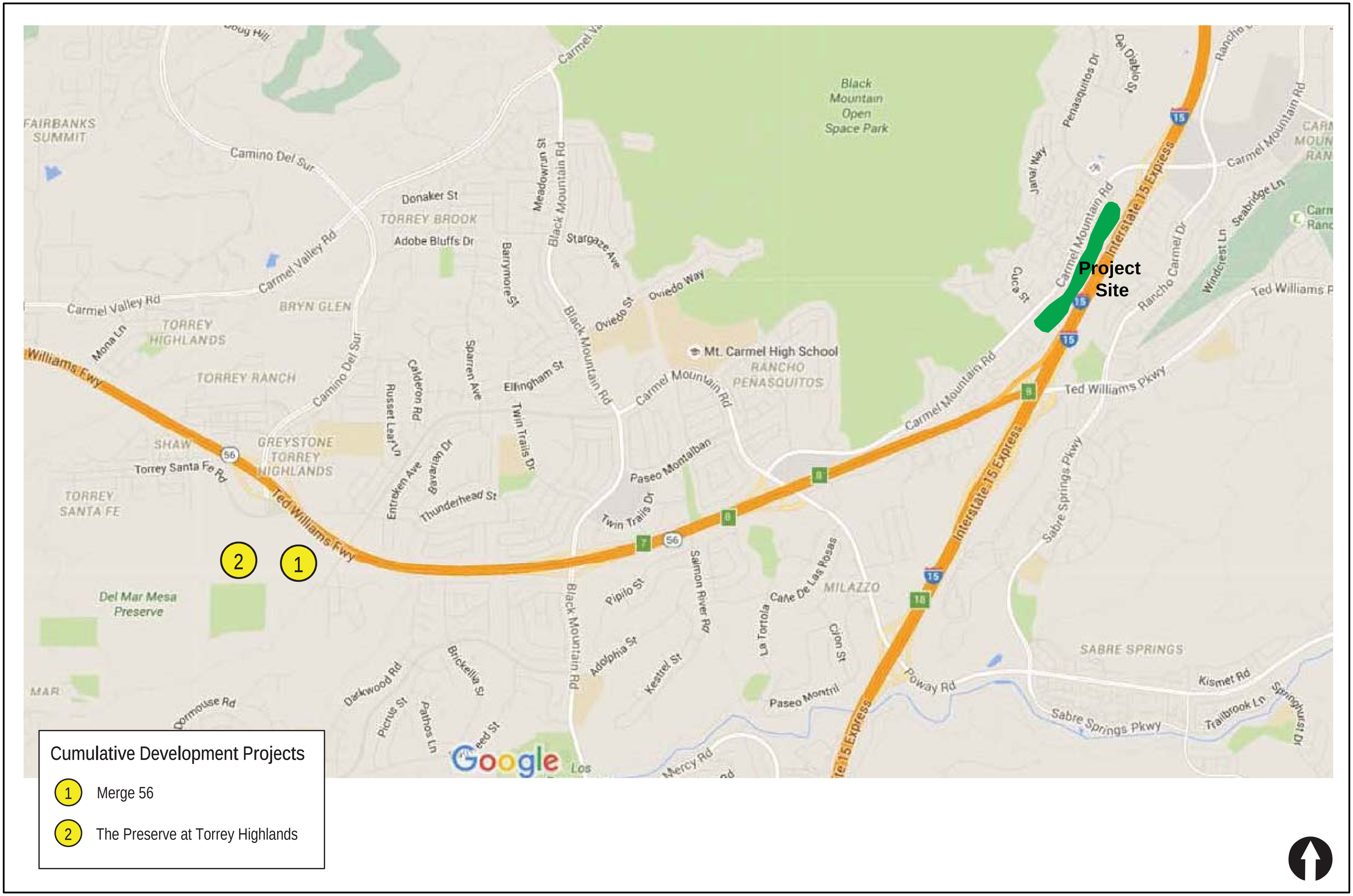

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Figure 9-1

Cumulative Projects Location Map

PACIFIC VILLAGE

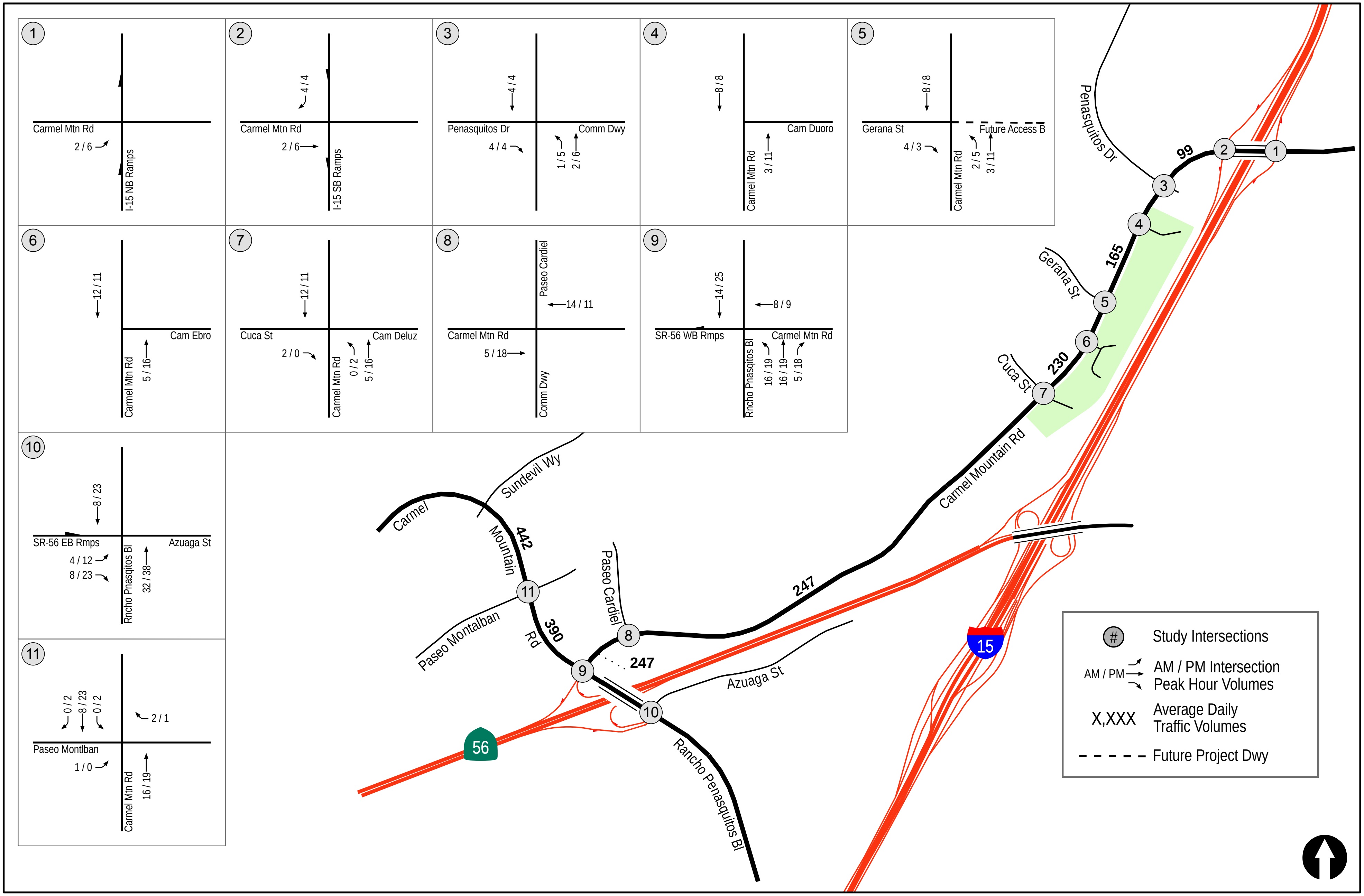

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Figure 9-2

Cumulative Projects Traffic Volumes

PACIFIC VILLAGE

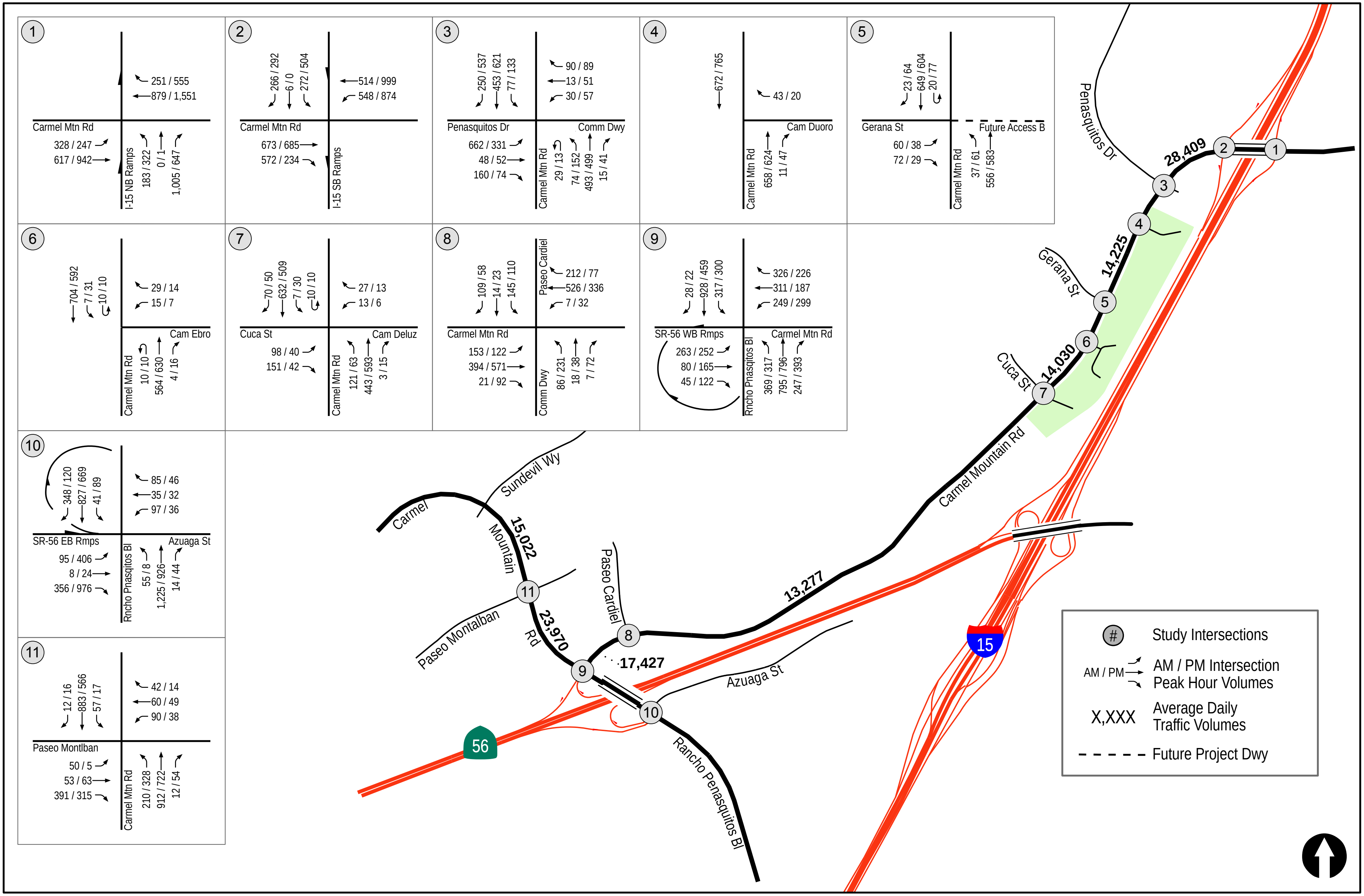

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Figure 9-3

Existing + Cumulative Projects Traffic Volumes

PACIFIC VILLAGE

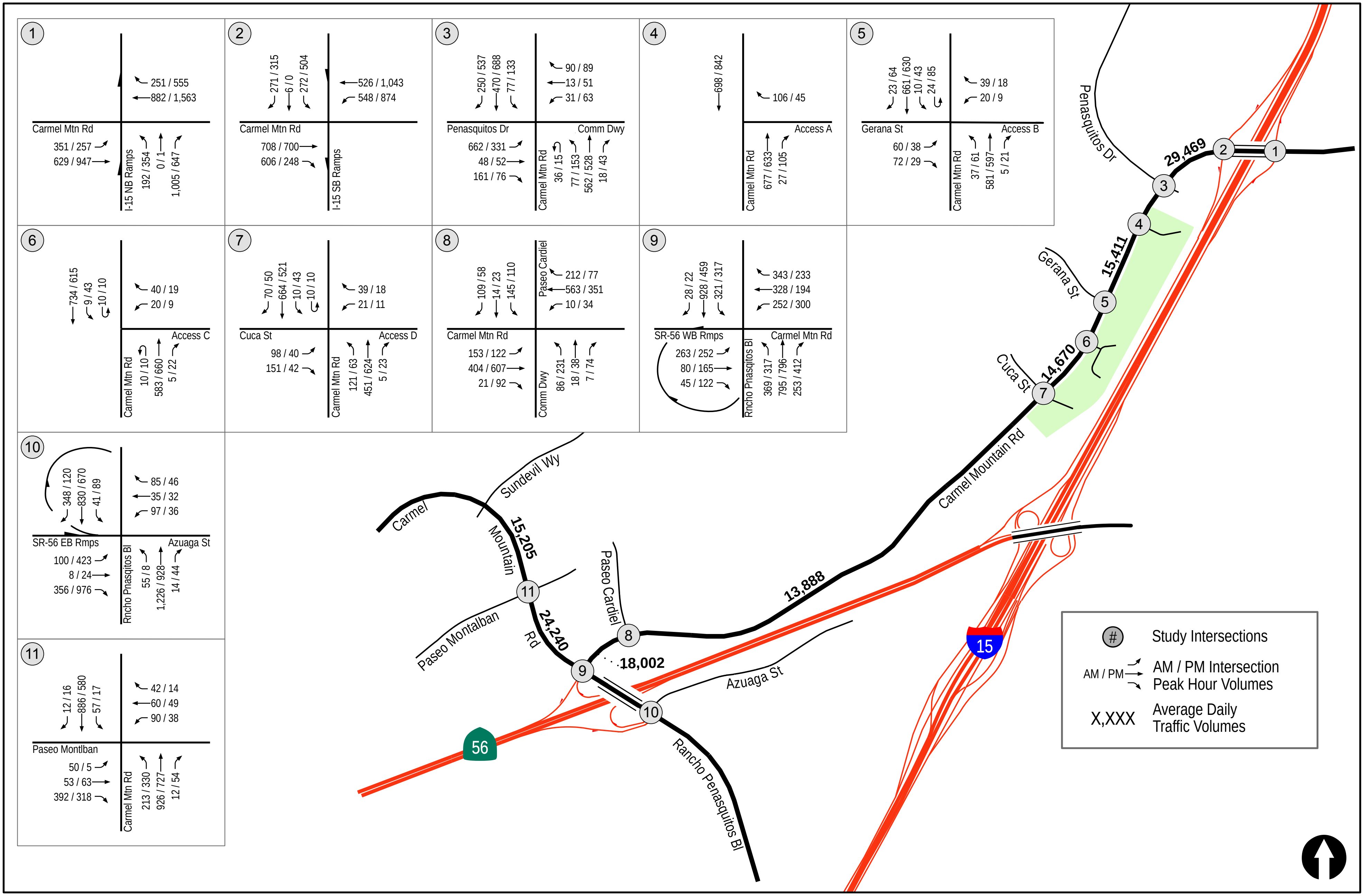

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Figure 9-4

Existing + Cumulative Projects + Project Traffic Volumes

PACIFIC VILLAGE

10.0 ANALYSIS OF NEAR-TERM SCENARIOS

All near-term analyses were completed assuming the existing lane geometries.

10.1 Existing + Cumulative Projects

10.1.1 *Intersection Analysis*

Table 10–1 summarizes the peak hour intersection operations for the Existing + Cumulative Projects condition. As seen in *Table 10–1*, with the addition of cumulative projects traffic, all intersections are calculated to operate at LOS D or better except for the following:

- Intersection #1. Carmel Mountain Road/ I-15 NB Ramps – LOS E during the PM peak hour
- Intersection #9. Rancho Peñasquitos Boulevard/ Carmel Mountain Road / SR 56 WB Ramps – LOS E during the AM peak hour
- Intersection #10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps – LOS F during the PM peak hour

Appendix G contains the peak hour intersection analysis worksheets for the Existing + Cumulative Projects condition.

10.1.2 *Segment Operations*

Table 10–2 summarizes the key segment operations in the study area for the Existing + Cumulative Projects condition. As seen in *Table 10–2*, with the addition of cumulative projects traffic, the study area segments are calculated to operate at LOS C or better.

10.2 Existing + Cumulative Projects + Project

10.2.1 *Intersection Analysis*

Table 10–1 summarizes the peak hour intersection operations for Existing + Cumulative Projects + Project conditions. As seen in *Table 10–1*, with the addition of cumulative projects and Project traffic, all intersections are calculated to continue to operate at LOS D or better except for the following:

- Intersection #1. Carmel Mountain Road/ I-15 NB Ramps – LOS E during the PM peak hour
- **<u>Intersection #5. Carmel Mountain Road/ Gerana Street/ Future Access B – LOS F/F during the AM/PM peak hours</u>**
- Intersection #9. Rancho Peñasquitos Boulevard/ Carmel Mountain Road / SR 56 WB Ramps – LOS E during the AM peak hour
- Intersection #10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps – LOS F during the PM peak hour

Based on City of San Diego significance criteria, **one (1) significant direct impact** was calculated with the addition of Project traffic at the intersection **bolded** and underlined above, as the increase in delay associated with the Project is greater than the allowable thresholds.

Appendix H contains the peak hour intersection analysis worksheets for the Existing + Cumulative Projects + Project condition.

10.2.2 *Segment Operations*

Table 10–2 summarizes the key segment operations in the study area for the Existing + Cumulative Projects + Project conditions. As seen in *Table 10–2,* with the addition of cumulative projects and Project traffic, the study area segments are calculated to continue to operate at LOS C or better.

Based on City of San Diego significance criteria, **no significant direct impacts** were calculated with the addition of Project traffic.

TABLE 10–1
NEAR-TERM INTERSECTION OPERATIONS

Intersection	Control Type	Peak Hour	Existing + Cumulative Projects		Existing + Cumulative Projects + Project		Delay Δ [c]	Sig?
			Delay [a]	LOS [b]	Delay	LOS		
1. Carmel Mountain Road / I-15 NB Ramps	Signal	AM PM	39.1 74.2	D E	40.6 75.4	D E	1.5 1.2	No
2. Carmel Mountain Road / I-15 SB Ramps	Signal	AM PM	27.0 37.1	C D	29.0 37.3	C D	2.0 0.2	No
3. Carmel Mountain Road / Peñasquitos Drive	Signal	AM PM	25.1 25.4	C C	25.6 26.4	C C	0.5 1.0	No
4. Carmel Mountain Road / Access A *(right-in/right-out only movements)*	MSSC [d]	AM PM	11.1 10.9	B B	12.2 11.5	B B	1.1 0.6	No
5. Carmel Mountain Road / Gerana Street / Future Access B [e]	MSSC	AM PM	27.3 29.6	D D	**46.3** **60.0**	**E** **F**	**19.0** **30.4**	**Yes**
6. Carmel Mountain Road / Access C	MSSC [d]	AM PM	15.2 15.4	C C	16.2 16.4	C C	1.0 1.0	No
7. Carmel Mountain Road / Cuca Street/ Access D	Signal	AM PM	17.6 10.5	B B	17.7 11.4	B B	0.1 0.9	No
8. Carmel Mountain Road / Paseo Cardiel	Signal	AM PM	15.5 18.3	B B	15.8 18.7	B B	0.3 0.4	No
9. Rancho Peñasquitos Blvd/ Carmel Mountain Road / SR 56 WB Ramps	Signal	AM PM	55.1 49.8	E D	55.6 54.4	E D	0.5 4.6	No
10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps	Signal	AM PM	47.1 164.8	D F	47.2 164.9	D F	0.1 0.1	No
11. Carmel Mountain Road / Paseo Montalban	Signal	AM PM	21.5 16.8	C B	21.6 16.9	C B	0.1 0.1	No

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. Δ denotes the increase in delay due to Project.
d. MSSC = Minor Street Stop-Controlled intersection. Minor street critical movement delay reported.
e. The existing Caminata Soleada right-turn in/right-turn out only driveway for Peñasquitos Village will be realigned with the Project to intersect Gerana Street as "Future Access B". Existing traffic volumes from Caminata Soleadad have been accounted for in the analysis.

General Notes:

1. Sig = Significant impact, yes or no.
2. **Bold** typeface and shading represents a significant direct impact.

SIGNALIZED DELAY/LOS THRESHOLDS Delay	LOS	UNSIGNALIZED DELAY/LOS THRESHOLDS Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

TABLE 10–2
NEAR-TERM STREET SEGMENT OPERATIONS

Street Segment	Existing Capacity (LOS E)[a]	Existing + Cumulative Projects			Existing + Cumulative Projects + Project			Δ [e]	Sig?
		ADT [b]	LOS [c]	V/C [d]	ADT	LOS	V/C		
Carmel Mountain Road									
1. I-15 SB Ramps to Peñasquitos Drive [f]	45,000	28,409	C	0.631	29,469	C	0.655	0.024	No
2. Peñasquitos Drive to Gerana Street	40,000	14,225	A	0.356	15,411	B	0.385	0.029	No
3. Gerana Street to Cuca Street	40,000	14,030	A	0.351	14,670	A	0.367	0.016	No
4. Cuca Street to Paseo Cardiel	40,000	13,272	A	0.332	13,888	A	0.347	0.015	No
5. Paseo Cardiel to Rancho Peñasquitos Boulevard	40,000	17,427	B	0.436	18,002	B	0.450	0.014	No
6. Rancho Peñasquitos Boulevard to Paseo Montalban [f]	45,000	23,970	B	0.533	24,240	B	0.539	0.006	No
7. Paseo Montalban to Sundevil Way	40,000	15,022	B	0.376	15,205	B	0.380	0.004	No

Footnotes:

a. Capacities based on City of San Diego Roadway Classification & LOS table (See *Appendix B*).
b. Average Daily Traffic.
c. Level of Service.
d. Volume to Capacity ratio.
e. Δ denotes a Project-induced increase in the Volume to Capacity ratio.
f. Carmel Mountain Road from I-15 SB to Peñasquitos Drive currently provides three lanes in the NB direction and two lanes SB for an increased capacity of 45,000 ADT. From Rancho Peñasquitos Boulevard/SR 56 WB Ramps to just south of Paseo Montalban the roadways has three lanes in the SB direction and two lanes NB for an increased capacity of 45,000 ADT.

General Notes:

1. Sig = Significant impact, yes or no.

11.0 YEAR 2035 CONDITIONS

The SANDAG 2050 Regional Transportation Plan (RTP) was adopted by the Board of Directors on October 28, 2011. In developing the RTP, the "Series 12" traffic forecast model series was prepared. The forecast model is completed in two stages. During the first stage, SANDAG produces a region-wide forecast based on existing demographic and economic trends. During the second stage, a sub-regional forecast is developed by working with local jurisdictions to understand existing and General Plan land use plans (including Community Plans). These land use plans then become an input to a sub-regional forecast model that uses data on existing development, future land use plans, proximity to existing job centers, past development patterns, and travel times to predict where growth is likely to occur in the future.

11.1 Year 2035 Network Conditions

As discussed in the trip distribution/assignment section of this report, *Section 7.3*, an SZA was obtained for the proposed Project TAZ using the Series 12 Year 2035 traffic model. The Year 2035 street network includes SR 56 as four lane facility (two eastbound, two westbound lanes) in the immediate vicinity of the Project and Carmel Mountain Road at its current configuration. Specifics on these two network components are mentioned below:

- SR 56 improvements to six lanes are not currently funded, and not programmed in the Regional Transportation Plan until 2040.
- Carmel Mountain Road from I-15 to Peñasquitos Drive is classified as a six-lane roadway in the Rancho Peñasquitos Community Plan. In the *Rancho Peñasquitos Public Facilities Financing Plan*, Project No. T-12 indicates that funding for this improvement is currently unidentified.

The time frame for implementation and funding source for both of the network changes listed above are currently unknown. Therefore, no street segment or intersection improvements over existing on-the-ground conditions were assumed in the Year 2035 analyses of study area intersections and streets segments included in this report.

Table 11–1 provides a summary of the Community Plan Roadway Classifications and capacities assumed in the analysis.

TABLE 11–1
COMMUNITY PLAN ROADWAY CLASSIFICATIONS

Street Segment	Currently Built As (Assumed in Year 2035 Analysis)	Community Plan Classification [a]
Carmel Mountain Road		
1. I-15 SB Ramps to Peñasquitos Drive	5-Ln Major	6-Ln Major
2. Peñasquitos Drive to Gerana Street	4-Ln Major	4-Ln Major
3. Gerana Street to Cuca Street	4-Ln Major	4-Ln Major
4. Cuca Street to Paseo Cardiel	4-Ln Major	4-Ln Major
5. Paseo Cardiel to Rancho Peñasquitos Boulevard	4-Ln Major	4-Ln Major
6. Rancho Peñasquitos Boulevard to Paseo Montalban	5-Ln Major	5-Ln Major
7. Paseo Montalban to Sundevil Way	4-Ln Major	4-Ln Major

Footnotes:

a. City of San Diego General Plan Classification based on *Rancho Peñasquitos Community Plan.*

General Notes:

1. The traffic analysis in this report utilized the current network configurations in the Year 2035 analysis.

11.2 Year 2035 Traffic Volumes

The Year 2035 volumes were obtained from the SANDAG Series 12 Year 2035 forecast traffic model to project the roadway segment baseline traffic volumes representing the Year 2035 Without Project conditions. The model-generated peak hour volumes are not considered accurate as the primary purpose of the model is to forecast average daily traffic volumes and not predict volumes on an hourly basis. Therefore, the peak hour turning movement volumes at an intersection were estimated from future ADT volumes using the relationship between existing peak hour turning movements and the existing ADT volumes. This same relationship can be assumed to generally continue in the future.

The net increase in traffic with the proposed Project was then added to the baseline Year 2035 traffic volumes to arrive at Year 2035 With Project conditions.

Figure 11–1 depicts the Year 2035 Without Project traffic volumes. ***Figure 11–2*** depicts the Year 2035 With Project traffic volumes.

Appendix I contains the Year 2035 traffic volume forecasts.

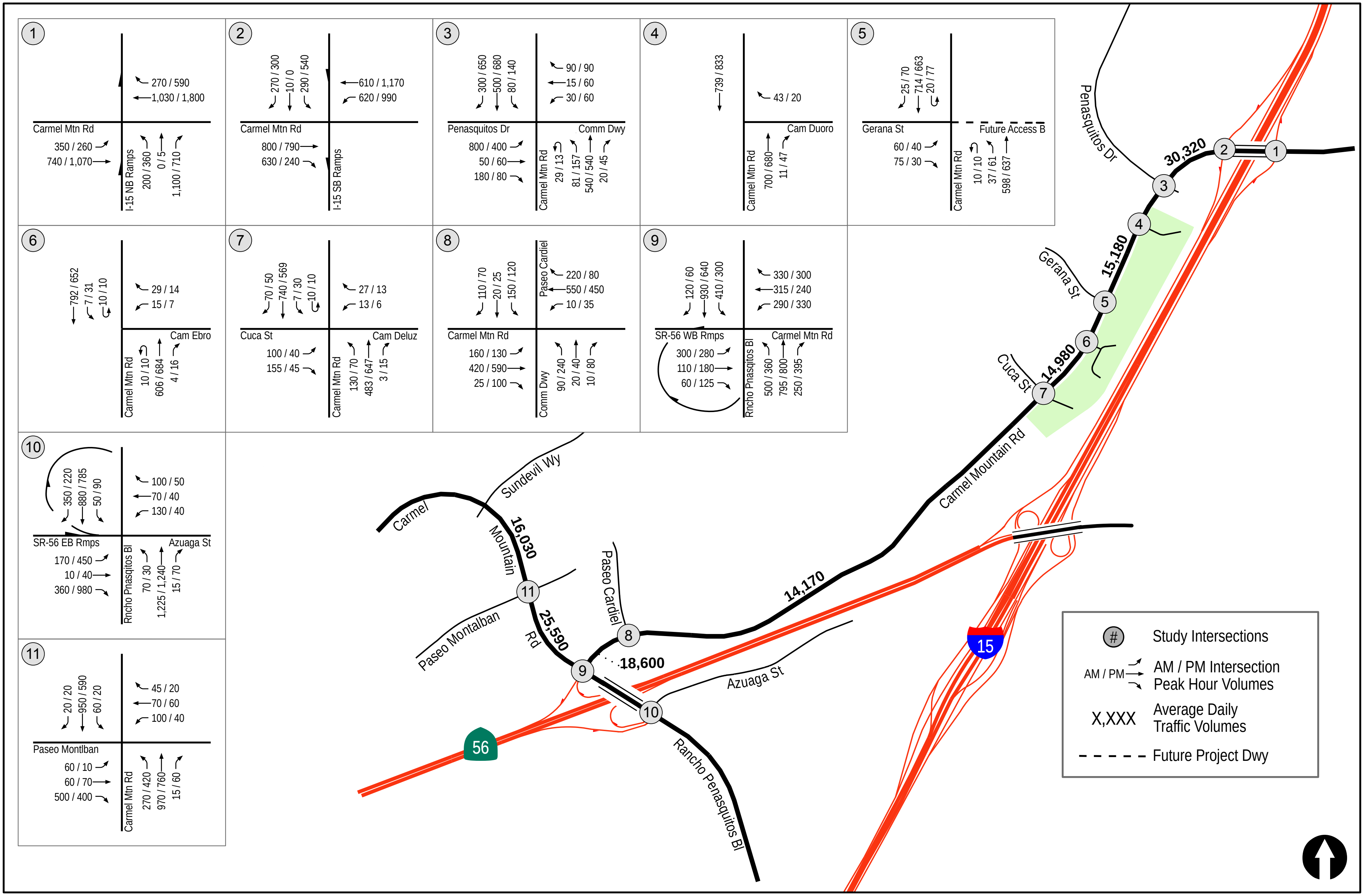

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Figure 11-1

Year 2035 Without Project Traffic Volumes

PACIFIC VILLAGE

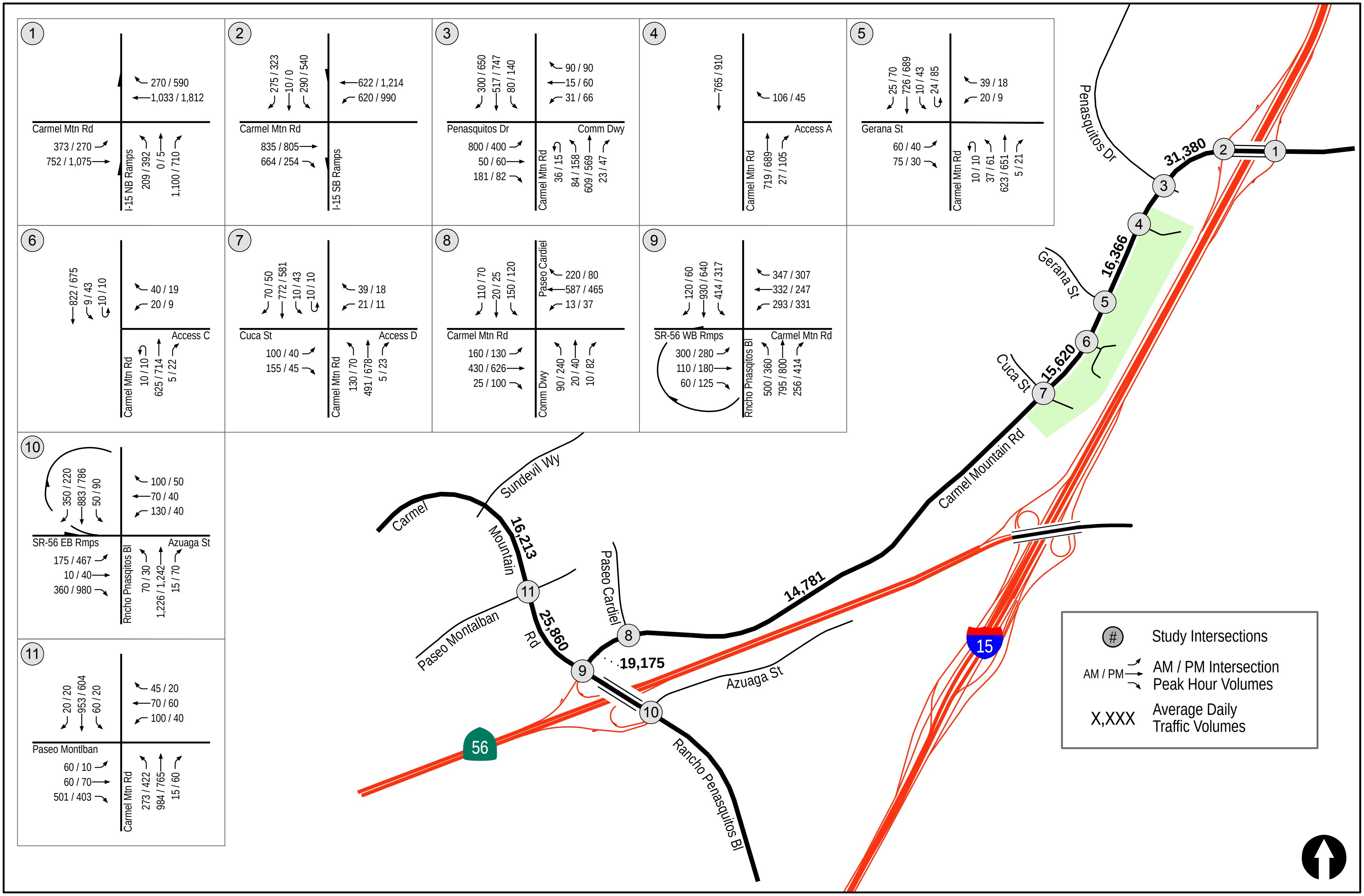

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Figure 11-2

Year 2035 With Project Traffic Volumes

Pacific Village

12.0 ANALYSIS OF YEAR 2035 SCENARIOS

12.1 Year 2035 Without Project

12.1.1 *Intersection Analysis*

Table 12–1 summarizes the peak hour intersection operations for the Year 2035 Without Project condition. As seen in *Table 12–1*, all intersections are calculated to continue to operate at LOS D or better except for the following:

- Intersection #1. Carmel Mountain Road/ I-15 NB Ramps – LOS E during the PM peak hour
- Intersection #5. Carmel Mountain Road/ Gerana Street/ Future Access B – LOS E during the PM peak hour
- Intersection #9. Rancho Peñasquitos Boulevard/Carmel Mountain Road / SR 56 WB Ramps – LOS F during the AM peak hour
- Intersection #10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps – LOS E/F during the AM/PM peak hours

Appendix J contains the peak hour intersection analysis worksheets for the Year 2035 Without Project condition.

12.1.2 *Segment Operations*

Table 12–2 summarizes the key segment operations in the study area for the Year 2035 Without Project condition. As seen in *Table 12–2*, the study area segments are calculated to operate at LOS C.

12.2 Year 2035 With Project

12.2.1 *Intersection Analysis*

Table 12–1 summarizes the peak hour intersection operations for the Year 2035 With Project condition. As seen in *Table 12–1*, with the addition of Project traffic, all intersections are calculated to continue to operate at LOS D or better except for the following:

- Intersection #1. Carmel Mountain Road/ I-15 NB Ramps – LOS E during the PM peak hour
- I**<u>ntersection #5. Carmel Mountain Road/ Gerana Street/ Future Access B – LOS F/F during the AM/PM peak hours</u>**
- Intersection #9. Rancho Peñasquitos Boulevard/ Carmel Mountain Road / SR 56 WB Ramps – LOS F during the AM peak hour
- Intersection #10. Rancho Peñasquitos Boulevard / SR 56 EB Ramps – LOS E/F during the AM/PM peak hours

Based on City of San Diego significance criteria, **<u>one (1) significant cumulative impact</u>** was calculated with the addition of Project traffic at the intersection **bolded** and <u>underlined</u> above, as the increase in delay associated with the Project is greater than the allowable thresholds.

Appendix K contains the peak hour intersection analysis worksheets for the Year 2035 With Project condition.

12.2.2 *Segment Operations*

Table 12–2 summarizes the key segment operations in the study area for the Year 2035 With Project condition. As seen in *Table 12–2*, with the addition of Project traffic, the study area segments are calculated to continue to operate at LOS C.

Based on City of San Diego significance criteria, **no significant cumulative impacts** were calculated with the addition of Project traffic.

TABLE 12–1
LONG-TERM INTERSECTION OPERATIONS

Intersection	Control Type	Peak Hour	Year 2035 Without Project		Year 2035 With Project		Delay Δ [c]	Sig?
			Delay	LOS	Delay	LOS		
1. Carmel Mountain Road / I-15 NB Ramps	Signal	AM PM	41.2 55.9	D E	41.2 56.8	D E	0.0 0.9	No
2. Carmel Mountain Road / I-15 SB Ramps	Signal	AM PM	32.8 42.5	C D	36.6 48.3	D D	3.8 5.8	No
3. Carmel Mountain Road / Peñasquitos Drive	Signal	AM PM	27.7 28.8	C C	28.4 30.0	C C	0.7 1.2	No
4. Carmel Mountain Road / Access A *(right-in-right-out only movements)*	MSSC [d]	AM PM	11.4 11.2	B B	12.5 11.9	B B	1.1 0.7	No
5. Carmel Mountain Road / Gerana Street / Future Access B	MSSC	AM PM	33.1 36.1	D E	**63.7** **84.6**	**F** **F**	**30.6** **48.5**	**Yes**
6. Carmel Mountain Road / Access C	MSSC [d]	AM PM	16.5 16.6	C C	17.7 17.8	C C	1.2 1.2	No
7. Carmel Mountain Road / Cuca Street / Access D	Signal	AM PM	18.4 11.0	B B	18.5 11.8	B B	0.1 0.8	No
8. Carmel Mountain Road / Paseo Cardiel	Signal	AM PM	16.4 20.2	B C	16.6 20.8	B C	0.2 0.6	No
9. Rancho Peñasquitos Blvd/ Carmel Mountain Road / SR 56 WB Ramps	Signal	AM PM	80.3 43.5	F D	80.5 43.8	F D	0.2 0.3	No
10. Rancho Peñasquitos Blvd / SR 56 EB Ramps	Signal	AM PM	56.4 159.3	E F	56.4 159.4	E F	0.0 0.1	No
11. Carmel Mountain Road / Paseo Montalban	Signal	AM PM	25.9 18.8	C B	26.1 19.0	C B	0.2 0.2	No

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. Δ denotes the increase in delay due to Project.
d. MSSC = Minor Street Stop-Controlled intersection. Minor street critical movement delay reported.

General Notes:

1. Sig = Significant impact, yes or no.
2. **Bold** typeface and shading represents a significant cumulative impact.

SIGNALIZED		UNSIGNALIZED	
DELAY/LOS THRESHOLDS		DELAY/LOS THRESHOLDS	
Delay	LOS	Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

TABLE 12–2
LONG-TERM STREET SEGMENT OPERATIONS

Street Segment	General Plan Capacity	Existing Capacity (LOS E) [a]	Year 2035 Without Project			Year 2035 With Project			Δ [e]	Sig?
			ADT [b]	LOS [c]	V/C [d]	ADT	LOS	V/C		
Carmel Mountain Road										
1. I-15 SB Ramps to Peñasquitos Drive	50,000	45,000	30,320	C	0.674	31,380	C	0.697	0.023	No
2. Peñasquitos Drive to Gerana Street	40,000	40,000	15,180	B	0.380	16,366	B	0.409	0.029	No
3. Gerana Street to Cuca Street	40,000	40,000	14,980	A	0.375	15,620	B	0.391	0.016	No
4. Cuca Street to Paseo Cardiel	40,000	40,000	14,170	A	0.354	14,781	A	0.370	0.016	No
5. Paseo Cardiel to Rancho Peñasquitos Boulevard	40,000	40,000	18,600	B	0.465	19,175	B	0.479	0.014	No
6. Rancho Peñasquitos Boulevard to Paseo Montalban	45,000	45,000	25,590	C	0.569	25,860	C	0.575	0.006	No
7. Paseo Montalban to Sundevil Way	40,000	40,000	16,030	B	0.401	16,213	B	0.405	0.004	No

Footnotes:

a. Capacities based on City of San Diego Roadway Classification & LOS table (See *Appendix B*).
b. Average Daily Traffic Volumes.
c. Level of Service.
d. Volume to Capacity.
e. Δ denotes a Project-induced increase in the Volume to Capacity ratio.

General Notes

1. Sig = Significant impact, yes or no.

13.0 OTHER TRANSPORTATION MODES

13.1 Pedestrians

Pedestrian circulation routes have been provided throughout the site to create enhanced pedestrian circulation and connectivity both within the site and to the surrounding streets. A new signalized crosswalk is proposed at Future Access B (realigned with Gerana Street) that will improve access to MTS Route 20 bus stops at this intersection. Non-contiguous sidewalk entrances are featured on both sides of each of the site entrances to maximize connectivity to Carmel Mountain Road. A non-contiguous sidewalk and pedestrian paseo is provided to connect all portions of the site to recreational amenities. The pedestrian paseo can be accessed from all units and features enhanced landscaping and accent paving at all driveway crossings to improve the pedestrian experience and reinforce neighborhood connectivity.

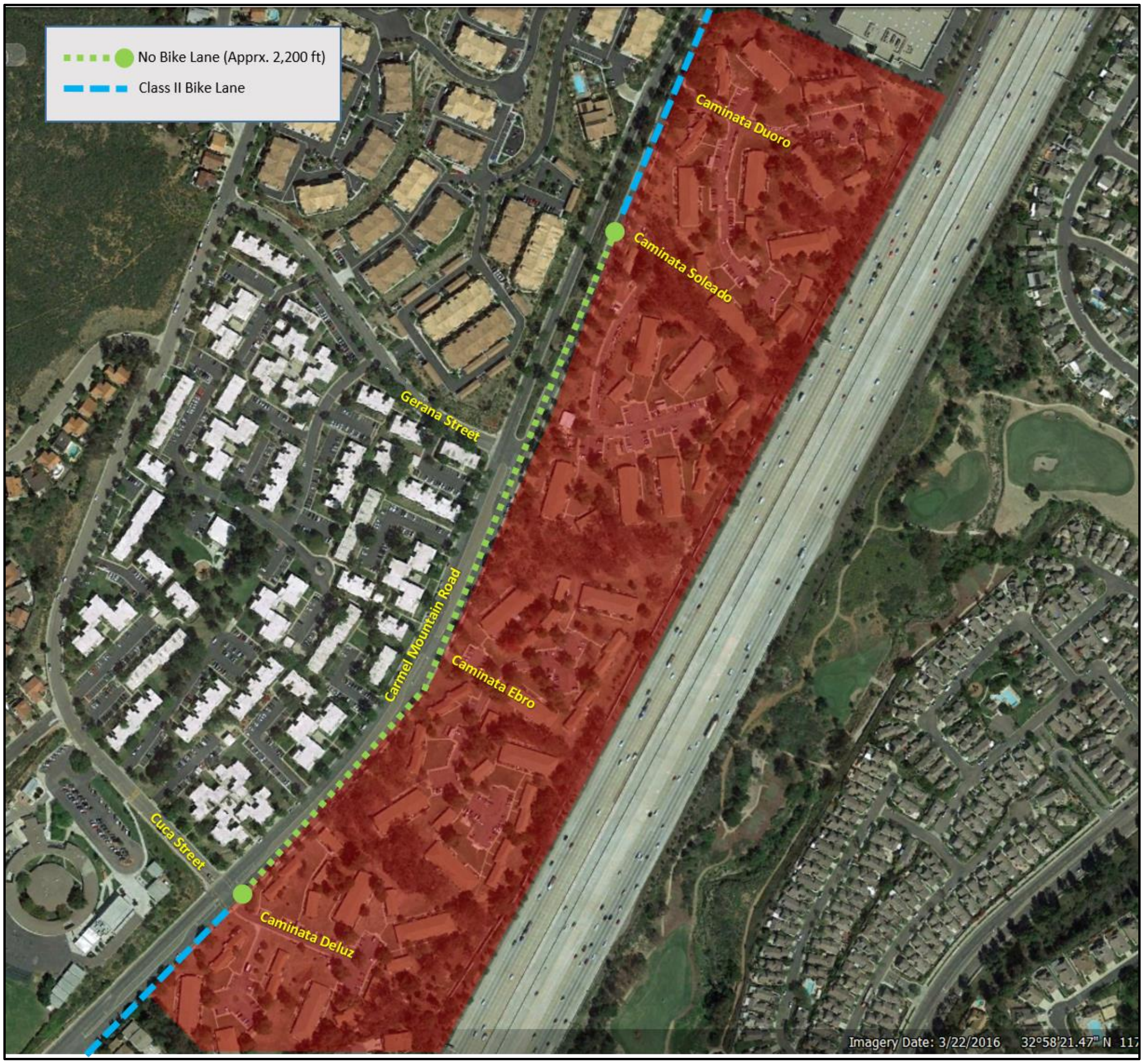
13.2 Bicycles

In the Project vicinity, Carmel Mountain Road is classified as a Four-Lane Major Road in the *Rancho Peñasquitos Community Plan*. This classification provides for a Class II bike lane, which in turn requires curbside parking prohibition. Carmel Mountain Road currently provides Class II bike lanes in both directions, with the exception of a gap in the northbound direction of approximately 2,200 feet. In this area, curbside parking is provided in lieu of the Class II bike lane. The gap begins at the Cuca Street/Caminata Deluz (future Access D) intersection, and continues along the Project frontage to Caminata Soleado. North of this intersection, the Class II bike lane resumes, and curbside parking is again prohibited.

The *City of San Diego Bike Master Plan* and the *Rancho Peñasquitos Community Plan* both indicate that the Class II bike lane should continue unabated along the entire extent of Carmel Mountain Road in the study area. To provide consistency with these plans, the Project proposes to remove the curbside parking and install a Class II bike lane along the frontage, closing the existing gap. This action will also be consistent with the City's Climate Action Plan Strategy 3 (Bicycling, Walking, Transit & Land Use) and goals for supporting transit/mode share opportunities within Transit Priority Areas (the Project lies within a mapped TPA).

The exhibit below graphically depicts the location of the existing bike lanes on the east side (Project frontage) of Carmel Mountain Road.

On site, bicyclists would share the internal roadways and walkways. Bike racks are located at the recreational amenity sites and outside the apartment buildings. Bike storage is also provided inside these buildings.



13.3 Transit

As mentioned earlier in *Section 3.3* of this report, bus stops are located along Carmel Mountain Road. Bus stops served by Route 20 are provided at the following locations:

- Peñasquitos Drive
- Caminata Soleado
  (future Access B to be realigned to Gerana Street)
- Gerana Street (Future Access B)
- Cuca Street (Access D)
- Caminata Ebro (Access C)
- Via San Marco
- Via Rimini
- Freeport Road
- Paseo Cardiel
- Rancho Peñasquitos Boulevard
- Stoney Creek Road

The locations along Carmel Mountain Road are within very close proximity to the Project site and the stops at Caminata Soleado, Caminata Ebro, Gerana Street and Cuca Street are fronting the Project site. Pedestrian crossings providing protected access to bus stops on both sides of the street are striped at the signalized intersections on Carmel Mountain Road at Peñasquitos Drive and Cuca Street. With the realignment of Access B to Gerana Street, a protected crosswalk will be provided via the intersection signalization, shortening the distance between Peñasquitos Drive and Cuca Street, further enhancing access to the transit stops.

Route 20 travels between the Rancho Bernardo Transit Station and Downtown San Diego. Monday through Friday it travels with 15 minute frequencies in the morning and 15-30 minute frequencies in the evening, between 4:55 AM and 11:26 PM. On Saturdays, it travels between 5:07 AM and 9:17 PM with 30 minute frequencies. Sundays it travels between 6:07 AM and 8:36 PM with hour long frequencies.

14.0 PARKING DISCUSSION

14.1 Minimum Required Parking

The City of San Diego Municipal Code (SDMC) was reviewed for determining the required parking supply for the proposed Project. Based on the different product types, the number of bedrooms per unit was used to determine the appropriate parking rate. Per the SDMC, one-bedroom units are required to provide 1.5 parking spaces, two-bedroom units are required to provide 2.0 parking spaces, and units consisting of three (3) to four (4) bedrooms shall provide 2.25 spaces. The common area parking requirement is an additional 15 to 20 percent above the off-street parking required. As noted in Section 142.0525(d), "Any multiple dwelling unit with a garage that does not provide a driveway that is at least 20 feet long, measured from the back of the sidewalk to that portion of the driveway most distant from the sidewalk…shall provide one (1) additional parking space. This additional parking space may be on-street, abutting the subject property." The single-family cluster units provide 99 additional spaces based on this requirement.

The apartment product proposes to provide 28 affordable units. The City parking rate for the affordable units is 1.0 space for one-bedroom units, 1.3 spaces for two-bedroom units, and 1.75 spaces for three-bedroom units.

Using City rates above, the "for sale" units (single-family cluster, tri-plexes and rowtowns) are required to provide 898 parking spaces including the 99 additional spaces (off-street or on-street) for the units that do not have 20-foot driveways. The apartments are required to provide 576 spaces. In total, the 601-unit Project would be required to provide a total of 1,474 parking spaces. A total of 60 motorcycle and 134 bicycle spaces are required.

14.2 Proposed Parking

A total of 1,444 off-street spaces are proposed by the Project. The "for sale" units (single-family cluster, tri-plexes and rowtowns) propose 912 parking spaces. The apartments propose to provide 532 spaces. On-site, there would be a parking shortfall of 30 spaces. A total of 60 motorcycle and 134 bicycle spaces are proposed in conformance with the code. ***Table 14–1*** shows a brief summary of the required and proposed parking.

There are currently approximately 83 on-street space fronting the Project site. As previously mentioned, the Project proposes to remove the existing on-street parking in compliance with the *City of San Diego Bicycle Master Plan*, *Rancho Peñasquitos Community Plan*, and *Street Design Manual*. This will support the City's Climate Action Plan Strategy 3 (Bicycling, Walking, Transit & Land Use) and goals for supporting transit/mode share opportunities within Transit Priority Areas (the Project lies within a mapped TPA). Thus, a parking supply deviation is requested with the Tentative Map submittal provided under separate cover.

TABLE 14–1
PARKING SUPPLY SUMMARY

<table>
<tr><th>Product Type</th><th># of Units</th><th>Bedroom Count</th><th>Basic Parking Ratios [a]</th><th>Basic Required Parking</th><th>Required % Common Area Parking</th><th>Required due to lack of 20’ Driveway</th><th>Total Garage Parking Provided</th><th>Total Surface Parking Provided</th><th>Accessible Parking Required</th><th>Motorcycle Parking Required</th><th>Bicycle Parking Required</th></tr>
<tr><td>SF Cluster</td><td>99</td><td>4</td><td>2.25</td><td>222.75</td><td>N/A</td><td>99</td><td>198</td><td>114</td><td rowspan="13">25 (Including 5 Van Accessible Spaces)</td><td>9.9</td><td>N/A</td></tr>
<tr><td rowspan="3">Triplex</td><td>35</td><td>2</td><td>2.00</td><td>70</td><td rowspan="3">45.5</td><td rowspan="3">N/A</td><td rowspan="3">210</td><td rowspan="3">90</td><td rowspan="3">10.5</td><td rowspan="3">N/A</td></tr>
<tr><td>35</td><td>3</td><td>2.25</td><td>78.75</td></tr>
<tr><td>35</td><td>4</td><td>2.25</td><td>78.75</td></tr>
<tr><td rowspan="3">Townhouses</td><td>70</td><td>2</td><td>2.00</td><td>140</td><td rowspan="3">50.5</td><td rowspan="3">N/A</td><td rowspan="3">240</td><td rowspan="3">60</td><td rowspan="3">12.0</td><td rowspan="3">N/A</td></tr>
<tr><td>25</td><td>3</td><td>2.25</td><td>56.25</td></tr>
<tr><td>25</td><td>4</td><td>2.25</td><td>56.25</td></tr>
<tr><td rowspan="3">E-Urban</td><td>101</td><td>1</td><td>1.50</td><td>151.5</td><td rowspan="3">69.45</td><td rowspan="6">N/A</td><td rowspan="6">226</td><td rowspan="6">306</td><td rowspan="3">24.9</td><td rowspan="3">120.60</td></tr>
<tr><td>86</td><td>2</td><td>2.00</td><td>172</td></tr>
<tr><td>62</td><td>3</td><td>2.25</td><td>139.5</td></tr>
<tr><td rowspan="3">Affordable</td><td>11</td><td>1</td><td>1.00</td><td>11</td><td rowspan="3">Visitor: 5.44
Staff: 1.81</td><td rowspan="3">2.8</td><td rowspan="3">13.60</td></tr>
<tr><td>10</td><td>2</td><td>1.30</td><td>13</td></tr>
<tr><td>7</td><td>3</td><td>1.75</td><td>12.25</td></tr>
<tr><td colspan="4">601 Total Dwelling Units</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td colspan="4" rowspan="2">Total Required Spaces</td><td>1202</td><td>172.70</td><td>99</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td colspan="3">1473.70</td><td>874</td><td>570</td><td>25</td><td>60.1</td><td>134.2</td></tr>
<tr><td colspan="4">Total Provided Spaces</td><td colspan="3">–</td><td colspan="2">1444</td><td>40</td><td>60</td><td>134</td></tr>
</table>

Source: Latitude 33 Planning & Engineering, 12/15/16.

Footnotes:

a. Ratios are based in Table 142-05C and Table 142-05D for the affordable units.

General Notes:

1. Parking has been calculated based on all applicable regulations from SDMC sections 142.0525 Multiple Dwelling Unit Residential Uses — Required Parking Ratios and 142.0527 Affordable Housing Parking Regulations.
2. N/A = Not applicable.

15.0 ACCESS ASSESSMENT

15.1 Site Access

Existing site access for Peñasquitos Village is provided via four (4) driveways on Carmel Mountain Road. The Project proposes to maintain four (4) driveways with the exception of realigning Access "B" from its current location to complete the fourth leg of the Carmel Mountain Road/ Gerana Street intersection. The access locations are listed below from north to south and are shown on *Figure 2–3* provided earlier in this report:

Access ID	Existing Street Name	Existing Configuration	Proposed Configuration
Access A	Caminata Duoro	Right-in/Right-out Only (unsignalized)	No change
Access B	Caminata Soleado	Right-in/Right-out Only (unsignalized)	Realigned to Gerana Street, full access, signalized
Access C	Caminata Ebro	Full access (unsignalized)	No change
Access D	Caminata Deluz	Full access (signalized)	No change

Access A is the northernmost access and is proposed to remain a stop-controlled right-turn in/right-turn out only driveway. This driveway would be the main access driveway for the "for rent" apartments. Trips destined to the south on Carmel Mountain Road would need to exit the driveway onto northbound Carmel Mountain Road and complete a northbound to southbound U-turn at the Carmel Mountain Road/ Peñasquitos Drive intersection. Trips originating from the north would travel southbound on Carmel Mountain Road and complete a southbound to northbound U-turn at the Carmel Mountain Road/ Gerana Street/Future Access B intersection.

Access B is the second-most northern access and is proposed to be realigned from its current location to connect to the Carmel Mountain Road/ Gerana Street intersection. With the realignment of this access point, a traffic signal would be installed as mitigation to improve operations at this intersection to acceptable levels. One 16-foot approach lane is proposed exiting the site with one 20-foot lane entering. Entering the site, the existing southbound left-turn pocket will be extended to a length of 250 feet with a 120 foot transition. The realignment will also reduce the amount of U-turns along this corridor by accommodating full turn movements and eliminating an existing right-turn in/right-turn out only driveway and the additional amount of U-turn trips that would otherwise use this intersection. This driveway will primarily serve the row towns and tri-plex units. A signal warrant analysis showing this unsignalized location meets signal warrants is provided in ***Appendix L***.

It should also be noted the improvements to this intersection will provide a new signalized crosswalk for pedestrians between the Peñasquitos Drive and Cuca Street intersections on Carmel Mountain Road. This will enhance the pedestrian circulation between the east and west sides of the roadways access transit stops.

Access C will remain in its existing location. This driveway will be minor street stop-controlled and continue to allow for full movements in/out of the site. A shared left-turn/right-turn lane is proposed exiting the site. It is anticipated that this driveway will primarily serve the tri-plex units and cluster homes.

Access D is the southernmost driveway and is proposed to remain at its current location opposite Cuca Street. This driveway is currently signalized and will be widened to provide a 12-foot shared left-turn/thru lane and a 16-foot dedicated right-turn lane exiting the site. It is anticipated that this driveway will primarily serve the cluster homes.

15.2 On-Site Circulation

As previously mentioned, the existing development is served by the four (4) access intersections along Carmel Mountain Road serving four (4) groupings of residential units. Within the existing site, there is no interconnectivity between these groupings. Each access point serves as the primary ingress/egress for the units located within each group and there is no way to circulate internally from one grouping of units to another.

With the development of the Project, a complete interconnected circulation system is proposed. This is an improvement over existing conditions given existing residents are currently required to exit their access driveway and travel onto Carmel Mountain Road to reach another access driveway. The design of the interconnected on-site circulation system will reduce both the total number of trips to Carmel Mountain Road and the out-of-direction travel that occurs with right-turn/right-turn out only driveways.

15.3 Access Volumes

Existing Development

As shown in *Table 7–1* of this report, the existing development on the site is currently generating traffic. The traffic generated by the site was distributed and assigned evenly to the four (4) existing driveways. ***Figure 13–1***, provided at the end of this section, shows the existing development driveway volumes for the Peñasquitos Village apartments.

Proposed Project

The traffic volumes generated by the proposed Project, as shown in *Table 7–1* provided earlier in this report, were also distributed and assigned to the four (4) driveways with the realignment of Access B across from Gerana Street. Although the driveways appear to be assigned to each distinct housing type based on the site design, since a well-connected internal circulation network is proposed, it is likely that trips will use the driveways providing the most convenient route to/from their origin/destination. Thus, the trips for the row towns, tri-plexes and cluster homes were evenly distributed to the three southern (3) driveways. The apartment trips were distributed to Access A, since this driveway is proposed as the main access point for these units. *Figure 13–1* also shows the proposed Project driveway volumes.

Net New Project Trips

The net increase in trips with the development of the proposed Project is also depicted on *Figure 15–1*. As seen on this graphic, the increase in trips at the Project driveways is about a 38% increase over existing driveway volumes.

Table 15–1 recaps the intersection levels of service for the Project access driveways under existing and post-Project conditions. As shown below, all access intersections are forecasted to operate at LOS C or better with development of the Project. Additionally, the Gerana Street/Access B intersection improves from LOS D to LOS C with the installation of a traffic signal proposed as mitigation. *Appendix L* provides the post-mitigation signalized intersection operations worksheets.

TABLE 15–1
ACCESS OPERATIONS

Intersection	Control Type	Peak Hour	Existing		Existing + Project		Existing + Cumulative Projects + Project		Year 2035 + Project	
			Delay [a]	LOS [b]	Delay	LOS	Delay	LOS	Delay	LOS
4. Carmel Mountain Rd/ Access A	MSSC [c]	AM	11.1	B	11.9	B	12.0	B	12.3	B
		PM	10.8	B	11.3	B	11.4	B	11.7	B
5. Carmel Mountain Rd/ Gerana St/ Access B	MSSC/ Signal [d]	AM	26.7	D	9.8	A	10.0	A	10.1	B
		PM	29.2	D	10.0	A	10.5	B	10.7	B
6. Carmel Mountain Rd/ Access C	MSSC	AM	15.1	C	16.1	C	16.2	C	17.7	C
		PM	15.1	C	16.0	C	16.1	C	17.8	C
7. Carmel Mountain Rd/ Cuca St/ Access D	Signal	AM	17.5	B	15.4	B	15.5	B	18.5	B
		PM	9.5	A	11.4	B	11.4	B	11.8	B

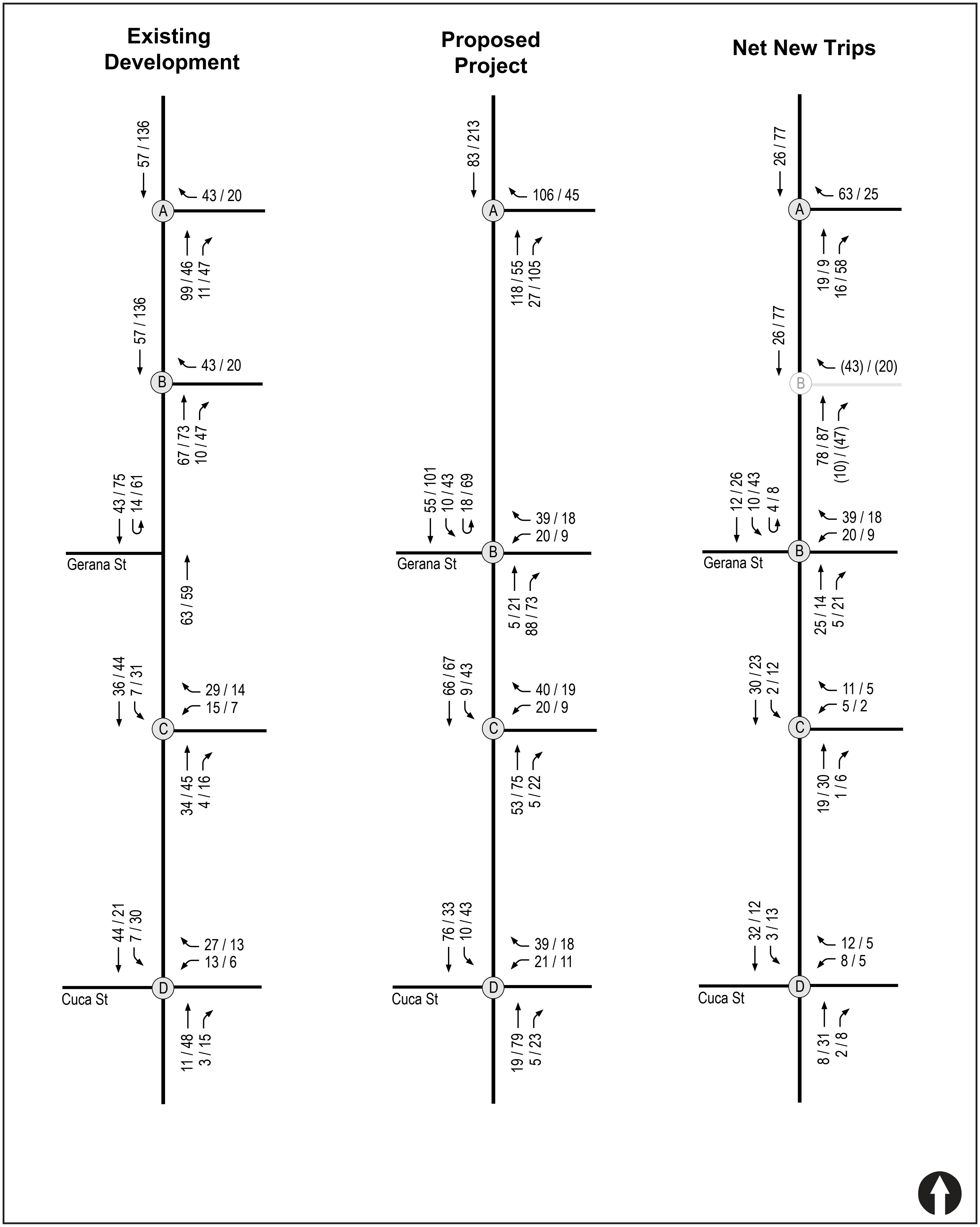
Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. MSSC = Minor Street Stop-Controlled intersection. Minor street critical movement delay reported.
d. A signal is proposed at this intersection to mitigate the Project's impacts to below significant levels. All "with Project" analysis shown above shows the post-mitigation traffic signal operations.

SIGNALIZED		UNSIGNALIZED	
DELAY/LOS THRESHOLDS		DELAY/LOS THRESHOLDS	
Delay	LOS	Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

15.4 Recommendations

The access scheme proposed by the Project results in improved circulation both internal to the site and along the Carmel Mountain Road corridor. Internally, access is improved by providing connectivity between the housing types allowing access to more full movement driveways than the current configuration. For Carmel Mountain Road, it eliminates U-turn movements with the realignment of Access B at Gerana Street. The mitigation to signalize the Gerana Street intersection will improve access for residents of the multi-family communities to the west of Carmel Mountain Road and it will improve the conditions for vehicles making the southbound to northbound U-turn movement where these vehicles currently have to make a judgement to find a gap in oncoming northbound traffic. As previously mentioned, a signal warrant analysis is provided in *Appendix L*.



LINSCOTT LAW & GREENSPAN engineers

N:\2472\Figures
Date: 09/28/16

Figure 15-1

Project Access Volumes

PACIFIC VILLAGE

16.0 SIGNIFICANCE OF IMPACTS, AND MITIGATION MEASURES

16.1 Significance of Impacts

Per City of San Diego significance thresholds and the analysis methodology presented in this report, Project-related traffic is calculated to result in one (1) direct and cumulative impact. The following section identifies the significance of impacts and recommended mitigation.

INTERSECTIONS

TRA-1. Intersection #5. Carmel Mountain Road/ Gerana Street/ Future Access B *(Direct & Cumulative Impact)*

STREET SEGMENTS

None.

16.2 Mitigation Measures

In order to mitigate the Project's direct and cumulative traffic impacts, the following is recommended.

INTERSECTIONS

TRA-1. **Intersection #5. Carmel Mountain Road/ Gerana Street/ Future Access B:** ***Access B*** is the second-most northern access and is proposed to be realigned from its current location to connect to the Carmel Mountain Road/ Gerana Street intersection. With the realignment of this access point, a traffic signal shall be installed reduce the impacts to below significant levels. One 16-foot approach lane is proposed exiting the site with one 20-foot lane entering. Entering the site, the existing southbound left-turn pocket will be extended to a length of 250 feet with a 120 foot transition. The realignment will also reduce the amount of U-turns along this corridor by accommodating full turn movements and eliminating an existing right-turn in/right-turn out only driveway and the additional amount of U-turn trips that would otherwise use this intersection. This driveway will primarily serve the row towns and tri-plex units. A signal warrant analysis showing this unsignalized location meets signal warrants is provided in *Appendix L*.

The post-mitigation level of service is provided earlier in this report in *Table 15–1*.

End of Report

LINSCOTT
LAW &
GREENSPAN
engineers

TECHNICAL APPENDICES

PACIFIC VILLAGE
(REDEVELOPMENT OF PEÑASQUITOS VILLAGE)
San Diego, California
January 27, 2017

LLG Ref. 3-15-2472

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Greenspan, Engineers
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APPENDICES

APPENDIX

APPENDIX A

INTERSECTION AND SEGMENT MANUAL COUNT SHEETS

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Carmel Mountain Road @ I-15 NB Ramps

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*

Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Carmel Mountain Road @ I-15 NB Ramps

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	0	0	0	29	261	0	112	0	25	0	132	48	607
7:15 AM	0	0	0	74	192	0	290	0	75	0	137	71	839
7:30 AM	0	0	0	71	214	0	264	0	38	0	180	99	866
7:45 AM	0	0	0	77	212	0	339	0	45	0	168	108	949
8:00 AM	0	0	0	78	177	0	248	1	43	0	85	94	726
8:15 AM	0	0	0	61	174	0	290	1	59	0	90	97	772
8:30 AM	0	0	0	87	180	0	282	1	53	0	127	92	822
8:45 AM	0	0	0	71	171	0	272	1	59	0	155	114	843
Total	0	0	0	548	1,581	0	2,097	4	397	0	1,074	723	6,424

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.86**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	0	0	0	251	879	0	1,005	0	183	0	617	326	3,261
PHF	#####	#####	#####	0.81	0.84	#####	0.74	#####	0.61	#####	0.86	0.75	0.86
Movement PHF		#DIV/0!			0.97			0.77			0.84		0.86

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	0	0	0	121	382	0	223	0	80	0	203	77	1,086
4:15 PM	0	0	0	134	412	0	147	1	74	0	222	65	1,055
4:30 PM	0	0	0	155	398	0	203	0	64	0	196	79	1,095
4:45 PM	0	0	0	137	392	0	183	0	90	0	228	55	1,085
5:00 PM	0	0	0	138	413	0	163	0	73	0	220	61	1,068
5:15 PM	0	0	0	152	440	0	129	0	60	0	230	51	1,062
5:30 PM	0	0	0	128	306	0	172	1	99	0	264	74	1,044
5:45 PM	0	0	0	138	346	0	191	0	98	0	207	61	1,041
Total	0	0	0	1,103	3,089	0	1,411	2	638	0	1,770	523	8,536

PM Intersection Peak Hour : **4:45 PM - 5:45 PM** Intersection PHF : **0.98**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	0	0	0	555	1551	0	647	1	322	0	942	241	4259
PHF	#####	#####	#####	0.913	0.881	#####	0.884	0.25	0.813	#####	0.892	0.814	0.98
Movement PHF		#DIV/0!			0.89			0.89			0.88		0.98

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

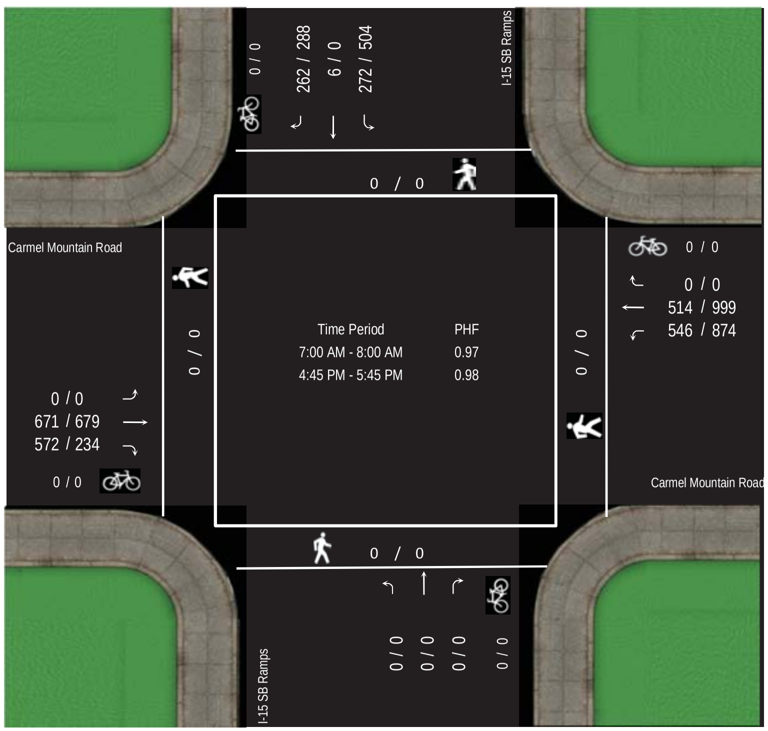
Location: Carmel Mountain Road @ I-15 SB Ramps

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Carmel Mountain Road @ I-15 SB Ramps

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	48	5	42	0	153	133	0	0	0	145	138	0	664
7:15 AM	78	0	77	0	135	130	0	0	0	160	131	0	711
7:30 AM	65	0	72	0	103	149	0	0	0	140	207	0	736
7:45 AM	71	1	81	0	123	134	0	0	0	127	195	0	732
8:00 AM	57	0	54	0	106	114	0	0	0	126	125	0	582
8:15 AM	67	1	62	0	105	128	0	0	0	131	125	0	619
8:30 AM	77	0	61	0	116	117	0	0	0	137	158	0	666
8:45 AM	60	0	70	0	127	103	0	0	0	92	199	0	651
Total	523	7	519	0	968	1,008	0	0	0	1,058	1,278	0	5,361

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.97**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	262	6	272	0	514	546	0	0	0	572	671	0	2,843
PHF	0.84	0.30	0.84	#####	0.84	0.92	#####	#####	#####	0.89	0.81	#####	0.97
Movement PHF		0.87			0.93			#DIV/0!			0.90		0.97

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	76	0	97	0	241	221	0	0	0	60	183	0	878
4:15 PM	72	0	114	0	283	203	0	0	0	57	173	0	902
4:30 PM	70	0	106	0	245	217	0	0	0	59	169	0	866
4:45 PM	62	0	124	0	277	205	0	0	0	58	159	0	885
5:00 PM	62	0	112	0	253	233	0	0	0	57	169	0	886
5:15 PM	76	0	126	0	285	215	0	0	0	53	155	0	910
5:30 PM	88	0	142	0	184	221	0	0	0	66	196	0	897
5:45 PM	61	0	120	0	235	209	0	0	0	69	148	0	842
Total	567	0	941	0	2,003	1,724	0	0	0	479	1,352	0	7,066

PM Intersection Peak Hour : **4:45 PM - 5:45 PM** Intersection PHF : **0.98**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	288	0	504	0	999	874	0	0	0	234	679	0	3578
PHF	0.82	#####	0.887	#####	0.876	0.938	#####	#####	#####	0.886	0.866	#####	0.98
Movement PHF		0.86			0.94			#DIV/0!			0.87		0.98

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

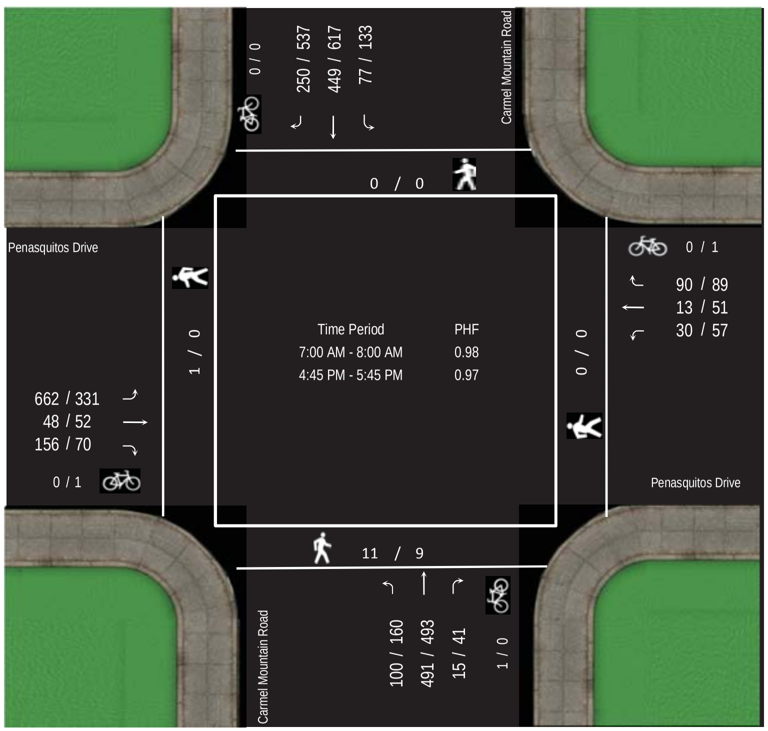
Location: Penasquitos Drive @ Carmel Mountain Road

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Penasquitos Drive @ Carmel Mountain Road

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	59	123	19	19	4	11	6	116	25	68	12	148	610
7:15 AM	63	121	29	22	1	4	2	118	31	41	15	151	598
7:30 AM	56	100	12	18	6	3	2	146	31	28	13	183	598
7:45 AM	72	105	17	31	2	12	5	111	13	19	8	180	575
8:00 AM	69	63	31	41	8	9	11	49	21	29	30	161	522
8:15 AM	66	78	28	38	9	7	9	64	18	21	17	154	509
8:30 AM	59	105	29	21	11	6	2	143	21	19	18	131	565
8:45 AM	53	103	31	26	5	4	15	144	7	17	11	121	537
Total	497	798	196	216	46	56	52	891	167	242	124	1,229	4,514

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.98**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	250	449	77	90	13	30	15	491	100	156	48	662	2,381
PHF	0.87	0.91	0.66	0.73	0.54	0.63	0.63	0.84	0.81	0.57	0.80	0.90	0.98
Movement PHF		0.91			0.74			0.85			0.95		0.98

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	99	182	36	34	12	10	9	107	26	13	8	102	638
4:15 PM	114	204	37	28	19	15	9	93	21	18	10	109	677
4:30 PM	103	181	31	36	10	13	9	101	26	14	13	91	628
4:45 PM	140	158	41	26	11	17	13	126	37	14	16	65	664
5:00 PM	106	178	31	25	11	15	9	128	31	23	9	73	639
5:15 PM	149	177	35	17	15	11	8	111	45	14	19	80	681
5:30 PM	142	104	26	21	14	14	11	128	47	19	8	113	647
5:45 PM	143	119	34	27	13	13	14	101	35	24	11	89	623
Total	996	1303	271	214	105	108	82	895	268	139	94	722	5,197

PM Intersection Peak Hour : **4:45 PM - 5:45 PM** Intersection PHF : **0.97**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	537	617	133	89	51	57	41	493	160	70	52	331	2631
PHF	0.90	0.867	0.811	0.856	0.85	0.838	0.788	0.963	0.851	0.761	0.684	0.732	0.97
Movement PHF		0.89			0.91			0.93			0.81		0.97

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Gerana Street @ Carmel Mountain Road

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*

Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Gerana Street @ Carmel Mountain Road

AM Period (7:00 AM - 9:00 AM)

	Southbound			Northbound		Eastbound		
	Right	Thru	U-turn	Thru	Left	Right	Left	TOTAL
7:00 AM	7	193	2	111	10	32	9	364
7:15 AM	4	155	7	136	12	12	12	338
7:30 AM	5	105	3	165	19	15	25	337
7:45 AM	7	100	8	150	4	9	14	292
8:00 AM	8	89	5	90	5	9	17	223
8:15 AM	2	74	3	104	4	7	11	205
8:30 AM	10	86	3	135	0	8	9	251
8:45 AM	5	70	5	139	8	4	15	246
Total	48	872	36	1,030	62	96	112	2,256

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.91**

	Southbound			Northbound		Eastbound		TOTAL
	Right	Thru	U-turn	Thru	Left	Right	Left	
Volume	23	553	20	562	45	68	60	1,331
PHF	0.82	0.72	0.63	0.85	0.59	0.53	0.60	0.91
Movement PHF		0.74		0.82		0.78		0.91

PM Period (4:00 PM - 6:00 PM)

	Southbound			Northbound		Eastbound		
	Right	Thru	U-turn	Thru	Left	Right	Left	TOTAL
4:00 PM	10	123	3	127	8	5	10	286
4:15 PM	11	147	11	123	5	4	8	309
4:30 PM	15	129	6	160	14	8	8	340
4:45 PM	18	133	6	163	11	12	6	349
5:00 PM	19	143	5	141	14	6	12	340
5:15 PM	12	119	7	156	15	3	8	320
5:30 PM	15	141	8	177	16	5	12	374
5:45 PM	13	146	6	137	14	3	6	325
Total	113	1081	52	1,184	97	46	70	2,643

PM Intersection Peak Hour : **4:45 PM - 5:45 PM** Intersection PHF : **0.92**

	Southbound			Northbound		Eastbound		TOTAL
	Right	Thru	U-turn	Thru	Left	Right	Left	
Volume	64	536	26	637	56	26	38	1383
PHF	0.84	0.937	0.8125	0.9	0.875	0.542	0.792	0.92
Movement PHF		0.94		0.90		0.89		0.92

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

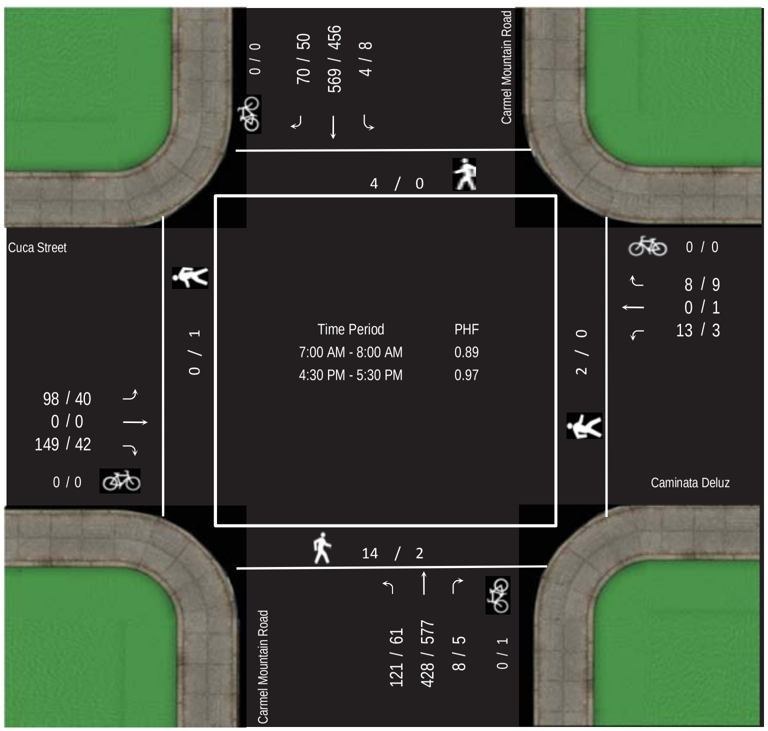
Location: Cuca Street @ Carmel Mountain Road

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Cuca Street @ Carmel Mountain Road

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	11	215	2	3	0	7	1	98	17	38	0	22	414
7:15 AM	18	157	1	1	0	4	2	112	24	34	0	19	372
7:30 AM	18	112	1	4	0	2	3	122	53	32	0	23	370
7:45 AM	23	85	0	0	0	0	2	96	27	45	0	34	312
8:00 AM	13	82	3	0	0	2	2	75	12	13	0	17	219
8:15 AM	14	54	1	0	1	0	2	79	29	16	0	21	217
8:30 AM	22	63	0	0	0	0	1	77	61	42	0	41	307
8:45 AM	23	53	0	0	0	0	0	80	35	42	0	46	279
Total	142	821	8	8	1	15	13	739	258	262	0	223	2,490

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.89**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	70	569	4	8	0	13	8	428	121	149	0	98	1,468
PHF	0.76	0.66	0.50	0.50	#####	0.46	0.67	0.88	0.57	0.83	#####	0.72	0.89
Movement PHF		0.71			0.53			0.78			0.78		0.89

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	15	107	1	0	0	0	0	128	15	6	0	4	276
4:15 PM	18	106	0	0	0	0	2	110	9	11	0	10	266
4:30 PM	14	119	1	2	1	1	0	139	15	8	0	10	310
4:45 PM	9	118	1	1	0	0	1	143	18	10	0	12	313
5:00 PM	11	126	5	4	0	1	3	140	11	14	0	8	323
5:15 PM	16	93	1	2	0	1	1	155	17	10	0	10	306
5:30 PM	9	105	0	0	0	0	1	142	17	7	0	9	290
5:45 PM	21	116	10	0	0	0	0	136	14	15	0	7	319
Total	113	890	19	9	1	3	8	1,093	116	81	0	70	2,403

PM Intersection Peak Hour : **4:30 PM - 5:30 PM** Intersection PHF : **0.97**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	50	456	8	9	1	3	5	577	61	42	0	40	1252
PHF	0.78	0.905	0.4	0.563	0.25	0.75	0.417	0.931	0.847	0.75	#####	0.833	0.97
Movement PHF		0.90			0.65			0.93			0.93		0.97

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

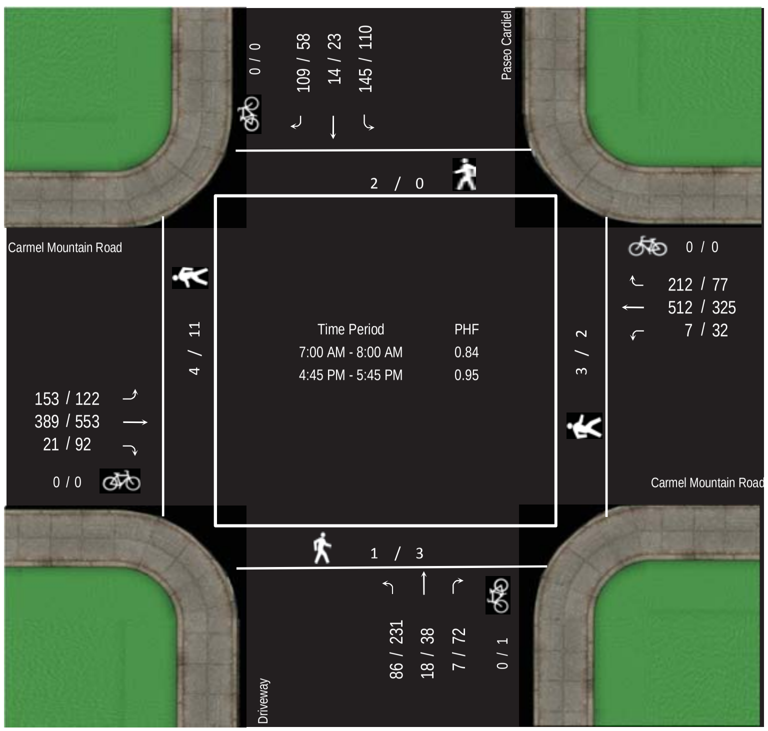
Location: Carmel Mountain Road @ Paseo Cardiel

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Carmel Mountain Road @ Paseo Cardiel

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	32	1	19	95	142	0	0	5	19	2	63	72	450
7:15 AM	31	4	44	90	146	1	2	11	23	3	86	55	496
7:30 AM	24	3	50	14	94	2	2	1	22	6	129	17	364
7:45 AM	22	6	32	13	130	4	3	1	22	10	111	9	363
8:00 AM	25	3	11	10	94	3	2	4	35	7	85	13	292
8:15 AM	25	2	14	14	84	4	2	4	36	8	87	11	291
8:30 AM	25	3	25	15	100	2	3	2	35	6	74	8	298
8:45 AM	19	2	11	9	113	6	3	2	26	14	73	14	292
Total	203	24	206	260	903	22	17	30	218	56	708	199	2,846

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.84**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	109	14	145	212	512	7	7	18	86	21	389	153	1,673
PHF	0.85	0.58	0.73	0.56	0.88	0.44	0.58	0.41	0.93	0.53	0.75	0.53	0.84
Movement PHF		0.85			0.77			0.77			0.93		0.84

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	8	5	32	12	72	10	6	6	41	13	105	27	337
4:15 PM	15	8	30	16	85	6	9	12	39	10	132	23	385
4:30 PM	6	6	14	21	65	11	12	13	54	17	128	24	371
4:45 PM	14	7	20	20	76	5	22	10	64	23	133	30	424
5:00 PM	9	6	25	18	84	11	15	10	59	23	145	29	434
5:15 PM	18	4	31	20	88	11	17	7	58	24	141	37	456
5:30 PM	17	6	34	19	77	5	18	11	50	22	134	26	419
5:45 PM	15	7	27	12	83	12	12	7	61	14	143	30	423
Total	102	49	213	138	630	71	111	76	426	146	1,061	226	3,249

PM Intersection Peak Hour : **4:45 PM - 5:45 PM** Intersection PHF : **0.95**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	58	23	110	77	325	32	72	38	231	92	553	122	1733
PHF	0.81	0.821	0.809	0.963	0.923	0.727	0.818	0.864	0.902	0.958	0.953	0.824	0.95
Movement PHF		0.84			0.91			0.89			0.95		0.95

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

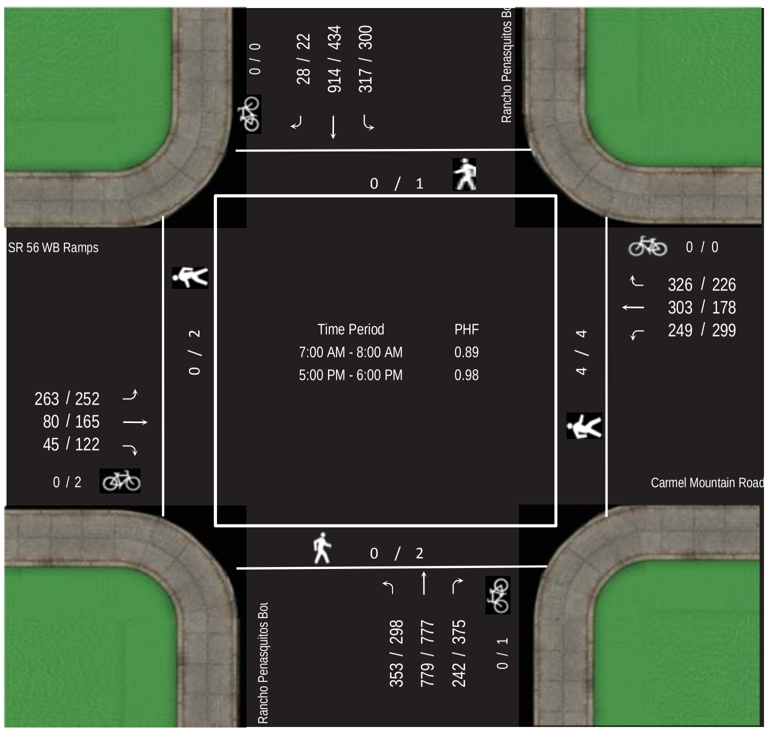
Location: Carmel Mountain Road @ Rancho Penasquitos Boulevard - SR 5

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Carmel Mountain Road @ Rancho Penasquitos Boulevard - S

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	2	214	49	79	68	65	66	252	113	7	32	90	1,037
7:15 AM	4	278	94	106	99	65	66	209	84	11	14	63	1,093
7:30 AM	17	280	111	60	94	41	49	185	77	10	12	49	985
7:45 AM	5	142	63	81	42	78	61	133	79	17	22	61	784
8:00 AM	3	253	53	45	57	54	40	134	98	2	12	29	780
8:15 AM	8	179	55	43	58	69	45	94	99	20	30	39	739
8:30 AM	3	152	43	40	77	79	56	241	62	10	15	35	813
8:45 AM	4	93	57	46	58	82	48	89	94	17	25	25	638
Total	46	1,591	525	500	553	533	431	1,337	706	94	162	391	6,869

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.89**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	28	914	317	326	303	249	242	779	353	45	80	263	3,899
PHF	0.41	0.82	0.71	0.77	0.77	0.80	0.92	0.77	0.78	0.66	0.63	0.73	0.89
Movement PHF		0.77			0.81			0.80			0.75		0.89

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	7	108	42	54	31	55	76	124	68	30	29	39	663
4:15 PM	3	115	62	58	44	57	68	162	74	25	23	56	747
4:30 PM	4	110	77	45	30	82	83	156	74	23	42	60	786
4:45 PM	7	89	84	69	58	63	86	173	82	31	48	50	840
5:00 PM	3	115	70	55	43	67	99	201	69	27	35	55	839
5:15 PM	6	137	66	55	52	63	93	196	78	20	51	63	880
5:30 PM	4	98	72	55	37	91	91	191	83	36	37	57	852
5:45 PM	9	84	92	61	46	78	92	189	68	39	42	77	877
Total	43	856	565	452	341	556	688	1,392	596	231	307	457	6,484

PM Intersection Peak Hour : **5:00 PM - 6:00 PM** Intersection PHF : **0.98**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	22	434	300	226	178	299	375	777	298	122	165	252	3448
PHF	0.61	0.792	0.815	0.926	0.856	0.821	0.947	0.966	0.898	0.782	0.809	0.818	0.98
Movement PHF		0.90			0.95			0.98			0.85		0.98

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

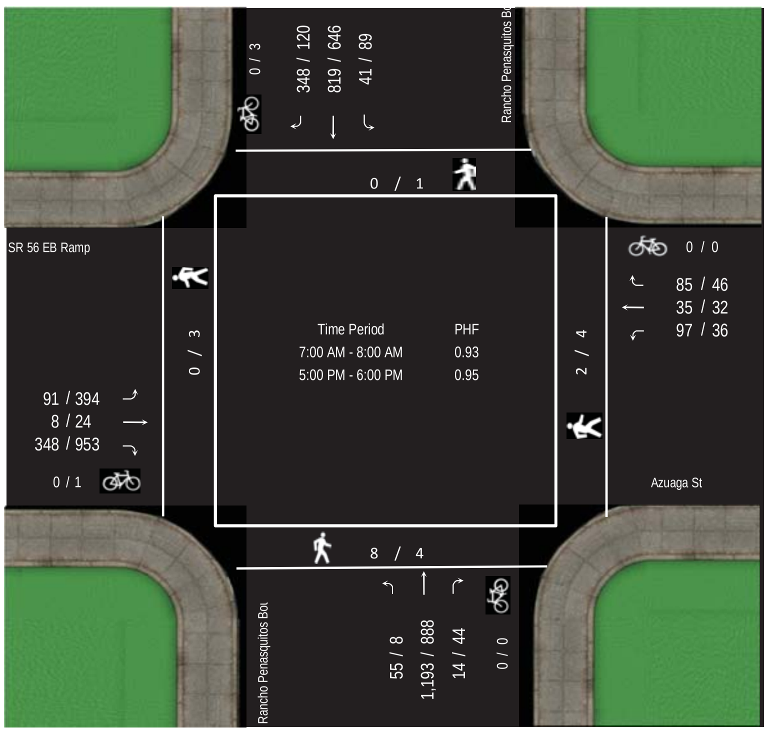
Location: SR 56 EB Ramp @ Rancho Penasquitos Boulevard

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: SR 56 EB Ramp @ Rancho Penasquitos Boulevard

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	73	210	3	22	13	25	2	352	4	70	0	26	800
7:15 AM	112	237	5	16	11	22	3	306	25	92	2	14	845
7:30 AM	92	221	18	21	4	28	6	317	9	83	2	17	818
7:45 AM	71	151	15	26	7	22	3	218	17	103	4	34	671
8:00 AM	100	203	6	22	8	14	2	183	10	107	3	36	694
8:15 AM	83	176	9	20	8	16	2	205	14	118	1	31	683
8:30 AM	68	166	7	22	16	15	2	347	16	85	0	39	783
8:45 AM	40	148	4	19	9	16	4	172	9	101	2	30	554
Total	639	1,512	67	168	76	158	24	2,100	104	759	14	227	5,848

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.93**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	348	819	41	85	35	97	14	1,193	55	348	8	91	3,134
PHF	0.78	0.86	0.57	0.82	0.67	0.87	0.58	0.85	0.55	0.84	0.50	0.67	0.93
Movement PHF		0.85			0.90			0.88			0.79		0.93

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	27	154	12	9	5	10	8	203	0	179	4	78	689
4:15 PM	22	156	19	8	4	11	13	282	1	141	14	59	730
4:30 PM	30	170	15	7	2	6	13	231	1	160	7	99	741
4:45 PM	19	143	21	11	5	12	14	203	4	133	8	74	647
5:00 PM	28	159	22	16	8	6	8	209	2	241	7	110	816
5:15 PM	24	179	17	8	10	12	7	226	5	235	6	84	813
5:30 PM	34	169	22	11	7	10	9	222	1	208	3	91	787
5:45 PM	34	139	28	11	7	8	20	231	0	269	8	109	864
Total	218	1269	156	81	48	75	92	1,807	14	1,566	57	704	6,087

PM Intersection Peak Hour : **5:00 PM - 6:00 PM** Intersection PHF : **0.95**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	120	646	89	46	32	36	44	888	8	953	24	394	3280
PHF	0.88	0.902	0.795	0.719	0.8	0.75	0.55	0.961	0.4	0.886	0.75	0.895	0.95
Movement PHF		0.95			0.95			0.94			0.89		0.95

Turn Count Summary

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

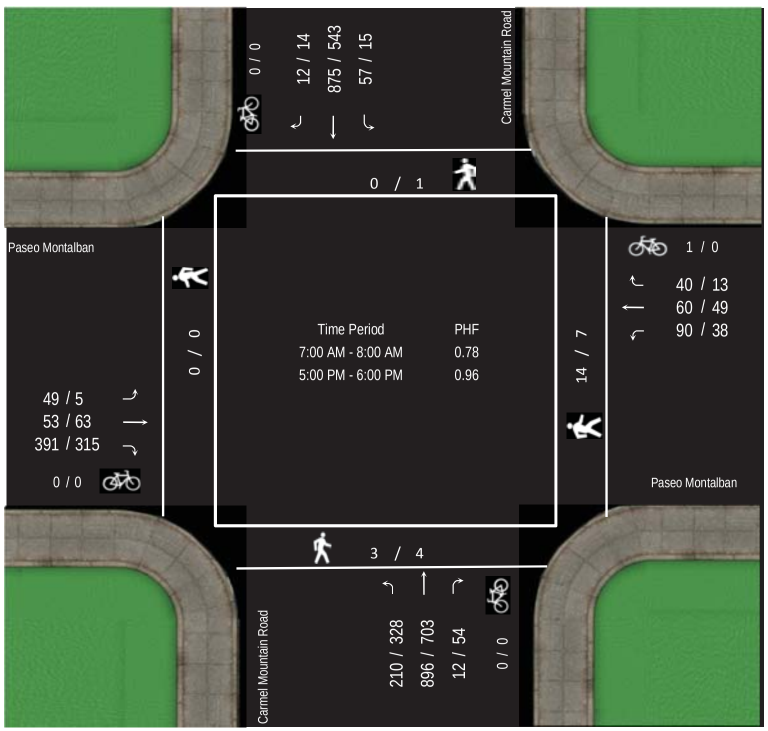
Location: Paseo Montalban @ Carmel Mountain Road

Date of Count: *Tuesday, November 17, 2015*

Analysts: *LV/CD*

Weather: *Sunny*

AVC Proj No: *15-0448*



Vehicular Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: Paseo Montalban @ Carmel Mountain Road

AM Period (7:00 AM - 9:00 AM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
7:00 AM	1	178	9	8	13	27	1	295	30	105	12	16	695
7:15 AM	2	302	24	21	20	26	6	276	58	109	18	17	879
7:30 AM	4	232	14	5	17	25	2	160	58	103	7	10	637
7:45 AM	5	163	10	6	10	12	3	165	64	74	16	6	534
8:00 AM	5	198	7	13	7	15	2	152	45	83	8	15	550
8:15 AM	9	185	5	9	9	14	2	104	41	76	6	10	470
8:30 AM	2	122	1	2	7	14	3	87	33	60	11	6	348
8:45 AM	2	98	6	2	10	11	2	72	55	53	8	4	323
Total	30	1,478	76	66	93	144	21	1,311	384	663	86	84	4,436

AM Intersection Peak Hour : **7:00 AM - 8:00 AM** Intersection PHF : **0.78**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	12	875	57	40	60	90	12	896	210	391	53	49	2,745
PHF	0.60	0.72	0.59	0.48	0.75	0.83	0.50	0.76	0.82	0.90	0.74	0.72	0.78
Movement PHF		0.72			0.71			0.82			0.86		0.78

PM Period (4:00 PM - 6:00 PM)

	Southbound			Westbound			Northbound			Eastbound			
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	TOTAL
4:00 PM	3	102	3	3	9	9	9	119	68	54	15	4	398
4:15 PM	1	98	9	5	13	6	18	140	84	98	15	5	492
4:30 PM	1	132	1	6	15	10	13	139	68	59	22	3	469
4:45 PM	2	101	4	2	13	12	11	186	86	75	17	0	509
5:00 PM	3	138	7	3	14	11	15	173	88	84	19	2	557
5:15 PM	8	155	1	2	17	10	20	171	75	76	11	1	547
5:30 PM	1	128	7	3	6	8	6	160	80	72	24	1	496
5:45 PM	2	122	0	5	12	9	13	199	85	83	9	1	540
Total	21	976	32	29	99	75	105	1,287	634	601	132	17	4,008

PM Intersection Peak Hour : **5:00 PM - 6:00 PM** Intersection PHF : **0.96**

	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Volume	14	543	15	13	49	38	54	703	328	315	63	5	2140
PHF	0.44	0.876	0.536	0.65	0.721	0.864	0.675	0.883	0.932	0.938	0.656	0.625	0.96
Movement PHF		0.87			0.86			0.91			0.91		0.96

24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 1. Carmel Mountain Road, I-15 SB Ramps to Penasquitos Drive

Orientation: *North-South*

Date of Count: *Tuesday, November 17, 2015*

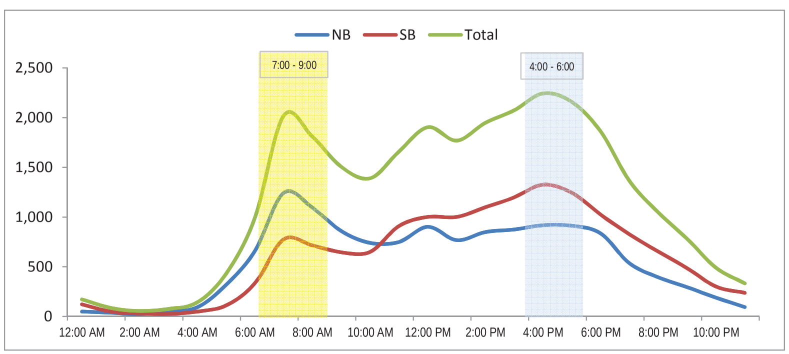
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume				28,302			
Time	NB	SB	Total	Time	NB	SB	Total
12:00 AM - 1:00 AM	50	122	172	12:00 PM - 1:00 PM	902	1,002	1,904
1:00 AM - 2:00 AM	38	49	87	1:00 PM - 2:00 PM	768	1,001	1,769
2:00 AM - 3:00 AM	24	31	55	2:00 PM - 3:00 PM	849	1,099	1,948
3:00 AM - 4:00 AM	51	26	77	3:00 PM - 4:00 PM	875	1,199	2,074
4:00 AM - 5:00 AM	92	50	142	4:00 PM - 5:00 PM	918	1,326	2,244
5:00 AM - 6:00 AM	318	111	429	5:00 PM - 6:00 PM	913	1,244	2,157
6:00 AM - 7:00 AM	658	333	991	6:00 PM - 7:00 PM	835	1,025	1,860
7:00 AM - 8:00 AM	1,243	776	2,019	7:00 PM - 8:00 PM	535	827	1,362
8:00 AM - 9:00 AM	1,093	715	1,808	8:00 PM - 9:00 PM	394	652	1,046
9:00 AM - 10:00 AM	859	646	1,505	9:00 PM - 10:00 PM	295	486	781
10:00 AM - 11:00 AM	740	650	1,390	10:00 PM - 11:00 PM	189	301	490
11:00 AM - 12:00 PM	749	910	1659	11:00 PM - 12:00 AM	95	238	333
Total	5,915	4,419	10,334	Total	7,568	10,400	17,968

24-Hour NB Volume 13,483 24-Hour SB Volume 14,819



24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 2. Carmel Mountain Road, Penasquitos Drive to Gerana Street

Orientation: *North-South*

Date of Count: *Tuesday, November 17, 2015*

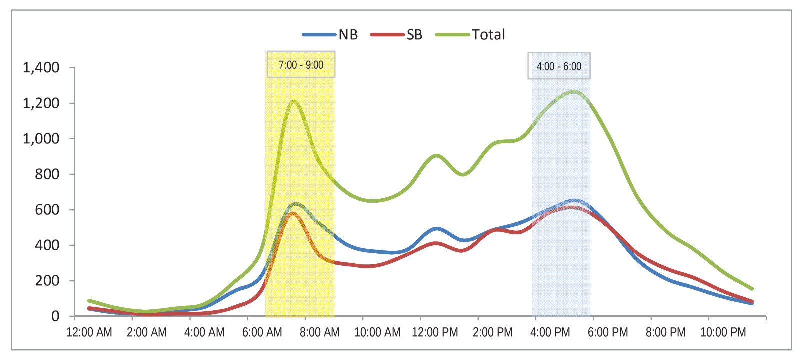
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume				14,057			
Time	NB	SB	Total	Time	NB	SB	Total
12:00 AM - 1:00 AM	42	46	88	12:00 PM - 1:00 PM	493	411	904
1:00 AM - 2:00 AM	19	26	45	1:00 PM - 2:00 PM	427	371	798
2:00 AM - 3:00 AM	17	10	27	2:00 PM - 3:00 PM	485	483	968
3:00 AM - 4:00 AM	30	15	45	3:00 PM - 4:00 PM	529	476	1,005
4:00 AM - 5:00 AM	52	17	69	4:00 PM - 5:00 PM	605	586	1,191
5:00 AM - 6:00 AM	139	49	188	5:00 PM - 6:00 PM	649	608	1,257
6:00 AM - 7:00 AM	233	152	385	6:00 PM - 7:00 PM	516	509	1,025
7:00 AM - 8:00 AM	622	576	1,198	7:00 PM - 8:00 PM	321	357	678
8:00 AM - 9:00 AM	520	344	864	8:00 PM - 9:00 PM	213	270	483
9:00 AM - 10:00 AM	399	292	691	9:00 PM - 10:00 PM	160	216	376
10:00 AM - 11:00 AM	364	286	650	10:00 PM - 11:00 PM	109	141	250
11:00 AM - 12:00 PM	372	345	717	11:00 PM - 12:00 AM	72	83	155
Total	2,809	2,158	4,967	Total	4,579	4,511	9,090

24-Hour NB Volume 7,388 24-Hour SB Volume 6,669



24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 3. Carmel Mountain Road, Gerana Street to Cuca Street

Orientation: *North-South*

Date of Count: *Tuesday, November 17, 2015*

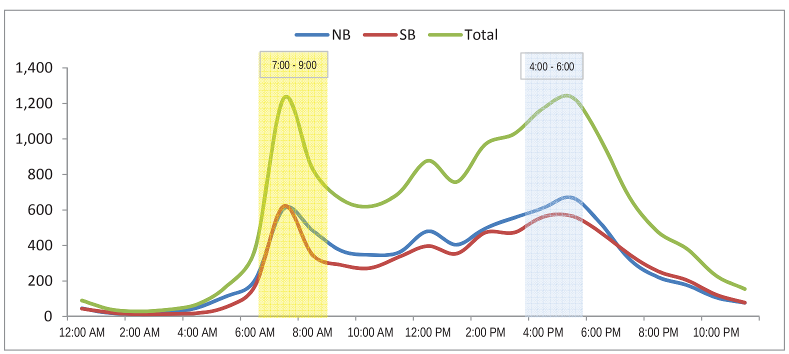
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume								13,795
Time	Hourly Volume			Time	Hourly Volume			
	NB	SB	Total		NB	SB	Total	
12:00 AM - 1:00 AM	46	44	90	12:00 PM - 1:00 PM	480	397	877	
1:00 AM - 2:00 AM	18	22	40	1:00 PM - 2:00 PM	404	354	758	
2:00 AM - 3:00 AM	17	12	29	2:00 PM - 3:00 PM	497	473	970	
3:00 AM - 4:00 AM	24	15	39	3:00 PM - 4:00 PM	556	473	1,029	
4:00 AM - 5:00 AM	50	19	69	4:00 PM - 5:00 PM	611	561	1,172	
5:00 AM - 6:00 AM	114	54	168	5:00 PM - 6:00 PM	670	566	1,236	
6:00 AM - 7:00 AM	204	170	374	6:00 PM - 7:00 PM	524	473	997	
7:00 AM - 8:00 AM	607	621	1,228	7:00 PM - 8:00 PM	322	349	671	
8:00 AM - 9:00 AM	485	347	832	8:00 PM - 9:00 PM	221	254	475	
9:00 AM - 10:00 AM	370	290	660	9:00 PM - 10:00 PM	176	204	380	
10:00 AM - 11:00 AM	347	273	620	10:00 PM - 11:00 PM	107	123	230	
11:00 AM - 12:00 PM	361	335	696	11:00 PM - 12:00 AM	77	78	155	
Total	2,643	2,202	4,845	Total	4,645	4,305	8,950	

24-Hour	NB	Volume	7,288	24-Hour	SB	Volume	6,507



24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 4. Carmel Mountain Road, Cuca Street to Paseo Cardiel

Orientation: *East-West*

Date of Count: *Tuesday, November 17, 2015*

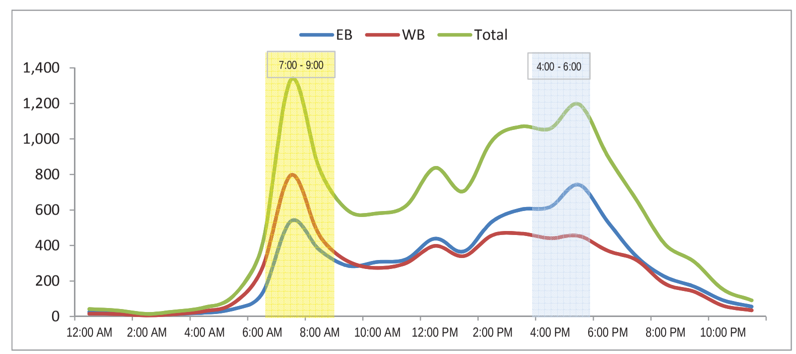
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume								13,025
Time	Hourly Volume			Time	Hourly Volume			
	EB	WB	Total		EB	WB	Total	
12:00 AM - 1:00 AM	26	16	42	12:00 PM - 1:00 PM	439	398	837	
1:00 AM - 2:00 AM	20	14	34	1:00 PM - 2:00 PM	366	340	706	
2:00 AM - 3:00 AM	9	6	15	2:00 PM - 3:00 PM	536	458	994	
3:00 AM - 4:00 AM	15	14	29	3:00 PM - 4:00 PM	603	467	1,070	
4:00 AM - 5:00 AM	21	30	51	4:00 PM - 5:00 PM	617	441	1,058	
5:00 AM - 6:00 AM	42	74	116	5:00 PM - 6:00 PM	742	454	1,196	
6:00 AM - 7:00 AM	128	269	397	6:00 PM - 7:00 PM	534	370	904	
7:00 AM - 8:00 AM	537	796	1,333	7:00 PM - 8:00 PM	338	318	656	
8:00 AM - 9:00 AM	374	455	829	8:00 PM - 9:00 PM	223	183	406	
9:00 AM - 10:00 AM	285	310	595	9:00 PM - 10:00 PM	169	140	309	
10:00 AM - 11:00 AM	307	274	581	10:00 PM - 11:00 PM	92	61	153	
11:00 AM - 12:00 PM	322	301	623	11:00 PM - 12:00 AM	56	35	91	
Total	2,086	2,559	4,645	Total	4,715	3,665	8,380	

24-Hour	EB	Volume	6,801	24-Hour	WB	Volume	6,224



24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 5. Carmel Mountain Road, Paseo Cardiel to Rancho Penasquitos Blvd

Orientation: *East-West*

Date of Count: *Tuesday, November 17, 2015*

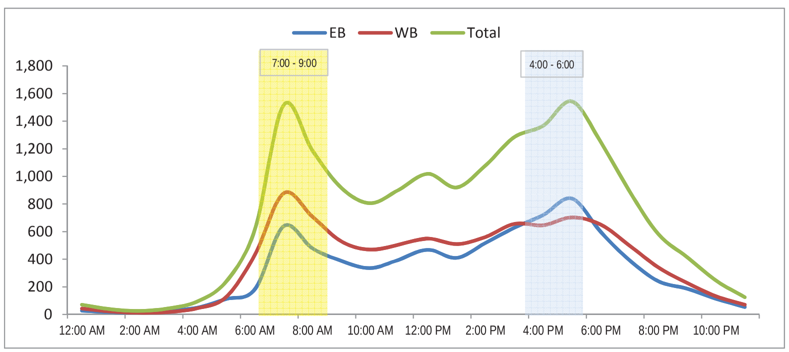
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume								17,176
Time	Hourly Volume			Time	Hourly Volume			
	EB	WB	Total		EB	WB	Total	
12:00 AM - 1:00 AM	28	43	71	12:00 PM - 1:00 PM	469	550	1,019	
1:00 AM - 2:00 AM	17	21	38	1:00 PM - 2:00 PM	410	510	920	
2:00 AM - 3:00 AM	13	13	26	2:00 PM - 3:00 PM	518	561	1,079	
3:00 AM - 4:00 AM	26	18	44	3:00 PM - 4:00 PM	628	656	1,284	
4:00 AM - 5:00 AM	49	45	94	4:00 PM - 5:00 PM	720	646	1,366	
5:00 AM - 6:00 AM	112	126	238	5:00 PM - 6:00 PM	840	703	1,543	
6:00 AM - 7:00 AM	182	432	614	6:00 PM - 7:00 PM	598	651	1,249	
7:00 AM - 8:00 AM	639	878	1,517	7:00 PM - 8:00 PM	393	499	892	
8:00 AM - 9:00 AM	479	708	1,187	8:00 PM - 9:00 PM	241	341	582	
9:00 AM - 10:00 AM	388	529	917	9:00 PM - 10:00 PM	187	228	415	
10:00 AM - 11:00 AM	336	470	806	10:00 PM - 11:00 PM	114	132	246	
11:00 AM - 12:00 PM	398	506	904	11:00 PM - 12:00 AM	54	71	125	
Total	2,667	3,789	6,456	Total	5,172	5,548	10,720	

24-Hour	EB	Volume	7,839	24-Hour	WB	Volume	9,337



24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 6. Carmel Mountain Road, Rancho Penasquitos Blvd to Paseo Montalban

Orientation: *North-South*

Date of Count: *Tuesday, November 17, 2015*

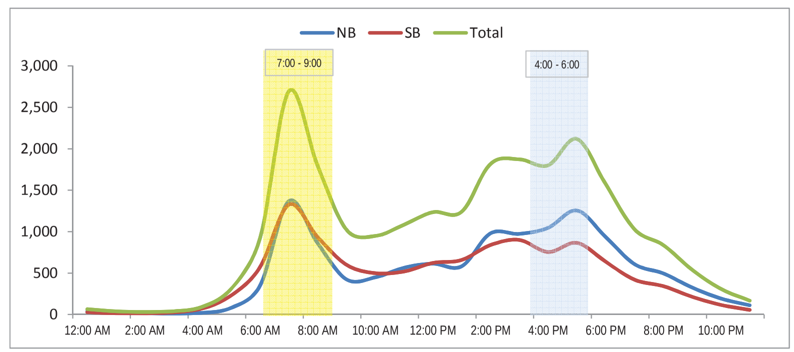
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume								23,580
Time	Hourly Volume			Time	Hourly Volume			
	NB	SB	Total		NB	SB	Total	
12:00 AM - 1:00 AM	36	28	64	12:00 PM - 1:00 PM	613	622	1,235	
1:00 AM - 2:00 AM	24	14	38	1:00 PM - 2:00 PM	582	658	1,240	
2:00 AM - 3:00 AM	16	15	31	2:00 PM - 3:00 PM	979	838	1,817	
3:00 AM - 4:00 AM	13	26	39	3:00 PM - 4:00 PM	973	900	1,873	
4:00 AM - 5:00 AM	21	73	94	4:00 PM - 5:00 PM	1,046	754	1,800	
5:00 AM - 6:00 AM	81	231	312	5:00 PM - 6:00 PM	1,255	864	2,119	
6:00 AM - 7:00 AM	348	572	920	6:00 PM - 7:00 PM	935	637	1,572	
7:00 AM - 8:00 AM	1,368	1,326	2,694	7:00 PM - 8:00 PM	608	420	1,028	
8:00 AM - 9:00 AM	860	934	1,794	8:00 PM - 9:00 PM	496	342	838	
9:00 AM - 10:00 AM	424	600	1,024	9:00 PM - 10:00 PM	326	214	540	
10:00 AM - 11:00 AM	449	499	948	10:00 PM - 11:00 PM	193	116	309	
11:00 AM - 12:00 PM	565	519	1084	11:00 PM - 12:00 AM	111	56	167	
Total	4,205	4,837	9,042	Total	8,117	6,421	14,538	

24-Hour	NB	Volume	12,322	24-Hour	SB	Volume	11,258



24 Hour Segment Count

Accurate Video Counts Inc
info@accuratevideocounts.com
(619) 987-5136

Location: 7. Carmel Mountain Road, Paseo Montalban to Sundevil Way

Orientation: *East-West*

Date of Count: *Tuesday, November 17, 2015*

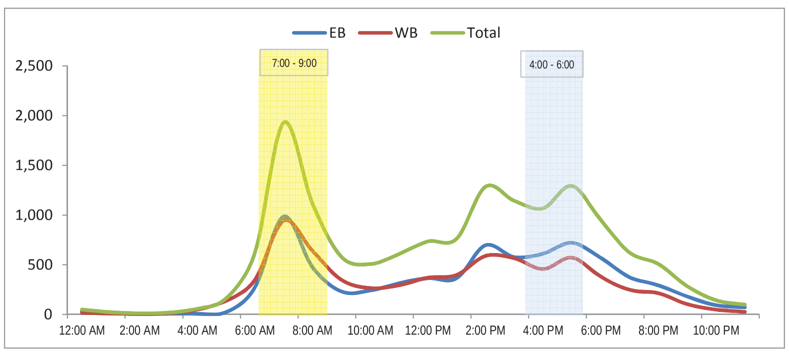
Analysts: *DASH*

Weather: *Sunny*

AVC Proj. No: *15-0448*

24 Hour Segment Volume								14,579
Time	Hourly Volume			Time	Hourly Volume			
	EB	WB	Total		EB	WB	Total	
12:00 AM - 1:00 AM	33	17	50	12:00 PM - 1:00 PM	365	370	735	
1:00 AM - 2:00 AM	15	8	23	1:00 PM - 2:00 PM	365	397	762	
2:00 AM - 3:00 AM	6	6	12	2:00 PM - 3:00 PM	696	589	1,285	
3:00 AM - 4:00 AM	6	13	19	3:00 PM - 4:00 PM	577	566	1,143	
4:00 AM - 5:00 AM	8	50	58	4:00 PM - 5:00 PM	612	457	1,069	
5:00 AM - 6:00 AM	24	138	162	5:00 PM - 6:00 PM	721	572	1,293	
6:00 AM - 7:00 AM	271	347	618	6:00 PM - 7:00 PM	570	381	951	
7:00 AM - 8:00 AM	985	944	1,929	7:00 PM - 8:00 PM	375	248	623	
8:00 AM - 9:00 AM	476	640	1,116	8:00 PM - 9:00 PM	294	214	508	
9:00 AM - 10:00 AM	232	349	581	9:00 PM - 10:00 PM	181	104	285	
10:00 AM - 11:00 AM	241	266	507	10:00 PM - 11:00 PM	94	49	143	
11:00 AM - 12:00 PM	314	294	608	11:00 PM - 12:00 AM	72	27	99	
Total	2,611	3,072	5,683	Total	4,922	3,974	8,896	

24-Hour	EB	Volume	7,533	24-Hour	WB	Volume	7,046



APPENDIX B

CITY OF SAN DIEGO ROADWAY CLASSIFICATION TABLE, RANCHO PEÑASQUITOS AND CARMEL MOUNTAIN RANCH CIRCULATION ELEMENT EXCERPTS

TABLE 2 (MODIFIED)

City of San Diego Roadway Classifications, Levels of Service (LOS) and Average Daily Traffic (ADT)

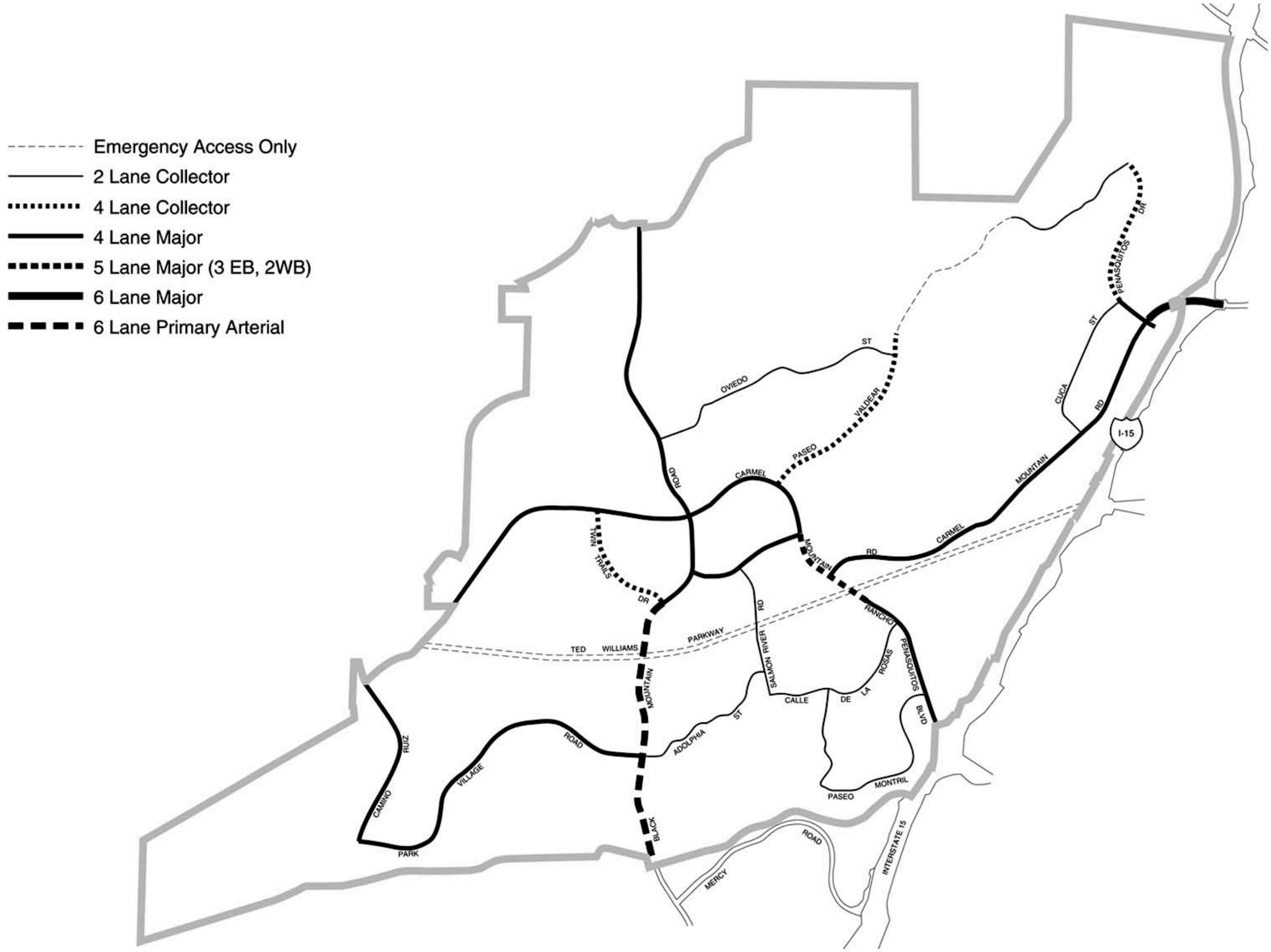
		LEVEL OF SERVICE[a]				
Street Classification	**Lanes**	**A**	**B**	**C**	**D**	**E**
Freeway	8 lanes	60,000	84,000	120,000	140,000	150,000
Freeway	6 lanes	45,000	63,000	90,000	110,000	120,000
Freeway	4 lanes	30,000	42,000	60,000	70,000	80,000
Expressway	6 lanes	30,000	42,000	60,000	70,000	80,000
Prime Arterial	11 lanes	32,000	44,750	63,750	74,500	85,000
Prime Arterial	10 lanes	30,000	42,000	60,000	70,000	80,000
Prime Arterial	9 lanes	28,750	40,250	57,500	66,250	75,000
Prime Arterial	8 lanes	27,500	38,500	55,000	62,500	70,000
Prime Arterial	7 lanes	26,250	36,750	52,500	58,750	65,000
Prime Arterial	6 lanes	25,000	35,000	50,000	55,000	60,000
Prime Arterial	5 lanes	23,000	32,000	45,000	50,000	55,000
Major Arterial	6 lanes	20,000	28,000	40,000	45,000	50,000
Prime Arterial[4]	4 lanes[4]	20,000	28,000	40,000	45,000	50,000
Major Arterial	5 lanes	17,500	24,500	35,000	40,000	45,000
Major Arterial	4 lanes	15,000	21,000	30,000	35,000	40,000
Collector	5 lanes	12,500	17,500	25,000	30,000	35,000
Collector (continuous left-turn lane)	4 lanes	10,000	14,000	20,000	25,000	30,000
Major Arterial (one-way)	4 lanes	11,400	15,600	20,000	27,000	33,400
	3 lanes	8,500	11,750	15,000	20,000	25,000
	2 lanes	5,700	7,800	10,000	13,500	16,700
Collector (no Center lane)	4 lanes					
	3 lanes	5,000	7,000	10,000	13,000	15,000
(continuous left-turn lane)	2 lanes					
Collector (one-way)	2 lanes	4,500	6,250	8,750	11,000	12,500
Collector (no fronting property)	2 lanes	4,000	5,500	7,500	9,000	10,000
Collector (commercial-industrial fronting)	2 lanes	2,500	3,500	5,000	6,500	8,000
Collector (multi-family)	2 lanes	2,500	3,500	5,000	6,500	8,000
Sub-collector (single-family)	2 lanes	—	—	2,200	—	—

Footnotes:

a. Approximate recommended ADT based on City of San Diego Street Design Manual.

General Notes:

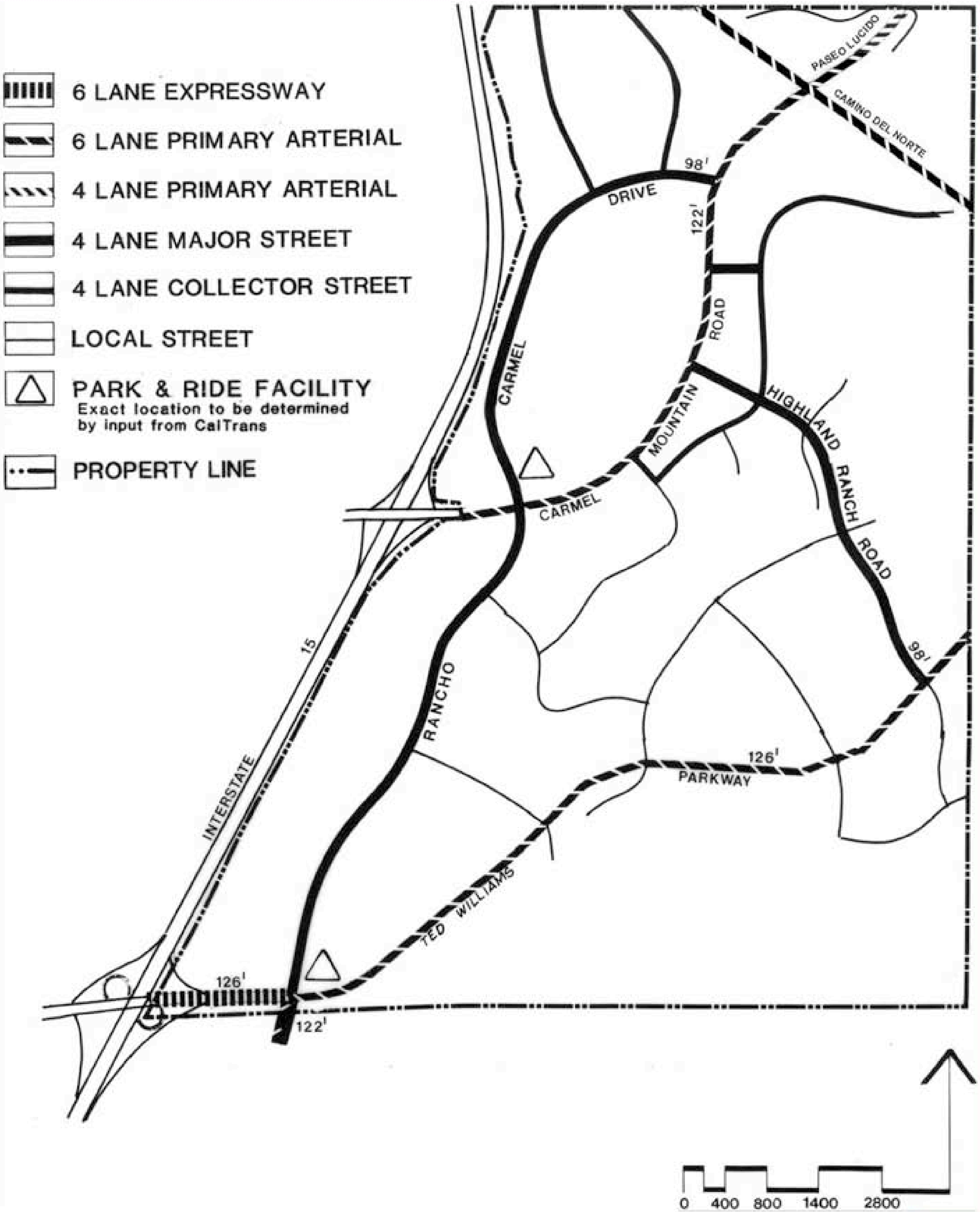
1. The volumes and the average daily level of service listed above are only intended as a general planning guideline.
2. Levels of service are not applied to residential streets since their primary purpose is to serve abutting lots, not carry through traffic. Levels of service normally apply to roads carrying through traffic between major trip generators and attractors.
3. ***Shaded areas indicate LLG-derived ADT capacities.***
4. Classification and capacity derived specifically for Kearny Villa Road in order to reflect the unique characteristics of this roadway.



Recommended Street Classifications

Rancho Peñasquitos Community Plan

FIGURE 28



Traffic Circulation

Carmel Mountain Ranch Community Plan

10
FIGURE

APPENDIX C

PEAK HOUR INTERSECTION ANALYSIS WORKSHEETS
EXISTING

1: I-15 NB Ramp & Carmel Mountain Rd — Existing AM
HCM 2010 Signalized Intersection Summary — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	326	617	0	0	879	251	183	0	1005	0	0	0
Future Volume (veh/h)	326	617	0	0	879	251	183	0	1005	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	354	671	0	0	955	273	199	0	1092			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	398	2447	0	0	1019	456	1324	0	1182			
Arrive On Green	0.04	0.16	0.00	0.00	0.29	0.29	0.37	0.00	0.37			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	354	671	0	0	955	273	199	0	1092			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	9.2	10.4	0.0	0.0	23.7	13.4	3.4	0.0	29.7			
Cycle Q Clear(g_c), s	9.2	10.4	0.0	0.0	23.7	13.4	3.4	0.0	29.7			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	398	2447	0	0	1019	456	1324	0	1182			
V/C Ratio(X)	0.89	0.27	0.00	0.00	0.94	0.60	0.15	0.00	0.92			
Avail Cap(c_a), veh/h	398	2447	0	0	1019	456	1380	0	1231			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.80	0.80	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	42.7	24.0	0.0	0.0	31.3	27.6	18.7	0.0	27.0			
Incr Delay (d2), s/veh	17.7	0.2	0.0	0.0	16.7	5.7	0.1	0.0	11.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.4	5.0	0.0	0.0	13.9	6.6	1.6	0.0	14.8			
LnGrp Delay(d),s/veh	60.4	24.3	0.0	0.0	47.9	33.3	18.8	0.0	38.4			
LnGrp LOS	E	C			D	C	B		D			
Approach Vol, veh/h		1025			1228			1291				
Approach Delay, s/veh		36.7			44.7			35.4				
Approach LOS		D			D			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		50.3			17.4	32.9		39.7
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		41.9			10.3	* 26		35.0
Max Q Clear Time (g_c+I1), s		12.4			11.2	25.7		31.7
Green Ext Time (p_c), s		6.7			0.0	0.2		1.9

Intersection Summary		
HCM 2010 Ctrl Delay		39.0
HCM 2010 LOS		D

Notes

2: I-15 SB Ramp & Carmel Mountain Rd — Existing AM
HCM 2010 Signalized Intersection Summary — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	671	572	548	514	0	0	0	0	272	6	262
Future Volume (veh/h)	0	671	572	548	514	0	0	0	0	272	6	262
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	729	622	596	559	0				387	0	192
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1556	696	660	2459	0				566	0	253
Arrive On Green	0.00	0.44	0.44	0.32	1.00	0.00				0.16	0.00	0.16
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	729	622	596	559	0				387	0	192
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	13.1	32.6	14.9	0.0	0.0				9.3	0.0	10.4
Cycle Q Clear(g_c), s	0.0	13.1	32.6	14.9	0.0	0.0				9.3	0.0	10.4
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1556	696	660	2459	0				566	0	253
V/C Ratio(X)	0.00	0.47	0.89	0.90	0.23	0.00				0.68	0.00	0.76
Avail Cap(c_a), veh/h	0	1556	696	696	2459	0				1143	0	510
HCM Platoon Ratio	1.00	1.00	1.00	1.67	1.67	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.47	0.47	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	17.8	23.3	29.8	0.0	0.0				35.7	0.0	36.2
Incr Delay (d2), s/veh	0.0	1.0	16.2	7.8	0.1	0.0				1.5	0.0	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	6.6	17.3	7.7	0.0	0.0				4.6	0.0	4.9
LnGrp Delay(d),s/veh	0.0	18.8	39.5	37.5	0.1	0.0				37.2	0.0	40.9
LnGrp LOS		B	D	D	A					D		D
Approach Vol, veh/h		1351			1155						579	
Approach Delay, s/veh		28.3			19.4						38.4	
Approach LOS		C			B						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.0	46.6		20.5		69.5		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 18	24.0		29.0		47.9		
Max Q Clear Time (g_c+I1), s	16.9	34.6		12.4		2.0		
Green Ext Time (p_c), s	0.4	0.0		1.9		17.5		

Intersection Summary		
HCM 2010 Ctrl Delay		26.9
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	662	48	156	30	13	90	29	73	491	15	77	449
Future Volume (vph)	662	48	156	30	13	90	29	73	491	15	77	449
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1696	1550	1681	1733	1583		1770	5060		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1696	1550	1681	1733	1583		1770	5060		1770	3539
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)	720	52	170	33	14	98	32	79	534	16	84	488
RTOR Reduction (vph)	0	0	116	0	0	91	0	0	3	0	0	0
Lane Group Flow (vph)	382	390	54	23	24	7	0	111	547	0	84	488
Confl. Peds. (#/hr)			11									
Confl. Bikes (#/hr)										1		
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	24.3	24.3	24.3	5.2	5.2	5.2		8.1	20.2		6.9	18.5
Effective Green, g (s)	24.3	24.3	24.3	5.2	5.2	5.2		8.1	20.2		6.9	18.5
Actuated g/C Ratio	0.32	0.32	0.32	0.07	0.07	0.07		0.11	0.26		0.09	0.24
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	532	537	491	113	117	107		186	1332		159	853
v/s Ratio Prot	0.23	c0.23		0.01	c0.01			c0.06	0.11		0.05	c0.14
v/s Ratio Perm			0.03			0.00						
v/c Ratio	0.72	0.73	0.11	0.20	0.21	0.06		0.60	0.41		0.53	0.57
Uniform Delay, d1	23.2	23.2	18.5	33.8	33.8	33.5		32.7	23.3		33.3	25.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00
Incremental Delay, d2	4.6	4.9	0.1	0.9	0.9	0.2		5.1	0.2		3.1	0.9
Delay (s)	27.8	28.1	18.6	34.7	34.7	33.7		37.9	23.3		36.5	26.5
Level of Service	C	C	B	C	C	C		D	C		D	C
Approach Delay (s)		26.3			34.0				25.8			21.7
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	76.7	Sum of lost time (s)	20.6
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	250
Future Volume (vph)	250
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	0.99
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1569
Flt Permitted	1.00
Satd. Flow (perm)	1569
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	272
RTOR Reduction (vph)	120
Lane Group Flow (vph)	152
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	42.8
Effective Green, g (s)	42.8
Actuated g/C Ratio	0.56
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	875
v/s Ratio Prot	0.05
v/s Ratio Perm	0.04
v/c Ratio	0.17
Uniform Delay, d1	8.3
Progression Factor	1.00
Incremental Delay, d2	0.1
Delay (s)	8.4
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

4: Carmel Mountain Rd & Access A
Existing AM
HCM 2010 TWSC
1/12/2016

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	43	655	11	0	664
Future Vol, veh/h	0	43	655	11	0	664
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	47	712	12	0	722

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1079	362	0	0	724	0
Stage 1	718	-	-	-	-	-
Stage 2	361	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	213	635	-	-	874	-
Stage 1	444	-	-	-	-	-
Stage 2	676	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	213	635	-	-	874	-
Mov Cap-2 Maneuver	213	-	-	-	-	-
Stage 1	444	-	-	-	-	-
Stage 2	676	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	635	874	-
HCM Lane V/C Ratio	-	-	0.074	-	-
HCM Control Delay (s)	-	-	11.1	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

5: Carmel Mountain Rd & Gerana St
Existing AM
HCM 2010 TWSC
1/12/2016

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Traffic Vol, veh/h	60	68	10	35	553	20	641	23
Future Vol, veh/h	60	68	10	35	553	20	641	23
Conflicting Peds, #/hr	2	1	0	2	0	0	0	2
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	-	120	-	140	-	-
Veh in Median Storage, #	0	-	-	-	0	-	0	-
Grade, %	0	-	-	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	65	74	11	38	601	22	697	25

Major/Minor	Minor2		Major1			Major2		
Conflicting Flow All	1153	365	796	724	0	439	-	0
Stage 1	755	-	-	-	-	-	-	-
Stage 2	398	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	4.14	-	6.44	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	2.22	-	2.52	-	-
Pot Cap-1 Maneuver	191	632	449	874	-	757	-	-
Stage 1	425	-	-	-	-	-	-	-
Stage 2	647	-	-	-	-	-	-	-
Platoon blocked, %					-		-	-
Mov Cap-1 Maneuver	190	630	692	692	-	757	-	-
Mov Cap-2 Maneuver	190	-	-	-	-	-	-	-
Stage 1	424	-	-	-	-	-	-	-
Stage 2	646	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	26.7	0.8	0.3
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR
Capacity (veh/h)	692	-	302	757	-	-
HCM Lane V/C Ratio	0.071	-	0.461	0.029	-	-
HCM Control Delay (s)	10.6	-	26.7	9.9	-	-
HCM Lane LOS	B	-	D	A	-	-
HCM 95th %tile Q(veh)	0.2	-	2.3	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	15	29	10	559	4	10	7	692
Future Vol, veh/h	15	29	10	559	4	10	7	692
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	16	32	11	608	4	11	8	752

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1045	306	549	0	0	643	612	0
Stage 1	632	-	-	-	-	-	-	-
Stage 2	413	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	224	690	644	-	-	562	963	-
Stage 1	492	-	-	-	-	-	-	-
Stage 2	636	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	224	690	644	-	-	657	657	-
Mov Cap-2 Maneuver	224	-	-	-	-	-	-	-
Stage 1	492	-	-	-	-	-	-	-
Stage 2	636	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.1	0.2	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	644	-	-	404	657	-
HCM Lane V/C Ratio	0.017	-	-	0.118	0.028	-
HCM Control Delay (s)	10.7	-	-	15.1	10.6	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	98	0	149	13	0	27	121	438	3	10	7	620
Future Volume (vph)	98	0	149	13	0	27	121	438	3	10	7	620
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			0.99		1.00	1.00			1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	1.00
Frt		0.92			0.91		1.00	1.00			1.00	0.98
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1657			1650		1770	3535			1770	3485
Flt Permitted		0.85			0.89		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1438			1496		1770	3535			1863	3485
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)	107	0	162	14	0	29	132	476	3	11	8	674
RTOR Reduction (vph)	0	105	0	0	33	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	164	0	0	10	0	132	479	0	0	19	741
Confl. Peds. (#/hr)			14			4			2			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		13.4			13.4		8.0	30.7			0.6	23.2
Effective Green, g (s)		13.4			13.4		8.0	30.7			0.6	23.2
Actuated g/C Ratio		0.23			0.23		0.13	0.52			0.01	0.39
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		324			338		238	1830			18	1363
v/s Ratio Prot							c0.07	0.14				c0.21
v/s Ratio Perm		c0.11			0.01						0.01	
v/c Ratio		0.51			0.03		0.55	0.26			1.06	0.54
Uniform Delay, d1		20.1			17.9		24.0	8.0			29.3	14.0
Progression Factor		1.00			1.00		1.00	1.00			1.01	1.00
Incremental Delay, d2		1.2			0.0		2.8	0.1			230.8	0.4
Delay (s)		21.3			17.9		26.8	8.1			260.4	14.4
Level of Service		C			B		C	A			F	B
Approach Delay (s)		21.3			17.9			12.1				20.5
Approach LOS		C			B			B				C

Intersection Summary			
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	59.3	Sum of lost time (s)	14.7
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

7: Carmel Mountain Rd & Cuca St/Caminata Deluz (Access D)
Existing AM

HCM Signalized Intersection Capacity Analysis
1/12/2016

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	70
Future Volume (vph)	70
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	76
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

8: Carmel Mountain Rd & Paseo Cardiel
Existing AM

HCM 2010 Signalized Intersection Summary
1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	153	389	21	7	512	212	86	18	7	145	14	109
Future Volume (veh/h)	153	389	21	7	512	212	86	18	7	145	14	109
Number	5	2	12	1	6	16	3	8	18	7	4	14
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		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	166	423	23	8	557	230	93	20	8	158	15	118
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	217	1653	90	15	906	373	278	54	15	461	41	320
Arrive On Green	0.12	0.48	0.48	0.01	0.37	0.37	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1774	3414	185	1774	2445	1007	708	238	67	1373	181	1422
Grp Volume(v), veh/h	166	219	227	8	403	384	121	0	0	158	0	133
Grp Sat Flow(s),veh/h/ln	1774	1770	1830	1774	1770	1682	1013	0	0	1373	0	1603
Q Serve(g_s), s	4.8	3.9	3.9	0.2	9.9	10.0	3.6	0.0	0.0	0.0	0.0	3.7
Cycle Q Clear(g_c), s	4.8	3.9	3.9	0.2	9.9	10.0	7.3	0.0	0.0	4.9	0.0	3.7
Prop In Lane	1.00		0.10	1.00		0.60	0.77		0.07	1.00		0.89
Lane Grp Cap(c), veh/h	217	857	886	15	656	623	347	0	0	461	0	360
V/C Ratio(X)	0.77	0.26	0.26	0.54	0.61	0.62	0.35	0.00	0.00	0.34	0.00	0.37
Avail Cap(c_a), veh/h	551	1447	1496	136	1026	976	730	0	0	854	0	819
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.7	8.1	8.1	26.4	13.7	13.7	19.7	0.0	0.0	17.9	0.0	17.5
Incr Delay (d2), s/veh	5.6	0.2	0.2	27.0	0.9	1.0	0.6	0.0	0.0	0.4	0.0	0.6
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	2.7	1.9	2.0	0.2	5.0	4.8	1.7	0.0	0.0	2.1	0.0	1.7
LnGrp Delay(d),s/veh	28.3	8.3	8.3	53.4	14.7	14.7	20.3	0.0	0.0	18.4	0.0	18.1
LnGrp LOS	C	A	A	D	B	B	C			B		B
Approach Vol, veh/h		612			795			121			291	
Approach Delay, s/veh		13.7			15.1			20.3			18.3	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.8	31.7		16.9	10.9	25.6		16.9
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	4.1	* 44		27.3	16.6	31.0		27.3
Max Q Clear Time (g_c+I1), s	2.2	5.9		6.9	6.8	12.0		9.3
Green Ext Time (p_c), s	0.0	9.9		2.0	0.3	7.8		1.9

Intersection Summary		
HCM 2010 Ctrl Delay		15.5
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	263	80	45	249	303	326	353	779	242	317	914	28
Future Volume (veh/h)	263	80	45	249	303	326	353	779	242	317	914	28
Number	3	8	18	7	4	14	1	6	16	5	2	12
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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	286	87	49	271	329	354	384	847	263	345	993	30
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	296	488	257	322	419	540	388	1570	701	399	1734	540
Arrive On Green	0.09	0.22	0.22	0.09	0.22	0.22	0.22	0.44	0.44	0.12	0.34	0.34
Sat Flow, veh/h	3442	2243	1181	3442	1863	1583	1774	3539	1579	3442	5085	1583
Grp Volume(v), veh/h	286	67	69	271	329	354	384	847	263	345	993	30
Grp Sat Flow(s),veh/h/ln	1721	1770	1654	1721	1863	1583	1774	1770	1579	1721	1695	1583
Q Serve(g_s), s	12.4	4.6	5.1	11.6	24.9	28.5	32.4	26.3	16.7	14.8	24.0	1.9
Cycle Q Clear(g_c), s	12.4	4.6	5.1	11.6	24.9	28.5	32.4	26.3	16.7	14.8	24.0	1.9
Prop In Lane	1.00		0.71	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	296	385	360	322	419	540	388	1570	701	399	1734	540
V/C Ratio(X)	0.97	0.18	0.19	0.84	0.79	0.66	0.99	0.54	0.38	0.86	0.57	0.06
Avail Cap(c_a), veh/h	296	441	412	422	522	627	388	1570	701	519	1734	540
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	0.68	0.68	0.68	0.60	0.60	0.60	0.70	0.70	0.70
Uniform Delay (d), s/veh	68.3	47.7	47.9	66.9	54.7	42.0	58.4	30.5	27.8	65.1	40.5	33.2
Incr Delay (d2), s/veh	43.0	0.2	0.3	8.1	4.3	1.4	32.6	0.8	0.9	8.3	1.0	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	7.7	2.3	2.4	5.9	13.4	12.7	19.4	13.0	7.4	7.5	11.4	0.9
LnGrp Delay(d),s/veh	111.4	48.0	48.2	75.0	59.1	43.3	91.1	31.3	28.8	73.5	41.4	33.3
LnGrp LOS	F	D	D	E	E	D	F	C	C	E	D	C
Approach Vol, veh/h		422			954			1494			1368	
Approach Delay, s/veh		91.0			57.7			46.2			49.3	
Approach LOS		F			E			D			D	

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	37.0	56.7	17.1	39.2	21.6	72.1	18.2	38.1
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 33	42.9	* 13	42.0	* 23	53.1	* 18	* 37
Max Q Clear Time (g_c+I1), s	34.4	26.0	14.4	30.5	16.8	28.3	13.6	7.1
Green Ext Time (p_c), s	0.0	12.3	0.0	3.3	0.6	16.2	0.4	4.4

Intersection Summary	
HCM 2010 Ctrl Delay	54.3
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	8	348	97	35	85	55	1193	14	41	819	348
Future Volume (veh/h)	91	8	348	97	35	85	55	1193	14	41	819	348
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	99	9	378	105	38	92	60	1297	15	45	890	378
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	485	10	421	154	42	102	90	1391	16	154	1502	1105
Arrive On Green	0.27	0.27	0.27	0.09	0.09	0.09	0.05	0.39	0.39	0.09	0.42	0.42
Sat Flow, veh/h	1774	37	1539	1774	484	1172	1774	3583	41	1774	3539	1583
Grp Volume(v), veh/h	99	0	387	105	0	130	60	640	672	45	890	378
Grp Sat Flow(s),veh/h/ln	1774	0	1575	1774	0	1656	1774	1770	1855	1774	1770	1583
Q Serve(g_s), s	4.9	0.0	27.2	6.6	0.0	8.9	3.8	39.9	39.9	2.7	22.2	10.9
Cycle Q Clear(g_c), s	4.9	0.0	27.2	6.6	0.0	8.9	3.8	39.9	39.9	2.7	22.2	10.9
Prop In Lane	1.00		0.98	1.00		0.71	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	485	0	431	154	0	144	90	687	720	154	1502	1105
V/C Ratio(X)	0.20	0.00	0.90	0.68	0.00	0.90	0.67	0.93	0.93	0.29	0.59	0.34
Avail Cap(c_a), veh/h	555	0	493	154	0	144	102	687	720	154	1502	1105
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	1.00	1.00	0.73	0.73	0.73
Uniform Delay (d), s/veh	32.1	0.0	40.2	51.0	0.0	52.0	53.6	33.7	33.7	49.2	25.5	6.9
Incr Delay (d2), s/veh	0.2	0.0	17.6	11.5	0.0	47.3	13.1	21.3	20.6	0.8	1.3	0.6
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	2.4	0.0	13.9	3.7	0.0	6.0	2.2	23.4	24.5	1.4	11.1	9.2
LnGrp Delay(d),s/veh	32.3	0.0	57.8	62.4	0.0	99.3	66.8	55.0	54.4	49.9	26.7	7.5
LnGrp LOS	C		E	E		F	E	E	D	D	C	A
Approach Vol, veh/h		486			235			1372			1313	
Approach Delay, s/veh		52.6			82.8			55.2			22.0	
Approach LOS		D			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	54.3		14.6	14.2	50.1		36.1
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.6	43.5		10.0	* 10	40.1		36.0
Max Q Clear Time (g_c+I1), s	5.8	24.2		10.9	4.7	41.9		29.2
Green Ext Time (p_c), s	0.0	15.4		0.0	0.0	0.0		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	43.9
HCM 2010 LOS	D

Notes

11: Carmel Mountain Rd & Paseo Montalban — Existing AM

HCM 2010 Signalized Intersection Summary — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	49	53	391	90	60	40	210	896	12	57	875	12
Future Volume (veh/h)	49	53	391	90	60	40	210	896	12	57	875	12
Number	3	8	18	7	4	14	1	6	16	5	2	12
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		0.98	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	53	0	464	98	65	43	228	974	13	62	951	13
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	385	0	914	393	228	151	325	1515	20	79	1336	18
Arrive On Green	0.04	0.00	0.19	0.06	0.22	0.22	0.09	0.42	0.42	0.04	0.37	0.37
Sat Flow, veh/h	1774	0	3152	1774	1041	689	3442	3575	48	1774	3575	49
Grp Volume(v), veh/h	53	0	464	98	0	108	228	482	505	62	471	493
Grp Sat Flow(s),veh/h/ln	1774	0	1576	1774	0	1730	1721	1770	1853	1774	1770	1854
Q Serve(g_s), s	1.6	0.0	8.4	3.0	0.0	3.6	4.4	14.8	14.8	2.4	15.6	15.6
Cycle Q Clear(g_c), s	1.6	0.0	8.4	3.0	0.0	3.6	4.4	14.8	14.8	2.4	15.6	15.6
Prop In Lane	1.00		1.00	1.00		0.40	1.00		0.03	1.00		0.03
Lane Grp Cap(c), veh/h	385	0	914	393	0	379	325	750	786	79	661	693
V/C Ratio(X)	0.14	0.00	0.51	0.25	0.00	0.28	0.70	0.64	0.64	0.79	0.71	0.71
Avail Cap(c_a), veh/h	428	0	1678	393	0	757	432	797	835	155	730	765
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.9	0.0	20.3	20.1	0.0	22.3	30.1	15.6	15.6	32.4	18.3	18.3
Incr Delay (d2), s/veh	0.2	0.0	0.4	0.3	0.0	0.4	3.3	1.6	1.6	15.8	2.9	2.8
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	0.8	0.0	3.7	1.5	0.0	1.8	2.2	7.6	7.9	1.5	8.1	8.5
LnGrp Delay(d),s/veh	21.0	0.0	20.7	20.4	0.0	22.7	33.4	17.3	17.2	48.2	21.2	21.1
LnGrp LOS	C		C	C		C	C	B	B	D	C	C
Approach Vol, veh/h		517			206			1215			1026	
Approach Delay, s/veh		20.8			21.6			20.3			22.8	
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	10.9	30.8	6.9	19.9	7.4	34.3	8.6	18.3
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	8.6	28.3	4.2	30.0	6.0	30.9	4.2	30.0
Max Q Clear Time (g_c+I1), s	6.4	17.6	3.6	5.6	4.4	16.8	5.0	10.4
Green Ext Time (p_c), s	0.2	8.1	0.0	2.6	0.0	10.0	0.0	2.5

Intersection Summary	
HCM 2010 Ctrl Delay	21.3
HCM 2010 LOS	C

Notes

1: I-15 NB Ramp & Carmel Mountain Rd — Existing PM

HCM 2010 Signalized Intersection Summary — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	241	942	0	0	1551	555	322	1	647	0	0	0
Future Volume (veh/h)	241	942	0	0	1551	555	322	1	647	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	262	1024	0	0	1686	603	351	0	703			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	496	3067	0	0	1377	616	944	0	842			
Arrive On Green	0.05	0.20	0.00	0.00	0.39	0.39	0.27	0.00	0.27			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	262	1024	0	0	1686	603	351	0	703			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	7.4	17.3	0.0	0.0	38.9	37.6	8.1	0.0	20.9			
Cycle Q Clear(g_c), s	7.4	17.3	0.0	0.0	38.9	37.6	8.1	0.0	20.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	496	3067	0	0	1377	616	944	0	842			
V/C Ratio(X)	0.53	0.33	0.00	0.00	1.22	0.98	0.37	0.00	0.83			
Avail Cap(c_a), veh/h	496	3067	0	0	1377	616	1242	0	1108			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.54	0.54	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	44.3	22.8	0.0	0.0	30.5	30.1	29.9	0.0	34.6			
Incr Delay (d2), s/veh	0.6	0.2	0.0	0.0	107.8	31.5	0.2	0.0	4.4			
Initial Q Delay(d3),s/veh	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	8.2	0.0	0.0	39.5	21.8	4.0	0.0	9.7			
LnGrp Delay(d),s/veh	44.9	23.0	0.0	0.0	138.3	61.6	30.1	0.0	39.0			
LnGrp LOS	D	C			F	E	C		D			
Approach Vol, veh/h		1286			2289			1054				
Approach Delay, s/veh		27.4			118.1			36.0				
Approach LOS		C			F			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		67.3			21.4	45.9		32.7
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		51.9			7.3	* 39		35.0
Max Q Clear Time (g_c+I1), s		19.3			9.4	40.9		22.9
Green Ext Time (p_c), s		10.1			0.0	0.0		3.6

Intersection Summary	
HCM 2010 Ctrl Delay	74.2
HCM 2010 LOS	E

Notes

2: I-15 SB Ramp & Carmel Mountain Rd — Existing PM
HCM 2010 Signalized Intersection Summary — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	679	234	874	999	0	0	0	0	504	0	288
Future Volume (veh/h)	0	679	234	874	999	0	0	0	0	504	0	288
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	738	254	950	1086	0				645	0	209
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1122	502	953	2304	0				774	0	345
Arrive On Green	0.00	0.32	0.32	0.09	0.21	0.00				0.22	0.00	0.22
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	738	254	950	1086	0				645	0	209
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	18.0	13.1	27.6	26.8	0.0				17.4	0.0	11.9
Cycle Q Clear(g_c), s	0.0	18.0	13.1	27.6	26.8	0.0				17.4	0.0	11.9
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1122	502	953	2304	0				774	0	345
V/C Ratio(X)	0.00	0.66	0.51	1.00	0.47	0.00				0.83	0.00	0.61
Avail Cap(c_a), veh/h	0	1122	502	953	2304	0				1029	0	459
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.09	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	29.5	27.8	45.4	24.2	0.0				37.4	0.0	35.2
Incr Delay (d2), s/veh	0.0	3.0	3.6	8.0	0.1	0.0				4.6	0.0	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
%ile BackOfQ(50%),veh/ln	0.0	9.3	6.2	14.2	13.2	0.0				9.0	0.0	5.3
LnGrp Delay(d),s/veh	0.0	32.5	31.4	53.3	24.3	0.0				41.9	0.0	36.9
LnGrp LOS		C	C	D	C					D		D
Approach Vol, veh/h		992			2036						854	
Approach Delay, s/veh		32.2			37.8						40.7	
Approach LOS		C			D						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	33.4	38.7		27.9		72.1		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 28	24.5		29.0		57.9		
Max Q Clear Time (g_c+I1), s	29.6	20.0		19.4		28.8		
Green Ext Time (p_c), s	0.0	3.9		2.4		17.8		

Intersection Summary	
HCM 2010 Ctrl Delay	37.0
HCM 2010 LOS	D

Notes

3: Carmel Mountain Rd & Penasquitos Dr — Existing PM
HCM Signalized Intersection Capacity Analysis — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	331	52	70	57	51	89	13	147	493	41	133	617
Future Volume (vph)	331	52	70	57	51	89	13	147	493	41	133	617
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1708	1551	1681	1761	1560		1770	5026		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1708	1551	1681	1761	1560		1770	5026		1770	3539
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)	360	57	76	62	55	97	14	160	536	45	145	671
RTOR Reduction (vph)	0	0	57	0	0	89	0	0	10	0	0	0
Lane Group Flow (vph)	209	208	19	56	61	8	0	174	571	0	145	671
Confl. Peds. (#/hr)			9									
Confl. Bikes (#/hr)			1			1						
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	18.7	18.7	18.7	6.6	6.6	6.6		9.2	20.0		10.7	21.0
Effective Green, g (s)	18.7	18.7	18.7	6.6	6.6	6.6		9.2	20.0		10.7	21.0
Actuated g/C Ratio	0.25	0.25	0.25	0.09	0.09	0.09		0.12	0.26		0.14	0.28
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	413	419	381	145	152	135		213	1320		248	976
v/s Ratio Prot	c0.12	0.12		0.03	c0.03			c0.10	0.11		0.08	c0.19
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.51	0.50	0.05	0.39	0.40	0.06		0.82	0.43		0.58	0.69
Uniform Delay, d1	24.7	24.7	21.9	32.8	32.9	31.9		32.6	23.3		30.6	24.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.96		1.00	1.00
Incremental Delay, d2	1.0	0.9	0.1	1.7	1.7	0.2		20.9	0.2		3.5	2.0
Delay (s)	25.7	25.6	22.0	34.5	34.6	32.1		53.5	22.7		34.1	26.6
Level of Service	C	C	C	C	C	C		D	C		C	C
Approach Delay (s)		25.1			33.5				29.8			21.1
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	76.1	Sum of lost time (s)	20.6
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	537
Future Volume (vph)	537
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	584
RTOR Reduction (vph)	234
Lane Group Flow (vph)	350
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	39.7
Effective Green, g (s)	39.7
Actuated g/C Ratio	0.52
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	825
v/s Ratio Prot	0.10
v/s Ratio Perm	0.12
v/c Ratio	0.42
Uniform Delay, d1	11.2
Progression Factor	1.00
Incremental Delay, d2	0.4
Delay (s)	11.5
Level of Service	B
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	20	613	47	0	757
Future Vol, veh/h	0	20	613	47	0	757
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	22	666	51	0	823

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1103	359	0	0	717	0
Stage 1	692	-	-	-	-	-
Stage 2	411	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	206	638	-	-	880	-
Stage 1	458	-	-	-	-	-
Stage 2	638	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	206	638	-	-	880	-
Mov Cap-2 Maneuver	206	-	-	-	-	-
Stage 1	458	-	-	-	-	-
Stage 2	638	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.8	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	638	880	-
HCM Lane V/C Ratio	-	-	0.034	-	-
HCM Control Delay (s)	-	-	10.8	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Traffic Vol, veh/h	38	26	10	56	572	77	596	64
Future Vol, veh/h	38	26	10	56	572	77	596	64
Conflicting Peds, #/hr	2	0	0	6	0	0	0	6
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	-	120	-	140	-	-
Veh in Median Storage, #	0	-	-	-	0	-	0	-
Grade, %	0	-	-	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	41	28	11	61	622	84	648	70

Major/Minor	Minor2		Major1			Major2		
Conflicting Flow All	1306	367	746	719	0	454	-	0
Stage 1	852	-	-	-	-	-	-	-
Stage 2	454	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	4.14	-	6.44	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	2.22	-	2.52	-	-
Pot Cap-1 Maneuver	151	630	483	878	-	740	-	-
Stage 1	378	-	-	-	-	-	-	-
Stage 2	606	-	-	-	-	-	-	-
Platoon blocked, %					-		-	-
Mov Cap-1 Maneuver	150	626	770	770	-	740	-	-
Mov Cap-2 Maneuver	150	-	-	-	-	-	-	-
Stage 1	377	-	-	-	-	-	-	-
Stage 2	605	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.2	1.1	1.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR
Capacity (veh/h)	770	-	217	740	-	-
HCM Lane V/C Ratio	0.093	-	0.321	0.113	-	-
HCM Control Delay (s)	10.2	-	29.2	10.5	-	-
HCM Lane LOS	B	-	D	B	-	-
HCM 95th %tile Q(veh)	0.3	-	1.3	0.4	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	7	14	10	614	16	10	31	581
Future Vol, veh/h	7	14	10	614	16	10	31	581
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	8	15	11	667	17	11	34	632

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1103	342	461	0	0	700	685	0
Stage 1	698	-	-	-	-	-	-	-
Stage 2	405	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	206	654	733	-	-	517	904	-
Stage 1	455	-	-	-	-	-	-	-
Stage 2	642	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	206	654	733	-	-	758	758	-
Mov Cap-2 Maneuver	206	-	-	-	-	-	-	-
Stage 1	455	-	-	-	-	-	-	-
Stage 2	642	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.1	0.2	0.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	733	-	-	379	758	-
HCM Lane V/C Ratio	0.015	-	-	0.06	0.059	-
HCM Control Delay (s)	10	-	-	15.1	10	-
HCM Lane LOS	A	-	-	C	B	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	40	0	42	6	0	13	61	577	15	10	30	498
Future Volume (vph)	40	0	42	6	0	13	61	577	15	10	30	498
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			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		0.93			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1680			1667		1770	3524			1770	3484
Flt Permitted		0.84			0.86		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1439			1454		1770	3524			1863	3484
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)	43	0	46	7	0	14	66	627	16	11	33	541
RTOR Reduction (vph)	0	78	0	0	18	0	0	1	0	0	0	6
Lane Group Flow (vph)	0	11	0	0	3	0	66	642	0	0	44	589
Confl. Peds. (#/hr)			2									
Confl. Bikes (#/hr)									1			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		6.0			6.0		4.3	25.9			2.3	23.8
Effective Green, g (s)		6.0			6.0		4.3	25.9			2.3	23.8
Actuated g/C Ratio		0.12			0.12		0.09	0.53			0.05	0.49
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		176			178		155	1870			87	1699
v/s Ratio Prot							c0.04	c0.18				0.17
v/s Ratio Perm		c0.01			0.00						0.02	
v/c Ratio		0.06			0.01		0.43	0.34			0.51	0.35
Uniform Delay, d1		18.9			18.8		21.1	6.6			22.7	7.7
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.01
Incremental Delay, d2		0.1			0.0		1.9	0.1			4.6	0.1
Delay (s)		19.1			18.8		23.0	6.7			27.2	7.9
Level of Service		B			B		C	A			C	A
Approach Delay (s)		19.1			18.8			8.2				9.2
Approach LOS		B			B			A				A

Intersection Summary			
HCM 2000 Control Delay	9.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	48.8	Sum of lost time (s)	14.7
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	122	553	92	32	325	77	231	38	72	110	23	58
Future Volume (veh/h)	122	553	92	32	325	77	231	38	72	110	23	58
Number	5	2	12	1	6	16	3	8	18	7	4	14
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	0.99		0.99	1.00		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	133	601	100	35	353	84	251	41	78	120	25	63
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	175	1015	169	53	756	178	421	69	102	596	172	433
Arrive On Green	0.10	0.33	0.33	0.03	0.27	0.27	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	1774	3037	504	1774	2845	669	852	188	278	1266	467	1176
Grp Volume(v), veh/h	133	350	351	35	218	219	370	0	0	120	0	88
Grp Sat Flow(s),veh/h/ln	1774	1770	1771	1774	1770	1745	1317	0	0	1266	0	1643
Q Serve(g_s), s	4.1	9.2	9.3	1.1	5.8	5.9	12.4	0.0	0.0	0.0	0.0	2.0
Cycle Q Clear(g_c), s	4.1	9.2	9.3	1.1	5.8	5.9	14.4	0.0	0.0	3.7	0.0	2.0
Prop In Lane	1.00		0.28	1.00		0.38	0.68		0.21	1.00		0.72
Lane Grp Cap(c), veh/h	175	592	592	53	470	464	592	0	0	596	0	605
V/C Ratio(X)	0.76	0.59	0.59	0.66	0.46	0.47	0.62	0.00	0.00	0.20	0.00	0.15
Avail Cap(c_a), veh/h	522	1048	1049	208	728	718	1192	0	0	1143	0	1314
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.8	15.6	15.6	27.1	17.3	17.4	16.2	0.0	0.0	12.4	0.0	11.9
Incr Delay (d2), s/veh	6.7	0.9	1.0	13.0	0.7	0.7	1.1	0.0	0.0	0.2	0.0	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	2.3	4.6	4.6	0.7	2.9	3.0	5.2	0.0	0.0	1.3	0.0	0.9
LnGrp Delay(d),s/veh	31.5	16.5	16.5	40.1	18.1	18.1	17.3	0.0	0.0	12.6	0.0	12.0
LnGrp LOS	C	B	B	D	B	B	B			B		B
Approach Vol, veh/h		834			472			370			208	
Approach Delay, s/veh		18.9			19.7			17.3			12.3	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.1	24.7		25.7	10.0	20.8		25.7
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	6.6	* 33		45.1	16.6	23.2		45.1
Max Q Clear Time (g_c+I1), s	3.1	11.3		5.7	6.1	7.9		16.4
Green Ext Time (p_c), s	0.0	7.6		3.8	0.2	6.4		3.7

Intersection Summary	
HCM 2010 Ctrl Delay	18.1
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	252	165	122	299	178	226	298	777	375	300	434	22
Future Volume (veh/h)	252	165	122	299	178	226	298	777	375	300	434	22
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	274	179	133	325	193	246	324	845	408	326	472	24
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	316	315	220	378	330	455	346	1739	766	379	2066	642
Arrive On Green	0.09	0.16	0.16	0.11	0.18	0.18	0.20	0.49	0.49	0.11	0.41	0.41
Sat Flow, veh/h	3442	1978	1380	3442	1863	1581	1774	3539	1560	3442	5085	1579
Grp Volume(v), veh/h	274	159	153	325	193	246	324	845	408	326	472	24
Grp Sat Flow(s),veh/h/ln	1721	1770	1589	1721	1863	1581	1774	1770	1560	1721	1695	1579
Q Serve(g_s), s	11.8	12.4	13.4	13.9	14.3	19.7	27.0	23.9	27.0	14.0	9.1	1.4
Cycle Q Clear(g_c), s	11.8	12.4	13.4	13.9	14.3	19.7	27.0	23.9	27.0	14.0	9.1	1.4
Prop In Lane	1.00		0.87	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	316	282	253	378	330	455	346	1739	766	379	2066	642
V/C Ratio(X)	0.87	0.56	0.60	0.86	0.58	0.54	0.94	0.49	0.53	0.86	0.23	0.04
Avail Cap(c_a), veh/h	317	416	374	491	522	617	376	1739	766	491	2066	642
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	0.85	0.85	0.85	0.42	0.42	0.42	0.85	0.85	0.85
Uniform Delay (d), s/veh	67.2	58.2	58.7	65.6	56.6	45.1	59.4	25.5	26.3	65.6	29.1	26.8
Incr Delay (d2), s/veh	21.5	1.8	2.3	10.0	1.4	0.9	15.9	0.4	1.1	10.1	0.2	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	6.6	6.2	6.1	7.2	7.5	8.7	14.8	11.8	11.8	7.2	4.3	0.6
LnGrp Delay(d),s/veh	88.7	60.0	61.0	75.6	58.0	45.9	75.4	25.9	27.4	75.7	29.4	26.9
LnGrp LOS	F	E	E	E	E	D	E	C	C	E	C	C
Approach Vol, veh/h		586			764			1577			822	
Approach Delay, s/veh		73.7			61.6			36.5			47.7	
Approach LOS		E			E			D			D	

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	33.5	66.4	18.0	32.1	20.7	79.2	20.7	29.4
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 32	43.0	* 14	42.0	* 21	53.4	* 21	* 35
Max Q Clear Time (g_c+I1), s	29.0	11.1	13.8	21.7	16.0	29.0	15.9	15.4
Green Ext Time (p_c), s	0.3	14.2	0.0	3.9	0.6	12.5	0.6	3.9

Intersection Summary	
HCM 2010 Ctrl Delay	49.9
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	394	24	953	36	32	46	8	888	44	89	646	120
Future Volume (veh/h)	394	24	953	36	32	46	8	888	44	89	646	120
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	1.00		0.98
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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	428	26	1036	39	35	50	9	965	48	97	702	130
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	656	14	565	145	57	81	74	1054	52	148	1235	1129
Arrive On Green	0.37	0.37	0.37	0.08	0.08	0.08	0.04	0.31	0.31	0.08	0.35	0.35
Sat Flow, veh/h	1774	38	1526	1774	693	990	1774	3430	171	1774	3539	1557
Grp Volume(v), veh/h	428	0	1062	39	0	85	9	498	515	97	702	130
Grp Sat Flow(s),veh/h/ln	1774	0	1565	1774	0	1684	1774	1770	1831	1774	1770	1557
Q Serve(g_s), s	24.0	0.0	44.4	2.5	0.0	5.9	0.6	32.5	32.5	6.4	19.3	3.1
Cycle Q Clear(g_c), s	24.0	0.0	44.4	2.5	0.0	5.9	0.6	32.5	32.5	6.4	19.3	3.1
Prop In Lane	1.00		0.98	1.00		0.59	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	656	0	579	145	0	138	74	544	563	148	1235	1129
V/C Ratio(X)	0.65	0.00	1.83	0.27	0.00	0.62	0.12	0.92	0.92	0.66	0.57	0.12
Avail Cap(c_a), veh/h	656	0	579	148	0	140	74	544	563	151	1235	1129
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	1.00	1.00	0.90	0.90	0.90
Uniform Delay (d), s/veh	31.4	0.0	37.8	51.7	0.0	53.3	55.4	40.1	40.1	53.3	31.7	5.2
Incr Delay (d2), s/veh	2.3	0.0	382.2	1.0	0.0	7.6	0.7	22.6	22.0	8.7	1.7	0.2
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	12.2	0.0	80.6	1.3	0.0	3.0	0.3	19.3	19.9	3.5	9.8	3.1
LnGrp Delay(d),s/veh	33.7	0.0	420.0	52.7	0.0	60.9	56.1	62.6	62.1	62.0	33.4	5.4
LnGrp LOS	C		F	D		E	E	E	E	E	C	A
Approach Vol, veh/h		1490			124			1022			929	
Approach Delay, s/veh		309.1			58.3			62.3			32.5	
Approach LOS		F			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	47.4		14.4	14.2	42.4		49.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 5	41.7		10.0	* 10	36.5		44.4
Max Q Clear Time (g_c+I1), s	2.6	21.3		7.9	8.4	34.5		46.4
Green Ext Time (p_c), s	0.0	12.4		0.1	0.0	1.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	157.5
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	63	315	38	49	13	328	703	54	15	543	14
Future Volume (veh/h)	5	63	315	38	49	13	328	703	54	15	543	14
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	5	0	387	41	53	14	357	764	59	16	590	15
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	359	0	1017	353	288	76	507	1521	117	28	1148	29
Arrive On Green	0.01	0.00	0.18	0.03	0.20	0.20	0.15	0.46	0.46	0.02	0.33	0.33
Sat Flow, veh/h	1774	0	3145	1774	1421	375	3442	3328	257	1774	3527	90
Grp Volume(v), veh/h	5	0	387	41	0	67	357	406	417	16	296	309
Grp Sat Flow(s),veh/h/ln	1774	0	1572	1774	0	1796	1721	1770	1815	1774	1770	1847
Q Serve(g_s), s	0.1	0.0	5.6	1.1	0.0	1.8	5.8	9.6	9.6	0.5	8.0	8.0
Cycle Q Clear(g_c), s	0.1	0.0	5.6	1.1	0.0	1.8	5.8	9.6	9.6	0.5	8.0	8.0
Prop In Lane	1.00		1.00	1.00		0.21	1.00		0.14	1.00		0.05
Lane Grp Cap(c), veh/h	359	0	1017	353	0	364	507	809	830	28	576	601
V/C Ratio(X)	0.01	0.00	0.38	0.12	0.00	0.18	0.70	0.50	0.50	0.58	0.51	0.51
Avail Cap(c_a), veh/h	487	0	2064	432	0	912	1022	1248	1280	138	860	898
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	0.0	15.5	19.0	0.0	19.6	24.0	11.3	11.3	29.0	16.2	16.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.1	0.0	0.2	1.8	0.5	0.5	17.5	0.7	0.7
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	0.1	0.0	2.5	0.5	0.0	0.9	2.9	4.7	4.9	0.4	4.0	4.2
LnGrp Delay(d),s/veh	20.0	0.0	15.7	19.2	0.0	19.8	25.8	11.8	11.8	46.5	16.9	16.9
LnGrp LOS	B		B	B		B	C	B	B	D	B	B
Approach Vol, veh/h		392			108			1180			621	
Approach Delay, s/veh		15.8			19.6			16.0			17.6	
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	13.1	24.5	4.7	16.9	5.3	32.3	6.4	15.3
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	17.6	28.8	4.6	30.1	4.6	41.8	4.6	30.1
Max Q Clear Time (g_c+I1), s	7.8	10.0	2.1	3.8	2.5	11.6	3.1	7.6
Green Ext Time (p_c), s	0.9	9.0	0.0	2.0	0.0	11.1	0.0	1.9

Intersection Summary	
HCM 2010 Ctrl Delay	16.6
HCM 2010 LOS	B

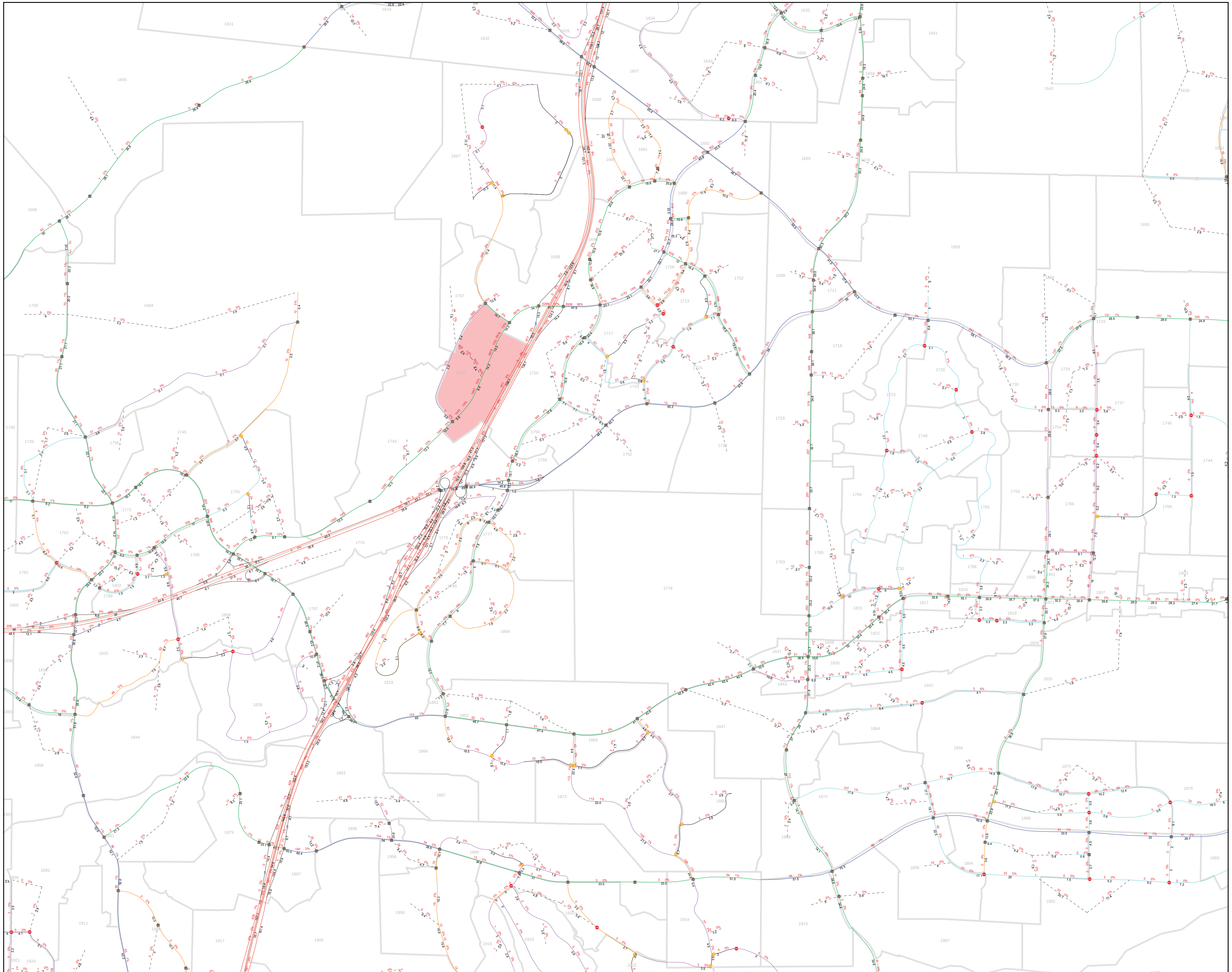
Notes

Appendix D

SANDAG Series 12 Select Zone Assignment

SANDAG
Series 12
2035rc11

TAZ 1719
Select Zone Plot



Functional Classifications
- Freeway
- Prime
- Major
- Collector
- Light Collector
- Rural Collector
- Local
- Freeway Ramp
- Local Ramp
- Zone Connector

Traffic Analysis Zones

\# Selz Volumes & Percentage

\# Unadjusted ADT(x1000)

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N

0 0.15 0.3 0.45
Miles

SANDAG

servicebureau

Date: November 16, 2015

APPENDIX E

PEAK HOUR INTERSECTION ANALYSIS WORKSHEETS
EXISTING + PROJECT

1: I-15 NB Ramp & Carmel Mountain Rd — Existing + Proj AM
HCM 2010 Signalized Intersection Summary
9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	349	629	0	0	882	251	192	0	1005	0	0	0
Future Volume (veh/h)	349	629	0	0	882	251	192	0	1005	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	379	684	0	0	959	273	209	0	1092			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	398	2447	0	0	1019	456	1324	0	1182			
Arrive On Green	0.04	0.16	0.00	0.00	0.29	0.29	0.37	0.00	0.37			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	379	684	0	0	959	273	209	0	1092			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	9.9	10.7	0.0	0.0	23.8	13.4	3.5	0.0	29.7			
Cycle Q Clear(g_c), s	9.9	10.7	0.0	0.0	23.8	13.4	3.5	0.0	29.7			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	398	2447	0	0	1019	456	1324	0	1182			
V/C Ratio(X)	0.95	0.28	0.00	0.00	0.94	0.60	0.16	0.00	0.92			
Avail Cap(c_a), veh/h	398	2447	0	0	1019	456	1380	0	1231			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.78	0.78	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	43.0	24.1	0.0	0.0	31.3	27.6	18.8	0.0	27.0			
Incr Delay (d2), s/veh	28.3	0.2	0.0	0.0	17.2	5.7	0.1	0.0	11.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.3	5.1	0.0	0.0	14.0	6.6	1.7	0.0	14.8			
LnGrp Delay(d),s/veh	71.3	24.3	0.0	0.0	48.5	33.3	18.8	0.0	38.4			
LnGrp LOS	E	C			D	C	B		D			
Approach Vol, veh/h		1063			1232			1301				
Approach Delay, s/veh		41.1			45.2			35.2				
Approach LOS		D			D			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		50.3			17.4	32.9		39.7
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		41.9			10.3	* 26		35.0
Max Q Clear Time (g_c+I1), s		12.7			11.9	25.8		31.7
Green Ext Time (p_c), s		7.0			0.0	0.1		1.9

Intersection Summary		
HCM 2010 Ctrl Delay		40.4
HCM 2010 LOS		D

Notes

2: I-15 SB Ramp & Carmel Mountain Rd — Existing + Proj AM
HCM 2010 Signalized Intersection Summary
9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	706	606	548	526	0	0	0	0	272	6	267
Future Volume (veh/h)	0	706	606	548	526	0	0	0	0	272	6	267
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	767	659	596	572	0				389	0	196
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1547	692	660	2450	0				575	0	257
Arrive On Green	0.00	0.44	0.44	0.32	1.00	0.00				0.16	0.00	0.16
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	767	659	596	572	0				389	0	196
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	14.0	36.1	14.9	0.0	0.0				9.3	0.0	10.7
Cycle Q Clear(g_c), s	0.0	14.0	36.1	14.9	0.0	0.0				9.3	0.0	10.7
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1547	692	660	2450	0				575	0	257
V/C Ratio(X)	0.00	0.50	0.95	0.90	0.23	0.00				0.68	0.00	0.76
Avail Cap(c_a), veh/h	0	1547	692	696	2450	0				1143	0	510
HCM Platoon Ratio	1.00	1.00	1.00	1.67	1.67	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.46	0.46	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	18.2	24.4	29.8	0.0	0.0				35.5	0.0	36.1
Incr Delay (d2), s/veh	0.0	1.1	24.3	7.6	0.1	0.0				1.4	0.0	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	7.1	20.4	7.7	0.0	0.0				4.7	0.0	5.0
LnGrp Delay(d),s/veh	0.0	19.3	48.7	37.4	0.1	0.0				36.9	0.0	40.7
LnGrp LOS		B	D	D	A					D		D
Approach Vol, veh/h		1426			1168						585	
Approach Delay, s/veh		32.9			19.1						38.2	
Approach LOS		C			B						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.0	46.3		20.7		69.3		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 18	24.0		29.0		47.9		
Max Q Clear Time (g_c+I1), s	16.9	38.1		12.7		2.0		
Green Ext Time (p_c), s	0.4	0.0		1.9		18.8		

Intersection Summary		
HCM 2010 Ctrl Delay		28.8
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	662	48	157	31	13	90	36	76	560	18	77	466
Future Volume (vph)	662	48	157	31	13	90	36	76	560	18	77	466
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1696	1550	1681	1733	1583		1770	5058		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1696	1550	1681	1733	1583		1770	5058		1770	3539
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)	720	52	171	34	14	98	39	83	609	20	84	507
RTOR Reduction (vph)	0	0	117	0	0	91	0	0	4	0	0	0
Lane Group Flow (vph)	382	390	54	24	24	7	0	122	625	0	84	507
Confl. Peds. (#/hr)			11									
Confl. Bikes (#/hr)										1		
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	24.5	24.5	24.5	5.2	5.2	5.2		8.2	20.8		6.9	19.0
Effective Green, g (s)	24.5	24.5	24.5	5.2	5.2	5.2		8.2	20.8		6.9	19.0
Actuated g/C Ratio	0.32	0.32	0.32	0.07	0.07	0.07		0.11	0.27		0.09	0.25
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	531	536	490	112	116	106		187	1357		157	867
v/s Ratio Prot	0.23	c0.23		c0.01	0.01			c0.07	0.12		0.05	c0.14
v/s Ratio Perm			0.03			0.00						
v/c Ratio	0.72	0.73	0.11	0.21	0.21	0.06		0.65	0.46		0.54	0.58
Uniform Delay, d1	23.5	23.5	18.8	34.2	34.2	33.9		33.3	23.7		33.8	25.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00
Incremental Delay, d2	4.6	4.9	0.1	1.0	0.9	0.2		7.9	0.2		3.5	1.0
Delay (s)	28.1	28.4	18.9	35.2	35.1	34.1		41.2	23.7		37.2	26.8
Level of Service	C	C	B	D	D	C		D	C		D	C
Approach Delay (s)		26.6			34.4				26.5			22.0
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	20.6
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	250
Future Volume (vph)	250
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	0.99
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1569
Flt Permitted	1.00
Satd. Flow (perm)	1569
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	272
RTOR Reduction (vph)	119
Lane Group Flow (vph)	153
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	43.5
Effective Green, g (s)	43.5
Actuated g/C Ratio	0.56
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	880
v/s Ratio Prot	0.05
v/s Ratio Perm	0.04
v/c Ratio	0.17
Uniform Delay, d1	8.3
Progression Factor	1.00
Incremental Delay, d2	0.1
Delay (s)	8.4
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection							
Int Delay, s/veh	0.9						

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	106	674	27	0	690
Future Vol, veh/h	0	106	674	27	0	690
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	115	733	29	0	750

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1122	381	0	0	762	0
Stage 1	747	-	-	-	-	-
Stage 2	375	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	200	617	-	-	846	-
Stage 1	429	-	-	-	-	-
Stage 2	665	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	200	617	-	-	846	-
Mov Cap-2 Maneuver	200	-	-	-	-	-
Stage 1	429	-	-	-	-	-
Stage 2	665	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	617	846	-
HCM Lane V/C Ratio	-	-	0.187	-	-
HCM Control Delay (s)	-	-	12.2	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0	-

Intersection															
Int Delay, s/veh	5.1														

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	60	0	68	20	0	39	10	35	578	5	24	10	653	23
Future Vol, veh/h	60	0	68	20	0	39	10	35	578	5	24	10	653	23
Conflicting Peds, #/hr	2	0	1	0	0	0	0	2	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	120	-	-	-	140	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Peak Hour Factor	92	92	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	2	2
Mvmt Flow	65	0	74	22	0	42	11	38	628	5	26	11	710	25

Major/Minor	Minor2			Minor1			Major1				Major2			
Conflicting Flow All	1210	1530	371	1160	1540	319	610	737	0	0	505	634	0	0
Stage 1	798	798	-	729	729	-	-	-	-	-	-	-	-	-
Stage 2	412	732	-	431	811	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	6.44	4.14	-	-	6.44	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.52	2.22	-	-	2.52	2.22	-	-
Pot Cap-1 Maneuver	138	116	626	151	114	677	589	865	-	-	687	945	-	-
Stage 1	346	396	-	380	426	-	-	-	-	-	-	-	-	-
Stage 2	588	425	-	573	391	-	-	-	-	-	-	-	-	-
Platoon blocked, %									-	-			-	-
Mov Cap-1 Maneuver	129	116	624	133	114	676	756	756	-	-	713	713	-	-
Mov Cap-2 Maneuver	129	116	-	133	114	-	-	-	-	-	-	-	-	-
Stage 1	346	395	-	380	426	-	-	-	-	-	-	-	-	-
Stage 2	550	425	-	504	390	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	44.7	21.3	0.7	0.5
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	756	-	-	223	284	713	-	-
HCM Lane V/C Ratio	0.065	-	-	0.624	0.226	0.052	-	-
HCM Control Delay (s)	10.1	-	-	44.7	21.3	10.3	-	-
HCM Lane LOS	B	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-	3.7	0.8	0.2	-	-

Intersection								
Int Delay, s/veh	0.9							

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	20	40	10	578	5	10	9	722
Future Vol, veh/h	20	40	10	578	5	10	9	722
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	22	43	11	628	5	11	10	785

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1087	317	573	0	0	677	634	0
Stage 1	653	-	-	-	-	-	-	-
Stage 2	434	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	211	679	622	-	-	534	945	-
Stage 1	480	-	-	-	-	-	-	-
Stage 2	621	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	211	679	622	-	-	646	646	-
Mov Cap-2 Maneuver	211	-	-	-	-	-	-	-
Stage 1	480	-	-	-	-	-	-	-
Stage 2	621	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0.2	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	622	-	-	390	646	-
HCM Lane V/C Ratio	0.017	-	-	0.167	0.032	-
HCM Control Delay (s)	10.9	-	-	16.1	10.8	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	98	0	149	21	0	39	121	446	5	10	10	652
Future Volume (vph)	98	0	149	21	0	39	121	446	5	10	10	652
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			0.99		1.00	1.00			1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	1.00
Frt		0.92			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1657			1655		1770	3533			1770	3488
Flt Permitted		0.84			0.86		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1421			1446		1770	3533			1863	3488
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)	107	0	162	23	0	42	132	485	5	11	11	709
RTOR Reduction (vph)	0	105	0	0	50	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	164	0	0	15	0	132	490	0	0	22	776
Confl. Peds. (#/hr)			14			4			2			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		13.6			13.6		8.0	29.9			1.4	23.2
Effective Green, g (s)		13.6			13.6		8.0	29.9			1.4	23.2
Actuated g/C Ratio		0.23			0.23		0.13	0.50			0.02	0.39
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		324			330		237	1775			43	1360
v/s Ratio Prot							c0.07	0.14				c0.22
v/s Ratio Perm		c0.12			0.01						0.01	
v/c Ratio		0.51			0.05		0.56	0.28			0.51	0.57
Uniform Delay, d1		20.0			17.9		24.1	8.5			28.7	14.2
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		1.2			0.1		2.8	0.1			9.9	0.6
Delay (s)		21.3			17.9		26.9	8.6			38.8	14.9
Level of Service		C			B		C	A			D	B
Approach Delay (s)		21.3			17.9			12.5				15.5
Approach LOS		C			B			B				B

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	59.5	Sum of lost time (s)	14.7
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	70
Future Volume (vph)	70
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	76
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	153	399	21	10	549	212	86	18	7	145	14	109
Future Volume (veh/h)	153	399	21	10	549	212	86	18	7	145	14	109
Number	5	2	12	1	6	16	3	8	18	7	4	14
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		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	166	434	23	11	597	230	93	20	8	158	15	118
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	216	1674	88	20	946	364	274	53	15	456	40	318
Arrive On Green	0.12	0.49	0.49	0.01	0.38	0.38	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1774	3419	181	1774	2499	961	705	236	67	1373	181	1422
Grp Volume(v), veh/h	166	224	233	11	423	404	121	0	0	158	0	133
Grp Sat Flow(s),veh/h/ln	1774	1770	1831	1774	1770	1690	1008	0	0	1373	0	1603
Q Serve(g_s), s	5.0	4.1	4.1	0.3	10.7	10.7	3.7	0.0	0.0	0.0	0.0	3.8
Cycle Q Clear(g_c), s	5.0	4.1	4.1	0.3	10.7	10.7	7.5	0.0	0.0	5.0	0.0	3.8
Prop In Lane	1.00		0.10	1.00		0.57	0.77		0.07	1.00		0.89
Lane Grp Cap(c), veh/h	216	866	896	20	670	640	342	0	0	456	0	358
V/C Ratio(X)	0.77	0.26	0.26	0.55	0.63	0.63	0.35	0.00	0.00	0.35	0.00	0.37
Avail Cap(c_a), veh/h	538	1413	1461	133	1002	957	710	0	0	833	0	799
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.3	8.2	8.2	26.9	13.9	13.9	20.3	0.0	0.0	18.5	0.0	18.0
Incr Delay (d2), s/veh	5.6	0.2	0.2	21.6	1.0	1.0	0.6	0.0	0.0	0.5	0.0	0.6
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	2.7	2.0	2.0	0.3	5.3	5.1	1.7	0.0	0.0	2.1	0.0	1.8
LnGrp Delay(d),s/veh	28.9	8.3	8.3	48.5	14.9	14.9	20.9	0.0	0.0	18.9	0.0	18.6
LnGrp LOS	C	A	A	D	B	B	C			B		B
Approach Vol, veh/h		623			838			121			291	
Approach Delay, s/veh		13.8			15.3			20.9			18.8	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.0	32.6		17.1	11.1	26.5		17.1
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	4.1	* 44		27.3	16.6	31.0		27.3
Max Q Clear Time (g_c+I1), s	2.3	6.1		7.0	7.0	12.7		9.5
Green Ext Time (p_c), s	0.0	10.5		2.0	0.3	8.0		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	15.7
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	263	80	45	252	320	343	353	779	248	321	914	28
Future Volume (veh/h)	263	80	45	252	320	343	353	779	248	321	914	28
Number	3	8	18	7	4	14	1	6	16	5	2	12
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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	286	87	49	274	348	373	384	847	270	349	993	30
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	296	507	267	325	437	557	388	1533	684	403	1686	525
Arrive On Green	0.09	0.23	0.23	0.09	0.23	0.23	0.22	0.43	0.43	0.12	0.33	0.33
Sat Flow, veh/h	3442	2243	1181	3442	1863	1583	1774	3539	1579	3442	5085	1583
Grp Volume(v), veh/h	286	67	69	274	348	373	384	847	270	349	993	30
Grp Sat Flow(s),veh/h/ln	1721	1770	1654	1721	1863	1583	1774	1770	1579	1721	1695	1583
Q Serve(g_s), s	12.4	4.6	5.0	11.8	26.4	30.0	32.4	26.8	17.5	14.9	24.3	1.9
Cycle Q Clear(g_c), s	12.4	4.6	5.0	11.8	26.4	30.0	32.4	26.8	17.5	14.9	24.3	1.9
Prop In Lane	1.00		0.71	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	296	400	374	325	437	557	388	1533	684	403	1686	525
V/C Ratio(X)	0.97	0.17	0.18	0.84	0.80	0.67	0.99	0.55	0.39	0.87	0.59	0.06
Avail Cap(c_a), veh/h	296	441	412	422	522	629	388	1533	684	519	1686	525
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	0.66	0.66	0.66	0.60	0.60	0.60	0.70	0.70	0.70
Uniform Delay (d), s/veh	68.3	46.7	46.9	66.8	54.1	41.3	58.4	31.7	29.1	65.1	41.6	34.2
Incr Delay (d2), s/veh	43.0	0.2	0.2	8.0	4.9	1.6	32.6	0.9	1.0	8.5	1.1	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	7.7	2.3	2.3	6.0	14.2	13.3	19.4	13.2	7.8	7.6	11.6	0.9
LnGrp Delay(d),s/veh	111.4	46.9	47.1	74.8	58.9	42.8	91.1	32.6	30.1	73.6	42.7	34.3
LnGrp LOS	F	D	D	E	E	D	F	C	C	E	D	C
Approach Vol, veh/h		422			995			1501			1372	
Approach Delay, s/veh		90.6			57.3			47.1			50.4	
Approach LOS		F			E			D			D	

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	37.0	55.2	17.1	40.7	21.8	70.5	18.3	39.4
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 33	42.9	* 13	42.0	* 23	53.1	* 18	* 37
Max Q Clear Time (g_c+I1), s	34.4	26.3	14.4	32.0	16.9	28.8	13.8	7.0
Green Ext Time (p_c), s	0.0	12.1	0.0	3.2	0.6	16.1	0.4	4.7

Intersection Summary	
HCM 2010 Ctrl Delay	54.8
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	96	8	348	97	35	85	55	1194	14	41	822	348
Future Volume (veh/h)	96	8	348	97	35	85	55	1194	14	41	822	348
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	104	9	378	105	38	92	60	1298	15	45	893	378
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	486	10	421	154	42	102	90	1390	16	154	1502	1105
Arrive On Green	0.27	0.27	0.27	0.09	0.09	0.09	0.05	0.39	0.39	0.09	0.42	0.42
Sat Flow, veh/h	1774	37	1539	1774	484	1172	1774	3584	41	1774	3539	1583
Grp Volume(v), veh/h	104	0	387	105	0	130	60	641	672	45	893	378
Grp Sat Flow(s),veh/h/ln	1774	0	1575	1774	0	1656	1774	1770	1855	1774	1770	1583
Q Serve(g_s), s	5.2	0.0	27.2	6.6	0.0	8.9	3.8	40.0	40.0	2.7	22.3	10.9
Cycle Q Clear(g_c), s	5.2	0.0	27.2	6.6	0.0	8.9	3.8	40.0	40.0	2.7	22.3	10.9
Prop In Lane	1.00		0.98	1.00		0.71	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	486	0	431	154	0	144	90	687	720	154	1502	1105
V/C Ratio(X)	0.21	0.00	0.90	0.68	0.00	0.90	0.67	0.93	0.93	0.29	0.59	0.34
Avail Cap(c_a), veh/h	555	0	493	154	0	144	102	687	720	154	1502	1105
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	1.00	1.00	0.72	0.72	0.72
Uniform Delay (d), s/veh	32.2	0.0	40.2	51.0	0.0	52.0	53.6	33.8	33.8	49.2	25.5	6.9
Incr Delay (d2), s/veh	0.2	0.0	17.6	11.5	0.0	47.3	13.1	21.4	20.8	0.7	1.3	0.6
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	2.6	0.0	13.9	3.7	0.0	6.0	2.2	23.5	24.5	1.4	11.2	9.2
LnGrp Delay(d),s/veh	32.4	0.0	57.8	62.4	0.0	99.3	66.8	55.2	54.5	49.9	26.7	7.5
LnGrp LOS	C		E	E		F	E	E	D	D	C	A
Approach Vol, veh/h		491			235			1373			1316	
Approach Delay, s/veh		52.4			82.8			55.4			22.0	
Approach LOS		D			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	54.3		14.6	14.2	50.1		36.1
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.6	43.5		10.0	* 10	40.1		36.0
Max Q Clear Time (g_c+I1), s	5.8	24.3		10.9	4.7	42.0		29.2
Green Ext Time (p_c), s	0.0	15.4		0.0	0.0	0.0		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	44.0
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	49	53	392	90	60	40	213	910	12	57	878	12
Future Volume (veh/h)	49	53	392	90	60	40	213	910	12	57	878	12
Number	3	8	18	7	4	14	1	6	16	5	2	12
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		0.98	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	53	0	465	98	65	43	232	989	13	62	954	13
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	384	0	917	393	228	151	329	1520	20	79	1336	18
Arrive On Green	0.04	0.00	0.19	0.06	0.22	0.22	0.10	0.43	0.43	0.04	0.37	0.37
Sat Flow, veh/h	1774	0	3152	1774	1041	689	3442	3576	47	1774	3575	49
Grp Volume(v), veh/h	53	0	465	98	0	108	232	489	513	62	472	495
Grp Sat Flow(s),veh/h/ln	1774	0	1576	1774	0	1730	1721	1770	1854	1774	1770	1854
Q Serve(g_s), s	1.6	0.0	8.4	3.0	0.0	3.6	4.5	15.1	15.1	2.4	15.7	15.7
Cycle Q Clear(g_c), s	1.6	0.0	8.4	3.0	0.0	3.6	4.5	15.1	15.1	2.4	15.7	15.7
Prop In Lane	1.00		1.00	1.00		0.40	1.00		0.03	1.00		0.03
Lane Grp Cap(c), veh/h	384	0	917	393	0	379	329	752	788	79	661	693
V/C Ratio(X)	0.14	0.00	0.51	0.25	0.00	0.29	0.70	0.65	0.65	0.79	0.71	0.71
Avail Cap(c_a), veh/h	427	0	1677	393	0	754	430	795	832	155	728	763
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.9	0.0	20.3	20.2	0.0	22.4	30.2	15.7	15.7	32.6	18.4	18.4
Incr Delay (d2), s/veh	0.2	0.0	0.4	0.3	0.0	0.4	3.5	1.8	1.7	15.8	3.0	2.9
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	0.8	0.0	3.7	1.5	0.0	1.8	2.3	7.7	8.1	1.5	8.2	8.5
LnGrp Delay(d),s/veh	21.1	0.0	20.7	20.5	0.0	22.8	33.7	17.5	17.4	48.3	21.4	21.3
LnGrp LOS	C		C	C		C	C	B	B	D	C	C
Approach Vol, veh/h		518			206			1234			1029	
Approach Delay, s/veh		20.8			21.7			20.5			22.9	
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	11.0	30.9	6.9	20.0	7.5	34.4	8.6	18.3
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	8.6	28.3	4.2	30.0	6.0	30.9	4.2	30.0
Max Q Clear Time (g_c+I1), s	6.5	17.7	3.6	5.6	4.4	17.1	5.0	10.4
Green Ext Time (p_c), s	0.2	8.0	0.0	2.6	0.0	9.9	0.0	2.5

Intersection Summary	
HCM 2010 Ctrl Delay	21.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	251	947	0	0	1563	555	354	1	647	0	0	0
Future Volume (veh/h)	251	947	0	0	1563	555	354	1	647	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	273	1029	0	0	1699	603	386	0	703			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	492	3062	0	0	1377	616	947	0	845			
Arrive On Green	0.05	0.20	0.00	0.00	0.39	0.39	0.27	0.00	0.27			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	273	1029	0	0	1699	603	386	0	703			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	7.8	17.4	0.0	0.0	38.9	37.6	8.9	0.0	20.9			
Cycle Q Clear(g_c), s	7.8	17.4	0.0	0.0	38.9	37.6	8.9	0.0	20.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	492	3062	0	0	1377	616	947	0	845			
V/C Ratio(X)	0.55	0.34	0.00	0.00	1.23	0.98	0.41	0.00	0.83			
Avail Cap(c_a), veh/h	492	3062	0	0	1377	616	1242	0	1108			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.50	0.50	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	44.5	22.9	0.0	0.0	30.5	30.1	30.2	0.0	34.5			
Incr Delay (d2), s/veh	0.7	0.1	0.0	0.0	111.8	31.5	0.3	0.0	4.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.8	8.2	0.0	0.0	40.3	21.8	4.4	0.0	9.7			
LnGrp Delay(d),s/veh	45.2	23.1	0.0	0.0	142.4	61.6	30.4	0.0	38.8			
LnGrp LOS	D	C			F	E	C		D			
Approach Vol, veh/h		1302			2302			1089				
Approach Delay, s/veh		27.7			121.2			35.8				
Approach LOS		C			F			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		67.2			21.3	45.9		32.8
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		51.9			7.3	* 39		35.0
Max Q Clear Time (g_c+I1), s		19.4			9.8	40.9		22.9
Green Ext Time (p_c), s		10.3			0.0	0.0		3.8

Intersection Summary	
HCM 2010 Ctrl Delay	75.5
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	694	248	874	1043	0	0	0	0	504	0	311
Future Volume (veh/h)	0	694	248	874	1043	0	0	0	0	504	0	311
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	754	270	950	1134	0				653	0	225
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1113	498	953	2295	0				783	0	349
Arrive On Green	0.00	0.31	0.31	0.09	0.21	0.00				0.22	0.00	0.22
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	754	270	950	1134	0				653	0	225
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	18.6	14.1	27.6	28.2	0.0				17.6	0.0	12.9
Cycle Q Clear(g_c), s	0.0	18.6	14.1	27.6	28.2	0.0				17.6	0.0	12.9
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1113	498	953	2295	0				783	0	349
V/C Ratio(X)	0.00	0.68	0.54	1.00	0.49	0.00				0.83	0.00	0.64
Avail Cap(c_a), veh/h	0	1113	498	953	2295	0				1029	0	459
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.09	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	29.9	28.3	45.4	24.9	0.0				37.2	0.0	35.4
Incr Delay (d2), s/veh	0.0	3.3	4.2	8.0	0.1	0.0				4.7	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	9.5	6.7	14.2	13.9	0.0				9.1	0.0	5.8
LnGrp Delay(d),s/veh	0.0	33.2	32.5	53.3	25.0	0.0				41.9	0.0	37.4
LnGrp LOS		C	C	D	C					D		D
Approach Vol, veh/h		1024			2084						878	
Approach Delay, s/veh		33.0			37.9						40.7	
Approach LOS		C			D						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	33.4	38.4		28.2		71.8		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 28	24.5		29.0		57.9		
Max Q Clear Time (g_c+I1), s	29.6	20.6		19.6		30.2		
Green Ext Time (p_c), s	0.0	3.5		2.5		18.0		

Intersection Summary	
HCM 2010 Ctrl Delay	37.3
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	331	52	72	63	51	89	15	148	522	43	133	684
Future Volume (vph)	331	52	72	63	51	89	15	148	522	43	133	684
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.99	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1708	1551	1681	1760	1560		1770	5027		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.99	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1708	1551	1681	1760	1560		1770	5027		1770	3539
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)	360	57	78	68	55	97	16	161	567	47	145	743
RTOR Reduction (vph)	0	0	59	0	0	89	0	0	9	0	0	0
Lane Group Flow (vph)	209	208	19	61	62	8	0	177	605	0	145	743
Confl. Peds. (#/hr)			9									
Confl. Bikes (#/hr)			1			1						
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	19.0	19.0	19.0	6.8	6.8	6.8		9.2	21.4		10.8	22.5
Effective Green, g (s)	19.0	19.0	19.0	6.8	6.8	6.8		9.2	21.4		10.8	22.5
Actuated g/C Ratio	0.24	0.24	0.24	0.09	0.09	0.09		0.12	0.27		0.14	0.29
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	408	415	377	146	153	135		208	1377		244	1019
v/s Ratio Prot	c0.12	0.12		c0.04	0.04			c0.10	0.12		0.08	c0.21
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.51	0.50	0.05	0.42	0.41	0.06		0.85	0.44		0.59	0.73
Uniform Delay, d1	25.5	25.5	22.6	33.8	33.7	32.7		33.8	23.4		31.6	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.97		1.00	1.00
Incremental Delay, d2	1.1	1.0	0.1	1.9	1.8	0.2		26.8	0.2		3.9	2.6
Delay (s)	26.6	26.4	22.7	35.7	35.5	32.9		60.5	22.8		35.4	27.7
Level of Service	C	C	C	D	D	C		E	C		D	C
Approach Delay (s)		25.9			34.4				31.3			22.0
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	78.1	Sum of lost time (s)	20.6
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	537
Future Volume (vph)	537
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	584
RTOR Reduction (vph)	229
Lane Group Flow (vph)	355
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	41.5
Effective Green, g (s)	41.5
Actuated g/C Ratio	0.53
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	841
v/s Ratio Prot	0.10
v/s Ratio Perm	0.12
v/c Ratio	0.42
Uniform Delay, d1	11.1
Progression Factor	1.00
Incremental Delay, d2	0.3
Delay (s)	11.4
Level of Service	B
Approach Delay (s)	
Approach LOS	
Intersection Summary	

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	45	622	105	0	834
Future Vol, veh/h	0	45	622	105	0	834
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	49	676	114	0	907

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1186	395	0	0	790	0
Stage 1	733	-	-	-	-	-
Stage 2	453	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	181	604	-	-	826	-
Stage 1	436	-	-	-	-	-
Stage 2	607	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	181	604	-	-	826	-
Mov Cap-2 Maneuver	181	-	-	-	-	-
Stage 1	436	-	-	-	-	-
Stage 2	607	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.5	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	604	826	-
HCM Lane V/C Ratio	-	-	0.081	-	-
HCM Control Delay (s)	-	-	11.5	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	38	0	26	9	0	18	10	56	586	21	85	43	622	64
Future Vol, veh/h	38	0	26	9	0	18	10	56	586	21	85	43	622	64
Conflicting Peds, #/hr	2	0	0	0	0	0	0	6	0	0	0	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	120	-	-	-	140	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Peak Hour Factor	92	92	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	2	2
Mvmt Flow	41	0	28	10	0	20	11	61	637	23	92	47	676	70

Major/Minor	Minor2			Minor1			Major1				Major2			
Conflicting Flow All	1453	1794	381	1410	1818	336	573	748	0	0	501	660	0	0
Stage 1	991	991	-	792	792	-	-	-	-	-	-	-	-	-
Stage 2	462	803	-	618	1026	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	6.44	4.14	-	-	6.44	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.52	2.22	-	-	2.52	2.22	-	-
Pot Cap-1 Maneuver	91	80	617	98	77	660	622	856	-	-	691	924	-	-
Stage 1	264	322	-	349	399	-	-	-	-	-	-	-	-	-
Stage 2	549	394	-	443	310	-	-	-	-	-	-	-	-	-
Platoon blocked, %									-	-			-	-
Mov Cap-1 Maneuver	88	80	613	93	77	657	800	800	-	-	739	739	-	-
Mov Cap-2 Maneuver	88	80	-	93	77	-	-	-	-	-	-	-	-	-
Stage 1	264	321	-	349	399	-	-	-	-	-	-	-	-	-
Stage 2	530	394	-	420	309	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	57.1	24.2	1	1.7
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	800	-	-	135	217	739	-	-
HCM Lane V/C Ratio	0.09	-	-	0.515	0.135	0.188	-	-
HCM Control Delay (s)	9.9	-	-	57.1	24.2	11	-	-
HCM Lane LOS	A	-	-	F	C	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-	2.5	0.5	0.7	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	9	19	10	644	22	10	43	604
Future Vol, veh/h	9	19	10	644	22	10	43	604
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	10	21	11	700	24	11	47	657

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1177	362	479	0	0	745	724	0
Stage 1	734	-	-	-	-	-	-	-
Stage 2	443	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	184	635	714	-	-	484	874	-
Stage 1	436	-	-	-	-	-	-	-
Stage 2	614	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	184	635	714	-	-	752	752	-
Mov Cap-2 Maneuver	184	-	-	-	-	-	-	-
Stage 1	436	-	-	-	-	-	-	-
Stage 2	614	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.1	0.1	0.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	714	-	-	355	752	-
HCM Lane V/C Ratio	0.015	-	-	0.086	0.077	-
HCM Control Delay (s)	10.1	-	-	16.1	10.2	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	40	0	42	11	0	18	61	608	23	10	43	510
Future Volume (vph)	40	0	42	11	0	18	61	608	23	10	43	510
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			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		0.93			0.92		1.00	0.99			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1680			1674		1770	3517			1770	3485
Flt Permitted		0.83			0.86		0.95	1.00			0.68	1.00
Satd. Flow (perm)		1429			1470		1770	3517			1263	3485
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)	43	0	46	12	0	20	66	661	25	11	47	554
RTOR Reduction (vph)	0	75	0	0	27	0	0	3	0	0	0	6
Lane Group Flow (vph)	0	14	0	0	5	0	66	683	0	0	58	602
Confl. Peds. (#/hr)			2									
Confl. Bikes (#/hr)									1			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		8.0			8.0		4.6	22.2			5.9	23.4
Effective Green, g (s)		8.0			8.0		4.6	22.2			5.9	23.4
Actuated g/C Ratio		0.16			0.16		0.09	0.44			0.12	0.46
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		225			231		160	1539			146	1608
v/s Ratio Prot							0.04	c0.19				0.17
v/s Ratio Perm		c0.01			0.00						c0.05	
v/c Ratio		0.06			0.02		0.41	0.44			0.40	0.37
Uniform Delay, d1		18.2			18.0		21.8	9.9			20.8	8.9
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.01
Incremental Delay, d2		0.1			0.0		1.7	0.2			1.8	0.1
Delay (s)		18.3			18.1		23.5	10.1			22.6	9.1
Level of Service		B			B		C	B			C	A
Approach Delay (s)		18.3			18.1			11.3				10.3
Approach LOS		B			B			B				B

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	50.7	Sum of lost time (s)	14.7
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

7: Carmel Mountain Rd & Cuca St/Caminata Deluz (Access D) Existing + Proj PM
HCM Signalized Intersection Capacity Analysis 9/29/2016

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Lennar PQ Synchro 9 Report
N:\2472\Analysis\Intersections\Existing + Proj PM.syn

8: Carmel Mountain Rd & Paseo Cardiel — Existing + Proj PM

HCM 2010 Signalized Intersection Summary — 9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	122	589	92	34	340	77	231	38	74	110	23	58
Future Volume (veh/h)	122	589	92	34	340	77	231	38	74	110	23	58
Number	5	2	12	1	6	16	3	8	18	7	4	14
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	0.99		0.99	1.00		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	133	640	100	37	370	84	251	41	80	120	25	63
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	174	1052	164	55	792	178	415	67	104	588	171	432
Arrive On Green	0.10	0.34	0.34	0.03	0.28	0.28	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	1774	3067	478	1774	2873	645	848	183	282	1264	467	1176
Grp Volume(v), veh/h	133	369	371	37	226	228	372	0	0	120	0	88
Grp Sat Flow(s),veh/h/ln	1774	1770	1776	1774	1770	1749	1313	0	0	1264	0	1643
Q Serve(g_s), s	4.3	10.1	10.1	1.2	6.2	6.3	13.0	0.0	0.0	0.0	0.0	2.1
Cycle Q Clear(g_c), s	4.3	10.1	10.1	1.2	6.2	6.3	15.1	0.0	0.0	3.9	0.0	2.1
Prop In Lane	1.00		0.27	1.00		0.37	0.67		0.22	1.00		0.72
Lane Grp Cap(c), veh/h	174	607	609	55	488	482	586	0	0	588	0	603
V/C Ratio(X)	0.76	0.61	0.61	0.67	0.46	0.47	0.64	0.00	0.00	0.20	0.00	0.15
Avail Cap(c_a), veh/h	505	1013	1017	201	704	696	1151	0	0	1102	0	1270
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.6	15.9	15.9	28.0	17.5	17.6	16.9	0.0	0.0	12.9	0.0	12.3
Incr Delay (d2), s/veh	6.7	1.0	1.0	13.5	0.7	0.7	1.1	0.0	0.0	0.2	0.0	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	2.4	5.1	5.1	0.8	3.1	3.1	5.5	0.0	0.0	1.4	0.0	1.0
LnGrp Delay(d),s/veh	32.4	16.9	16.9	41.4	18.2	18.3	18.1	0.0	0.0	13.1	0.0	12.4
LnGrp LOS	C	B	B	D	B	B	B			B		B
Approach Vol, veh/h		873			491			372			208	
Approach Delay, s/veh		19.3			20.0			18.1			12.8	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	25.8		26.3	10.1	21.9		26.3
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	6.6	* 33		45.1	16.6	23.2		45.1
Max Q Clear Time (g_c+I1), s	3.2	12.1		5.9	6.3	8.3		17.1
Green Ext Time (p_c), s	0.0	7.9		3.8	0.2	6.6		3.7

Intersection Summary		
HCM 2010 Ctrl Delay		18.5
HCM 2010 LOS		B

Notes

9: Rancho Penasquitos Blvd & SR 56 WB Ramps & Carmel Mountain Rd — Existing + Proj PM

HCM 2010 Signalized Intersection Summary — 9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	252	165	122	300	185	233	298	777	394	317	434	22
Future Volume (veh/h)	252	165	122	300	185	233	298	777	394	317	434	22
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	274	179	133	326	201	253	324	845	428	345	472	24
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	316	321	224	379	336	468	346	1709	753	397	2051	637
Arrive On Green	0.09	0.16	0.16	0.11	0.18	0.18	0.20	0.48	0.48	0.12	0.40	0.40
Sat Flow, veh/h	3442	1978	1380	3442	1863	1581	1774	3539	1560	3442	5085	1579
Grp Volume(v), veh/h	274	159	153	326	201	253	324	845	428	345	472	24
Grp Sat Flow(s),veh/h/ln	1721	1770	1589	1721	1863	1581	1774	1770	1560	1721	1695	1579
Q Serve(g_s), s	11.8	12.4	13.4	14.0	14.9	20.1	27.0	24.3	29.3	14.8	9.2	1.4
Cycle Q Clear(g_c), s	11.8	12.4	13.4	14.0	14.9	20.1	27.0	24.3	29.3	14.8	9.2	1.4
Prop In Lane	1.00		0.87	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	316	287	258	379	336	468	346	1709	753	397	2051	637
V/C Ratio(X)	0.87	0.55	0.59	0.86	0.60	0.54	0.94	0.49	0.57	0.87	0.23	0.04
Avail Cap(c_a), veh/h	317	416	374	491	522	625	376	1709	753	491	2051	637
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	0.86	0.86	0.86	0.40	0.40	0.40	0.84	0.84	0.84
Uniform Delay (d), s/veh	67.2	57.9	58.3	65.6	56.5	44.3	59.4	26.3	27.6	65.2	29.4	27.1
Incr Delay (d2), s/veh	21.5	1.7	2.2	10.1	1.5	0.8	15.6	0.4	1.3	11.3	0.2	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	6.6	6.2	6.0	7.2	7.8	8.9	14.7	12.0	12.8	7.7	4.3	0.6
LnGrp Delay(d),s/veh	88.7	59.5	60.5	75.7	57.9	45.1	75.0	26.8	28.9	76.5	29.7	27.2
LnGrp LOS	F	E	E	E	E	D	E	C	C	E	C	C
Approach Vol, veh/h		586			780			1597			841	
Approach Delay, s/veh		73.4			61.2			37.1			48.8	
Approach LOS		E			E			D			D	

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	33.5	66.0	18.0	32.6	21.5	77.9	20.7	29.8
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 32	43.0	* 14	42.0	* 21	53.4	* 21	* 35
Max Q Clear Time (g_c+I1), s	29.0	11.2	13.8	22.1	16.8	31.3	16.0	15.4
Green Ext Time (p_c), s	0.3	14.3	0.0	3.9	0.5	11.9	0.6	3.9

Intersection Summary		
HCM 2010 Ctrl Delay		50.2
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	411	24	953	36	32	46	8	890	44	89	647	120
Future Volume (veh/h)	411	24	953	36	32	46	8	890	44	89	647	120
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	1.00		0.98
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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	447	26	1036	39	35	50	9	967	48	97	703	130
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	656	14	565	145	57	81	74	1054	52	148	1235	1129
Arrive On Green	0.37	0.37	0.37	0.08	0.08	0.08	0.04	0.31	0.31	0.08	0.35	0.35
Sat Flow, veh/h	1774	38	1526	1774	693	990	1774	3431	170	1774	3539	1557
Grp Volume(v), veh/h	447	0	1062	39	0	85	9	499	516	97	703	130
Grp Sat Flow(s),veh/h/ln	1774	0	1565	1774	0	1684	1774	1770	1831	1774	1770	1557
Q Serve(g_s), s	25.5	0.0	44.4	2.5	0.0	5.9	0.6	32.6	32.6	6.4	19.4	3.1
Cycle Q Clear(g_c), s	25.5	0.0	44.4	2.5	0.0	5.9	0.6	32.6	32.6	6.4	19.4	3.1
Prop In Lane	1.00		0.98	1.00		0.59	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	656	0	579	145	0	138	74	544	563	148	1235	1129
V/C Ratio(X)	0.68	0.00	1.83	0.27	0.00	0.62	0.12	0.92	0.92	0.66	0.57	0.12
Avail Cap(c_a), veh/h	656	0	579	148	0	140	74	544	563	151	1235	1129
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	1.00	1.00	0.90	0.90	0.90
Uniform Delay (d), s/veh	31.8	0.0	37.8	51.7	0.0	53.3	55.4	40.1	40.1	53.3	31.7	5.2
Incr Delay (d2), s/veh	2.9	0.0	382.2	1.0	0.0	7.6	0.7	22.8	22.3	8.7	1.7	0.2
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	12.9	0.0	80.6	1.3	0.0	3.0	0.3	19.4	20.0	3.5	9.8	3.1
LnGrp Delay(d),s/veh	34.7	0.0	420.0	52.7	0.0	60.9	56.1	62.9	62.4	62.0	33.5	5.4
LnGrp LOS	C		F	D		E	E	E	E	E	C	A
Approach Vol, veh/h		1509			124			1024			930	
Approach Delay, s/veh		305.9			58.3			62.6			32.5	
Approach LOS		F			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	47.4		14.4	14.2	42.4		49.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 5	41.7		10.0	* 10	36.5		44.4
Max Q Clear Time (g_c+I1), s	2.6	21.4		7.9	8.4	34.6		46.4
Green Ext Time (p_c), s	0.0	12.4		0.1	0.0	1.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	157.0
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	63	318	38	49	13	330	708	54	15	557	14
Future Volume (veh/h)	5	63	318	38	49	13	330	708	54	15	557	14
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	5	0	391	41	53	14	359	770	59	16	605	15
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	359	0	1020	352	289	76	508	1531	117	28	1157	29
Arrive On Green	0.01	0.00	0.18	0.03	0.20	0.20	0.15	0.46	0.46	0.02	0.33	0.33
Sat Flow, veh/h	1774	0	3145	1774	1421	375	3442	3330	255	1774	3529	87
Grp Volume(v), veh/h	5	0	391	41	0	67	359	409	420	16	303	317
Grp Sat Flow(s),veh/h/ln	1774	0	1573	1774	0	1796	1721	1770	1815	1774	1770	1847
Q Serve(g_s), s	0.1	0.0	5.7	1.1	0.0	1.8	5.9	9.7	9.7	0.5	8.3	8.3
Cycle Q Clear(g_c), s	0.1	0.0	5.7	1.1	0.0	1.8	5.9	9.7	9.7	0.5	8.3	8.3
Prop In Lane	1.00		1.00	1.00		0.21	1.00		0.14	1.00		0.05
Lane Grp Cap(c), veh/h	359	0	1020	352	0	365	508	814	835	28	580	606
V/C Ratio(X)	0.01	0.00	0.38	0.12	0.00	0.18	0.71	0.50	0.50	0.58	0.52	0.52
Avail Cap(c_a), veh/h	486	0	2049	430	0	903	1012	1236	1268	136	852	889
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.1	0.0	15.6	19.2	0.0	19.7	24.3	11.4	11.4	29.3	16.3	16.3
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.1	0.0	0.2	1.8	0.5	0.5	17.6	0.7	0.7
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	0.1	0.0	2.5	0.5	0.0	0.9	2.9	4.8	4.9	0.4	4.2	4.3
LnGrp Delay(d),s/veh	20.1	0.0	15.9	19.3	0.0	20.0	26.1	11.8	11.8	46.8	17.0	17.0
LnGrp LOS	C		B	B		B	C	B	B	D	B	B
Approach Vol, veh/h		396			108			1188			636	
Approach Delay, s/veh		15.9			19.7			16.1			17.8	
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	13.2	24.8	4.7	17.1	5.3	32.7	6.4	15.4
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	17.6	28.8	4.6	30.1	4.6	41.8	4.6	30.1
Max Q Clear Time (g_c+I1), s	7.9	10.3	2.1	3.8	2.5	11.7	3.1	7.7
Green Ext Time (p_c), s	0.9	9.0	0.0	2.0	0.0	11.3	0.0	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.7
HCM 2010 LOS	B

Notes

APPENDIX F

CUMULATIVE PROJECTS DATA

INTERSECTION	DIRECTION	TOTAL CUMULATIVE						Merge 56						The Preserve at Torrey Highlands					
		Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm
1 Carmel Mtn Rd / I-15 NB Ramps	Sb	0	0	0	0	0	0												
	Wb	0	0	0	0	0	0												
	Nb	0	0	0	0	0	0												
	Eb	0	0	0	0	2	6					2	6						
2 Carmel Mtn Rd / I-15 SB Ramps	Sb	4	4	0	0	0	0	4	4										
	Wb	0	0	0	0	0	0												
	Nb	0	0	0	0	0	0												
	Eb	0	0	2	6	0	0			2	6								
3 Carmel Mtn Rd / Penasquitos Dr	Sb	0	0	4	4	0	0			4	4								
	Wb	0	0	0	0	0	0												
	Nb	0	0	2	6	1	5			2	6	1	3					0	2
	Eb	4	4	0	0	0	0	2	3					2	1				
4. CMR/ Caminito Duoro/Apartments RIRO (Future Access A)	Sb	0	0	8	8	0	0			6	7					2	1		
	Wb	0	0	0	0	0	0												
	Nb	0	0	3	11	0	0			3	9					0	2		
	Eb	0	0	0	0	0	0												
5. CMR/ Gerana St (Future Full Access B)	Sb	0	0	8	8	0	0			6	7					2	1		
	Wb	0	0	0	0	0	0												
	Nb	0	0	3	11	2	5			3	9	1	3			0	2	1	2
	Eb	4	3	0	0	0	0	2	2					2	1				
6. CMR/ Caminata Ebro Full Access (Future Access C)	Sb	0	0	12	11	0	0			8	9					4	2		
	Wb	0	0	0	0	0	0												
	Nb	0	0	5	16	0	0			4	12					1	4		
	Eb	0	0	0	0	0	0												
7. CMR/ Cuca St (Future Full Access D)	Sb	0	0	12	11	0	0			8	9					4	2		
	Wb	0	0	0	0	0	0												
	Nb	0	0	5	16	0	2			4	12					1	4	0	2
	Eb	2	0	0	0	0	0							2	0				
8 Carmel Mtn Rd / Paseo Cardiel	Sb	0	0	0	0	0	0												
	Wb	0	0	14	11	0	0			8	9					6	2		
	Nb	0	0	0	0	0	0												
	Eb	0	0	5	18	0	0			4	12					1	6		
9 Carmel Mtn Rd / Rancho PQ Blvd / SR-56 WB Ramp	Sb	0	0	14	25	0	0			8	23					6	2		
	Wb	0	0	8	9	0	0			8	9								
	Nb	5	18	16	19	16	19	4	12	16	19	16	19	1	6				
	Eb	0	0	0	0	0	0												
10 Rancho PQ Blvd /SR-56 EB Ramp	Sb	0	0	8	23	0	0			8	23								
	Wb	0	0	0	0	0	0												
	Nb	0	0	32	38	0	0			32	38								
	Eb	8	23	0	0	4	12	8	23			4	12						
11 Carmel Mtn Rd /Paseo Montalban	Sb	0	2	8	23	0	2			8	23			0	2			0	2
	Wb	2	1	0	0	0	0							2	1				
	Nb	0	0	16	19	0	0			16	19								
	Eb	0	0	0	0	1	0											1	0
12. CMR/ Caminito Soleado RIRO (Existing Access B to be Deleted)	Sb	0	0	0	0	0	0												
	Wb	0	0	0	0	0	0												
	Nb	0	0	0	0	0	0												
	Eb	0	0	0	0	0	0												

STREET SEGMENT	TOTAL CUMULATIVE ONLY	Merge 56	Preserve at TH
Carmel Mountain Road			
I-15 SB Ramps to Penasquitos Dr	99	99	0
Penasquitos Dr to Gerana St	165	147	18
Gerana St to Cuca St	230	195	35
Cuca St to Paseo Cardiel	247	195	52
Paseo Cardiel to Rancho Penasquitos Blvd	247	195	52
Rancho Penasquitos Blvd to Paseo Montalban	390	390	0
Paseo Montalban to Sundevil Way	442	390	52

APPENDIX G

PEAK HOUR INTERSECTION ANALYSIS WORKSHEETS
EXISTING + CUMULATIVE

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	328	617	0	0	879	251	183	0	1005	0	0	0
Future Volume (veh/h)	328	617	0	0	879	251	183	0	1005	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	357	671	0	0	955	273	199	0	1092			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	398	2447	0	0	1019	456	1324	0	1182			
Arrive On Green	0.04	0.16	0.00	0.00	0.29	0.29	0.37	0.00	0.37			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	357	671	0	0	955	273	199	0	1092			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	9.3	10.4	0.0	0.0	23.7	13.4	3.4	0.0	29.7			
Cycle Q Clear(g_c), s	9.3	10.4	0.0	0.0	23.7	13.4	3.4	0.0	29.7			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	398	2447	0	0	1019	456	1324	0	1182			
V/C Ratio(X)	0.90	0.27	0.00	0.00	0.94	0.60	0.15	0.00	0.92			
Avail Cap(c_a), veh/h	398	2447	0	0	1019	456	1380	0	1231			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.80	0.80	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	42.7	24.0	0.0	0.0	31.3	27.6	18.7	0.0	27.0			
Incr Delay (d2), s/veh	18.8	0.2	0.0	0.0	16.7	5.7	0.1	0.0	11.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.5	5.0	0.0	0.0	13.9	6.6	1.6	0.0	14.8			
LnGrp Delay(d),s/veh	61.5	24.3	0.0	0.0	47.9	33.3	18.8	0.0	38.4			
LnGrp LOS	E	C			D	C	B		D			
Approach Vol, veh/h		1028			1228			1291				
Approach Delay, s/veh		37.2			44.7			35.4				
Approach LOS		D			D			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		50.3			17.4	32.9		39.7
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		41.9			10.3	* 26		35.0
Max Q Clear Time (g_c+I1), s		12.4			11.3	25.7		31.7
Green Ext Time (p_c), s		6.7			0.0	0.2		1.9

Intersection Summary			
HCM 2010 Ctrl Delay			39.1
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	673	572	548	514	0	0	0	0	272	6	266
Future Volume (veh/h)	0	673	572	548	514	0	0	0	0	272	6	266
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	732	622	596	559	0				389	0	195
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1550	693	660	2453	0				573	0	256
Arrive On Green	0.00	0.44	0.44	0.32	1.00	0.00				0.16	0.00	0.16
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	732	622	596	559	0				389	0	195
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	13.2	32.7	14.9	0.0	0.0				9.3	0.0	10.6
Cycle Q Clear(g_c), s	0.0	13.2	32.7	14.9	0.0	0.0				9.3	0.0	10.6
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1550	693	660	2453	0				573	0	256
V/C Ratio(X)	0.00	0.47	0.90	0.90	0.23	0.00				0.68	0.00	0.76
Avail Cap(c_a), veh/h	0	1550	693	696	2453	0				1143	0	510
HCM Platoon Ratio	1.00	1.00	1.00	1.67	1.67	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.47	0.47	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	17.9	23.4	29.8	0.0	0.0				35.5	0.0	36.1
Incr Delay (d2), s/veh	0.0	1.0	16.7	7.8	0.1	0.0				1.4	0.0	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	6.6	17.4	7.7	0.0	0.0				4.7	0.0	4.9
LnGrp Delay(d),s/veh	0.0	19.0	40.1	37.5	0.1	0.0				37.0	0.0	40.8
LnGrp LOS		B	D	D	A					D		D
Approach Vol, veh/h		1354			1155						584	
Approach Delay, s/veh		28.7			19.4						38.2	
Approach LOS		C			B						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.0	46.4		20.6		69.4		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 18	24.0		29.0		47.9		
Max Q Clear Time (g_c+I1), s	16.9	34.7		12.6		2.0		
Green Ext Time (p_c), s	0.4	0.0		1.9		17.5		

Intersection Summary			
HCM 2010 Ctrl Delay			27.0
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	662	48	160	30	13	90	29	74	493	15	77	453
Future Volume (vph)	662	48	160	30	13	90	29	74	493	15	77	453
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1696	1550	1681	1733	1583		1770	5060		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1696	1550	1681	1733	1583		1770	5060		1770	3539
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)	720	52	174	33	14	98	32	80	536	16	84	492
RTOR Reduction (vph)	0	0	119	0	0	91	0	0	3	0	0	0
Lane Group Flow (vph)	382	390	55	23	24	7	0	112	549	0	84	492
Confl. Peds. (#/hr)			11									
Confl. Bikes (#/hr)										1		
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	24.5	24.5	24.5	5.2	5.2	5.2		8.1	20.3		6.9	18.6
Effective Green, g (s)	24.5	24.5	24.5	5.2	5.2	5.2		8.1	20.3		6.9	18.6
Actuated g/C Ratio	0.32	0.32	0.32	0.07	0.07	0.07		0.11	0.26		0.09	0.24
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	534	539	493	113	117	106		186	1334		158	854
v/s Ratio Prot	0.23	c0.23		0.01	c0.01			c0.06	0.11		0.05	c0.14
v/s Ratio Perm			0.04			0.00						
v/c Ratio	0.72	0.72	0.11	0.20	0.21	0.06		0.60	0.41		0.53	0.58
Uniform Delay, d1	23.2	23.3	18.6	33.9	33.9	33.6		32.9	23.4		33.5	25.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00
Incremental Delay, d2	4.5	4.8	0.1	0.9	0.9	0.2		5.4	0.2		3.4	0.9
Delay (s)	27.7	28.0	18.7	34.8	34.8	33.9		38.4	23.4		36.9	26.7
Level of Service	C	C	B	C	C	C		D	C		D	C
Approach Delay (s)		26.2			34.2				25.9			21.8
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	20.6
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	250
Future Volume (vph)	250
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	0.99
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1569
Flt Permitted	1.00
Satd. Flow (perm)	1569
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	272
RTOR Reduction (vph)	120
Lane Group Flow (vph)	152
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	43.1
Effective Green, g (s)	43.1
Actuated g/C Ratio	0.56
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	878
v/s Ratio Prot	0.06
v/s Ratio Perm	0.04
v/c Ratio	0.17
Uniform Delay, d1	8.3
Progression Factor	1.00
Incremental Delay, d2	0.1
Delay (s)	8.4
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	43	658	11	0	672
Future Vol, veh/h	0	43	658	11	0	672
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	47	715	12	0	730

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1086	364	0	0	727	0
Stage 1	721	-	-	-	-	-
Stage 2	365	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	211	633	-	-	872	-
Stage 1	443	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	211	633	-	-	872	-
Mov Cap-2 Maneuver	211	-	-	-	-	-
Stage 1	443	-	-	-	-	-
Stage 2	673	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	633	872	-
HCM Lane V/C Ratio	-	-	0.074	-	-
HCM Control Delay (s)	-	-	11.1	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	3

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Traffic Vol, veh/h	60	72	10	37	556	20	649	23
Future Vol, veh/h	60	72	10	37	556	20	649	23
Conflicting Peds, #/hr	2	1	0	2	0	0	0	2
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	-	120	-	140	-	-
Veh in Median Storage, #	0	-	-	-	0	-	0	-
Grade, %	0	-	-	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	65	78	11	40	604	22	705	25

Major/Minor	Minor2		Major1			Major2		
Conflicting Flow All	1167	369	809	732	0	441	-	0
Stage 1	763	-	-	-	-	-	-	-
Stage 2	404	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	4.14	-	6.44	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	2.22	-	2.52	-	-
Pot Cap-1 Maneuver	187	628	440	868	-	754	-	-
Stage 1	421	-	-	-	-	-	-	-
Stage 2	643	-	-	-	-	-	-	-
Platoon blocked, %					-		-	-
Mov Cap-1 Maneuver	186	626	687	687	-	754	-	-
Mov Cap-2 Maneuver	186	-	-	-	-	-	-	-
Stage 1	420	-	-	-	-	-	-	-
Stage 2	642	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	27.3	0.8	0.3
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR
Capacity (veh/h)	687	-	302	754	-	-
HCM Lane V/C Ratio	0.074	-	0.475	0.029	-	-
HCM Control Delay (s)	10.7	-	27.3	9.9	-	-
HCM Lane LOS	B	-	D	A	-	-
HCM 95th %tile Q(veh)	0.2	-	2.4	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	15	29	10	564	4	10	7	704
Future Vol, veh/h	15	29	10	564	4	10	7	704
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	16	32	11	613	4	11	8	765

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1057	309	559	0	0	649	617	0
Stage 1	637	-	-	-	-	-	-	-
Stage 2	420	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	220	687	635	-	-	557	959	-
Stage 1	489	-	-	-	-	-	-	-
Stage 2	631	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	220	687	635	-	-	652	652	-
Mov Cap-2 Maneuver	220	-	-	-	-	-	-	-
Stage 1	489	-	-	-	-	-	-	-
Stage 2	631	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.2	0.2	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	635	-	-	399	652	-
HCM Lane V/C Ratio	0.017	-	-	0.12	0.028	-
HCM Control Delay (s)	10.8	-	-	15.2	10.7	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	98	0	151	13	0	27	121	443	3	10	7	632
Future Volume (vph)	98	0	151	13	0	27	121	443	3	10	7	632
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			0.99		1.00	1.00			1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	1.00
Frt		0.92			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1656			1650		1770	3535			1770	3486
Flt Permitted		0.85			0.89		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1439			1495		1770	3535			1863	3486
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)	107	0	164	14	0	29	132	482	3	11	8	687
RTOR Reduction (vph)	0	105	0	0	33	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	166	0	0	10	0	132	485	0	0	19	754
Confl. Peds. (#/hr)			14			4			2			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		13.5			13.5		8.0	30.9			0.6	23.4
Effective Green, g (s)		13.5			13.5		8.0	30.9			0.6	23.4
Actuated g/C Ratio		0.23			0.23		0.13	0.52			0.01	0.39
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		325			338		237	1832			18	1368
v/s Ratio Prot							c0.07	0.14				c0.22
v/s Ratio Perm		c0.12			0.01						0.01	
v/c Ratio		0.51			0.03		0.56	0.26			1.06	0.55
Uniform Delay, d1		20.2			17.9		24.1	8.0			29.5	14.0
Progression Factor		1.00			1.00		1.00	1.00			1.01	1.00
Incremental Delay, d2		1.4			0.0		2.8	0.1			230.8	0.5
Delay (s)		21.5			18.0		27.0	8.1			260.5	14.5
Level of Service		C			B		C	A			F	B
Approach Delay (s)		21.5			18.0			12.1				20.5
Approach LOS		C			B			B				C

Intersection Summary			
HCM 2000 Control Delay	17.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	59.6	Sum of lost time (s)	14.7
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	70
Future Volume (vph)	70
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	76
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	153	394	21	7	526	212	86	18	7	145	14	109
Future Volume (veh/h)	153	394	21	7	526	212	86	18	7	145	14	109
Number	5	2	12	1	6	16	3	8	18	7	4	14
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		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	166	428	23	8	572	230	93	20	8	158	15	118
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	216	1665	89	15	921	370	277	53	15	459	41	319
Arrive On Green	0.12	0.49	0.49	0.01	0.37	0.37	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1774	3417	183	1774	2465	989	707	238	67	1373	181	1422
Grp Volume(v), veh/h	166	221	230	8	410	392	121	0	0	158	0	133
Grp Sat Flow(s),veh/h/ln	1774	1770	1830	1774	1770	1685	1011	0	0	1373	0	1603
Q Serve(g_s), s	4.9	3.9	4.0	0.2	10.2	10.2	3.6	0.0	0.0	0.0	0.0	3.8
Cycle Q Clear(g_c), s	4.9	3.9	4.0	0.2	10.2	10.2	7.4	0.0	0.0	4.9	0.0	3.8
Prop In Lane	1.00		0.10	1.00		0.59	0.77		0.07	1.00		0.89
Lane Grp Cap(c), veh/h	216	862	892	15	661	630	345	0	0	459	0	360
V/C Ratio(X)	0.77	0.26	0.26	0.54	0.62	0.62	0.35	0.00	0.00	0.34	0.00	0.37
Avail Cap(c_a), veh/h	546	1434	1483	135	1017	968	722	0	0	846	0	811
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.9	8.1	8.1	26.6	13.8	13.8	19.9	0.0	0.0	18.1	0.0	17.7
Incr Delay (d2), s/veh	5.6	0.2	0.2	27.0	1.0	1.0	0.6	0.0	0.0	0.4	0.0	0.6
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	2.7	1.9	2.0	0.2	5.1	4.9	1.7	0.0	0.0	2.1	0.0	1.7
LnGrp Delay(d),s/veh	28.5	8.3	8.3	53.6	14.7	14.8	20.5	0.0	0.0	18.6	0.0	18.3
LnGrp LOS	C	A	A	D	B	B	C			B		B
Approach Vol, veh/h		617			810			121			291	
Approach Delay, s/veh		13.7			15.1			20.5			18.5	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	4.9	32.1		17.0	11.0	26.0		17.0
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	4.1	* 44		27.3	16.6	31.0		27.3
Max Q Clear Time (g_c+I1), s	2.2	6.0		6.9	6.9	12.2		9.4
Green Ext Time (p_c), s	0.0	10.2		2.0	0.3	7.9		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	15.5
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	263	80	45	249	311	326	369	795	247	317	928	28
Future Volume (veh/h)	263	80	45	249	311	326	369	795	247	317	928	28
Number	3	8	18	7	4	14	1	6	16	5	2	12
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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	286	87	49	271	338	354	401	864	268	345	1009	30
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	296	488	257	322	419	540	394	1569	700	399	1716	534
Arrive On Green	0.09	0.22	0.22	0.09	0.23	0.23	0.22	0.44	0.44	0.12	0.34	0.34
Sat Flow, veh/h	3442	2243	1181	3442	1863	1583	1774	3539	1579	3442	5085	1583
Grp Volume(v), veh/h	286	67	69	271	338	354	401	864	268	345	1009	30
Grp Sat Flow(s),veh/h/ln	1721	1770	1654	1721	1863	1583	1774	1770	1579	1721	1695	1583
Q Serve(g_s), s	12.4	4.6	5.1	11.6	25.8	28.5	33.3	27.0	17.1	14.8	24.6	1.9
Cycle Q Clear(g_c), s	12.4	4.6	5.1	11.6	25.8	28.5	33.3	27.0	17.1	14.8	24.6	1.9
Prop In Lane	1.00		0.71	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	296	385	360	322	419	540	394	1569	700	399	1716	534
V/C Ratio(X)	0.97	0.17	0.19	0.84	0.81	0.66	1.02	0.55	0.38	0.86	0.59	0.06
Avail Cap(c_a), veh/h	296	441	412	422	522	627	394	1569	700	519	1716	534
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	0.68	0.68	0.68	0.56	0.56	0.56	0.69	0.69	0.69
Uniform Delay (d), s/veh	68.3	47.7	47.9	66.9	55.0	41.9	58.3	30.7	28.0	65.1	41.1	33.6
Incr Delay (d2), s/veh	43.0	0.2	0.3	8.0	5.1	1.3	38.4	0.8	0.9	8.3	1.0	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	7.7	2.3	2.4	5.9	13.8	12.7	20.5	13.4	7.6	7.5	11.7	0.9
LnGrp Delay(d),s/veh	111.4	47.9	48.1	74.9	60.1	43.3	96.8	31.5	28.9	73.4	42.1	33.7
LnGrp LOS	F	D	D	E	E	D	F	C	C	E	D	C
Approach Vol, veh/h		422			963			1533			1384	
Approach Delay, s/veh		91.0			58.1			48.1			49.7	
Approach LOS		F			E			D			D	

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	37.5	56.1	17.1	39.3	21.6	72.0	18.2	38.2
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 33	42.4	* 13	42.0	* 23	53.1	* 18	* 37
Max Q Clear Time (g_c+I1), s	35.3	26.6	14.4	30.5	16.8	29.0	13.6	7.1
Green Ext Time (p_c), s	0.0	11.8	0.0	3.3	0.6	16.2	0.4	4.5

Intersection Summary	
HCM 2010 Ctrl Delay	55.1
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	8	356	97	35	85	55	1225	14	41	827	348
Future Volume (veh/h)	95	8	356	97	35	85	55	1225	14	41	827	348
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	103	9	387	105	38	92	60	1332	15	45	899	378
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	494	10	428	154	42	102	90	1375	15	154	1486	1105
Arrive On Green	0.28	0.28	0.28	0.09	0.09	0.09	0.05	0.38	0.38	0.09	0.42	0.42
Sat Flow, veh/h	1774	36	1540	1774	484	1172	1774	3585	40	1774	3539	1583
Grp Volume(v), veh/h	103	0	396	105	0	130	60	657	690	45	899	378
Grp Sat Flow(s),veh/h/ln	1774	0	1575	1774	0	1656	1774	1770	1855	1774	1770	1583
Q Serve(g_s), s	5.1	0.0	27.9	6.6	0.0	8.9	3.8	41.9	41.9	2.7	22.7	10.9
Cycle Q Clear(g_c), s	5.1	0.0	27.9	6.6	0.0	8.9	3.8	41.9	41.9	2.7	22.7	10.9
Prop In Lane	1.00		0.98	1.00		0.71	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	494	0	438	154	0	144	90	679	712	154	1486	1105
V/C Ratio(X)	0.21	0.00	0.90	0.68	0.00	0.90	0.67	0.97	0.97	0.29	0.61	0.34
Avail Cap(c_a), veh/h	555	0	493	154	0	144	102	679	712	154	1486	1105
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	1.00	1.00	0.69	0.69	0.69
Uniform Delay (d), s/veh	31.8	0.0	40.0	51.0	0.0	52.0	53.6	34.8	34.8	49.2	25.9	6.9
Incr Delay (d2), s/veh	0.2	0.0	18.6	11.5	0.0	47.3	13.1	27.6	27.0	0.7	1.3	0.6
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	2.5	0.0	14.4	3.7	0.0	6.0	2.2	25.7	26.8	1.4	11.4	9.3
LnGrp Delay(d),s/veh	32.0	0.0	58.6	62.4	0.0	99.3	66.8	62.4	61.8	49.9	27.2	7.5
LnGrp LOS	C		E	E		F	E	E	E	D	C	A
Approach Vol, veh/h		499			235			1407			1322	
Approach Delay, s/veh		53.1			82.8			62.3			22.3	
Approach LOS		D			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	53.8		14.6	14.2	49.6		36.6
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.6	43.5		10.0	* 10	40.1		36.0
Max Q Clear Time (g_c+I1), s	5.8	24.7		10.9	4.7	43.9		29.9
Green Ext Time (p_c), s	0.0	15.3		0.0	0.0	0.0		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	47.1
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	53	391	90	60	42	210	912	12	57	883	12
Future Volume (veh/h)	50	53	391	90	60	42	210	912	12	57	883	12
Number	3	8	18	7	4	14	1	6	16	5	2	12
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		0.98	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	54	0	464	98	65	46	228	991	13	62	960	13
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	382	0	914	393	221	156	325	1519	20	79	1340	18
Arrive On Green	0.04	0.00	0.20	0.06	0.22	0.22	0.09	0.42	0.42	0.04	0.37	0.37
Sat Flow, veh/h	1774	0	3152	1774	1010	715	3442	3576	47	1774	3575	48
Grp Volume(v), veh/h	54	0	464	98	0	111	228	490	514	62	475	498
Grp Sat Flow(s),veh/h/ln	1774	0	1576	1774	0	1725	1721	1770	1854	1774	1770	1854
Q Serve(g_s), s	1.7	0.0	8.4	3.0	0.0	3.7	4.4	15.2	15.2	2.4	15.8	15.8
Cycle Q Clear(g_c), s	1.7	0.0	8.4	3.0	0.0	3.7	4.4	15.2	15.2	2.4	15.8	15.8
Prop In Lane	1.00		1.00	1.00		0.41	1.00		0.03	1.00		0.03
Lane Grp Cap(c), veh/h	382	0	914	393	0	377	325	752	787	79	663	695
V/C Ratio(X)	0.14	0.00	0.51	0.25	0.00	0.29	0.70	0.65	0.65	0.79	0.72	0.72
Avail Cap(c_a), veh/h	424	0	1674	393	0	752	430	795	833	155	728	763
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.9	0.0	20.4	20.1	0.0	22.4	30.2	15.7	15.7	32.5	18.4	18.4
Incr Delay (d2), s/veh	0.2	0.0	0.4	0.3	0.0	0.4	3.3	1.8	1.7	15.8	3.1	2.9
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	0.8	0.0	3.7	1.5	0.0	1.8	2.2	7.7	8.1	1.5	8.2	8.6
LnGrp Delay(d),s/veh	21.1	0.0	20.8	20.5	0.0	22.9	33.5	17.5	17.4	48.3	21.4	21.3
LnGrp LOS	C		C	C		C	C	B	B	D	C	C
Approach Vol, veh/h		518			209			1232			1035	
Approach Delay, s/veh		20.8			21.7			20.4			23.0	
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	10.9	31.0	7.0	19.9	7.5	34.4	8.6	18.3				
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9				
Max Green Setting (Gmax), s	8.6	28.3	4.2	30.0	6.0	30.9	4.2	30.0				
Max Q Clear Time (g_c+I1), s	6.4	17.8	3.7	5.7	4.4	17.2	5.0	10.4				
Green Ext Time (p_c), s	0.2	8.0	0.0	2.6	0.0	9.9	0.0	2.5				
Intersection Summary												
HCM 2010 Ctrl Delay			21.5									
HCM 2010 LOS			C									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	247	942	0	0	1551	555	322	1	647	0	0	0
Future Volume (veh/h)	247	942	0	0	1551	555	322	1	647	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	268	1024	0	0	1686	603	351	0	703			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	496	3067	0	0	1377	616	944	0	842			
Arrive On Green	0.05	0.20	0.00	0.00	0.39	0.39	0.27	0.00	0.27			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	268	1024	0	0	1686	603	351	0	703			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	7.6	17.3	0.0	0.0	38.9	37.6	8.1	0.0	20.9			
Cycle Q Clear(g_c), s	7.6	17.3	0.0	0.0	38.9	37.6	8.1	0.0	20.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	496	3067	0	0	1377	616	944	0	842			
V/C Ratio(X)	0.54	0.33	0.00	0.00	1.22	0.98	0.37	0.00	0.83			
Avail Cap(c_a), veh/h	496	3067	0	0	1377	616	1242	0	1108			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.52	0.52	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	44.4	22.8	0.0	0.0	30.5	30.1	29.9	0.0	34.6			
Incr Delay (d2), s/veh	0.6	0.2	0.0	0.0	107.8	31.5	0.2	0.0	4.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.7	8.1	0.0	0.0	39.5	21.8	4.0	0.0	9.7			
LnGrp Delay(d),s/veh	45.0	23.0	0.0	0.0	138.3	61.6	30.1	0.0	39.0			
LnGrp LOS	D	C			F	E	C		D			
Approach Vol, veh/h		1292			2289			1054				
Approach Delay, s/veh		27.5			118.1			36.0				
Approach LOS		C			F			D				
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2			5	6		8				
Phs Duration (G+Y+Rc), s		67.3			21.4	45.9		32.7				
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1				
Max Green Setting (Gmax), s		51.9			7.3	* 39		35.0				
Max Q Clear Time (g_c+I1), s		19.3			9.6	40.9		22.9				
Green Ext Time (p_c), s		10.2			0.0	0.0		3.6				
Intersection Summary												
HCM 2010 Ctrl Delay			74.2									
HCM 2010 LOS			E									
Notes												

2: I-15 SB Ramp & Carmel Mountain Rd — Existing + Cumulative Projects PM

HCM 2010 Signalized Intersection Summary — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	685	234	874	999	0	0	0	0	504	0	292
Future Volume (veh/h)	0	685	234	874	999	0	0	0	0	504	0	292
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	745	254	950	1086	0				647	0	211
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1120	501	953	2302	0				776	0	346
Arrive On Green	0.00	0.32	0.32	0.09	0.21	0.00				0.22	0.00	0.22
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	745	254	950	1086	0				647	0	211
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	18.2	13.1	27.6	26.8	0.0				17.4	0.0	12.0
Cycle Q Clear(g_c), s	0.0	18.2	13.1	27.6	26.8	0.0				17.4	0.0	12.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1120	501	953	2302	0				776	0	346
V/C Ratio(X)	0.00	0.67	0.51	1.00	0.47	0.00				0.83	0.00	0.61
Avail Cap(c_a), veh/h	0	1120	501	953	2302	0				1029	0	459
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.09	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	29.6	27.8	45.4	24.3	0.0				37.3	0.0	35.2
Incr Delay (d2), s/veh	0.0	3.1	3.6	8.0	0.1	0.0				4.6	0.0	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
%ile BackOfQ(50%),veh/ln	0.0	9.4	6.2	14.2	13.2	0.0				9.0	0.0	5.4
LnGrp Delay(d),s/veh	0.0	32.7	31.5	53.3	24.3	0.0				41.9	0.0	37.0
LnGrp LOS		C	C	D	C					D		D
Approach Vol, veh/h		999			2036						858	
Approach Delay, s/veh		32.4			37.9						40.7	
Approach LOS		C			D						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	33.4	38.6		28.0		72.0		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 28	24.5		29.0		57.9		
Max Q Clear Time (g_c+I1), s	29.6	20.2		19.4		28.8		
Green Ext Time (p_c), s	0.0	3.7		2.4		17.9		

Intersection Summary	
HCM 2010 Ctrl Delay	37.1
HCM 2010 LOS	D

Notes

3: Carmel Mountain Rd & Penasquitos Dr — Existing + Cumulative Projects PM

HCM Signalized Intersection Capacity Analysis — 1/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	331	52	74	57	51	89	13	152	499	41	133	621
Future Volume (vph)	331	52	74	57	51	89	13	152	499	41	133	621
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1708	1551	1681	1761	1560		1770	5027		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1708	1551	1681	1761	1560		1770	5027		1770	3539
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)	360	57	80	62	55	97	14	165	542	45	145	675
RTOR Reduction (vph)	0	0	60	0	0	89	0	0	10	0	0	0
Lane Group Flow (vph)	209	208	20	56	61	8	0	179	577	0	145	675
Confl. Peds. (#/hr)			9									
Confl. Bikes (#/hr)			1			1						
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	18.8	18.8	18.8	6.6	6.6	6.6		9.2	20.0		10.7	21.0
Effective Green, g (s)	18.8	18.8	18.8	6.6	6.6	6.6		9.2	20.0		10.7	21.0
Actuated g/C Ratio	0.25	0.25	0.25	0.09	0.09	0.09		0.12	0.26		0.14	0.28
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	414	421	382	145	152	135		213	1319		248	975
v/s Ratio Prot	c0.12	0.12		0.03	c0.03			c0.10	0.11		0.08	c0.19
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.50	0.49	0.05	0.39	0.40	0.06		0.84	0.44		0.58	0.69
Uniform Delay, d1	24.7	24.6	21.9	32.9	32.9	32.0		32.8	23.4		30.7	24.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.96		1.00	1.00
Incremental Delay, d2	1.0	0.9	0.1	1.7	1.7	0.2		24.6	0.2		3.5	2.1
Delay (s)	25.7	25.5	22.0	34.6	34.7	32.2		57.3	22.8		34.2	26.9
Level of Service	C	C	C	C	C	C		E	C		C	C
Approach Delay (s)		25.0			33.5				30.9			21.2
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	76.2	Sum of lost time (s)	20.6
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	537
Future Volume (vph)	537
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	584
RTOR Reduction (vph)	233
Lane Group Flow (vph)	351
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	39.8
Effective Green, g (s)	39.8
Actuated g/C Ratio	0.52
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	826
v/s Ratio Prot	0.10
v/s Ratio Perm	0.12
v/c Ratio	0.43
Uniform Delay, d1	11.2
Progression Factor	1.00
Incremental Delay, d2	0.4
Delay (s)	11.5
Level of Service	B
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	20	624	47	0	765
Future Vol, veh/h	0	20	624	47	0	765
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	22	678	51	0	832

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1120	365	0	0	729	0
Stage 1	704	-	-	-	-	-
Stage 2	416	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	200	632	-	-	871	-
Stage 1	452	-	-	-	-	-
Stage 2	634	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	200	632	-	-	871	-
Mov Cap-2 Maneuver	200	-	-	-	-	-
Stage 1	452	-	-	-	-	-
Stage 2	634	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.9	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	632	871	-
HCM Lane V/C Ratio	-	-	0.034	-	-
HCM Control Delay (s)	-	-	10.9	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Traffic Vol, veh/h	38	29	10	61	583	77	604	64
Future Vol, veh/h	38	29	10	61	583	77	604	64
Conflicting Peds, #/hr	2	0	0	6	0	0	0	6
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	-	120	-	140	-	-
Veh in Median Storage, #	0	-	-	-	0	-	0	-
Grade, %	0	-	-	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	41	32	11	66	634	84	657	70

Major/Minor	Minor2		Major1			Major2		
Conflicting Flow All	1332	371	758	728	0	463	-	0
Stage 1	861	-	-	-	-	-	-	-
Stage 2	471	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	4.14	-	6.44	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	2.22	-	2.52	-	-
Pot Cap-1 Maneuver	146	626	474	871	-	731	-	-
Stage 1	374	-	-	-	-	-	-	-
Stage 2	594	-	-	-	-	-	-	-
Platoon blocked, %					-		-	-
Mov Cap-1 Maneuver	146	622	768	768	-	731	-	-
Mov Cap-2 Maneuver	146	-	-	-	-	-	-	-
Stage 1	373	-	-	-	-	-	-	-
Stage 2	593	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	29.6	1.1	1.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR
Capacity (veh/h)	768	-	218	731	-	-
HCM Lane V/C Ratio	0.1	-	0.334	0.114	-	-
HCM Control Delay (s)	10.2	-	29.6	10.6	-	-
HCM Lane LOS	B	-	D	B	-	-
HCM 95th %tile Q(veh)	0.3	-	1.4	0.4	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	7	14	10	630	16	10	31	592
Future Vol, veh/h	7	14	10	630	16	10	31	592
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	8	15	11	685	17	11	34	643

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1126	351	470	0	0	717	702	0
Stage 1	715	-	-	-	-	-	-	-
Stage 2	411	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	199	645	723	-	-	504	891	-
Stage 1	446	-	-	-	-	-	-	-
Stage 2	638	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	199	645	723	-	-	744	744	-
Mov Cap-2 Maneuver	199	-	-	-	-	-	-	-
Stage 1	446	-	-	-	-	-	-	-
Stage 2	638	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15.4	0.2	0.7
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	723	-	-	369	744	-
HCM Lane V/C Ratio	0.015	-	-	0.062	0.06	-
HCM Control Delay (s)	10.1	-	-	15.4	10.1	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	40	0	42	6	0	13	63	593	15	10	30	509
Future Volume (vph)	40	0	42	6	0	13	63	593	15	10	30	509
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			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		0.93			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1680			1667		1770	3525			1770	3485
Flt Permitted		0.84			0.89		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1439			1501		1770	3525			1863	3485
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)	43	0	46	7	0	14	68	645	16	11	33	553
RTOR Reduction (vph)	0	74	0	0	18	0	0	2	0	0	0	7
Lane Group Flow (vph)	0	15	0	0	3	0	68	659	0	0	44	600
Confl. Peds. (#/hr)			2									
Confl. Bikes (#/hr)									1			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		8.1			8.1		4.6	24.6			2.4	22.3
Effective Green, g (s)		8.1			8.1		4.6	24.6			2.4	22.3
Actuated g/C Ratio		0.16			0.16		0.09	0.49			0.05	0.45
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		234			244		163	1744			89	1563
v/s Ratio Prot							c0.04	c0.19				0.17
v/s Ratio Perm		c0.01			0.00						0.02	
v/c Ratio		0.06			0.01		0.42	0.38			0.49	0.38
Uniform Delay, d1		17.6			17.4		21.3	7.8			23.1	9.1
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.01
Incremental Delay, d2		0.1			0.0		1.7	0.1			4.3	0.2
Delay (s)		17.7			17.5		23.0	7.9			27.2	9.4
Level of Service		B			B		C	A			C	A
Approach Delay (s)		17.7			17.5			9.3				10.6
Approach LOS		B			B			A				B

Intersection Summary			
HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	49.7	Sum of lost time (s)	14.7
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	122	571	92	32	336	77	231	38	72	110	23	58
Future Volume (veh/h)	122	571	92	32	336	77	231	38	72	110	23	58
Number	5	2	12	1	6	16	3	8	18	7	4	14
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	0.99		0.99	1.00		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	133	621	100	35	365	84	251	41	78	120	25	63
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	175	1036	167	53	776	177	418	68	102	593	171	432
Arrive On Green	0.10	0.34	0.34	0.03	0.27	0.27	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	1774	3053	491	1774	2865	652	852	186	277	1266	467	1176
Grp Volume(v), veh/h	133	360	361	35	224	225	370	0	0	120	0	88
Grp Sat Flow(s),veh/h/ln	1774	1770	1774	1774	1770	1748	1315	0	0	1266	0	1643
Q Serve(g_s), s	4.2	9.6	9.7	1.1	6.0	6.2	12.7	0.0	0.0	0.0	0.0	2.1
Cycle Q Clear(g_c), s	4.2	9.6	9.7	1.1	6.0	6.2	14.7	0.0	0.0	3.8	0.0	2.1
Prop In Lane	1.00		0.28	1.00		0.37	0.68		0.21	1.00		0.72
Lane Grp Cap(c), veh/h	175	601	602	53	479	473	588	0	0	593	0	603
V/C Ratio(X)	0.76	0.60	0.60	0.66	0.47	0.48	0.63	0.00	0.00	0.20	0.00	0.15
Avail Cap(c_a), veh/h	514	1032	1034	204	717	708	1173	0	0	1125	0	1293
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.2	15.7	15.7	27.5	17.4	17.5	16.6	0.0	0.0	12.7	0.0	12.1
Incr Delay (d2), s/veh	6.7	1.0	1.0	13.2	0.7	0.7	1.1	0.0	0.0	0.2	0.0	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	2.4	4.9	4.9	0.7	3.0	3.0	5.3	0.0	0.0	1.3	0.0	0.9
LnGrp Delay(d),s/veh	31.9	16.6	16.7	40.7	18.1	18.2	17.7	0.0	0.0	12.8	0.0	12.2
LnGrp LOS	C	B	B	D	B	B	B			B		B
Approach Vol, veh/h		854			484			370			208	
Approach Delay, s/veh		19.0			19.8			17.7			12.6	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.1	25.2		25.9	10.0	21.3		25.9
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	6.6	* 33		45.1	16.6	23.2		45.1
Max Q Clear Time (g_c+I1), s	3.1	11.7		5.8	6.2	8.2		16.7
Green Ext Time (p_c), s	0.0	7.8		3.8	0.2	6.5		3.7

Intersection Summary			
HCM 2010 Ctrl Delay			18.3
HCM 2010 LOS			B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	252	165	122	299	187	226	317	796	393	300	459	22
Future Volume (veh/h)	252	165	122	299	187	226	317	796	393	300	459	22
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	274	179	133	325	203	246	345	865	427	326	499	24
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	316	316	220	378	331	455	365	1737	766	379	2009	624
Arrive On Green	0.09	0.16	0.16	0.11	0.18	0.18	0.21	0.49	0.49	0.11	0.40	0.40
Sat Flow, veh/h	3442	1978	1380	3442	1863	1581	1774	3539	1560	3442	5085	1579
Grp Volume(v), veh/h	274	159	153	325	203	246	345	865	427	326	499	24
Grp Sat Flow(s),veh/h/ln	1721	1770	1589	1721	1863	1581	1774	1770	1560	1721	1695	1579
Q Serve(g_s), s	11.8	12.4	13.4	13.9	15.1	19.7	28.8	24.7	28.8	14.0	9.9	1.4
Cycle Q Clear(g_c), s	11.8	12.4	13.4	13.9	15.1	19.7	28.8	24.7	28.8	14.0	9.9	1.4
Prop In Lane	1.00		0.87	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	316	283	254	378	331	455	365	1737	766	379	2009	624
V/C Ratio(X)	0.87	0.56	0.60	0.86	0.61	0.54	0.94	0.50	0.56	0.86	0.25	0.04
Avail Cap(c_a), veh/h	317	416	374	491	522	617	376	1737	766	491	2009	624
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	0.85	0.85	0.85	0.35	0.35	0.35	0.84	0.84	0.84
Uniform Delay (d), s/veh	67.2	58.2	58.6	65.6	56.9	45.0	58.7	25.7	26.8	65.6	30.4	27.9
Incr Delay (d2), s/veh	21.5	1.8	2.3	10.0	1.6	0.8	15.7	0.4	1.0	10.0	0.2	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	6.6	6.2	6.1	7.2	7.9	8.7	15.7	12.1	12.6	7.2	4.7	0.6
LnGrp Delay(d),s/veh	88.7	59.9	60.9	75.6	58.5	45.9	74.4	26.1	27.8	75.6	30.7	28.0
LnGrp LOS	F	E	E	E	E	D	E	C	C	E	C	C
Approach Vol, veh/h		586			774			1637			849	
Approach Delay, s/veh		73.6			61.7			36.7			47.8	
Approach LOS		E			E			D			D	

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	35.1	64.8	18.0	32.2	20.7	79.1	20.7	29.5
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 32	43.0	* 14	42.0	* 21	53.4	* 21	* 35
Max Q Clear Time (g_c+I1), s	30.8	11.9	13.8	21.7	16.0	30.8	15.9	15.4
Green Ext Time (p_c), s	0.1	14.7	0.0	4.0	0.6	12.5	0.6	3.9

Intersection Summary			
HCM 2010 Ctrl Delay			49.8
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	406	24	976	36	32	46	8	926	44	89	669	120
Future Volume (veh/h)	406	24	976	36	32	46	8	926	44	89	669	120
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	1.00		0.98
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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	441	26	1061	39	35	50	9	1007	48	97	727	130
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	656	14	565	145	57	81	74	1056	50	148	1235	1129
Arrive On Green	0.37	0.37	0.37	0.08	0.08	0.08	0.04	0.31	0.31	0.08	0.35	0.35
Sat Flow, veh/h	1774	37	1527	1774	693	990	1774	3438	164	1774	3539	1557
Grp Volume(v), veh/h	441	0	1087	39	0	85	9	518	537	97	727	130
Grp Sat Flow(s),veh/h/ln	1774	0	1564	1774	0	1684	1774	1770	1833	1774	1770	1557
Q Serve(g_s), s	25.0	0.0	44.4	2.5	0.0	5.9	0.6	34.4	34.4	6.4	20.2	3.1
Cycle Q Clear(g_c), s	25.0	0.0	44.4	2.5	0.0	5.9	0.6	34.4	34.4	6.4	20.2	3.1
Prop In Lane	1.00		0.98	1.00		0.59	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	656	0	579	145	0	138	74	544	563	148	1235	1129
V/C Ratio(X)	0.67	0.00	1.88	0.27	0.00	0.62	0.12	0.95	0.95	0.66	0.59	0.12
Avail Cap(c_a), veh/h	656	0	579	148	0	140	74	544	563	151	1235	1129
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	1.00	1.00	0.89	0.89	0.89
Uniform Delay (d), s/veh	31.7	0.0	37.8	51.7	0.0	53.3	55.4	40.7	40.7	53.3	32.0	5.2
Incr Delay (d2), s/veh	2.7	0.0	401.6	1.0	0.0	7.6	0.7	28.6	28.0	8.7	1.8	0.2
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	12.7	0.0	83.7	1.3	0.0	3.0	0.3	21.2	21.8	3.5	10.2	3.1
LnGrp Delay(d),s/veh	34.4	0.0	439.4	52.7	0.0	60.9	56.1	69.4	68.8	62.0	33.9	5.4
LnGrp LOS	C		F	D		E	E	E	E	E	C	A
Approach Vol, veh/h		1528			124			1064			954	
Approach Delay, s/veh		322.5			58.3			69.0			32.8	
Approach LOS		F			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	47.4		14.4	14.2	42.4		49.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 5	41.7		10.0	* 10	36.5		44.4
Max Q Clear Time (g_c+I1), s	2.6	22.2		7.9	8.4	36.4		46.4
Green Ext Time (p_c), s	0.0	12.5		0.1	0.0	0.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	164.8
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	63	315	38	49	14	328	722	54	17	566	16
Future Volume (veh/h)	5	63	315	38	49	14	328	722	54	17	566	16
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	5	0	387	41	53	15	357	785	59	18	615	17
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	355	0	1013	351	282	80	505	1537	116	31	1166	32
Arrive On Green	0.01	0.00	0.17	0.03	0.20	0.20	0.15	0.46	0.46	0.02	0.33	0.33
Sat Flow, veh/h	1774	0	3145	1774	1397	395	3442	3335	251	1774	3518	97
Grp Volume(v), veh/h	5	0	387	41	0	68	357	416	428	18	309	323
Grp Sat Flow(s),veh/h/ln	1774	0	1572	1774	0	1792	1721	1770	1816	1774	1770	1846
Q Serve(g_s), s	0.1	0.0	5.7	1.1	0.0	1.9	5.9	10.0	10.0	0.6	8.5	8.5
Cycle Q Clear(g_c), s	0.1	0.0	5.7	1.1	0.0	1.9	5.9	10.0	10.0	0.6	8.5	8.5
Prop In Lane	1.00		1.00	1.00		0.22	1.00		0.14	1.00		0.05
Lane Grp Cap(c), veh/h	355	0	1013	351	0	362	505	816	837	31	587	612
V/C Ratio(X)	0.01	0.00	0.38	0.12	0.00	0.19	0.71	0.51	0.51	0.59	0.53	0.53
Avail Cap(c_a), veh/h	482	0	2040	428	0	898	1008	1231	1263	136	848	884
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.3	0.0	15.8	19.3	0.0	19.9	24.4	11.4	11.4	29.3	16.3	16.3
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.1	0.0	0.2	1.8	0.5	0.5	16.6	0.7	0.7
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	0.1	0.0	2.5	0.6	0.0	1.0	3.0	5.0	5.1	0.4	4.2	4.4
LnGrp Delay(d),s/veh	20.3	0.0	16.0	19.5	0.0	20.1	26.2	11.9	11.9	45.9	17.0	17.0
LnGrp LOS	C		B	B		C	C	B	B	D	B	B
Approach Vol, veh/h		392			109			1201			650	
Approach Delay, s/veh		16.1			19.9			16.2			17.8	
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	13.2	25.1	4.7	17.0	5.4	32.9	6.4	15.4
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	17.6	28.8	4.6	30.1	4.6	41.8	4.6	30.1
Max Q Clear Time (g_c+I1), s	7.9	10.5	2.1	3.9	2.6	12.0	3.1	7.7
Green Ext Time (p_c), s	0.9	9.2	0.0	2.0	0.0	11.5	0.0	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.8
HCM 2010 LOS	B

Notes

APPENDIX H

PEAK HOUR INTERSECTION ANALYSIS WORKSHEETS
EXISTING + CUMULATIVE + PROJECT

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	351	629	0	0	882	251	192	0	1005	0	0	0
Future Volume (veh/h)	351	629	0	0	882	251	192	0	1005	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	382	684	0	0	959	273	209	0	1092			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	398	2447	0	0	1019	456	1324	0	1182			
Arrive On Green	0.04	0.16	0.00	0.00	0.29	0.29	0.37	0.00	0.37			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	382	684	0	0	959	273	209	0	1092			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	10.0	10.7	0.0	0.0	23.8	13.4	3.5	0.0	29.7			
Cycle Q Clear(g_c), s	10.0	10.7	0.0	0.0	23.8	13.4	3.5	0.0	29.7			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	398	2447	0	0	1019	456	1324	0	1182			
V/C Ratio(X)	0.96	0.28	0.00	0.00	0.94	0.60	0.16	0.00	0.92			
Avail Cap(c_a), veh/h	398	2447	0	0	1019	456	1380	0	1231			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.78	0.78	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	43.1	24.1	0.0	0.0	31.3	27.6	18.8	0.0	27.0			
Incr Delay (d2), s/veh	29.8	0.2	0.0	0.0	17.2	5.7	0.1	0.0	11.4			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	6.4	5.1	0.0	0.0	14.0	6.6	1.7	0.0	14.8			
LnGrp Delay(d),s/veh	72.9	24.3	0.0	0.0	48.5	33.3	18.8	0.0	38.4			
LnGrp LOS	E	C			D	C	B		D			
Approach Vol, veh/h		1066			1232			1301				
Approach Delay, s/veh		41.7			45.2			35.2				
Approach LOS		D			D			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		50.3			17.4	32.9		39.7
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		41.9			10.3	* 26		35.0
Max Q Clear Time (g_c+I1), s		12.7			12.0	25.8		31.7
Green Ext Time (p_c), s		7.0			0.0	0.1		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	40.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	708	606	548	526	0	0	0	0	272	6	271
Future Volume (veh/h)	0	708	606	548	526	0	0	0	0	272	6	271
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	770	659	596	572	0				391	0	199
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1540	689	660	2444	0				582	0	260
Arrive On Green	0.00	0.44	0.44	0.32	1.00	0.00				0.16	0.00	0.16
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	770	659	596	572	0				391	0	199
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	14.1	36.2	14.9	0.0	0.0				9.3	0.0	10.8
Cycle Q Clear(g_c), s	0.0	14.1	36.2	14.9	0.0	0.0				9.3	0.0	10.8
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1540	689	660	2444	0				582	0	260
V/C Ratio(X)	0.00	0.50	0.96	0.90	0.23	0.00				0.67	0.00	0.77
Avail Cap(c_a), veh/h	0	1540	689	696	2444	0				1143	0	510
HCM Platoon Ratio	1.00	1.00	1.00	1.67	1.67	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.46	0.46	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	18.3	24.6	29.8	0.0	0.0				35.3	0.0	36.0
Incr Delay (d2), s/veh	0.0	1.2	25.1	7.6	0.1	0.0				1.4	0.0	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	7.1	20.5	7.7	0.0	0.0				4.7	0.0	5.0
LnGrp Delay(d),s/veh	0.0	19.5	49.7	37.4	0.1	0.0				36.7	0.0	40.7
LnGrp LOS		B	D	D	A					D		D
Approach Vol, veh/h		1429			1168						590	
Approach Delay, s/veh		33.4			19.2						38.0	
Approach LOS		C			B						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.0	46.2		20.9		69.1		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 18	24.0		29.0		47.9		
Max Q Clear Time (g_c+I1), s	16.9	38.2		12.8		2.0		
Green Ext Time (p_c), s	0.4	0.0		1.9		18.8		

Intersection Summary	
HCM 2010 Ctrl Delay	29.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	662	48	161	31	13	90	36	77	562	18	77	470
Future Volume (vph)	662	48	161	31	13	90	36	77	562	18	77	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1696	1550	1681	1733	1583		1770	5058		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1696	1550	1681	1733	1583		1770	5058		1770	3539
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)	720	52	175	34	14	98	39	84	611	20	84	511
RTOR Reduction (vph)	0	0	120	0	0	91	0	0	4	0	0	0
Lane Group Flow (vph)	382	390	55	24	24	7	0	123	627	0	84	511
Confl. Peds. (#/hr)			11									
Confl. Bikes (#/hr)										1		
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	24.5	24.5	24.5	5.2	5.2	5.2		8.2	20.8		6.9	19.0
Effective Green, g (s)	24.5	24.5	24.5	5.2	5.2	5.2		8.2	20.8		6.9	19.0
Actuated g/C Ratio	0.32	0.32	0.32	0.07	0.07	0.07		0.11	0.27		0.09	0.25
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	531	536	490	112	116	106		187	1357		157	867
v/s Ratio Prot	0.23	c0.23		c0.01	0.01			c0.07	0.12		0.05	c0.14
v/s Ratio Perm			0.04			0.00						
v/c Ratio	0.72	0.73	0.11	0.21	0.21	0.06		0.66	0.46		0.54	0.59
Uniform Delay, d1	23.5	23.5	18.8	34.2	34.2	33.9		33.3	23.7		33.8	25.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00
Incremental Delay, d2	4.6	4.9	0.1	1.0	0.9	0.2		8.1	0.3		3.5	1.0
Delay (s)	28.1	28.4	18.9	35.2	35.1	34.1		41.4	23.7		37.2	26.8
Level of Service	C	C	B	D	D	C		D	C		D	C
Approach Delay (s)		26.5			34.4				26.6			22.0
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	20.6
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

3: Carmel Mountain Rd & Penasquitos Dr — Existing + Cumul + Proj AM
HCM Signalized Intersection Capacity Analysis — 9/29/2016

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	250
Future Volume (vph)	250
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	0.99
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1569
Flt Permitted	1.00
Satd. Flow (perm)	1569
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	272
RTOR Reduction (vph)	119
Lane Group Flow (vph)	153
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	43.5
Effective Green, g (s)	43.5
Actuated g/C Ratio	0.56
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	880
v/s Ratio Prot	0.05
v/s Ratio Perm	0.04
v/c Ratio	0.17
Uniform Delay, d1	8.3
Progression Factor	1.00
Incremental Delay, d2	0.1
Delay (s)	8.4
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

Lennar PQ — Synchro 9 Report
N:\2472\Analysis\Intersections\Existing + Cuml + Proj AM.syn

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	106	677	27	0	698
Future Vol, veh/h	0	106	677	27	0	698
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	115	736	29	0	759

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1130	383	0	0	765	0
Stage 1	751	-	-	-	-	-
Stage 2	379	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	197	615	-	-	844	-
Stage 1	427	-	-	-	-	-
Stage 2	662	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	197	615	-	-	844	-
Mov Cap-2 Maneuver	197	-	-	-	-	-
Stage 1	427	-	-	-	-	-
Stage 2	662	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	615	844	-
HCM Lane V/C Ratio	-	-	0.187	-	-
HCM Control Delay (s)	-	-	12.2	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0	-

Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	60	0	72	20	0	39	10	37	581	5	24	10	661	23
Future Vol, veh/h	60	0	72	20	0	39	10	37	581	5	24	10	661	23
Conflicting Peds, #/hr	2	0	1	0	0	0	0	2	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	120	-	-	-	140	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Peak Hour Factor	92	92	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	2	2
Mvmt Flow	65	0	78	22	0	42	11	40	632	5	26	11	718	25

Major/Minor	Minor2			Minor1			Major1				Major2			
Conflicting Flow All	1225	1546	376	1171	1555	320	621	745	0	0	507	637	0	0
Stage 1	807	807	-	736	736	-	-	-	-	-	-	-	-	-
Stage 2	418	739	-	435	819	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	6.44	4.14	-	-	6.44	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.52	2.22	-	-	2.52	2.22	-	-
Pot Cap-1 Maneuver	135	113	622	148	112	676	580	859	-	-	685	943	-	-
Stage 1	341	392	-	377	423	-	-	-	-	-	-	-	-	-
Stage 2	583	422	-	570	388	-	-	-	-	-	-	-	-	-
Platoon blocked, %									-	-			-	-
Mov Cap-1 Maneuver	126	113	620	129	112	675	751	751	-	-	711	711	-	-
Mov Cap-2 Maneuver	126	113	-	129	112	-	-	-	-	-	-	-	-	-
Stage 1	341	391	-	377	423	-	-	-	-	-	-	-	-	-
Stage 2	545	422	-	497	387	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	46.3	21.9	0.8	0.5
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	751	-	-	223	277	711	-	-
HCM Lane V/C Ratio	0.068	-	-	0.643	0.232	0.052	-	-
HCM Control Delay (s)	10.1	-	-	46.3	21.9	10.3	-	-
HCM Lane LOS	B	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-	3.9	0.9	0.2	-	-

Intersection								
Int Delay, s/veh	0.9							

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	20	40	10	583	5	10	9	734
Future Vol, veh/h	20	40	10	583	5	10	9	734
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	22	43	11	634	5	11	10	798

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1098	320	582	0	0	683	639	0
Stage 1	658	-	-	-	-	-	-	-
Stage 2	440	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	207	676	614	-	-	530	941	-
Stage 1	477	-	-	-	-	-	-	-
Stage 2	616	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	207	676	614	-	-	642	642	-
Mov Cap-2 Maneuver	207	-	-	-	-	-	-	-
Stage 1	477	-	-	-	-	-	-	-
Stage 2	616	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.2	0.2	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	614	-	-	385	642	-
HCM Lane V/C Ratio	0.018	-	-	0.169	0.032	-
HCM Control Delay (s)	11	-	-	16.2	10.8	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.6	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	98	0	151	21	0	39	121	451	5	10	10	664
Future Volume (vph)	98	0	151	21	0	39	121	451	5	10	10	664
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			0.99		1.00	1.00			1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	1.00
Frt		0.92			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1656			1655		1770	3533			1770	3489
Flt Permitted		0.84			0.86		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1422			1445		1770	3533			1863	3489
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)	107	0	164	23	0	42	132	490	5	11	11	722
RTOR Reduction (vph)	0	105	0	0	50	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	166	0	0	15	0	132	495	0	0	22	789
Confl. Peds. (#/hr)			14			4			2			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		13.7			13.7		8.0	30.1			1.4	23.4
Effective Green, g (s)		13.7			13.7		8.0	30.1			1.4	23.4
Actuated g/C Ratio		0.23			0.23		0.13	0.50			0.02	0.39
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		325			331		236	1778			43	1365
v/s Ratio Prot							c0.07	0.14				c0.23
v/s Ratio Perm		c0.12			0.01						0.01	
v/c Ratio		0.51			0.04		0.56	0.28			0.51	0.58
Uniform Delay, d1		20.1			18.0		24.2	8.6			28.9	14.3
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		1.4			0.1		2.9	0.1			9.9	0.6
Delay (s)		21.5			18.0		27.1	8.7			38.8	14.9
Level of Service		C			B		C	A			D	B
Approach Delay (s)		21.5			18.0			12.5				15.6
Approach LOS		C			B			B				B

Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	59.8	Sum of lost time (s)	14.7
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	70
Future Volume (vph)	70
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	76
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	153	404	21	10	563	212	86	18	7	145	14	109
Future Volume (veh/h)	153	404	21	10	563	212	86	18	7	145	14	109
Number	5	2	12	1	6	16	3	8	18	7	4	14
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		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	166	439	23	11	612	230	93	20	8	158	15	118
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	216	1685	88	20	961	361	272	53	15	453	40	317
Arrive On Green	0.12	0.49	0.49	0.01	0.38	0.38	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1774	3422	179	1774	2518	945	704	236	67	1373	181	1422
Grp Volume(v), veh/h	166	227	235	11	430	412	121	0	0	158	0	133
Grp Sat Flow(s),veh/h/ln	1774	1770	1831	1774	1770	1693	1007	0	0	1373	0	1603
Q Serve(g_s), s	5.0	4.1	4.1	0.3	11.0	11.0	3.7	0.0	0.0	0.0	0.0	3.9
Cycle Q Clear(g_c), s	5.0	4.1	4.1	0.3	11.0	11.0	7.6	0.0	0.0	5.1	0.0	3.9
Prop In Lane	1.00		0.10	1.00		0.56	0.77		0.07	1.00		0.89
Lane Grp Cap(c), veh/h	216	871	902	20	676	647	340	0	0	453	0	357
V/C Ratio(X)	0.77	0.26	0.26	0.55	0.64	0.64	0.36	0.00	0.00	0.35	0.00	0.37
Avail Cap(c_a), veh/h	533	1400	1448	132	993	950	703	0	0	826	0	792
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	23.5	8.2	8.2	27.2	13.9	13.9	20.5	0.0	0.0	18.6	0.0	18.2
Incr Delay (d2), s/veh	5.7	0.2	0.2	21.6	1.0	1.1	0.6	0.0	0.0	0.5	0.0	0.6
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	2.8	2.1	2.1	0.3	5.4	5.2	1.7	0.0	0.0	2.1	0.0	1.8
LnGrp Delay(d),s/veh	29.2	8.3	8.3	48.8	14.9	15.0	21.1	0.0	0.0	19.1	0.0	18.8
LnGrp LOS	C	A	A	D	B	B	C			B		B
Approach Vol, veh/h		628			853			121			291	
Approach Delay, s/veh		13.8			15.4			21.1			19.0	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.0	33.0		17.2	11.1	26.9		17.2
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	4.1	* 44		27.3	16.6	31.0		27.3
Max Q Clear Time (g_c+I1), s	2.3	6.1		7.1	7.0	13.0		9.6
Green Ext Time (p_c), s	0.0	10.7		2.0	0.3	8.1		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	15.8
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	263	80	45	252	328	343	369	795	253	321	928	28
Future Volume (veh/h)	263	80	45	252	328	343	369	795	253	321	928	28
Number	3	8	18	7	4	14	1	6	16	5	2	12
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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	286	87	49	274	357	373	401	864	275	349	1009	30
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	296	508	267	325	437	557	394	1532	683	403	1668	519
Arrive On Green	0.09	0.23	0.23	0.09	0.23	0.23	0.22	0.43	0.43	0.12	0.33	0.33
Sat Flow, veh/h	3442	2243	1181	3442	1863	1583	1774	3539	1579	3442	5085	1583
Grp Volume(v), veh/h	286	67	69	274	357	373	401	864	275	349	1009	30
Grp Sat Flow(s),veh/h/ln	1721	1770	1654	1721	1863	1583	1774	1770	1579	1721	1695	1583
Q Serve(g_s), s	12.4	4.6	5.0	11.8	27.2	30.0	33.3	27.5	17.9	14.9	25.0	1.9
Cycle Q Clear(g_c), s	12.4	4.6	5.0	11.8	27.2	30.0	33.3	27.5	17.9	14.9	25.0	1.9
Prop In Lane	1.00		0.71	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	296	401	374	325	437	557	394	1532	683	403	1668	519
V/C Ratio(X)	0.97	0.17	0.18	0.84	0.82	0.67	1.02	0.56	0.40	0.87	0.60	0.06
Avail Cap(c_a), veh/h	296	441	412	422	522	629	394	1532	683	519	1668	519
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	0.65	0.65	0.65	0.56	0.56	0.56	0.69	0.69	0.69
Uniform Delay (d), s/veh	68.3	46.7	46.8	66.8	54.3	41.2	58.3	31.9	29.2	65.1	42.2	34.5
Incr Delay (d2), s/veh	43.0	0.2	0.2	7.9	5.6	1.5	38.4	0.8	1.0	8.5	1.1	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	7.7	2.3	2.3	5.9	14.7	13.3	20.5	13.6	8.0	7.6	11.9	0.9
LnGrp Delay(d),s/veh	111.4	46.9	47.1	74.7	60.0	42.7	96.8	32.8	30.2	73.5	43.4	34.7
LnGrp LOS	F	D	D	E	E	D	F	C	C	E	D	C
Approach Vol, veh/h		422			1004			1540			1388	
Approach Delay, s/veh		90.6			57.6			49.0			50.8	
Approach LOS		F			E			D			D	

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	37.5	54.7	17.1	40.7	21.8	70.4	18.3	39.4
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 33	42.4	* 13	42.0	* 23	53.1	* 18	* 37
Max Q Clear Time (g_c+I1), s	35.3	27.0	14.4	32.0	16.9	29.5	13.8	7.0
Green Ext Time (p_c), s	0.0	11.6	0.0	3.2	0.6	16.0	0.4	4.8

Intersection Summary	
HCM 2010 Ctrl Delay	55.6
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	8	356	97	35	85	55	1226	14	41	830	348
Future Volume (veh/h)	100	8	356	97	35	85	55	1226	14	41	830	348
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	109	9	387	105	38	92	60	1333	15	45	902	378
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	494	10	428	154	42	102	90	1375	15	154	1486	1105
Arrive On Green	0.28	0.28	0.28	0.09	0.09	0.09	0.05	0.38	0.38	0.09	0.42	0.42
Sat Flow, veh/h	1774	36	1540	1774	484	1172	1774	3585	40	1774	3539	1583
Grp Volume(v), veh/h	109	0	396	105	0	130	60	658	690	45	902	378
Grp Sat Flow(s),veh/h/ln	1774	0	1575	1774	0	1656	1774	1770	1856	1774	1770	1583
Q Serve(g_s), s	5.4	0.0	27.9	6.6	0.0	8.9	3.8	42.0	42.0	2.7	22.8	10.9
Cycle Q Clear(g_c), s	5.4	0.0	27.9	6.6	0.0	8.9	3.8	42.0	42.0	2.7	22.8	10.9
Prop In Lane	1.00		0.98	1.00		0.71	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	494	0	438	154	0	144	90	679	712	154	1486	1105
V/C Ratio(X)	0.22	0.00	0.90	0.68	0.00	0.90	0.67	0.97	0.97	0.29	0.61	0.34
Avail Cap(c_a), veh/h	555	0	493	154	0	144	102	679	712	154	1486	1105
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	1.00	1.00	0.68	0.68	0.68
Uniform Delay (d), s/veh	31.9	0.0	40.0	51.0	0.0	52.0	53.6	34.8	34.8	49.2	26.0	6.9
Incr Delay (d2), s/veh	0.2	0.0	18.6	11.5	0.0	47.3	13.1	27.8	27.2	0.7	1.3	0.6
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	2.7	0.0	14.4	3.7	0.0	6.0	2.2	25.7	26.8	1.4	11.4	9.3
LnGrp Delay(d),s/veh	32.1	0.0	58.6	62.4	0.0	99.3	66.8	62.6	62.0	49.9	27.2	7.5
LnGrp LOS	C		E	E		F	E	E	E	D	C	A
Approach Vol, veh/h		505			235			1408			1325	
Approach Delay, s/veh		52.9			82.8			62.5			22.4	
Approach LOS		D			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	53.8		14.6	14.2	49.6		36.6
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.6	43.5		10.0	* 10	40.1		36.0
Max Q Clear Time (g_c+I1), s	5.8	24.8		10.9	4.7	44.0		29.9
Green Ext Time (p_c), s	0.0	15.3		0.0	0.0	0.0		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	47.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	53	392	90	60	42	213	926	12	57	886	12
Future Volume (veh/h)	50	53	392	90	60	42	213	926	12	57	886	12
Number	3	8	18	7	4	14	1	6	16	5	2	12
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		0.98	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	54	0	465	98	65	46	232	1007	13	62	963	13
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	381	0	917	392	221	156	329	1524	20	79	1340	18
Arrive On Green	0.04	0.00	0.19	0.06	0.22	0.22	0.10	0.43	0.43	0.04	0.37	0.37
Sat Flow, veh/h	1774	0	3152	1774	1010	715	3442	3577	46	1774	3576	48
Grp Volume(v), veh/h	54	0	465	98	0	111	232	498	522	62	477	499
Grp Sat Flow(s),veh/h/ln	1774	0	1576	1774	0	1725	1721	1770	1854	1774	1770	1854
Q Serve(g_s), s	1.7	0.0	8.5	3.0	0.0	3.7	4.5	15.5	15.5	2.4	15.9	15.9
Cycle Q Clear(g_c), s	1.7	0.0	8.5	3.0	0.0	3.7	4.5	15.5	15.5	2.4	15.9	15.9
Prop In Lane	1.00		1.00	1.00		0.41	1.00		0.02	1.00		0.03
Lane Grp Cap(c), veh/h	381	0	917	392	0	377	329	754	790	79	663	695
V/C Ratio(X)	0.14	0.00	0.51	0.25	0.00	0.29	0.71	0.66	0.66	0.79	0.72	0.72
Avail Cap(c_a), veh/h	423	0	1673	392	0	750	429	792	830	154	726	760
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.0	0.0	20.4	20.2	0.0	22.5	30.3	15.8	15.8	32.7	18.5	18.5
Incr Delay (d2), s/veh	0.2	0.0	0.4	0.3	0.0	0.4	3.6	1.9	1.8	15.8	3.1	3.0
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	0.8	0.0	3.7	1.5	0.0	1.8	2.3	7.9	8.2	1.5	8.3	8.6
LnGrp Delay(d),s/veh	21.2	0.0	20.8	20.6	0.0	23.0	33.9	17.7	17.7	48.4	21.6	21.4
LnGrp LOS	C		C	C		C	C	B	B	D	C	C
Approach Vol, veh/h		519			209			1252			1038	
Approach Delay, s/veh		20.9			21.8			20.7			23.1	
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	11.0	31.1	7.0	20.0	7.5	34.6	8.6	18.4
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	8.6	28.3	4.2	30.0	6.0	30.9	4.2	30.0
Max Q Clear Time (g_c+I1), s	6.5	17.9	3.7	5.7	4.4	17.5	5.0	10.5
Green Ext Time (p_c), s	0.2	8.0	0.0	2.6	0.0	9.8	0.0	2.5

Intersection Summary			
HCM 2010 Ctrl Delay			21.6
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	257	947	0	0	1563	555	354	1	647	0	0	0
Future Volume (veh/h)	257	947	0	0	1563	555	354	1	647	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	279	1029	0	0	1699	603	386	0	703			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	492	3062	0	0	1377	616	947	0	845			
Arrive On Green	0.05	0.20	0.00	0.00	0.39	0.39	0.27	0.00	0.27			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	279	1029	0	0	1699	603	386	0	703			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	7.9	17.4	0.0	0.0	38.9	37.6	8.9	0.0	20.9			
Cycle Q Clear(g_c), s	7.9	17.4	0.0	0.0	38.9	37.6	8.9	0.0	20.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	492	3062	0	0	1377	616	947	0	845			
V/C Ratio(X)	0.57	0.34	0.00	0.00	1.23	0.98	0.41	0.00	0.83			
Avail Cap(c_a), veh/h	492	3062	0	0	1377	616	1242	0	1108			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.49	0.49	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	44.6	22.9	0.0	0.0	30.5	30.1	30.2	0.0	34.5			
Incr Delay (d2), s/veh	0.7	0.1	0.0	0.0	111.8	31.5	0.3	0.0	4.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	3.8	8.2	0.0	0.0	40.3	21.8	4.4	0.0	9.7			
LnGrp Delay(d),s/veh	45.4	23.0	0.0	0.0	142.4	61.6	30.4	0.0	38.8			
LnGrp LOS	D	C			F	E	C		D			
Approach Vol, veh/h		1308			2302			1089				
Approach Delay, s/veh		27.8			121.2			35.8				
Approach LOS		C			F			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		67.2			21.3	45.9		32.8
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		51.9			7.3	* 39		35.0
Max Q Clear Time (g_c+I1), s		19.4			9.9	40.9		22.9
Green Ext Time (p_c), s		10.3			0.0	0.0		3.8

Intersection Summary			
HCM 2010 Ctrl Delay			75.4
HCM 2010 LOS			E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰↰	↑↑					↰	✥	↱
Traffic Volume (veh/h)	0	700	248	874	1043	0	0	0	0	504	0	315
Future Volume (veh/h)	0	700	248	874	1043	0	0	0	0	504	0	315
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	761	270	950	1134	0				654	0	228
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1112	497	953	2294	0				784	0	350
Arrive On Green	0.00	0.31	0.31	0.09	0.21	0.00				0.22	0.00	0.22
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	761	270	950	1134	0				654	0	228
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	18.8	14.1	27.6	28.2	0.0				17.6	0.0	13.1
Cycle Q Clear(g_c), s	0.0	18.8	14.1	27.6	28.2	0.0				17.6	0.0	13.1
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1112	497	953	2294	0				784	0	350
V/C Ratio(X)	0.00	0.68	0.54	1.00	0.49	0.00				0.83	0.00	0.65
Avail Cap(c_a), veh/h	0	1112	497	953	2294	0				1029	0	459
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.09	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	30.0	28.4	45.4	24.9	0.0				37.2	0.0	35.5
Incr Delay (d2), s/veh	0.0	3.4	4.2	8.0	0.1	0.0				4.7	0.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	9.7	6.7	14.2	13.9	0.0				9.1	0.0	5.9
LnGrp Delay(d),s/veh	0.0	33.4	32.6	53.3	25.0	0.0				41.9	0.0	37.5
LnGrp LOS		C	C	D	C					D		D
Approach Vol, veh/h		1031			2084						882	
Approach Delay, s/veh		33.2			37.9						40.8	
Approach LOS		C			D						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	33.4	38.4		28.2		71.8		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 28	24.5		29.0		57.9		
Max Q Clear Time (g_c+I1), s	29.6	20.8		19.6		30.2		
Green Ext Time (p_c), s	0.0	3.3		2.5		18.1		

Intersection Summary	
HCM 2010 Ctrl Delay	37.3
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations	↰	↰↑	↱	↰	↰↑	↱		↰↰	↑↑↑↱		↰	↑↑
Traffic Volume (vph)	331	52	76	63	51	89	15	153	528	43	133	688
Future Volume (vph)	331	52	76	63	51	89	15	153	528	43	133	688
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.99	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1708	1551	1681	1760	1560		1770	5028		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.99	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1708	1551	1681	1760	1560		1770	5028		1770	3539
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)	360	57	83	68	55	97	16	166	574	47	145	748
RTOR Reduction (vph)	0	0	63	0	0	89	0	0	9	0	0	0
Lane Group Flow (vph)	209	208	20	61	62	8	0	182	612	0	145	748
Confl. Peds. (#/hr)			9									
Confl. Bikes (#/hr)			1			1						
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	19.0	19.0	19.0	6.8	6.8	6.8		9.2	21.5		10.8	22.6
Effective Green, g (s)	19.0	19.0	19.0	6.8	6.8	6.8		9.2	21.5		10.8	22.6
Actuated g/C Ratio	0.24	0.24	0.24	0.09	0.09	0.09		0.12	0.27		0.14	0.29
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	408	414	376	146	153	135		208	1382		244	1022
v/s Ratio Prot	c0.12	0.12		c0.04	0.04			c0.10	0.12		0.08	c0.21
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.51	0.50	0.05	0.42	0.41	0.06		0.88	0.44		0.59	0.73
Uniform Delay, d1	25.6	25.5	22.7	33.8	33.8	32.8		33.9	23.4		31.6	25.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.97		1.00	1.00
Incremental Delay, d2	1.1	1.0	0.1	1.9	1.8	0.2		30.9	0.2		3.9	2.7
Delay (s)	26.7	26.5	22.8	35.8	35.5	33.0		64.7	22.9		35.5	27.8
Level of Service	C	C	C	D	D	C		E	C		D	C
Approach Delay (s)		25.9			34.5				32.3			22.1
Approach LOS		C			C				C			C

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	20.6
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	537
Future Volume (vph)	537
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	584
RTOR Reduction (vph)	228
Lane Group Flow (vph)	356
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	41.6
Effective Green, g (s)	41.6
Actuated g/C Ratio	0.53
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	842
v/s Ratio Prot	0.10
v/s Ratio Perm	0.12
v/c Ratio	0.42
Uniform Delay, d1	11.1
Progression Factor	1.00
Incremental Delay, d2	0.3
Delay (s)	11.4
Level of Service	B
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	45	633	105	0	842
Future Vol, veh/h	0	45	633	105	0	842
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	49	688	114	0	915

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1203	401	0	0	802	0
Stage 1	745	-	-	-	-	-
Stage 2	458	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	177	599	-	-	817	-
Stage 1	430	-	-	-	-	-
Stage 2	604	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	177	599	-	-	817	-
Mov Cap-2 Maneuver	177	-	-	-	-	-
Stage 1	430	-	-	-	-	-
Stage 2	604	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.5	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	599	817	-
HCM Lane V/C Ratio	-	-	0.082	-	-
HCM Control Delay (s)	-	-	11.5	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	38	0	29	9	0	18	10	61	597	21	85	43	630	64
Future Vol, veh/h	38	0	29	9	0	18	10	61	597	21	85	43	630	64
Conflicting Peds, #/hr	2	0	0	0	0	0	0	6	0	0	0	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	120	-	-	-	140	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Peak Hour Factor	92	92	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	2	2
Mvmt Flow	41	0	32	10	0	20	11	66	649	23	92	47	685	70

Major/Minor	Minor2			Minor1			Major1				Major2			
Conflicting Flow All	1479	1826	385	1438	1850	342	582	756	0	0	510	672	0	0
Stage 1	1000	1000	-	815	815	-	-	-	-	-	-	-	-	-
Stage 2	479	826	-	623	1035	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	6.44	4.14	-	-	6.44	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.52	2.22	-	-	2.52	2.22	-	-
Pot Cap-1 Maneuver	87	76	613	94	74	654	614	851	-	-	682	915	-	-
Stage 1	261	319	-	338	389	-	-	-	-	-	-	-	-	-
Stage 2	537	385	-	440	307	-	-	-	-	-	-	-	-	-
Platoon blocked, %									-	-			-	-
Mov Cap-1 Maneuver	84	76	609	89	74	651	797	797	-	-	730	730	-	-
Mov Cap-2 Maneuver	84	76	-	89	74	-	-	-	-	-	-	-	-	-
Stage 1	261	318	-	338	389	-	-	-	-	-	-	-	-	-
Stage 2	518	385	-	415	306	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	60	24.9	1	1.7
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	797	-	-	134	210	730	-	-
HCM Lane V/C Ratio	0.097	-	-	0.543	0.14	0.191	-	-
HCM Control Delay (s)	10	-	-	60	24.9	11.1	-	-
HCM Lane LOS	B	-	-	F	C	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-	2.7	0.5	0.7	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	9	19	10	660	22	10	43	615
Future Vol, veh/h	9	19	10	660	22	10	43	615
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	10	21	11	717	24	11	47	668

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1200	371	488	0	0	762	741	0
Stage 1	751	-	-	-	-	-	-	-
Stage 2	449	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	178	626	704	-	-	472	862	-
Stage 1	427	-	-	-	-	-	-	-
Stage 2	610	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	178	626	704	-	-	739	739	-
Mov Cap-2 Maneuver	178	-	-	-	-	-	-	-
Stage 1	427	-	-	-	-	-	-	-
Stage 2	610	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.4	0.1	0.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	704	-	-	346	739	-
HCM Lane V/C Ratio	0.015	-	-	0.088	0.078	-
HCM Control Delay (s)	10.2	-	-	16.4	10.3	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	40	0	42	11	0	18	63	624	23	10	43	521
Future Volume (vph)	40	0	42	11	0	18	63	624	23	10	43	521
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			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		0.93			0.92		1.00	0.99			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1680			1674		1770	3518			1770	3486
Flt Permitted		0.83			0.86		0.95	1.00			0.68	1.00
Satd. Flow (perm)		1429			1470		1770	3518			1263	3486
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)	43	0	46	12	0	20	68	678	25	11	47	566
RTOR Reduction (vph)	0	75	0	0	27	0	0	3	0	0	0	6
Lane Group Flow (vph)	0	14	0	0	5	0	68	700	0	0	58	614
Confl. Peds. (#/hr)			2									
Confl. Bikes (#/hr)									1			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		8.0			8.0		4.7	22.8			5.9	23.9
Effective Green, g (s)		8.0			8.0		4.7	22.8			5.9	23.9
Actuated g/C Ratio		0.16			0.16		0.09	0.44			0.12	0.47
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		222			229		162	1563			145	1624
v/s Ratio Prot							0.04	c0.20				0.18
v/s Ratio Perm		c0.01			0.00						c0.05	
v/c Ratio		0.06			0.02		0.42	0.45			0.40	0.38
Uniform Delay, d1		18.5			18.3		22.0	9.9			21.1	8.9
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.01
Incremental Delay, d2		0.1			0.0		1.8	0.2			1.8	0.1
Delay (s)		18.6			18.4		23.8	10.1			22.9	9.1
Level of Service		B			B		C	B			C	A
Approach Delay (s)		18.6			18.4			11.3				10.3
Approach LOS		B			B			B				B

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	51.3	Sum of lost time (s)	14.7
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	122	607	92	34	351	77	231	38	74	110	23	58
Future Volume (veh/h)	122	607	92	34	351	77	231	38	74	110	23	58
Number	5	2	12	1	6	16	3	8	18	7	4	14
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	0.99		0.99	1.00		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	133	660	100	37	382	84	251	41	80	120	25	63
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	174	1072	162	55	811	177	412	66	103	585	171	431
Arrive On Green	0.10	0.35	0.35	0.03	0.28	0.28	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	1774	3081	466	1774	2892	630	847	181	282	1264	467	1176
Grp Volume(v), veh/h	133	379	381	37	232	234	372	0	0	120	0	88
Grp Sat Flow(s),veh/h/ln	1774	1770	1778	1774	1770	1752	1310	0	0	1264	0	1643
Q Serve(g_s), s	4.3	10.5	10.5	1.2	6.4	6.6	13.3	0.0	0.0	0.0	0.0	2.1
Cycle Q Clear(g_c), s	4.3	10.5	10.5	1.2	6.4	6.6	15.4	0.0	0.0	3.9	0.0	2.1
Prop In Lane	1.00		0.26	1.00		0.36	0.67		0.22	1.00		0.72
Lane Grp Cap(c), veh/h	174	615	618	55	496	491	582	0	0	585	0	602
V/C Ratio(X)	0.76	0.62	0.62	0.68	0.47	0.48	0.64	0.00	0.00	0.21	0.00	0.15
Avail Cap(c_a), veh/h	497	998	1003	198	693	686	1132	0	0	1085	0	1251
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.0	16.0	16.0	28.4	17.6	17.7	17.3	0.0	0.0	13.1	0.0	12.6
Incr Delay (d2), s/veh	6.8	1.0	1.0	13.7	0.7	0.7	1.2	0.0	0.0	0.2	0.0	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	2.4	5.2	5.3	0.8	3.3	3.3	5.6	0.0	0.0	1.4	0.0	1.0
LnGrp Delay(d),s/veh	32.8	17.0	17.0	42.1	18.3	18.4	18.4	0.0	0.0	13.3	0.0	12.7
LnGrp LOS	C	B	B	D	B	B	B			B		B
Approach Vol, veh/h		893			503			372			208	
Approach Delay, s/veh		19.4			20.1			18.4			13.0	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	26.4		26.6	10.2	22.4		26.6
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	6.6	* 33		45.1	16.6	23.2		45.1
Max Q Clear Time (g_c+I1), s	3.2	12.5		5.9	6.3	8.6		17.4
Green Ext Time (p_c), s	0.0	8.1		3.8	0.2	6.7		3.7

Intersection Summary		
HCM 2010 Ctrl Delay		18.7
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	252	165	122	300	194	233	317	796	412	317	459	22
Future Volume (veh/h)	252	165	122	300	194	233	317	796	412	317	459	22
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	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	1900	1863	1863	1863	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	274	179	133	326	211	253	345	865	448	345	499	24
Adj No. of Lanes	2	2	0	2	1	1	1	2	0	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	316	324	226	379	339	455	364	1107	567	363	1990	618
Arrive On Green	0.09	0.16	0.16	0.11	0.18	0.18	0.21	0.49	0.49	0.11	0.39	0.39
Sat Flow, veh/h	3442	1978	1380	3442	1863	1581	1774	2254	1154	3442	5085	1579
Grp Volume(v), veh/h	274	159	153	326	211	253	345	677	636	345	499	24
Grp Sat Flow(s),veh/h/ln	1721	1770	1589	1721	1863	1581	1774	1770	1639	1721	1695	1579
Q Serve(g_s), s	11.8	12.4	13.4	14.0	15.7	20.4	28.8	47.3	48.4	15.0	9.9	1.4
Cycle Q Clear(g_c), s	11.8	12.4	13.4	14.0	15.7	20.4	28.8	47.3	48.4	15.0	9.9	1.4
Prop In Lane	1.00		0.87	1.00		1.00	1.00		0.70	1.00		1.00
Lane Grp Cap(c), veh/h	316	290	260	379	339	455	364	869	805	363	1990	618
V/C Ratio(X)	0.87	0.55	0.59	0.86	0.62	0.56	0.95	0.78	0.79	0.95	0.25	0.04
Avail Cap(c_a), veh/h	317	416	374	491	522	609	364	869	805	363	1990	618
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	0.85	0.85	0.85	0.34	0.34	0.34	0.83	0.83	0.83
Uniform Delay (d), s/veh	67.2	57.6	58.0	65.6	56.6	45.3	58.8	31.4	31.7	66.7	30.8	28.2
Incr Delay (d2), s/veh	21.5	1.6	2.1	10.1	1.6	0.9	16.4	2.4	2.8	31.0	0.3	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	6.6	6.2	6.0	7.2	8.2	9.0	15.7	23.7	22.5	8.7	4.7	0.6
LnGrp Delay(d),s/veh	88.7	59.2	60.1	75.7	58.2	46.2	75.2	33.8	34.5	97.7	31.1	28.3
LnGrp LOS	F	E	E	E	E	D	E	C	C	F	C	C
Approach Vol, veh/h		586			790			1658			868	
Approach Delay, s/veh		73.2			61.6			42.7			57.5	
Approach LOS		E			E			D			E	

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	35.0	64.2	18.0	32.8	20.0	79.2	20.7	30.1
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 31	44.0	* 14	42.0	* 16	59.0	* 21	* 35
Max Q Clear Time (g_c+I1), s	30.8	11.9	13.8	22.4	17.0	50.4	16.0	15.4
Green Ext Time (p_c), s	0.0	17.5	0.0	4.0	0.0	6.7	0.6	4.0

Intersection Summary		
HCM 2010 Ctrl Delay		54.4
HCM 2010 LOS		D

Notes

10: Rancho Penasquitos Blvd & SR 56 EB Ramps/Azuaga St — Existing + Cuml + Proj PM
HCM 2010 Signalized Intersection Summary — 9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	423	24	976	36	32	46	8	928	44	89	670	120
Future Volume (veh/h)	423	24	976	36	32	46	8	928	44	89	670	120
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	1.00		0.98
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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	460	26	1061	39	35	50	9	1009	48	97	728	130
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	656	14	565	145	57	81	74	1056	50	148	1235	1129
Arrive On Green	0.37	0.37	0.37	0.08	0.08	0.08	0.04	0.31	0.31	0.08	0.35	0.35
Sat Flow, veh/h	1774	37	1527	1774	693	990	1774	3439	164	1774	3539	1557
Grp Volume(v), veh/h	460	0	1087	39	0	85	9	519	538	97	728	130
Grp Sat Flow(s),veh/h/ln	1774	0	1564	1774	0	1684	1774	1770	1833	1774	1770	1557
Q Serve(g_s), s	26.5	0.0	44.4	2.5	0.0	5.9	0.6	34.5	34.5	6.4	20.2	3.1
Cycle Q Clear(g_c), s	26.5	0.0	44.4	2.5	0.0	5.9	0.6	34.5	34.5	6.4	20.2	3.1
Prop In Lane	1.00		0.98	1.00		0.59	1.00		0.09	1.00		1.00
Lane Grp Cap(c), veh/h	656	0	579	145	0	138	74	544	563	148	1235	1129
V/C Ratio(X)	0.70	0.00	1.88	0.27	0.00	0.62	0.12	0.96	0.96	0.66	0.59	0.12
Avail Cap(c_a), veh/h	656	0	579	148	0	140	74	544	563	151	1235	1129
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	1.00	1.00	0.89	0.89	0.89
Uniform Delay (d), s/veh	32.2	0.0	37.8	51.7	0.0	53.3	55.4	40.8	40.8	53.3	32.0	5.2
Incr Delay (d2), s/veh	3.3	0.0	401.6	1.0	0.0	7.6	0.7	29.0	28.4	8.6	1.8	0.2
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	13.5	0.0	83.7	1.3	0.0	3.0	0.3	21.2	21.9	3.5	10.2	3.1
LnGrp Delay(d),s/veh	35.5	0.0	439.4	52.7	0.0	60.9	56.1	69.7	69.1	62.0	33.9	5.4
LnGrp LOS	D		F	D		E	E	E	E	E	C	A
Approach Vol, veh/h		1547			124			1066			955	
Approach Delay, s/veh		319.3			58.3			69.3			32.8	
Approach LOS		F			E			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	47.4		14.4	14.2	42.4		49.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 5	41.7		10.0	* 10	36.5		44.4
Max Q Clear Time (g_c+I1), s	2.6	22.2		7.9	8.4	36.5		46.4
Green Ext Time (p_c), s	0.0	12.5		0.1	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	164.2
HCM 2010 LOS	F

Notes

11: Carmel Mountain Rd & Paseo Montalban — Existing + Cuml + Proj PM
HCM 2010 Signalized Intersection Summary — 9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	63	318	38	49	14	330	727	54	17	580	16
Future Volume (veh/h)	5	63	318	38	49	14	330	727	54	17	580	16
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	5	0	391	41	53	15	359	790	59	18	630	17
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	355	0	1015	349	283	80	506	1546	115	31	1175	32
Arrive On Green	0.01	0.00	0.17	0.03	0.20	0.20	0.15	0.46	0.46	0.02	0.33	0.33
Sat Flow, veh/h	1774	0	3145	1774	1397	395	3442	3337	249	1774	3521	95
Grp Volume(v), veh/h	5	0	391	41	0	68	359	419	430	18	317	330
Grp Sat Flow(s),veh/h/ln	1774	0	1572	1774	0	1792	1721	1770	1817	1774	1770	1846
Q Serve(g_s), s	0.1	0.0	5.8	1.1	0.0	1.9	6.0	10.1	10.1	0.6	8.8	8.8
Cycle Q Clear(g_c), s	0.1	0.0	5.8	1.1	0.0	1.9	6.0	10.1	10.1	0.6	8.8	8.8
Prop In Lane	1.00		1.00	1.00		0.22	1.00		0.14	1.00		0.05
Lane Grp Cap(c), veh/h	355	0	1015	349	0	363	506	820	842	31	591	616
V/C Ratio(X)	0.01	0.00	0.39	0.12	0.00	0.19	0.71	0.51	0.51	0.59	0.54	0.54
Avail Cap(c_a), veh/h	480	0	2026	425	0	889	998	1219	1251	134	840	876
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.4	0.0	15.9	19.5	0.0	20.1	24.6	11.4	11.4	29.6	16.4	16.4
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.1	0.0	0.2	1.9	0.5	0.5	16.7	0.8	0.7
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	0.1	0.0	2.5	0.6	0.0	1.0	3.0	5.0	5.1	0.4	4.4	4.6
LnGrp Delay(d),s/veh	20.5	0.0	16.2	19.6	0.0	20.3	26.5	11.9	11.9	46.3	17.2	17.1
LnGrp LOS	C		B	B		C	C	B	B	D	B	B
Approach Vol, veh/h		396			109			1208			665	
Approach Delay, s/veh		16.2			20.1			16.3			17.9	
Approach LOS		B			C			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	13.3	25.4	4.7	17.2	5.4	33.3	6.4	15.5
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	17.6	28.8	4.6	30.1	4.6	41.8	4.6	30.1
Max Q Clear Time (g_c+I1), s	8.0	10.8	2.1	3.9	2.6	12.1	3.1	7.8
Green Ext Time (p_c), s	0.9	9.2	0.0	2.0	0.0	11.7	0.0	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.9
HCM 2010 LOS	B

Notes

APPENDIX I

YEAR 2035 TRAFFIC VOLUME FORECAST

INTERSECTION	DIRECTION	LEG	EXISTING TRAFFIC VOLUMES						CALCULATED			EXISTING ADT	
									AM	PM	AVGERAGE		
			Ram	Rpm	Tam	Tpm	Lam	Lpm	8%	8%		COUNTED	SELECTED
1 Carmel Mtn Rd / I-15 NB Ramps	Sb	North	0	0	0	0	0	0	7212.5	9962.5	8587.5		8590
	Wb	East	251	555	879	1551	0	0	34400	46187.5	40293.75		40290
	Nb	South	1005	647	0	1	183	322	14850	12125	13487.5		13490
	Eb	West	0	0	617	942	326	241	25062.5	38200	31631.25		31630
2 Carmel Mtn Rd / I-15 SB Ramps	Sb	North	262	288	6	0	272	504	6750	9900	8325		8330
	Wb	East	0	0	514	999	548	874	25062.5	38200	31631.25		31630
	Nb	South	0	0	0	0	0	0	14075	13850	13962.5		13960
	Eb	West	572	234	671	679	0	0	25237.5	27500	26368.75	28310	28310
3 Carmel Mtn Rd / Penasquitos Dr	Sb	North	250	537	449	617	77	133	25237.5	27500	26368.75	28310	28310
	Wb	East	90	89	13	51	30	57	3412.5	5287.5	4350		4350
	Nb	South	15	41	491	493	73	147	15175	17812.5	16493.75	14060	14060
	Eb	West	156	70	48	52	662	331	15025	14850	14937.5		14940
4. CMR/ Caminito Duoro/Apartments RIRO (Future Access A)	Sb	North	0	0	664	757	0	0	17025	17375	17200	14060	14060
	Wb	East	43	20	0	0	0	0	675	837.5	756.25		760
	Nb	South	11	47	655	613	0	0	16625	17712.5	17168.75	14060	14060
	Eb	West	0	0	0	0	0	0	0	0	0		1
5. CMR/ Gerana St (Future Full Access B)	Sb	North	23	64	641	596	0	0	15962.5	15875	15918.75	14060	14060
	Wb	East	0	0	0	0	0	0	0	0	0		1
	Nb	South	0	0	553	572	35	56	16212.5	15625	15918.75	13800	13800
	Eb	West	68	26	0	0	60	38	2325	2300	2312.5		2310
6. CMR/ Caminata Ebro Full Access (Future Access C)	Sb	North	0	0	692	581	7	31	16087.5	15500	15793.75	13800	13800
	Wb	East	29	14	0	0	15	7	687.5	850	768.75		770
	Nb	South	4	16	559	614	0	0	15875	15225	15550	13800	13800
	Eb	West	0	0	0	0	0	0	0	0	0		1
7. CMR/ Cuca St (Future Full Access D)	Sb	North	70	50	620	498	7	30	15750	15100	15425	13800	13800
	Wb	East	27	13	0	0	13	6	625	800	712.5		710
	Nb	South	3	15	438	577	121	61	16800	14987.5	15893.75	13030	13030
	Eb	West	149	42	0	0	98	40	5475	2412.5	3943.75		3940
8 Carmel Mtn Rd / Paseo Cardiel	Sb	North	109	58	14	23	145	110	8137.5	5350	6743.75		6740
	Wb	East	212	77	512	325	7	32	15900	14612.5	15256.25	13030	13030
	Nb	South	7	72	18	38	86	231	1912.5	6100	4006.25		4010
	Eb	West	21	92	389	553	153	122	15875	17262.5	16568.75	17180	17180
9 Carmel Mtn Rd / Rancho PQ Blvd / SR-56 WB Ramp	Sb	North	28	22	914	434	317	300	32837.5	25137.5	28987.5		
	Wb	East	326	226	303	178	249	299	18962.5	19287.5	19125		
	Nb	South	242	375	779	777	353	298	32275	28812.5	30543.75		
	Eb	West	45	122	80	165	263	252	13400	12962.5	13181.25		
10 Rancho PQ Blvd /SR-56 EB Ramp	Sb	North	348	120	819	646	41	89	32212.5	27287.5	29750		
	Wb	East	85	46	35	32	97	36	3500	3387.5	3443.75		
	Nb	South	14	44	1193	888	55	8	31575	32187.5	31881.25		
	Eb	West	348	953	8	24	91	394	11062.5	19137.5	15100		
11 Carmel Mtn Rd /Paseo Montalban	Sb	North	12	14	875	543	57	15	24112.5	16162.5	20137.5	14580	14580
	Wb	East	40	13	60	49	90	38	3900	2900	3400		3400
	Nb	South	12	54	896	703	210	328	30925	24762.5	27843.75	23580	23580
	Eb	West	391	315	53	63	49	5	9687.5	9675	9681.25		9680
12. CMR/ Caminito Soleado RIRO (Existing Access B to be Deleted)	Sb	North	0	0	684	737	0	0	16875	17462.5	17168.75		
	Wb	East	43	20	0	0	0	0	662.5	837.5	750		
	Nb	South	10	47	623	640	0	0	16462.5	17800	17131.25		
	Eb	West	0	0	0	0	0	0	0	0	0		0

INTERSECTION	DIRECTION	LEG	APPROACH %ADT						DEPARTURE %ADT						2030 ADT			GROWTH FACTOR
			Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm	FORECAST	ASSUMED	SELECTED	
1 Carmel Mtn Rd / I-15 NB Ramps	Sb	North	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	8100	9000	9000	1.05
	Wb	East	0.62%	1.38%	2.18%	3.85%	0.00%	0.00%	2.92%	6.46%	2.78%	4.90%	0.00%	0.00%	47500		47500	1.18
	Nb	South	7.45%	4.80%	0.00%	0.01%	1.36%	2.39%	2.49%	1.61%	0.00%	0.01%	0.58%	1.02%	14400		14400	1.07
	Eb	West	0.00%	0.00%	1.95%	2.98%	1.03%	0.76%	0.00%	0.00%	1.53%	2.34%	3.80%	2.81%	38900		38900	1.23
2 Carmel Mtn Rd / I-15 SB Ramps	Sb	North	3.15%	3.46%	0.07%	0.00%	3.27%	6.05%	0.93%	1.02%	0.04%	0.00%	0.86%	1.59%	7500	8500	8500	1.02
	Wb	East	0.00%	0.00%	1.63%	3.16%	1.73%	2.76%	0.00%	0.00%	1.82%	3.53%	3.93%	6.26%	38900		38900	1.23
	Nb	South	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	15300		15300	1.10
	Eb	West	2.02%	0.83%	2.37%	2.40%	0.00%	0.00%	4.10%	1.68%	2.12%	2.15%	0.00%	0.00%	31300		31300	1.11
3 Carmel Mtn Rd / Penasquitos Dr	Sb	North	0.88%	1.90%	1.59%	2.18%	0.27%	0.47%	1.67%	3.59%	3.19%	4.39%	1.77%	3.06%	31300		31300	1.11
	Wb	East	2.07%	2.05%	0.30%	1.17%	0.69%	1.31%	0.32%	0.31%	0.09%	0.34%	0.21%	0.41%		4500	4500	1.03
	Nb	South	0.11%	0.29%	3.49%	3.51%	0.52%	1.05%	0.34%	0.94%	1.73%	1.74%	0.49%	0.98%	14600	15500	15500	1.10
	Eb	West	1.04%	0.47%	0.32%	0.35%	4.43%	2.22%	1.11%	0.50%	1.10%	1.20%	2.34%	1.17%	19200		19200	1.29
4. CMR/ Caminito Duoro/Apartments RIRO (Future Access A)	Sb	North	0.00%	0.00%	4.72%	5.38%	0.00%	0.00%	0.00%	0.00%	4.72%	5.38%	0.00%	0.00%	14600	15500	15500	1.10
	Wb	East	5.66%	2.63%	0.00%	0.00%	0.00%	0.00%	0.31%	0.14%	0.00%	0.00%	0.00%	0.00%		760	760	1.00
	Nb	South	0.08%	0.33%	4.66%	4.36%	0.00%	0.00%	1.45%	6.18%	4.66%	4.36%	0.00%	0.00%	14600	15500	15500	1.10
	Eb	West	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			1	1.00
5. CMR/ Gerana St (Future Full Access B)	Sb	North	0.16%	0.46%	4.56%	4.24%	0.00%	0.00%	1.00%	2.77%	4.64%	4.32%	0.00%	0.00%	14600	15500	15500	1.10
	Wb	East	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			1	1.00
	Nb	South	0.00%	0.00%	4.01%	4.14%	0.25%	0.41%	0.00%	0.00%	3.93%	4.07%	1.52%	2.42%	9100	15000	15000	1.09
	Eb	West	2.94%	1.13%	0.00%	0.00%	2.60%	1.65%	0.49%	0.19%	0.00%	0.00%	0.43%	0.27%		2500	2500	1.08
6. CMR/ Caminata Ebro Full Access (Future Access C)	Sb	North	0.00%	0.00%	5.01%	4.21%	0.05%	0.22%	0.00%	0.00%	5.01%	4.21%	0.91%	4.03%	9100	15000	15000	1.09
	Wb	East	3.77%	1.82%	0.00%	0.00%	1.95%	0.91%	0.21%	0.10%	0.00%	0.00%	0.11%	0.05%		770	770	1.00
	Nb	South	0.03%	0.12%	4.05%	4.45%	0.00%	0.00%	0.52%	2.08%	4.05%	4.45%	0.00%	0.00%	9100	15000	15000	1.09
	Eb	West	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			1	1.00
7. CMR/ Cuca St (Future Full Access D)	Sb	North	0.51%	0.36%	4.49%	3.61%	0.05%	0.22%	1.78%	1.27%	4.76%	3.82%	0.99%	4.23%	9100	15000	15000	1.09
	Wb	East	3.80%	1.83%	0.00%	0.00%	1.83%	0.85%	0.20%	0.09%	0.00%	0.00%	0.10%	0.05%		400	400	0.56
	Nb	South	0.02%	0.12%	3.36%	4.43%	0.93%	0.47%	0.42%	2.11%	3.17%	4.18%	3.07%	1.55%	12600	13500	13500	1.04
	Eb	West	3.78%	1.07%	0.00%	0.00%	2.49%	1.02%	1.14%	0.32%	0.00%	0.00%	0.71%	0.29%	3500	4100	4100	1.04
8 Carmel Mtn Rd / Paseo Cardiel	Sb	North	1.62%	0.86%	0.21%	0.34%	2.15%	1.63%	0.63%	0.34%	0.35%	0.57%	1.11%	0.84%	4900	7000	7000	1.04
	Wb	East	1.63%	0.59%	3.93%	2.49%	0.05%	0.25%	3.15%	1.14%	2.98%	1.89%	0.17%	0.80%	14200		14200	1.09
	Nb	South	0.17%	1.80%	0.45%	0.95%	2.14%	5.76%	0.05%	0.55%	0.27%	0.56%	0.50%	1.34%		4200	4200	1.05
	Eb	West	0.12%	0.54%	2.26%	3.22%	0.89%	0.71%	0.52%	2.29%	2.99%	4.24%	2.27%	1.81%	17900		17900	1.04
9 Carmel Mtn Rd / Rancho PQ Blvd / SR-56 WB Ramp	Sb	North	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
	Wb	East	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
	Nb	South	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
	Eb	West	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
10 Rancho PQ Blvd /SR-56 EB Ramp	Sb	North	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
	Wb	East	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
	Nb	South	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
	Eb	West	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				#DIV/0!
11 Carmel Mtn Rd /Paseo Montalban	Sb	North	0.08%	0.10%	6.00%	3.72%	0.39%	0.10%	0.12%	0.14%	3.71%	2.30%	1.68%	0.44%	16200		16200	1.11
	Wb	East	1.18%	0.38%	1.76%	1.44%	2.65%	1.12%	0.27%	0.09%	0.62%	0.51%	0.38%	0.16%	300	3700	3700	1.09
	Nb	South	0.05%	0.23%	3.80%	2.98%	0.89%	1.39%	0.35%	1.59%	6.15%	4.82%	2.17%	3.39%	24400		24400	1.03
	Eb	West	4.04%	3.25%	0.55%	0.65%	0.51%	0.05%	1.66%	1.34%	1.56%	1.85%	0.34%	0.03%	13400		13400	1.38
12. CMR/ Caminito Soleado RIRO (Existing Access B to be Deleted)	Sb	North	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	16200		16200	#DIV/0!
	Wb	East	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	300	3700	3700	#DIV/0!
	Nb	South	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	24400		24400	#DIV/0!
	Eb	West	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	13400		13400	#DIV/0!

INTERSECTION	DIRECTION	LEG	2030 APROACH TRAFFIC VOLUMES						2030 DEPARTURE TRAFFIC VOLUMES						2030 WEIGHTED AVERAGE TRAFFIC VOLUMES					
			Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm
1 Carmel Mtn Rd / I-15 NB Ramps	Sb	North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wb	East	296	654	1,036	1,829	0	0	263	581	1081	1907	0	0	269	594	1061	1873	0	0
	Nb	South	1,073	691	0	1	195	344	1185	763	0	1	225	396	1101	709	0	1	204	359
	Eb	West	0	0	759	1,159	401	296	0	0	727	1111	342	253	0	0	745	1137	354	262
2 Carmel Mtn Rd / I-15 SB Ramps	Sb	North	267	294	6	0	278	514	290	318	7	0	335	620	272	299	6	0	289	536
	Wb	East	0	0	632	1,229	674	1,075	0	0	568	1105	601	958	0	0	598	1163	623	994
	Nb	South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Eb	West	632	259	742	751	0	0	627	256	825	835	0	0	629	257	781	791	0	0
3 Carmel Mtn Rd / Penasquitos Dr	Sb	North	276	594	496	682	85	147	321	690	495	680	80	138	306	657	495	681	80	139
	Wb	East	93	92	13	53	31	59	100	98	17	66	33	63	94	93	14	56	32	60
	Nb	South	17	45	541	543	80	162	16	42	543	545	94	189	16	43	542	544	87	175
	Eb	West	200	90	62	67	851	425	172	77	50	54	732	366	186	83	52	57	810	405
4. CMR/ Caminito Duoro/Apartments RIRO (Future Access A)	Sb	North	0	0	732	835	0	0	0	0	732	835	0	0	0	0	732	835	0	0
	Wb	East	43	20	0	0	0	0	47	22	0	0	0	0	43	20	0	0	0	0
	Nb	South	12	52	722	676	0	0	11	47	722	676	0	0	11	47	722	676	0	0
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. CMR/ Gerana St (Future Full Access B)	Sb	North	25	71	707	657	0	0	25	69	697	648	0	0	25	69	702	652	0	0
	Wb	East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nb	South	0	0	601	622	38	61	0	0	610	631	38	61	0	0	605	626	38	61
	Eb	West	74	28	0	0	65	41	74	28	0	0	66	42	74	28	0	0	65	41
6. CMR/ Caminata Ebro Full Access (Future Access C)	Sb	North	0	0	752	632	8	34	0	0	752	632	7	31	0	0	752	632	7	31
	Wb	East	29	14	0	0	15	7	32	15	0	0	16	8	29	14	0	0	15	7
	Nb	South	4	17	608	667	0	0	4	16	608	667	0	0	4	16	608	667	0	0
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7. CMR/ Cuca St (Future Full Access D)	Sb	North	76	54	674	541	8	33	73	52	642	516	4	17	74	53	658	528	4	18
	Wb	East	15	7	0	0	7	3	29	14	0	0	13	6	16	8	0	0	8	4
	Nb	South	3	16	454	598	125	63	2	8	476	627	126	63	2	9	465	612	126	63
	Eb	West	155	44	0	0	102	42	154	44	0	0	107	43	155	44	0	0	103	42
8 Carmel Mtn Rd / Paseo Cardiel	Sb	North	113	60	15	24	151	114	114	60	15	24	158	120	113	60	15	24	153	116
	Wb	East	231	84	558	354	8	35	220	80	533	339	7	34	224	81	547	347	7	34
	Nb	South	7	75	19	40	90	242	8	78	19	39	90	241	7	76	19	40	90	242
	Eb	West	22	96	405	576	159	127	22	96	424	603	159	127	22	96	416	591	159	127
9 Carmel Mtn Rd / Rancho PQ Blvd / SR-56 WB Ramp	Sb	North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wb	East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nb	South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Rancho PQ Blvd /SR-56 EB Ramp	Sb	North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wb	East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nb	South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Carmel Mtn Rd /Paseo Montalban	Sb	North	13	16	972	603	63	17	17	19	905	562	62	16	15	18	947	587	62	16
	Wb	East	44	14	65	53	98	41	44	14	83	68	93	39	44	14	70	57	97	41
	Nb	South	12	56	927	727	217	339	13	59	996	781	291	454	13	58	969	761	269	421
	Eb	West	541	436	73	87	68	7	405	326	58	69	54	6	501	404	62	73	62	6
12. CMR/ Caminito Soleado RIRO (Existing Access B to be Deleted)	Sb	North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Wb	East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nb	South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

INTERSECTION	DIRECTION	LEG	2030 ROUNDED TRAFFIC VOLUMES						Existing + Cumulative						CHECK					
			Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm	Ram	Rpm	Tam	Tpm	Lam	Lpm
1 Carmel Mtn Rd / I-15 NB Ramps	Sb	North	0	0	0	0	0	0	0	0	0	0	0	0						
	Wb	East	270	590	1030	1800	0	0	0	0	0	0	0	0						
	Nb	South	1100	710	0	5	200	360	191	351	0	0	0	0						
	Eb	West	0	0	740	1070	350	260	346	250	0	0	0	0	< EX	< EX				
2 Carmel Mtn Rd / I-15 SB Ramps	Sb	North	270	300	10	0	290	540	272	504	0	0	4	4	< EX	< EX				
	Wb	East	0	0	610	1170	620	990	548	874	0	0	0	0	< EX	< EX				
	Nb	South	0	0	0	0	0	0	0	0	0	0	0	0						
	Eb	West	630	260	800	790	0	0	0	0	0	0	0	0						
3 Carmel Mtn Rd / Penasquitos Dr	Sb	North	310	660	500	680	80	140	77	133	0	0	0	0						
	Wb	East	90	90	15	60	30	60	31	63	0	0	0	0						
	Nb	South	20	45	540	540	90	180	76	148	31	13	0	0	< EX	< EX				
	Eb	West	190	80	50	60	810	400	662	331	0	0	4	4	< EX	< EX				
4. CMR/ Caminito Duoro/Apartments RIRO (Future Access A)	Sb	North	0	0	730	830	0	0	0	0	0	0	0	0						
	Wb	East	45	20	0	0	0	0	0	0	0	0	0	0						
	Nb	South	15	50	645	680	0	0	0	0	0	0	0	0						
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0						
5. CMR/ Gerana St (Future Full Access B)	Sb	North	25	70	700	650	20	65	10	43	21	76	0	0						
	Wb	East	0	0	0	0	0	0	20	9	0	0	0	0	< EX	< EX				
	Nb	South	0	0	580	630	40	65	35	56	10	10	0	0	< EX	< EX				
	Eb	West	75	30	0	0	70	40	60	38	0	0	4	3		< EX				
6. CMR/ Caminata Ebro Full Access (Future Access C)	Sb	North	0	0	750	630	10	35	10	43	10	10	0	0	< EX	< EX				
	Wb	East	30	20	0	0	20	10	20	9	0	0	0	0						
	Nb	South	5	20	610	670	0	0	0	0	10	10	0	0						
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0						
7. CMR/ Cuca St (Future Full Access D)	Sb	North	70	50	660	530	5	20	10	43	10	10	0	0						
	Wb	East	20	10	0	5	15	5	21	10	0	0	0	0	< EX					
	Nb	South	0	10	460	630	130	70	121	61	0	0	0	0	< EX	< EX				
	Eb	West	155	45	0	0	100	40	98	40	0	0	2	0						
8 Carmel Mtn Rd / Paseo Cardiel	Sb	North	110	70	20	25	150	120	145	110	0	0	0	0	< EX	< EX				
	Wb	East	220	80	550	450	10	35	9	33	0	0	0	0						
	Nb	South	10	80	20	40	90	240	86	231	0	0	0	0	< EX	< EX				
	Eb	West	25	100	420	590	160	130	153	122	0	0	0	0	< EX	< EX				
9 Carmel Mtn Rd / Rancho PQ Blvd / SR-56 WB Ramp	Sb	North	0	0	0	0	0	0	321	316	0	0	0	0	< EX	< EX				
	Wb	East	0	0	0	0	0	0	252	300	0	0	0	0	< EX	< EX				
	Nb	South	0	0	0	0	0	0	353	298	0	0	5	18	< EX	< EX			< EX	< EX
	Eb	West	0	0	0	0	0	0	263	252	0	0	0	0	< EX	< EX				
10 Rancho PQ Blvd /SR-56 EB Ramp	Sb	North	0	0	0	0	0	0	41	89	0	0	0	0	< EX	< EX				
	Wb	East	0	0	0	0	0	0	97	36	0	0	0	0	< EX	< EX				
	Nb	South	0	0	0	0	0	0	55	8	0	0	0	0	< EX	< EX				
	Eb	West	0	0	0	0	0	0	95	408	0	0	8	23	< EX	< EX			< EX	< EX
11 Carmel Mtn Rd /Paseo Montalban	Sb	North	20	20	950	590	60	20	57	15	0	0	0	2	< EX					
	Wb	East	45	20	70	60	100	40	90	38	0	0	2	1	< EX	< EX				
	Nb	South	15	60	970	760	270	420	213	330	0	0	0	0	< EX	< EX				
	Eb	West	500	400	60	70	60	10	49	5	0	0	0	0						
12. CMR/ Caminito Soleado RIRO (Existing Access B to be Deleted)	Sb	North	0	0	0	0	0	0	0	0	0	0	0	0						
	Wb	East	45	20	0	0	0	0	0	0	0	0	0	0						
	Nb	South	15	0	0	0	0	0	0	0	0	0	0	0						
	Eb	West	0	0	0	0	0	0	0	0	0	0	0	0						

N:\2472\Calcs\2472.Peak Hour

INTERSECTION	DIRECTION	LEG	FINAL Year 2035								CHECK					
			Ram	Rpm	Tam	Tpm	Lam	Lpm	Uam	Upm	Ram	Rpm	Tam	Tpm	Lam	Lpm
1 Carmel Mtn Rd / I-15 NB Ramps	Sb	North	0	0	0	0	0	0								
	Wb	East	270	590	1030	1800	0	0								
	Nb	South	1100	710	0	5	200	360								
	Eb	West	0	0	740	1070	350	260			< EX	< EX				
2 Carmel Mtn Rd / I-15 SB Ramps	Sb	North	270	300	10	0	290	540			< EX	< EX				
	Wb	East	0	0	610	1170	620	990			< EX	< EX				
	Nb	South	0	0	0	0	0	0								
	Eb	West	630	240	800	790	0	0								
3 Carmel Mtn Rd / Penasquitos Dr	Sb	North	300	650	500	680	80	140								
	Wb	East	90	90	15	60	30	60								
	Nb	South	20	45	540	540	81	157	29	13	< EX	< EX				
	Eb	West	180	80	50	60	800	400			< EX	< EX				
4. CMR/ Caminito Duoro/Apartments RIRO (Future Access A)	Sb	North	0	0	739	833	0	0								
	Wb	East	43	20	0	0	0	0								
	Nb	South	11	47	700	680	0	0								
	Eb	West	0	0	0	0	0	0								
5. CMR/ Gerana St (Future Full Access B)	Sb	North	25	70	714	663			20	77						
	Wb	East	0	0	0	0	0	0			< EX	< EX				
	Nb	South	0	0	598	637	37	61	10	10	< EX	< EX				
	Eb	West	75	30	0	0	60	40				< EX				
6. CMR/ Caminata Ebro Full Access (Future Access C)	Sb	North	0	0	792	652	7	31	10	10	< EX	< EX				
	Wb	East	29	14	0	0	15	7								
	Nb	South	4	16	606	684			10	10						
	Eb	West	0	0	0	0	0	0								
7. CMR/ Cuca St (Future Full Access D)	Sb	North	70	50	740	569	7	30	10	10						
	Wb	East	27	13	0	0	13	6								
	Nb	South	3	15	483	647	130	70			< EX	< EX				
	Eb	West	155	45	0	0	100	40								
8 Carmel Mtn Rd / Paseo Cardiel	Sb	North	110	70	20	25	150	120			< EX	< EX				
	Wb	East	220	80	550	450	10	35								
	Nb	South	10	80	20	40	90	240			< EX	< EX				
	Eb	West	25	100	420	590	160	130			< EX	< EX				
			See "comparison" tab.													
9 Carmel Mtn Rd / Rancho PQ Blvd / SR-56 WB Ramp	Sb	North	120	60	930	640	410	300			< EX	< EX				
	Wb	East	330	300	315	240	290	330								
	Nb	South	250	395	795	800	500	360			< EX					
	Eb	West	60	125	110	180	300	280			< EX	< EX				
			See "comparison" tab.													
10 Rancho PQ Blvd /SR-56 EB Ramp	Sb	North	350	220	880	785	50	90								
	Wb	East	100	50	70	40	130	40								
	Nb	South	15	70	1225	1240	70	30			< EX					
	Eb	West	360	980	10	40	170	450								
11 Carmel Mtn Rd /Paseo Montalban	Sb	North	20	20	950	590	60	20			< EX					
	Wb	East	45	20	70	60	100	40			< EX	< EX				
	Nb	South	15	60	970	760	270	420			< EX	< EX				
	Eb	West	500	400	60	70	60	10								
12. CMR/ Caminito Soleado RIRO (Existing Access B to be Deleted)	Sb	North	0	0	759	810	0	0								
	Wb	East	43	20	0	0	0	0								
	Nb	South	10	47	668	707	0	0								
	Eb	West	0	0	0	0	0	0								

STREET SEGMENT	Year 2035 Without Project	Year 2035 (Merge Model)	Ex+Cuml	Growth Percentage	Year 2035 Series 12 Shelf	Year 2020 Series 12 Shelf	Year 2008 Series 12 Shelf	2035-2020
Carmel Mountain Road								
I-15 SB Ramps to Penasquitos Dr	30,320	33,800	28,409	19%	31,300	29,500	27,800	6%
Penasquitos Dr to Gerana St	15,180	14,200	14,225	0%	14,600	13,700	12,900	7%
Gerana St to Cuca St	14,980	8,800	14,030	-37%	9,100	8,300	9,000	10%
Cuca St to Paseo Cardiel	14,170	12,400	13,277	-7%	12,600	11,400	11,200	11%
Paseo Cardiel to Rancho Penasquitos Blvd	18,600	12,400	17,427	-29%	17,200	17,200	17,900	0%
Rancho Penasquitos Blvd to Paseo Montalban	25,590	29,500	23,970	23%	24,400	23,100	24,600	6%
Paseo Montalban to Sundevil Way	16,030	14,100	15,022	-6%	16,200	14,900	16,000	9%

APPENDIX J

PEAK HOUR INTERSECTION ANALYSIS WORKSHEETS
YEAR 2035 WITHOUT PROJECT

1: I-15 NB Ramp & Carmel Mountain Rd — Year 2035 AM
HCM 2010 Signalized Intersection Summary — 1/14/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	350	740	0	0	1030	270	200	0	1100	0	0	0
Future Volume (veh/h)	350	740	0	0	1030	270	200	0	1100	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	380	804	0	0	1120	293	217	0	1196			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	1996	4865	0	0	1058	473	1380	0	1231			
Arrive On Green	0.19	0.32	0.00	0.00	0.30	0.30	0.39	0.00	0.39			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	380	804	0	0	1120	293	217	0	1196			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	8.3	10.3	0.0	0.0	26.9	14.3	3.6	0.0	33.4			
Cycle Q Clear(g_c), s	8.3	10.3	0.0	0.0	26.9	14.3	3.6	0.0	33.4			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1996	4865	0	0	1058	473	1380	0	1231			
V/C Ratio(X)	0.19	0.17	0.00	0.00	1.06	0.62	0.16	0.00	0.97			
Avail Cap(c_a), veh/h	1996	4865	0	0	1058	473	1380	0	1231			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.62	0.62	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	18.7	4.8	0.0	0.0	31.6	27.1	17.9	0.0	27.0			
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	44.6	6.0	0.1	0.0	19.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.0	4.9	0.0	0.0	19.6	7.1	1.8	0.0	17.7			
LnGrp Delay(d),s/veh	18.7	4.9	0.0	0.0	76.2	33.1	18.0	0.0	46.1			
LnGrp LOS	B	A			F	C	B		D			
Approach Vol, veh/h		1184			1413			1413				
Approach Delay, s/veh		9.3			67.2			41.7				
Approach LOS		A			E			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		94.4			60.5	33.9		41.1
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		41.9			9.3	* 27		35.0
Max Q Clear Time (g_c+I1), s		12.3			10.3	28.9		35.4
Green Ext Time (p_c), s		8.2			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	41.2
HCM 2010 LOS	D

Notes

2: I-15 SB Ramp & Carmel Mountain Rd — Year 2035 AM
HCM 2010 Signalized Intersection Summary — 1/14/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	800	630	620	610	0	0	0	0	290	10	270
Future Volume (veh/h)	0	800	630	620	610	0	0	0	0	290	10	270
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	870	685	674	663	0				411	0	199
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1517	679	681	2441	0				585	0	261
Arrive On Green	0.00	0.43	0.43	0.26	0.92	0.00				0.16	0.00	0.16
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	870	685	674	663	0				411	0	199
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	16.8	38.6	17.6	1.9	0.0				9.8	0.0	10.8
Cycle Q Clear(g_c), s	0.0	16.8	38.6	17.6	1.9	0.0				9.8	0.0	10.8
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1517	679	681	2441	0				585	0	261
V/C Ratio(X)	0.00	0.57	1.01	0.99	0.27	0.00				0.70	0.00	0.76
Avail Cap(c_a), veh/h	0	1517	679	681	2441	0				1143	0	510
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.14	0.14	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	19.5	25.7	33.1	1.2	0.0				35.5	0.0	35.9
Incr Delay (d2), s/veh	0.0	1.6	36.9	10.5	0.0	0.0				1.6	0.0	4.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	8.4	23.7	9.3	0.8	0.0				4.9	0.0	5.0
LnGrp Delay(d),s/veh	0.0	21.1	62.6	43.6	1.3	0.0				37.1	0.0	40.5
LnGrp LOS		C	F	D	A					D		D
Approach Vol, veh/h		1555			1337						610	
Approach Delay, s/veh		39.4			22.6						38.2	
Approach LOS		D			C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.5	45.6		20.9		69.1		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 18	24.4		29.0		47.9		
Max Q Clear Time (g_c+I1), s	19.6	40.6		12.8		3.9		
Green Ext Time (p_c), s	0.0	0.0		2.0		22.0		

Intersection Summary	
HCM 2010 Ctrl Delay	32.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	800	50	180	30	15	90	29	81	540	20	80	500
Future Volume (vph)	800	50	180	30	15	90	29	81	540	20	80	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1695	1549	1681	1738	1583		1770	5054		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1695	1549	1681	1738	1583		1770	5054		1770	3539
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)	870	54	196	33	16	98	32	88	587	22	87	543
RTOR Reduction (vph)	0	0	129	0	0	92	0	0	4	0	0	0
Lane Group Flow (vph)	461	463	67	24	25	6	0	120	605	0	87	543
Confl. Peds. (#/hr)			11									
Confl. Bikes (#/hr)										1		
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	28.1	28.1	28.1	5.4	5.4	5.4		7.9	20.8		7.2	19.6
Effective Green, g (s)	28.1	28.1	28.1	5.4	5.4	5.4		7.9	20.8		7.2	19.6
Actuated g/C Ratio	0.34	0.34	0.34	0.07	0.07	0.07		0.10	0.25		0.09	0.24
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	578	583	533	111	115	104		171	1288		156	850
v/s Ratio Prot	c0.27	0.27		0.01	c0.01			c0.07	0.12		0.05	c0.15
v/s Ratio Perm			0.04			0.00						
v/c Ratio	0.80	0.79	0.13	0.22	0.22	0.06		0.70	0.47		0.56	0.64
Uniform Delay, d1	24.2	24.1	18.3	36.1	36.1	35.7		35.7	25.7		35.7	27.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00
Incremental Delay, d2	7.5	7.4	0.1	1.0	1.0	0.3		12.3	0.3		4.3	1.6
Delay (s)	31.7	31.5	18.4	37.1	37.1	36.0		48.0	25.8		39.9	29.4
Level of Service	C	C	B	D	D	D		D	C		D	C
Approach Delay (s)		29.3			36.3				29.5			23.1
Approach LOS		C			D				C			C

Intersection Summary			
HCM 2000 Control Delay	27.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	20.6
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	300
Future Volume (vph)	300
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	0.99
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1569
Flt Permitted	1.00
Satd. Flow (perm)	1569
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	326
RTOR Reduction (vph)	135
Lane Group Flow (vph)	191
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	47.7
Effective Green, g (s)	47.7
Actuated g/C Ratio	0.58
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	917
v/s Ratio Prot	0.07
v/s Ratio Perm	0.05
v/c Ratio	0.21
Uniform Delay, d1	8.0
Progression Factor	1.00
Incremental Delay, d2	0.1
Delay (s)	8.1
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	43	700	11	0	739
Future Vol, veh/h	0	43	700	11	0	739
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	47	761	12	0	803

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1169	386	0	0	773	0
Stage 1	767	-	-	-	-	-
Stage 2	402	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	186	612	-	-	838	-
Stage 1	419	-	-	-	-	-
Stage 2	644	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	186	612	-	-	838	-
Mov Cap-2 Maneuver	186	-	-	-	-	-
Stage 1	419	-	-	-	-	-
Stage 2	644	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.4	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	612	838	-
HCM Lane V/C Ratio	-	-	0.076	-	-
HCM Control Delay (s)	-	-	11.4	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0	-

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Traffic Vol, veh/h	60	75	10	37	598	20	714	25
Future Vol, veh/h	60	75	10	37	598	20	714	25
Conflicting Peds, #/hr	2	1	0	2	0	0	0	2
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	-	120	-	140	-	-
Veh in Median Storage, #	0	-	-	-	0	-	0	-
Grade, %	0	-	-	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	65	82	11	40	650	22	776	27

Major/Minor	Minor2		Major1			Major2		
Conflicting Flow All	1262	406	885	805	0	475	-	0
Stage 1	835	-	-	-	-	-	-	-
Stage 2	427	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	4.14	-	6.44	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	2.22	-	2.52	-	-
Pot Cap-1 Maneuver	162	594	393	815	-	718	-	-
Stage 1	386	-	-	-	-	-	-	-
Stage 2	626	-	-	-	-	-	-	-
Platoon blocked, %					-		-	-
Mov Cap-1 Maneuver	161	592	630	630	-	718	-	-
Mov Cap-2 Maneuver	161	-	-	-	-	-	-	-
Stage 1	385	-	-	-	-	-	-	-
Stage 2	625	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	33.1	0.8	0.3
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR
Capacity (veh/h)	630	-	270	718	-	-
HCM Lane V/C Ratio	0.081	-	0.543	0.03	-	-
HCM Control Delay (s)	11.2	-	33.1	10.2	-	-
HCM Lane LOS	B	-	D	B	-	-
HCM 95th %tile Q(veh)	0.3	-	3	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	15	29	10	606	4	10	7	792
Future Vol, veh/h	15	29	10	606	4	10	7	792
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	16	32	11	659	4	11	8	861

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1150	332	628	0	0	695	663	0
Stage 1	683	-	-	-	-	-	-	-
Stage 2	467	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	192	664	574	-	-	520	922	-
Stage 1	463	-	-	-	-	-	-	-
Stage 2	597	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	192	664	574	-	-	613	613	-
Mov Cap-2 Maneuver	192	-	-	-	-	-	-	-
Stage 1	463	-	-	-	-	-	-	-
Stage 2	597	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.5	0.2	0.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	574	-	-	361	613	-
HCM Lane V/C Ratio	0.019	-	-	0.132	0.03	-
HCM Control Delay (s)	11.4	-	-	16.5	11.1	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	100	0	155	13	0	27	130	483	3	10	7	740
Future Volume (vph)	100	0	155	13	0	27	130	483	3	10	7	740
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			0.99		1.00	1.00			1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	1.00
Frt		0.92			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1655			1650		1770	3536			1770	3493
Flt Permitted		0.85			0.89		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1439			1486		1770	3536			1863	3493
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)	109	0	168	14	0	29	141	525	3	11	8	804
RTOR Reduction (vph)	0	106	0	0	34	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	171	0	0	9	0	141	528	0	0	19	873
Confl. Peds. (#/hr)			14			4			2			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		14.0			14.0		8.4	34.2			0.6	26.3
Effective Green, g (s)		14.0			14.0		8.4	34.2			0.6	26.3
Actuated g/C Ratio		0.22			0.22		0.13	0.54			0.01	0.41
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		317			328		234	1907			17	1448
v/s Ratio Prot							c0.08	0.15				c0.25
v/s Ratio Perm		c0.12			0.01						0.01	
v/c Ratio		0.54			0.03		0.60	0.28			1.12	0.60
Uniform Delay, d1		21.8			19.4		25.9	7.9			31.4	14.5
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		1.8			0.0		4.3	0.1			258.7	0.7
Delay (s)		23.6			19.4		30.3	8.0			290.1	15.2
Level of Service		C			B		C	A			F	B
Approach Delay (s)		23.6			19.4			12.7				21.0
Approach LOS		C			B			B				C

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	63.4	Sum of lost time (s)	14.7
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

7: Carmel Mountain Rd & Cuca St/Caminata Deluz (Access D) — Year 2035 AM

HCM Signalized Intersection Capacity Analysis — 1/14/2016

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	70
Future Volume (vph)	70
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	76
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

8: Carmel Mountain Rd & Paseo Cardiel — Year 2035 AM

HCM 2010 Signalized Intersection Summary — 1/14/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	420	25	10	550	220	90	20	10	150	20	110
Future Volume (veh/h)	160	420	25	10	550	220	90	20	10	150	20	110
Number	5	2	12	1	6	16	3	8	18	7	4	14
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		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	174	457	27	11	598	239	98	22	11	163	22	120
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	225	1673	99	20	931	372	268	55	19	455	58	316
Arrive On Green	0.13	0.49	0.49	0.01	0.38	0.38	0.23	0.23	0.23	0.23	0.23	0.23
Sat Flow, veh/h	1774	3397	200	1774	2470	986	680	238	84	1367	250	1364
Grp Volume(v), veh/h	174	238	246	11	428	409	131	0	0	163	0	142
Grp Sat Flow(s),veh/h/ln	1774	1770	1827	1774	1770	1686	1002	0	0	1367	0	1614
Q Serve(g_s), s	5.4	4.5	4.5	0.4	11.3	11.4	4.2	0.0	0.0	0.0	0.0	4.2
Cycle Q Clear(g_c), s	5.4	4.5	4.5	0.4	11.3	11.4	8.4	0.0	0.0	5.6	0.0	4.2
Prop In Lane	1.00		0.11	1.00		0.58	0.75		0.08	1.00		0.85
Lane Grp Cap(c), veh/h	225	871	900	20	667	635	343	0	0	455	0	374
V/C Ratio(X)	0.77	0.27	0.27	0.55	0.64	0.64	0.38	0.00	0.00	0.36	0.00	0.38
Avail Cap(c_a), veh/h	516	1356	1400	128	962	916	673	0	0	792	0	772
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.1	8.5	8.5	28.1	14.6	14.6	21.0	0.0	0.0	19.0	0.0	18.5
Incr Delay (d2), s/veh	5.6	0.2	0.2	21.8	1.0	1.1	0.7	0.0	0.0	0.5	0.0	0.6
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	3.0	2.2	2.3	0.3	5.7	5.4	2.0	0.0	0.0	2.3	0.0	2.0
LnGrp Delay(d),s/veh	29.7	8.7	8.7	49.9	15.6	15.7	21.7	0.0	0.0	19.5	0.0	19.1
LnGrp LOS	C	A	A	D	B	B	C			B		B
Approach Vol, veh/h		658			848			131			305	
Approach Delay, s/veh		14.2			16.1			21.7			19.3	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.0	33.9		18.1	11.6	27.3		18.1
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	4.1	* 44		27.3	16.6	31.0		27.3
Max Q Clear Time (g_c+I1), s	2.4	6.5		7.6	7.4	13.4		10.4
Green Ext Time (p_c), s	0.0	10.9		2.1	0.3	8.1		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.4
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	300	110	60	290	315	330	500	795	250	410	930	120
Future Volume (veh/h)	300	110	60	290	315	330	500	795	250	410	930	120
Number	3	8	18	7	4	14	1	6	16	5	2	12
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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	326	120	65	315	342	359	543	864	272	446	1011	130
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	248	428	219	368	416	581	400	1527	681	495	1779	554
Arrive On Green	0.07	0.19	0.19	0.11	0.22	0.22	0.23	0.43	0.43	0.14	0.35	0.35
Sat Flow, veh/h	3442	2268	1160	3442	1863	1583	1774	3539	1579	3442	5085	1583
Grp Volume(v), veh/h	326	92	93	315	342	359	543	864	272	446	1011	130
Grp Sat Flow(s),veh/h/ln	1721	1770	1658	1721	1863	1583	1774	1770	1579	1721	1695	1583
Q Serve(g_s), s	10.8	6.7	7.2	13.5	26.2	27.8	33.8	27.5	17.7	19.1	24.2	8.7
Cycle Q Clear(g_c), s	10.8	6.7	7.2	13.5	26.2	27.8	33.8	27.5	17.7	19.1	24.2	8.7
Prop In Lane	1.00		0.70	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	248	334	313	368	416	581	400	1527	681	495	1779	554
V/C Ratio(X)	1.32	0.28	0.30	0.86	0.82	0.62	1.36	0.57	0.40	0.90	0.57	0.23
Avail Cap(c_a), veh/h	248	388	364	477	522	671	400	1527	681	539	1779	554
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	0.65	0.65	0.65	0.51	0.51	0.51	0.64	0.64	0.64
Uniform Delay (d), s/veh	69.6	52.1	52.3	65.9	55.4	38.8	58.1	32.1	29.3	63.2	39.6	34.5
Incr Delay (d2), s/veh	167.7	0.4	0.5	7.9	5.6	0.9	169.6	0.8	0.9	12.1	0.8	0.6
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	10.9	3.3	3.4	6.8	14.1	12.3	35.4	13.6	7.9	9.9	11.5	3.9
LnGrp Delay(d),s/veh	237.3	52.5	52.8	73.8	61.0	39.7	227.7	32.9	30.2	75.3	40.4	35.2
LnGrp LOS	F	D	D	E	E	D	F	C	C	E	D	D
Approach Vol, veh/h		511			1016			1679			1587	
Approach Delay, s/veh		170.4			57.4			95.4			49.8	
Approach LOS		F			E			F			D	

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	38.0	58.0	15.0	39.0	25.8	70.2	20.2	33.8
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 34	44.0	* 11	42.0	* 24	54.3	* 21	* 33
Max Q Clear Time (g_c+I1), s	35.8	26.2	12.8	29.8	21.1	29.5	15.5	9.2
Green Ext Time (p_c), s	0.0	13.2	0.0	3.7	0.4	16.9	0.5	4.7

Intersection Summary			
HCM 2010 Ctrl Delay			80.3
HCM 2010 LOS			F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	170	10	360	130	70	100	70	1225	15	50	880	350
Future Volume (veh/h)	170	10	360	130	70	100	70	1225	15	50	880	350
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	185	11	391	141	76	109	76	1332	16	54	957	380
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	500	12	432	154	60	86	102	1360	16	154	1449	1095
Arrive On Green	0.28	0.28	0.28	0.09	0.09	0.09	0.06	0.38	0.38	0.09	0.41	0.41
Sat Flow, veh/h	1774	43	1533	1774	693	994	1774	3582	43	1774	3539	1583
Grp Volume(v), veh/h	185	0	402	141	0	185	76	658	690	54	957	380
Grp Sat Flow(s),veh/h/ln	1774	0	1577	1774	0	1687	1774	1770	1855	1774	1770	1583
Q Serve(g_s), s	9.6	0.0	28.3	9.1	0.0	10.0	4.9	42.2	42.3	3.3	25.2	11.2
Cycle Q Clear(g_c), s	9.6	0.0	28.3	9.1	0.0	10.0	4.9	42.2	42.3	3.3	25.2	11.2
Prop In Lane	1.00		0.97	1.00		0.59	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	500	0	445	154	0	147	102	672	704	154	1449	1095
V/C Ratio(X)	0.37	0.00	0.90	0.91	0.00	1.26	0.75	0.98	0.98	0.35	0.66	0.35
Avail Cap(c_a), veh/h	555	0	494	154	0	147	102	672	704	154	1449	1095
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	1.00	1.00	0.66	0.66	0.66
Uniform Delay (d), s/veh	33.1	0.0	39.8	52.1	0.0	52.5	53.4	35.2	35.2	49.4	27.5	7.2
Incr Delay (d2), s/veh	0.5	0.0	18.9	47.9	0.0	160.7	25.6	29.9	29.3	0.9	1.6	0.6
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	4.8	0.0	14.6	6.5	0.0	11.2	3.1	26.2	27.4	1.7	12.5	9.6
LnGrp Delay(d),s/veh	33.6	0.0	58.6	100.0	0.0	213.2	79.0	65.2	64.5	50.3	29.1	7.8
LnGrp LOS	C		E	F		F	E	E	E	D	C	A
Approach Vol, veh/h		587			326			1424			1391	
Approach Delay, s/veh		50.7			164.2			65.6			24.1	
Approach LOS		D			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.8	52.6		14.6	14.2	49.2		37.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.6	43.5		10.0	* 10	40.1		36.0
Max Q Clear Time (g_c+I1), s	6.9	27.2		12.0	5.3	44.3		30.3
Green Ext Time (p_c), s	0.0	13.8		0.0	0.0	0.0		1.7

Intersection Summary			
HCM 2010 Ctrl Delay			56.4
HCM 2010 LOS			E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	60	500	100	70	45	270	970	15	60	950	20
Future Volume (veh/h)	60	60	500	100	70	45	270	970	15	60	950	20
Number	3	8	18	7	4	14	1	6	16	5	2	12
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		0.98	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	65	0	586	109	76	49	293	1054	16	65	1033	22
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	396	0	1056	381	253	163	378	1499	23	83	1265	27
Arrive On Green	0.04	0.00	0.22	0.06	0.24	0.24	0.11	0.42	0.42	0.05	0.36	0.36
Sat Flow, veh/h	1774	0	3154	1774	1053	679	3442	3568	54	1774	3544	75
Grp Volume(v), veh/h	65	0	586	109	0	125	293	523	547	65	516	539
Grp Sat Flow(s),veh/h/ln	1774	0	1577	1774	0	1732	1721	1770	1852	1774	1770	1849
Q Serve(g_s), s	2.1	0.0	11.4	3.5	0.0	4.4	6.2	18.2	18.2	2.7	19.8	19.8
Cycle Q Clear(g_c), s	2.1	0.0	11.4	3.5	0.0	4.4	6.2	18.2	18.2	2.7	19.8	19.8
Prop In Lane	1.00		1.00	1.00		0.39	1.00		0.03	1.00		0.04
Lane Grp Cap(c), veh/h	396	0	1056	381	0	416	378	744	778	83	632	660
V/C Ratio(X)	0.16	0.00	0.55	0.29	0.00	0.30	0.77	0.70	0.70	0.78	0.82	0.82
Avail Cap(c_a), veh/h	424	0	1612	381	0	694	395	744	778	142	669	699
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.1	0.0	20.4	20.6	0.0	23.3	32.4	17.9	17.9	35.3	21.8	21.8
Incr Delay (d2), s/veh	0.2	0.0	0.5	0.4	0.0	0.4	8.9	3.0	2.9	14.7	7.4	7.2
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	1.0	0.0	5.0	1.7	0.0	2.2	3.4	9.5	9.9	1.7	10.9	11.3
LnGrp Delay(d),s/veh	21.3	0.0	20.8	21.1	0.0	23.7	41.3	20.9	20.7	50.0	29.3	29.0
LnGrp LOS	C		C	C		C	D	C	C	D	C	C
Approach Vol, veh/h		651			234			1363			1120	
Approach Delay, s/veh		20.9			22.5			25.2			30.3	
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	12.6	31.9	7.4	22.9	7.9	36.7	8.6	21.7
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	8.6	28.3	4.2	30.0	6.0	30.9	4.2	30.0
Max Q Clear Time (g_c+I1), s	8.2	21.8	4.1	6.4	4.7	20.2	5.5	13.4
Green Ext Time (p_c), s	0.0	4.9	0.0	3.3	0.0	8.5	0.0	3.0

Intersection Summary		
HCM 2010 Ctrl Delay		25.9
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	260	1070	0	0	1800	590	360	5	710	0	0	0
Future Volume (veh/h)	260	1070	0	0	1800	590	360	5	710	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	283	1163	0	0	1957	641	395	0	772			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	573	3699	0	0	1794	803	929	0	829			
Arrive On Green	0.05	0.24	0.00	0.00	0.51	0.51	0.26	0.00	0.26			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	283	1163	0	0	1957	641	395	0	772			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	10.4	24.4	0.0	0.0	65.9	43.6	12.0	0.0	30.9			
Cycle Q Clear(g_c), s	10.4	24.4	0.0	0.0	65.9	43.6	12.0	0.0	30.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	573	3699	0	0	1794	803	929	0	829			
V/C Ratio(X)	0.49	0.31	0.00	0.00	1.09	0.80	0.43	0.00	0.93			
Avail Cap(c_a), veh/h	573	3699	0	0	1794	803	955	0	853			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.46	0.46	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	56.1	22.8	0.0	0.0	32.0	26.6	39.8	0.0	46.8			
Incr Delay (d2), s/veh	0.3	0.1	0.0	0.0	50.6	8.2	0.3	0.0	16.3			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	5.0	11.5	0.0	0.0	44.5	20.9	5.9	0.0	15.4			
LnGrp Delay(d),s/veh	56.4	22.9	0.0	0.0	82.6	34.7	40.2	0.0	63.1			
LnGrp LOS	E	C			F	C	D		E			
Approach Vol, veh/h		1446			2598			1167				
Approach Delay, s/veh		29.4			70.8			55.3				
Approach LOS		C			E			E				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		101.9			29.0	72.9		40.2
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		81.9			10.3	* 66		35.0
Max Q Clear Time (g_c+I1), s		26.4			12.4	67.9		32.9
Green Ext Time (p_c), s		13.5			0.0	0.0		1.1

Intersection Summary		
HCM 2010 Ctrl Delay		55.9
HCM 2010 LOS		E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	790	240	990	1170	0	0	0	0	540	0	300
Future Volume (veh/h)	0	790	240	990	1170	0	0	0	0	540	0	300
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	859	261	1076	1272	0				688	0	217
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1085	486	1153	2426	0				758	0	338
Arrive On Green	0.00	0.31	0.31	0.22	0.46	0.00				0.21	0.00	0.21
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	859	261	1076	1272	0				688	0	217
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	28.9	17.8	39.9	33.3	0.0				24.6	0.0	16.2
Cycle Q Clear(g_c), s	0.0	28.9	17.8	39.9	33.3	0.0				24.6	0.0	16.2
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1085	486	1153	2426	0				758	0	338
V/C Ratio(X)	0.00	0.79	0.54	0.93	0.52	0.00				0.91	0.00	0.64
Avail Cap(c_a), veh/h	0	1085	486	1205	2426	0				811	0	362
HCM Platoon Ratio	1.00	1.00	1.00	0.67	0.67	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.09	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	41.3	37.4	49.0	20.1	0.0				49.9	0.0	46.6
Incr Delay (d2), s/veh	0.0	5.9	4.2	1.6	0.1	0.0				13.4	0.0	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	15.0	8.3	19.3	16.2	0.0				13.5	0.0	7.4
LnGrp Delay(d),s/veh	0.0	47.2	41.6	50.5	20.1	0.0				63.3	0.0	50.0
LnGrp LOS		D	D	D	C					E		D
Approach Vol, veh/h		1120			2348						905	
Approach Delay, s/veh		45.9			34.1						60.1	
Approach LOS		D			C						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	49.2	46.9		33.9		96.1		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 46	36.0		29.7		87.2		
Max Q Clear Time (g_c+I1), s	41.9	30.9		26.6		35.3		
Green Ext Time (p_c), s	1.7	4.6		1.2		30.3		

Intersection Summary	
HCM 2010 Ctrl Delay	42.5
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	400	60	80	60	60	90	13	157	540	45	140	680
Future Volume (vph)	400	60	80	60	60	90	13	157	540	45	140	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1706	1550	1681	1761	1560		1770	5027		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1706	1550	1681	1761	1560		1770	5027		1770	3539
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)	435	65	87	65	65	98	14	171	587	49	152	739
RTOR Reduction (vph)	0	0	64	0	0	89	0	0	10	0	0	0
Lane Group Flow (vph)	248	252	23	58	72	9	0	185	626	0	152	739
Confl. Peds. (#/hr)			9									
Confl. Bikes (#/hr)			1			1						
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	22.0	22.0	22.0	7.3	7.3	7.3		9.0	22.1		11.0	23.6
Effective Green, g (s)	22.0	22.0	22.0	7.3	7.3	7.3		9.0	22.1		11.0	23.6
Actuated g/C Ratio	0.27	0.27	0.27	0.09	0.09	0.09		0.11	0.27		0.13	0.29
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	448	454	413	148	155	138		193	1346		236	1012
v/s Ratio Prot	0.15	0.15		0.03	c0.04			c0.10	0.12		0.09	c0.21
v/s Ratio Perm			0.01			0.01						
v/c Ratio	0.55	0.56	0.06	0.39	0.46	0.06		0.96	0.47		0.64	0.73
Uniform Delay, d1	26.0	26.0	22.5	35.5	35.7	34.5		36.6	25.3		33.9	26.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.98	0.98		1.00	1.00
Incremental Delay, d2	1.5	1.5	0.1	1.7	2.2	0.2		52.2	0.3		5.9	2.7
Delay (s)	27.5	27.5	22.6	37.2	37.9	34.7		88.1	25.0		39.8	29.3
Level of Service	C	C	C	D	D	C		F	C		D	C
Approach Delay (s)		26.8			36.3				39.2			23.1
Approach LOS		C			D				D			C

Intersection Summary			
HCM 2000 Control Delay	28.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	82.5	Sum of lost time (s)	20.6
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	650
Future Volume (vph)	650
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	707
RTOR Reduction (vph)	201
Lane Group Flow (vph)	506
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	45.6
Effective Green, g (s)	45.6
Actuated g/C Ratio	0.55
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	874
v/s Ratio Prot	c0.15
v/s Ratio Perm	0.17
v/c Ratio	0.58
Uniform Delay, d1	12.1
Progression Factor	1.00
Incremental Delay, d2	0.9
Delay (s)	13.1
Level of Service	B
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	20	680	47	0	833
Future Vol, veh/h	0	20	680	47	0	833
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	22	739	51	0	905

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1218	395	0	0	790	0
Stage 1	765	-	-	-	-	-
Stage 2	453	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	173	604	-	-	826	-
Stage 1	420	-	-	-	-	-
Stage 2	607	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	173	604	-	-	826	-
Mov Cap-2 Maneuver	173	-	-	-	-	-
Stage 1	420	-	-	-	-	-
Stage 2	607	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	604	826	-
HCM Lane V/C Ratio	-	-	0.036	-	-
HCM Control Delay (s)	-	-	11.2	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBU	NBL	NBT	SBU	SBT	SBR
Traffic Vol, veh/h	40	30	10	61	637	77	663	70
Future Vol, veh/h	40	30	10	61	637	77	663	70
Conflicting Peds, #/hr	2	0	0	6	0	0	0	6
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	-	120	-	140	-	-
Veh in Median Storage, #	0	-	-	-	0	-	0	-
Grade, %	0	-	-	-	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	43	33	11	66	692	84	721	76

Major/Minor	Minor2		Major1			Major2		
Conflicting Flow All	1429	406	829	799	0	505	-	0
Stage 1	928	-	-	-	-	-	-	-
Stage 2	501	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	4.14	-	6.44	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	2.22	-	2.52	-	-
Pot Cap-1 Maneuver	126	594	427	819	-	687	-	-
Stage 1	345	-	-	-	-	-	-	-
Stage 2	574	-	-	-	-	-	-	-
Platoon blocked, %					-		-	-
Mov Cap-1 Maneuver	126	590	713	713	-	687	-	-
Mov Cap-2 Maneuver	126	-	-	-	-	-	-	-
Stage 1	344	-	-	-	-	-	-	-
Stage 2	573	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	36.1	1.1	1
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBU	SBT	SBR
Capacity (veh/h)	713	-	190	687	-	-
HCM Lane V/C Ratio	0.108	-	0.4	0.122	-	-
HCM Control Delay (s)	10.7	-	36.1	11	-	-
HCM Lane LOS	B	-	E	B	-	-
HCM 95th %tile Q(veh)	0.4	-	1.8	0.4	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	7	14	10	684	16	10	31	652
Future Vol, veh/h	7	14	10	684	16	10	31	652
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	0	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	8	15	11	743	17	11	34	709

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1217	380	517	0	0	776	761	0
Stage 1	774	-	-	-	-	-	-	-
Stage 2	443	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	173	618	675	-	-	462	847	-
Stage 1	415	-	-	-	-	-	-	-
Stage 2	614	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	173	618	675	-	-	698	698	-
Mov Cap-2 Maneuver	173	-	-	-	-	-	-	-
Stage 1	415	-	-	-	-	-	-	-
Stage 2	614	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.6	0.1	0.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	675	-	-	333	698	-
HCM Lane V/C Ratio	0.016	-	-	0.069	0.064	-
HCM Control Delay (s)	10.4	-	-	16.6	10.5	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	40	0	45	6	0	13	70	647	15	10	30	569
Future Volume (vph)	40	0	45	6	0	13	70	647	15	10	30	569
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			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		0.93			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1678			1667		1770	3526			1770	3491
Flt Permitted		0.84			0.88		0.95	1.00			0.98	1.00
Satd. Flow (perm)		1443			1499		1770	3526			1817	3491
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)	43	0	49	7	0	14	76	703	16	11	33	618
RTOR Reduction (vph)	0	77	0	0	18	0	0	2	0	0	0	5
Lane Group Flow (vph)	0	15	0	0	3	0	76	717	0	0	44	667
Confl. Peds. (#/hr)			2									
Confl. Bikes (#/hr)									1			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		8.1			8.1		4.8	23.6			4.1	22.8
Effective Green, g (s)		8.1			8.1		4.8	23.6			4.1	22.8
Actuated g/C Ratio		0.16			0.16		0.10	0.47			0.08	0.45
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		231			240		168	1651			147	1579
v/s Ratio Prot							c0.04	c0.20				0.19
v/s Ratio Perm		c0.01			0.00						0.02	
v/c Ratio		0.06			0.01		0.45	0.43			0.30	0.42
Uniform Delay, d1		17.9			17.8		21.6	8.9			21.8	9.3
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.01
Incremental Delay, d2		0.1			0.0		1.9	0.2			1.1	0.2
Delay (s)		18.1			17.8		23.5	9.1			22.9	9.6
Level of Service		B			B		C	A			C	A
Approach Delay (s)		18.1			17.8			10.5				10.4
Approach LOS		B			B			B				B

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	50.4	Sum of lost time (s)	14.7
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	590	100	35	450	80	240	40	80	120	25	70
Future Volume (veh/h)	130	590	100	35	450	80	240	40	80	120	25	70
Number	5	2	12	1	6	16	3	8	18	7	4	14
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	0.99		0.99	1.00		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	141	641	109	38	489	87	261	43	87	130	27	76
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	183	1052	179	55	827	146	410	65	109	593	165	463
Arrive On Green	0.10	0.35	0.35	0.03	0.28	0.28	0.38	0.38	0.38	0.38	0.38	0.38
Sat Flow, veh/h	1774	3025	514	1774	3006	532	822	168	283	1254	429	1208
Grp Volume(v), veh/h	141	375	375	38	287	289	391	0	0	130	0	103
Grp Sat Flow(s),veh/h/ln	1774	1770	1769	1774	1770	1769	1274	0	0	1254	0	1637
Q Serve(g_s), s	4.9	11.1	11.1	1.3	8.9	9.0	15.4	0.0	0.0	0.0	0.0	2.6
Cycle Q Clear(g_c), s	4.9	11.1	11.1	1.3	8.9	9.0	18.1	0.0	0.0	4.6	0.0	2.6
Prop In Lane	1.00		0.29	1.00		0.30	0.67		0.22	1.00		0.74
Lane Grp Cap(c), veh/h	183	615	615	55	487	487	583	0	0	593	0	628
V/C Ratio(X)	0.77	0.61	0.61	0.70	0.59	0.59	0.67	0.00	0.00	0.22	0.00	0.16
Avail Cap(c_a), veh/h	464	932	932	185	647	647	1035	0	0	1003	0	1164
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	27.7	17.1	17.1	30.5	19.9	19.9	18.4	0.0	0.0	13.5	0.0	12.9
Incr Delay (d2), s/veh	6.7	1.0	1.0	14.7	1.1	1.2	1.3	0.0	0.0	0.2	0.0	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	2.7	5.6	5.6	0.9	4.5	4.5	6.4	0.0	0.0	1.6	0.0	1.2
LnGrp Delay(d),s/veh	34.4	18.1	18.1	45.2	21.0	21.1	19.7	0.0	0.0	13.6	0.0	13.0
LnGrp LOS	C	B	B	D	C	C	B			B		B
Approach Vol, veh/h		891			614			391			233	
Approach Delay, s/veh		20.7			22.5			19.7			13.4	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.4	27.9		29.2	10.9	23.3		29.2
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	6.6	* 33		45.1	16.6	23.2		45.1
Max Q Clear Time (g_c+I1), s	3.3	13.1		6.6	6.9	11.0		20.1
Green Ext Time (p_c), s	0.0	8.7		4.2	0.2	6.5		3.9

Intersection Summary	
HCM 2010 Ctrl Delay	20.2
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	180	125	330	240	300	360	800	395	300	640	60
Future Volume (veh/h)	280	180	125	330	240	300	360	800	395	300	640	60
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	304	196	136	359	261	326	391	870	429	326	696	65
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	312	386	253	414	408	521	388	1594	702	380	1740	540
Arrive On Green	0.09	0.19	0.19	0.12	0.22	0.22	0.44	0.90	0.90	0.11	0.34	0.34
Sat Flow, veh/h	3442	2033	1335	3442	1863	1581	1774	3539	1559	3442	5085	1579
Grp Volume(v), veh/h	304	169	163	359	261	326	391	870	429	326	696	65
Grp Sat Flow(s),veh/h/ln	1721	1770	1599	1721	1863	1581	1774	1770	1559	1721	1695	1579
Q Serve(g_s), s	13.2	12.8	13.8	15.4	19.1	26.1	32.8	7.2	9.1	14.0	15.6	4.2
Cycle Q Clear(g_c), s	13.2	12.8	13.8	15.4	19.1	26.1	32.8	7.2	9.1	14.0	15.6	4.2
Prop In Lane	1.00		0.84	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	312	336	303	414	408	521	388	1594	702	380	1740	540
V/C Ratio(X)	0.97	0.50	0.54	0.87	0.64	0.63	1.01	0.55	0.61	0.86	0.40	0.12
Avail Cap(c_a), veh/h	312	393	355	532	522	617	388	1594	702	498	1740	540
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.75	0.75	0.75	0.09	0.09	0.09	0.81	0.81	0.81
Uniform Delay (d), s/veh	68.0	54.5	54.8	64.8	53.2	42.5	42.2	4.4	4.5	65.6	37.6	33.9
Incr Delay (d2), s/veh	43.8	1.2	1.5	9.0	1.3	1.1	15.7	0.1	0.4	9.4	0.6	0.4
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	8.2	6.4	6.2	7.8	10.0	11.5	17.6	3.2	3.5	7.1	7.4	1.9
LnGrp Delay(d),s/veh	111.8	55.6	56.3	73.9	54.4	43.6	57.9	4.6	4.9	74.9	38.2	34.2
LnGrp LOS	F	E	E	E	D	D	F	A	A	E	D	C
Approach Vol, veh/h		636			946			1690			1087	
Approach Delay, s/veh		82.7			58.1			17.0			49.0	
Approach LOS		F			E			B			D	

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	37.0	56.8	17.8	38.4	20.7	73.1	22.2	34.0
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 33	42.2	* 14	42.0	* 22	53.3	* 23	* 33
Max Q Clear Time (g_c+I1), s	34.8	17.6	15.2	28.1	16.0	11.1	17.4	15.8
Green Ext Time (p_c), s	0.0	14.9	0.0	4.2	0.6	19.9	0.7	4.6

Intersection Summary	
HCM 2010 Ctrl Delay	43.5
HCM 2010 LOS	D

Notes

10: Rancho Penasquitos Blvd & SR 56 EB Ramps/Azuaga St — Year 2035 PM
HCM 2010 Signalized Intersection Summary — 1/14/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	450	40	980	40	40	50	30	1240	70	90	785	220
Future Volume (veh/h)	450	40	980	40	40	50	30	1240	70	90	785	220
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	1.00		0.98
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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	489	43	1065	43	43	54	33	1348	76	98	853	239
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	738	25	627	118	50	63	59	1106	62	118	1267	1216
Arrive On Green	0.42	0.42	0.42	0.07	0.07	0.07	0.03	0.32	0.32	0.13	0.72	0.72
Sat Flow, veh/h	1774	61	1508	1774	750	942	1774	3406	192	1774	3539	1557
Grp Volume(v), veh/h	489	0	1108	43	0	97	33	699	725	98	853	239
Grp Sat Flow(s),veh/h/ln	1774	0	1569	1774	0	1692	1774	1770	1828	1774	1770	1557
Q Serve(g_s), s	33.3	0.0	62.4	3.5	0.0	8.5	2.7	48.7	48.7	8.1	19.8	3.3
Cycle Q Clear(g_c), s	33.3	0.0	62.4	3.5	0.0	8.5	2.7	48.7	48.7	8.1	19.8	3.3
Prop In Lane	1.00		0.96	1.00		0.56	1.00		0.10	1.00		1.00
Lane Grp Cap(c), veh/h	738	0	653	118	0	113	59	575	593	118	1267	1216
V/C Ratio(X)	0.66	0.00	1.70	0.36	0.00	0.86	0.56	1.22	1.22	0.83	0.67	0.20
Avail Cap(c_a), veh/h	738	0	653	118	0	113	75	575	593	118	1267	1216
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.83	0.83	0.83
Uniform Delay (d), s/veh	35.3	0.0	43.8	67.0	0.0	69.3	71.4	50.6	50.7	64.2	16.5	1.9
Incr Delay (d2), s/veh	2.2	0.0	320.5	1.9	0.0	44.8	8.0	112.8	114.4	31.6	2.4	0.3
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	16.8	0.0	85.1	1.8	0.0	5.4	1.5	41.8	43.4	5.0	9.9	4.1
LnGrp Delay(d),s/veh	37.5	0.0	364.3	68.8	0.0	114.1	79.4	163.4	165.0	95.7	18.9	2.2
LnGrp LOS	D		F	E		F	E	F	F	F	B	A
Approach Vol, veh/h		1597			140			1457			1190	
Approach Delay, s/veh		264.2			100.2			162.3			21.8	
Approach LOS		F			F			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	59.2		14.6	14.2	54.2		67.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.3	52.4		10.0	* 10	48.7		62.4
Max Q Clear Time (g_c+I1), s	4.7	21.8		10.5	10.1	50.7		64.4
Green Ext Time (p_c), s	0.0	22.3		0.0	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	159.3
HCM 2010 LOS	F

Notes

11: Carmel Mountain Rd & Paseo Montalban — Year 2035 PM
HCM 2010 Signalized Intersection Summary — 1/14/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	70	400	40	60	20	420	760	60	20	590	20
Future Volume (veh/h)	10	70	400	40	60	20	420	760	60	20	590	20
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	11	0	486	43	65	22	457	826	65	22	641	22
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	355	0	1154	341	287	97	591	1569	123	36	1119	38
Arrive On Green	0.01	0.00	0.19	0.03	0.22	0.22	0.17	0.47	0.47	0.02	0.32	0.32
Sat Flow, veh/h	1774	0	3147	1774	1332	451	3442	3322	261	1774	3491	120
Grp Volume(v), veh/h	11	0	486	43	0	87	457	440	451	22	325	338
Grp Sat Flow(s),veh/h/ln	1774	0	1574	1774	0	1782	1721	1770	1814	1774	1770	1842
Q Serve(g_s), s	0.3	0.0	7.8	1.3	0.0	2.7	8.5	11.7	11.8	0.8	10.3	10.3
Cycle Q Clear(g_c), s	0.3	0.0	7.8	1.3	0.0	2.7	8.5	11.7	11.8	0.8	10.3	10.3
Prop In Lane	1.00		1.00	1.00		0.25	1.00		0.14	1.00		0.07
Lane Grp Cap(c), veh/h	355	0	1154	341	0	385	591	836	857	36	567	590
V/C Ratio(X)	0.03	0.00	0.42	0.13	0.00	0.23	0.77	0.53	0.53	0.62	0.57	0.57
Avail Cap(c_a), veh/h	457	0	1952	404	0	797	900	1099	1127	121	758	788
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.4	0.0	16.0	20.6	0.0	21.7	26.6	12.5	12.5	32.7	19.0	19.0
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.2	0.0	0.3	2.3	0.5	0.5	16.2	0.9	0.9
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	0.2	0.0	3.4	0.6	0.0	1.4	4.3	5.9	6.0	0.6	5.1	5.3
LnGrp Delay(d),s/veh	21.4	0.0	16.2	20.8	0.0	22.0	28.9	13.0	13.0	48.9	19.9	19.9
LnGrp LOS	C		B	C		C	C	B	B	D	B	B
Approach Vol, veh/h		497			130			1348			685	
Approach Delay, s/veh		16.4			21.6			18.4			20.9	
Approach LOS		B			C			B			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	16.0	26.8	5.1	19.4	5.7	37.0	6.6	18.0
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	17.6	28.8	4.6	30.1	4.6	41.8	4.6	30.1
Max Q Clear Time (g_c+I1), s	10.5	12.3	2.3	4.7	2.8	13.8	3.3	9.8
Green Ext Time (p_c), s	1.0	9.1	0.0	2.6	0.0	12.1	0.0	2.5

Intersection Summary	
HCM 2010 Ctrl Delay	18.8
HCM 2010 LOS	B

Notes

APPENDIX K

PEAK HOUR INTERSECTION ANALYSIS WORKSHEETS
YEAR 2035 WITH PROJECT

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	373	752	0	0	1033	270	209	0	1100	0	0	0
Future Volume (veh/h)	373	752	0	0	1033	270	209	0	1100	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	405	817	0	0	1123	293	227	0	1196			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	1996	4865	0	0	1058	473	1380	0	1231			
Arrive On Green	0.19	0.32	0.00	0.00	0.30	0.30	0.39	0.00	0.39			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	405	817	0	0	1123	293	227	0	1196			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	8.9	10.4	0.0	0.0	26.9	14.3	3.8	0.0	33.4			
Cycle Q Clear(g_c), s	8.9	10.4	0.0	0.0	26.9	14.3	3.8	0.0	33.4			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	1996	4865	0	0	1058	473	1380	0	1231			
V/C Ratio(X)	0.20	0.17	0.00	0.00	1.06	0.62	0.16	0.00	0.97			
Avail Cap(c_a), veh/h	1996	4865	0	0	1058	473	1380	0	1231			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.58	0.58	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	18.9	4.9	0.0	0.0	31.6	27.1	18.0	0.0	27.0			
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	45.6	6.0	0.1	0.0	19.1			
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(50%),veh/ln	4.3	4.9	0.0	0.0	19.8	7.1	1.8	0.0	17.7			
LnGrp Delay(d),s/veh	18.9	5.0	0.0	0.0	77.1	33.1	18.0	0.0	46.1			
LnGrp LOS	B	A			F	C	B		D			
Approach Vol, veh/h		1222			1416			1423				
Approach Delay, s/veh		9.6			68.0			41.6				
Approach LOS		A			E			D				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		94.4			60.5	33.9		41.1
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		41.9			9.3	* 27		35.0
Max Q Clear Time (g_c+I1), s		12.4			10.9	28.9		35.4
Green Ext Time (p_c), s		8.4			0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	41.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	835	664	620	622	0	0	0	0	290	10	275
Future Volume (veh/h)	0	835	664	620	622	0	0	0	0	290	10	275
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	908	722	674	676	0				412	0	203
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1508	675	681	2432	0				594	0	265
Arrive On Green	0.00	0.43	0.43	0.26	0.91	0.00				0.17	0.00	0.17
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	908	722	674	676	0				412	0	203
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	17.8	38.3	17.6	2.0	0.0				9.8	0.0	11.0
Cycle Q Clear(g_c), s	0.0	17.8	38.3	17.6	2.0	0.0				9.8	0.0	11.0
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1508	675	681	2432	0				594	0	265
V/C Ratio(X)	0.00	0.60	1.07	0.99	0.28	0.00				0.69	0.00	0.77
Avail Cap(c_a), veh/h	0	1508	675	681	2432	0				1143	0	510
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.14	0.14	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	19.9	25.8	33.1	1.3	0.0				35.3	0.0	35.8
Incr Delay (d2), s/veh	0.0	1.8	55.0	10.5	0.0	0.0				1.5	0.0	4.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	9.1	27.0	9.3	0.8	0.0				4.9	0.0	5.1
LnGrp Delay(d),s/veh	0.0	21.7	80.8	43.6	1.3	0.0				36.8	0.0	40.4
LnGrp LOS		C	F	D	A					D		D
Approach Vol, veh/h		1630			1350						615	
Approach Delay, s/veh		47.9			22.4						38.0	
Approach LOS		D			C						D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	23.5	45.3		21.2		68.8		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 18	24.4		29.0		47.9		
Max Q Clear Time (g_c+I1), s	19.6	40.3		13.0		4.0		
Green Ext Time (p_c), s	0.0	0.0		2.0		23.3		

Intersection Summary	
HCM 2010 Ctrl Delay	36.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	800	50	181	31	15	90	36	84	609	23	80	517
Future Volume (vph)	800	50	181	31	15	90	36	84	609	23	80	517
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1695	1549	1681	1736	1583		1770	5054		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	0.98	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1695	1549	1681	1736	1583		1770	5054		1770	3539
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)	870	54	197	34	16	98	39	91	662	25	87	562
RTOR Reduction (vph)	0	0	130	0	0	91	0	0	4	0	0	0
Lane Group Flow (vph)	461	463	67	24	26	7	0	130	683	0	87	562
Confl. Peds. (#/hr)			11									
Confl. Bikes (#/hr)										1		
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	28.2	28.2	28.2	5.5	5.5	5.5		7.9	21.4		7.2	20.2
Effective Green, g (s)	28.2	28.2	28.2	5.5	5.5	5.5		7.9	21.4		7.2	20.2
Actuated g/C Ratio	0.34	0.34	0.34	0.07	0.07	0.07		0.10	0.26		0.09	0.25
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	575	580	530	112	115	105		169	1312		154	867
v/s Ratio Prot	c0.27	0.27		0.01	c0.01			c0.07	0.14		0.05	c0.16
v/s Ratio Perm			0.04			0.00						
v/c Ratio	0.80	0.80	0.13	0.21	0.23	0.06		0.77	0.52		0.56	0.65
Uniform Delay, d1	24.6	24.5	18.6	36.4	36.4	36.0		36.4	26.1		36.1	27.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00
Incremental Delay, d2	7.9	7.6	0.1	1.0	1.0	0.3		18.8	0.4		4.7	1.7
Delay (s)	32.5	32.1	18.7	37.4	37.4	36.3		55.1	26.3		40.8	29.6
Level of Service	C	C	B	D	D	D		E	C		D	C
Approach Delay (s)		29.9			36.7				30.9			23.4
Approach LOS		C			D				C			C

Intersection Summary			
HCM 2000 Control Delay	28.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	20.6
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	300
Future Volume (vph)	300
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	0.99
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1569
Flt Permitted	1.00
Satd. Flow (perm)	1569
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	326
RTOR Reduction (vph)	135
Lane Group Flow (vph)	191
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	48.4
Effective Green, g (s)	48.4
Actuated g/C Ratio	0.59
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	921
v/s Ratio Prot	0.07
v/s Ratio Perm	0.05
v/c Ratio	0.21
Uniform Delay, d1	8.0
Progression Factor	1.00
Incremental Delay, d2	0.1
Delay (s)	8.1
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	106	719	27	0	765
Future Vol, veh/h	0	106	719	27	0	765
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	115	782	29	0	832

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1212	405	0	0	811	0
Stage 1	796	-	-	-	-	-
Stage 2	416	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	175	595	-	-	811	-
Stage 1	405	-	-	-	-	-
Stage 2	634	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	175	595	-	-	811	-
Mov Cap-2 Maneuver	175	-	-	-	-	-
Stage 1	405	-	-	-	-	-
Stage 2	634	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.5	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	595	811	-
HCM Lane V/C Ratio	-	-	0.194	-	-
HCM Control Delay (s)	-	-	12.5	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0	-

Intersection	
Int Delay, s/veh	6.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	60	0	75	20	0	39	10	37	623	5	24	10	726	25
Future Vol, veh/h	60	0	75	20	0	39	10	37	623	5	24	10	726	25
Conflicting Peds, #/hr	2	0	1	0	0	0	0	2	0	0	0	0	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	120	-	-	-	140	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Peak Hour Factor	92	92	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	2	2
Mvmt Flow	65	0	82	22	0	42	11	40	677	5	26	11	789	27

Major/Minor	Minor2			Minor1			Major1				Major2			
Conflicting Flow All	1320	1664	412	1252	1674	343	677	818	0	0	541	683	0	0
Stage 1	879	879	-	782	782	-	-	-	-	-	-	-	-	-
Stage 2	441	785	-	470	892	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	6.44	4.14	-	-	6.44	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.52	2.22	-	-	2.52	2.22	-	-
Pot Cap-1 Maneuver	115	96	589	129	95	653	534	806	-	-	652	906	-	-
Stage 1	309	363	-	353	403	-	-	-	-	-	-	-	-	-
Stage 2	565	402	-	543	358	-	-	-	-	-	-	-	-	-
Platoon blocked, %									-	-			-	-
Mov Cap-1 Maneuver	107	96	587	111	95	652	697	697	-	-	677	677	-	-
Mov Cap-2 Maneuver	107	96	-	111	95	-	-	-	-	-	-	-	-	-
Stage 1	309	362	-	353	403	-	-	-	-	-	-	-	-	-
Stage 2	527	402	-	467	357	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	63.7	24.7	0.7	0.5
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	697	-	-	196	246	677	-	-
HCM Lane V/C Ratio	0.073	-	-	0.749	0.261	0.055	-	-
HCM Control Delay (s)	10.6	-	-	63.7	24.7	10.6	-	-
HCM Lane LOS	B	-	-	F	C	B	-	-
HCM 95th %tile Q(veh)	0.2	-	-	5	1	0.2	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	20	40	10	625	5	10	9	822
Future Vol, veh/h	20	40	10	625	5	10	9	822
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	22	43	11	679	5	11	10	893

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1192	342	652	0	0	728	685	0
Stage 1	704	-	-	-	-	-	-	-
Stage 2	488	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	180	654	554	-	-	496	904	-
Stage 1	452	-	-	-	-	-	-	-
Stage 2	583	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	180	654	554	-	-	605	605	-
Mov Cap-2 Maneuver	180	-	-	-	-	-	-	-
Stage 1	452	-	-	-	-	-	-	-
Stage 2	583	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.7	0.2	0.3
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	554	-	-	348	605	-
HCM Lane V/C Ratio	0.02	-	-	0.187	0.034	-
HCM Control Delay (s)	11.6	-	-	17.7	11.2	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.7	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	100	0	155	21	0	39	130	491	5	10	10	772
Future Volume (vph)	100	0	155	21	0	39	130	491	5	10	10	772
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			0.99		1.00	1.00			1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	1.00
Frt		0.92			0.91		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1655			1655		1770	3533			1770	3495
Flt Permitted		0.84			0.85		0.95	1.00			1.00	1.00
Satd. Flow (perm)		1422			1425		1770	3533			1863	3495
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)	109	0	168	23	0	42	141	534	5	11	11	839
RTOR Reduction (vph)	0	106	0	0	51	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	171	0	0	14	0	141	539	0	0	22	908
Confl. Peds. (#/hr)			14			4			2			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		14.1			14.1		8.4	33.6			1.4	26.5
Effective Green, g (s)		14.1			14.1		8.4	33.6			1.4	26.5
Actuated g/C Ratio		0.22			0.22		0.13	0.53			0.02	0.42
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		314			315		233	1863			40	1453
v/s Ratio Prot							c0.08	0.15				c0.26
v/s Ratio Perm		c0.12			0.01						0.01	
v/c Ratio		0.54			0.05		0.61	0.29			0.55	0.62
Uniform Delay, d1		22.0			19.5		26.1	8.4			30.8	14.7
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2		1.9			0.1		4.4	0.1			15.3	0.8
Delay (s)		23.9			19.6		30.5	8.5			46.2	15.5
Level of Service		C			B		C	A			D	B
Approach Delay (s)		23.9			19.6			13.0				16.2
Approach LOS		C			B			B				B

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	63.7	Sum of lost time (s)	14.7
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	70
Future Volume (vph)	70
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	76
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	430	25	13	587	220	90	20	10	150	20	110
Future Volume (veh/h)	160	430	25	13	587	220	90	20	10	150	20	110
Number	5	2	12	1	6	16	3	8	18	7	4	14
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		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	174	467	27	14	638	239	98	22	11	163	22	120
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	224	1690	97	25	969	363	264	54	19	450	58	314
Arrive On Green	0.13	0.50	0.50	0.01	0.38	0.38	0.23	0.23	0.23	0.23	0.23	0.23
Sat Flow, veh/h	1774	3401	196	1774	2520	943	678	236	84	1367	250	1364
Grp Volume(v), veh/h	174	242	252	14	448	429	131	0	0	163	0	142
Grp Sat Flow(s),veh/h/ln	1774	1770	1828	1774	1770	1693	998	0	0	1367	0	1614
Q Serve(g_s), s	5.5	4.7	4.7	0.5	12.2	12.2	4.3	0.0	0.0	0.0	0.0	4.3
Cycle Q Clear(g_c), s	5.5	4.7	4.7	0.5	12.2	12.2	8.7	0.0	0.0	5.7	0.0	4.3
Prop In Lane	1.00		0.11	1.00		0.56	0.75		0.08	1.00		0.85
Lane Grp Cap(c), veh/h	224	879	908	25	680	651	338	0	0	450	0	372
V/C Ratio(X)	0.78	0.28	0.28	0.57	0.66	0.66	0.39	0.00	0.00	0.36	0.00	0.38
Avail Cap(c_a), veh/h	505	1325	1369	125	940	900	655	0	0	774	0	755
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	24.7	8.6	8.6	28.6	14.8	14.8	21.6	0.0	0.0	19.5	0.0	18.9
Incr Delay (d2), s/veh	5.7	0.2	0.2	18.8	1.1	1.1	0.7	0.0	0.0	0.5	0.0	0.6
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	3.1	2.3	2.3	0.4	6.1	5.8	2.0	0.0	0.0	2.3	0.0	2.0
LnGrp Delay(d),s/veh	30.4	8.7	8.7	47.4	15.9	16.0	22.3	0.0	0.0	20.0	0.0	19.6
LnGrp LOS	C	A	A	D	B	B	C			B		B
Approach Vol, veh/h		668			891			131			305	
Approach Delay, s/veh		14.4			16.4			22.3			19.8	
Approach LOS		B			B			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	5.2	34.8		18.3	11.8	28.2		18.3
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	4.1	* 44		27.3	16.6	31.0		27.3
Max Q Clear Time (g_c+I1), s	2.5	6.7		7.7	7.5	14.2		10.7
Green Ext Time (p_c), s	0.0	11.5		2.1	0.3	8.2		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	16.6
HCM 2010 LOS	B

Notes

9: Rancho Penasquitos Blvd & SR 56 WB Ramps & Carmel Mountain Rd Year 2035 + Proj AM
HCM 2010 Signalized Intersection Summary
9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	300	110	60	293	332	347	500	795	256	414	930	120
Future Volume (veh/h)	300	110	60	293	332	347	500	795	256	414	930	120
Number	3	8	18	7	4	14	1	6	16	5	2	12
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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	326	120	65	318	361	377	543	864	278	450	1011	130
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	248	446	228	371	433	597	400	1493	666	498	1735	540
Arrive On Green	0.07	0.20	0.20	0.11	0.23	0.23	0.23	0.42	0.42	0.14	0.34	0.34
Sat Flow, veh/h	3442	2268	1160	3442	1863	1583	1774	3539	1579	3442	5085	1583
Grp Volume(v), veh/h	326	92	93	318	361	377	543	864	278	450	1011	130
Grp Sat Flow(s),veh/h/ln	1721	1770	1658	1721	1863	1583	1774	1770	1579	1721	1695	1583
Q Serve(g_s), s	10.8	6.6	7.2	13.6	27.7	29.2	33.8	28.0	18.5	19.3	24.5	8.8
Cycle Q Clear(g_c), s	10.8	6.6	7.2	13.6	27.7	29.2	33.8	28.0	18.5	19.3	24.5	8.8
Prop In Lane	1.00		0.70	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	248	348	326	371	433	597	400	1493	666	498	1735	540
V/C Ratio(X)	1.32	0.26	0.29	0.86	0.83	0.63	1.36	0.58	0.42	0.90	0.58	0.24
Avail Cap(c_a), veh/h	248	388	364	477	522	672	400	1493	666	539	1735	540
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	0.64	0.64	0.64	0.51	0.51	0.51	0.63	0.63	0.63
Uniform Delay (d), s/veh	69.6	51.1	51.3	65.8	54.8	38.2	58.1	33.2	30.4	63.1	40.6	35.5
Incr Delay (d2), s/veh	167.7	0.4	0.5	7.9	6.4	1.0	169.6	0.8	1.0	12.4	0.9	0.7
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	10.9	3.3	3.3	6.9	15.0	12.9	35.4	13.9	8.3	10.0	11.7	4.0
LnGrp Delay(d),s/veh	237.3	51.5	51.8	73.7	61.2	39.2	227.7	34.0	31.4	75.5	41.6	36.1
LnGrp LOS	F	D	D	E	E	D	F	C	C	E	D	D
Approach Vol, veh/h		511			1056			1685			1591	
Approach Delay, s/veh		170.1			57.1			96.0			50.7	
Approach LOS		F			E			F			D	

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	38.0	56.7	15.0	40.3	25.9	68.8	20.4	35.0
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 34	44.0	* 11	42.0	* 24	54.3	* 21	* 33
Max Q Clear Time (g_c+I1), s	35.8	26.5	12.8	31.2	21.3	30.0	15.6	9.2
Green Ext Time (p_c), s	0.0	13.1	0.0	3.6	0.4	16.7	0.5	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	80.5
HCM 2010 LOS	F

Notes

10: Rancho Penasquitos Blvd & SR 56 EB Ramps/Azuaga St Year 2035 + Proj AM
HCM 2010 Signalized Intersection Summary
9/29/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	175	10	360	130	70	100	70	1226	15	50	883	350
Future Volume (veh/h)	175	10	360	130	70	100	70	1226	15	50	883	350
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	190	11	391	141	76	109	76	1333	16	54	960	380
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	500	12	433	154	60	86	102	1360	16	154	1448	1095
Arrive On Green	0.28	0.28	0.28	0.09	0.09	0.09	0.06	0.38	0.38	0.09	0.41	0.41
Sat Flow, veh/h	1774	43	1534	1774	693	994	1774	3582	43	1774	3539	1583
Grp Volume(v), veh/h	190	0	402	141	0	185	76	658	691	54	960	380
Grp Sat Flow(s),veh/h/ln	1774	0	1577	1774	0	1687	1774	1770	1855	1774	1770	1583
Q Serve(g_s), s	9.9	0.0	28.3	9.1	0.0	10.0	4.9	42.3	42.3	3.3	25.3	11.2
Cycle Q Clear(g_c), s	9.9	0.0	28.3	9.1	0.0	10.0	4.9	42.3	42.3	3.3	25.3	11.2
Prop In Lane	1.00		0.97	1.00		0.59	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	500	0	445	154	0	147	102	672	704	154	1448	1095
V/C Ratio(X)	0.38	0.00	0.90	0.91	0.00	1.26	0.75	0.98	0.98	0.35	0.66	0.35
Avail Cap(c_a), veh/h	555	0	494	154	0	147	102	672	704	154	1448	1095
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	1.00	1.00	0.65	0.65	0.65
Uniform Delay (d), s/veh	33.2	0.0	39.8	52.1	0.0	52.5	53.4	35.2	35.2	49.4	27.5	7.2
Incr Delay (d2), s/veh	0.5	0.0	18.8	47.9	0.0	160.7	25.6	30.1	29.5	0.9	1.6	0.6
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	4.9	0.0	14.6	6.5	0.0	11.2	3.1	26.3	27.4	1.7	12.6	9.6
LnGrp Delay(d),s/veh	33.7	0.0	58.6	100.0	0.0	213.2	79.0	65.4	64.7	50.3	29.1	7.8
LnGrp LOS	C		E	F		F	E	E	E	D	C	A
Approach Vol, veh/h		592			326			1425			1394	
Approach Delay, s/veh		50.6			164.2			65.8			24.1	
Approach LOS		D			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.8	52.6		14.6	14.2	49.2		37.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.6	43.5		10.0	* 10	40.1		36.0
Max Q Clear Time (g_c+I1), s	6.9	27.3		12.0	5.3	44.3		30.3
Green Ext Time (p_c), s	0.0	13.7		0.0	0.0	0.0		1.7

Intersection Summary	
HCM 2010 Ctrl Delay	56.4
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	60	501	100	70	45	273	984	15	60	953	20
Future Volume (veh/h)	60	60	501	100	70	45	273	984	15	60	953	20
Number	3	8	18	7	4	14	1	6	16	5	2	12
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		0.98	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	65	0	588	109	76	49	297	1070	16	65	1036	22
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	396	0	1060	380	253	163	382	1500	22	83	1262	27
Arrive On Green	0.04	0.00	0.22	0.06	0.24	0.24	0.11	0.42	0.42	0.05	0.36	0.36
Sat Flow, veh/h	1774	0	3154	1774	1053	679	3442	3569	53	1774	3544	75
Grp Volume(v), veh/h	65	0	588	109	0	125	297	531	555	65	517	541
Grp Sat Flow(s),veh/h/ln	1774	0	1577	1774	0	1732	1721	1770	1852	1774	1770	1849
Q Serve(g_s), s	2.1	0.0	11.4	3.5	0.0	4.4	6.3	18.6	18.6	2.7	19.9	19.9
Cycle Q Clear(g_c), s	2.1	0.0	11.4	3.5	0.0	4.4	6.3	18.6	18.6	2.7	19.9	19.9
Prop In Lane	1.00		1.00	1.00		0.39	1.00		0.03	1.00		0.04
Lane Grp Cap(c), veh/h	396	0	1060	380	0	416	382	744	779	83	630	659
V/C Ratio(X)	0.16	0.00	0.55	0.29	0.00	0.30	0.78	0.71	0.71	0.78	0.82	0.82
Avail Cap(c_a), veh/h	424	0	1613	380	0	693	395	744	779	142	668	698
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.1	0.0	20.3	20.7	0.0	23.3	32.4	18.0	18.0	35.4	22.0	22.0
Incr Delay (d2), s/veh	0.2	0.0	0.5	0.4	0.0	0.4	9.3	3.2	3.1	14.7	7.7	7.4
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	1.1	0.0	5.0	1.8	0.0	2.2	3.5	9.7	10.1	1.7	11.0	11.4
LnGrp Delay(d),s/veh	21.3	0.0	20.8	21.1	0.0	23.7	41.7	21.2	21.1	50.0	29.7	29.4
LnGrp LOS	C		C	C		C	D	C	C	D	C	C
Approach Vol, veh/h		653			234			1383			1123	
Approach Delay, s/veh		20.8			22.5			25.6			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	12.7	31.9	7.4	22.9	7.9	36.7	8.6	21.7
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	8.6	28.3	4.2	30.0	6.0	30.9	4.2	30.0
Max Q Clear Time (g_c+I1), s	8.3	21.9	4.1	6.4	4.7	20.6	5.5	13.4
Green Ext Time (p_c), s	0.0	4.8	0.0	3.3	0.0	8.3	0.0	3.0

Intersection Summary	
HCM 2010 Ctrl Delay	26.1
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	270	1075	0	0	1812	590	392	5	710	0	0	0
Future Volume (veh/h)	270	1075	0	0	1812	590	392	5	710	0	0	0
Number	5	2	12	1	6	16	3	8	18			
Initial Q (Qb), veh	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			
Parking Bus, Adj	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	0	0	1863	1863	1863	1863	1863			
Adj Flow Rate, veh/h	293	1168	0	0	1970	641	430	0	772			
Adj No. of Lanes	2	3	0	0	2	1	2	0	2			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92			
Percent Heavy Veh, %	2	2	0	0	2	2	2	2	2			
Cap, veh/h	593	3728	0	0	1794	803	930	0	830			
Arrive On Green	0.06	0.24	0.00	0.00	0.51	0.51	0.26	0.00	0.26			
Sat Flow, veh/h	3442	5253	0	0	3632	1583	3548	0	3167			
Grp Volume(v), veh/h	293	1168	0	0	1970	641	430	0	772			
Grp Sat Flow(s),veh/h/ln	1721	1695	0	0	1770	1583	1774	0	1583			
Q Serve(g_s), s	10.7	24.5	0.0	0.0	65.9	43.6	13.2	0.0	30.9			
Cycle Q Clear(g_c), s	10.7	24.5	0.0	0.0	65.9	43.6	13.2	0.0	30.9			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	593	3728	0	0	1794	803	930	0	830			
V/C Ratio(X)	0.49	0.31	0.00	0.00	1.10	0.80	0.46	0.00	0.93			
Avail Cap(c_a), veh/h	593	3728	0	0	1794	803	955	0	853			
HCM Platoon Ratio	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.42	0.42	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	55.8	22.4	0.0	0.0	32.0	26.6	40.3	0.0	46.8			
Incr Delay (d2), s/veh	0.3	0.1	0.0	0.0	53.4	8.2	0.4	0.0	16.2			
Initial Q Delay(d3),s/veh	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	11.6	0.0	0.0	45.2	20.9	6.6	0.0	15.4			
LnGrp Delay(d),s/veh	56.1	22.5	0.0	0.0	85.5	34.7	40.6	0.0	63.0			
LnGrp LOS	E	C			F	C	D		E			
Approach Vol, veh/h		1461			2611			1202				
Approach Delay, s/veh		29.3			73.0			55.0				
Approach LOS		C			E			E				

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2			5	6		8
Phs Duration (G+Y+Rc), s		102.7			29.8	72.9		40.2
Change Period (Y+Rc), s		7.0			7.0	* 7		6.1
Max Green Setting (Gmax), s		81.9			10.3	* 66		35.0
Max Q Clear Time (g_c+I1), s		26.5			12.7	67.9		32.9
Green Ext Time (p_c), s		13.7			0.0	0.0		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	56.8
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	805	254	990	1214	0	0	0	0	540	0	323
Future Volume (veh/h)	0	805	254	990	1214	0	0	0	0	540	0	323
Number	5	2	12	1	6	16				7	4	14
Initial Q (Qb), veh	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
Parking Bus, Adj	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	1863	1863	1863	1863	0				1863	1863	1863
Adj Flow Rate, veh/h	0	875	276	1076	1320	0				696	0	234
Adj No. of Lanes	0	2	1	2	2	0				2	0	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92				0.92	0.92	0.92
Percent Heavy Veh, %	0	2	2	2	2	0				2	2	2
Cap, veh/h	0	1072	480	1160	2420	0				765	0	341
Arrive On Green	0.00	0.30	0.30	0.11	0.23	0.00				0.22	0.00	0.22
Sat Flow, veh/h	0	3632	1583	3442	3632	0				3548	0	1583
Grp Volume(v), veh/h	0	875	276	1076	1320	0				696	0	234
Grp Sat Flow(s),veh/h/ln	0	1770	1583	1721	1770	0				1774	0	1583
Q Serve(g_s), s	0.0	29.8	19.1	40.3	42.8	0.0				24.9	0.0	17.7
Cycle Q Clear(g_c), s	0.0	29.8	19.1	40.3	42.8	0.0				24.9	0.0	17.7
Prop In Lane	0.00		1.00	1.00		0.00				1.00		1.00
Lane Grp Cap(c), veh/h	0	1072	480	1160	2420	0				765	0	341
V/C Ratio(X)	0.00	0.82	0.58	0.93	0.55	0.00				0.91	0.00	0.69
Avail Cap(c_a), veh/h	0	1072	480	1205	2420	0				811	0	362
HCM Platoon Ratio	1.00	1.00	1.00	0.33	0.33	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.09	0.09	0.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	42.0	38.3	56.2	32.5	0.0				49.8	0.0	46.9
Incr Delay (d2), s/veh	0.0	6.9	5.0	1.4	0.1	0.0				13.8	0.0	5.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	15.6	9.0	19.5	21.0	0.0				13.6	0.0	8.2
LnGrp Delay(d),s/veh	0.0	48.8	43.2	57.6	32.6	0.0				63.6	0.0	51.9
LnGrp LOS		D	D	E	C					E		D
Approach Vol, veh/h		1151			2396						930	
Approach Delay, s/veh		47.5			43.8						60.6	
Approach LOS		D			D						E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		
Phs Duration (G+Y+Rc), s	49.5	46.4		34.1		95.9		
Change Period (Y+Rc), s	* 5.7	7.0		6.1		7.0		
Max Green Setting (Gmax), s	* 46	36.0		29.7		87.2		
Max Q Clear Time (g_c+I1), s	42.3	31.8		26.9		44.8		
Green Ext Time (p_c), s	1.5	3.9		1.1		28.0		

Intersection Summary	
HCM 2010 Ctrl Delay	48.3
HCM 2010 LOS	D

Notes

HCM Signalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	400	60	82	66	60	90	15	158	569	47	140	747
Future Volume (vph)	400	60	82	66	60	90	15	158	569	47	140	747
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	1.00		1.00	0.91		1.00	0.95
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.99		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	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99		1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)	1681	1706	1550	1681	1761	1560		1770	5027		1770	3539
Flt Permitted	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00		0.95	1.00
Satd. Flow (perm)	1681	1706	1550	1681	1761	1560		1770	5027		1770	3539
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)	435	65	89	72	65	98	16	172	618	51	152	812
RTOR Reduction (vph)	0	0	66	0	0	89	0	0	9	0	0	0
Lane Group Flow (vph)	248	252	23	65	72	9	0	188	660	0	152	812
Confl. Peds. (#/hr)			9									
Confl. Bikes (#/hr)			1			1						
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	NA
Protected Phases	4	4		8	8		5	5	2		1	6
Permitted Phases			4			8						
Actuated Green, G (s)	22.1	22.1	22.1	7.3	7.3	7.3		9.0	23.3		11.2	25.0
Effective Green, g (s)	22.1	22.1	22.1	7.3	7.3	7.3		9.0	23.3		11.2	25.0
Actuated g/C Ratio	0.26	0.26	0.26	0.09	0.09	0.09		0.11	0.28		0.13	0.30
Clearance Time (s)	5.3	5.3	5.3	4.9	4.9	4.9		4.4	5.5		4.4	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	442	448	407	146	153	135		189	1394		236	1053
v/s Ratio Prot	0.15	0.15		0.04	c0.04			c0.11	0.13		0.09	c0.23
v/s Ratio Perm			0.02			0.01						
v/c Ratio	0.56	0.56	0.06	0.45	0.47	0.06		0.99	0.47		0.64	0.77
Uniform Delay, d1	26.8	26.8	23.2	36.4	36.5	35.2		37.5	25.2		34.5	26.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.98	0.98		1.00	1.00
Incremental Delay, d2	1.6	1.6	0.1	2.2	2.3	0.2		63.6	0.3		5.9	3.6
Delay (s)	28.4	28.4	23.2	38.6	38.8	35.4		100.5	25.0		40.4	30.4
Level of Service	C	C	C	D	D	D		F	C		D	C
Approach Delay (s)		27.6			37.3				41.5			23.9
Approach LOS		C			D				D			C

Intersection Summary			
HCM 2000 Control Delay	30.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	84.0	Sum of lost time (s)	20.6
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	650
Future Volume (vph)	650
Ideal Flow (vphpl)	1900
Total Lost time (s)	5.3
Lane Util. Factor	1.00
Frpb, ped/bikes	1.00
Flpb, ped/bikes	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1583
Flt Permitted	1.00
Satd. Flow (perm)	1583
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	707
RTOR Reduction (vph)	197
Lane Group Flow (vph)	510
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Turn Type	pm+ov
Protected Phases	4
Permitted Phases	6
Actuated Green, G (s)	47.1
Effective Green, g (s)	47.1
Actuated g/C Ratio	0.56
Clearance Time (s)	5.3
Vehicle Extension (s)	3.0
Lane Grp Cap (vph)	887
v/s Ratio Prot	c0.15
v/s Ratio Perm	0.17
v/c Ratio	0.58
Uniform Delay, d1	12.0
Progression Factor	1.00
Incremental Delay, d2	0.9
Delay (s)	12.9
Level of Service	B
Approach Delay (s)	
Approach LOS	

Intersection Summary

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	0	45	689	105	0	910
Future Vol, veh/h	0	45	689	105	0	910
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	49	749	114	0	989

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1301	432	0	0	863	0
Stage 1	806	-	-	-	-	-
Stage 2	495	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	153	572	-	-	775	-
Stage 1	400	-	-	-	-	-
Stage 2	578	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	153	572	-	-	775	-
Mov Cap-2 Maneuver	153	-	-	-	-	-
Stage 1	400	-	-	-	-	-
Stage 2	578	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.9	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	572	775	-
HCM Lane V/C Ratio	-	-	0.086	-	-
HCM Control Delay (s)	-	-	11.9	0	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	40	0	30	9	0	18	10	61	651	21	85	43	689	70
Future Vol, veh/h	40	0	30	9	0	18	10	61	651	21	85	43	689	70
Conflicting Peds, #/hr	2	0	0	0	0	0	0	6	0	0	0	0	0	6
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	120	-	-	-	140	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Grade, %	-	0	-	-	0	-	-	-	0	-	-	-	0	-
Peak Hour Factor	92	92	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	2	2
Mvmt Flow	43	0	33	10	0	20	11	66	708	23	92	47	749	76

Major/Minor	Minor2			Minor1			Major1				Major2			
Conflicting Flow All	1575	1952	421	1528	1978	371	635	827	0	0	553	730	0	0
Stage 1	1067	1067	-	873	873	-	-	-	-	-	-	-	-	-
Stage 2	508	885	-	655	1105	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.54	6.54	6.94	7.54	6.54	6.94	6.44	4.14	-	-	6.44	4.14	-	-
Critical Hdwy Stg 1	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-	6.54	5.54	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	4.02	3.32	3.52	4.02	3.32	2.52	2.22	-	-	2.52	2.22	-	-
Pot Cap-1 Maneuver	74	63	581	80	61	626	568	800	-	-	641	870	-	-
Stage 1	237	297	-	311	366	-	-	-	-	-	-	-	-	-
Stage 2	516	361	-	421	285	-	-	-	-	-	-	-	-	-
Platoon blocked, %									-	-			-	-
Mov Cap-1 Maneuver	71	63	577	75	61	623	746	746	-	-	687	687	-	-
Mov Cap-2 Maneuver	71	63	-	75	61	-	-	-	-	-	-	-	-	-
Stage 1	237	297	-	311	366	-	-	-	-	-	-	-	-	-
Stage 2	497	361	-	395	285	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	84.6	28.7	1	1.7
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	746	-	-	114	181	687	-	-
HCM Lane V/C Ratio	0.103	-	-	0.667	0.162	0.203	-	-
HCM Control Delay (s)	10.4	-	-	84.6	28.7	11.6	-	-
HCM Lane LOS	B	-	-	F	D	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-	3.5	0.6	0.8	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Traffic Vol, veh/h	9	19	10	714	22	10	43	675
Future Vol, veh/h	9	19	10	714	22	10	43	675
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	-	None	-	-	None
Storage Length	0	-	90	-	-	-	100	-
Veh in Median Storage, #	0	-	-	0	-	-	-	0
Grade, %	0	-	-	0	-	-	-	0
Peak Hour Factor	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2
Mvmt Flow	10	21	11	776	24	11	47	734

Major/Minor	Minor1		Major1			Major2		
Conflicting Flow All	1292	400	536	0	0	821	800	0
Stage 1	810	-	-	-	-	-	-	-
Stage 2	482	-	-	-	-	-	-	-
Critical Hdwy	6.84	6.94	6.44	-	-	6.44	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.52	-	-	2.52	2.22	-
Pot Cap-1 Maneuver	155	600	657	-	-	432	819	-
Stage 1	398	-	-	-	-	-	-	-
Stage 2	587	-	-	-	-	-	-	-
Platoon blocked, %				-	-			-
Mov Cap-1 Maneuver	155	600	657	-	-	693	693	-
Mov Cap-2 Maneuver	155	-	-	-	-	-	-	-
Stage 1	398	-	-	-	-	-	-	-
Stage 2	587	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.8	0.1	0.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBU	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	657	-	-	312	693	-
HCM Lane V/C Ratio	0.017	-	-	0.098	0.083	-
HCM Control Delay (s)	10.6	-	-	17.8	10.7	-
HCM Lane LOS	B	-	-	C	B	-
HCM 95th %tile Q(veh)	0.1	-	-	0.3	0.3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	40	0	45	11	0	18	70	678	23	10	43	581
Future Volume (vph)	40	0	45	11	0	18	70	678	23	10	43	581
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Lane Util. Factor		1.00			1.00		1.00	0.95			1.00	0.95
Frpb, ped/bikes		0.99			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		0.93			0.92		1.00	1.00			1.00	0.99
Flt Protected		0.98			0.98		0.95	1.00			0.95	1.00
Satd. Flow (prot)		1677			1674		1770	3519			1770	3492
Flt Permitted		0.83			0.86		0.95	1.00			0.54	1.00
Satd. Flow (perm)		1433			1466		1770	3519			1007	3492
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)	43	0	49	12	0	20	76	737	25	11	47	632
RTOR Reduction (vph)	0	78	0	0	27	0	0	2	0	0	0	5
Lane Group Flow (vph)	0	14	0	0	5	0	76	760	0	0	58	681
Confl. Peds. (#/hr)			2									
Confl. Bikes (#/hr)									1			
Turn Type	Perm	NA		Perm	NA		Prot	NA		custom	Prot	NA
Protected Phases		4			8		5	2			1	6
Permitted Phases	4			8						1		
Actuated Green, G (s)		8.0			8.0		4.9	24.2			7.4	26.6
Effective Green, g (s)		8.0			8.0		4.9	24.2			7.4	26.6
Actuated g/C Ratio		0.15			0.15		0.09	0.45			0.14	0.49
Clearance Time (s)		4.9			4.9		4.4	5.3			4.4	5.4
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		211			216		160	1571			137	1713
v/s Ratio Prot							0.04	c0.22				0.20
v/s Ratio Perm		c0.01			0.00						c0.06	
v/c Ratio		0.06			0.02		0.47	0.48			0.42	0.40
Uniform Delay, d1		19.9			19.8		23.4	10.6			21.4	8.7
Progression Factor		1.00			1.00		1.00	1.00			1.00	1.01
Incremental Delay, d2		0.1			0.0		2.2	0.2			2.1	0.2
Delay (s)		20.0			19.8		25.6	10.8			23.5	8.9
Level of Service		C			B		C	B			C	A
Approach Delay (s)		20.0			19.8			12.2				10.1
Approach LOS		C			B			B				B

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	54.2	Sum of lost time (s)	14.7
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	50
Future Volume (vph)	50
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	54
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	1
Confl. Bikes (#/hr)	
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	626	100	37	465	80	240	40	82	120	25	70
Future Volume (veh/h)	130	626	100	37	465	80	240	40	82	120	25	70
Number	5	2	12	1	6	16	3	8	18	7	4	14
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	0.99		0.99	1.00		0.99
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	1900	1863	1863	1900	1900	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	141	680	109	40	505	87	261	43	89	130	27	76
Adj No. of Lanes	1	2	0	1	2	0	0	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	182	1088	174	56	861	148	404	63	110	585	164	462
Arrive On Green	0.10	0.36	0.36	0.03	0.28	0.28	0.38	0.38	0.38	0.38	0.38	0.38
Sat Flow, veh/h	1774	3054	489	1774	3022	518	818	164	287	1252	429	1208
Grp Volume(v), veh/h	141	394	395	40	295	297	393	0	0	130	0	103
Grp Sat Flow(s),veh/h/ln	1774	1770	1774	1774	1770	1771	1269	0	0	1252	0	1637
Q Serve(g_s), s	5.1	12.1	12.1	1.5	9.4	9.5	16.2	0.0	0.0	0.0	0.0	2.7
Cycle Q Clear(g_c), s	5.1	12.1	12.1	1.5	9.4	9.5	19.0	0.0	0.0	4.7	0.0	2.7
Prop In Lane	1.00		0.28	1.00		0.29	0.66		0.23	1.00		0.74
Lane Grp Cap(c), veh/h	182	630	632	56	504	505	576	0	0	585	0	626
V/C Ratio(X)	0.77	0.62	0.63	0.71	0.58	0.59	0.68	0.00	0.00	0.22	0.00	0.16
Avail Cap(c_a), veh/h	433	931	933	184	677	678	971	0	0	942	0	1093
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	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.7	17.5	17.5	31.5	20.1	20.2	19.2	0.0	0.0	14.0	0.0	13.4
Incr Delay (d2), s/veh	6.8	1.0	1.0	15.5	1.1	1.1	1.4	0.0	0.0	0.2	0.0	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	2.8	6.1	6.1	1.0	4.7	4.8	6.7	0.0	0.0	1.7	0.0	1.3
LnGrp Delay(d),s/veh	35.5	18.5	18.5	47.0	21.2	21.3	20.7	0.0	0.0	14.2	0.0	13.5
LnGrp LOS	D	B	B	D	C	C	C			B		B
Approach Vol, veh/h		930			632			393			233	
Approach Delay, s/veh		21.1			22.9			20.7			13.9	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.5	29.2		30.0	11.1	24.5		30.0
Change Period (Y+Rc), s	4.4	* 5.8		4.9	4.4	5.8		4.9
Max Green Setting (Gmax), s	6.8	* 35		43.8	16.0	25.1		43.8
Max Q Clear Time (g_c+I1), s	3.5	14.1		6.7	7.1	11.5		21.0
Green Ext Time (p_c), s	0.0	9.1		4.2	0.2	7.2		3.9

Intersection Summary	
HCM 2010 Ctrl Delay	20.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	180	125	331	247	307	360	800	414	317	640	60
Future Volume (veh/h)	280	180	125	331	247	307	360	800	414	317	640	60
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	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	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	304	196	136	360	268	334	391	870	450	345	696	65
Adj No. of Lanes	2	2	0	2	1	1	1	2	1	2	3	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	312	391	257	415	414	534	388	1565	689	398	1724	535
Arrive On Green	0.09	0.19	0.19	0.12	0.22	0.22	0.44	0.88	0.88	0.12	0.34	0.34
Sat Flow, veh/h	3442	2033	1336	3442	1863	1581	1774	3539	1559	3442	5085	1579
Grp Volume(v), veh/h	304	169	163	360	268	334	391	870	450	345	696	65
Grp Sat Flow(s),veh/h/ln	1721	1770	1599	1721	1863	1581	1774	1770	1559	1721	1695	1579
Q Serve(g_s), s	13.2	12.8	13.7	15.4	19.6	26.6	32.8	8.4	11.8	14.8	15.7	4.3
Cycle Q Clear(g_c), s	13.2	12.8	13.7	15.4	19.6	26.6	32.8	8.4	11.8	14.8	15.7	4.3
Prop In Lane	1.00		0.84	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	312	340	308	415	414	534	388	1565	689	398	1724	535
V/C Ratio(X)	0.97	0.50	0.53	0.87	0.65	0.62	1.01	0.56	0.65	0.87	0.40	0.12
Avail Cap(c_a), veh/h	312	393	355	532	522	626	388	1565	689	498	1724	535
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.75	0.75	0.75	0.09	0.09	0.09	0.81	0.81	0.81
Uniform Delay (d), s/veh	68.0	54.1	54.5	64.8	53.0	41.7	42.2	5.3	5.5	65.2	38.0	34.2
Incr Delay (d2), s/veh	43.8	1.1	1.4	9.1	1.4	1.1	15.7	0.1	0.4	10.5	0.6	0.4
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	8.2	6.4	6.2	7.9	10.3	11.8	17.6	3.9	4.8	7.6	7.4	1.9
LnGrp Delay(d),s/veh	111.8	55.2	55.9	73.9	54.4	42.8	57.9	5.5	6.0	75.7	38.5	34.5
LnGrp LOS	F	E	E	E	D	D	F	A	A	E	D	C
Approach Vol, veh/h		636			962			1711			1106	
Approach Delay, s/veh		82.4			57.7			17.6			49.9	
Approach LOS		F			E			B			D	

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	37.0	56.4	17.8	38.8	21.5	71.8	22.3	34.4
Change Period (Y+Rc), s	* 4.2	5.5	* 4.2	5.5	* 4.2	5.5	* 4.2	* 5.5
Max Green Setting (Gmax), s	* 33	42.2	* 14	42.0	* 22	53.3	* 23	* 33
Max Q Clear Time (g_c+I1), s	34.8	17.7	15.2	28.6	16.8	13.8	17.4	15.7
Green Ext Time (p_c), s	0.0	15.0	0.0	4.2	0.6	19.5	0.7	4.7

Intersection Summary	
HCM 2010 Ctrl Delay	43.8
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	467	40	980	40	40	50	30	1242	70	90	786	220
Future Volume (veh/h)	467	40	980	40	40	50	30	1242	70	90	786	220
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.99	1.00		0.98
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	1900	1863	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	508	43	1065	43	43	54	33	1350	76	98	854	239
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	738	25	627	118	50	63	59	1106	62	118	1267	1216
Arrive On Green	0.42	0.42	0.42	0.07	0.07	0.07	0.03	0.32	0.32	0.13	0.72	0.72
Sat Flow, veh/h	1774	61	1508	1774	750	942	1774	3406	191	1774	3539	1557
Grp Volume(v), veh/h	508	0	1108	43	0	97	33	700	726	98	854	239
Grp Sat Flow(s),veh/h/ln	1774	0	1569	1774	0	1692	1774	1770	1828	1774	1770	1557
Q Serve(g_s), s	35.1	0.0	62.4	3.5	0.0	8.5	2.7	48.7	48.7	8.1	19.9	3.3
Cycle Q Clear(g_c), s	35.1	0.0	62.4	3.5	0.0	8.5	2.7	48.7	48.7	8.1	19.9	3.3
Prop In Lane	1.00		0.96	1.00		0.56	1.00		0.10	1.00		1.00
Lane Grp Cap(c), veh/h	738	0	653	118	0	113	59	575	593	118	1267	1216
V/C Ratio(X)	0.69	0.00	1.70	0.36	0.00	0.86	0.56	1.22	1.22	0.83	0.67	0.20
Avail Cap(c_a), veh/h	738	0	653	118	0	113	75	575	593	118	1267	1216
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.82	0.82	0.82
Uniform Delay (d), s/veh	35.8	0.0	43.8	67.0	0.0	69.3	71.4	50.6	50.7	64.2	16.5	1.9
Incr Delay (d2), s/veh	2.7	0.0	320.5	1.9	0.0	44.8	8.0	113.5	115.1	31.5	2.4	0.3
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	17.8	0.0	85.1	1.8	0.0	5.4	1.5	41.9	43.5	5.0	9.9	4.1
LnGrp Delay(d),s/veh	38.5	0.0	364.3	68.8	0.0	114.1	79.4	164.1	165.7	95.7	18.9	2.2
LnGrp LOS	D		F	E		F	E	F	F	F	B	A
Approach Vol, veh/h		1616			140			1459			1191	
Approach Delay, s/veh		261.9			100.2			163.0			21.8	
Approach LOS		F			F			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.2	59.2		14.6	14.2	54.2		67.0
Change Period (Y+Rc), s	* 4.2	5.5		4.6	* 4.2	5.5		4.6
Max Green Setting (Gmax), s	* 6.3	52.4		10.0	* 10	48.7		62.4
Max Q Clear Time (g_c+I1), s	4.7	21.9		10.5	10.1	50.7		64.4
Green Ext Time (p_c), s	0.0	22.3		0.0	0.0	0.0		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		159.1
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	70	403	40	60	20	422	765	60	20	604	20
Future Volume (veh/h)	10	70	403	40	60	20	422	765	60	20	604	20
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		0.99	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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	11	0	489	43	65	22	459	832	65	22	657	22
Adj No. of Lanes	1	0	2	1	1	0	2	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	355	0	1156	339	288	97	592	1578	123	35	1128	38
Arrive On Green	0.01	0.00	0.19	0.03	0.22	0.22	0.17	0.47	0.47	0.02	0.32	0.32
Sat Flow, veh/h	1774	0	3147	1774	1332	451	3442	3325	260	1774	3495	117
Grp Volume(v), veh/h	11	0	489	43	0	87	459	443	454	22	333	346
Grp Sat Flow(s),veh/h/ln	1774	0	1574	1774	0	1782	1721	1770	1815	1774	1770	1842
Q Serve(g_s), s	0.3	0.0	7.9	1.3	0.0	2.7	8.6	11.9	11.9	0.8	10.6	10.7
Cycle Q Clear(g_c), s	0.3	0.0	7.9	1.3	0.0	2.7	8.6	11.9	11.9	0.8	10.6	10.7
Prop In Lane	1.00		1.00	1.00		0.25	1.00		0.14	1.00		0.06
Lane Grp Cap(c), veh/h	355	0	1156	339	0	385	592	840	861	35	571	594
V/C Ratio(X)	0.03	0.00	0.42	0.13	0.00	0.23	0.78	0.53	0.53	0.62	0.58	0.58
Avail Cap(c_a), veh/h	455	0	1940	401	0	790	892	1090	1118	120	751	782
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	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.6	0.0	16.1	20.8	0.0	21.9	26.9	12.5	12.5	33.0	19.2	19.2
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.2	0.0	0.3	2.5	0.5	0.5	16.3	0.9	0.9
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	0.2	0.0	3.4	0.6	0.0	1.4	4.3	5.9	6.0	0.6	5.3	5.5
LnGrp Delay(d),s/veh	21.6	0.0	16.4	20.9	0.0	22.2	29.3	13.0	13.0	49.3	20.1	20.1
LnGrp LOS	C		B	C		C	C	B	B	D	C	C
Approach Vol, veh/h		500			130			1356			701	
Approach Delay, s/veh		16.5			21.8			18.5			21.0	
Approach LOS		B			C			B			C	

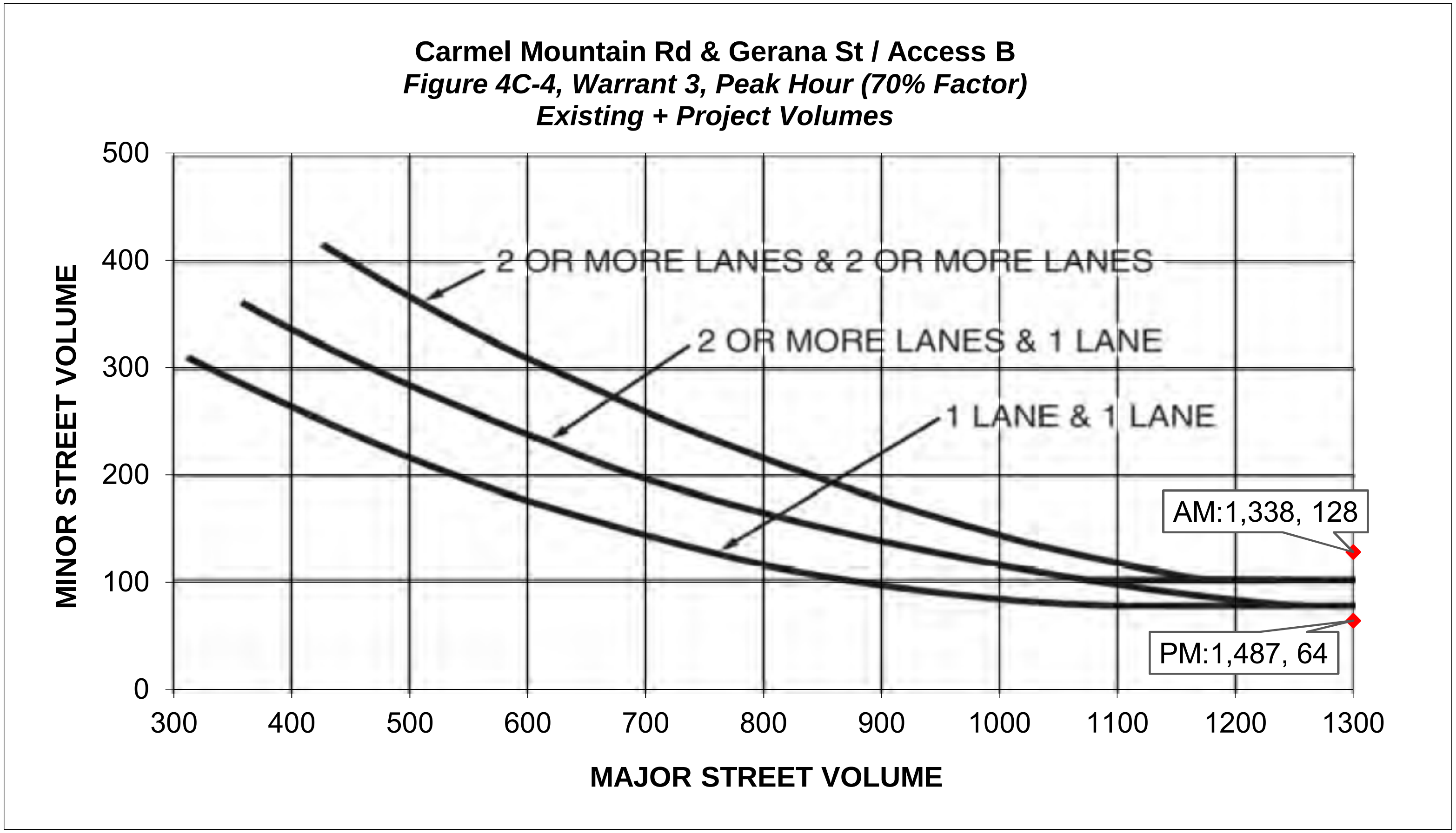
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.1	27.1	5.1	19.6	5.8	37.4	6.6	18.1
Change Period (Y+Rc), s	4.4	5.2	4.4	4.9	4.4	5.2	4.4	4.9
Max Green Setting (Gmax), s	17.6	28.8	4.6	30.1	4.6	41.8	4.6	30.1
Max Q Clear Time (g_c+I1), s	10.6	12.7	2.3	4.7	2.8	13.9	3.3	9.9
Green Ext Time (p_c), s	1.0	9.1	0.0	2.6	0.0	12.2	0.0	2.5

Intersection Summary		
HCM 2010 Ctrl Delay		19.0
HCM 2010 LOS		B

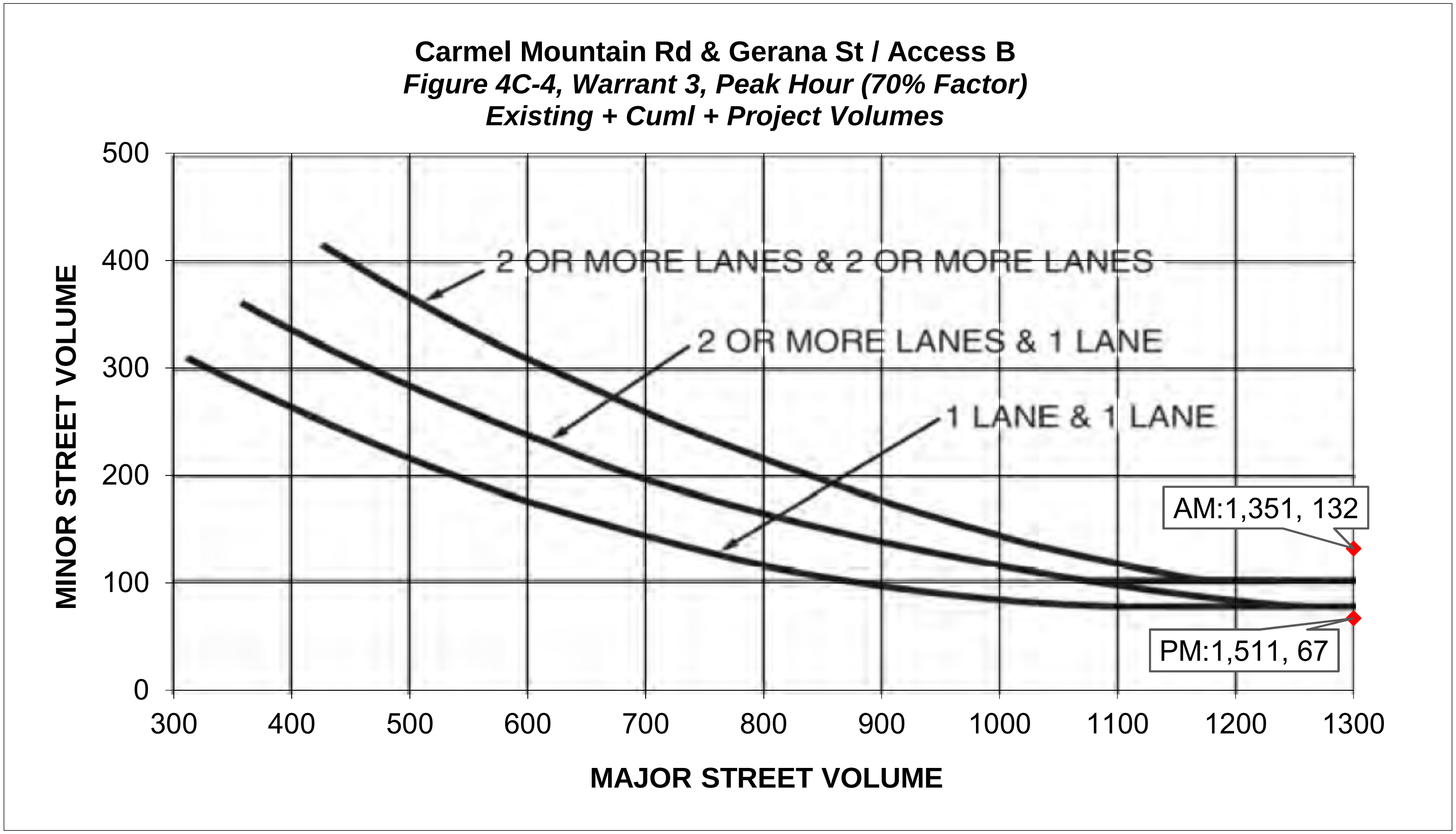
Notes

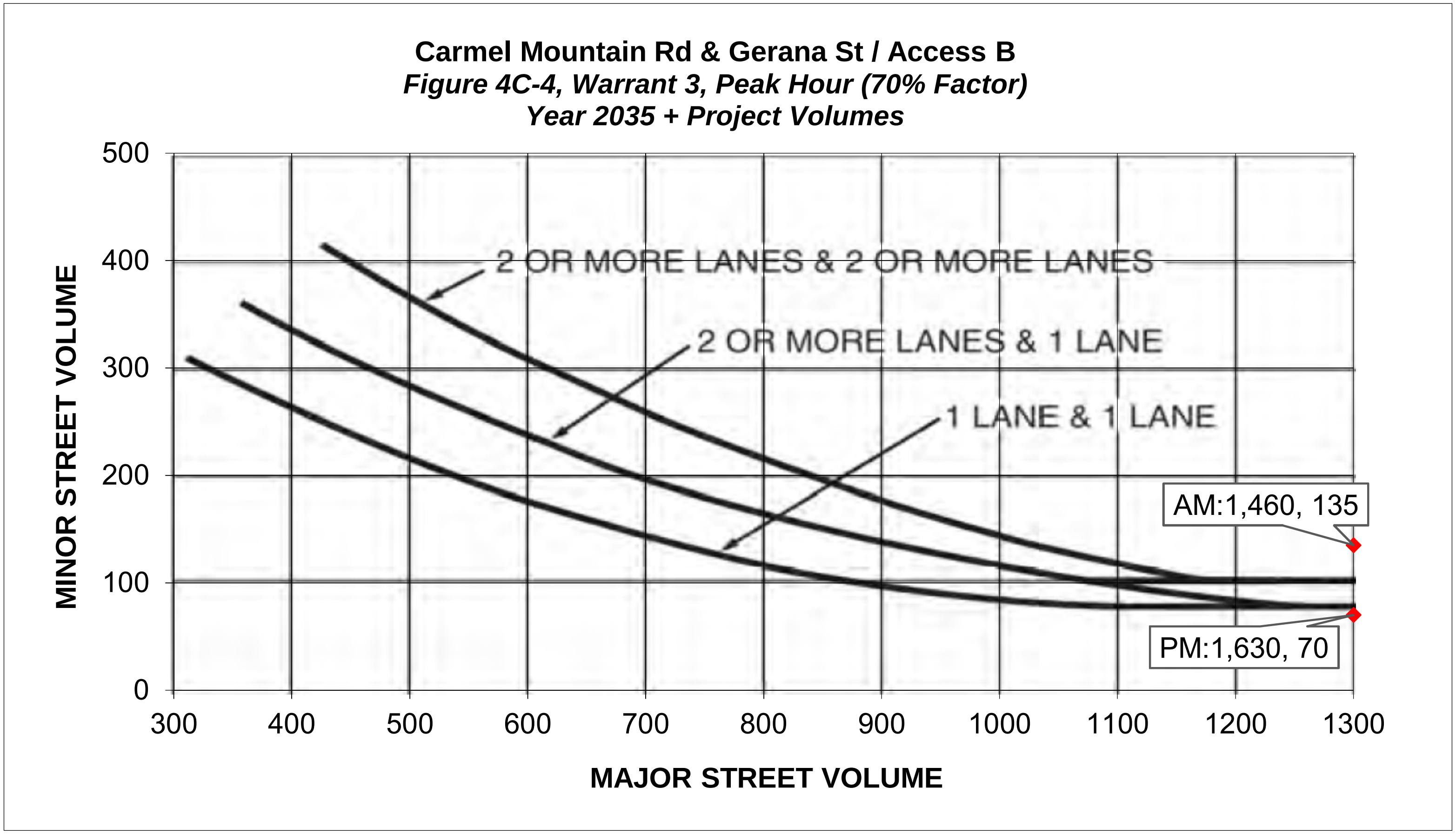
APPENDIX L

CARMEL MOUNTAIN ROAD/ GERANA STREET/ FUTURE ACCESS B SIGNAL WARRANT ANALYSIS & SIGNALIZED INTERSECTION ANALYSIS WORKSHEETS



Carmel Mountain Rd & Gerana St / Access B
Figure 4C-4, Warrant 3, Peak Hour (70% Factor)
Existing + Project Volumes
MINOR STREET VOLUME
500
400
300
200
100
0
2 OR MORE LANES & 2 OR MORE LANES
2 OR MORE LANES & 1 LANE
1 LANE & 1 LANE
AM:1,338, 128
PM:1,487, 64
300
400
500
600
700
800
900
1000
1100
1200
1300
MAJOR STREET VOLUME


Carmel Mountain Rd & Gerana St / Access B
Figure 4C-4, Warrant 3, Peak Hour (70% Factor)
Existing + Cuml + Project Volumes
MINOR STREET VOLUME
MAJOR STREET VOLUME
0
100
200
300
400
500
300
400
500
600
700
800
900
1000
1100
1200
1300
2 OR MORE LANES & 2 OR MORE LANES
2 OR MORE LANES & 1 LANE
1 LANE & 1 LANE
AM:1,351, 132
PM:1,511, 67


Carmel Mountain Rd & Gerana St / Access B
Figure 4C-4, Warrant 3, Peak Hour (70% Factor)
Year 2035 + Project Volumes
MINOR STREET VOLUME
500
400
300
200
100
0
2 OR MORE LANES & 2 OR MORE LANES
2 OR MORE LANES & 1 LANE
1 LANE & 1 LANE
AM:1,460, 135
PM:1,630, 70
300
400
500
600
700
800
900
1000
1100
1200
1300
MAJOR STREET VOLUME

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	60	0	68	20	0	39	10	35	578	5	24	10
Future Volume (vph)	60	0	68	20	0	39	10	35	578	5	24	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5			4.5
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.93			0.91			1.00	1.00			1.00
Flt Protected		0.98			0.98			0.95	1.00			0.95
Satd. Flow (prot)		1677			1669			1768	3535			1770
Flt Permitted		0.82			0.89			1.00	1.00			0.95
Satd. Flow (perm)		1406			1510			1862	3535			1770
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)	65	0	74	22	0	42	11	38	628	5	26	11
RTOR Reduction (vph)	0	78	0	0	53	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	61	0	0	11	0	0	49	632	0	0	37
Confl. Peds. (#/hr)	2		1					2				
Turn Type	Perm	NA		Perm	NA		custom	Prot	NA		Prot	Prot
Protected Phases		4			8			5	2		1	1
Permitted Phases	4			8			5					
Actuated Green, G (s)		7.6			7.6			1.9	21.8			1.6
Effective Green, g (s)		7.6			7.6			1.9	21.8			1.6
Actuated g/C Ratio		0.17			0.17			0.04	0.49			0.04
Clearance Time (s)		4.5			4.5			4.5	4.5			4.5
Vehicle Extension (s)		3.0			3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		240			257			79	1731			63
v/s Ratio Prot									0.18			0.02
v/s Ratio Perm		c0.04			0.01			c0.03				
v/c Ratio		0.25			0.04			0.62	0.37			0.59
Uniform Delay, d1		16.0			15.4			20.9	7.1			21.1
Progression Factor		1.00			1.00			1.00	1.01			1.00
Incremental Delay, d2		0.6			0.1			14.2	0.1			13.2
Delay (s)		16.6			15.5			35.2	7.3			34.3
Level of Service		B			B			D	A			C
Approach Delay (s)		16.6			15.5				9.3			
Approach LOS		B			B				A			

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	653	23
Future Volume (vph)	653	23
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.5	
Lane Util. Factor	0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	3519	
Flt Permitted	1.00	
Satd. Flow (perm)	3519	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	710	25
RTOR Reduction (vph)	3	0
Lane Group Flow (vph)	732	0
Confl. Peds. (#/hr)		2
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	21.5	
Effective Green, g (s)	21.5	
Actuated g/C Ratio	0.48	
Clearance Time (s)	4.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1700	
v/s Ratio Prot	c0.21	
v/s Ratio Perm		
v/c Ratio	0.43	
Uniform Delay, d1	7.5	
Progression Factor	1.00	
Incremental Delay, d2	0.2	
Delay (s)	7.7	
Level of Service	A	
Approach Delay (s)	9.0	
Approach LOS	A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	38	0	26	9	0	18	10	56	586	21	85	43
Future Volume (vph)	38	0	26	9	0	18	10	56	586	21	85	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5			4.5
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.95			0.91			1.00	0.99			1.00
Flt Protected		0.97			0.98			0.95	1.00			0.95
Satd. Flow (prot)		1709			1667			1766	3521			1770
Flt Permitted		0.80			0.86			1.00	1.00			0.95
Satd. Flow (perm)		1408			1461			1859	3521			1770
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)	41	0	28	10	0	20	11	61	637	23	92	47
RTOR Reduction (vph)	0	61	0	0	27	0	0	0	3	0	0	0
Lane Group Flow (vph)	0	8	0	0	3	0	0	72	657	0	0	139
Confl. Peds. (#/hr)	2							6				
Turn Type	Perm	NA		Perm	NA		custom	Prot	NA		Prot	Prot
Protected Phases		4			8			5	2		1	1
Permitted Phases	4			8			5					
Actuated Green, G (s)		5.1			5.1			3.4	20.4			6.7
Effective Green, g (s)		5.1			5.1			3.4	20.4			6.7
Actuated g/C Ratio		0.11			0.11			0.07	0.45			0.15
Clearance Time (s)		4.5			4.5			4.5	4.5			4.5
Vehicle Extension (s)		3.0			3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		157			163			138	1571			259
v/s Ratio Prot									0.19			c0.08
v/s Ratio Perm		c0.01			0.00			0.04				
v/c Ratio		0.05			0.02			0.52	0.42			0.54
Uniform Delay, d1		18.1			18.1			20.4	8.6			18.1
Progression Factor		1.00			1.00			1.00	1.01			1.00
Incremental Delay, d2		0.1			0.1			3.5	0.2			2.1
Delay (s)		18.3			18.1			23.9	8.9			20.2
Level of Service		B			B			C	A			C
Approach Delay (s)		18.3			18.1				10.4			
Approach LOS		B			B				B			

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	45.7	Sum of lost time (s)	13.5
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	622	64
Future Volume (vph)	622	64
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.5	
Lane Util. Factor	0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	3481	
Flt Permitted	1.00	
Satd. Flow (perm)	3481	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	676	70
RTOR Reduction (vph)	9	0
Lane Group Flow (vph)	737	0
Confl. Peds. (#/hr)		6
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	23.7	
Effective Green, g (s)	23.7	
Actuated g/C Ratio	0.52	
Clearance Time (s)	4.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1805	
v/s Ratio Prot	c0.21	
v/s Ratio Perm		
v/c Ratio	0.41	
Uniform Delay, d1	6.7	
Progression Factor	1.00	
Incremental Delay, d2	0.2	
Delay (s)	6.9	
Level of Service	A	
Approach Delay (s)	9.0	
Approach LOS	A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	60	0	72	20	0	39	10	37	581	5	24	10
Future Volume (vph)	60	0	72	20	0	39	10	37	581	5	24	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5			4.5
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.93			0.91			1.00	1.00			1.00
Flt Protected		0.98			0.98			0.95	1.00			0.95
Satd. Flow (prot)		1675			1669			1768	3535			1770
Flt Permitted		0.82			0.89			1.00	1.00			0.95
Satd. Flow (perm)		1410			1511			1862	3535			1770
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)	65	0	78	22	0	42	11	40	632	5	26	11
RTOR Reduction (vph)	0	78	0	0	53	0	0	0	1	0	0	0
Lane Group Flow (vph)	0	65	0	0	11	0	0	51	636	0	0	37
Confl. Peds. (#/hr)	2		1					2				
Turn Type	Perm	NA		Perm	NA		custom	Prot	NA		Prot	Prot
Protected Phases		4			8			5	2		1	1
Permitted Phases	4			8			5					
Actuated Green, G (s)		7.7			7.7			1.9	21.8			1.6
Effective Green, g (s)		7.7			7.7			1.9	21.8			1.6
Actuated g/C Ratio		0.17			0.17			0.04	0.49			0.04
Clearance Time (s)		4.5			4.5			4.5	4.5			4.5
Vehicle Extension (s)		3.0			3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		243			260			79	1727			63
v/s Ratio Prot									0.18			0.02
v/s Ratio Perm		c0.05			0.01			c0.03				
v/c Ratio		0.27			0.04			0.65	0.37			0.59
Uniform Delay, d1		16.0			15.4			21.0	7.1			21.2
Progression Factor		1.00			1.00			1.00	1.01			1.00
Incremental Delay, d2		0.6			0.1			16.7	0.1			13.2
Delay (s)		16.6			15.4			37.8	7.3			34.4
Level of Service		B			B			D	A			C
Approach Delay (s)		16.6			15.4				9.6			
Approach LOS		B			B				A			

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	44.6	Sum of lost time (s)	13.5
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	661	23
Future Volume (vph)	661	23
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.5	
Lane Util. Factor	0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	3519	
Flt Permitted	1.00	
Satd. Flow (perm)	3519	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	718	25
RTOR Reduction (vph)	3	0
Lane Group Flow (vph)	740	0
Confl. Peds. (#/hr)		2
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	21.5	
Effective Green, g (s)	21.5	
Actuated g/C Ratio	0.48	
Clearance Time (s)	4.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1696	
v/s Ratio Prot	c0.21	
v/s Ratio Perm		
v/c Ratio	0.44	
Uniform Delay, d1	7.6	
Progression Factor	1.00	
Incremental Delay, d2	0.2	
Delay (s)	7.8	
Level of Service	A	
Approach Delay (s)	9.0	
Approach LOS	A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	38	0	29	9	0	18	10	61	597	21	85	43
Future Volume (vph)	38	0	29	9	0	18	10	61	597	21	85	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5			4.5
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.94			0.91			1.00	0.99			1.00
Flt Protected		0.97			0.98			0.95	1.00			0.95
Satd. Flow (prot)		1704			1667			1767	3521			1770
Flt Permitted		0.81			0.86			0.74	1.00			0.95
Satd. Flow (perm)		1417			1458			1377	3521			1770
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)	41	0	32	10	0	20	11	66	649	23	92	47
RTOR Reduction (vph)	0	65	0	0	27	0	0	0	3	0	0	0
Lane Group Flow (vph)	0	8	0	0	3	0	0	77	669	0	0	139
Confl. Peds. (#/hr)	2							6				
Turn Type	Perm	NA		Perm	NA		custom	Prot	NA		Prot	Prot
Protected Phases		4			8			5	2		1	1
Permitted Phases	4			8			5					
Actuated Green, G (s)		5.1			5.1			5.4	19.6			6.6
Effective Green, g (s)		5.1			5.1			5.4	19.6			6.6
Actuated g/C Ratio		0.11			0.11			0.12	0.44			0.15
Clearance Time (s)		4.5			4.5			4.5	4.5			4.5
Vehicle Extension (s)		3.0			3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		161			165			165	1540			260
v/s Ratio Prot									0.19			c0.08
v/s Ratio Perm		c0.01			0.00			0.06				
v/c Ratio		0.05			0.02			0.47	0.43			0.53
Uniform Delay, d1		17.7			17.6			18.4	8.8			17.7
Progression Factor		1.00			1.00			1.00	1.01			1.00
Incremental Delay, d2		0.1			0.1			2.1	0.2			2.1
Delay (s)		17.8			17.7			20.4	9.0			19.8
Level of Service		B			B			C	A			B
Approach Delay (s)		17.8			17.7				10.2			
Approach LOS		B			B				B			

Intersection Summary			
HCM 2000 Control Delay	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	44.8	Sum of lost time (s)	13.5
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	630	64
Future Volume (vph)	630	64
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.5	
Lane Util. Factor	0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	3482	
Flt Permitted	1.00	
Satd. Flow (perm)	3482	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	685	70
RTOR Reduction (vph)	9	0
Lane Group Flow (vph)	746	0
Confl. Peds. (#/hr)		6
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	20.8	
Effective Green, g (s)	20.8	
Actuated g/C Ratio	0.46	
Clearance Time (s)	4.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1616	
v/s Ratio Prot	c0.21	
v/s Ratio Perm		
v/c Ratio	0.46	
Uniform Delay, d1	8.2	
Progression Factor	1.00	
Incremental Delay, d2	0.2	
Delay (s)	8.4	
Level of Service	A	
Approach Delay (s)	10.2	
Approach LOS	B	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	60	0	75	20	0	39	10	37	623	5	24	10
Future Volume (vph)	60	0	75	20	0	39	10	37	623	5	24	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5			4.5
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		0.99			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.92			0.91			1.00	1.00			1.00
Flt Protected		0.98			0.98			0.95	1.00			0.95
Satd. Flow (prot)		1673			1669			1769	3535			1770
Flt Permitted		0.83			0.89			1.00	1.00			0.95
Satd. Flow (perm)		1414			1514			1862	3535			1770
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)	65	0	82	22	0	42	11	40	677	5	26	11
RTOR Reduction (vph)	0	78	0	0	53	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	69	0	0	11	0	0	51	682	0	0	37
Confl. Peds. (#/hr)	2		1					2				
Turn Type	Perm	NA		Perm	NA		custom	Prot	NA		Prot	Prot
Protected Phases		4			8			5	2		1	1
Permitted Phases	4			8			5					
Actuated Green, G (s)		7.8			7.8			1.9	23.0			1.6
Effective Green, g (s)		7.8			7.8			1.9	23.0			1.6
Actuated g/C Ratio		0.17			0.17			0.04	0.50			0.03
Clearance Time (s)		4.5			4.5			4.5	4.5			4.5
Vehicle Extension (s)		3.0			3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		240			257			77	1771			61
v/s Ratio Prot									0.19			0.02
v/s Ratio Perm		c0.05			0.01			c0.03				
v/c Ratio		0.29			0.04			0.66	0.38			0.61
Uniform Delay, d1		16.6			15.9			21.7	7.1			21.8
Progression Factor		1.00			1.00			1.00	1.01			1.00
Incremental Delay, d2		0.7			0.1			19.4	0.1			15.9
Delay (s)		17.3			16.0			41.1	7.3			37.7
Level of Service		B			B			D	A			D
Approach Delay (s)		17.3			16.0				9.7			
Approach LOS		B			B				A			

Intersection Summary			
HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	45.9	Sum of lost time (s)	13.5
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	726	25
Future Volume (vph)	726	25
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.5	
Lane Util. Factor	0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	3519	
Flt Permitted	1.00	
Satd. Flow (perm)	3519	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	789	27
RTOR Reduction (vph)	3	0
Lane Group Flow (vph)	813	0
Confl. Peds. (#/hr)		2
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	22.7	
Effective Green, g (s)	22.7	
Actuated g/C Ratio	0.49	
Clearance Time (s)	4.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1740	
v/s Ratio Prot	c0.23	
v/s Ratio Perm		
v/c Ratio	0.47	
Uniform Delay, d1	7.6	
Progression Factor	1.00	
Incremental Delay, d2	0.2	
Delay (s)	7.8	
Level of Service	A	
Approach Delay (s)	9.1	
Approach LOS	A	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	40	0	30	9	0	18	10	61	651	21	85	43
Future Volume (vph)	40	0	30	9	0	18	10	61	651	21	85	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5			4.5	4.5			4.5
Lane Util. Factor		1.00			1.00			1.00	0.95			1.00
Frpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Flpb, ped/bikes		1.00			1.00			1.00	1.00			1.00
Frt		0.94			0.91			1.00	1.00			1.00
Flt Protected		0.97			0.98			0.95	1.00			0.95
Satd. Flow (prot)		1704			1667			1767	3523			1770
Flt Permitted		0.81			0.86			0.70	1.00			0.95
Satd. Flow (perm)		1416			1456			1305	3523			1770
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)	43	0	33	10	0	20	11	66	708	23	92	47
RTOR Reduction (vph)	0	67	0	0	27	0	0	0	3	0	0	0
Lane Group Flow (vph)	0	9	0	0	3	0	0	77	728	0	0	139
Confl. Peds. (#/hr)	2							6				
Turn Type	Perm	NA		Perm	NA		custom	Prot	NA		Prot	Prot
Protected Phases		4			8			5	2		1	1
Permitted Phases	4			8			5					
Actuated Green, G (s)		5.2			5.2			5.7	20.9			6.6
Effective Green, g (s)		5.2			5.2			5.7	20.9			6.6
Actuated g/C Ratio		0.11			0.11			0.12	0.45			0.14
Clearance Time (s)		4.5			4.5			4.5	4.5			4.5
Vehicle Extension (s)		3.0			3.0			3.0	3.0			3.0
Lane Grp Cap (vph)		159			163			161	1593			252
v/s Ratio Prot									0.21			c0.08
v/s Ratio Perm		c0.01			0.00			0.06				
v/c Ratio		0.05			0.02			0.48	0.46			0.55
Uniform Delay, d1		18.3			18.2			18.9	8.7			18.4
Progression Factor		1.00			1.00			1.00	1.01			1.00
Incremental Delay, d2		0.1			0.1			2.2	0.2			2.6
Delay (s)		18.4			18.3			21.2	9.0			21.0
Level of Service		B			B			C	A			C
Approach Delay (s)		18.4			18.3				10.2			
Approach LOS		B			B				B			

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	46.2	Sum of lost time (s)	13.5
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (vph)	689	70
Future Volume (vph)	689	70
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.5	
Lane Util. Factor	0.95	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.99	
Flt Protected	1.00	
Satd. Flow (prot)	3482	
Flt Permitted	1.00	
Satd. Flow (perm)	3482	
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	749	76
RTOR Reduction (vph)	9	0
Lane Group Flow (vph)	816	0
Confl. Peds. (#/hr)		6
Turn Type	NA	
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	21.8	
Effective Green, g (s)	21.8	
Actuated g/C Ratio	0.47	
Clearance Time (s)	4.5	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	1643	
v/s Ratio Prot	c0.23	
v/s Ratio Perm		
v/c Ratio	0.50	
Uniform Delay, d1	8.4	
Progression Factor	1.00	
Incremental Delay, d2	0.2	
Delay (s)	8.7	
Level of Service	A	
Approach Delay (s)	10.4	
Approach LOS	B	

Intersection Summary

END OF APPENDICES

Pacific Village Project

Waste Management Plan

September 2016

Prepared for:
Lennar Homes of California
25 Enterprise, Suite 400
Aliso Viejo, CA 92656

Prepared by:
HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, CA 91942

WASTE MANAGEMENT PLAN

FOR THE

PACIFIC VILLAGE PROJECT

Prepared For:

Lennar Homes of California
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Aliso Viejo, CA 92656

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September 2016

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (cont.)

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
AMSL	above mean sea level
APN	Assessor's Parcel Number
Applicant	Lennar Homes of California
C&D	Construction and Demolition
CalRecycle	California Department of Resources Recycling and Recovery
CEQA	California Environmental Quality Act
CF	cubic foot/feet
City	City of San Diego
CIWMA	California Integrated Waste Management Act of 1989
CY	cubic yard(s)
DSD	City of San Diego Development Services Department
ESD	City of San Diego Environmental Services Department
FEMA	Federal Emergency Management Agency
ft.	foot/feet
HOA	Homeowners Association
IWMP	Integrated Waste Management Plan
lbs	pounds
LEED	Leadership in Energy and Environmental Design
Project	Pacific Village Project
SDP	Site Development Permit
SF	square foot/feet
SRRE	Source Reduction and Recycling Element
State	State of California
SWMC	Solid Waste Management Coordinator
WDM	Waste Diversion Measures
WMP	Waste Management Plan

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1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

The purpose of this Waste Management Plan (WMP) is to identify the quantity of solid waste that would be generated by the Pacific Village (Project) throughout demolition, construction, and operation, and to identify measures to reduce the potential impacts associated with management of such waste.

Proper separation and diversion of recyclable waste materials is required in order to divert each material type to a recycling/reuse facility with the highest possible diversion rate. As discussed further in Section 2.0, *Regulatory Framework*, in order to comply with City of San Diego's (City's) waste reduction ordinances and the waste diversion goals established in State Assembly Bill (AB) 341, the Project must achieve a 75 percent diversion rate during demolition and construction. The City's California Environmental Quality Act (CEQA) Significance Thresholds for solid waste identify a threshold of 1,500 tons of waste or more during construction and demolition (C&D) for direct solid waste impacts, and 60 tons of waste or more during C&D for potentially significant cumulative solid waste impacts (City 2011). The City Environmental Services Department's (ESD) *2016 Certified Construction & Demolition Recycling Facility Directory* (City 2016a) provides guidance on identifying recycling/reuse facility locations, accepted materials, recycling/reuse rates, and associated disposal fees and/or the value of the materials accepted for recycling/reuse.

This WMP has been prepared consistent with applicable federal, State, and local laws, regulations and standards pertinent to the Project. Its goal is to implement an approach for managing waste that conserves landfill space, preserves environmental quality, conserves natural resources, and reduces disposal costs. The WMP describes the project measures and design features that would reduce the amount of waste generated and how waste reduction and recycling goals would be achieved. Responsibility for ensuring ongoing WMP compliance would be under the direction of the Project Solid Waste Management Coordinator, as assigned by Lennar Homes of California (Applicant).

1.2 PROJECT LOCATION

The approximately 41.6-acre Project site is located adjacent to the west side of Interstate (I-) 15, immediately north of the intersection of I-15 and State Route 56 in Rancho Peñasquitos, a community of the City of San Diego (Figures 1 and 2, *Regional Location Map*, and *Project Vicinity [Aerial Photograph]*, respectively). The Project site supports an existing residential development, consisting of single-story "Garden Apartment" structures, non-residential structures associated with the residential use, and light to heavy landscaping, including many large mature trees.

Surrounding land uses include commercial/retail uses and residential tract housing to the north, multi-family residential uses to the west, undeveloped land to the south and west, single-family residential uses to the south, and I-15 to the east. The primary access to the property is from Carmel Mountain Road, located west of the property. The site is characterized by moderate slopes and terraces descending to the east, with elevations on-site ranging from approximately 575 feet above mean sea level (AMSL) to 640 feet AMSL.

1.3 PROJECT DESCRIPTION

The proposed Project is the redevelopment of the property into single family for-sale homes ("for-sale component") and apartment homes ("for-rent component") (refer to Appendix A for Project site plans). The for-sale component envisions three building types, including 99 detached cluster homes, 105 triplex homes, and 120 row townhomes on 30 acres, totaling approximately 565,209 gross square feet (SF). The for-sale component would consist of two-story residential units with direct access garages at grade, as well as guest parking throughout the community. A homeowners association (HOA)-maintained recreation center and other open space areas would be provided throughout the community.

The for-rent component called "E-Urban" would include 277 apartment homes in three-story buildings, totaling approximately 286,966 gross SF. The E-Urban buildings feature internal corridors and are wrapped around small courtyards. Apartment homes are configured with both stacked flats and with living spaces over garages. Parking would be provided in a two-level parking structure with 229 spaces. Parking would also be located around the buildings in both tandem and side-by-side configurations.

Separate vehicle entrances would be provided for the for-rent component than the for-sale component. Three entry and exit points are planned fronting Carmel Mountain Road. The for-rent component would have a separate entrance from Carmel Mountain Road that leads directly to the proposed leasing and clubhouse facilities. The approximately 9,356-SF leasing and clubhouse facilities would consist of a two-story, centrally located building with adjacent pool, spa, deck, and tennis court. The Project would include landscaping throughout the development, including along the proposed roadways, access drives, community facilities, and parking areas. A total of 554 parking spaces would be provided.

Utility services would be provided through construction of new pipelines/extensions from existing utility infrastructure within surrounding roadways. Existing on-site utilities are proposed to be removed. Grading would be balanced on site.

2.0 REGULATORY FRAMEWORK

2.1 STATE OF CALIFORNIA

The State of California (State) Integrated Waste Management Act (CIWMA) of 1989 [California AB 939], which is administered by the California Department of Resources Recycling and Recovery (CalRecycle), requires counties to develop an Integrated Waste Management Plan (IWMP) that describes local waste diversion and disposal conditions, and lays out realistic programs to achieve the waste diversion goals. IWMPs compile Source Reduction and Recycling Elements (SRREs) that are required to be prepared by each local government, including cities. SRREs analyze the local waste stream to determine where to focus diversion efforts, and provide a framework to meet waste reduction mandates. The goal of the solid waste management efforts

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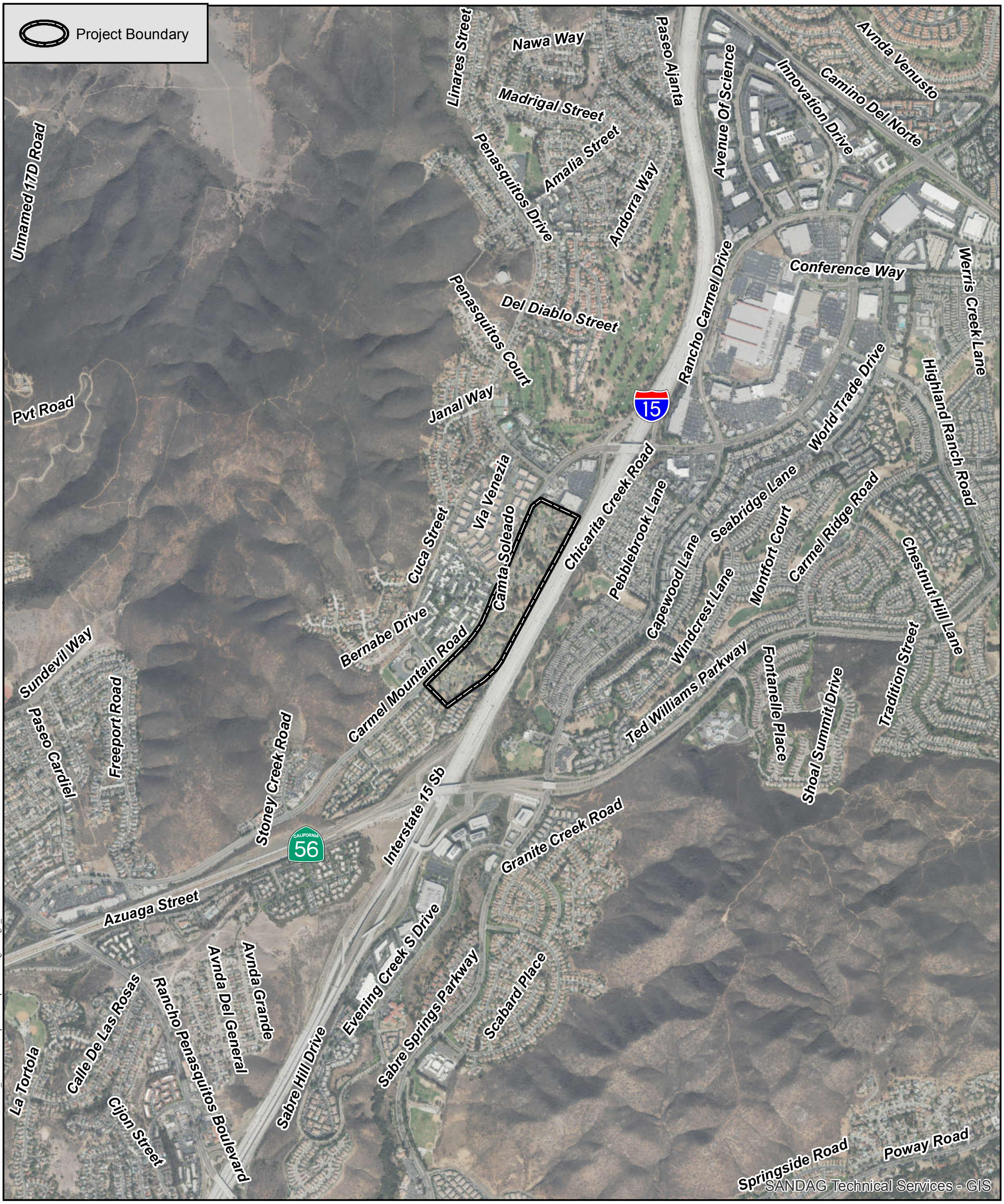
Regional Location Map

PACIFIC VILLAGE PROJECT

HELIX Environmental Planning

N 0 8 Miles

Figure 1



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Project Vicinity (Aerial Photograph)

PACIFIC VILLAGE PROJECT

HELIX Environmental Planning

N 0 2,000 Feet

Figure 2

is not to increase recycling, but to decrease the amount of waste entering landfills. AB 939 required all cities and counties to divert a minimum 50 percent of all solid waste from landfill disposal.

In 2011, the State legislature enacted AB 341 (California Public Resource Code Section 42649.2), increasing the diversion target to 75 percent statewide. AB 341 also requires the provision of recycling service to commercial and residential facilities that generate 4 cubic yards (CY) or more of solid waste per week.

In October of 2014, Governor Brown signed AB 1826 Chesbro (Chapter 727, Statutes of 2014), requiring businesses to recycle their organic waste on and after April 1, 2016, depending on the amount of waste they generate per week. Organic waste means food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste. For businesses that generate 8 or more CY of organic waste per week, this requirement began April 1, 2016, while those that generate 4 CY of organic waste per week must have an organic waste recycling program in place beginning January 1, 2017. This law also requires that on and after January 1, 2016, local jurisdictions across the State implement an organic waste recycling program to divert organic waste generated by businesses, including multi-family residential dwellings that consist of five or more units. This law phases in the mandatory recycling of commercial organics over time, while also offering an exemption process for rural counties.

2.2 CITY OF SAN DIEGO

The City has enacted codes and policies directed at the achievement of State-required diversion levels, including the Refuse and Recyclable Materials Storage Regulations (San Diego Municipal Code (SDMC) Chapter 14, Article 2 Division 8), Recycling Ordinance (City 2007; Municipal Code Chapter 6, Article 6, Division 7), and the Construction and Demolition (C&D) Debris Deposit Ordinance (City 2008; Municipal Code Chapter 6, Article 6, Division 6). The City's Zero Waste Plan, a component of the City's Climate Action Plan, was approved and adopted by City Council on July 13, 2015. The Zero Waste Plan identifies goals and strategies to achieve 75 percent diversion by 2020, 90 percent diversion by 2035, and "zero" waste by 2040 (City 2015).

As stated in the City Development Services Department (DSD) CEQA Significance Determination Thresholds (City 2011), implementation of these regulations and ordinances alone is not projected to achieve a 50 percent diversion rate, far below the current 75 percent diversion level targeted by the State and identified in the Zero Waste Plan for 2020. The City's ESD estimates that compliance with existing City ordinances and regulations alone achieves only an approximate 40 percent diversion rate (City 2013). Therefore, discretionary projects must undertake additional measures to comply with existing regulations.

2.2.1 City of San Diego CEQA Significance Determination Thresholds

The City's CEQA Significance Determination Thresholds establish solid waste generation thresholds for discretionary projects. Proposed projects that involve construction, demolition, and/or renovation that meet or exceed the thresholds described below are considered to have potentially significant solid waste impacts and require the preparation of a WMP.

Direct Impacts

Projects that include the construction, demolition, or renovation of 1,000,000 SF or more of building space may generate approximately 1,500 tons of waste or more during construction and demolition, and are considered to have direct impacts on solid waste services.

- Direct impacts result from the generation of large amounts of waste, which brings facilities closer to daily throughput limits, shortens facility lifespans, requires increased numbers of trucks and other equipment, and makes it difficult for the City to achieve required waste reduction levels. Waste management planning is based on a steady rate of waste generation and does not assume increased waste generation due to growth.

- While all projects are required to comply with the City's waste management ordinances, direct and cumulative impacts are mitigated by the implementation of project-specific WMPs, which may reduce solid waste impacts to below a level of significance.

- For projects over 1,000,000 square feet, a significant direct and cumulative solid waste impact would result if the compliance with the City's ordinances and the WMP fail to reduce the impacts of such projects to below a level of significance and/or if a WMP for the project is not prepared and conceptually approved by the ESD prior to distribution of the draft environmental document for public review.

Cumulative Impacts

Projects that include the construction, demolition, and/or renovation of 40,000 SF or more of building space may generate approximately 60 tons of waste or more per year, and are considered to have cumulative impacts on solid waste services.

While all projects are required to comply with the City's waste management ordinances, cumulative impacts are mitigated by the implementation of a project-specific WMP that reduces solid waste impacts to below a level of significance.

LEED Projects Exceeding the Significance Thresholds

Projects that intend certification as U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Silver or better would include LEED measures as part of their WMP. This would demonstrate implementation of sustainability measures intended to assure a minimal project "environmental footprint," including mitigating the types of impacts caused by waste generation.

Although the Project would not include construction, demolition, or renovation of 1,000,000 SF or more, it would generate more than 1,500 tons of solid waste materials during demolition and construction. Therefore, without solid waste diversion measures, the Project would exceed the City's threshold for direct solid waste impacts. Further, the Project proposes construction of more than 40,000 SF, thereby also exceeding the City's threshold for cumulative solid waste impacts without implementation of solid waste diversion measures. Because implementation of the Project without waste diversion measures would exceed direct and cumulative solid waste thresholds, preparation of this WMP is required under CEQA to ensure that the Project contribution to the overall waste produced within the City would be reduced sufficiently to allow the City to comply with the waste reduction targets established in the Public Resources Code and State statutes.

2.2.2 City of San Diego Refuse and Recyclable Materials Storage Ordinance

SDMC Section 142.0801 et seq. contains the language of the City Refuse and Recyclable Materials Storage Ordinance (Storage Ordinance), an ordinance that is required by State law. Table 1, *Required Minimum Storage Areas for Residential Development* (Municipal Code Table 142-08B), provides information on minimum exterior refuse and recyclable material storage areas for residential development.

Table 1
REQUIRED MINIMUM STORAGE AREAS FOR RESIDENTIAL DEVELOPMENT

Number of Dwelling Units	Minimum Refuse Storage Area (SF)	Minimum Recyclable Material Storage Area (SF)	Total Minimum Storage Area (SF)
2-6	12	12	24
7-15	24	24	48
16-25	48	48	96
26-50	96	96	192
51-75	144	144	288
76-100	192	192	348
101-125	240	240	480
126-150	288	288	676
151-175	336	336	672
176-200	384	384	768
200+	384 + 48 for every 25 dwelling units above 201	384 + 48 for every 25 dwelling units above 201	768 + 96 for every 25 dwelling units above 201

SF = square feet

Table 2, *Required Minimum Storage Areas for Non-residential Development* (Municipal Code Table 142-08C), provides information on minimum exterior refuse and recyclable material storage areas for non-residential development.

Table 2 REQUIRED MINIMUM STORAGE AREAS FOR NON-RESIDENTIAL DEVELOPMENT			
Gross Floor Area (SF)	**Minimum Refuse Storage Area (SF)**	**Minimum Recyclable Material Storage Area (SF)**	**Total Minimum Storage Area (SF)**
0-5,000	12	12	24
5,001-10,000	24	24	48
10,001-25,000	48	48	96
25,001-50,000	96	96	192
50,001-75,000	144	144	288
75,001-100,000	192	192	384
100,001+	192+48 SF for every 25,000 SF of building area above 100,001	192+48 SF for every 25,000 SF of building area above 100,001	384+96 SF for every 25,000 SF of building area above 100,001

SF = square feet

2.2.3 City of San Diego Recycling Ordinance

The City's Recycling Ordinance, found in SDMC Section 66.0701 et seq., was adopted in November 2007 (City 2007). The Recycling Ordinance requires the provision of recycling service for all commercial facilities, all single-family residences, and multi-family residences with more than 49 units. The Ordinance also provides an exemption for land uses that generate less than 6 CY of waste per week. However, as noted above, AB 341, which was chaptered after the City enacted this ordinance, has imposed a requirement that "captures" any uses being served with 4 CY or more of refuse capacity. This State requirement makes the provision of recycling service a virtually universal requirement. In addition, the Recycling Ordinance also requires development of educational materials to ensure occupants are informed about the City's ordinance and recycling services, including information on types of recyclable materials accepted.

2.2.4 City of San Diego Construction and Demolition (C&D) Debris Deposit Ordinance

On July 1, 2008, the City's C&D Debris Deposit Ordinance became effective (City 2008). An amendment to the ordinance and revisions to the associated C&D deposit schedule were approved by the City Council on December 10, 2013 (effective January 1, 2014) and on April 19, 2016 (effective June 22, 2016). The C&D Debris Deposit Ordinance is designed to keep C&D materials out of local landfills and ensure that materials are diverted from disposal. The ordinance creates an economic incentive to recycle C&D debris through the collection of fully refundable deposits that are returned, in whole or in part, upon proof of the amount of C&D debris the project applicant diverted from landfill disposal. The ordinance requires that the majority of construction, demolition and remodeling projects requiring building, combination, and demolition permits pay a refundable C&D Debris Recycling Deposit and divert at least 65 percent of their debris by recycling, reusing, or donating usable materials. The deposit is held until the applicant provides receipts demonstrating that a minimum 65 percent of the material generated has been diverted from disposal in landfills.

The C&D Ordinance stipulates that projects will be required to divert 75 percent of their wastes when mixed debris facilities with a permitted daily tonnage capacity of at least 1,000 tons maintain a 75 percent diversion rate for three consecutive calendar year quarters. Greater than 75 percent diversion also may be required for a project if a higher goal is specified during discretionary permitting. Mixed debris recyclers in San Diego County currently achieve between 65 and 85 percent diversion rates at their facilities (refer to Appendix B). This is because not everything that comes through the door is usable or marketable. While there are two facilities that achieve a diversion rate of 75 percent or greater, the others have diversion rates of 65 percent. For a project that would dispose of mixed debris at one of the facilities that achieve a 65 percent diversion rate, virtually all clean C&D waste from a project must be source separated and sent to a material-specific recycling facility, such as aggregate and metal recyclers, in order to achieve an overall diversion rate of 75 percent. Higher diversion rates can also be accomplished by salvage and/or on-site reuse of C&D materials. The City's C&D thresholds and deposit amounts are shown below in Table 3, *City C&D Deposit Schedule*.

Table 3
CITY C&D DEPOSIT SCHEDULE

Building Category	Deposit per SF[1]	Minimum SF Subject to Ordinance	Maximum SF Subject to Ordinance	Range of Deposits
Residential New Construction, Non-residential Alterations, Demolition	$0.40	1,000	100,000	$400-$40,000
Non-residential New Construction	$0.20	1,000	50,000	$200-$10,000
Flat Rate				
Residential Alterations	$1,000	1,000	6,999	$1,000

Source: City 2016c

[1] Deposit amounts are applied to the entire area(s) where work will be performed, and are calculated based on square footage.

SF = square feet

3.0 PRE-CONSTRUCTION WASTE GENERATION AND DIVERSION: DEMOLITION, CLEARING/GRUBBING, AND GRADING

All C&D-generated waste would be subject to compliance with the source separation and diversion requirements contained in this WMP to divert, recycle, and/or re-use these materials to the maximum degree possible. "Mixed C&D Debris" recyclers attain at most an 85 percent diversion rate, whereas as identified in the City's 2016 Certified Construction & Demolition Recycling Facility Directory (Appendix B), "source separated" material recyclers can attain nearly 100 percent diversion rates (City 2016a). As a result, in order to achieve the highest level of waste diversion from landfills, and highest dollar value for the quality of materials, the Project would source separate (segregate) clean recyclable materials on the site by material type, to the maximum extent practicable, and divert them for recycling or reuse at City-certified facilities specializing in each material type.

3.1 DEMOLITION

Prior to initiation of the Project's construction activities, site preparation would require the clearing/grubbing of existing vegetation as well as the demolition of the existing residential buildings; paved parking lot areas; sidewalks, curbs, and gutters; and underground utilities. These demolition activities are described below.

3.1.1 Building Demolition

A total of 71 structures are located on site. These include 59 single-story, multiple-unit residential buildings comprised of 23 Model A, 15 Model B, and 21 Model C residential buildings. Eight laundry buildings, one leasing office, and three storage buildings are also located on site. All existing structures would be demolished.

Salvage

No salvage of materials in the existing building is proposed.

Recycling

The overall estimated quantity of debris from the multi-unit residential buildings, office, storage, and laundry buildings is based on the "General Building Formula" contained in the Federal Emergency Management Agency's (FEMA) *Debris Estimating Field Guide* (2010). The formula multiplies building length, width, and height (in feet) by a constant of 0.33 to account for air space in the building, and divides the resulting number by 27 to convert cubic feet to cubic yards (FEMA 2010):

$$\frac{\text{Length x Width x Height x 0.33}}{27} = \text{CY}$$

The existing 7,320-SF Model A residential buildings are comprised of a single story and have an approximate height of 13 feet. Using these dimensions, structural debris from the Project is estimated as follows:

$$\frac{(7{,}320 \text{ SF x } 13 \text{ ft x } 0.33)}{27} = 1{,}163 \text{ CY}$$

The total quantity of debris from the 23 Model A buildings would be 26,750 CY.

The existing 3,216-SF Model B residential buildings are comprised of a single story and have an approximate height of 13 feet. Using these dimensions, structural debris from 15 buildings is estimated to be 511 CY per building for a total of 7,665 CY.

The existing 1,608-SF Model C residential buildings are comprised of a single story and have an approximate height of 13 feet. Using these dimensions, structural debris from 21 buildings is estimated to be 255 CY per building for a total of 5,355 CY.

The total quantity of debris from all residential buildings would be 39,770 CY.

The existing 1,020-SF office is comprised of a single story and has an approximate height of 13 feet. Using these dimensions, structural debris from this building is estimated to be 162 CY.

The existing 1,610-SF laundry buildings have an approximate height of 10 feet. Using these dimensions, structural debris from eight buildings is estimated to be 197 CY per building for a total of 1,576 CY.

The existing 460-SF storage buildings have an approximate height of 10 feet. Using these dimensions, structural debris from three buildings is estimated to be 56 CY per building for a total of 168 CY.

The total quantity of debris from all non-residential buildings would be 1,906 CY. Combined with residential building debris, the Project total would be 41,676 CY of demolition debris.

As specific materials likely to be contained in the existing building are not known, estimates were pulled from *the Military Base Closure Handbook – A Guide to Construction and Demolition Materials Recovery* (CalRecycle 2002). According to this handbook, demolition of typical residential wood structures result in a C&D waste stream (by volume) as follows:

- 80 percent wood
- 13 percent brick
- 4 percent concrete
- 3 percent metal

In addition to the percentages listed above, it is assumed that there are other recyclable "mixed debris" materials present in unknown quantities, which are estimated to comprise 20 percent of the total demolition debris. These materials would be too damaged or mixed to be source separated into clean materials, and would be disposed of accordingly. An additional eight percent non-recyclable "waste" also was factored into the total waste stream anticipated for demolition of the structure. Factoring in the 28 percent mixed debris and trash that would be generated during demolition, the wood, brick, metal, and concrete breakdown provided in the *Military Base Closure Handbook* would account for the remaining 72 percent of total waste. The complete breakdown of waste types and volumes of demolition waste anticipated to be generated are shown in Table 4, *Residential Structure Demolition Waste Content*.

Table 4 **RESIDENTIAL STRUCTURE DEMOLITION WASTE CONTENT**		
Material	**Percent Waste by Material (%)[1]**	**Volume Waste by Material (CY)[2]**
Wood – Clean[3]	29	12,086
Wood – Treated[3]	29	12,086
Brick	9	3,751
Concrete	3	1,250
Metal	2	834
Mixed debris	20	8,335
Trash	8	3,334
TOTAL	**100**	**41,676**

Sources: FEMA 2010; CalRecycle 2002

[1] Estimated percentages for wood, metal, brick, and concrete provided by the *Military Base Closure Handbook – A Guide to Construction and Demolition Materials Recovery* (CalRecycle 2002) were broken down from the 72 percent of demolition materials remaining after subtracting 20 percent mixed debris and 8 percent trash. For example, the percent waste by material for concrete was generated by multiplying 72 by 0.04 (or 4 percent composition) to yield 3 percent of the total waste generated during demolition.

[2] Table information subject to field verification during demolition.

[3] For estimation purposes, wood waste materials are split 50 percent clean, and 50 percent treated to conservatively account for inability to recycle treated wood.

CY = cubic yards

It is assumed that treated wood, in addition to approximately eight percent of demolition waste, would not be recyclable. These materials would be disposed of at the Miramar Landfill at a zero percent diversion rate. The additional 20 percent of “mixed debris” demolition materials would be disposed of at a City-approved mixed debris materials recycling facility at a minimum 65 percent diversion rate (refer also to Appendix B).

3.1.2 Parking Lot/Sidewalk/Curb and Gutter Demolition

The demolition area is anticipated to include the entire Project site, including internal roadways, parking lots, concrete drainage ditches, curbs, and sidewalks throughout the property. Demolition estimates for the existing on-site pavement and concrete was estimated to total approximately 293,431 SF (pers. comm. Latitude 33 2016). Approximately 205,402 SF and 88,029 SF of the Project site is estimated (from aerial imagery) to be paved with asphalt and concrete/Portland cement, respectively. Demolition estimates for these materials have been calculated based on the following assumptions:

- Demolition estimate for asphalt (paved parking areas) assumes 3 inches thick and 142 pounds per cubic foot (pounds (lbs)/cubic feet [CF]). This would equate to approximately 7,291,771 lbs, or 3,646 tons, based on the 205,402 SF of existing on-site asphalt.

- Demolition estimates for concrete/Portland cement (sidewalks, curbs, gutters, etc.) assumes 4.5 inches thick and 150 lbs/CF. This would equate to approximately 4,951,631 lbs, or 2,486 tons, based on the 88,029 SF of concrete within the existing sidewalks, curbs, and gutters.

Salvage

Although demolished asphalt and concrete material have salvage potential, no salvage plans have been prepared. No salvage is proposed.

Recycling

Quantities of parking lot, sidewalk, and curb demolition materials are estimated to consist of approximately 3,646 tons of asphalt and 2,486 tons of concrete/Portland cement. These materials would be transported off site for recycling or reuse at City-certified facilities specializing in each material type, as applicable (City's 2*016 Certified Construction & Demolition Recycling Facility Directory*, Appendix B).

3.1.3 <u>Utilities Demolition</u>

Existing on-site utilities are proposed to be removed and replaced. Existing on-site water lines were estimated to total approximately 2,919 linear feet of 3-inch-diameter asbestos cement pipeline and 4,237 linear feet 8-inch-diameter asbestos cement pipeline (pers. comm. Latitude 33 2016). Existing on-site sewer lines were estimated to total approximately 2,998 linear feet of 8-inch-diameter vitrified clay pipeline (pers. comm. Latitude 33 2016). Demolition estimates for these materials have been calculated based on the following assumptions:

- 3-inch asbestos concrete cement water pipes weigh approximately 4.6 lbs per linear foot of pipe (Logard Asbestos Cement 2005). Assuming 2,919 feet of water pipeline, approximately 13,427 lbs, or 6.7 tons, would be removed.

- 8-inch asbestos concrete cement water pipes weigh approximately 21.2 lbs per linear foot of pipe (Logard Asbestos Cement 2005). Assuming 4,237 feet of water pipeline, approximately 89,824 lbs, or 45 tons, would be removed.

- 8-inch vitrified clay sewer pipes weigh approximately 30 lbs per linear foot of pipe (Gladding McBean). Assuming 2,998 feet of sewer pipeline, approximately 89,940 lbs, or 45 tons, would be removed.

Demolition would require a total of 193,191 lbs, or 96.6 tons of pipeline materials to be removed from the site.

Salvage

There is no potential for salvage of existing utilities materials.

Recycling

There is no potential for recycling of existing utilities materials.

3.2 CLEARING AND GRUBBING

The Project is anticipated to require net export of approximately 6,341.4 tons, or 42,276 CY, of removed vegetation (clearing and grubbing) during the clearing and grubbing process (pers. comm. Lennar 2016). The total estimated tonnage is based the City's *C&D Debris Conversion Rate Table*, which identifies a weight of 0.15 tons/CY of vegetation (City 2016b; Appendix C).

Salvage

Most of the existing landscaping on the Project site would be removed; however, existing trees would be retained and used on site, where possible.

Recycling

Vegetation would be processed and recycled at a target rate of 100 percent diversion at Miramar Greenery, a City-certified green waste recycling facility. The City's *2016 Certified Construction & Demolition Recycling Facility Directory* (Appendix B) states the diversion rate for clean source-separated materials shall be 100 percent. Other waste materials associated with the clearing and grubbing are anticipated to include negligible amounts of waste generated by contractors working on the site during the grading process.

3.3 GRADING

Excavation material would be balanced on site and is not anticipated to require export of any remaining soil off site. Should a situation arise which requires export of excavation material from the Project site, soil would be diverted at a rate of 100 percent to one of the facilities from the City's *2016 Certified Construction & Demolition Recycling Facility Directory* (Appendix B). Certified facilities include the following:

- Hanson Aggregates West, Miramar, 9229 Harris Plant Road, San Diego, CA 92126
- Vulcan Carol Canyon Landfill and Recycle Site, 10051 Black Mountain Road, San Diego, CA 92126
- Enniss Incorporated, 12421 Vigilante Road, Lakeside, CA 92040
- Moody's, 3210 Oceanside Boulevard, Oceanside, CA 92056
- Robertson's Ready Mix, 2094 Willow Glen Drive, El Cajon, CA 92019

Other waste materials associated with grading are anticipated to include negligible amounts of waste generated by contractors working on site during the grading process.

3.4 SUMMARY OF PRE-CONSTRUCTION DEMOLITION, CLEARING, AND GRUBBING, AND GRADING WASTE GENERATION AND DIVERSION

As discussed above, the waste materials to be generated during demolition, clearing and grubbing, and excavation for Project implementation would be source separated for recycling or reuse at City-certified facilities specializing in each material type, as applicable. A summary of anticipated waste generation volumes and diversion rates for pre-construction activities is provided in Table 5, *Pre-Construction Demolition, Clearing/Grubbing, and Grading Solid Waste Generation, Diversion Rates, and Facilities.*

Salvage

Demolition of the 71 structures, surface parking lots, concrete drainage ditches, and curb/gutter/sidewalks would generate salvageable materials. However, as no specific inventory of reusable items has been conducted at this preliminary stage and no salvage plan has been prepared, no salvage is proposed.

Recycling

Materials generated during pre-construction demolition, clearing and grubbing, and grading that are designated for recycling would be source separated on site during these activities. The City's 2016 Certified Construction & Demolition Recycling Facility Directory, updated quarterly, states the diversion rate for these materials shall be 100 percent, except mixed C&D debris which achieves a maximum 85 percent diversion rate at the EDCO CDI Recycling and Buy Back Center (City 2016a). As shown in the table, an overall 99 percent diversion rate is targeted for demolition and grading materials.

Table 5
PRE-CONSTRUCTION DEMOLITION, CLEARING/GRUBBING, AND GRADING SOLID WASTE GENERATION, DIVERSION RATES, AND FACILITIES

Source of Material	Material	Volume (CY)	Tons/Unit Conversion Factor	Tons	Diversion Rate (Percent)	Facility/ Destination of Materials	Tons Diverted	Tons Disposed
Building Demolition	Clean Wood	12,086	0.15	1,812.9	100	B	1,812.9	0
	Treated Wood	12,086	0.15	1,812.9	0	C	0	1,812.9
	Brick	3,751	0.7	2,625.7	100	A	2,625.7	0
	Concrete	1,250	1.2	1,500	100	A	1,500	0
	Metal	834	0.51	425.3	100	A	425.3	0
	Mixed Debris	8,335	1.19	9,918.7	65	A	6,447.1	3,471.5
	Trash	3,334	0.18	600.1	0	C	0	600.1
Parking/ Sidewalks/ Gutter Demolition	Asphalt	--	--	3,646	100	A	3,646	0
	Concrete	--	--	2,486	100	A	2,486	0
Utilities Demolition	Concrete/piping	--	--	96.7	0	C	0	96.7
Grading/ Clearing/ Grubbing	Landscape Debris	42,276	0.15	6,341.4	100	B	6,341.4	0
			TOTAL	**31,265.7**	**81**	**--**	**25,284.5**	**5,981.2**

Sources: City's *2016 Certified Construction & Demolition Recycling Facility Directory* (City 2016a; Appendix B), City's *C&D Debris Conversion Rate Table* (City 2016b; Appendix C)

Facility/Destination Key:

A. Appropriate facility on City's 2016 Certified Construction & Demolition Recycling Facility Directory

B. Miramar Greenery, 5180 Convoy Street, San Diego, CA 92111

C. Miramar Landfill, 5180 Convoy Street, San Diego, CA 92111

Notes:

- Table information subject to field verification during pre-construction.
- The Applicant would contract with source separating recycling facilities listed in the City's *2016 Certified Construction & Demolition Recycling Facility Directory* (City 2016a) with an equal or greater diversion rate to ensure diversion rates meet those estimated in this table.
- Demolition estimate for asphalt concrete and Portland cement calculated from square footage provided by Latitude 33 (2016).

Total diversion rate based on the percentage of total tons of waste diverted over the total tons of waste generated.

4.0 CONSTRUCTION WASTE GENERATION AND DIVERSION

In order to estimate the quantity of waste generated during construction, City ESD staff recommends assuming each material type (carpet, ceiling tiles, etc.) would approximately equal the square footage of each structure. This square footage can then be multiplied by the weight of the material, and divided by ten (percent) to account for waste generated during the construction process. A ten percent construction waste generation rate is a very conservative figure, used here for analysis of the "worst-case" scenario based on the following reasoning:

- The costs of purchasing construction materials in excess of the quantity required are prohibitive.
- Many materials, such as metal studs, come prefabricated in specific sizes, such that the contractor can accurately predict and purchase the specific quantity that would be required.
- Contractors can return unused and unneeded items (such as metal studs, appliances, fixtures, etc.) and/or utilize materials (such as brick or drywall) on other projects.
- Not all materials would be utilized throughout Project square footage, so generation rates based on the total square footage are bound to be overestimated.

No specific construction materials or quantities are available at this preliminary planning level. The Project proposes Type V construction for all structures. These construction types typically consist of wood-frame structures that include concrete components. Floor coverings are anticipated to consist of carpeting and ceramic tiling. Based on the proposed structures, the following building materials which may generate waste are likely to be used during construction:

- Metals
- Concrete
- Asphalt
- Brick/Masonry
- Wood
- Drywall
- Carpet/Carpet padding
- Ceramic tile
- Ceiling tile
- Roofing materials

Other waste generated would consist of packaging materials from construction material, appliances, windows, etc., including the following:

- Corrugated cardboard (packaging)
- Industrial plastics (plastic wrap, fasteners, etc.)
- Styrofoam (appliance packaging, not peanuts)

4.1 ESTIMATED CONSTRUCTION WASTE GENERATION AND DIVERSION

The City uses a rule of thumb of 3 lbs/SF of waste materials generated during construction (3 lbs = 0.0015 tons). Material quantities are based on City guidance as follows:

- Total Project SF x each material type = Total quantity of construction materials required
- Total construction material required x 10 percent = Anticipated quantity of construction waste generated

Anticipated Project construction waste generation is shown in Table 6, *Construction Solid Waste Generation, Diversion Rates, and Facilities.*

Table 6
CONSTRUCTION SOLID WASTE GENERATION, DIVERSION RATES, AND FACILITIES

Source of Material	Building Gross SF	Material	Diversion Rate (Percent)[1]	Tons Diverted[2]	Tons Disposed
Single Family Detached Housing	192,961	Metals	100	28.9	0
		Concrete/Asphalt	100	28.9	0
		Wood	100	28.9	0
		Drywall	100	28.9	0
		Carpet	100	28.9	0
		Carpet padding	100	28.9	0
		Mixed Debris	65	18.8	10.1
		Trash	0	0	28.9
		TOTAL		**192.5**	**39.1**
Triplex Housing	167,580	Metals	100	25.1	0
		Concrete/Asphalt	100	25.1	0
		Wood	100	25.1	0
		Drywall	100	25.1	0
		Carpet	100	25.1	0
		Carpet padding	100	25.1	0
		Mixed Debris	65	16.3	8.8
		Trash	0	0	25.1
		TOTAL		**166.4**	**34.7**
Row Housing	204,668	Metals	100	30.7	0
		Concrete/Asphalt	100	30.7	0
		Wood	100	30.7	0
		Drywall	100	30.7	0
		Carpet	100	30.7	0
		Carpet padding	100	30.7	0
		Mixed Debris	65	20.0	10.7
		Trash	0	0	30.7
		TOTAL		**203.2**	**42.4**

Table 6 (cont.) CONSTRUCTION SOLID WASTE GENERATION, DIVERSION RATES, AND FACILITIES					
Source of Material	**Building Gross SF**	**Material**	**Diversion Rate (Percent)[1]**	**Tons Diverted[2]**	**Tons Disposed**
E-Urban Housing	345,926	Metals	100	51.9	0
		Concrete/Asphalt	100	51.9	0
		Wood	100	51.9	0
		Drywall	100	51.9	0
		Carpet	100	51.9	0
		Carpet padding	100	51.9	0
		Mixed Debris	65	33.7	18.2
		Trash	0	0	51.9
		TOTAL		**345.1**	**70.1**
Maintenance Building	2,406	Metals	100	0.4	0
		Concrete/Asphalt	100	0.4	0
		Wood	100	0.4	0
		Drywall	100	0.4	0
		Carpet	100	0.4	0
		Carpet padding	100	0.4	0
		Mixed Debris	65	0.2	0.1
		Trash	0	0	0.4
		TOTAL		**2.4**	**0.5**
Clubhouse/ Leasing Building	9,356	Metals	100	1.4	0
		Concrete/Asphalt	100	1.4	0
		Wood	100	1.4	0
		Drywall	100	1.4	0
		Carpet	100	1.4	0
		Carpet padding	100	1.4	0
		Mixed Debris	65	0.9	0.5
		Trash	0	0	1.4
		TOTAL		**9.3**	**1.9**
Parking Garage	87,000	Metals	100	13.1	0
		Concrete/Asphalt	100	13.1	0
		Wood	100	13.1	0
		Mixed Debris	65	8.5	4.6
		Trash	0	0	13.1
		TOTAL		**47.6**	**17.6**
Storage Building	5,000	Metals	100	0.8	0
		Concrete	100	0.8	0
		Wood	100	0.8	0
		Drywall	100	0.8	0
		Mixed Debris	65	0.5	0.3
		Trash	0	0	0.8
		TOTAL		**3.5**	**1.0**

Table 6 (cont.) CONSTRUCTION SOLID WASTE GENERATION, DIVERSION RATES, AND FACILITIES					
Source of Material	**Building Gross SF**	**Material**	**Diversion Rate (Percent)[1]**	**Tons Diverted[2]**	**Tons Disposed**
Common Areas (Parking, Sidewalks, etc.)	128,528	Concrete/Asphalt	100	19.3	0
		TOTAL		**19.3**	**0**
		PROJECT TOTAL	**83**	**991.0**	**205.5**

Source: City 2012

[1] Trash would be taken to the Miramar Landfill (5180 Convoy Street, San Diego, CA 92111) at a zero percent diversion rate. All other construction debris would be taken to an appropriate facility listed on the City's *2016 Certified Construction & Demolition Recycling Facility Directory*. Facilities that process metals, concrete/asphalt, wood, drywall, carpet, and carpet padding all achieve a 100 percent diversion rate for these materials. Facilities that process mixed debris achieve a minimum 65 percent diversion rate, which was conservatively assumed for this project (City 2016a; Appendix B).

[2] For each material type, construction waste quantities are calculated based on:
- Three lbs of waste per total Project SF (10,000 SF x 3 lbs = 30,000 lbs/SF, or 15 tons/SF [1 lb = 0.0005 tons])
- Total construction material required x 10 percent = anticipated quantity of construction waste generated (1.5 tons)

lbs = pounds; SF = square feet

Note that numbers may not total due to rounding

4.2 PROPOSED POST-CONSUMER CONTENT CONSTRUCTION MATERIALS

In order to further minimize waste, the Project would utilize recycled content construction materials, where possible. Given the preliminary nature of the Project plans, an overall target of five percent is anticipated, with verification of purchase of materials equating to this target to be provided prior to or during the pre-construction meeting. See Section 6.1, for the construction waste management, coordination, and oversight measures that would be pursuant to this WMP.

5.0 OCCUPANCY WASTE GENERATION AND DIVERSION

The Project would be managed under the Applicant or its designee(s). The City's Storage Ordinance (SDMC Section 142.0801 et. seq.) requires the provision of separate bins for recyclable waste products to be separated from non-recyclable solid waste. Recycling containers would be provided at convenient locations throughout the development in compliance with the Storage Ordinance, meeting or exceeding the minimums shown in Tables 1 and 2. A minimum of 2,304 SF of recycling and non-recyclable solid waste storage areas would be distributed throughout the residential areas of the development, based on the 601 units proposed (refer to Table 1). A minimum of 192 SF of recycling and non-recyclable solid waste storage areas would be provided within the other areas of the development (i.e., clubhouse facilities, leasing building, parking structure, and storage building), based on an estimated gross floor area of 103,762 SF for these uses (refer to Table 2).

The Applicant, or its designee(s), would educate the vendor(s) for on-site custodial duties regarding the appropriate waste diversion program to ensure the proper handling of waste. Each vendor employee would be educated on the principles of proper waste handling and diversion to meet the Applicant's goal to reduce/reuse/recycle. The City's ESD provides a list of waste generation factors for the occupancy phase of development, included as Appendix D of this report. The estimated waste generation and diversion for the proposed residential and non-residential uses is shown in Table 7, *Estimated Annual Solid Waste Generation and Diversion Rates*. Because of their uses, the storage building and parking structure were not included in these generation rates.

Table 7
ESTIMATED ANNUAL SOLID WASTE GENERATION AND DIVERSION RATES

Land Use	Square Footage	Dwelling Units	Waste Generation Factor	Tons Generated (per year)	Expected Percent Diverted from Source-Separated Recycling[1,2]	Tons Diverted (per year)	Tons Disposed (per year)
Residential Units[3]	--	324	1.6	518.4	40	207.4	311
Multi-family Units[4]	--	277	1.2	332.4	40	133	199.4
Leasing Office/ Clubhouse	9,356	--	0.0017	15.9	40	6.4	0.5
Maintenance Building	2,406	--	0.0042	10.10	40	4	6.1
TOTAL	**11,762**	**601**	**--**	**876.8**	**40**	**350.7**	**526.1**

Source: City 2012 (Appendix D)
[1] Reflects compliance with existing City Storage Ordinance and City Recycling Ordinance.
[2] The Applicant would contract with City-approved recycling haulers and disposal facilities.
[3] Residential units include single family homes, row homes, and triplex units.
[4] Multi-family units includes E-Urban units

6.0 WASTE REDUCTION, RECYCLING, AND DIVERSION MEASURES

The Applicant is committed to waste reduction during all aspects of Project demolition, clearing, grading, construction, and operation, and would incorporate the Waste Diversion Measures (WDM) described below to ensure compliance with applicable solid waste disposal and waste reduction regulations and ordinances. Mandatory compliance with these measures shall be included in all Project contractor agreements, clearly reflected on Project plans, and verifiable by City ESD staff through written submittals and/or site inspections as described below.

6.1 CONSTRUCTION WASTE MANAGEMENT, COORDINATION, AND OVERSIGHT

a. Contractor Agreements and City Coordination

All WDM described herein shall be included as part of contractor agreements and clearly reflected on Project plans identifying activities required to be undertaken during demolition, clearing, grading, and construction. These measures shall also be provided in checklist format to City ESD staff prior to the initiation of any activities identified in the WMP. ESD staff shall be allowed access to the Project site, Project plans, and contractor education program meetings and materials (described below) to verify conformance with these measures.

b. Designation of a Solid Waste Management Coordinator

Prior to initiation of any construction, demolition, clearing, grading, or grubbing activities on site, the Applicant shall designate a Solid Waste Management Coordinator (SWMC) for the property with the authority to provide guidelines and procedures for contractor(s) and staff to implement waste reduction and recycling efforts. These responsibilities shall include, but are not limited to, the following:

- Prepare a Contractor Education Program on the waste separation and diversion/disposal procedures specified in this WMP. The Contractor Education Program shall contain, at a minimum, the following information:
  - Written and visual description of each waste type required to be source separated
  - Written and graphic description of how each waste type must be treated prior to and during source separation
  - Direction on which waste types go to mixed-debris facilities
  - Direction on which waste types go to Miramar Landfill
  - Direction on materials requiring special handling, such as hazardous materials
  - Contact designated contractor in case of questions or emergency
  - Contact at City ESD in case of questions or emergency
  - Phone number, address, and telephone contact information for each contracted hauler and disposal/diversion facility to be utilized
- Ensure the correct number and signage of bins, as specified in this WMP.
- Ensure a maximum five percent contamination by different waste types/non-recyclable materials by weight in the bins.
- Ensure no overtopping of bins occurs.
- Work with contractor(s) to refine estimated quantities of each type of material that would be recycled, reused, or disposed of as waste, then assist contractor(s) with documentation of that waste through receipts at each recycling and landfill facility identified in this WMP, or as otherwise agreed to by ESD staff.
- Issue stop work orders if procedures and standards specified in this WMP are not being followed/met.
- Coordinate with ESD and/or Mitigation Monitoring staff, including regular communication and invitations to the work site, and ensure appropriate staff members are involved at every stage.

- Ensure ESD staff attendance at the contractor education meeting and pre-construction meetings of each phase of the development.

c. Contractor Waste Management Training

The Project's SWMC or an ESD-approved contractor designee shall carry out Contractor Education Program presentations ensuring all Project personnel are trained regarding content and requirements of this WMP. Prior to beginning work on any portion of the Project, each member of the team, including all workers, subcontractors, and suppliers, shall be provided with a copy of the WMP, and undergo training on proper waste management procedures applicable to the Project.

- The Project's SMWC, or ESD-approved Contractor-designee shall carry out contractor waste management training presentations for each new group or individual hired, contracted, or assigned to work on the Project.

- The SMWC and/or Contractor-designee shall ensure that each person working on the Project has completed the waste management training by maintaining a written log to be signed and dated by each trainee upon completion of the training program. Copies of this written log, along with a list of all applicable personnel, shall be provided to City ESD staff for verification during each phase of Project activities.

d. Daily Site Inspections by Contractor(s)

The Project contractor(s) shall conduct daily inspections of the construction site to ensure compliance with the requirements of this WMP and with all other applicable laws and ordinances. Daily inspections shall include verifying the availability and number of dumpsters based on amount of debris being generated, verifying trash and recycled materials dumpsters are correctly labeled, ensuring proper sorting and segregation of materials, and ensuring excess materials are properly salvaged. The Project contractor(s) shall report the results of the daily site inspections to the SWMC.

e. Regular Removal of Waste Materials

The Project contractor(s) shall ensure removal of construction waste materials in sufficient frequency to prevent over-topping of bins. The accumulation and burning of on-site grading/land-clearing and construction waste materials shall be prohibited.

f. City Verification

The Applicant shall ensure a representative of the City's ESD attends pre-construction meetings prior to clearing, grading, and construction to ensure that the following items are verified:

- Material segregation, recycling, and reuse is occurring per the WMP;

- Asphalt/concrete material is being reused on site or transported to an appropriate facility for reuse;

- Grubbed materials are sent to a suitable green waste recycling facility;
- Contract documents have appropriate estimates and constraints to avoid “overbuying” construction materials;
- Contract documents specify methods to achieve five percent post-consumer content goal;
- Contamination levels (i.e., different waste types/non-recyclable materials) do not exceed five percent by weight;
- An appropriate diversion rate (as specified in this WMP) has been included on the deposit form;
- Contract documents specify agreements for each recyclable/reusable material type to be taken to an appropriate recycling/reuse facility, as specified in this WMP; and
- Minimum exterior refuse and recyclable material storage areas have been incorporated into Project plans, as a requirement of the City of San Diego Storage Ordinance (Municipal Code Section 142.0801 et. seq.).

6.2 CONSTRUCTION WASTE REDUCTION, DIVERSION COMPLIANCE, AND VERIFICATION

a. Identification, Separation, and Diversion of Recyclable/Reusable Materials

The Applicant shall ensure that:

- Throughout Project activities, waste materials shall be source separated on site into the appropriate bin based on materials type, according to the categories in this WMP. Materials generated during clearing, grading, and construction that would be source separated and recycled are listed below:
  - Mixed C&D (wood, dirt, concrete, drywall, brick, metals, rock, asphalt, tile, cardboard)
  - Metals
  - Concrete
  - Asphalt
  - Brick/Masonry
  - Wood
  - Drywall
  - Carpet/Carpet padding
  - Ceramic tile
  - Ceiling tile
  - Roofing materials

- A separate bin for each clean waste material type to be generated during each phase of demolition, clearing, grading, and construction activity shall be provided on the site, subject to the following requirements:

  - Containers shall be clearly labeled, with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.

  - The collection containers for recyclable grading/land-clearing and construction waste shall contain no more than five percent non-recyclable materials, by weight.

  - Regular visual inspections of dumpsters and recycling bins shall be conducted to remove contaminants.

  - Recycling areas shall be clearly identified with large signs. Lists of acceptable and unacceptable materials shall be posted on recycling bins and throughout the Project site and all recycled material signage shall be visible on at least two sides of haul containers.

  - Recycling bins shall be placed in areas that would be readily accessible and would minimize misuse or contamination. The SWMC shall be responsible for these efforts and they shall be reviewed at pre-construction meetings and/or during contractor education meetings, if conducted separately.

  - Recyclable and/or reusable waste materials collected in source-separated bins shall be diverted to recycling/reuse facilities as designated in Tables 5 and 6 of this WMP, or to another facility listed on the City's *2016 Certified Construction & Demolition Recycling Facility Directory*, should the designated facilities not be available.

b. Source Reduction Measures

Project contractors and subcontractors, in cooperation with the Project's SWMC and ESD staff, as applicable, shall coordinate to minimize the over-purchasing of construction materials to lower the amount of materials taken to recycling and disposal facilities. The Project shall minimize over-purchasing through purchase of pre-cut materials, whenever possible. The following steps shall be undertaken:

- Detailed material estimates shall be used to reduce risk of unplanned and potentially wasteful material cuts.

- Contractor and subcontractor material purchasing agreements shall include a waste reduction provision requesting that: materials and equipment be delivered in packaging made of recyclable material; vendors reduce the amount of packaging; packaging be taken back by vendors for reuse or recycling; and vendors take back all unused product. Contracts containing this language shall be made available to ESD staff during ESD site visits for inspection.

- Post-consumer content products shall be employed in the design and construction of the new facilities with the goal of achieving five percent post-consumer content materials. Efforts to use post-consumer content may include using products manufactured with post-consumer content materials (i.e., products that were bought, used, and recycled by consumers), such as natural textiles, aggregate, or concrete. Receipts demonstrating post-consumer content shall be provided to ESD staff at or prior to the pre-construction meetings.

- Prior to submittal, final Project plans shall indicate the anticipated source and quantity of materials to be reused on site, and the source, quantity, and percentage of post-consumer content waste products anticipated to be utilized for Project construction.

- Contractors shall include the anticipated source and quantity of post-consumer content products proposed for reuse or purchase in their project bid.

- Final Project plans inclusive of the information above shall be provided to ESD for verification.

6.3 OPERATIONAL WASTE MANAGEMENT AND DIVERSION MEASURES

The Applicant shall undertake and/or shall specify in contract language and/or sales/lease agreements with any tenant, operator, and/or future owner, a list of recycling requirements with which the Applicant or future tenants, operators, and/or owners shall be obligated to comply, including, but not limited to, the following:

- Recycling areas shall be clearly identified with large signs.

- Lists of acceptable and unacceptable materials shall be posted on recycling bins.

- All recycled material signage shall be visible on at least two sides of recycling containers.

- Recycling bins shall be placed in areas that would be readily accessible and would minimize misuse or contamination.

- Prepare and distribute recycling educational materials for inspection by ESD prior to certificate of occupancy.

- After materials are approved, distribute to all Project site owners/occupants.

- Green waste generated by ongoing landscaping and landscape maintenance activities shall be source separated by the landscaping contractor, and diverted to Miramar Greenery.

Prior to issuance of any certificate of occupancy/tentative certificate of occupancy, the Applicant shall invite a representative of the City ESD to:

- Inspect and approve storage areas that have been provided consistent with the City's Storage Ordinance;

- Ensure that a hauler has been retained to provide recyclable materials collection, and, if applicable, landscape waste collection; and

- Inspect and approve education materials for building tenants/owners that are required pursuant to the City's Recycling Ordinance.

For specialized product purchasing (e.g., with recycled content) to be used during occupancy, the Applicant shall provide for inspection by ESD the documentation that would be used to carry out this requirement.

7.0 CONCLUSION

As discussed under Regulatory Framework, a project may result in a significant direct impact under City CEQA Significance Thresholds if it generates more than 1,500 tons of solid waste materials during construction and demolition. Projects that include the construction, demolition, and/or renovation of 40,000 SF or more of building space or generate approximately 60 tons of waste or more, are considered to have potentially significant cumulative impacts on solid waste services. Further, AB 341 requires the diversion of 75 percent of solid waste, and mandatory provision of recycling collection service during occupancy.

7.1 SUMMARY OF WASTE GENERATION AND DIVERSION

During pre-construction demolition, clearing/grubbing, and grading, the Project would produce 31,265.7 tons of excavated soils, green waste, asphalt/concrete, and other C&D waste, and divert 25,284.5 tons of these materials from the landfill, as identified in Table 5. Approximately 5,981.2 tons of solid waste material generated during pre-construction is anticipated to be disposed of as non-recyclable/non-reusable waste at Miramar Landfill, for an overall pre-construction diversion rate of 81 percent.

During construction, the Project would produce 1,196.5 tons of solid waste (metal, concrete, asphalt, wood, drywall, carpet, carpet padding, mixed debris, and trash), and divert 991 tons of solid waste materials from the landfill, as identified in Table 6. The diverted material would consist of clean, source-separated (segregated) recyclable and/or reusable material, as well as mixed debris, to be deposited at the recycling/reuse facilities identified in the City's *2016 Certified Construction & Demolition Recycling Facility Directory* (Appendix B; City 2016a). Approximately 205.5 tons of solid waste material generated during construction is anticipated to be disposed of as non-recyclable/non-reusable waste at Miramar Landfill, for an overall diversion rate during construction of approximately 83 percent.

During occupancy, it has been estimated that the Project would generate 876.8 tons of waste per year, and would divert 350.7 tons per year to recycling/reuse facilities, resulting in an estimated 40 percent diversion of waste from the landfill, as identified in Table 7. These materials would consist of clean, recyclable materials, gathered in on-site recycling bins. Approximately 526.1 tons per year, or 60 percent of occupancy material generated, are estimated to be disposed of as non-recyclable/non-reusable waste at Miramar Landfill.

7.2 COMPLIANCE WITH CITY AND STATE REGULATIONS

Project compliance with City and State regulations is addressed below.

7.2.1 State of California

Based on the quantified waste generation and diversion rates discussed above, the Project would exceed the 75 percent solid waste diversion rate for waste produced during each of the construction phases. The Project would fail to meet the 75 percent waste reduction target annually once the buildings are occupied. This shortcoming is overcome by the following factors:

- The segregation proposed during pre-construction and construction would achieve an 80 and 83 percent diversion rate, respectively, exceeding the 75 percent target.
- The Project would incorporate mandatory waste reduction, recycling, and diversion measures as identified in Sections 6.1 and 6.2 of this WMP during pre-construction and construction, to further reduce solid waste impacts.
- Ongoing diversion of green waste (landscaping debris) to Miramar Greenery would avoid unnecessary contributions to Miramar Landfill.
- To minimize generation of waste materials, the Project would incorporate recycled, post-consumer content materials in interiors and exteriors, to the extent practicable.

In addition to these measures implemented during pre-construction and construction activities, the Applicant would commit to the recycling requirements identified in Section 6.3 of this WMP, to further reduce solid waste impacts during occupancy.

7.2.2 City of San Diego

Based on the quantified waste generation and diversion rates discussed above, the Project would result in a significant impact regarding the City's CEQA Significance Determination Thresholds for direct impacts to solid waste facilities during demolition and construction.

The Project would be above the City's threshold (generation of more than 1,500 tons of solid waste materials) for direct impacts to solid waste facilities during demolition and construction (5,981.25 + 205.5 = 6,186.5 tons C&D materials to Miramar Landfill).

Regarding cumulative impacts, the Project proposes greater than 40,000 SF of building space, and the Project would be above the City's 60-ton threshold for disposal of waste during C&D. During occupancy, the Project would achieve an average 40 percent diversion of waste via source-separated recycling and would dispose of approximately 526.1 tons of waste per year once the buildings are occupied. This would exceed the City's CEQA Significance Determination Threshold for cumulative impacts to solid waste services.

As mitigation, the City requires implementation of this document, a project-specific WMP, to identify measures for waste reduction. These exceedances would be overcome by the waste reduction achieved during construction, in addition to the measures specified in Sections 6.1 and 6.2 of this WMP, which would provide adequate waste management. The Project would exceed the 75 percent solid waste diversion rate for waste produced during demolition and construction phases by achieving 81 percent and 83 percent diversion rates, respectively. The Project would provide at least 2,496 SF of trash and recycling storage space, per the City Storage Ordinance (Tables 1 and 2). The Project would comply with the City Recycling Ordinance by providing adequate space, bins, and educational materials for recycling during occupancy, and would implement the measures provided in Section 6.3 to reduce waste generated once the development is occupied.

Upon compliance with waste diversion measures included in this WMP, plus implementation of sustainability and efficiency features, it is anticipated that the Project's contribution to cumulative solid waste generation would be reduced to a level that is less than cumulatively considerable.

8.0 REFERENCES

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Appendix A

ARCHITECTURAL SITE PLANS

Appendix B

2016 CERTIFIED CONSTRUCTION & DEMOLITION RECYCLING FACILITY DIRECTORY

Environmental Services

2016 Certified Construction & Demolition Recycling Facility Directory

These facilities are certified by the City of San Diego to accept materials listed in each category. Hazardous materials are not accepted. The diversion rate for these materials shall be considered 100%, except mixed C&D debris which updates quarterly. The City is not responsible for changes in facility information. Please call ahead to confirm details such as accepted materials, days and hours of operation, limitations on vehicle types, and cost. For more information visit: www.recyclingworks.com.

Please note: In order to receive recycling credit, Mixed C&D Facility and transfer station receipts must: *-be coded as construction & demolition (C&D) debris* *-have project address or permit number on receipt* **Make sure to notify weighmaster that your load is subject to the City of San Diego C&D Ordinance.* *Note about landfills: Miramar Landfill and other landfills do not recycle mixed C&D debris.*	Mixed C&D Debris	Asphalt/Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile/Porcelain	Clean Fill Dirt	Clean Wood/Green Waste	Drywall	Industrial Plastics	Lamps/Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
EDCO Recovery & Transfer 3660 Dalbergia St, San Diego, CA 92113 619-234-7774 | www.edcodisposal.com/public-disposal	65%											•					
EDCO Station Transfer Station & Buy Back Center 8184 Commercial St, La Mesa, CA 91942 619-466-3355 | www.edcodisposal.com/public-disposal	65%				•							•			•		
EDCO CDI Recycling & Buy Back Center 224 S. Las Posas Rd, San Marcos, CA 92078 760-744-2700 | www.edcodisposal.com/public-disposal	85%				•										•		
Escondido Resource Recovery 1044 W. Washington Ave, Escondido 760-745-3203 | www.edcodisposal.com/public-disposal	65%																
Fallbrook Transfer Station & Buy Back Center 550 W. Aviation Rd, Fallbrook, CA 92028 760-728-6114 | www.edcodisposal.com/public-disposal	65%				•										•		
Otay C&D/Inert Debris Processing Facility 1700 Maxwell Rd, Chula Vista, CA 91913 619-421-3773 | www.sd.disposal.com	77%																
Ramona Transfer Station & Buy Back Center 324 Maple St, Ramona, CA 92065 760-789-0516 | www.edcodisposal.com/public-disposal	65%				•										•		
SANCO Resource Recovery & Buy Back Center 6750 Federal Blvd, Lemon Grove, CA 91945 619-287-5696 | www.edcodisposal.com/public-disposal	65%				•										•		
All American Recycling 10805 Kenney St, Santee, CA 92071 619-508-1155 (Must call for appointment)						•											
Allan Company 6733 Consolidated Wy, San Diego, CA 92121 858-578-9300 | www.allancompany.com/facilities.htm					•										•		
Allan Company Miramar Recycling 5165 Convoy St, San Diego, CA 92111 858-268-8971 | www.allancompany.com/facilities.htm					•										•		
AMS 4674 Cardin St, San Diego, CA 92111 858-541-1977 | www.a-m-s.com								•									

	Mixed C&D Debris	Asphalt/Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile/Porcelain	Clean Fill Dirt	Clean Wood/Green Waste	Drywall	Industrial Plastics	Lamps/Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
Armstrong World Industries, Inc. 300 S. Myrida St, Pensacola, FL 32505 877-276-7876 (Press 1, Then 8) www.armstrong.com/commceilingsna								•									
Cactus Recycling 8710 Avenida De La Fuente, San Diego, CA 92154 619-661-1283 | www.cactusrecycling.com					•								•		•		•
DFS Flooring 10178 Willow Creek Road, San Diego, CA 92131 858-630-5200 | www.dfsflooring.com						•	•										
Enniss Incorporated 12421 Vigilante Rd, Lakeside, CA 92040 619-443-9024 | www.ennissinc.com		•	•						•	•							
Escondido Sand and Gravel 500 N. Tulip St, Escondido, CA 92025 760-432-4690 | www.weirasphalt.com/esg		•															
Habitat for Humanity ReStore 10222 San Diego Mission Rd, San Diego, CA 92108 619-516-5267 | www.sdhfh.org/restore.php				•													
Hanson Aggregates West – Lakeside Plant 12560 Highway 67, Lakeside, CA 92040 858-547-2141		•															
Hanson Aggregates West – Miramar 9229 Harris Plant Rd, San Diego, CA 92126 858-974-3849		•								•							
Hidden Valley Steel & Scrap, Inc. 1342 Simpson Wy, Escondido, CA 92029 760-747-6330															•		
HVAC Exchange 2675 Faivre St, Chula Vista, CA 91911 619-423-1855 | www.thehvacexchange.com															•		
IMS Recycling Services 2740 Boston Ave, San Diego, CA 92113 619-423-1564 | www.imsrecyclingservices.com					•								•				
IMS Recycling Services 2697 Main St, San Diego, CA 92113 619-231-2521 | www.imsrecyclingservices.com													•		•		
Inland Pacific Resource Recovery 12650 Slaughterhouse Canyon Rd, Lakeside, CA 92040 619-390-1418											•						
Lamp Disposal Solutions 1405 30th Street, San Diego, CA 92154 858-569-1807 | www.lampdisposalsolutions.com														•			
Universal Waste Disposal 8051 Wing Avenue, El Cajon, CA 92020 619-438-1093 | www.universalwastedisposal.com														•			
Los Angeles Fiber Company 4920 S. Boyle Ave, Vernon, CA 90058 323-589-5637 | www.lafiber.com						•	•										

	Mixed C&D Debris	Asphalt/Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile/Porcelain	Clean Fill Dirt	Clean Wood/Green Waste	Drywall	Industrial Plastics	Lamps/Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
Miramar Greenery, City of San Diego 5180 Convoy St, San Diego, CA 92111 858-694-7000 | www.sandiego.gov/environmental-services/miramar/greenery.shtml											•						
Moody's 3210 Oceanside Blvd., Oceanside, CA 92056 760-433-3316		•								•						•	
Otay Valley Rock, LLC 2041 Heritage Rd, Chula Vista, CA 91913 619-591-4717 | www.otayrock.com		•															
Reclaimed Aggregates Chula Vista 855 Energy Wy, Chula Vista, CA 91913 619-656-1836		•														•	
Reconstruction Warehouse 3650 Hancock St., San Diego, CA 92110 619-795-7326 | www.recowarehouse.com				•													
Robertson's Ready Mix 2094 Willow Glen Dr, El Cajon, CA 92019 619-593-1856		•								•						•	
Romero General Construction Corp. 8354 Nelson Wy, Escondido, CA 92026 760-749-9312 | www.romerogc.com/crushing/nelsonway.htm		•															
SA Recycling 3055 Commercial St., San Diego, CA 92113 619-238-6740 | www.sarecycling.com															•		
SA Recycling 1211 S. 32nd St., San Diego, CA 92113 619-234-6691 | www.sarecycling.com															•		
Vulcan Carol Canyon Landfill and Recycle Site 10051 Black Mountain Rd, San Diego, CA 92126 858-530-9465 | www.vulcanmaterials.com/carrollcanyon		•	•							•						•	

Appendix C

2016 CITY OF SAN DIEGO CONSTRUCTION & DEMOLITION (C&D) DEBRIS CONVERSION RATE TABLE

CITY OF SAN DIEGO

Construction & Demolition (C&D) Debris Conversion Rate Table

This worksheet lists materials typically generated from a constructionor demolition project and provides formulas for converting common units (i.e. cubic yards, square feet, and board feet) to tons. It is a tool that should be used for preparing your Waste Mangement Form - Part I, which requires that quantities be provided in tons.
Note: Weigh receipts are required for your refund request.

Step 1: Enter the estimated quantity for each applicable material in Column I, based on units

Step 2: Multiply by Tons/Unit figure listed in Column II. Enter the result for each material in Column III.
If using Excel version, column III will automatically calculate tons.

Step 3: Enter quantities for each separated material from Column III on this worksheet into the corresponding section of your Waste Management Form - Part I.

		Column I			Column II		Column III
Category	**Material**	**Volume**	**Unit**		**Tons/Unit**		**Tons**
Asphalt/Concrete	Asphalt (broken)		cy	x	0.70	=	
	Concrete (broken)		cy	x	1.20	=	
	Concrete (solid slab)		cy	x	1.30	=	
Brick/Masonry/Tile	Brick (broken)		cy	x	0.70	=	
	Brick (whole, palletized)		cy	x	1.51	=	
	Masonry Brick (broken)		cy	x	0.60	=	
	Tile		sq ft	x	0.00175	=	
Building Materials (doors, windows, cabinets, etc.)			cy	x	0.15	=	
Cardboard (flat)			cy	x	0.05	=	
Carpet	By square foot		sq ft	x	0.0005	=	
	By cubic yard		cy	x	0.30	=	
Carpet Padding/Foam			sq ft	x	0.000125	=	
Ceiling Tiles	Whole (palletized)		sq ft	x	0.0003	=	
	Loose		cy	x	0.09	=	
Drywall (new or used)	1/2" (by square foot)		sq ft	x	0.0008	=	
	5/8" (by square foot)		sq ft	x	0.00105	=	
	Demo/used (by cubic yd)		cy	x	0.25	=	
Earth	Loose/Dry		cy	x	1.20	=	
	Excavated/Wet		cy	x	1.30	=	
	Sand (loose)		cy	x	1.20	=	
Landscape Debris (brush, trees, etc)			cy	x	0.15	=	
Mixed Debris	Construction		cy	x	0.18	=	
	Demolition		cy	x	1.19	=	
Scrap metal			cy	x	0.51	=	
Shingles, asphalt			cy	x	0.22	=	
Stone (crushed)			cy	x	2.35	=	
Unpainted Wood & Pallets	By board foot		bd ft	x	0.001375	=	
	By cubic yard		cy	x	0.15	=	
Garbage/Trash			cy	x	0.18	=	
Other (estimated weight)			cy	x	estimate	=	
			cy	x	estimate	=	
			cy	x	estimate	=	
					Total All		

Appendix D

CITY OF SAN DIEGO WASTE GENERATION FACTORS – OCCUPANCY PHASE

Waste Generation Factors – Occupancy Phase

The following factors are used by the City of San Diego Environmental Services Department to estimate the expected waste generation in a new residential or commercial development.

Residential Uses
Residential Unit = 1.6 tons/year/unit
Multi-family Unit = 1.2 tons/year/unit

Example: To calculate the amount of waste that will be generated from a project with 100 new homes, multiply the number of homes by the generation factor.
100 single family homes x 1.6 = 160 tons/year
100 multi-family units x 1.2 = 120 tons/year

Commercial/Industrial Uses

General Retail	0.0028
Restaurants & Bars	0.0122
Hotels/Motels	0.0045
Food Stores	0.0073
Auto/Service/Repair	0.0051
Medical Offices	0.0033
Hospitals	0.0055
Office	0.0017
Transp/Utilities	0.0085
Manufacturing	0.0059
Education	0.0013
Unclassified Services	0.0042

Example: To calculate the amount of waste that could be generated from a new building with 10,000 square feet for offices and 10,000 square feet for manufacturing, multiply the square footage for each use by the generation factor.
10,000 square feet x 0.0017 = 17 tons/year
10,000 square feet x 0.0059 = 59 tons per year
Total estimated waste generation for building = 76 tons/year

2014000427

THE CITY OF SAN DIEGO

M E M O R A N D U M

DATE: November 17, 2016

TO: Morgan Dresser, Junior Planner, Development Services Department

FROM: Shelby Gilmartin, Junior Engineer, Long-Range Planning & Water Resources Division Shelby Gilmartin

SUBJECT: Water Supply Assessment for the Pacific Village Project (Project No. 470158 / SAP No. 24006477)

In response to your request, please find attached a Water Supply Assessment (WSA) for the Pacific Village Project approved by the Director of Public Utilities Department.

The Public Utilities Department (Department) prepared this WSA to assess whether sufficient water supplied is, or will be, available to meet the projected water demands of the Project. The findings verify that there is sufficient water supply to serve the existing water demands, projected water demands, and future water demands of the Project within the Department's water service area, in normal and dry year forecasts during a 20-year projection.

If you have any questions, please call me at (619) 533-5454.

SG/kw

Shelby Gilmartin

Attachment: Water Supply Assessment Report

cc: Ray Palmucci, Deputy City Attorney, Office of the City Attorney
Lan C. Wiborg, Deputy Director, Long-Range Planning & Water Resources Division
George Adrian, P.E. Program Manager, Long-Range Planning & Water Resources Division
Seevani Bista, P.E. Associate Engineer, Long-Range Planning & Water Resources Division

RMU 6.8.4

SD Public Utilities

WATER SUPPLY ASSESSMENT REPORT

Pacific Village Project

Prepared by:

City of San Diego Public Utilities Department

Reviewed by:

11/10/16

Halla Razak, Director
Public Utilities Department

Date

Prepared: November 2016

City of San Diego Public Utilities Department
Water Supply Assessment Report

Pacific Village Project

Table of Contents

Section 1 - Purpose

On January 1, 2002, Senate Bill 610 (SB 610) and Senate Bill 221 (SB 221) took effect. The intent of SB 610 and SB 221 was to improve the link between information on water supply availability and certain land-use decisions made by cities and counties. Under SB 610 (codified in the Water Code beginning at Section 10910), a water supply assessment (WSA) must be furnished to cities and counties for inclusion in any environmental documentation of projects (defined in the Water Code) that propose to construct 500 or more residential units, or that will use an amount of water equivalent to what would be used by 500 residential units, and are subject to the California Environmental Quality Act (CEQA). Under SB 221, approval by a city or county of certain residential subdivisions requires an affirmative written verification of sufficient water supply or water supply verification (WSV).

Not every project that is subject to the requirements of SB 610 is also subject to the mandatory water verification of SB 221 (e.g., if subdivision map approval is not required). Conversely, not every project that is subject to the requirements of SB 221 must also obtain a SB 610 water supply assessment.

A foundational document for compliance for both SB 610 and SB 221 is the Urban Water Management Plan (UWMP) of the relevant water agency. Both of these statutes repeatedly identify the UWMP as a planning document that can be used by a water supplier to meet the standards set forth in both statutes. Thorough and complete UWMPs will allow water suppliers to use UWMPs as a foundation to fulfill the specific requirements of the two statutes. Cities, counties, water districts, property owners and developers utilize this document when planning for and proposing new projects. It is crucial that cities, counties and water suppliers work closely when developing and updating these planning documents. The City of San Diego's 2015 UWMP, which is used as the basis for this Report (WSA), was adopted by the San Diego City Council in June 2016.

The City of San Diego Development Services Department (DSD) requested that the City of San Diego Public Utilities Department (Department) prepare this WSA as part of the environmental review for the Pacific Village Project (Project). A more detailed description of the Project is provided in Section 2 of this WSA. This WSA evaluates water supplies that are or will be available during normal, single-dry year, and multiple-dry water years during a 20-year projection to meet the projected demands of the Project, in addition to existing and planned future water demands of the Department. This WSA provides an assessment of the availability of sufficient water supplies for the Project only, and does not constitute approval of the Project.

This WSA also includes identification of existing water supply entitlements, water rights, water service contracts, or agreements relevant to the identified water supply for the Project and quantities of water received in prior years pursuant to those entitlements, rights, contracts and agreements.

This Report has been prepared in compliance with the requirements under SB 610 by the Department in consultation with DSD, the San Diego County Water Authority (Water Authority) and the Metropolitan Water District of Southern California (MWD).

Section 2 - Project Description

The proposed Pacific Village Project (Project) site is approximately 41.45 acres of currently developed land in the community of Carmel Mountain Ranch, in San Diego, California. Regional access to the site is from Interstate 15 (I-15) from the east. The site is bounded by Carmel Mountain Road to the north and west, and State Route 56 (SR 56) to the south. The existing structures and improvements (over 50 apartment buildings, 16-inch high priority gas line, and a sewer line easement) will be demolished and the area graded for the construction of 601 dwelling units. The proposed development consists of: 99 single family units, 105 triplex units, 120 townhouse units, and 277 apartments. Additional buildings and land uses onsite will include: a clubhouse/leasing office, maintenance building, storage building, and two swimming pools. The project includes proposed landscaping materials that are a mix of: recreational turf, moderate water use shrubs, low water use shrubs, and low water use vegetation for a bio-retention basin. The project site map is shown in Figure 2-1.

FIGURE 2-1
VICINITY MAP OF PROJECT

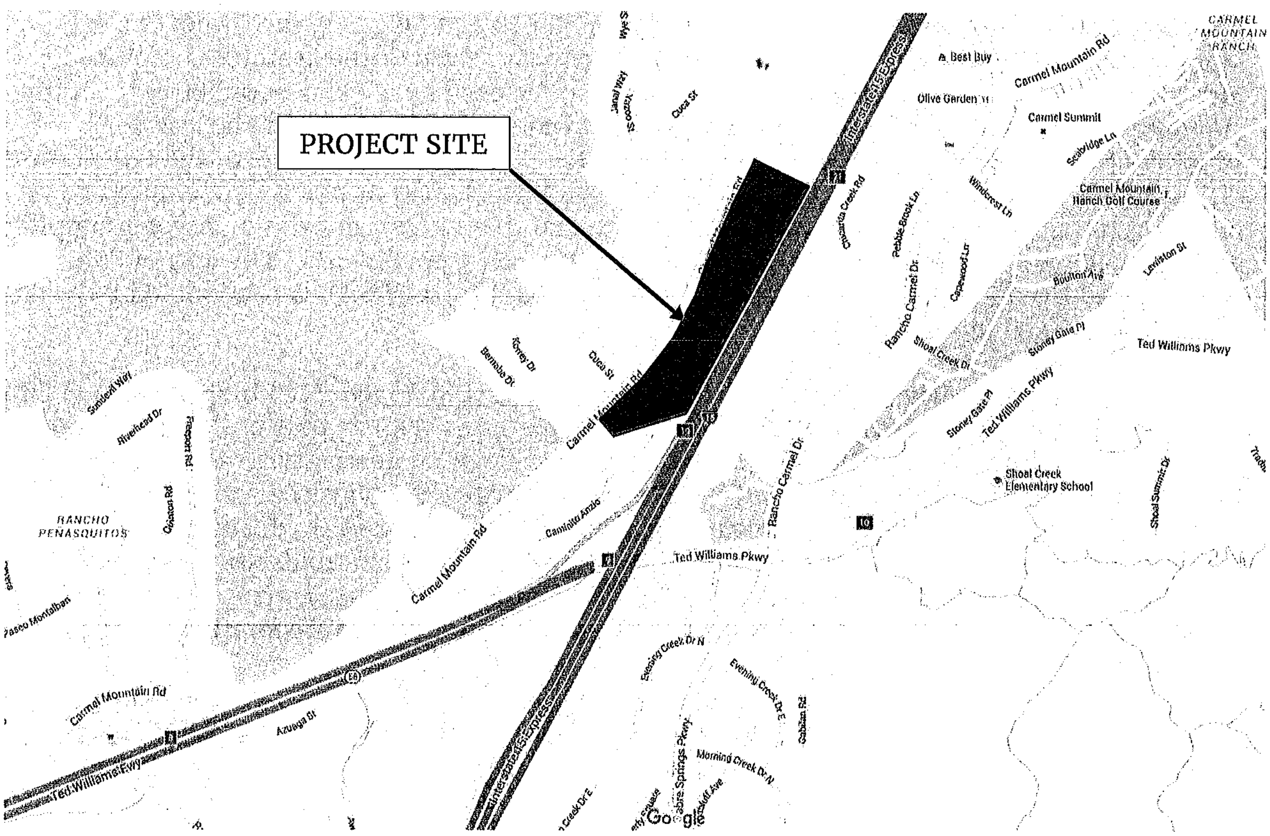

TABLE 2-1
PROJECT SITE AREA USES

Building Type	Number of Units	Number of Bedrooms
Single Family Units	99	4
Triplex Units	105	2 & 3
Townhouse Units	120	3 & 4
Apartments	277	1, 2, & 3
TOTAL	**601**	N/A
Building Type / Land Use	Area (SF)	
Leasing Office/Clubhouse/ Maintenance Building	11,762	
Swimming Pools	2,625	
Landscaping	439,497	

The Project will not be incorporating any specific water conservation measures beyond the California Plumbing Code requirements, nor will it be pursuing any Leadership in Energy and Environmental Design (LEED) certifications related to water use.

Section 3 - Findings

Water Assessment

Project: This Report identifies that the proposed water demand projections for the Project are included in the regional water resource planning documents of the City, Water Authority and MWD. Current and future water supplies, as well as actions necessary to develop the future water supplies, have been identified. This Report demonstrates that there will be sufficient water supplies available during normal, single-dry year, and multiple-dry water years over a 20-year projection to meet the unanticipated demands of the Project.

The Water Authority's 2015 UWMP provides for a comprehensive planning analysis at a regional level, and includes water use associated with accelerated forecasted residential development as part of its municipal and industrial sector demand projections. These housing units were identified by the San Diego Association of Government (SANDAG) land use plan in the course of its regional housing needs assessment, but are not yet included in existing general land use plans of local jurisdictions. The demand associated with accelerated forecasted residential development is intended to account for SANDAG's land use development currently projected to occur between 2040 and 2050, but has the likely potential to occur on an accelerated schedule. SANDAG estimates that this accelerated forecasted residential development could occur within the planning horizon (2015 to 2040) of the 2015 UWMP. These units are not yet included in local jurisdictions' general plans, so their projected demands are incorporated at a regional level. When necessary, this additional demand increment, termed Accelerated Forecasted Growth, can be used by member agencies to meet the demands of development projects not identified in the general land use plans.

As demonstrated in Table 3-1 of this Report, prepared by the Department in compliance with the requirements of SB 610, using the City's and Water Authority's 2015 UWMP based upon San Diego Association of Governments (SANDAG) Series 13 Forecast land use, there is sufficient water planned to supply the Project's estimated annual average usage. The projected water demands of the Project are 144,602 gallons per day (GPD) or 162.0 acre feet per year (AFY). In the City's 2015 UWMP, the planned water demands of this project site are 59,144 GPD or 66.2 AFY in 2040. However, because the historical billed water use at the site is already greater than the City's 2015 UWMP, and the City is able to meet this water demand, the billed value will be used for the demand calculation. The 5 year average (2011-2015) billed water use data from the City for the City is 113,844 GPD (127.5 AFY). As such, the remaining projected water demand is estimated to be 30,758 GPD or 34.5 AFY, and is accounted for through the Accelerated Forecasted Growth demand increment of the Water Authority's 2015 UWMP (refer to Appendix A at the end of this report). As documented in the Water Authority's 2015 UWMP, the Water Authority is planning to meet future and existing demands which include the demand increment associated with the accelerated forecasted growth. The Water Authority will also assist its member agencies in tracking the certified Environmental Impact Reports (EIRs) provided by the agencies which include water supply assessments that utilize the accelerated forecasted growth demand increment, to demonstrate adequate supplies for the development (refer to Appendix B at the end of the report). In addition, the next update of the demand forecast for the Water Authority's 2015 UWMP will be based on SANDAG's most recently updated forecast, which will include the Project.

Existing and Future Developments Planned to occur by 2040: The City's 2015 UWMP demonstrates there will be sufficient water supplies available to meet demands for existing and planned future developments that are projected to occur by 2040. Based on a normal water supply year, the estimated water supply projected in five-year increments for a 20-year projection will meet the City's projected water demand of 200,984 acre-feet[A] (AF) in 2020 to 273,408 AF in 2040 (**Table 6-6**) for these developments. Similarly, based on a single-dry year forecast (**Table 6-7**), the estimated water supply will meet the projected water demand of 290,292 AF (2040). Based on a multiple-dry year, third year supply (**Table 6-8**), the estimated water supply will meet the projected demands of; 208,665 AF (2020); 251,402 AF (2025); 275,139 AF (2030); 284,412 AF (2035); and 284,058 AF (2040).

TABLE 3-1
WATER DEMAND ANALYSIS

Projected Water Demands for Pacific Village Project				
Existing	**Area** (square feet)		**Gallons per Day**	**AFY**
Billed Water Use Data[8]	NA	NA	113,844	127.5
Proposed	**Area** (square feet)	**Quantity** (people/employees/ showers)	**Gallons per Day**	**AFY**
Single-family Units[2]	NA	99	35,600	39.9
Multi-family Units[1]	NA	502	88,352	99.0
Pools[4]	2,625	NA	1,313	1.5
Pool House (Showers)[5]	NA	66	660	0.7
Leasing Office/ Clubhouse/ Maintenance Building[6]	11,762	43	2,580	2.9
Landscaping[7]	439,497	NA	16,097	18.0
		Total	**144,602**	**162.0**
Net Water Demands				
Projected			144,602	162.0
Existing Water Use on Site from Billed Water Use Data			113,844	127.5
Planned from Water Authority's Accelerated Forecasted Growth			30,758	34.5
Net Unanticipated Demands			0	0

Table 3-1 Notes:

1. 80 gpcd is the City's standard for multi-family unit consumption (includes small landscaping water demands). The City's standard for multi-family housing is 2.2 persons per unit.

[A] An acre-foot of water equals 325,851 gallons, which is enough water for two average families of four for one year.

2. 116 gpcd is the City's standard for single-family unit consumption (includes small landscaping water demands). The City's standard for single-family housing density is 3.1 persons per unit.
3. The utilization of 60 gallons per person day is the City's standard for employment water use (includes nominal landscaping water demand).
4. Swimming pool water usage is estimated at 50gpd/100 square feet (American Society of Plumbing)
5. A pool load capacity is 1 pool user per 20 square feet (Title 24, Department of Health Services). Assuming a flow rate of 2gpm for the shower head, and an average 5 minute shower.
6. One (1) employee per 275 square feet is the City's standard for estimating employee density.
7. Landscaping demands were based on the City's Landscape Calculator: http://apps/sandiego.gov/landcalc/
8. The billed water use data is a 5-year average based on data from 2011-2015, obtained from the City of San Diego Customer Care Account Center.

Conclusion

In summary, these findings substantiate that there is sufficient water supply planned to serve this Project's future water demands within the Department service area in normal, single-dry year, and multiple-dry water year forecasts.

Therefore, this Report concludes that the projected level of water use for this Project is within the regional water resource planning documents of the City, the Water Authority and MWD. Current and future water supplies, as well as the actions necessary to develop these supplies, have been identified in the water resources planning documents of the Department, the Water Authority, and MWD to serve the projected demands of the Project, in addition to existing and planned future water demands of the Department.

Section 4 - City of San Diego Public Utilities Department

The City purchased its initial water system in 1901, from the privately owned San Diego Water & Telephone Company. Since then, continual expansion of the water system has been required to meet the demands of the growing population of the City. To meet the demand, the Department purchased a number of reservoirs between 1913 and 1935 to supplement local water supplies. Despite low annual precipitation in the area (approximately 10 inches per year), these reservoirs supplied the City's growing demands until 1940.

The need to import water emerged with the increased demand generated by the presence of the United States Navy prior to and during World War II, and the ensuing population growth. As a result, the Department and other local retail water distributors formed the Water Authority in 1944 for the purpose of purchasing Colorado River water from MWD. The Department and other local retail water distributors began receiving imported water from the Colorado River in 1947.

Today, the Department treats and delivers more than 170,000 AFY of water to approximately 1.38 million residents. The water system extends over 404 square miles, including 342 square miles in the City. The Department potable water system serves the City and certain surrounding areas, including both retail and wholesale customers. The Project is located within the Department service area.

In addition to delivering potable water, the City has a recycled water program. Its objectives are to: optimize the use of local water supplies, lessen reliance on imported water, and free up capacity in the potable system. Recycled water provides the City a dependable, year-round, locally produced and controlled water resource.

4.1 Overview of Potable System Facilities

The water system consists of: nine raw water storage facilities with over 569,000 AF of storage capacity, three water treatment plants, 32 treated water storage facilities, and more than 3,295 miles of transmission and distribution lines.

The Department maintains and operates nine local surface raw water storage facilities, which are connected directly or indirectly to the City's water treatment operations. The Lower Otay, Barrett and Morena Reservoirs (135,348 AF total capacity) service the Otay Water Treatment Plant in south San Diego; the El Capitan, San Vicente, Sutherland, and Lake Murray Reservoirs (396,357 AF total capacity) service the Alvarado Water Treatment Plant in central San Diego; and the Miramar Reservoir (6,682 AF total capacity) services the Miramar Water Treatment Plant in north San Diego. Lake Hodges Reservoir has a total capacity of 30,632 AF and is connected to Olivenhain Reservoir, which is owned by the Water Authority. Olivenhain Reservoir is connected to the Water Authority's second aqueduct. Through this connection, Hodges water can be delivered to all City treatment plants. The City has the ability to access 50 percent of the local water available in Hodges Reservoir via the Water Authority's delivery system.

The Department maintains and operates three water treatment plants with a combined total rated capacity 423,637 AFY (378.2 million gallons per day (MGD)). The Miramar Water Treatment Plant (Miramar WTP), originally constructed in 1962, has a rated capacity of 161,300 AFY (144 MGD), with the ability to increase to 240,830 AFY (215 MGD) after the replacement of the two old clearwells. Construction to replace the two old clearwells began in

June 2016, and is scheduled to be completed in July 2020. The Miramar WTP generally serves the City's geographical area north of the San Diego River (north San Diego). The Alvarado Water Treatment Plant (Alvarado WTP), operational since 1951, had an initial capacity rating of 134,417 AFY (120 MGD). Several hydraulic improvements and upgrades were completed in 2011, which increased the capacity of the plant to 224,028 AFY (200 MGD). The California Department of Public Health (CDPH) has approved this rating for the Alvarado WTP. The Alvarado WTP generally serves the geographical area from National City to the San Diego River (central San Diego). The Otay Water Treatment Plant (Otay WTP) was constructed in 1940, and has a current rated capacity of 38,309 AFY (34.2 MGD), which meets current and short-term forecasted demands. The Otay WTP has hydraulic capacity to increase to 67,209 AFY (60 MGD) in the future. In order to do so, approval from CDPH is required, based upon a future high filtration rate study. The Otay WTP generally serves the geographical area bordering Mexico (south San Diego) and parts of the southeastern portion of central San Diego. All upgrade work was completed in 2012 including the construction of a third flocculation and sedimentation basin, filter piping and media improvements.

The Department maintains and operates thirty one (31) treated water storage facilities including steel tanks, standpipes, concrete tanks and rectangular concrete reservoirs, with capacities varying from less than one to 35 million gallons.

The water system consists of more than 3,295 miles of pipelines, including transmission lines up to 84 inches in diameter and distribution lines as small as four inches in diameter. Transmission lines are pipelines 16 inches and larger in diameter that convey raw water to the water treatment plants and convey treated water from the water treatment plants to the treated water storage facilities. Distribution lines are pipelines 16 inches and smaller in diameter that directly service the retail users connected to a meter. In addition, the Department maintains and operates 50 water pump stations that deliver treated water from the water treatment plants to approximately 281,491 metered service connections in 130 individual pressure zones in the City's retail service area. The Department also maintains several emergency connections to and from neighboring water agencies, including the Santa Fe Irrigation District (Miramar WTP), the City of Poway (Miramar WTP), Olivenhain Municipal Water District (Miramar WTP), the Cal-American Water Company (Alvarado and Otay WTP), Sweetwater Authority (Otay WTP), and the Otay Water District (Otay WTP).

4.2 Overview of Recycled System Facilities

The City's recycled water system consists primarily of two water reclamation plants. With a combined total wastewater treatment capacity of 50,406 AFY (45 MGD), three recycled water storage facilities with over 12 million gallons (MG) of storage capacity, and more than 97 miles of transmission and distribution lines.

Located in the Miramar area, the North City Water Reclamation Plant (NCWRP) treats an average of 18,523 AFY (16.49 MGD) of wastewater, although the plant has an ultimate treatment capability of 33,604 AFY (30 MGD). In Fiscal Year (FY) 2016, a total of 6,851 AFY (6.09 MGD) was beneficially reused. The Department maintains and operates the Northern Service Area distribution system which consists of approximately 94 miles of recycled water pipeline, two reservoirs, and two pump stations. The City has completed Phase II of the Recycled Water Master Plan. This portion extends recycled water distribution along the Highway 56 corridor to the Carmel Valley area. By the end of FY 2016, 683 meters were served by the recycled water distribution system. In addition, there are plans to extend the recycled water distribution system through the Sorrento Mesa area, east of Highway 5, and north of Mira Mesa Boulevard. Public Utilities staff continues to work with potential "in-fill" customers interested in using recycled water for irrigation and/or industrial purposes, who are located within close proximity of the recycled water distribution system.

Located at the end of Dairy Mart Road, near the International Border with Mexico, the South Bay Water Reclamation Plant (SBWRP) treats an average of 8,200 AFY (7.30 MGD) of wastewater. The SBWRP has a treatment capability of 16,802 AFY (15.0 MGD). In FY 2016, an average of 3,743 AFY (3.33 MGD) was beneficially reused. The Department maintains and operates the Southern Service Area distribution system which consists of three miles of recycled water pipeline, one storage tank, one pump station and service to seven meters. Due to the limited size of the distribution system, the majority of the recycled water is sold to the Otay Water District.

Section 5 - Existing and Projected Supplies

The Department relies on imported water as its major water supply source, and is a Water Authority member agency. The Water Authority is a member agency of MWD. The statutory relationships between the Water Authority, MWD, and its member agencies, respectively, establish the scope of the Department's entitlements to water from these two agencies. Due to the Department's reliance on these two agencies, this Report relies and includes information on the existing and projected supplies, supply programs, and related projects of the Water Authority and MWD.

The City relies on the long-term water resources planning documents of the Water Authority and MWD to support the work on this Report. Please note that agencies must update their Urban Water Management Plans every five years. The 2015 UWMPs were completed and submitted to the State on July 1, 2016, and are the most current point of reference. The 2015 UWMP documents are available at the following websites and contacts:

San Diego County Water Authority – Contact:
Ms. Dana Friehauf, Water Resources Manager (858) 522-6749

http://www.sdcwa.org/uwmp

Metropolitan Water District of Southern California – Contact:
Ms. Grace Chan, Resource Planning & Development Manager (213) 217-6798

http://mwdh2o.com/PDF_About_Your_Water/2.4.2_Regional_Urban_Water_Management_Plan.pdf

Until the 1990s, the Water Authority was 95% dependent on imported water supplies from MWD to meet demands in the San Diego region. In 1991, the Water Authority faced a potential 50% cutback in supplies from MWD that was abated by the "March Miracle" rains. Immediately following, the Water Authority embarked upon an aggressive water supply diversification strategy coupled with an aggressive water storage program that has resulted in much greater water supply reliability for the region. Additionally, MWD has increased its regional storage ten-fold, and has provided financial incentives towards local water supply development by its member agencies. A brief overview of MWD and the Water Authority, including the Department relationship to these agencies, is included below.

A description of local surface and local recycled water supplies available to the Department can be found in Section 5.4 of this Report.

5.1 Metropolitan Water District of Southern California

Metropolitan Water District was created in 1928, under the authority of the Metropolitan Water District Act[B] (the "MWD Act"). MWD's primary purpose is to provide a supplemental supply of wholesale water for domestic and municipal uses to its constituent agencies. When Metropolitan began delivering water, its service area consisted of approximately 625 square miles. Its service area has increased by 4,575 square miles since that time. The expansion is primarily the result of annexation of the service areas of member agencies.

Today, MWD's service area comprises approximately 5,200 square miles. It includes portions of the six counties of: Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura. There are 26 member agencies of MWD, consisting of 14 cities, 11 municipal water districts and the San Diego County Water Authority (Water Authority). The Water Authority is MWD's largest customer, purchasing or exchanging 28.3 percent of all water flowing through MWD's system[C].

A Board of Directors, currently numbering 38 members, governs MWD. Each constituent agency has at least one representative on the MWD Board. Representation and voting rights are based upon the assessed valuation of property within each constituent agency. The Water Authority has four members represented on the MWD Board with 17.47 percent of the weighted vote. The total population of the MWD service area is currently estimated at more than 19 million.

MWD's existing water supplies have been historically sufficient to meet demands within its service area during years of normal precipitation. Although MWD plans and manages reserve supplies to account for normal occurrences of drought conditions, regulatory actions, including, but not limited to, restrictions under the Federal and California Endangered Species Acts, have at times placed limitations on MWD's ability to provide water to its member agencies.

In the future, population growth, regulatory restrictions, and other factors such as climate change could impact MWD's ability to supply its member agencies even in normal years. However, it is important to note that the cost of MWD's water supplies is approaching a point at which the development of local water supplies is increasingly cost-competitive. As such, major initiatives are underway by retail water agencies to develop local water supplies and reduce MWD deliveries. This suggests that a new scenario may be emerging in which MWD may have surplus water supplies on a more regular basis as its member retail water agencies increasingly roll off imported water supplies in favor of available, more reliable, local water supplies.

<u>MWD Water Supply</u>

The Water Authority has preferential rights to 18.42 percent of MWD's water supplies, which currently include water from its two sources the Colorado River and the State Water Project (SWP).

<u>Colorado River Water:</u> The Colorado River was MWD's original source of water after its establishment in 1928. MWD owns and operates the 242 mile-long Colorado River Aqueduct,

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[B] California Statutes 1927, Chapter 429, as reenacted in 1969 as Chapter 209, as amended
[C] http://www.mwdh2o.com/PDF_Who_We_Are/2015-MWD-Annual-Report-web.pdf, page 139

which starts at Lake Havasu in Arizona and terminates at Diamond Valley Lake in Riverside County.

Under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the "Law of the River" that govern the use of water from the Colorado River, California is entitled to 4.4 million acre-feet of Colorado River water annually. Additionally, California is entitled to one-half of any surplus water that may be available for shared use with Arizona and Nevada as determined on an annual basis by the United States Secretary of the Interior. Under the priority system that governs the distribution of Colorado River water made available to California, MWD holds the fourth (4^{th}) priority right of 550,000 acre-feet per year, and a fifth (5^{th}) priority right of 662,000 acre-feet per year. MWD's fourth priority right is within California's basic annual apportionment of 4.4 million acre-feet; however, the fifth priority right is outside of this entitlement and is not considered a firm supply of water. MWD also retains a "call" on 100,000 acre-feet per year on water transferred to the Coachella Valley Water District and the Desert Water Agency, if needed, so long as they pay for the financial obligations associated with the water during the call period.

Several fish and other wildlife species either directly or indirectly have the potential to affect Colorado River operations, thus changing the amount of water deliveries to the Colorado River Aqueduct. A number of species that are on either "endangered" or "threatened" lists under the federal and/or California endangered species acts (ESAs) are present in the area of the Lower Colorado River. MWD and other stakeholder agencies have developed a multi-species conservation program that allows MWD to obtain federal and state permits for any incidental take of protected species resulting from current and future water and power operations of its Colorado River facilities, and to minimize any uncertainty from additional listings of endangered species.

In order to maximize the potential for Colorado River supplies, MWD has established partnering opportunities with the Imperial Irrigation District to fund and implement a joint agricultural conservation program. This program provided 105,000 acre-feet additional water supplies in FY 2015 during drought conditions[D]. Additionally, MWD has partnered with the Palo Verde Irrigation District in a voluntary Land Management and Crop Rotation Program that provided an additional 65,000 acre-feet of Colorado River supplies in FY 2015.

State Water Project: The State Water Projects is owned by the State of California and operated by the State Department of Water Resources (DWR). The SWP's source waters originate in Northern California with water captured from the Feather River Watershed behind Lake Oroville Dam. The Oroville Dam releases water into the Feather River which is tributary to the Sacramento River, where it combines with other drainages from the western Sierras in the Sacramento-San Joaquin River Delta east of the San Francisco Bay Estuary. MWD receives water pumped from the Harvey O. Banks Pumping Plant in the southern portion of the Sacramento-San Joaquin River Delta, via the 444 mile-long California Aqueduct, to four delivery points near the northern and eastern boundaries of MWD. MWD is one of 29 agencies that have long-term contracts for water service from DWR, and is the largest agency in terms of the number of population served, the share of SWP water to which it is entitled, and the total amount of annual payments made to DWR. MWD's contract with DWR provides for the ultimate delivery of up to 1,911,400 acre-feet per year (46 percent of the total SWP entitlement). The SWP was originally intended to meet demands of 4.2 million acre-feet per year. Initial SWP facilities were completed in the early 1970s, and it was envisioned that

[D] http://www.mwdh2o.com/PDF_Who_We_Are/2015-MWD-Annual-Report-web.pdf, page 27 additional facilities would be constructed as contractor demands increased. Several factors, including public opposition, increased costs, and increased non-SWP demands for limited water supplies, combined to delay the construction of additional facilities.

The quantity of SWP water available for delivery each year is controlled by hydrology, environmental and operational considerations. In addition to its importance to urban and agricultural water users, the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta) is of critical ecological importance. The Bay-Delta is the largest estuary on the west coast of the United States and provides habitat for more than 750 plant and animal species. One-hundred-fifty (150) years of human activity have contributed to the destruction of habitat, the decline of several estuarine and anadromous fish species, and the deterioration of water quality. These activities include: increasing water demands from urban and agricultural uses, the dredging and filling of tidal marshes, the construction of levees, urban runoff, agricultural drainage, runoff from abandoned mines, and the introduction of non-native species, thus affecting the supply and reliability of this source.

DWR has altered the operations of the SWP to accommodate species of fish listed under the ESAs. These changes in project operations have reduced SWP deliveries. The impact on total SWP operations attributable to the ESA listed Delta smelt and salmon species biological opinions combined is estimated to be one million acre-feet in an average year, reducing SWP deliveries from approximately 3.3 million acre-feet to approximately 2.3 million acre-feet for the year under average hydrology. The reduction in SWP deliveries attributable to these biological opinions can vary greatly depending on the level of precipitation and are estimated to range from 0.3 million acre-feet during critically dry years to 1.3 million acre-feet in above normal water years. SWP deliveries to contractors for calendar years 2008 through 2012 were reduced by a total of approximately 2.3 million acre-feet as a result of pumping restrictions.

The year 2016 proved to be an extremely difficult water year for California as it endured a fifth year of drought and record high temperatures. The MWD Board of Directors established a 15 percent restriction of supply deliveries on its member agencies while Governor Edmund G. Brown Jr. issued Executive Order B-29-15 that directed the State Water Resources Control Board (State Water Board) to impose restrictions on urban water suppliers statewide to achieve a statewide 25 percent reduction in potable urban usage through February 2016.

California Water Fix

The California Department of Water Resources (DWR) is in the process of introducing a plan known as the *California Water Fix.* Which would construct 35 miles of twin tunnels capable of transferring 9,000 cubic feet per second of freshwater from three intake facilities north of the Delta to the expanded Clifton Court Forebay located south of the Delta. There two pumping plants would be constructed to maintain optimal water levels in the forebay for the existing State Water Project (SWP) and Central Valley Project (CVP) pumping facilities to better facilitate water exports during times of large rain events.

The proposed project is expected to provide additional water supply reliability for water importers, although the benefits will still be weather dependent.

CALIFORNIA WATER FIX
RELIABLE CLEAN WATER

The Governor's actions were unprecedented and placed a requirement on the City of San Diego to reduce its demands by 16 percent as compared to 2013 water demands. Other retail water agencies within the San Diego region had conservation standards of between 8 and 36 percent, depending on the amount of conservation already achieved by each agency. A weighted average of the conservation standards placed on all retail water agencies within the Water Authority's service territory equated to a 20 percent reduction in demands region-wide. The State Water Board estimated that a 25 percent statewide reduction in demands would result in a reduction in demands of 1.2 million acre-feet during the 270 days of the emergency order.

A mandated 16 percent reduction in San Diego's demands translated to a reduction in sales of approximately 35,000 acre-feet per year, which San Diego was able to accomplish. On November 13, 2015, Governor Brown issued Executive Order B-36-15 calling for an extension of urban water use restrictions until October 31, 2016, should drought conditions persist through January 2016. The State Water Board modified the restrictions at its February 2, 2016 meeting to allow credit to a water agency's conservation standard for growth, climate and the development of local drought-resilient supplies, with a cap of 8 percent total credit. The City of San Diego was credited 8 percent for the development of desalinated seawater supplies at Carlsbad. As a result, San Diego's conservation standard was reduced from 16 percent to 8 percent.

The 2016 water year began with an improved water supply picture. With runoff from spring storms boosting reservoir levels, DWR increased its SWP water delivery estimate to 60 percent of requests for the calendar year. As a result, MWD lifted allocations to its member agencies on May 10, 2016. On May 18, 2016, the State Water Board adopted a statewide water conservation approach that allows urban water supplies to replace their prior state-assigned percentage target reduction with a localized "stress test" approach based on a showing of whether they have at least a three-year water supply under extended drought conditions.

5.2 San Diego County Water Authority

The Water Authority service area lies within the foothill and coastal areas of the westerly third of San Diego County, encompassing 952,208 acres (1,488 square miles). When the Water Authority was established in 1944, its service area consisted of 94,707 acres. Of the total population of San Diego County, 97 percent live within the Water Authority's service area. Growth has primarily resulted from the addition and annexation of service areas by member agencies. The City, with a population of approximately 1.38 million served and a service area of 210,726 acres, is by far the Water Authority's largest member agency and customer.

The Water Authority's service area is a semi-arid region where the natural occurrence of water from rainfall and groundwater provides a firm water supply for only a small portion of the water demands of the current population. Since 1990, the Water Authority has provided an average of 85 to 91 percent of the water supply within its service area. As a wholesaling entity, the Water Authority has no retail customers, only water delivery, storage and treatment services to its member agencies.

The Water Authority's mission is to provide its member agencies with a safe and reliable water supply. Historically, the principal source of supply for the Water Authority's service area has been water purchased from MWD for sale to the Water Authority's member agencies. However, drought conditions and population growth in the Water Authority's service area have highlighted the need for diversification of the region's water supplies. Consistent with its mission statement, the Water Authority has actively pursued a strategy of supply diversification that includes the acquisition and importation of additional water supplies, the development of additional local water supply projects and augmentation of its water supply via local and regional water storage capacity.

Water supplies utilized within the Water Authority service area originate from two sources: (1) water imported by the Water Authority and (2) local supplies (such as local runoff, groundwater, recycled water and seawater desalination). Until 2015, local supplies have constituted an average of 15 percent of the Water Authority's water supplies. As of December 2015, 50 MGD of desalinated seawater has been added to the mix of local supplies from with the region, boosting local supplies to an average of approximately 25 percent. Although MWD remains the Water Authority's largest source of imported water, recent years have also seen the diversification of sources of imported water through core and spot water transfers with other agencies.

The Quantification Settlement Agreement (QSA) for the Colorado River was completed in October 2003. This historic agreement was enacted to help settle disputes regarding the persistent over-drafting of the state's 4.4 million acre-foot basic annual apportionment of Colorado River water. The agreement includes a long-term transfer of conserved water from the Imperial Irrigation District to the Water Authority. The QSA also commits the state to a restoration path for the environmentally sensitive Salton Sea and provides full mitigation for these water supply programs. Specific programs under the QSA that directly benefit the Water Authority include the San Diego County Water Authority-Imperial Irrigation District water transfer agreement, which currently transfers 100,000 acre-feet of high priority Colorado River water to the Water Authority and will provide up to 200,000 acre-feet of water a year through water conservation measures in Imperial Valley in 2021. The QSA also allows for the transfer of water from the Imperial Irrigation District (IID), for water conserved through the implementation of the Water Authority performed projects to install concrete linings on portions of the previously earthen All-American and Coachella Canals. The canal lining projects reduced the losses of water that historically occurred through seepage. MWD assigned to the Water Authority its right to develop approximately 77,700 acre-feet of conserved Colorado River water annually.

The QSA ensures that the San Diego region receives a minimum of seventy-five years of stable Colorado River water supplies. On November 5, 2003, the IID filed a validation action in Imperial County Superior Court, seeking a judicial determination that thirteen agreements associated with the San Diego County Water Authority-Imperial Irrigation District water transfer and the QSA are valid, legal and binding. Other lawsuits also were filed contemporaneously challenging the execution, approval and implementation of the QSA on various grounds. All of the QSA cases were coordinated in the Sacramento Superior Court. A final judgment, invalidating 11 of the 13, agreements in Phase 1 of the trial was entered on February 11, 2010, and subsequently appealed. On December 7, 2011, the Court of Appeal issued its opinion reversing the judgment and remanding to the trial court for further proceedings. The appellate Court decision resolved many issues in the case, including the validity and constitutionality of the QSA. Trial on compliance with the California Environmental Quality Act was held in November 2012. On June 4, 2013, the court validated the 2003 QSA and related twelve agreements regarding transfers and exchanges of Colorado River water between southern California water agencies. The IID, Coachella Valley Water District, MWD, and Water Authority all sought validation of the agreements from the court under California Water Code section 22762 and California Code of Civil Procedure section 860 et seq., quantifying the amount of Colorado River water each agency may divert and subsequently transfer. The court found the agreements to be valid and adopted in compliance with the requirements of the Brown Act and the California Environmental Quality Act (CEQA).

The ruling represents the latest chapter in the longstanding dispute regarding the diversion and use of California's apportionment of the Colorado River under state and federal law.

In late November 2012, the Water Authority's Board of Directors approved a 30-year Water Purchase Agreement with Poseidon Resources, a private investor-owned company, to purchase water from the proposed Carlsbad Desalination Plant, which is a fully-permitted ocean desalination plant and conveyance pipeline. The plant began producing 50 million gallons a day in December 2015, and is now generating enough water to meet between ten and fourteen percent of the region's current demands[E].

In addition to developing its own regional supplies of water, the Water Authority has also encouraged the development of additional local water supply projects such as water recycling and groundwater projects, through the award of Local Water Supply Development (LWSD) incentives of up to $200 per acre-foot for recycled water and groundwater produced and beneficially reused within the Water Authority's service area. The purpose of the Water Authority's LWSD program is to promote the development of cost-effective water recycling and groundwater projects that prevent or reduce a demand for imported water and improve regional water supply reliability. The LWSD Program reimburses member agencies for all, or a portion of the difference between the actual per acre-foot cost of producing recycled water, and the revenue generated by the LWSD participant through the sale of that acre-foot of recycled water (not to exceed $200 per acre-foot). In February 2008, the program was expanded to include funding for local brackish and seawater desalination projects. However, funding for new LWSD program projects is no longer appropriated in the Water Authority's budget.

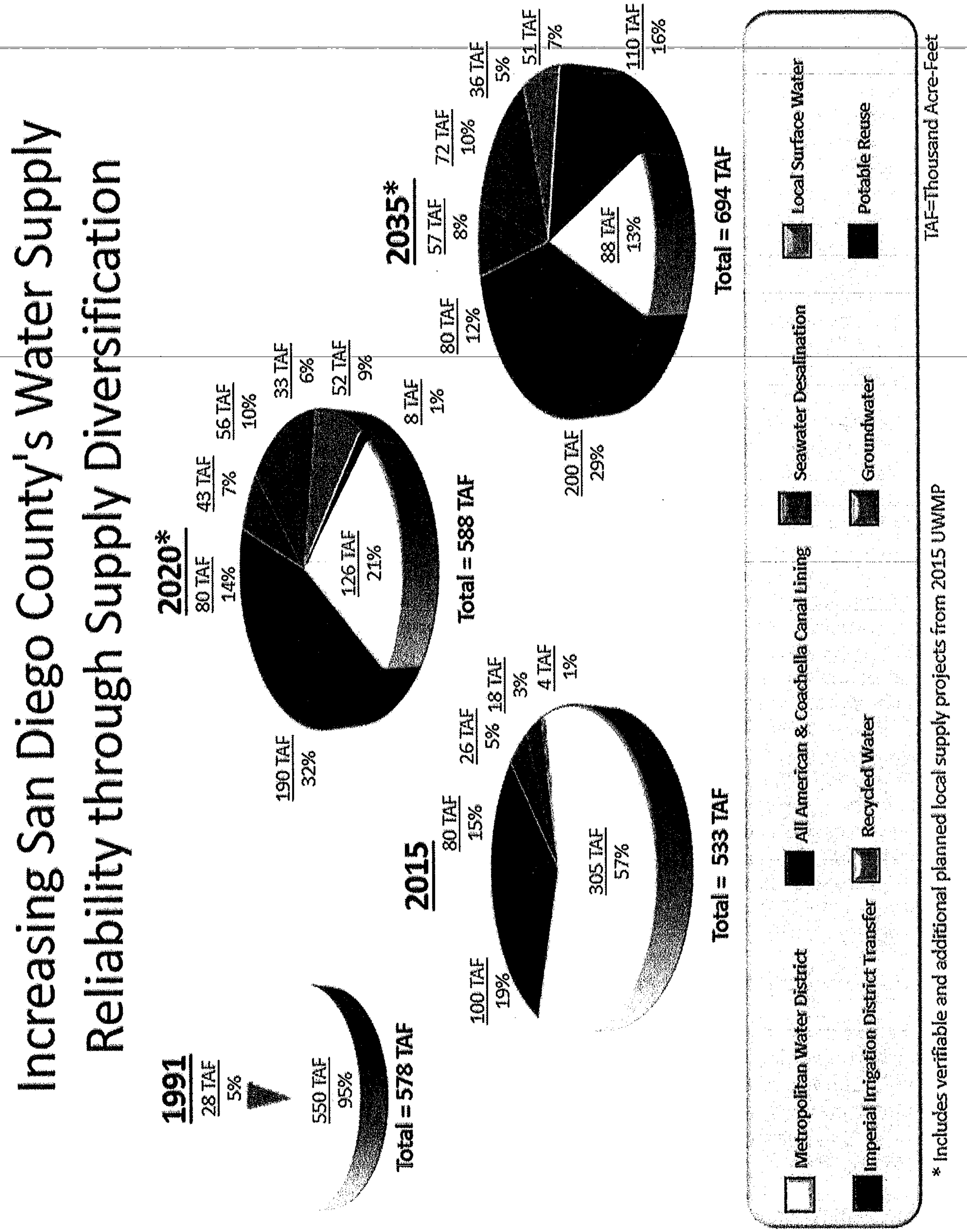
In addition to the region's investments in new supplies, the Water Authority has also undertaken a multi-phased Emergency Storage Program that built one new dam (Olivenhain, 2003), and raised another (San Vicente, 2015), to increase emergency and carryover storage in the region by 176,000 acre-feet. The Water Authority began filling San Vicente in 2015. The additional in-region storage capacity will allow the Water Authority and its member agencies to be prepared for emergency conditions and also to buffer against dry year reductions in deliveries from imported supplies.

As a result of the efforts undertaken by the Water Authority and its member agencies to diversify supplies and augment local storage, the region was able to certify supply sufficiency and achieve a zero percent conservation standard in response to the State Water Board's May 18, 2016 adopted rule requiring stress test analyses[F].

[E] http://carlsbaddesal.sdcwa.org/

[F] http://www.sdcwa.org/regional-supply-sufficiency

FIGURE 5-1
SAN DIEGO COUNTY WATER AUTHORITY'S WATER SUPPLY DIVERSIFICATION



5.3 2009 Comprehensive Water Package

On November 4, 2009, the California State Legislature passed a comprehensive package of water legislation (the "2009 State Water Legislation") that included five bills (four of which were subsequently signed by Governor Schwarzenegger) addressing California's statewide water situation, with particular emphasis on the San Francisco Bay/Sacramento-San Joaquin-Delta (Bay-Delta). The 2009 State Water Legislation included an urban water conservation mandate of twenty percent for most localities in the State by 2020 (also known as the "20x2020 requirement"), and new regulations establishing strategic monitoring of groundwater levels around the state. The 2009 State Water Legislation also created two new governmental agencies – the Delta Stewardship Council and the Sacramento-San Joaquin Delta Conservancy. The Delta Stewardship Council is charged with developing and implementing a Delta Plan, which would include the Bay Delta Conservation Plan, upon meeting certain conditions. The Sacramento-San Joaquin Delta Conservancy will implement ecosystem restoration activities in the Bay-Delta. In addition, the 2009 State Water Legislation included legislation addressing unauthorized Bay-Delta water diversions. At this time, it is not known what effect the 2009 State Water Legislation will have on future water supplies.

Additionally, the 2009 Legislation package included an $11.1 billion State general obligation bond measure. The water bond measure was originally certified to be on the State's 2010 ballot, but was subsequently pulled due to unfavorable public polling. That same bond measure was subsequently delayed twice. During the previous 2013-2014 legislative session, several bills were introduced with the intent of reducing and reconfiguring the dedicated expenditures in the original water bond measure. In late 2014, the legislature introduced the "Water Quality, Supply, and Infrastructure Improvement Act of 2014," which proposed a trimmed down version of the 2009 bond measure for a total of $7.5 billion. It was subsequently placed on the November 4, 2014 statewide ballot as Proposition 1, and approved by voters. Proposition 1 is a general obligation bond measure to fund a variety of state water supply infrastructure projects, such as public water system improvements, surface and groundwater storage, drinking water protection, water recycling and advanced water treatment technology, water supply management and conveyance, wastewater treatment, drought relief, emergency water supplies, and ecosystem and watershed protection and restoration. The bond funds will be distributed through a competitive grant process overseen by various state agencies, including the Department of Water Resources, the State Water Resources Control Board, and the California Water Commission. The State is in the process of developing and adopting guidelines for the various funding programs contained in Proposition 1. Some have been completed (such as the Water Recycling Funding Program/WRFP), and others are still in development (such as the Water Storage Investment Program/SWIP).

5.4 Public Utilities Department

The Department currently purchases approximately ninety percent of its water from the Water Authority, which supplies the water (raw and treated) through two aqueducts consisting of five pipelines. While the Department imports a majority of its water, it uses four local supply sources to meet or offset potable demands: local surface water, groundwater, conservation, and recycled water (see Figure 5-1: San Diego County Water Authority's Water Supply Diversification).

The availability of sufficient imported and regional water supplies to serve existing and planned uses within the Department service area is demonstrated in the prior discussion on the water supply reliability of MWD and the Water Authority. The City has been receiving water from the Water Authority since 1947, and during the last twenty years purchased between 155,300 and 228,300 AFY. For CY 2016 water purchases totaled approximately 155,300 AF. Depending upon demands, growth and the success of local water supply initiatives, this could remain somewhat constant, or increase up to a projected maximum of 295,998 AFY in 2035 during normal years. For the purpose of this analysis the maximum is used.

5.4.1 Demonstrating the Availability of Sufficient Supplies

Imported Supplies

Section 5, Subdivision 11, of the County Water Authority Act, states that the Water Authority "as far as practicable, shall provide each of its member agencies with adequate supplies of water to meet their expanding and increasing needs." Depending on local weather and supply conditions, the Water Authority provides between 75 to 95 percent of the total supplies used by its 24-member agencies. As mentioned in Section 4, the Public Utilities Department and other local retail water distributors formed the Water Authority in 1944 for the purpose of purchasing Colorado River water from the MWD.

Local Surface Water Supplies

The Department maintains and operates nine local surface raw water storage reservoirs which are connected directly or indirectly to water treatment operations. In the San Diego region, approximately thirteen percent of local precipitation produces surface run-off to streams that supply Department reservoirs. Approximately half of this run-off is used for the municipal water supply, while the remainder evaporates during reservoir storage. In very wet years, the run-off remainder may spill over the reservoir dams and return to the Pacific Ocean. Average rainfall produces less than half of the average run-off in San Diego. The local climate requires about average rainfall to saturate the soils sufficiently for significant surface run-off to occur. Therefore, most of the run-off to reservoirs is produced in years with much greater than average rainfall. Some flooding may occur even during average or below average rainfall years if the annual rainfall is concentrated in a few intense storms.

The use of local water is affected by availability and water resource management policies. The Department's policy is to use local water first to reduce imported water purchases and costs. The Department also operates emergency and seasonal storage programs in conjunction with its policy.

The purpose of emergency storage is to increase the reliability of the imported water aqueduct system. This is accomplished by maintaining an accessible amount of stored water that could provide an uninterrupted supply of water to the City's water treatment facilities, should an interruption to the supply of imported water occur. The management of reservoirs is guided by Council Policy 400-04, which outlines the City's Emergency Water Storage Program. The policy mandates that the Department store sufficient water in active, available storage to meet six-tenths (6/10) of the normal annual (7.2 months) City water demand requirements (conservation is not included). Active, available storage is that portion of the water that is above the lowest usable outlet of each reservoir.

The monthly emergency storage requirement changes from month-to-month, and is based on the upcoming seven months water demand. This results in a seasonally fluctuating emergency storage requirement, generally peaking in April and reaching its minimum in

October. This seasonally fluctuating requirement makes a portion of the required emergency storage capacity available for impounding or seasonal storage.

The purpose of seasonal storage is to increase imported water supply. This is done by storing surplus imported water in the wet winter season for use during the dry summer season. This may also be accomplished by increased use of imported water in lieu of local water in the winter when local water may be saved in reservoirs or groundwater basins for summer use. In addition to increased water yield, this type of seasonal operation also reduces summer peaking on the imported water delivery system.

Drought Management

On January 17, 2014, California Governor Jerry Brown declared a drought in California. This prompted water agencies to enact drought response measures. The City of San Diego implemented Drought Response Level 1 on July 1, 2014, and then Level 2 on November 1, 2014 to help meet the Governor's call to conserve water. On April 1, 2015 Governor Brown issued Executive Order B-29-15 mandating water reductions across the State of California. In response, the State Water Resources Control Board issued water use restrictions for immediate implementation, resulting in a sixteen percent reduction target for the City of San Diego, compared to 2013 usage, effective June 1, 2015 through February 28, 2016. The City of San Diego implemented stricter irrigation schedules and pursued aggressive enforcement of drought related water use restrictions, and as a result achieved an average seventeen percent reduction from 2013 usage. Such stricter schedules include:

- Water before 10 am or after 6 pm, on two assigned days per week only, and for only 5 minutes per station when using a standard irrigation system.
- Turn off irrigation during rain events, and for at least 48 hours following significant rainfall.
- Stop operating ornamental fountains except for maintenance.

In February 2016, California's State Water Resources Control Board (SWRCB) revised the City's conservation target down to 8 percent, reflecting actual population growth and implementation of alternative water supplies. However, due to El Nino storms filling northern California reservoirs close to capacity levels, the SWRCB allowed water agencies to submit individual certifications attesting to their ability to meet future water demands; specifically, for water demands for the next three years, assuming that they will be dry years. The City submitted its certification based on the CWA's assessment, stating that regionally there is enough water to meet the demands for the next three years. The SWRCB accepted this certification, thus eliminating any reduction goal for the City. Additionally, the SWRCB is developing long-term water use efficiency goals, as required by the Governor's recent mandate.

Conservation

The Department's Water Conservation Program is effective in promoting permanent water savings. Established by the City Council in 1985, the Water Conservation Program accounts for more than 13,793 acre-feet of potable water savings in FY 2015. This savings has been achieved by creating a water conservation ethic, adopting programs, policies and ordinances designed to promote water conservation practices, and implementing comprehensive public information and education campaigns.

The City offers a broad range of conservation methods to help meet the needs of our residential and commercial water customers. These include, but are not limited to, the following:

- Rebate programs for high efficiency toilets, washing machines and residential and commercial water saving devices
- Rebates for replacing grass with water wise landscapes, micro-irrigation systems and weather based irrigation controllers
- Rain barrel and downspout redirection rebates
- Graywater rebates
- Incentives to replace malfunctioning pressure regulating valves
- Indoor commercial water use surveys
- Residential interior/exterior and commercial landscape survey programs
- Public education and outreach

Research conducted by the City, the Water Authority, and the Water Research Foundation has shown that prior to the current drought, more than half of residential water-use is outdoors. Therefore, the City added outdoor conservation programs to focus on water efficient landscaping and irrigation management, which provide the best opportunity to achieve significant water savings.

Tools and services available for customers include:

Commercial and Residential Water-Use Survey Programs — this service includes an account for all water-use on the property. The surveyor also checks to see if the irrigation system is functioning properly and for uniform coverage. On average, residential surveys result in a savings in water of fifteen percent, while commercial surveys, depending on type of facility, can achieve 15 to 25 percent water savings.

The Water Conservation Section teamed up with the Transportation & Storm Water Department to include rain barrels and downspout redirects as items that can receive rebates. Rain barrels are used to collect rainwater from hard surfaces such as household rooftops, while downspout redirects are used to channel rain water to landscape areas rather than draining into the streets. When citizens install a rain barrel at their home, they are helping to maintain a healthy urban watershed by reducing the demand on the potable water system, while also reducing the amount of wet weather runoff that is collected and sent into the public storm water system.

'San Diego Municipal Code (SDMC) 67.06 Water Submeters' was adopted in April 2010, to encourage water conservation in multi-family residential and mixed-use buildings by requiring the use of water submeters for each individual residential unit. Billing individual residential units based on the actual amount of water consumed in the unit creates a financial incentive for residents of multi-family residential units to conserve water.

Planning efforts to increase water conservation is an ongoing process. The aforementioned water conservation programs undergo periodic reevaluation to ensure the realization of forecasted savings. Additionally, changes in water conservation technologies may require reassessment of long-range plans. The Department continues to work with proven water conservation programs, while including irrigation management programs to maximize water savings; regularly examines new technologies and annually checks progress toward conservation goals; and, continues to work collaboratively with MWD and the Water Authority to formulate new conservation initiatives. The City's most recent water conservation report, is available at http://www.sandiego.gov/water/pdf/purewater/2014/fy14annualwater140101.pdf. The report provides an ongoing assessment and status update, redirecting or enhancing efforts as needed. The programs outlined in the document undergo periodic reevaluation to ensure the realization of forecasted savings.

Recycled Water Supplies

In FY 2016, the beneficial reuse of the recycled water was 10,278 AF (6,719 AF from the NCWRP and 3,559 AF from the SBWRP). Landscape irrigation continues to be the leading use of the recycled water, however, the customer base has become more varied over the years with an increase in the number of industrial and dual plumbed meter connections.

Proactive marketing activities targeting existing irrigation customers to encourage them to convert their cooling systems to recycled water, coupled with outreach efforts to connect new customers have been successful. Recycled water meter connections have increased over 63 percent since 2007. By the end of FY 2016, the City is providing recycled water service to 685 retail meters and 5 wholesale meter connections, including the City of Poway, Olivenhain Municipal Water District (3 connections) and Otay Water District. The FY 2016 top ten retail customers included: the City of San Diego Park & Recreation Department, Santaluz Golf Course, Miramar Marine Corps Air Station, Black Mountain Ranch and Del Sur Community Home Owners Association (HOA), El Camino Memorial Park, California Department of Transportation (Caltrans), the Irvine Company, University of California - San Diego (UCSD), Village Nurseries, and La Jolla Colony Association.

In FY 2016, financial incentives from the sale of recycled water resulted in over $1.9 million in savings towards imported water purchases. The financial incentives are a result of the Local Water Supply Development Program and the Local Resources Program agreements with the Metropolitan Water District and the San Diego County Water Authority.

The Department, in cooperation with the Park & Recreation Department, has aggressively pursued the retrofitting of City parkland, street landscaping and open space to use recycled water for irrigation; sites fronting recycled water distribution pipelines were targeted. In 2007 only 23 recycled water meters were serving City sites; by the end of FY 2016, that number has grown to 113 meter connections.

Public Utilities Department's Capital Improvement Program

The Department reevaluates the Water projects contained in the Capital Improvements Program (CIP) and the timing thereof periodically. Changes to the CIP are made to reflect changing priorities within the water system and occur as a result of project scope changes, date revisions, project sequencing, and operational considerations. The Department expended approximately $812 million from July 1, 2007, through June 30, 2016 on CIP projects. Improvements included projects to upgrade and expand water treatment plants, rehabilitate raw and treated water storage facilities, construct major transmission pipelines, replace and/or upgrade existing pump stations, replace cast iron water mains citywide, expand the recycled water system, and other new supply initiatives. In November 2015, the City Council adopted water rate increases of 9.8 percent that began on January 1, 2016, and subsequent water rate increases of 6.4 percent that began on July 1, 2016. These rate increases will provide needed revenue to fund the upgrade and expansion of the water system in order to ensure a reliable water supply for all City residents, and to meet Department of Public Health mandates.

The Department updated the water facilities master plan in December 2015, and has identified ninety projects through the master planning effort for CIP implementation from fiscal years 2016-2035. The prioritization of CIP projects is based on the adopted City Council Policy 800-14 (CP 800-14).

Summary of Supplies

Historic imported water deliveries from the Water Authority to the Public Utilities Department and local surface water, groundwater, conservation savings and recycled water deliveries are shown in **Table 5-1.**

Table 5-1
Historic Imported, Local and Recycled Water Demands*
Public Utilities Department

Fiscal Year	Imported Water (acre-feet)	Local Surface Water (acre-feet)	Conservation[1] (acre-feet)	Recycled Water (acre-feet)	Groundwater (acre-feet)	Total[2] (acre-feet)
1990	233,158	22,500	-	-	-	255,658
1995	162,404	59,024	8,914	-	-	230,342
2000	207,874	39,098	17,410	3,250	-	267,632
2005	204,144	26,584	29,410	4,294	-	264,432
2010	188,337	13,117	34,317	12,173	500	248,444

Table 5-1 Notes:
[1]Conserved water results in savings and is not a direct supply.
[2]Total includes water supplied and conserved.
*Includes retail and wholesale demands

5.4.2 Plans for Acquiring Additional Supplies

Future Supplies

The Department completed the City Council approved 2012 Long-Range Water Resources Plan (2012 LRWRP) on December 10, 2013. The 2012 LRWRP is a high level strategy document that evaluates water supply and demand-side objectives against multiple planning objectives. The 2012 LRWRP was an open participatory – stakeholder driven process that evaluated over twenty water supply options such as water conservation, recycled water, groundwater storage, brackish groundwater desalination, rainwater harvesting, graywater and potable reuse. The plan takes a long-range viewpoint through the year 2035 in addressing risk and the uncertainty of future water supply conditions. It is a plan that sets the tone or direction of where the City places its efforts in developing local water supplies.

Conservation and water recycling programs have been implemented and are under investigation for ways to be expanded or increased. The Department is also investigating the development of groundwater and potable reuse.

Conservation

Like many agencies in California, the City is committed to reducing its per capita water consumption by at least twenty percent by the year 2020. Aside from the existing programs listed in Section 5.4.1 of this report, the City is also implementing the following programs to help reduce overall water consumption:

Conservation-oriented rate structures – A new rate structure, which took effect in January 2014, added a fourth new tier for single-family residential customers that recognizes water conservation efforts, and increases the rates for higher tiers to discourage high volume usage. The City Council voted to maintain this four tier residential rate structure through FY 2019.

Advanced Metering Infrastructure (AMI) – The Department has completed the installation of a citywide AMI fixed network, and the installation of all AMI meters is expected to be completed by February 2018. Data from the AMI system/endpoint became available to customers and customer service staff in July 2016. This information gives customers an additional tool to manage their water use and help detect leaks.

Recycled Water

Recycled Water Study:

The Recycled Water Study was presented and unanimously accepted by the City Council on July 17, 2012, following a three-year effort that included extensive stakeholder involvement. The Study can be located at the following link:
http://www.sandiego.gov/water/pdf/waterreuse/2012/recycledfinaldraft120510.pdf.

During the 2008 to 2010 Point Loma Wastewater Treatment Plant (Point Loma WTP) permit modification process, San Diego Coastkeeper and the San Diego Chapter of the Surfrider Foundation, entered into a Cooperative agreement with the City to conduct the Recycled Water Study (Study). In accordance with the agreement, the San Diego Coastkeeper and the San Diego Chapter of the Surfrider Foundation did not oppose the United States Environmental Protection Agency's (USEPA) decision to grant the permit modification. The City Council authorized the execution of the Cooperative Agreement on February 18, 2009. The modified

Permit allowed Point Loma WTP to continue operating as a chemically enhanced primary treatment facility (CEPT) for five years until the permit expired on July 31, 2015. The permit must be renewed rather than upgrading the treatment system to meet secondary standards as required in the Federal Clean Water Act. The interim regulators administratively continue the present permit until final action on the renewal is taken. The Study concluded meeting all terms of the Agreement with Coastkeeper and Surfrider. The Recycled Water Study identified five Reuse Alternatives. Non-Potable Reuse, Indirect Potable Reuse, and wastewater off-load to the Point Loma WTP are the common components of each of the five alternatives. All reuse alternatives presented in the study achieve the study goals, provide a bold vision for the future water reuse in the Metro Service Area, and provides potential savings to ratepayers. For additional details on the Reuse Alternatives, please see the Recycled Water Study Report Dated July 2012, in the above link.

Potable Reuse:

Potable Reuse is an approach the City is considering for maximizing the use of recycled water. Recycled water that is used for non-drinking uses, like irrigation and industrial processes, would undergo advanced water purification (AWP) to render it safe for reuse as a drinking water supply. The AWP process uses multiple treatment barriers to remove contaminants from the water and prevent them from re-entering the water supply. It begins with membrane filtration, followed by reverse osmosis, and ends with advanced oxidation. The result is purified water that meets all drinking water standards, and is similar in quality to distilled water. There are two major types: Indirect Potable Reuse (IPR) and Direct Potable Reuse (DPR). With IPR, the purified water is sent to an environmental buffer; for the City's IPR concept, San Vicente Reservoir would be the environmental buffer. The water in San Vicente is treated at a drinking water treatment plant before it is distributed for drinking purposes. Direct potable reuse differs in that there is no environmental buffer. The California Department of Public health is mandated to determine the feasibility of establishing DPR regulations. Industry experts expect that DPR regulatory criteria to include the use of additional treatment or engineered storage barriers to compensate for the absence of an environmental buffer. The City is monitoring the development of DPR regulations and how they might influence the viability of potable reuse implementation.

Water Purification Demonstration Project:

In order to assess the feasibility of indirect potable reuse with reservoir augmentation (IPR/RA), the City initiated a Water Purification Demonstration Project (Demonstration Project). The Demonstration Project evaluated the feasibility of using advanced water purification (AWP) technology to produce water that can be sent to San Vicente Reservoir, subsequently treated, and later be distributed as potable water. As part of the Demonstration Project, the City tested and operated a one-million gallon per day demonstration-scale AWP Facility from June 2011 to August 2012. The purified water was routinely tested to determine the effectiveness of the treatment equipment, and operating data was gathered to develop a cost estimate for full-scale facilities. A study of San Vicente Reservoir was also conducted to establish residence time and short circuiting conditions of the purified water in the reservoir. An extensive public outreach and education program was implemented to educate the public about the potential benefits and implications of an IPR/RA project. The City also coordinated with the State's regulatory agencies to help define the requirements for an IPR/RA project.

The Final Project reports have been completed and are available at the following link: www.purewatersd.org/projectreports. The Demonstration Project reports were presented to full City Council on April 23, 2013. The City Council adopted the Demonstration Project Reports, and directed staff to determine a preferred implementation plan and schedule that considers potable reuse options for maximizing local water supply and reduced flows to the Point Loma Wastewater Treatment Plant. This follow on effort, now known as the Pure Water San Diego Program, is described in more detail below.

Pure Water San Diego Program:

The Department's Pure Water San Diego Program (Program) is a multi-year program ending in the year 2035. The program will create a safe and reliable local water supply through potable reuse, while reducing the Point Loma Wastewater Treatment Plant's ocean discharges and accomplishing secondary equivalency.

Potable reuse is an approach that would allow the City to maximize the use of recycled water. Recycled water that is used for non-drinking uses like irrigation and industrial processes, would undergo advanced water purification (AWP) to render it safe for use as a raw water supply. The AWP process uses multiple treatment barriers to remove contaminants from the water and prevent them from re-entering the water supply. It begins with ozone/BAC, membrane filtration, followed by reverse osmosis, and ends with advanced oxidation. The result is purified water that meets all drinking water standards and is similar in quality to distilled water.

Pure Water will be implemented in two or three phases. The first phase which consists of 30 MGD advanced water purification facility will be located in the northern part of the City. The other two phases may be located either all in the central area, or may be split between central and southern areas. Decision on the location for phase two will be made once evaluations of benefits and challenges associated with each location is determined. Under all scenarios the water will be treated again at a drinking water plant before being distributed for consumption.

Other ongoing Pure Water work includes designing the treatment and conveyance facilities, finalizing the method for water-wastewater cost allocation, continued outreach and education, and working closely with regulatory and other key stakeholders.

The City's application for a National Pollution Discharge Elimination Permit (modified permit) was received by the United States Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board (RWQCB) in January 2015. The current permit expired on July 31, 2015, and in the interim, regulators administratively continue the present permit until final action on the renewal is taken. On October 28, 2016, the USEPA and RWQCB announced their tentative decision to approve the renewal of the modified permit, citing the benefits of the Pure Water Program as a new source of potable water, while also reducing the discharge to the ocean. This action initiated the public hearing process that will culminate in a final decision expected by mid-2017. Pure Water is integral to both the application to renew Point Loma's Permit and the proposed permanent solution for future permits to be considered a secondary equivalent.

This comprehensive effort will provide a secure and reliable long-term local water supply for San Diego, while resolving the decade's long issues associated with Point Loma WTP.

Groundwater

There are several groundwater basins in the San Diego region that the City has rights, concerns, jurisdiction and an interest in developing for municipal supply or other beneficial use. These basins are:

- San Pasqual Valley Basin
- Mission Valley Basin
- Santee/El Monte Basin
- San Diego Formation (includes the Sweetwater Valley Basin, Otay Valley Basin, and Tijuana Basin)[G]

The City of San Diego is committed to protecting its groundwater resources and preserving its established Pueblo water rights throughout the San Diego River Basin and in the San Diego Formation, which extend outside the municipal boundary. This right attaches to it, the use of all surface waters and groundwater of the streams that flowed through the original pueblo, including their tributaries, from their source to their mouth. The City's Pueblo right protects its ability to extract water from the basin to the extent of the needs of its inhabitants.

The City is presently assessing the development of all of its groundwater resources. While the City has no immediate plan to extract basin groundwater, it has stated its intent to develop the right and has asserted its right to develop any and all available groundwater needed for its inhabitants. The location of groundwater wells throughout the basin can be viewed as evidence of the City's intent, ability and preliminary efforts to develop basin groundwater resources.

The groundwater quality from these basins is predominantly brackish. Improved technologies provide consideration of affordable water sources, such as brackish groundwater, that were not available a few decades ago. Groundwater is a viable alternative and is part of the City's planning efforts. Local water supply projects, particularly groundwater exploration, benefit City rate payers, offer drought protection, and are locally controlled.

The City is the Monitoring Entity for the San Pasqual Valley Basin as identified by the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Working cooperatively with the California Department of Water Resources (DWR), the City established a network of monitoring wells for CASGEM to regularly and systematically track seasonal and long-term trends in groundwater elevations for this alluvial groundwater basin. Included in the monitoring network plan are three multi-level monitoring wells that were installed by the United States Geological Survey (USGS) under a cooperative agreement with the City. Participation in the statewide CASGEM program allows basin groundwater data to be maintained and readily available through DWR's public data base.

Also, work with DWR on the Sustainable Groundwater Management Act (SGMA) of 2014 provides a framework for sustainable management of groundwater supplies by local authorities. Local agencies involved in the implementation must form local groundwater sustainability agencies within two years. For agencies in basins deemed high or median

[G] A Basin modification Application was submitted to the California Department of Water Resources (DWR) requesting a modification to the boundaries of the basins within the San Diego Formation as defined by DWR Bulletin 118. The modification was approved July 2016, and the three basins were consolidated to include the whole of the underlying San Diego Formation aquifer as a groundwater basin – referred to as the "Coastal Plan of San Diego."

priority, groundwater sustainability plans must be adopted by 2022, and critically overdrafted basins by 2020. By 2040, groundwater agencies in critically overdrafted basins should achieve sustainable groundwater management to avoid undesirable results, such as chronic depletion of groundwater, reduction of groundwater storage, degradation of water quality, depletion of surface water, or subsidence.

In general, the groundwater basins in the San Diego region are characterized by stable groundwater levels. Groundwater quality is often brackish, with total dissolved solids (TDS), chloride, and sodium impairing its use as a potable supply.

Groundwater Basin Descriptions

The San Pasqual Valley Basin is an alluvial aquifer that underlies the designated agricultural preserve San Pasqual Valley. San Pasqual Valley Basin is valued for its groundwater and surface water resources. Nearly all the land overlaying San Pasqual Valley Basin is owned and managed by the City. Much of this property is leased to individuals for various agricultural and commercial land uses. The San Pasqual Valley Basin is located approximately 25 miles northeast of downtown San Diego. The total surface area of the groundwater basin is approximately 4,540 acres, with storage capacity of 58,000 acre-feet, and a safe yield of approximately 5,800 acre-feet per year.

The City has completed several feasibility studies to understand the enhancement of the long-term sustainability and quality of surface and groundwater within the basin. Currently, the City is exploring synergistic opportunities for *regional water use* amongst North County agencies and water districts surrounding the San Pasqual Valley Basin. The City continues to explore opportunities for protecting the groundwater resources for beneficial uses, including: water supply, agriculture, and the environment.

The City has been investigating the Mission Valley groundwater Basin. Topographically, Mission Valley is a narrow, east-west trending valley carved out by the San Diego River as it drains westward from Mission Gorge to the Pacific Ocean. The most conducive portion of the aquifer lies within the extent of an historical well field where the City has retained ownership of the property and where a substantial portion is overlain by Qualcomm Stadium and its parking lot.

In 1963 a fuel tank farm was built in Mission Valley at the mouth of Murphy Canyon, known as Mission Valley Terminal (MVT). Underground fuel contamination was suspected to being in 1986. From 1986 to 1991, approximately 200,000 gallons of gasoline was released underground from the MTV located upstream of Qualcomm Stadium and contaminated the aquifer. The contamination extended from the tank farm, beneath Qualcomm property, to approximately where Interstate 805 crosses the San Diego River. Although remediation of the Mission Valley Basin has been ongoing for a period of time, the City is waiting for remediation to be complete before resuming its plans for development of the aquifer for municipal supply. The City settled litigations regarding the spill in June 2016.

The City has been producing groundwater from the Santee/El Monte Basin, which is located in the upper reach of the San Diego River. The City's existing San Vicente production well was constructed in 2004 and pumps a maximum of 600 gallons per minute. The well conveys groundwater directly to the City's existing raw water line and ultimately to the City's Alvarado Treatment Plant.

The San Diego Formation is a coastal plain, groundwater basin covering much of National City and the City of Chula Vista in the southern portion of San Diego County. The San Diego Formation is a confined groundwater basin that underlies the Otay Valley Basin, Sweetwater Valley Basin, and Tijuana Basin as identified by DWR in Bulletin 118. The City desires to use the San Diego Formation for groundwater municipal supply and seeks to manage the safe yield of the groundwater system in a prudent and efficient manner.

The City has been investigating the San Diego Formation for many years to gain a better understanding of the Basin and its possibilities. The City has been better able to characterize the water quality and quantity in the San Diego Formation through aquifer testing and monitoring well installation that have occurred since 2007. In addition, the City has been working with the USGS to develop an integrated and comprehensive understanding of the geology and hydrology of the San Diego Formation, and to use this understanding to evaluate a sustainable, long-term environmentally sound use of the basin for municipal supply.

In 2013, Sweetwater Authority reached an agreement with the City to share potable water from the Richard A. Reynolds Desalination Facility, after its expansion, and jointly fund the project. This project proposes to increase the capacity of the brackish groundwater desalination facility from 3,600 AFY to 8,800 AFY. Under the terms of this agreement, the City will receive 50 percent of any water produced over 3,600 AFY at the facility. Beginning in 2020, the projected volume will be approximately 2,600 AFY. Even with the projected supply reaching 2,600 AFY, the City is assumed to average 1,900 AFY. Sweetwater Authority will be responsible for owning, constructing, and operating the brackish groundwater desalination facility.

Section 6 - Projected Demands

Approximately every three years the Public Utilities Department (Department) calculates projected water demands within its service area for planning purposes. A computer model is used (IWR-MAIN) to break down water-use by major water-use sectors: Commercial, Industrial, Residential and Public uses. Using past water-use data from the Department and demographic data provided by SANDAG land use, the model is able to correlate the data to determine sector water demands. Using this correlated data, future demographic data is used to project water demands. The model also accounts for water conservation, weather and water rate changes.

In addition to the Department, the Water Authority and MWD use regional growth forecasts to calculate projected water demands within their respective service areas. This provides for consistency between the retail and wholesale agencies projected water demands, thereby ensuring that adequate supplies are being planned for the Department's existing and future water users. The SANDAG forecasts are based on adopted community plan land use, but not citywide zoning. SANDAG forecasts the number of residents, dwelling units, and employees in an area, but not square footage, hotel rooms, or visitors (non-residents or non-employees). For urban areas the smallest forecast geography is typically at the block level, but for suburban and less developed areas the forecast geography can be larger. SANDAG typically updates the regional growth forecast every three to four years. The Department water demand projections, based on the SANDAG Series 13 Forecast land use, are incorporated in the City's 2015 UWMP. These projections are then forwarded to the Water Authority for use in the preparation of their UWMP, which is further incorporated into MWD's UWMP to calculate the ultimate water demands of the region (see **Figure 6-1**).

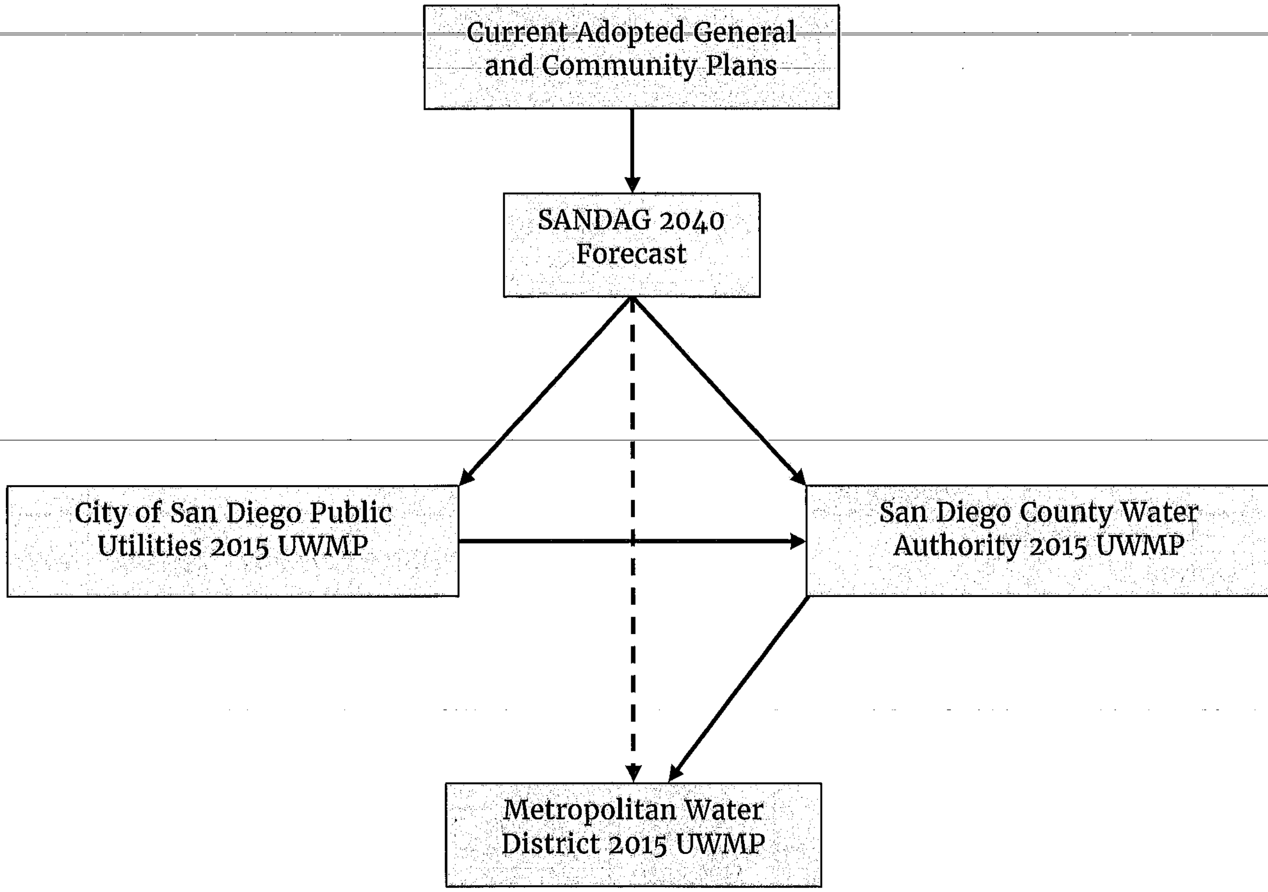
Recently, water demands for the City have been greatly suppressed due to mandatory water use restrictions and public education that were put in place by the City as a result of the current statewide mandate for conservation in response to emergency drought conditions. Because of these suppressed demands, the City had to develop near-term water use projections for its Cost of Service Study (developed in 2015). These short-term water use projections are used for setting water rates to the year 2020, and were much lower than the new long-term water demand forecast.

Thus, a method was developed to bridge the gap between the short-term water use projections and long-term water demand forecast. This method assumes that once mandatory water use restrictions are lifted, water demands would return to pre-drought (2008) levels within 15 years. In past droughts, it only took 5 to 7 years for water demands to return to pre-drought levels; but because of the severity of this drought it was assumed to take longer for the bounce back in water demands to occur.

The Department updates its UWMP every five years. The 2015 UWMP, was completed and adopted in June 2016. The time extension granted for the completion of the 2015 UWMP marks a continued focus on water use reduction strategies.

The Governor signed Assembly Bill (AB) 2067 which amended the water code extending the deadline for submitting 2015 UWMP. The bill requires each urban water supplier to submit its 2015 UWMP to the Department of Water Resources by July 1, 2016.

FIGURE 6-1
WATER DEMAND PROJECTIONS



The demands from the 2015 UWMP are used throughout this Report. The historical and projected water demands for a normal year are shown in **Table 6-1**.

As part of the requirements for complying with SB 610, **Table 6-7** and **Table 6-8,** show the single-dry year and consecutive multiple-dry year demands. All tables in this section are based on data from the 2015 UWMP.

TABLE 6-1
PAST, CURRENT, AND PROJECTED WATER DELIVERIES

Sector	Type of Use	Treatment Level	Water Use (AFY)			
			2010		2015	
			Meters	Use	Meters	Use
Single-Family Residential	Indoor and outdoor uses	Drinking Water	219,555	67,267	224,162	60,573
Multifamily Residential	Indoor and outdoor uses	Drinking Water	28,992	40,124	30,471	37,799
CII	Indoor and outdoor uses	Drinking Water	15,539	46,350	17,064	46,072
Irrigation	Landscape irrigation	Drinking Water	7,359	23,537	7,679	22,668
Other	Dust mitigation, cleaning	Drinking Water	214	89	464	0
Subtotal of Retail Area			**271,659**	**177,367**	**279,840**	**167,112**

Sector	Water Use (AFY)				
	2020	2025	2030	2035	2040
Single-family Residential	62,638	80,762	86,340	87,932	87,180
Multifamily Residential	56,766	73,191	90,080	95,841	95,786
CII	48,936	48,238	47,542	47,755	48,014
Sub-Total (Retail Area)	**168,340**	**202,191**	**223,962**	**231,528**	**230,980**

Note: The billing categories shown in the 2020 to 2040 water deliveries do not include the irrigation category that was shown in the 2010 and 2015 water deliveries as that water use was distributed among the multifamily (to account for irrigation of common association property) and CII sectors.

Source: 2020 to 2030 is extrapolation from 2015 Cost of Service Study; 2030 and after is from City's Update of Long-Term Water Demand Forecast, July 2015

Table 6-2 Summarizes the current and planned water sources the City is relying on to meet future demands.

TABLE 6-2
PLANNED WATER SUPPLY SOURCES

Basin	Average Year Water Supply (AFY)					
	2015*	2020	2025	2030	2035	2040
Verifiable Supply (Existing and Planned)						
Surface Water	6,279	22,900	22,800	22,700	22,600	22,500
Groundwater	500	3,100	3,100	3,100	3,100	3,100
Recycled Water (non-potable)	8,195	13,650	13,650	13,650	13,650	13,650
Total Verifiable Local Water Supplies	**14,974**	**39,650**	**39,550**	**39,450**	**39,350**	**39,250**
SDCWA Water Purchases with Verifiable Regional Water Supplies	**173,754**	**161,334**	**202,488**	**225,390**	**234,398**	**234,158**
Total Verifiable Water Supplies	**198,957**	**200,984**	**242,038**	**264,840**	**273,748**	**273,408**

*2015 represents actual supplies under very dry hydrologic conditions – resulting in very low surface water supplies.

6.1 Water Sales to Other Agencies

Potable Water

The City, through past agreements, sells treated water to the California American Water Company (Cal-Am), which provides water service to the cities of Coronado and Imperial Beach, and Naval Air Station North Island. The population of Naval Station North Island is located within the City of Coronado, whereas the other military bases that the City serves are within the City. The City also sells untreated water to Santa Fe Irrigation District and San Dieguito Water District. **Table 6-3** presents the water sales to other agencies.

Per the agreement between the City and Cal-Am, only local surface water is sold to Cal-Am to provide water to supply Cal-Am customers. A portion of City residents in the South Bay area are also served by Cal-Am, and can be served by imported water as well. Per the agreement between the City and the City of Del Mar, the City takes deliveries of water, which the City of Del Mar purchases from the Water Authority, through the Second Aqueduct Connection at Miramar. This water is then treated at the City's Miramar WTP and transported to the City of Del Mar through several interconnections.

The City has agreements to provide surplus treated water to Otay Water District, and untreated exchange water to Ramona Municipal Water District. These water deliveries occur infrequently and for short periods of time, and are therefore not shown in **Table 6-3**.

TABLE 6-3
SALES TO OTHER AGENCIES-POTABLE

Sector	Water Use (AFY)					
	2015	2020	2025	2030	2035	2040
Wholesale Water Sales	10,229	12,200	14,106	15,453	15,759	15,821

Source: 2020 to 2030 is extrapolation from 2015 Cost of Service Study; 2030 and after is from City's Update of Long- Term Water Demand Forecast, July 2015

Recycled and Non-Revenue Water

The City has three separate agreements to sell recycled water. Olivenhain Municipal Water District and the City of Poway are provided recycled water from the City's North City Water Reclamation Plant, while Otay Water District receives recycled water from the City's South Bay Water Reclamation Plant.

Non-Revenue Water (NRW) is the difference between the potable water supplied to the system (also known as potable water production), and the potable water sold to customers (also known as metered water deliveries). NRW typically includes legitimate uses that are not metered, such as street cleaning, line flushing and fire suppression, as well as unaccounted for water. Unaccounted for water can be attributed to unauthorized consumption, meter inaccuracies, data errors, leakage on mains, leakage and overflow at storage, and leakage at service connections. Typically, NRW is presented as a percentage of total potable water production. Historically, the City reported 4.3 percent of NRW in the 2005 UWMP, and 9.0 percent of NRW in the 2010 UWMP. Non-Revenue Water for 2015 was determined to be 7.4 percent (estimated at 13,421 AFY), based on the American Water Works Association's Water Audit Software, as required by the 2015 UWMP.

TABLE 6-4
ADDITIONAL WATER USES AND LOSSES

Use	Water Use (AFY)						
	2010	2015	2020	2025	2030	2035	2040
Non-Revenue Water	12,593	13,421	15,700	18,809	18,020	18,613	18,576
Recycled Water[1]	7,951	8,195	13,650	13,650	13,650	13,650	13,650

1. Excludes wholesale recycled water that City provides outside of its service area.

Table 6-5 is a summary of and displays City's past water use from 2010 and 2015 with projected water use shown for 2020 thru 2040.

TABLE 6-5
TOTAL WATER-USE

Use	Water Demand (AFY)						
	2010	2015	2020	2025	2030	2035	2040
Retail Potable Water Sales	177,368	167,112	168,340	202,191	223,962	231,528	230,980
Wholesale Potable Water Sales	11,493	10,229	12,200	14,106	15,453	15,759	15,821
Non-Revenue Water	12,593	13,421	15,700	18,809	18,020	18,613	18,576
Sub-Total (Potable)	**201,454**	**190,762**	**196,240**	**235,106**	**257,435**	**265,900**	**265,377**
Recycled Water (Non-Potable)	7,951	8,195	13,650	13,650	13,650	13,650	13,650
Total Demand	**209,405**	**198,957**	**209,890**	**248,756**	**271,085**	**279,550**	**279,027**

The analysis in **Table 6-6** below compares the projected normal water supply and customer demands from 2010 to 2040, in five-year increments.

TABLE 6-6
PROJECTED NORMAL SUPPLY AND DEMAND COMPARISON

Normal Year Demands/Supplies	Demand and Supplies (AFY)				
	2020	2025	2030	2035	2040
Water Demand (with wholesale and conservation)	**200,984**	**242,038**	**264,840**	**273,748**	**273,408**
Local Water Supplies					
Recycled Water (City service area	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	22,900	22,800	22,700	22,600	22,500
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**39,650**	**39,550**	**39,450**	**39,350**	**39,250**
Water Supply from SDCWA (purchased water)	161,334	202,488	225,390	234,398	234,158
Total City Water Supplies	**200,984**	**242,038**	**264,840**	**273,748**	**273,408**
Estimated Water Shortages	0	0	0	0	0

6.2 Projected Single-dry Year Water Supply and Demand

Table 6-7 provides a comparison of a single-dry year water supply with projected total water use over the next twenty-five years, in five-year increments. The City's demands in single-dry years are projected to be higher similar in proportion to the increase in regional water demands projected in the Water Authority's 2015 UWMP. An increase in use for landscape irrigation accounts for most of the increase in demands. It is assumed that recycled water demands would not increase in single-dry years. The wholesale water supplies from the Water Authority are assumed to increase to meet the difference between the City's increased water demands and reduced local water supplies.

TABLE 6-7
PROJECTED SINGLE-DRY YEAR SUPPLY AND DEMAND COMPARISON

Single-Dry Year (1990) Demands/Supplies	Demand and Supplies (AFY)				
	2020	2025	2030	2035	2040
Water Demand (with wholesale and conservation)	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	16,657	16,584	16,512	16,439	16,366
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**33,407**	**33,334**	**33,262**	**33,189**	**33,116**
Water Supply from SDCWA (purchased water)	179,754	223,549	247,906	257,466	257,176
Total City Water Supplies	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Estimated Water Shortages	0	0	0	0	0

6.3 Projected Multiple-dry Year Water Supply and Demand

Table 6-8 compares the total water supply available in multiple-dry water years with projected total water use over the next twenty-five years. The City's demands in multiple-dry years are projected to be higher, similar in proportion to the increase in regional water demands projected in Water Authority's 2015 UWMP. It is presumed that recycled water demands would not increase in multiple-dry years. The wholesale water supplies from Water Authority are assumed to increase to meet the difference between the City's increased water demands and reduced local water supplies. Multiple-dry year scenarios represent hot, dry weather periods which may generate urban water demands that are greater than normal.

No extraordinary conservation measures are reflected in the demand projections. The recycled water supplies are assumed to experience no reduction in a dry year.

TABLE 6-8
PROJECTED SUPPLY AND DEMAND COMPARISON DURING MULTIPLE DRY YEAR PERIOD ENDING IN 2040

Dry Year 1 (1990) Demands/Supplies	Demand and Supplies (AFY)				
	2020	2025	2030	2035	2040
Water Demand (with wholesale and conservation)	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	16,657	16,584	16,512	16,439	16,366
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**33,407**	**33,334**	**33,262**	**33,189**	**33,116**
Water Supply from SDCWA (purchased water)	179,754	223,549	247,906	257,466	257,176
Total City Water Supplies	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Estimated Water Shortages	0	0	0	0	0
Dry Year 2 (1991) Demands/Supplies	**Demand and Supplies (AFY)**				
	2020	**2025**	**2030**	**2035**	**2040**
Water Demand (with wholesale and conservation)	**200,610**	**241,581**	**264,338**	**273,228**	**272,888**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	16,233	16,162	16,091	16,020	15,949
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**32,983**	**32,912**	**32,841**	**32,770**	**32,699**
Water Supply from SDCWA (purchased water)	167,627	208,669	231,469	240,457	240,189
Total City Water Supplies	**200,610**	**241,581**	**264,338**	**273,228**	**272,888**
Estimated Water Shortages	0	0	0	0	0
Dry Year 3 (1992) Demands/Supplies	**Demand and Supplies (AFY)**				
	2020	**2025**	**2030**	**2035**	**2040**
Water Demand (with wholesale and conservation)	**208,665**	**251,402**	**275,139**	**284,412**	**284,058**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	18,962	18,879	18,796	18,714	18,631
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**35,712**	**35,629**	**35,546**	**35,464**	**35,381**
Water Supply from SDCWA (purchased water)	175,953	215,773	239,592	248,948	248,677
Total City Water Supplies	**208,665**	**251,402**	**275,139**	**284,412**	**284,058**
Estimated Water Shortages	0	0	0	0	0

Section 7 - Conclusion - Availability of Sufficient Supplies

The Project is consistent with water demand assumptions in the regional water resource planning documents of the City, the Water Authority and MWD. The Public Utilities Department receives the majority of its water supply from MWD through the Water Authority. In addition, MWD and the Water Authority have developed water supply plans to improve reliability and reduce dependence upon existing imported supplies. MWD's Regional Urban Water Management Plan and Integrated Resources Plan, the Water Authority's 2015 UWMP and annual water supply report include projects that meet long-term supply needs through securing water from the State Water Project, Colorado River, local water supply development and recycled water.

The forecasted normal year water demands compared with projected supplies for the Public Utilities Department are shown in **Table 7-1**. This demonstrates that with existing supplies and implementation of the projects discussed in the three agencies' planning documents there will be adequate water supplies to serve all anticipated growth (existing and future planned uses) and development.

TABLE 7-1
PROJECTED SUPPLY AND DEMAND COMPARISON – NORMAL YEAR

Normal Year Demands/Supplies	Demand and Supplies (AFY)				
	2020	2025	2030	2035	2040
Water Demand (with wholesale and conservation)	**200,984**	**242,038**	**264,840**	**273,748**	**273,408**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	22,900	22,800	22,700	22,600	22,500
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**39,650**	**39,550**	**39,450**	**39,350**	**39,250**
Water Supply from SDCWA (purchased water)	161,334	202,488	225,390	234,398	234,158
Total City Water Supplies	**200,984**	**242,038**	**264,840**	**273,748**	**273,408**
Estimated Water Shortages	0	0	0	0	0

Table 7-2 provides a comparison of a single-dry year water supply with projected total water use over the next 25 years, in five-year increments.

TABLE 7-2
PROJECTED SINGLE-DRY YEAR SUPPLY AND DEMAND COMPARISON

Single-Dry Year (1990)	Demand and Supplies (AFY)				
	2020	2025	2030	2035	2040
Water Demand (with wholesale and conservation)	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	16,657	16,584	16,512	16,439	16,366
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**33,407**	**33,334**	**33,262**	**33,189**	**33,116**
Water Supply from SDCWA (purchased water)	179,754	223,549	247,906	257,466	257,176
Total City Water Supplies	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Estimated Water Shortages	0	0	0	0	0

The multiple-dry year scenarios, within a 25-year projection, are shown in **Table 7-3**. This demonstrates that supplies will be adequate to meet all anticipated growth (existing and future planned uses) and development in multiple-dry year periods.

TABLE 7-3
PROJECTED SUPPLY AND DEMAND COMPARISON DURING MULTIPLE DRY YEAR PERIOD ENDING IN 2040

Dry Year 1 (1990) Demands/Supplies	Demand and Supplies (AFY)				
	2020	2025	2030	2035	2040
Water Demand (with wholesale and conservation)	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	16,657	16,584	16,512	16,439	16,366
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**33,407**	**33,334**	**33,262**	**33,189**	**33,116**
Water Supply from SDCWA (purchased water)	179,754	223,549	247,906	257,466	257,176
Total City Water Supplies	**213,161**	**256,883**	**281,167**	**290,654**	**290,292**
Estimated Water Shortages	0	0	0	0	0
Dry Year 2 (1991) Demands/Supplies	**Demand and Supplies (AFY)**				
	2020	**2025**	**2030**	**2035**	**2040**
Water Demand (with wholesale and conservation)	**200,610**	**241,581**	**264,338**	**273,228**	**272,888**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	16,233	16,162	16,091	16,020	15,949
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**32,983**	**32,912**	**32,841**	**32,770**	**32,699**
Water Supply from SDCWA (purchased water)	167,627	208,669	231,469	240,457	240,189
Total City Water Supplies	**200,610**	**241,581**	**264,338**	**273,228**	**272,888**
Estimated Water Shortages	0	0	0	0	0
Dry Year 3 (1992) Demands/Supplies	**Demand and Supplies (AFY)**				
	2020	**2025**	**2030**	**2035**	**2040**
Water Demand (with wholesale and conservation)	**208,665**	**251,402**	**275,139**	**284,412**	**284,058**
Local Water Supplies					
Recycled Water (City service area only)	13,650	13,650	13,650	13,650	13,650
Local Surface Supply	18,962	18,879	18,796	18,714	18,631
Groundwater	3,100	3,100	3,100	3,100	3,100
Sub-Total Local Supplies	**35,712**	**35,629**	**35,546**	**35,464**	**35,381**
Water Supply from SDCWA (purchased water)	175,953	215,773	239,592	248,948	248,677
Total City Water Supplies	**208,665**	**251,402**	**275,139**	**284,412**	**284,058**
Estimated Water Shortages	0	0	0	0	0

This Report demonstrates that there are sufficient water supplies over a 25-year planning horizon to meet the projected demands of the Project as well as the existing and other planned development projects within the Public Utilities Department service area in normal, dry year, and multiple-dry year forecasts. This Project is proposing water demands which are included in the regional water resource planning documents of the City, the Water Authority, and MWD.

Source Documents

California Department of Water Resources (DWR), Progress on Incorporating Climate Change into Management of California's Water Resources, July 2006 Report
California Climate Change Center, 2006 Biennial Report: Our Changing Climate: Assessing the Risks to California, 2006
California Department of Water Resources Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001, March 2011
DSD Memorandum - Request for assessment and project description, February 2013
MWD 2010 Regional Urban Water Management Plan
MWD Report on Metropolitan's Water Supplies, A Blueprint for Water Reliability, March 2003
MWD Integrated Resources Plan Update, Oct 2010
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Public Utilities Department Annual 2012 Water Conservation Report
Public Utilities Department Recycled Water Study July 2012
Public Utilities Department Recycled Water Master Plan August 2011
Public Utilities Department Water Purification Demonstration Project Report
Water Authority 2010 Urban Water Management Plan
Water Authority Regional Water Facilities Master Plan, 2003
Water Department Long-Range Water Resources Plan (2002-2030), December 2002
Water Department The City of San Diego Subordinated Water Revenue Bonds, Series 2002, October 2002

APPENDIX A

San Diego County Water Authority's Approval Email for the use of the Accelerated Forecasted Growth (AFG) of its 2015 UWMP

From: Friehauf, Dana [mailto:DFriehauf@sdcwa.org]
Sent: Monday, October 31, 2016 2:38 PM
To: Wiborg, Lan <LWiborg@sandiego.gov>
Cc: Adrian, George <GAdrian@sandiego.gov>; Bista, Seevani <SBista@sandiego.gov>; Bombardier, Tim <tbombardier@sdcwa.org>
Subject: AFG request for Pacific Village

Dear Lan,

Thank you for your email regarding the City of San Diego's Pacific Village Project. The following is the Water Authority's response to your request to use the Accelerated Forecasted Growth (AFG) component of the Water Authority's 2015 Urban Water Management Plan to meet the unanticipated water demands associated with the Pacific Village Project.

The purpose of the AFG component of the demand forecast is to estimate, on a regional basis, additional demand associated with proposed projects not yet included in local jurisdictions' general plans and to plan for sufficient regional supplies to reliably meet the water demand of those projects. The Pacific Village Project identified in your October 20, 2016 e-mail meets the criteria for the AFG component of the Water Authority's 2015 UWMP and we are planning to have water supplies to reliably meet the demand associated with the project. Our accounting of the remaining AFG component will be adjusted to reflect the additional demand associated with the proposed Pacific Village Project.

In order to accurately account for utilization of the AFG, we request that the City of San Diego send the Water Authority notification of when this project or any other project that utilized the AFG demand component is approved.

Please let me know if you have any questions or wish to discuss this matter further.

Regards,
Dana

Dana Friehauf
Water Resources Manager
San Diego County Water Authority
858-522-6749

From: Wiborg, Lan
Sent: Thursday, October 20, 2016 3:21 PM
To: Friehauf, Dana <DFriehauf@sdcwa.org>; Bombardier, Tim <tbombardier@sdcwa.org>
Cc: Bista, Seevani <SBista@sandiego.gov>; Adrian, George <GAdrian@sandiego.gov>; Gilmartin, Shelby <SGilmartin@sandiego.gov>
Subject: AFG request for Pacific Village

Good afternoon Dana:

The City of San Diego is preparing a Water Supply Assessment for the Pacific Village Project, in accordance with the requirements of SB 610.

The proposed Pacific Village Project (Project) site is approximately 41.45 acres of currently developed land in the community of Carmel Mountain Ranch, in San Diego, California. The existing structures and improvements (over 50 apartment buildings, 16-inch high priority gas line, and a sewer line easement) will be demolished and the area graded for the construction of 601 dwelling units.

The proposed development consists of: 99 single family units, 105 triplex units, 120 townhouse units, and 277 apartments. Additional buildings and land uses onsite will include: a clubhouse/leasing office, maintenance building, storage building, and two swimming pools. The project includes proposed landscaping materials that are a mix of: recreational turf, moderate water use shrubs, low water use shrubs, and low water use vegetation for a bio-retention basin. A vicinity map is attached for your convenience.

The projected water demands of the Project are 162.0 AFY. In the City's 2015 UWMP, the planned water demands of this project site are 66.2 AFY in 2040. However, because the historical billed water use at the site is already greater than the City's 2015 UWMP, and the City is able to meet this water demand, the billed value will be used for the demand calculation. The 5 year average (2011-2015) billed water use data for the accounts on the property provided by the City is 127.5 AFY. As such, the remaining projected water demand is estimated to be **34.5 AFY** as seen in the table below:

	Preserve at Torrey Highlands Project Not Accounted for in the SANDAG's Series 13 Forecast			
	Water Demands (Acre-Feet per Year)			
Project	**Planned**	**Currently Used**	**Projected**	**Delta**
Pacific Village	66.2	127.5	162.0	-34.5
Total				**-34.5**

The City is requesting the use of the Accelerated Forecasted Growth (AFG) component of the Water Authority's 2015 Urban Water Management Plan to meet demands associated with this project, similar to other projects requested. Attached please find a table showing the total AFG that the City has requested to date based on the 2015 UWMP.

Your assistance with this request is greatly appreciated.

Thank you,

Lan

Lan C. Wiborg
Deputy Director
Public Utilities Department
Long-Range Planning & Water Resources Division

T1 (619) 533-4112
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APPENDIX B

San Diego County Water Authority's Accelerated Forecasted Growth (AFG) Demand Track

TABLE B-1: 2015 UWMP Accelerated Forecast Growth

Response Date	Agency	Project	Estimated (AF)	Running Total (AF)	Date Certified EIR Received
Value carried forward from Total AFG Demand Increment Needed based on 2010 UWMP – Series 13 *See Table B-2*			**2,583.5**	2,583.3	
Projects based on Series 12 - 2010 UWMP (2015 UWMP not yet adopted)					
4/7/2016	CSD	7th and Market	**115.5**	2,699.0	
4/7/2016	CoSD	Town & Country	**192.3**	2,891.3	
Projects based on Series 13 – 2015 UWMP					
7/26/2016	CSD	Broadway Block Amendment	**69.5**	2,960.8	
8/3/2016	CoSD	University of San Diego Master Plan Update	**231.8**	3,192.6	
9/16/2016	CoSD	Preserve at Torrey Highlands	**138.1**	3,330.7	
	CoSD	Pacific Village	**34.5**	3,365.2	
			Running Total	**3,365.2**	
		Total City Usage	**3,365.2**		

Note: CoSD: City of San Diego
PoSD: Port of San Diego
CSD: Civic San Diego
CCDC: Centre City Development Corporation

TABLE B-2: 2010 UWMP Accelerated Forecast Growth - Series 13 Projections

Response Date	Agency	Project	Estimated (AF)	Running Total (AF)	Date Certified EIR Received
08/24/2011	CoSD	San Diego Corporate Center / One Paseo	153.6	153.6	04/24/2012
08/24/2011	CoSD	Metropolitan Airpark / Brown Field	168.4	322.0	04/24/2012
08/24/2011	CoSD	Barrio Logan Community Plan	581.6	903.6	04/24/2012
08/24/2011	CoSD	Otay Mesa Community Plan	---	903.6	04/24/2012
08/24/2011	CCDC	15th and Island	107.2	1,010.8	04/24/2012
09/26/2011	PoSD	San Diego Convention Center & Hotel	51.2	1,062.0	09/19/2012
01/31/2012	CoSD	Watermark	---	1,062.0	
04/11/2012	CCDC	11th and Broadway	---	1,062.0	12/04/2012
02/13/2013	CoSD	Liberty Station	98.8	1,160.8	06/04/2013
04/02/2013	CoSD	Cisterra Tower Development	64.0	1,224.8	
04/02/2013	CoSD	Kaiser Permanente San Diego Central Hospital	113.4	1,338.2	
02/28/2013	CoSD	Chollas Triangle Development	16.5	1,354.7	
06/05/2014	CoSD	Glen at Scripps Ranch	26.2	1,380.9	
10/01/2014	CoSD	Encanto Community Update	1,036.7	2,417.6	
10/06/2014	CSD	Revised Ballpark Village Parcel C Residence	91.5	2,509.1	
12/08/2014	CoSD	MERGE 56 Development	74.7	2,583.5	
04/15/2015	CoSD	Stone Creek Development	---	2,583.5	
			Running Total	**2,583.5**	