The City of San Diego

PRIORITY DEVELOPMENT PROJECT (PDP) STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) FOR

"B" Street Apartments

PTS No. 422242

REGISTERED PROFESSIONAL ENGINEER
ANTONY K. CHRISTENSEN
NO. C54021
EXP. 12-31-17
CIVIL
STATE OF CALIFORNIA

ENGINEER OF WORK:

Antony K. Christensen, RCE 54021
Provide Wet Signature and Stamp Above Line

PREPARED FOR:

Janco LLC
P.O. Box 231446
Encinitas, CA 92023
(619) 572-3556
Gordon.matthew0@gmail.com

PREPARED BY:

Christensen Engineering & Surveying
7888 Silverton Avenue, Suite "J"
San Diego, CA 92126
858-454-7600

DATE:
April 04, 2016
Revised July 13, 2016
Revised August 25, 2016
Revised September 29, 2016

Approved by: City of San Diego Date

TABLE OF CONTENTS

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

CERTIFICATION PAGE

Project Name: "B" Street Apartments
Permit Application Number: PTS No. 422242

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

Antony K. Christensen, RCE 54021

Christensen Engineering & Surveying

Date

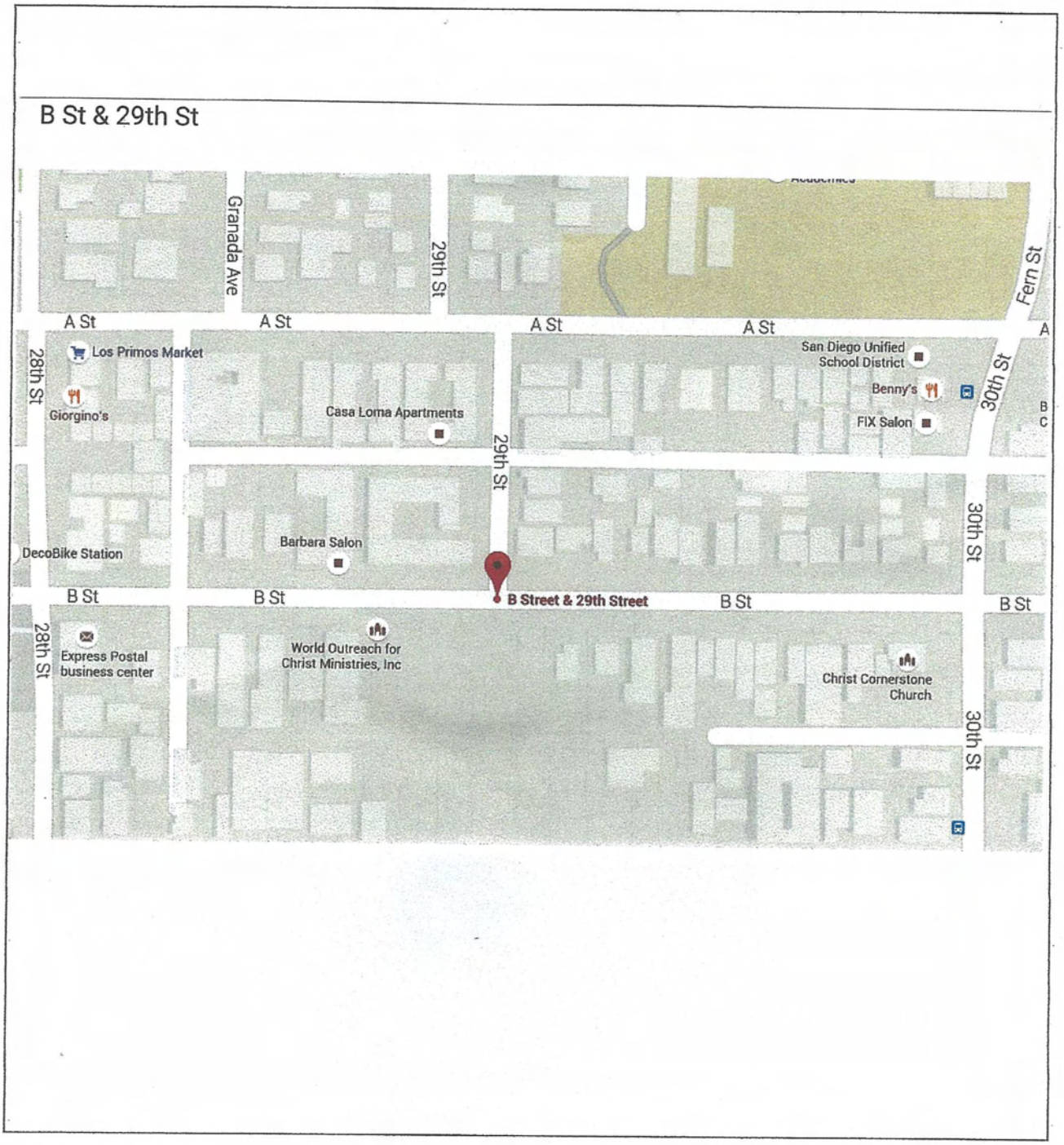
SUBMITTAL RECORD

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	10/19-2016	☐ Preliminary Design/Planning/CEQA ☒ Final Design	Initial Submittal
2		☐ Preliminary Design/Planning/CEQA ☐ Final Design	
3		☐ Preliminary Design/Planning/CEQA ☐ Final Design	
4		☐ Preliminary Design/Planning/CEQA ☐ Final Design	

PROJECT VICINITY MAP

Project Name: "B" Street Apartments
Permit Application Number: PTS No. 422242



STORM WATER REQUIREMENTS APPLICABILITY CHECKLIST

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

City of San Diego
Development Services
1222 First Ave., MS-302
San Diego, CA 92101
(619) 446-5000

THE CITY OF SAN DIEGO

Storm Water Requirements Applicability Checklist

FORM DS-560
FEBRUARY 2016

Project Address:	Project Number *(for City Use Only)*:
29th and B Street	422242

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 administered by the State Water Resources Control Board.

For all project 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 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 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.
   - Individual Right of Way Permits that exclusively include only ONE of the following activities: water service, sewer lateral, or 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, pot holing, 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 proposes 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 questions 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/index.shtml

PART B: Determine Construction Site Priorit

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.

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 requiring a Water Pollution Control Plan but 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.

If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Development 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 impervious 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 or redevelopment projects of a retail gasoline outlet (RGO) that create and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. ☐ Yes ☒ No

9. **New development or redevelopment projects of an automotive repair shops that creates and/or replaces 5,000 square feet or more of impervious surfaces.** 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 STORM WATER REQUIREMENTS**. ☐
2. The project is a **STANDARD DEVELOPMENT 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 a hydromodification plan management ☒

Name of Owner or Agent *(Please Print)*: Joy D. Christensen

Title: Assistant Engineer

Signature: Joy D. Christensen

Date: July 15, 2016

Applicability of Permanent, Post-Construction Storm Water BMP Requirements	Form I-1

Project Identification

Project Name: "B" Street Apartments

Permit Application Number: PTS No. | Date: October 19, 2016

Determination of Requirements

The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short summary 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.

Step	Answer	Progression
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.	☒ Yes	Go to Step 2.
	☐ No	Stop. Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.
Discussion / justification if the project is not a "development project" (e.g., the project includes only interior remodels within an existing building):		
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) in its entirety for guidance, AND complete Storm Water Requirements Applicability Checklist.	☐ Standard Project	Stop. Standard Project requirements apply.
	☒ PDP	PDP requirements apply, including PDP SWQMP. Go to Step 3.
	☐ PDP Exempt	Stop. Standard Project requirements apply. Provide discussion and list any additional requirements below.
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:		

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 (not required if prior lawful approval does not apply):		
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 not 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 not apply: The project site and area upstream of it is not in a CCSYA.		

Site Information Checklist For PDPs	Form I-3B
Project Summary Information	
Project Name	"B" Street Apartments
Project Address	29th at B Street San Diego, CA 92102
Assessor's Parcel Number(s) (APN(s))	539-521-01,02,
Permit Application Number	PTS NO. 422242
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)	San Diego Mesa Hydrologic Area (908.2) Cholla Hydrologic Sub-Area 908.22
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	0.589 Acres (_____ Square Feet)
Area to be disturbed by the project (Project Footprint)	0.582 Acres (_____ Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	0.348 Acres (_____ Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	0.241 Acres (_____ 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.	(0.348 Acre increase) ∞%

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:
Site has had previous grading, including the construction of sewer mains and storm drains and pervious easement access area.

Existing Land Cover Includes (select all that apply):
☒ Vegetative Cover
☒ Non-Vegetated Pervious Areas
☐ Impervious Areas
Description / Additional Information:

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
☒ GW Depth > 20 feet

Existing Natural Hydrologic Features (select all that apply):
☐ Watercourses
☐ Seeps
☐ Springs
☐ Wetlands
☒None
Description / Additional Information:

Outlet from public storm drain into basin with public storm drain outlet

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:

Runoff from the area of the project and a large area northerly and westerly of the site is conveyed to a basin that is located adjacent to the project. The basin is located easterly and southerly of the site. Following construction this drainage pattern will persist. The runoff conveyed to the basin is picked up by a City of San Diego storm drain and conveyed southerly where it eventually enters San Diego Bay. Runoff offsite (westerly) from a concrete alley will be picked up by a trench drain and conveyed to the basin.. Three Biofiltration Basins will be used to treat site impervious surface runoff. That runoff will continue to flow to the basin as it did before development.

This neighborhood is primarily improved with multi-family residences but the project site itself is unimproved so the runoff coefficient selected for the pre-construction site evaluation is C=0.45. Post-construction the entire area is evaluated using a runoff coefficient of C = 0.70. For water quality purposes the runoff factor is determined from a weighted average using the method outlined in the City of San Diego Storm Water Manual. That value is C = 0.58.

A detailed description of the drainage patterns and flows are discussed and demonstrated in the Drainage Study and were developed using the City of San Diego Drainage Design Manual rational method. See attachment "D".

.

Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:

The project site is currently developed public storm drain and sewer main and an improved sewer easement and will be redeveloped as a multifamily development.

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

The project includes the construction of buildings with walkways and driveways.

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

This project includes landscaped areas interspersed amongst the impervious areas.

Does the project include grading and changes to site topography?

☒ Yes

☐ No

Description / Additional Information:

Grading will be employed to improve the site for structures and driveways.

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-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Description / Additional Information:

The existing 36" public storm drain will be extended and an existing 18" public storm drain will be re-routed. Onsite runoff from impervious surfaces will be conveyed to three Biofiltration Basins for treatment and detention before being conveyed to the same basin as it currently is and then into the same public storm drain.

See the attached drainage study for a detailed discussion of drainage.

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:

There will be onsite area drains, garages and covered refuse area.

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)

According to the California 2010 303d list published by the San Diego Regional Water Quality Control Board the nearest impaired water body is the San Diego Bay impaired by coliform bacteria, benthic community effects, copper and sediment toxicity. The San Diego Bay is approximately 1 mile southwesterly of the project and the project does not directly discharge into the San Diego Bay. Runoff is comingled with that from the public storm drains.

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

Surface water beneficial uses include water contact recreational activities, non-contact recreational activities, warm freshwater habitat and wildlife habitat. Groundwater beneficial uses include municipal water supply.

Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations.
None exist downstream of this project.

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

San Diego Bay is approximately 1 mile southwesterly of the project site.

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

No MHPA is located in proximity to the site.

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
San Diego Bay	Bacteria; Dissolved copper,	Bacteria; Dissolved copper,
	lead, and zinc	lead, and zinc

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			
Nutrients			
Heavy Metals			
Organic Compounds			
Trash & Debris			
Oxygen Demanding Substances			
Oil & Grease			
Bacteria & Viruses			
Pesticides			

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:

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 is one point of compliance and that is at the outlet of the outlet of the basin under C Street.

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:

Prepared by REC Consultants entitled Hydromodification Screen for Susceptibility Analysis of: B Street Receiving Creek, dated July 08, 2016. See attachment. The onsite basin and the unnamed creek at 29th Street were evaluated.

Discussion / Additional Information: (optional)

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.

None.

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.

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: No non-storm water discharges are expected from this site.			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented: The propose curb inlet fronting the site will be stenciled. No other drains will exist that will require stencilling.			
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: No materials will be stored outside the buildings and there is no run-on to the site except that which flows over pervious surfaces.			
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: No materials will be stored outside the buildings			
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: Trash will be contained in an area will a roof to project it from rain impacting the refuse area.			

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 <u>all</u> "No" answers shown above. .			

Site Design 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: No natural drainage pathways exist in the project area. The basin southerly of the site conveys public storm drain runoff. The existing 36" public storm drain will be extended.			
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: While trees will be incorporated into site design no credit is sought for their use. No natural undisturbed areas exist onsite.			

Form I-5 Page 2 of 4			
Site Design Requirement	Applied?		
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented: The site uses areas of landscaping to decrease impervious surface area. The minimum size of parking is used to develop the site and is in covered garages. Pervious surfaces are used for walkways and some driveways.			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-4 not implemented:			
SD-5 Impervious Area Dispersion	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented:			
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:			
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 map?	☒ 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 if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-8 not implemented: The landscape area does not afford an opportunity to use the minimum required volume of runoff to drawdown in 36 hrs based on criteria found in the Storm Water Manual. Neither does the use for Toilet and Urinal flushing (no urinals exist onsite).			
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.

Partial infiltration is used for this project. It was determined the site could be developed using three biofiltration basin. The basins were sized using SWMM Modeling. Both pollutant treatment and flow control are achieved in each biofiltration basin. See attached report.

(Continue on page 2 as necessary.)

Form I-6 Page 2 of X
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. IMP-A, B, & C	
Construction Plan Sheet No. Sheet A03	
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 ○ Detention pond or 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	Antony K. Christensen, RCE Christensen Engineering & Surveying 7888 Silverton Avenue, Suite "J" San Diego, CA 92126 858-271-9901
Who will be the final owner of this BMP?	Janco LLC P.O. Box 231446 Encinitas, CA 92023
Who will maintain this BMP into perpetuity?	Janco, LLC or assigns
What is the funding mechanism for maintenance?	Funding will be maintained through a Storm Water Management and Discharge Control Maintenance Agreement

Form I-6 Page 4 of X (Copy as many as needed)
Structural BMP ID No. IMPs- A-C
Construction Plan Sheet No. Sheets 2 & 3 of the Preliminary Grading Plan
Discussion (as needed):

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
February 2016

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

ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

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 ☐ 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

DRAINAGE MANAGEMENT AREA EXHIBIT

E.W. MORSE'S SUBDIVISION OF PUEBLO LOT NO. 1150 AND THE NW 1/4 OF 1151

MAP NO. 547

BLOCK 62

29TH STREET

B STREET

EX. 10" REHABILITATED CP SEWER PER DWG. 27679-05-D

EX. 2" HP GAS PER DWG. 26034-10-D

EX. 36" RCP DRAIN PER DWG. 3222-L

EX. 12" PVC SEWER PER DWG. 27679-05-D

EX. STRIPING

EX. MH 11A PER DWG. 27679-05-D (IE 172.30) 202.3 RIM +/-

EX. MH 11 PER DWG. 27679-05-D (IE 181.44)

10' DRAINAGE EASEMENT SHOWN ON DWG 1453-B BUT NOT AS OF PUBLIC RECORD. IN TITLE REPORT

EASEMENT FOR PEDESTRIAN USES IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EASEMENT FOR GENERAL UTILITY AND SEWER IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EX. 18" CMP DRAIN PER DWG. 27679-05-D

AN EASEMENT FOR SEWER, IN FAVOR OF THE CITY OF SAN DIEGO OVER A 10' WIDE PORTION OF LOT 6 PER DOCUMENT RECORDED IN BOOK 453, PAGE 135 OF DEEDS, JANUARY 25, 1909. THE EXACT LOCATION IS NOT SPECIFIED IN SAID DOCUMENT.

300' +/- EX. PH

DMA - C
11473 SF
FLOWS TO
IMP-C (316 SF)
68.8% IMPERVIOUS

201.7 FS +/-
173.7 TOP +/-
28' COVER +/-
31' I.E. +/- (170.7 +/-)

202.7 FS +/-

N89°07'40"W 141.75'

N89°01'45"W 30.01'

200.8 TW
200.8 BW

PATIO

UNIT 7
FF = 200'

UNIT 9
FF = 200'

UNIT 1
FF = 194.4'

UNIT 8
FF = 200'

UNIT 2
FF = 194.4'

UNIT 10
FF = 181'

UNIT 11
FF = 180.5'

UNIT 3
FF = 184'

UNIT 4
FF = 183'

UNIT 5
FF = 182'

UNIT 6
FF = 181'

IMP-C
316 SF

IMP-B
264 SF

IMP-A
42 SF

LIGHTWELL

2.15'

3.0'

PROPOSED 30' WIDE PUBLIC SEWER EASEMENT

MAP NO. 547

BLOCK 63

9 8 7

24

DMA - B
9717 SF
FLOWS TO
IMP-B (264 SF)
71.6% IMPERVIOUS

DMA - A
1367 SF
FLOWS TO
IMP-A (42 SF)
PERMEABLE PAVING

DMA - OS
1367 SF
FLOWS TO
IMP-A (42 SF)
PERMEABLE PAVING

DMA - D
2485 SF
SELF TREATING
0% IMPERVIOUS

S00°53'23"W 149.56'

S00°52'29"W 149.20'

GENERAL UTILITY EASEMENT IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EASEMENT FOR DRAINAGE IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683490, O.R.

SITE BOUNDARY LINE

N89°13'58"W 141.79'

N89°13'58"W 30.01'

EX MH PER DWG 27679-10-D (161.75 (E) 173 RIM +/-

180.0 TW
178.0 BW

LOT 1 MAP NO. 16049

12" TRENCH DRAIN TO COLLECT RUNOF BEFORE IT REACHES VACATED ALLEY AND CONVEY IT TO CHANNEL

GRASS-CRETE PAVEMENT (OR EQUIVALENT) TO REPLACE GRAVEL-PAVE

FOR WORK SOUTHERLY OF PROJECT SITE SEE PRIVATE EASEMENT AGREEMENT

SCALE: 1" = 10'
CONTOUR INTERVAL: 2'
0 10 20 30 40

SITE DEVELOPMENT
PRELIMINARY GRADING PLAN

EXHIBIT CHECKLIST:

HYDROLOGIC SOIL GROUP: "D" (UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICES WEB SOIL SURVEY)

APPROXIMATE DEPTH TO GROUNDWATER: GREATER THAN 20'

EXISTING NATURAL HYDROLOGIC RESOURCES: NO WATERCOURSES, SEEP. SPRINGS OR WETLANDS EXIST IN THE PROJECT AREA

CRITICAL COARSE SEDIMENT YIELD AREAS: POTENTIAL CCSYAs (PCCSYAs) DO NOT OCCUR ONSITE OR UPSTREAM

EXISTING TOPOGRAPHY AND IMPERVIOUS AREAS: TOPOGRAPHY IS SHOWN NO IMPERVIOUS AREAS EXIST IN THE AREA TO BE DEVELOPED

EXISTING AND PROPOSED SITE DRAINAGE NETWORK AND CONNECTIONS TO DRAINAGE OFFSITE: 36" CP DRAIN EXISTS ONSITE DRAINAGE FROM ONSITE IMPERVIOUS SURFACES WILL BE PUMPED TO "C" STREET AND THEN TO THE PUBLIC STORM DRAIN SYSTEM A NEW 36" RCP DRAIN WILL BE CONSTRUCTED

PROPOSED GRADING: IS SHOWN ON DMA MAP

PROPOSED IMPERVOUS FEATURES: IMPERVIOUS ROOF AND WALKWAYS AND DRIVEWAYS

PROPOSED DESIGN FEATURES AND SURFACE TREATMENTS USED TO MINIMIZE IMPERVIOUSNESS: ARE SHOWN AND LANDSCAPING IS USED TO MINIMIZE IMPERVOUSNESS.

DMA MANAGEMENT AREA BOUNDARIES, NUMBERS, AREAS AND TYPES: SHOWN

POTENTIAL POLLUTANT SOURCE AREAS AND SOURCE CONTROLS:

EXISTING ONSITE STORM DRAIN INTLET: DO NOT EXIST
INDOOR DRAINS, GARAGES AND PESTICIDE USE: GARAGES ARE SHOWN
LANDSCAPE/OUTSIDE PESTICIDE USE: NOT ANTICIPATED TO BE USED
POOLS, SPAS, PONDS: NOT EMPLOYED
FOOD SERVICE: NOT EMPLOYED
REFUSE AREAS: COVERED REFUSE AREA WILL BE EMPLOYED AS SHOWN
INDUSTRIAL PROCESSE: DO NOT OCCUR
OUTDOOR STORAGE OF EQUIPMENT OR MATERIALS: DOES NOT EXIST
VEHICLE CLEANING: DOES NOT EXIST
VEHICLE AND EQUIPMENT REPAIR: DOES NOT EXIST
FUEL DISPENSING AREAS: DO NOT EXIST
LOADING DOCKS: DO NOT EXIST
FIRE SPRINKLER TEST WATER: WILL BE CONVEYED TO SEWER
MISCELLANEOUS DRAIN OR WASH WATER: DOES NOT EXIST
PLAZAS, SIDEWALKS AND PARKING LOTS: ARE AS SHOWN

STRUCTURAL BMP SHOWN AS TO LOCATION, TYPE, SIZE AND DETAIL ARE SHOWN (BIOFILTRATION BASINS)

HYDROMODIFICATION REQUIREMENTS MET BY IMP-A, IMP-B AND IMP-C.

DRAINAGE MANAGEMENT AREA TABLE				
ID	AREA	IMPERVIOUS AREA	PERCENT IMPERVIOUSNESS	SYMBOL
DMA-A IMP-A	1367 SF 42 SF	0 SF N/A	0% N/A	
DMA-OS IMP-A	1367 SF 42 SF	0 SF N/A	0% N/A	
DMA-B IMP-B	9717SF 264 SF	6953 SF N/A	71.6% N/A	
DMA-C IMP-C	11473 SF 316 SF	7892 SF N/A	68.8% N/A	
DMA-D NO IMP	2485 SF	0 SF SELF-TREATING	0%	

ANTONY K. CHRISTENSEN, RCE 54021 — AUGUST 25, 2016 Date

REGISTERED PROFESSIONAL ENGINEER ANTONY K. CHRISTENSEN No. 54021 Exp. 12-31-17 CIVIL STATE OF CALIFORNIA

Prepared By:

CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-9901 FAX (858) 271-8912

Project Address:

"B" STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:

"B" STREET ROW HOMES

Sheet Title:

DMA EXHIBIT

Revision 6:
Revision 5:
Revision 4: 08-18-16 REVISE DMAs
Revision 3: 04-02-16 REVISE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

Original Date: APRIL 06, 2015

Sheet 3 of 3 Sheets

DEP# _____

JN 2015-07

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)
☐ Critical coarse sediment yield areas to be protected
☐ 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
☐ 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)
☐ Structural BMPs (identify location, type of BMP, and size/detail)

Harvest and Use Feasibility Checklist	Form I-7

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:_____

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.
[Provide a summary of calculations here]

From Table B.3-3 for Low Plant Water use 390 gal/36hr/Ac
Area of landscaping = 0.206 Ac
Landscape water demand = 390 x 0.206 = 80.3 gallon = 10.7 cf

From Table B.3-1 for residential use 9.3 gpd/resident (Assuming 4 residents / apartment and 11 apartments
Results in 409.2 gal/ 24 hours. Therefore 613.8 gal/36 hours = 82 cf

Total 36 hr demand 92.7 cf

3. Calculate the DCV using worksheet B-2.1.
DCV = 668 (cubic feet)

3a. Is the 36 hour demand greater than or equal to the DCV?	3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36 hour demand less than 0.25DCV?
☐ Yes / ☒ No ⇨ ⇩	☐ Yes / ☒ No ⇨ ⇩	☒ Yes ⇩
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.	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.	Harvest and use is considered to be infeasible.

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.

Categorization of Infiltration Feasibility Condition		Form I-8	
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?			
Criteria	Screening Question	Yes	No
1	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.		X
Provide basis: Infiltration testing of the compacted fill in the previously graded alley at the rear of the site has been performed (see attached "Infiltration Testing..."). The remainder of the site has not been graded and requires import (source unknown) to achieve finished grades. We recommend that the import have infiltration rates no less than 0.17 in/hr (average of infiltration rates in alley) and that infiltration testing of the import be performed when the import source is known to confirm the infiltration rates. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
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.	X	
Provide basis: Geotechnical recommendations to mitigate potential geotechnical hazards due to storm water infiltration to acceptable levels are provided in the attached "Geotechnical Update..." and "Addendum to Geotechnical Update...". Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Form I-8 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	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.		
Provide basis: No infiltration rates greater than 0.5 in/hr have been measured at the site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	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.		
Provide basis: No infiltration rates greater than 0.5 in/hr have been measured at the site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	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	Possible Partial 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

Form I-8 Page 3 of 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?			
Criteria	Screening Question	Yes	No
5	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.	X	
Provide basis: Two tests using Open Pit Falling Head test method have been performed. Results were 0.22 in/hr and 0.12 in/hr without safety factors. For design considerations, the following infiltration values will be used: 0.11 in/hr for IMP-A (as 0.22 in/hr test is closest to IMP-A and a Safety Factor of 2 is used); an average value of 0.17 in/hr divided by 2 = 0.085 in/hr will be used for IMP-B and IMP-C. As both are located in fill conditions, a requirement to use soils with an infiltration capacity no less than 0.17 in/hr will be included. 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.			
6	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.	X	
Provide basis: Geotechnical recommendations to mitigate potential geotechnical hazards due to storm water infiltration to acceptable levels are provided in the attached "Geotechnical Update..." and "Addendum to Geotechnical Update...". Please refer to answer 5. A gravel layer under the french drain with a thickness calculated in accordance to the requirements of the BLP Manual and in accordance to the infiltration results displayed in answer 5 will be included. A french drain is also added above that gravel thickness for safety reasons, in case the soil does not infiltrate as expected. 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.			

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.	X	
Provide basis: Mounding concerns should be minor as a french drain system is added in the IMPs once the water exceeds a certain minimum depth in the gravel layer. Storm water pollutant concerns are unknown at this time but the expected little infiltration has a low risk of mobilizing potential pollutants that could be present in the soil, especially considering the depth of the ground water as a boring with a depth of 35 ft failed to find the water table. Infiltrated water will travel at least 35 ft before reaching the water table, so the water will be filtered by then. In addition we are not aware of any known soil contamination present at the site. 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: It is not known at this point the status of the downstream water rights. In addition, this question requires the expertise of water-rights lawyers to determine if any violation can be expected downstream by reducing the runoff slightly via infiltration of the water into the IMPs. Due to the location of the project in a highly urbanized area, it is unlikely that violation of water rights might occur; however, the Civil Team is not responsible for potential violations in water rights that could occur. Infiltration has been included on the project as part of the Water Board strategy of reducing runoff, and as a request of the City. 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.			
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.	Partial 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

Factor of Safety and Design Infiltration Rate Worksheet				Form I-9	
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Level of pretreatment/ expected sediment loads	0.5	1	0.50
		Redundancy/resiliency	0.25	2	0.50
		Compaction during construction	0.25	3	0.75
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{total} = S_A \times S_B$					1.75 (use 2.0)
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					0.22 & 0.12
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					0.11 & 0.06
Supporting Data					
Briefly describe infiltration test and provide reference to test forms: Two open pit falling head tests were performed (see attached "Infiltration Testing...").					

The numeric sizing criteria in this appendix are subdivided into:

- **Appendix B.5.1:** Standard[1] biofiltration BMP sizing; and
- **Appendix B.5.2:** Non-Standard[2] and Compact[3] biofiltration BMP sizing.

If a BMP meets the criteria in **Appendix B.5.1**, then it is considered compliant with the required pollutant control performance standard (i.e., for both retention and pollutant removal). It is not necessary to complete worksheets in this appendix for BMPs that meet the criteria in **Appendix B.5.1**. The volume retention performance standard for partial retention BMPs is presented in Figure B.5-2.

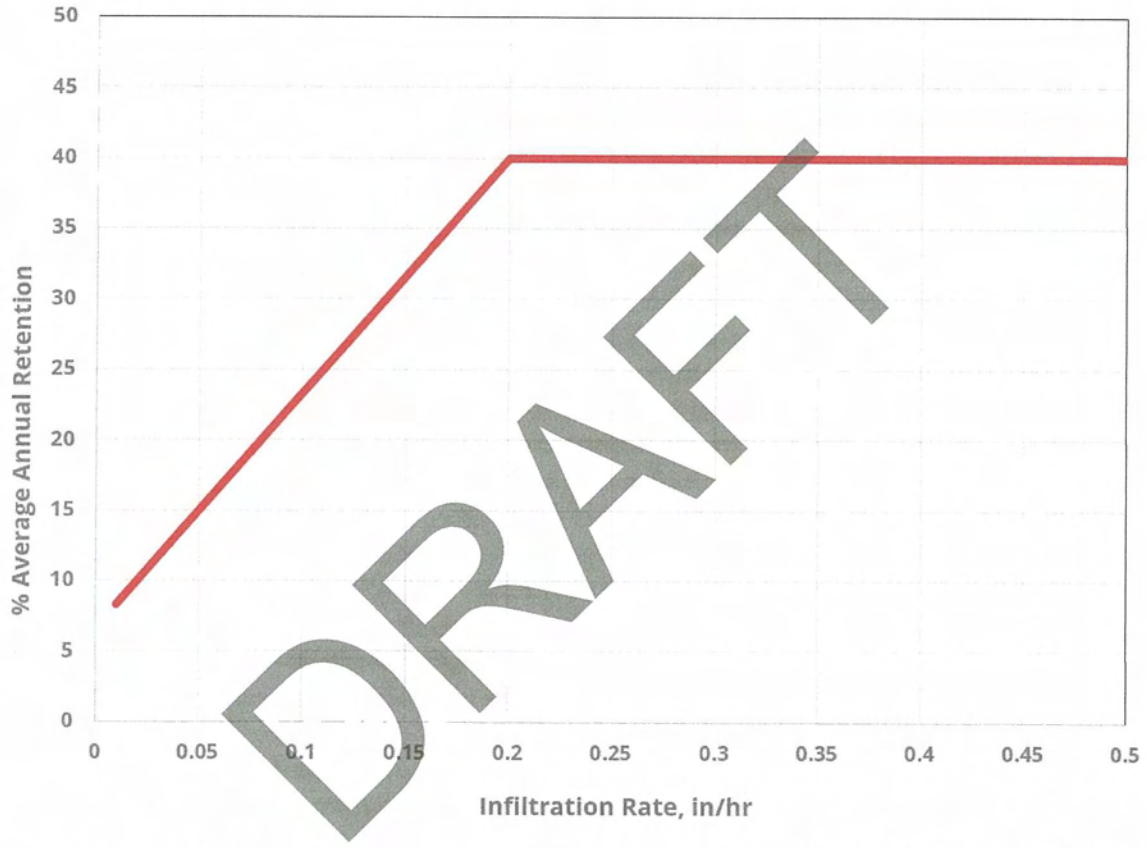


Figure B.5-2 Volume Retention Performance Standard for Partial Infiltration Condition

Note: For biofiltration BMP sizing, the design infiltration rate must be calculated using a factor of safety of 2 i.e., **Design infiltration rate = Measured infiltration rate/2**

The required performance standards for different biofiltration BMPs are summarized in **Table B.5-1** below:

[1] Standard biofiltration BMPs have a media filtration rate equal to or smaller than 5 in/hr. and a media surface area of 3% of contributing area times adjusted runoff factor or greater.

[2] Non-Standard biofiltration BMPs have a media filtration rate equal to or smaller than 5 in/hr. and a media surface area smaller than 3% of contributing area times adjusted runoff factor.

[3] Compact (high rate) biofiltration BMPs have a media filtration rate greater than 5 in/hr. and a media surface area smaller than 3% of contributing area times adjusted runoff factor.

Worksheet B.2-1. DCV

Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	0.063	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.30	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	39	cubic-feet

BIOFILTRATION A

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs

Simple Sizing Method for Biofiltration BMPs	Worksheet B.5-1		
1	Remaining DCV after implementing retention BMPs	39	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	0.11	in/hr.
3	Designed drawdown time for aggregate storage below the underdrain	11	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	1.21	inches
5	Aggregate pore space	0.4	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	3.0	inches
7	Assumed surface area of the biofiltration BMP	42	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	10.535	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	28	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	9	inches
12	Media Thickness [18 inches minimum]	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	15	inches
14	Media available pore space	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by othe outlet use the outlet rate which will be less than 5 in/hr.	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	18.6	inches
19	Total Depth Treated [Line 17 + Line 18]	48.6	inches
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	42.0	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	10.4	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	21.0	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	13.6	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	1367	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5.2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	36.9	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 26)	42.0	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	0.27	unitless
30	Min. req. fraction of DCV retained for partial infiltr. condition (new Fig. B.5-2)	0.25	unitless
31	Is the retained DCV ≥ needed? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion	Yes	

BIOFILTRATION A

Worksheet B.2-1. DCV

Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	0.223	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.673	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	286	cubic-feet

BIOFILTRATION B

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1	
1	Remaining DCV after implementing retention BMPs	286	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	0.085	in/hr.
3	Designed drawdown time for aggregate storage below the underdrain	14	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	1.19	inches
5	Aggregate pore space	0.4	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	3.0	inches
7	Assumed surface area of the biofiltration BMP	264	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	65.78	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	221	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum]	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	15	inches
14	Media available pore space	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by othe outlet use the outlet rate which will be less than 5 in/hr.	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15.6	inches
19	Total Depth Treated [Line 17 + Line 18]	45.6	inches
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	330.8	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	87.0	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	165.4	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	127.2	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	9717	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.673	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5.2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	196.2	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 26)	264.0	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	0.23	unitless
30	Min. req. fraction of DCV retained for partial infiltr. condition (new Fig. B.5-2)	0.21	unitless
31	Is the retained DCV ≥ needed? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion	Yes	

Worksheet B.2-1. DCV

Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.52	inches
2	Area tributary to BMP (s)	A=	0.263	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.650	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	326	cubic-feet

BIOFILTRATION C

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1	
1	Remaining DCV after implementing retention BMPs	326	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	0.085	in/hr.
3	Designed drawdown time for aggregate storage below the underdrain	14	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	1.19	inches
5	Aggregate pore space	0.4	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	3.0	inches
7	Assumed surface area of the biofiltration BMP	316	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	78.74	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	248	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum]	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	15	inches
14	Media available pore space	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by othe outlet use the outlet rate which will be less than 5 in/hr.	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15.6	inches
19	Total Depth Treated [Line 17 + Line 18]	45.6	inches
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	371.4	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	97.7	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	185.7	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	142.9	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	11473	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.650	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5.2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	223.7	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 26)	316.0	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	0.24	unitless
30	Min. req. fraction of DCV retained for partial infiltr. condition (new Fig. B.5-2)	0.21	unitless
31	Is the retained DCV ≥ needed? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion	Yes	

E.13. BF-1 Biofiltration

Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category

Biofiltration

Manual Category

Biofiltration

Applicable Performance Standard

Pollutant Control
Flow Control

Primary Benefits

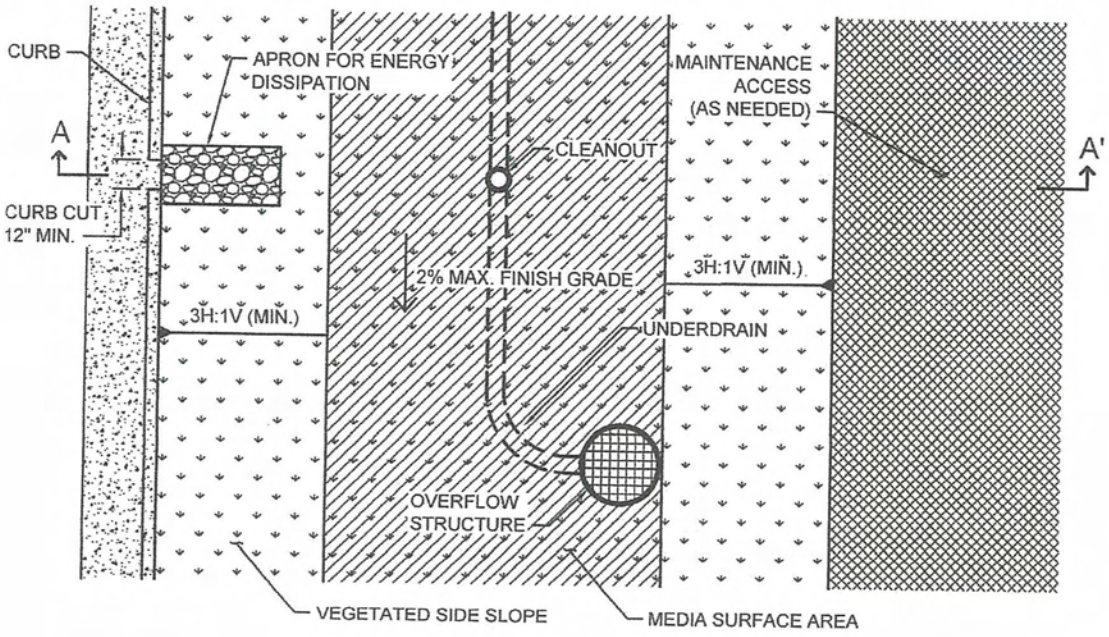
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

Description

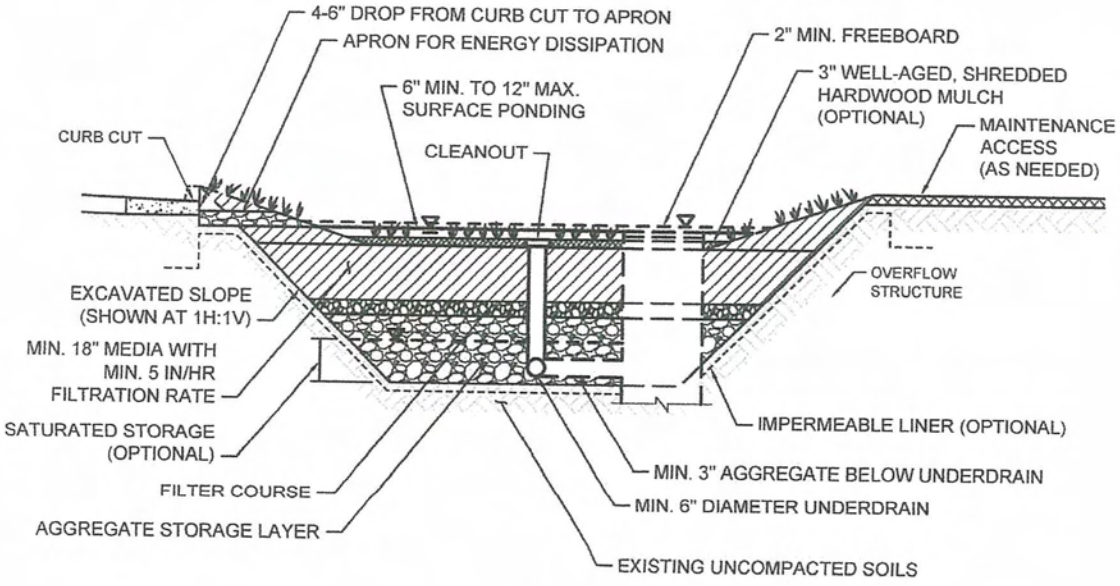
Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer (aka choking layer) consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Figure E.13-E.13-1: Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

	Siting and Design	Intent/Rationale
□	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
□	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
□	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
□	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		

	Siting and Design	Intent/Rationale
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hour for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Mandatory)		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		

	Siting and Design	Intent/Rationale
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. Additional Criteria for media hydraulic conductivity described in the bioretention soil media model specification (Appendix F.4)	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting the following media specifications: Model biorention soil media specification provided in Appendix F.4 or County of San Diego Low Impact Development Handbook: Appendix G - Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade and can result in poor water quality performance for turbidity and suspended solids. Filter fabric is more likely to clog.

	Siting and Design	Intent/Rationale
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	To reduce clogging potential, a two-layer filter course (aka choking stone system) is used consisting of one 3" layer of clean and washed ASTM 33 Fine Aggregate Sand overlying a 3" layer of ASTM No 8 Stone (Appendix F.5).	This specification has been developed to maintain permeability while limiting the migration of media material into the stone reservoir and underdrain system.
Aggregate Storage Layer		
☐	ASTM #57 open graded stone is used for the storage layer and a two layer filter course (detailed above) is used above this layer	This layer provides additional storage capacity. ASTM #8 stone provides an acceptable choking/bridging interface with the particles in ASTM #57 stone.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 8 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains should be affixed with an upturned elbow to an elevation at least 9 to 12 inches above the invert of the underdrain.	An upturned elbow reduces velocity in the underdrain pipe and can help reduce mobilization of sediments from the underdrain and media bed.

	Siting and Design	Intent/Rationale
□	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
□	An underdrain cleanout with a minimum 8-inch diameter and lockable cap is placed every 50 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
□	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

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.

Indicate which Items are Included:

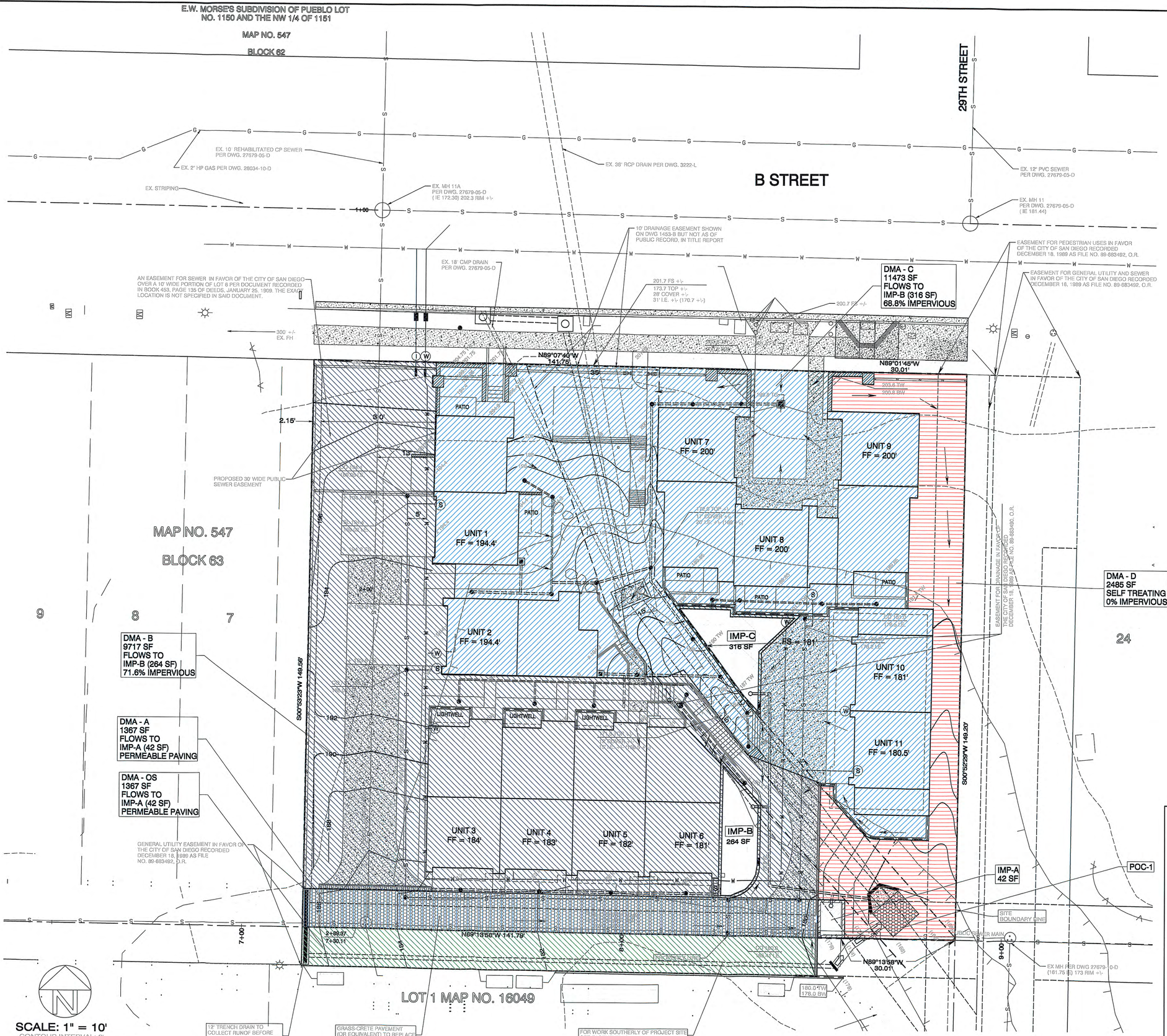
Attachment Sequence	Contents	Checklist
Attachment 2a	Hydromodification Management Exhibit (Required)	☐ Included See Hydromodification Management Exhibit Checklist.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 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 ☐ Not performed
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	☒ 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 See Chapter 6 and Appendix G of the BMP Design Manual	☒ Included in SWMM (see 1e) ☐ 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)
☐ Critical coarse sediment yield areas to be protected
☐ 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
☐ 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)

HYDROMODIFICATION MANAGEMENT EXHIBIT



SITE DEVELOPMENT
PRELIMINARY GRADING PLAN

EXHIBIT CHECKLIST:

HYDROLOGIC SOIL GROUP: "D" (UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICES WEB SOIL SURVEY)

APPROXIMATE DEPTH TO GROUNDWATER: GREATER THAN 20'

EXISTING NATURAL HYDROLOGIC RESOURCES: NO WATERCOURSES, SEEP, SPRINGS OR WETLANDS EXIST IN THE PROJECT AREA

CRITICAL COARSE SEDIMENT YIELD AREAS: POTENTIAL CCSYAs (FCCSYAs) DO NOT OCCUR ONSITE OR UPSTREAM OF THE PROJECT SITE

EXISTING TOPOGRAPHY AND IMPERVIOUS AREAS: TOPOGRAPHY IS SHOWN NO IMPERVIOUS AREAS EXIST IN THE AREA TO BE DEVELOPED

EXISTING AND PROPOSED SITE DRAINAGE NETWORK AND CONNECTIONS TO DRAINAGE OFFSITE: 36" CP DRAIN EXISTS ONSITE DRAINAGE FROM ONSITE IMPERVIOUS SURFACES WILL BE PUMPED TO "O" STREET AND THEN TO THE PUBLIC STORM DRAIN SYSTEM A NEW 36" RCP DRAIN WILL BE CONSTRUCTED

PROPOSED GRADING: IS SHOWN ON THE EXHIBIT

PROPOSED IMPERVOUS FEATURES: IMPERVIOUS ROOF AND DRIVEWAY IS SHOWN

PROPOSED DESIGN FEATURES AND SURFACE TREATMENTS USED TO MINIMIZE IMPERVIOUSNESS: ARE SHOWN AND PERVIOUS PAVING AND LANDSCAPING IS USED TO MINIMIZE IMPERVOUSNESS.

POINT(S) OF COMPLIANCE (POC) FOR HYDROMODIFICATION MANAGEMENT: IS THE OUTLET FROM PROJECT THE THE SE CORNER (AT THE HEADWALL FOR THE PUBLIC DRAIN)

EXISTING AND PROPOSED DRAINAGE BOUNDARY AND DRAINAGE AREA TO EACH POC: SHOWN AND CALLED OUT ON EXHIBIT FOR EACH DMA AREA

STRUCTURAL BMPs FOR HYDROMODIFICATION MANAGEMENT: SHOWN AS IMP-A, B & C

DRAINAGE MANAGEMENT AREA TABLE				
ID	AREA	IMPERVIOUS AREA	PERCENT IMPERVIOUSNESS	SYMBOL
DMA-A IMP-A	1367 SF 42 SF	0 SF N/A	0% N/A	
DMA-OS IMP-A	1367 SF 42 SF	0 SF N/A	0% N/A	
DMA-B IMP-B	9717SF 264 SF	6953 SF N/A	71.6% N/A	
DMA-C IMP-C	11473 SF 316 SF	7892 SF N/A	68.8% N/A	
DMA-D NO IMP	2485 SF	0 SF SELF-TREATING	0%	

AUGUST 25, 2016
ANTONY K. CHRISTENSEN, RCE 54021 — Date

REGISTERED PROFESSIONAL ENGINEER ANTONY K. CHRISTENSEN No. 54021 Exp. 12-31-17 CIVIL STATE OF CALIFORNIA

Prepared By:

CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-9901 FAX (858) 271-8912

Project Address:

"B" STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:

"B" STREET ROW HOMES

Sheet Title:

HYDROMODIFICATION EXHIBIT

Revision 6:
Revision 5:
Revision 4: 08-18-16 REVISE DMAs
Revision 3: 04-02-16 REVISE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

Original Date: APRIL 06, 2015

Sheet 3 of 3 Sheets

DEP#

JN 2015-07

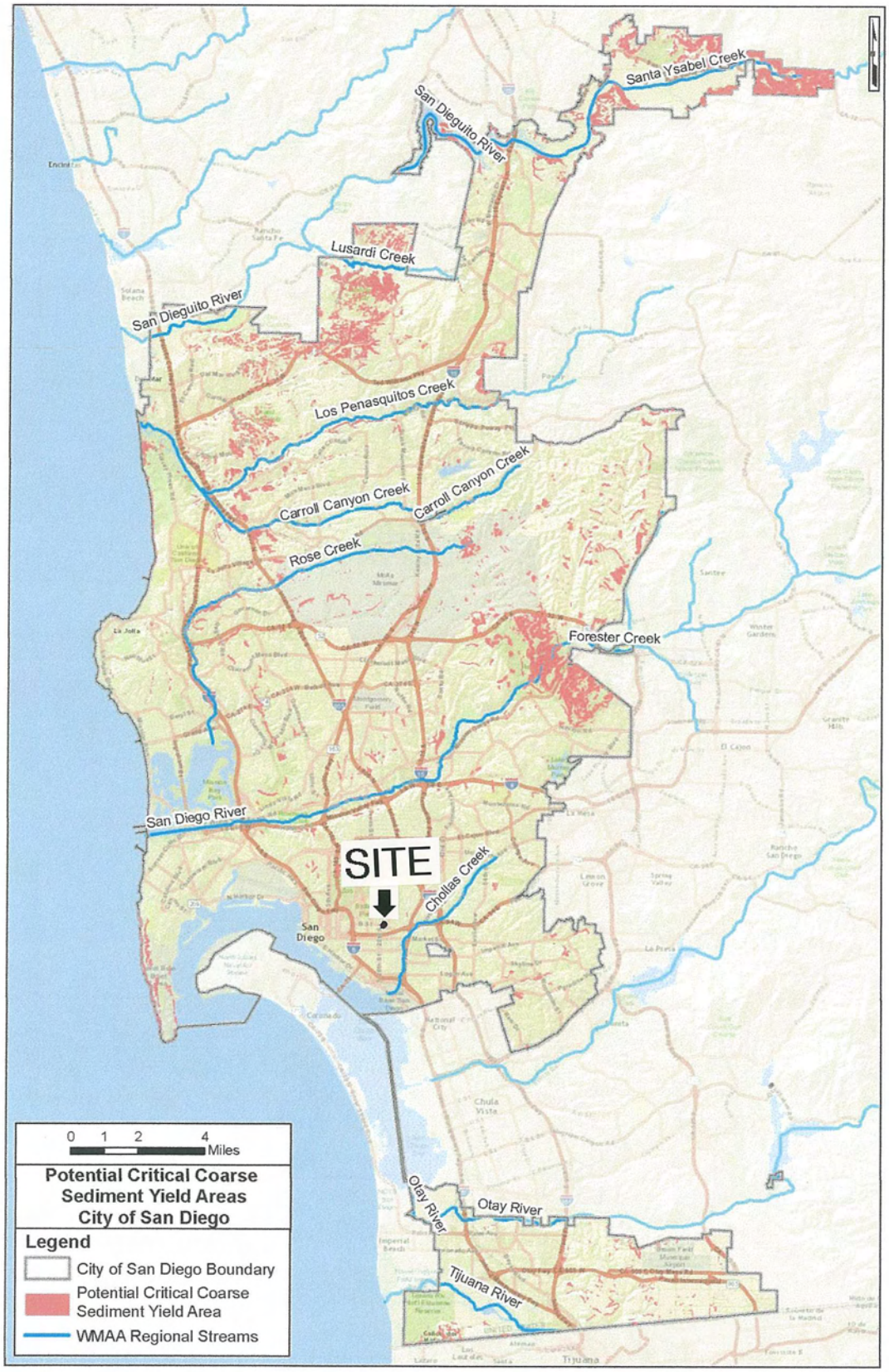
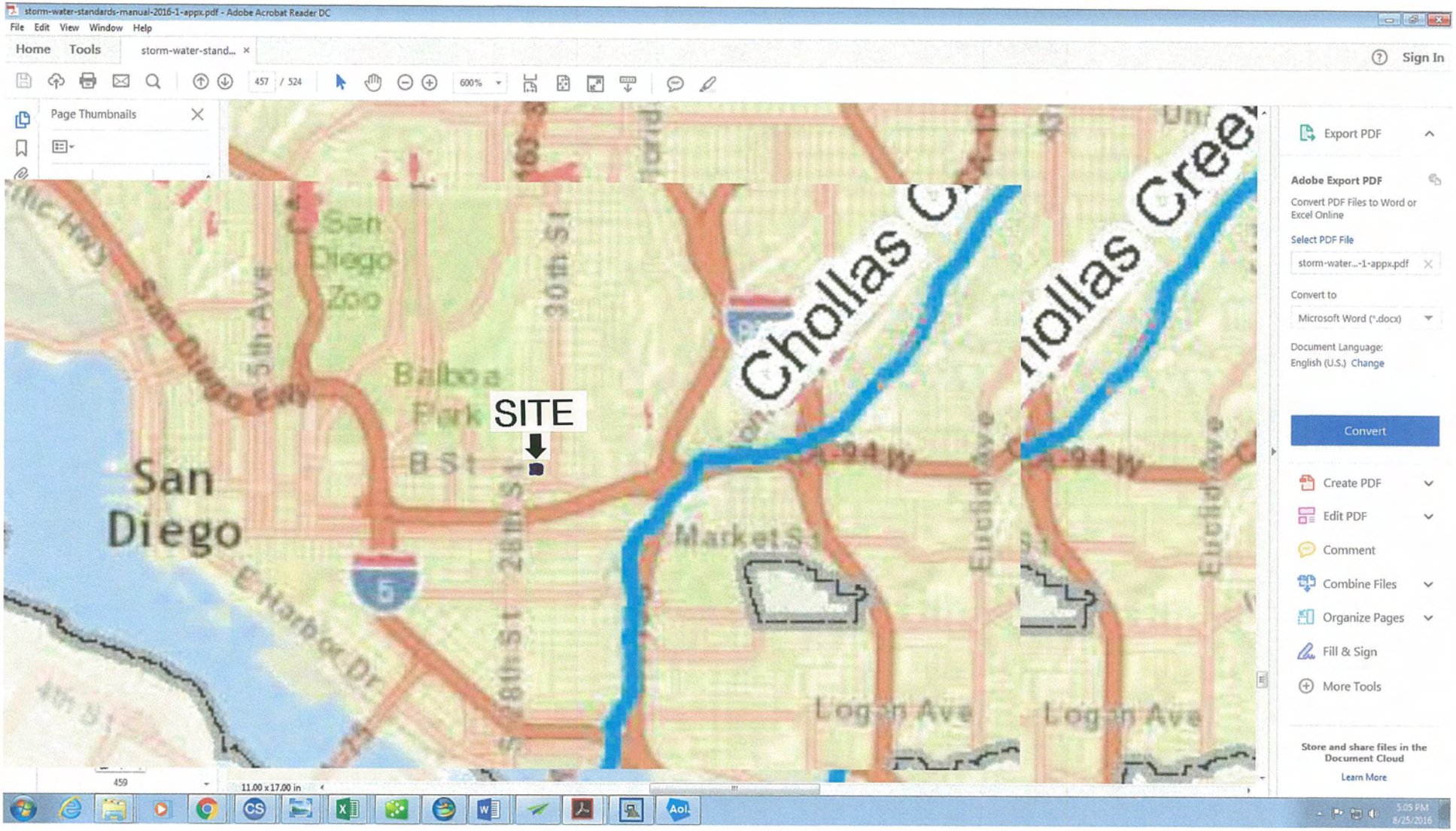
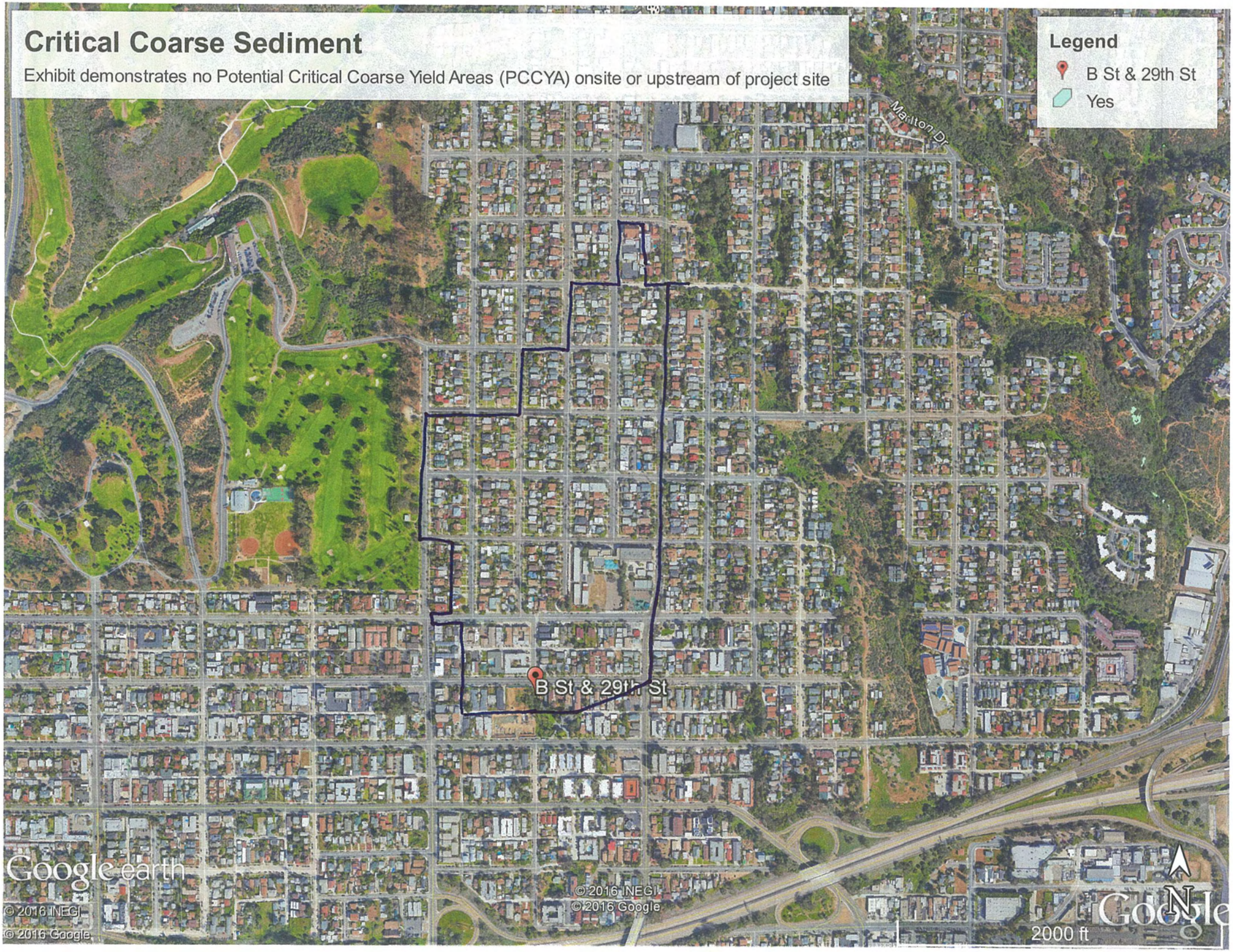


Figure H-G.2-1 Potential Critical Coarse Sediment Yield Areas


storm-water-standards-manual-2016-1-appx.pdf - Adobe Acrobat Reader DC
File Edit View Window Help
Home Tools
Sign In
Page Thumbnails
San Diego Zoo
Balboa Park
SITE
San Diego
Chollas Creek
Market St
Logan Ave
Export PDF
Adobe Export PDF
Convert PDF Files to Word or Excel Online
Select PDF File
Convert to
Microsoft Word (*.docx)
Document Language:
English (U.S.) Change
Convert
Create PDF
Edit PDF
Comment
Combine Files
Organize Pages
Fill & Sign
More Tools
Store and share files in the Document Cloud
Learn More


Critical Coarse Sediment
Exhibit demonstrates no Potential Critical Coarse Yield Areas (PCCYA) onsite or upstream of project site
Legend
B St & 29th St
Yes
Marlton Dr
B St & 29th St
Google earth
© 2016 INEGI
© 2016 Google
© 2016 INEGI
© 2016 Google
2000 ft
N

TECHNICAL MEMORANDUM:

SWMM Modeling for Hydromodification Compliance of:

B Street Apartments

Prepared For:

BH-3

July 8, 2016. Revised: August 24, 2016. Second Revision: September 26, 2016.

Prepared by:

Luis Parra, PhD, CPSWQ, ToR, D.WRE.
R.C.E. 66377

REC Consultants
2442 Second Avenue
San Diego, CA 92101
Telephone: (619) 232-9200

TECHNICAL MEMORANDUM

TO: BH-3

FROM: Luis Parra, PhD, PE, CPSWQ, ToR, D.WRE.
David Edwards, PE.

DATE: July 8, 2016. Revised: 8/24/2016. Second revision: 9/26/2016.

RE: Summary of SWMM Modeling for Hydromodification Compliance for B Street Apartments, San Diego, CA.

INTRODUCTION

This memorandum summarizes the approach used to model the proposed residential development in the City of San Diego using the Environmental Protection Agency (EPA) Storm Water Management Model 5.0 (SWMM). SWMM models were prepared for the pre and post-developed conditions at the site in order to determine if the proposed LID biofiltration facilities have sufficient volume to meet Order R9-2013-001 requirements of the California Regional Water Quality Control Board San Diego Region (SDRWQCB), as explained in the Final Hydromodification Management Plan (HMP), dated March 2011, prepared for the County of San Diego by Brown and Caldwell.

SWMM MODEL DEVELOPMENT

The B Street Apartments project proposes the development multifamily residential apartment units along with the associated parking lot and access roads and driveways. Two (2) SWMM models were prepared for this study: the first for the pre-development and the second for the post-developed conditions. The project site drains to one (1) Point of Compliance (POC-1) located on the southeast corner of the project.

The SWMM model was used since we have found it to be more comparable to San Diego area watersheds than the alternative San Diego Hydrology Model (SDHM) and also because it is a non-proprietary model approved by the HMP document. For both SWMM models, flow duration curves were prepared to determine if the proposed HMP facilities are sufficient to meet the current HMP requirements.

The inputs required to develop SWMM models include rainfall, watershed characteristics, and BMP configurations. The Lindbergh rain gauge from the Project Clean Water website was used for this study, since it is the most representative of the project site precipitation due to elevation and proximity to the project site. Please see gauge location and project location map on attachment 5.

Evaporation for the site was modeled using average monthly values from the BMP manual based on the location of the site. The project site is located in Zone 4 so the values for Zone 4 on Table G.1-1 on Appendix G of the County of San Diego BMP Design Manual dated February 26, 2016 were used. The site was modeled with Type D hydrologic soil as this is the existing soil determined from the NRCS Web Soil Survey in the surrounding areas. Specific site information is not available neither in the NRCS We Soil Survey nor the Soils Map from the county; therefore the soil information closest to the site was use to

assume the soil type. Soils have been assumed to be uncompact in the existing condition to represent the current natural state of the site. In the post developed conditions the site was assumed to be compacted. Other SWMM inputs for the subareas are discussed in the appendices to this document, where the selection of the parameters is explained in detail.

HMP MODELING

EXISTING CONDITIONS

The current site is a natural site which drains southeasterly to one (1) point of compliance from the project site. This POC-1 is located along the southeast boundary of the project.

TABLE 1 – SUMMARY OF EXISTING CONDITIONS

DMA	Tributary Area, A (Ac)	Impervious Percentage [(1)], Ip
1	0.621[(2)]	0.00%
TOTAL	0.621	--

Notes: (1) – Per the 2013 RWQCB permit, existing condition impervious surfaces are not to be accounted for in existing conditions analysis. (2): Area includes 0.032 acres of the Alley outside the property.

DEVELOPED CONDITIONS

Storm water runoff from the proposed project site is routed to one (1) POC on the southeast corner of the project. Prior to discharging into the POC, runoff from the developed portion of the project is intercepted by 3 onsite receiving LID BMPs. Once flows are routed via the proposed LID BMPs, developed onsite flows are then conveyed to the POC mentioned above where they confluence with flows from an area that remains pervious in post conditions and is unfeasible to treat. Table 2 below lists all DMAs.

It is assumed all storm water quality requirements for the project will be met by the biofiltration LID BMPs. However, detailed water quality requirements are not discussed within this technical memo. For further information in regards to storm water quality requirements for the project and drawdown time, please refer to the site specific Storm Water Quality Management Plan (SWQMP).

TABLE 2 – SUMMARY OF DEVELOPED CONDITIONS

DMA	BMP	Tributary Area, A (Ac)[(1)]	Impervious Percentage, Ip
A	IMP A	0.064	0.00%
B	IMP B	0.229	71.56%
C	IMP C	0.271	68.79%
D	None	0.057	0.00%
TOTAL	--	**0.621**	--

Notes: (1) – Tributary areas include the area of the LID BMP.

Three (3) LID biofiltration BMP basins are located within the project site and are responsible for handling hydromodification requirements for the project. In developed conditions, the basin will have a surface depth and a riser spillway structure (see dimensions in Table 3). Flows will then discharge from the basin via the outlet structure or infiltrate through the base of the facilities to the receiving amended soil and low flow orifice located in the gravel layer. The riser structure will act as a spillway such that peak flows can be safely discharged to the receiving storm drain system.

Beneath the basin's invert lies the proposed LID biofiltration portion of each drainage facility. This portion of each basin is comprised of a 3-inch layer of mulch, an 18-inch layer of amended soil (a highly sandy, organic rich composite with an infiltration capacity of at least 5 inches/hr) and a layer of gravel. The basins will not be lined at the horizontal bottom of the gravel to allow infiltration into the underlying soil.

The biofiltration basins were modeled using the biofiltration LID module within SWMM. The biofiltration/infiltration module can model the amended soil layer, and a surface storage pond up to the elevation of the invert of the spillway. It should be noted that detailed outlet structure location and elevations will be shown on the construction plans based on the recommendations of this study.

BMP MODELING FOR HMP PURPOSES

Modeling of dual purpose Water Quality/HMP BMPs

Three biofiltration LID BMPs are proposed for water quality treatment and hydromodification conformance for the project site. Tables 3 & 4 illustrate the dimensions required for HMP compliance according to the SWMM model that was undertaken for the project.

TABLE 3 – SUMMARY OF DEVELOPED DUAL PURPOSE BMP

BMP	Tributary Area (Ac)	DIMENSIONS					
		BMP Area[1], (ft^2)	Low Flow Orifice (in)[5]	Gravel Depth (in)[6]	Depth to Riser Invert (ft)[2]	Weir Perimeter Length[3] (ft)	Total Surface Depth[4] (ft)
BMP A	0.032	42	8.0	18	0.75	2.09	1.0
BMP B	0.229	264	8.0	18	0.79	2.09	1.0
BMP C	0.281	316	8.0	18	0.79	2.09	1.0

Notes:
(1): Area of amended soil = area of gravel = area of the BMP
(2): Depth of ponding beneath riser structure's surface spillway.
(3): Overflow length, the internal perimeter of the riser is the circumference of the round riser which has an 8 inch diameter pipe; therefore the circumference C = πD/12 so that C = 2.09.
(4): Total surface depth of BMP from top crest elevation to surface invert.
(5): Low Flow orifice = French Drain diameter (no plate necessary)
(6): Gravel depth is as follows: 3" of sand (ASTM 33), 3" of pea gravel (ASTM 8), 9" of gravel up to invert of French Drain and 3" of gravel from invert of French drain to bottom of gravel layer for a total of 12" of gravel (ASTM 57).

TABLE 4 – SUMMARY OF RISER DETAILS:

BMP	Low Surface Orifice		Top Riser	
	# - dia (in)	Elev.[1] (ft)	Length[2] (ft)	Elev.[1] (ft)
BMP A	n/a	n/a	2.09	0.75
BMP B	4 - x 1.0	0.5	2.09	0.79
BMP C	4 - x 1.0	0.5	2.09	0.79

Notes: (1): Basin ground surface elevation assumed to be 0.00 ft elevation.
(2): Overflow length is the internal perimeter/circumference of the riser structure.

FLOW DURATION CURVE COMPARISON

The Flow Duration Curve (FDC) for the site was compared at POC-1 by exporting the hourly runoff time series results from SWMM to a spreadsheet. The FDC was compared between 50% of the existing condition Q_2 up to the existing condition Q_{10} for POC-1. The Q_2 and Q_{10} were determined with a partial duration statistical analysis of the runoff time series in an Excel spreadsheet using the Cunnane plotting position method (which is the preferred plotting methodology in the HMP Permit). As the SWMM Model includes a statistical analysis based on the Weibull Plotting Position Method, the Weibull Method was also used within the spreadsheet to ensure that the results were similar to those obtained by the SWMM Model.

The 50% range is used based upon the susceptibility study prepared for this project [6]. The receiving creek is low susceptibility and therefore the low-flow threshold is 50% of Q_2.

The range between 50% of Q_2 and Q_{10} was divided into 100 equal time intervals; the number of hours that each flow rate was exceeded was counted from the hourly series. Additionally, the intermediate peaks with a return period "i" were obtained (Q_i with i=3 to 9). For the purpose of the plot, the values were presented as percentage of time exceeded for each flow rate. FDC comparison at the POC is illustrated in Figure 1 in both normal and logarithmic scale. Attachment 5 provides a detailed drainage exhibit for the post-developed condition.

As can be seen in Figure 1, the FDC for the proposed condition with the HMP BMP is within 110% of the curve for the existing condition in both peak flows and durations. The additional runoff volume generated from developing the site will be released to the existing point of discharge at a flow rate below the 50% Q_2 lower threshold for the POC. Additionally, the project will also not increase peak flow rates between the Q_2 and the Q_{10}, as shown in the graphic and also in the peak flow tables in Attachment 1.

It should be pointed out that the Susceptibility analysis in some cases depends on the interpretation of the geomorphologist, especially for systems near transition conditions. However, as can be seen in figure 2, even if an extremely conservative value of medium susceptibility is used the system still satisfies hydromodification compliance. Therefore, the precise determination of low or medium susceptibility is not relevant in this project.

DRAWDOWN CONSIDERATIONS

As the receiving creek is a low susceptibility creek, there is no need to constrain the low flow orifice of the French Drains in this project because the capacity of the French Drains of all 3 LIDs combined is less than 50% of Q_2. At the same time, the capacity of the French Drains is larger than the infiltration capacity of the amended soil. Therefore, the amended soil becomes the critical path for determining surface drying time, meaning that the surface will drain at a rate of 5 in/hr. The depth of the surface for LIDs 1, 2, and 3 is respectively 9 inches, 9.5 inches and 9.5 inches; therefore, the drying time of the surface is 1.8 hrs, 1.9 hrs and 1.9 hrs respectively, smaller than 24 hours for all three cases.

CONSIDERATIONS ABOUT INTERMEDIATE SLOTS

As a result of a City review, a clarification is needed in regards of the function of the intermediate slots in the BMPs B and C. There are two types of orifices: low-flow orifices constraining the perforated French Drains of each BMP (which are not needed here per the explanation of the section before) and surface orifice at an elevation of 6 inches or more above the surface. The LID orifices in the French drain (or the French Drain itself as in this case) control the low flows. Orifices at the surface are included above the Water Quality Volume requirement and are a necessity to optimize hydromodification sizing because they control intermediate discharges. Both are useful for hydromodification control. The removal of surface orifices shifts the Flow Duration Curve out of compliance and they are needed to optimize the facilities and achieve hydromodification compliance with the sizes provided. The reader should understand that the existence of surface orifices is not incompatible with the existence of low-flow orifices in the gravel layer, and both are present in BMPs B and C.

SUMMARY

This study has demonstrated that the proposed HMP BMPs provided for the B Street Apartments project site are sufficient to meet the current HMP criteria if the cross-section areas and volumes recommended within this technical memorandum, and the respective orifice and outlet structure are incorporated as specified within the proposed project site.

KEY ASSUMPTIONS

1. Type D Soil is was assumed for the site based on available information for the surrounding areas.
2. The basins will be lined vertically only to prevent lateral infiltration into the underlying soil.
3. Basin will not be lined horizontally at the bottom. 3 inch of gravel under the French Drain will be added.

ATTACHMENTS

1. Q_2 to Q_{10} Comparison Tables
2. Flow Duration Curve Analysis
3. List of the "n" largest Peaks: Pre-Development and Post-Development Conditions
4. Area Vs Elevation & Discharge Vs Elevation
5. Pre & Post Development Maps, Project Plan and Section Sketches
6. SWMM Input Data in Input Format (Existing and Proposed Models)
7. EPA SWMM Figures and Explanations
8. Soil Maps
9. Summary files from the SWMM Model

REFERENCES

[1] – *"Review and Analysis of San Diego County Hydromodification Management Plan (HMP): Assumptions, Criteria, Methods, & Modeling Tools – Prepared for the Cities of San Marcos, Oceanside & Vista"*, May 2012, TRWE Engineering.

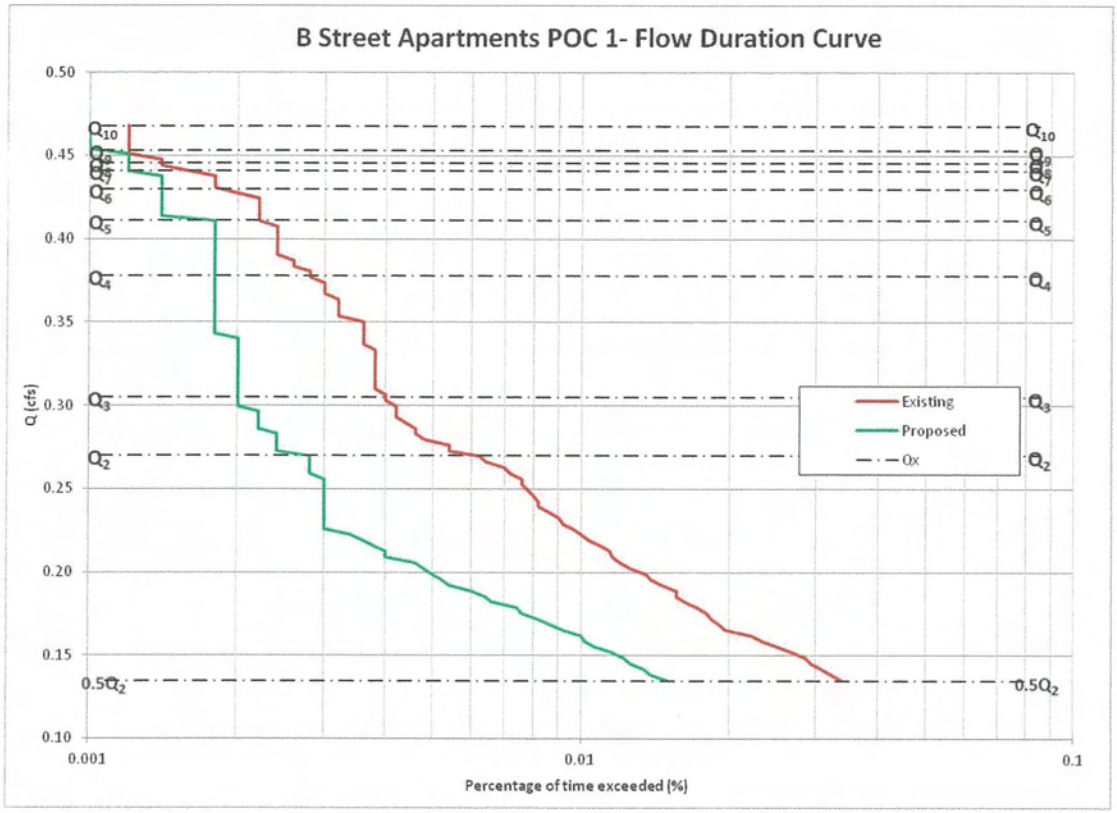
[2] – *"Final Hydromodification Management Plan (HMP) prepared for the County of San Diego"*, March 2011, Brown and Caldwell.

[3] - Order R9-2007-001, California Regional Water Quality Control Board San Diego Region (SDRWQCB).

[4] – "*Handbook of Hydrology*", David R. Maidment, Editor in Chief. 1992, McGraw Hill.

[5] – "*County of San Diego BMP Design Manual*", February 2016.

[6] – "Technical Memorandum: Hydromodification Screen for Susceptibility Analysis of: B Street Apartments Receiving Creek", REC Consultants, July 8, 2016.



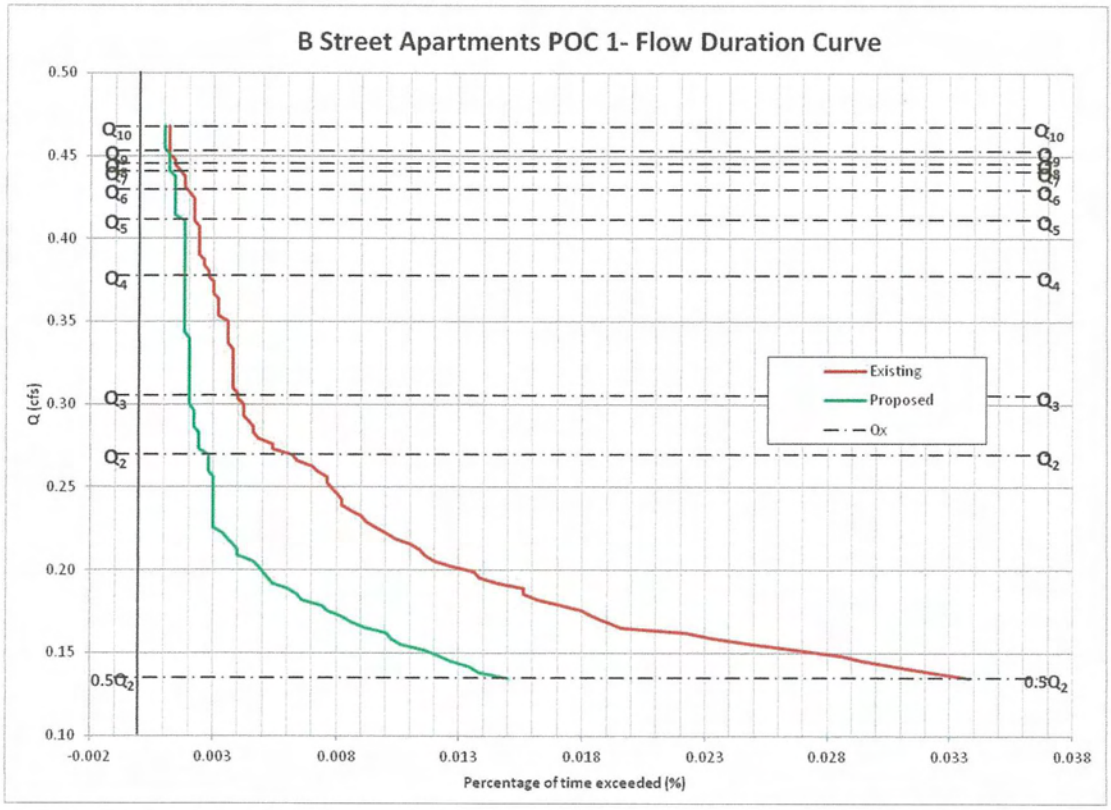


Figure 1a and 1b. Flow Duration Curve Comparison (logarithmic and normal "x" scale)

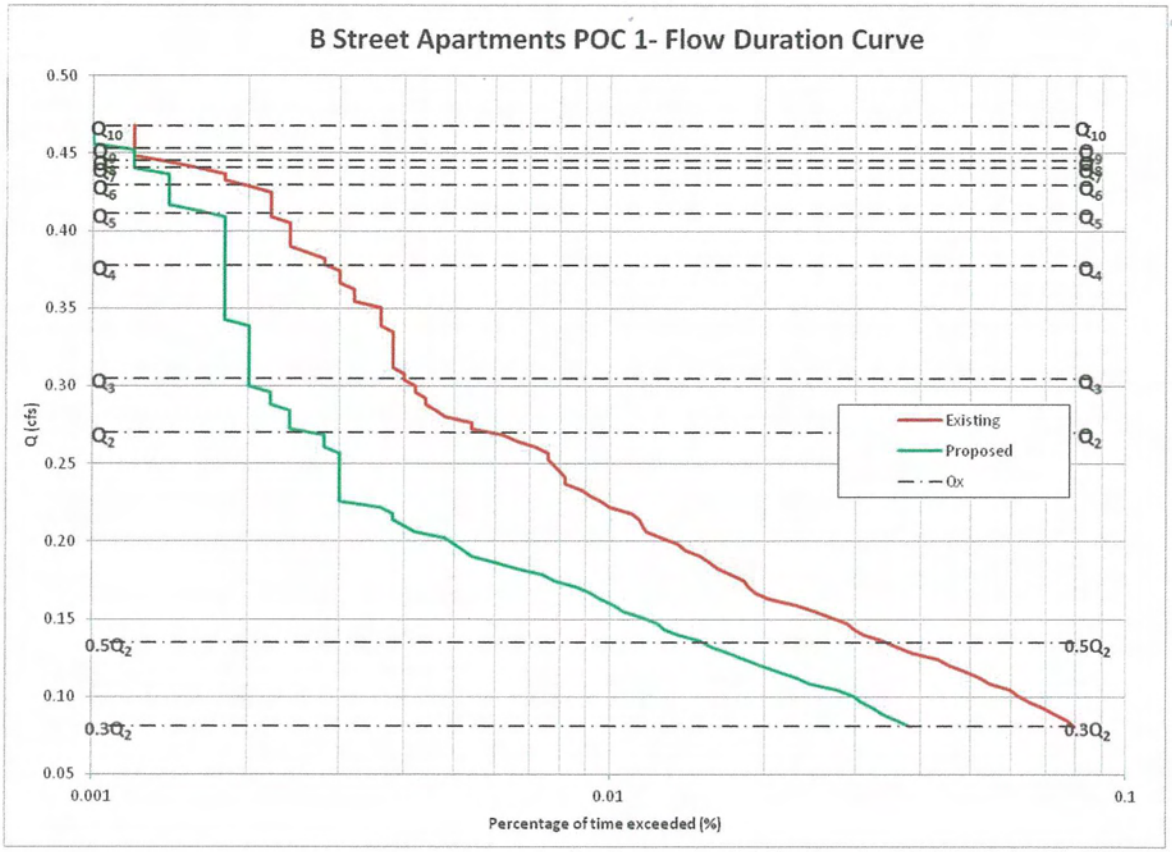


Figure 2. FDC Comparison if Low-Flow Threshold Were $0.3Q_2$

ATTACHMENT 1.

Q_2 to Q_{10} Comparison Table – POC 1

Return Period	Existing Condition (cfs)	Mitigated Condition (cfs)	Reduction, Exist - Mitigated (cfs)
2-year	0.270	0.177	0.093
3-year	0.305	0.207	0.099
4-year	0.378	0.234	0.143
5-year	0.411	0.276	0.136
6-year	0.430	0.346	0.083
7-year	0.441	0.413	0.028
8-year	0.446	0.425	0.021
9-year	0.453	0.443	0.010
10-year	0.468	0.451	0.017

ATTACHMENT 2

FLOW DURATION CURVE ANALYSIS

1) Flow duration curve shall not exceed the existing conditions by more than 10%, neither in peak flow nor duration.

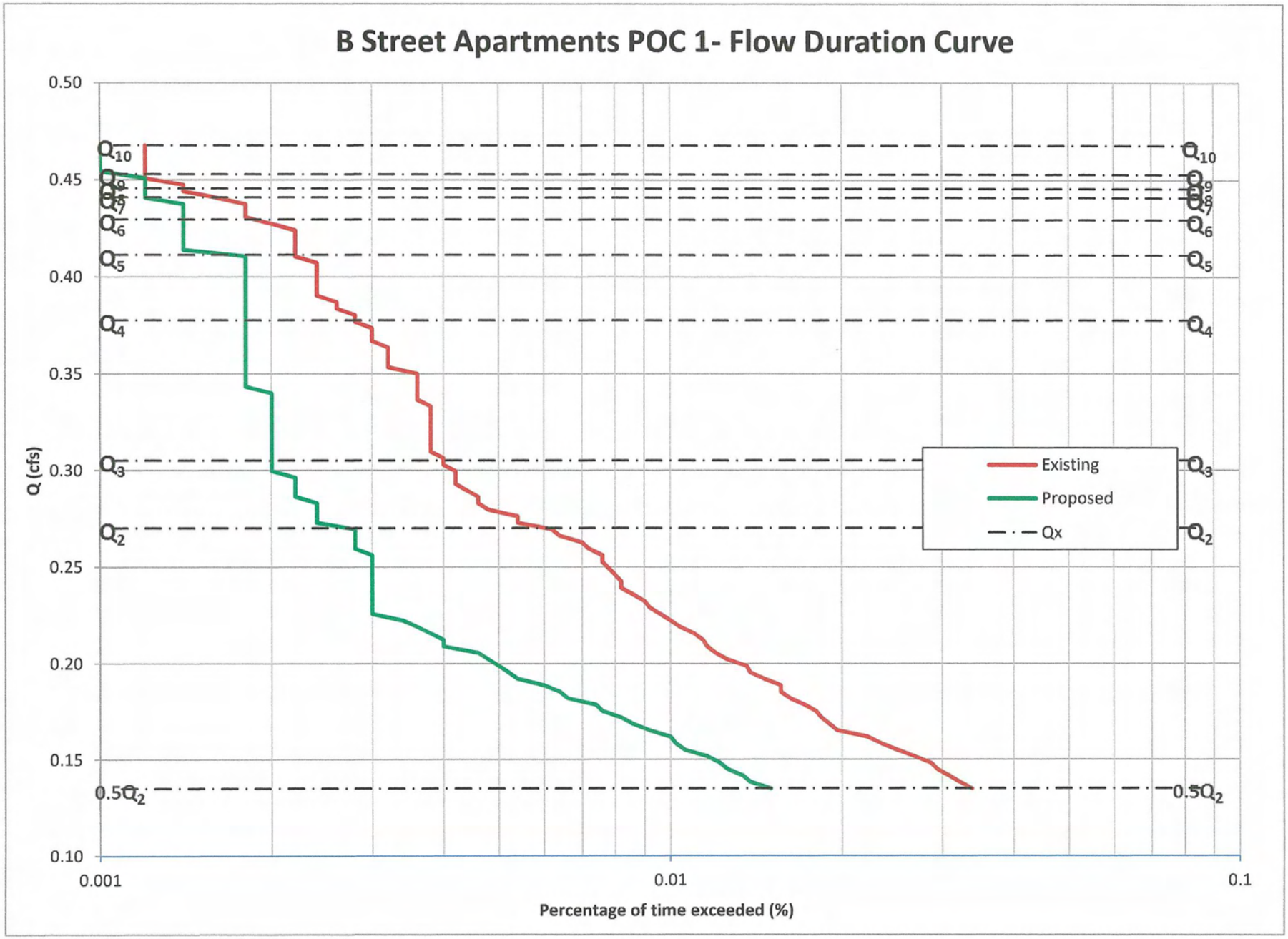
The figures on the following pages illustrate that the flow duration curve in post-development conditions after the proposed BMP is below the existing flow duration curve. The flow duration curve table following the curve shows that if the interval $0.50Q_2 - Q_{10}$ is divided in 100 sub-intervals, then a) the post development divided by pre-development durations are never larger than 110% (the permit allows up to 110%); and b) there are no more than 10 intervals in the range 101%-110% which would imply an excess over 10% of the length of the curve (the permit allows less than 10% of excesses measured as 101-110%).

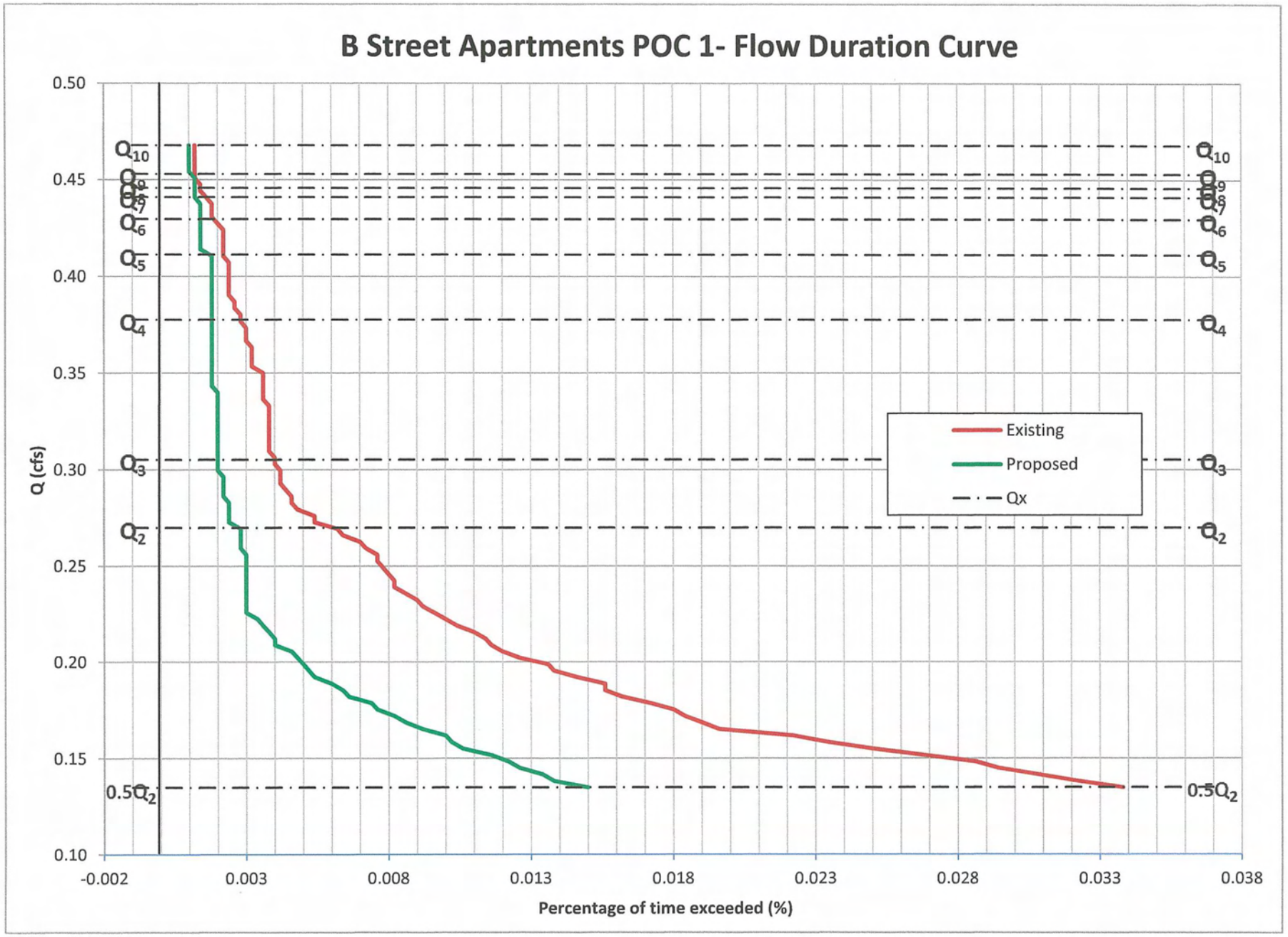
Consequently, the design passes the hydromodification test.

It is important to note that the flow duration curve can be expressed in the "x" axis as percentage of time, hours per year, total number of hours, or any other similar time variable. As those variables only differ by a multiplying constant, their plot in logarithmic scale is going to look exactly the same, and compliance can be observed regardless of the variable selected. However, in order to satisfy the City of San Diego HMP example, % of time exceeded is the variable of choice in the flow duration curve. The selection of a logarithmic scale in lieu of the normal scale is preferred, as differences between the pre-development and post-development curves can be seen more clearly in the entire range of analysis. Both graphics are presented just to prove the difference.

In terms of the "y" axis, the peak flow value is the variable of choice. As an additional analysis performed by REC, not only the range of analysis is clearly depicted (50% of Q_2 to Q_{10}) but also all intermediate flows are shown (Q_2, Q_3, Q_4, Q_5, Q_6, Q_7, Q_8 and Q_9) in order to demonstrate compliance at any range $Q_x - Q_{x+1}$. It must be pointed out that one of the limitations of both the SWMM and SDHM models is that the intermediate analysis is not performed (to obtain Q_i from i = 2 to 10). REC performed the analysis using the Cunnane Plotting position Method (the preferred method in the HMP permit) from the "n" largest independent peak flows obtained from the continuous time series.

The largest "n" peak flows are attached in this appendix, as well as the values of Q_i with a return period "i", from i=2 to 10. The Q_i values are also added into the flow-duration plot.


B Street Apartments POC 1- Flow Duration Curve
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
Q (cfs)
Q_{10}
Q_9
Q_8
Q_7
Q_6
Q_5
Q_4
Q_3
Q_2
$0.5Q_2$
Existing
Proposed
Qx
0.001
0.01
0.1
Percentage of time exceeded (%)


B Street Apartments POC 1- Flow Duration Curve
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
Q (cfs)
Q_{10}
Q_9
Q_8
Q_7
Q_6
Q_5
Q_4
Q_3
Q_2
$0.5Q_2$
Existing
Proposed
Qx
-0.002
0.003
0.008
0.013
0.018
0.023
0.028
0.033
0.038
Percentage of time exceeded (%)

ATTACHMENT 3

List of the "n" Largest Peaks: Pre & Post-Developed Conditions

Basic Probabilistic Equation:

R = 1/P R: Return period (years).

P: Probability of a flow to be equaled or exceeded any given year (dimensionless).

Cunnane Equation:

$$P = \frac{i-0.4}{n+0.2}$$

Weibull Equation:

$$P = \frac{i}{n+1}$$

i: Position of the peak whose probability is desired (sorted from large to small).

n: Number of years analyzed.

Explanation of Variables for the Tables in this Attachment

Peak: Refers to the peak flow at the date given, taken from the continuous simulation hourly results of the n year analyzed.

Posit: If all peaks are sorted from large to small, the position of the peak in a sorting analysis is included under the variable Posit.

Date: Date of the occurrence of the peak at the outlet from the continuous simulation

Note: All peaks are not annual maxima; instead they are defined as event maxima, with a threshold to separate peaks of at least 12 hours. In other words, any peak P in a time series is defined as a value where dP/dt = 0, and the peak is the largest value in 25 hours (12 hours before, the hour of occurrence and 12 hours after the occurrence, so it is in essence a daily peak).

Flow Duration Curve Data for B St Apartments POC-1 , City of San Diego CA

Q2 = 0.27 cfs Fraction 50 %
Q10 = 0.47 cfs
Step = 0.0034 cfs
Count = 499679 hours
57.00 years

	Existing Condition			Detention Optimized			Pass or
Interval	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	Fail?
1	0.135	169	3.38E-02	75	1.50E-02	44%	Pass
2	0.138	161	3.22E-02	69	1.38E-02	43%	Pass
3	0.142	154	3.08E-02	67	1.34E-02	44%	Pass
4	0.145	147	2.94E-02	63	1.26E-02	43%	Pass
5	0.148	143	2.86E-02	61	1.22E-02	43%	Pass
6	0.152	134	2.68E-02	58	1.16E-02	43%	Pass
7	0.155	125	2.50E-02	53	1.06E-02	42%	Pass
8	0.159	117	2.34E-02	51	1.02E-02	44%	Pass
9	0.162	111	2.22E-02	50	1.00E-02	45%	Pass
10	0.165	98	1.96E-02	46	9.21E-03	47%	Pass
11	0.169	95	1.90E-02	43	8.61E-03	45%	Pass
12	0.172	92	1.84E-02	41	8.21E-03	45%	Pass
13	0.175	90	1.80E-02	38	7.60E-03	42%	Pass
14	0.179	86	1.72E-02	37	7.40E-03	43%	Pass
15	0.182	81	1.62E-02	33	6.60E-03	41%	Pass
16	0.185	78	1.56E-02	32	6.40E-03	41%	Pass
17	0.189	78	1.56E-02	30	6.00E-03	38%	Pass
18	0.192	73	1.46E-02	27	5.40E-03	37%	Pass
19	0.196	69	1.38E-02	26	5.20E-03	38%	Pass
20	0.199	68	1.36E-02	25	5.00E-03	37%	Pass
21	0.202	63	1.26E-02	24	4.80E-03	38%	Pass
22	0.206	60	1.20E-02	23	4.60E-03	38%	Pass
23	0.209	58	1.16E-02	20	4.00E-03	34%	Pass
24	0.212	57	1.14E-02	20	4.00E-03	35%	Pass
25	0.216	55	1.10E-02	19	3.80E-03	35%	Pass
26	0.219	52	1.04E-02	18	3.60E-03	35%	Pass
27	0.222	50	1.00E-02	17	3.40E-03	34%	Pass
28	0.226	48	9.61E-03	15	3.00E-03	31%	Pass
29	0.229	46	9.21E-03	15	3.00E-03	33%	Pass
30	0.232	45	9.01E-03	15	3.00E-03	33%	Pass
31	0.236	43	8.61E-03	15	3.00E-03	35%	Pass
32	0.239	41	8.21E-03	15	3.00E-03	37%	Pass
33	0.243	41	8.21E-03	15	3.00E-03	37%	Pass
34	0.246	40	8.01E-03	15	3.00E-03	38%	Pass
35	0.249	39	7.81E-03	15	3.00E-03	38%	Pass
36	0.253	38	7.60E-03	15	3.00E-03	39%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
37	0.256	38	7.60E-03	15	3.00E-03	39%	Pass
38	0.259	36	7.20E-03	14	2.80E-03	39%	Pass
39	0.263	35	7.00E-03	14	2.80E-03	40%	Pass
40	0.266	32	6.40E-03	14	2.80E-03	44%	Pass
41	0.269	31	6.20E-03	14	2.80E-03	45%	Pass
42	0.273	27	5.40E-03	12	2.40E-03	44%	Pass
43	0.276	27	5.40E-03	12	2.40E-03	44%	Pass
44	0.280	24	4.80E-03	12	2.40E-03	50%	Pass
45	0.283	23	4.60E-03	12	2.40E-03	52%	Pass
46	0.286	23	4.60E-03	11	2.20E-03	48%	Pass
47	0.290	22	4.40E-03	11	2.20E-03	50%	Pass
48	0.293	21	4.20E-03	11	2.20E-03	52%	Pass
49	0.296	21	4.20E-03	11	2.20E-03	52%	Pass
50	0.300	21	4.20E-03	10	2.00E-03	48%	Pass
51	0.303	20	4.00E-03	10	2.00E-03	50%	Pass
52	0.306	20	4.00E-03	10	2.00E-03	50%	Pass
53	0.310	19	3.80E-03	10	2.00E-03	53%	Pass
54	0.313	19	3.80E-03	10	2.00E-03	53%	Pass
55	0.317	19	3.80E-03	10	2.00E-03	53%	Pass
56	0.320	19	3.80E-03	10	2.00E-03	53%	Pass
57	0.323	19	3.80E-03	10	2.00E-03	53%	Pass
58	0.327	19	3.80E-03	10	2.00E-03	53%	Pass
59	0.330	19	3.80E-03	10	2.00E-03	53%	Pass
60	0.333	19	3.80E-03	10	2.00E-03	53%	Pass
61	0.337	18	3.60E-03	10	2.00E-03	56%	Pass
62	0.340	18	3.60E-03	10	2.00E-03	56%	Pass
63	0.343	18	3.60E-03	9	1.80E-03	50%	Pass
64	0.347	18	3.60E-03	9	1.80E-03	50%	Pass
65	0.350	18	3.60E-03	9	1.80E-03	50%	Pass
66	0.354	16	3.20E-03	9	1.80E-03	56%	Pass
67	0.357	16	3.20E-03	9	1.80E-03	56%	Pass
68	0.360	16	3.20E-03	9	1.80E-03	56%	Pass
69	0.364	16	3.20E-03	9	1.80E-03	56%	Pass
70	0.367	15	3.00E-03	9	1.80E-03	60%	Pass
71	0.370	15	3.00E-03	9	1.80E-03	60%	Pass
72	0.374	15	3.00E-03	9	1.80E-03	60%	Pass
73	0.377	14	2.80E-03	9	1.80E-03	64%	Pass
74	0.380	14	2.80E-03	9	1.80E-03	64%	Pass
75	0.384	13	2.60E-03	9	1.80E-03	69%	Pass
76	0.387	13	2.60E-03	9	1.80E-03	69%	Pass
77	0.390	12	2.40E-03	9	1.80E-03	75%	Pass
78	0.394	12	2.40E-03	9	1.80E-03	75%	Pass
79	0.397	12	2.40E-03	9	1.80E-03	75%	Pass
80	0.401	12	2.40E-03	9	1.80E-03	75%	Pass
81	0.404	12	2.40E-03	9	1.80E-03	75%	Pass

Interval	Existing Condition			Detention Optimized			Pass or Fail?
	Q (cfs)	Hours > Q	% time	Hours>Q	% time	Post/Pre	
82	0.407	12	2.40E-03	9	1.80E-03	75%	Pass
83	0.411	11	2.20E-03	9	1.80E-03	82%	Pass
84	0.414	11	2.20E-03	7	1.40E-03	64%	Pass
85	0.417	11	2.20E-03	7	1.40E-03	64%	Pass
86	0.421	11	2.20E-03	7	1.40E-03	64%	Pass
87	0.424	11	2.20E-03	7	1.40E-03	64%	Pass
88	0.427	10	2.00E-03	7	1.40E-03	70%	Pass
89	0.431	9	1.80E-03	7	1.40E-03	78%	Pass
90	0.434	9	1.80E-03	7	1.40E-03	78%	Pass
91	0.438	9	1.80E-03	7	1.40E-03	78%	Pass
92	0.441	8	1.60E-03	6	1.20E-03	75%	Pass
93	0.444	7	1.40E-03	6	1.20E-03	86%	Pass
94	0.448	7	1.40E-03	6	1.20E-03	86%	Pass
95	0.451	6	1.20E-03	6	1.20E-03	100%	Pass
96	0.454	6	1.20E-03	5	1.00E-03	83%	Pass
97	0.458	6	1.20E-03	5	1.00E-03	83%	Pass
98	0.461	6	1.20E-03	5	1.00E-03	83%	Pass
99	0.464	6	1.20E-03	5	1.00E-03	83%	Pass
100	0.468	6	1.20E-03	5	1.00E-03	83%	Pass

Peak Flows calculated with Cunnane Plotting Position

Return Period (years)	Pre-dev. Q (cfs)	Post-Dev. Q (cfs)	Reduction (cfs)
10	0.468	0.451	0.017
9	0.453	0.443	0.010
8	0.446	0.425	0.021
7	0.441	0.413	0.028
6	0.430	0.346	0.083
5	0.411	0.276	0.136
4	0.378	0.234	0.143
3	0.305	0.207	0.099
2	0.270	0.177	0.093

List of Peak events and Determination of Q2 and Q10 (Pre-Development)

B Street Apartments - POC-1

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**0.47**	**0.47**
9	**0.45**	**0.46**
8	**0.45**	**0.45**
7	**0.44**	**0.44**
6	**0.43**	**0.43**
5	**0.41**	**0.42**
4	**0.38**	**0.38**
3	**0.31**	**0.31**
2	**0.27**	**0.27**

Note:
Cunnane is the preferred method by the HMP permit.

Peaks (cfs)	Date	Posit	Period of Return (Years) Weibull	Cunnane
0.204	11/13/1950	57	1.02	1.01
0.205	3/16/1954	56	1.04	1.03
0.205	1/12/1993	55	1.05	1.05
0.206	4/6/1986	54	1.07	1.07
0.208	2/23/2005	53	1.09	1.09
0.212	12/2/1961	52	1.12	1.11
0.215	2/6/1950	51	1.14	1.13
0.218	2/23/2000	50	1.16	1.15
0.219	2/17/1971	49	1.18	1.18
0.22	1/14/1969	48	1.21	1.20
0.221	12/21/2002	47	1.23	1.23
0.223	2/17/1998	46	1.26	1.25
0.224	4/22/1988	45	1.29	1.28
0.226	12/31/1976	44	1.32	1.31
0.229	11/10/1949	43	1.35	1.34
0.231	11/25/1983	42	1.38	1.38
0.234	2/8/1976	41	1.41	1.41
0.236	5/8/1977	40	1.45	1.44
0.237	1/18/1993	39	1.49	1.48
0.243	2/6/1969	38	1.53	1.52
0.246	1/18/1952	37	1.57	1.56
0.257	12/28/2004	36	1.61	1.61
0.258	3/11/1995	35	1.66	1.65
0.262	1/6/1979	34	1.71	1.70
0.263	3/17/1982	33	1.76	1.75
0.263	3/24/1983	32	1.81	1.81
0.268	11/17/1986	31	1.87	1.87
0.27	2/25/1981	30	1.93	1.93
0.27	2/21/2005	29	2.00	2.00
0.271	12/18/1967	28	2.07	2.07
0.272	3/1/1981	27	2.15	2.15
0.277	3/6/1975	26	2.23	2.23
0.278	2/14/1995	25	2.32	2.33
0.279	12/4/1987	24	2.42	2.42
0.281	2/3/1958	23	2.52	2.53
0.287	4/21/1988	22	2.64	2.65
0.292	1/31/1993	21	2.76	2.78
0.301	3/1/1983	20	2.90	2.92
0.309	12/23/1995	19	3.05	3.08
0.351	12/4/1974	18	3.22	3.25
0.352	1/12/1960	17	3.41	3.45
0.364	3/8/1968	16	3.63	3.67
0.376	3/16/1986	15	3.87	3.92
0.382	11/5/1987	14	4.14	4.21
0.389	1/10/1978	13	4.46	4.54
0.409	1/10/1955	12	4.83	4.93
0.425	10/27/2004	11	5.27	5.40
0.429	1/25/1995	10	5.80	5.96
0.439	2/24/1998	9	6.44	6.65
0.444	2/28/1970	8	7.25	7.53
0.448	11/21/1967	7	8.29	8.67
0.471	1/31/1979	6	9.67	10.21
0.475	11/16/1972	5	11.60	12.43
0.502	12/29/2004	4	14.50	15.89
0.54	2/20/1980	3	19.33	22.00
0.603	3/7/1952	2	29.00	35.75
0.81	12/10/1965	1	58.00	95.33

List of Peak events and Determination of Q2 and Q10 (Post-Development)

B Street Apartments - POC-1

T (Year)	Cunnane (cfs)	Weibull (cfs)
10	**0.45**	**0.46**
9	**0.44**	**0.45**
8	**0.42**	**0.43**
7	**0.41**	**0.41**
6	**0.35**	**0.36**
5	**0.28**	**0.28**
4	**0.23**	**0.24**
3	**0.21**	**0.21**
2	**0.18**	**0.18**

Note:
Cunnane is the preferred method by the HMP permit.

Peaks (cfs)	Date	Posit	Period of Return (Years)	
			Weibull	Cunnane
0.124	8/17/1977	57	1.02	1.01
0.124	3/2/1992	56	1.04	1.03
0.125	12/28/1989	55	1.05	1.05
0.127	1/6/1977	54	1.07	1.07
0.127	1/12/2001	53	1.09	1.09
0.128	2/21/2000	52	1.12	1.11
0.13	2/2/1983	51	1.14	1.13
0.131	3/16/1958	50	1.16	1.15
0.132	2/3/1998	49	1.18	1.18
0.134	2/23/2000	48	1.21	1.20
0.137	2/7/1950	47	1.23	1.23
0.139	12/2/1961	46	1.26	1.25
0.141	12/5/1966	45	1.29	1.28
0.143	1/16/1978	44	1.32	1.31
0.145	2/25/2003	43	1.35	1.34
0.148	3/22/1954	42	1.38	1.38
0.15	2/15/1986	41	1.41	1.41
0.151	3/2/1983	40	1.45	1.44
0.153	2/19/1993	39	1.49	1.48
0.155	11/16/1965	38	1.53	1.52
0.158	12/30/1951	37	1.57	1.56
0.162	11/5/1987	36	1.61	1.61
0.164	3/11/1995	35	1.66	1.65
0.165	3/24/1983	34	1.71	1.70
0.167	2/17/1998	33	1.76	1.75
0.171	2/8/1976	32	1.81	1.81
0.171	1/10/1978	31	1.87	1.87
0.172	1/14/1978	30	1.93	1.93
0.177	2/8/1998	29	2.00	2.00
0.179	1/18/1952	28	2.07	2.07
0.185	1/4/1995	27	2.15	2.15
0.186	3/1/1983	26	2.23	2.23
0.186	1/15/1993	25	2.32	2.33
0.19	10/10/1986	24	2.42	2.42
0.193	2/24/1998	23	2.52	2.53
0.196	3/16/1986	22	2.64	2.65
0.204	1/12/1960	21	2.76	2.78
0.206	3/1/1981	20	2.90	2.92
0.207	2/14/1995	19	3.05	3.08
0.213	1/14/1969	18	3.22	3.25
0.219	11/13/1950	17	3.41	3.45
0.224	3/6/1975	16	3.63	3.67
0.225	1/25/1995	15	3.87	3.92
0.258	2/21/2005	14	4.14	4.21
0.271	11/16/1972	13	4.46	4.54
0.272	11/21/1967	12	4.83	4.93
0.298	1/6/1979	11	5.27	5.40
0.342	12/4/1974	10	5.80	5.96
0.412	1/10/1955	9	6.44	6.65
0.414	3/8/1968	8	7.25	7.53
0.44	12/29/2004	7	8.29	8.67
0.453	10/27/2004	6	9.67	10.21
0.476	1/31/1979	5	11.60	12.43
0.493	2/28/1970	4	14.50	15.89
0.523	3/7/1952	3	19.33	22.00
0.529	2/20/1980	2	29.00	35.75
0.804	12/10/1965	1	58.00	95.33

ATTACHMENT 4

AREA VS ELEVATION

The storage provided by the LID BMP is entered into the LID Module within SWMM – please refer to Attachment 7 for further information.

Volume provided above the first surface outlet is accounted for in the basin module within SWMM. A stage-storage relationship is provided within this Module, a copy of which is located on the following pages.

DISCHARGE VS ELEVATION

The orifice has been selected to maximize its size while still restricting flows to conform with the required 50% of the Q_2 event flow as mandated in the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. While REC acknowledges that the orifice is small, to increase the size of the outlet would impact the basin's ability to restrict flows beneath the HMP thresholds, thus preventing the BMP from conformance with HMP requirements.

In order to further reduce the risk of blockage of the orifices, regular maintenance of the riser and orifice must be performed to ensure potential blockages are minimized. A detail of the orifice and riser structure is provided in Attachment 5 of this memorandum.

A stage-discharge relationship is provided on the following pages for the surface outlet structure. The LID low flow orifice discharge relationship is addressed within the LID Module within SWMM – please refer to Attachment 7 for further information.

DISCHARGE EQUATIONS

1) Weir:

$$Q_W = C_W \cdot L \cdot H^{3/2} \quad (1)$$

2) Slot:

As an orifice: $$Q_s = B_s \cdot h_s \cdot c_g \cdot \sqrt{2g\left(H - \frac{h_s}{2}\right)} \quad (2.a)$$

As a weir: $$Q_s = C_W \cdot B_s \cdot H^{3/2} \quad (2.b)$$

For H > h_s slot works as weir until orifice equation provides a smaller discharge. The elevation such that equation (2.a) = equation (2.b) is the elevation at which the behavior changes from weir to orifice.

3) Vertical Orifices

As an orifice: $$Q_o = 0.25 \cdot \pi D^2 \cdot c_g \cdot \sqrt{2g\left(H - \frac{D}{2}\right)} \quad (3.a)$$

As a weir: Critical depth and geometric family of circular sector must be solved to determined Q as a function of H:

$$\frac{Q_O^2}{g} = \frac{A_{cr}^3}{T_{cr}}; \quad H = y_{cr} + \frac{A_{cr}}{2 \cdot T_{cr}}; \; T_{cr} = 2\sqrt{y_{cr}(D - y_{cr})}; \quad A_{cr} = \frac{D^2}{8}[\alpha_{cr} - sin(\alpha_{cr})];$$

$$y_{cr} = \frac{D}{2}[1 - sin(0.5 \cdot \alpha_{cr})] \quad (3.b.1, 3.b.2, 3.b.3, 3.b.4 \text{ and } 3.b.5)$$

There is a value of H (approximately H = 110% D) from which orifices no longer work as weirs as critical depth is not possible at the entrance of the orifice. This value of H is obtained equaling the discharge using critical equations and equations (3.b).

A mathematical model is prepared with the previous equations depending on the type of discharge.

The following are the variables used above:

Q_W, Q_s, Q_O = Discharge of weir, slot or orifice (cfs)

C_W, c_g : Coefficients of discharge of weir (typically 3.1) and orifice (0.61 to 0.62)

L, B_s, D, h_s : Length of weir, width of slot, diameter of orifice and height of slot, respectively; (ft)

H: Level of water in the pond over the invert of slot, weir or orifice (ft)

A_{cr}, T_{cr}, y_{cr}, α_{cr}: Critical variables for circular sector: area (sq-ft), top width (ft), critical depth (ft), and angle to the center, respectively.

Stage-Area for Biofiltration A

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	46	0	BIOFILTRATION (1)
0.04	46	2	
0.08	46	4	
0.13	46	6	
0.17	46	8	
0.21	46	10	
0.25	46	12	
0.29	46	13	
0.33	46	15	
0.38	46	17	
0.42	46	19	
0.46	46	21	
0.50	46	23	
0.54	46	25	
0.58	46	27	
0.63	46	29	
0.67	46	31	
0.71	46	33	
0.75	46	35	Emergency Weir (2)
0.79	46	36	
0.83	46	38	
0.88	46	40	
0.92	46	42	
0.96	46	44	
1.00	46	46	

SUB SURFACE STORAGE BASIN A

Elevation (ft)	Area (ft^2)	Volume (ft^3)		
-1.50	46	20.7	Amended Soil Base (0.3 voids)	
-2.75	46	23.0	Gravel Base (0.4 voids)	
Gravel & Amended Soil	**TOTAL =**	43.7	(ft^3)	
Surface Total	**TOTAL =**	11.5	(ft^3)	
IMP	**TOTAL =**	**55.2**	**(ft^3)**	

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)
(2): This elevation corresponds to the top of the riser elevation.

Effective Depth:	9.00 in

Stage-Area for Biofiltration B

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	264	0	BIOFILTRATION (1)
0.04	264	11	
0.08	264	22	
0.13	264	33	
0.17	264	44	
0.21	264	55	
0.25	264	66	
0.29	264	77	
0.33	264	88	
0.38	264	99	
0.42	264	110	
0.46	264	121	
0.50	264	132	Surface Orifice (2)
0.54	264	143	
0.58	264	154	
0.63	264	165	
0.67	264	176	
0.71	264	187	
0.75	264	198	
0.79	264	209	Emergency Weir (3)
0.83	264	220	
0.88	264	231	
0.92	264	242	
0.96	264	253	
1.00	264	264	

SUB SURFACE STORAGE BASIN B

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.50	264	118.8	Amended Soil Base (0.3 voids)
-2.75	264	132.0	Gravel Base (0.4 voids)
Gravel & Amended Soil	**TOTAL =**	250.8	(ft^3)
Surface Total	**TOTAL =**	66.0	(ft^3)
IMP	**TOTAL =**	**316.8**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)
(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)
(3): This elevation corresponds to the top of the riser elevation.

Effective Depth:	6.00 in

Stage-Area for Biofiltration C

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	316	0	BIOFILTRATION (1)
0.04	316	13	
0.08	316	26	
0.13	316	40	
0.17	316	53	
0.21	316	66	
0.25	316	79	
0.29	316	92	
0.33	316	105	
0.38	316	119	
0.42	316	132	
0.46	316	145	
0.50	316	158	Surface Orifice (2)
0.54	316	171	
0.58	316	184	
0.63	316	198	
0.67	316	211	
0.71	316	224	
0.75	316	237	
0.79	316	250	Emergency Weir (3)
0.83	316	263	
0.88	316	277	
0.92	316	290	
0.96	316	303	
1.00	316	316	

SUB SURFACE STORAGE BASIN C

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
-1.50	316	142.2	Amended Soil Base (0.3 voids)
-2.75	316	158.0	Gravel Base (0.4 voids)
Gravel & Amended Soil	**TOTAL =**	300.2	(ft^3)
Surface Total	**TOTAL =**	79.0	(ft^3)
IMP	**TOTAL =**	**379.2**	**(ft^3)**

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)
(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)
(3): This elevation corresponds to the top of the riser elevation.

Effective Depth:	6.00 in

Outlet structure for Discharge of BMPs B & C

Discharge vs Elevation Table

Low orifice	1.000 "	Lower slot		Lower Weir			
Number of orif:	4	Number of slots:	0	Number of weirs:	0		
Cg-low:	0.61	Invert:	0.00 ft	Invert:	0.000 ft		
		B	0.00 ft	B:	0.000 ft		
Middle orifice	2.500 "	hslot	0.000 ft				
Number of orif:	0.000						
Cg-middle:	0.61	Upper slot		Upper Weir		Emergency weir	
invert elev:	0 ft	Number of slots:	0	Number of weirs:	0	Invert:	0.292 ft
		Invert:	0.00 ft	Invert:	0.000 ft	W:	2.09 ft
*Note: h = head above the invert of the lowest surface discharge opening.		B:	0.00 ft	B:	0.00 ft		
		hslot	0.000 ft				

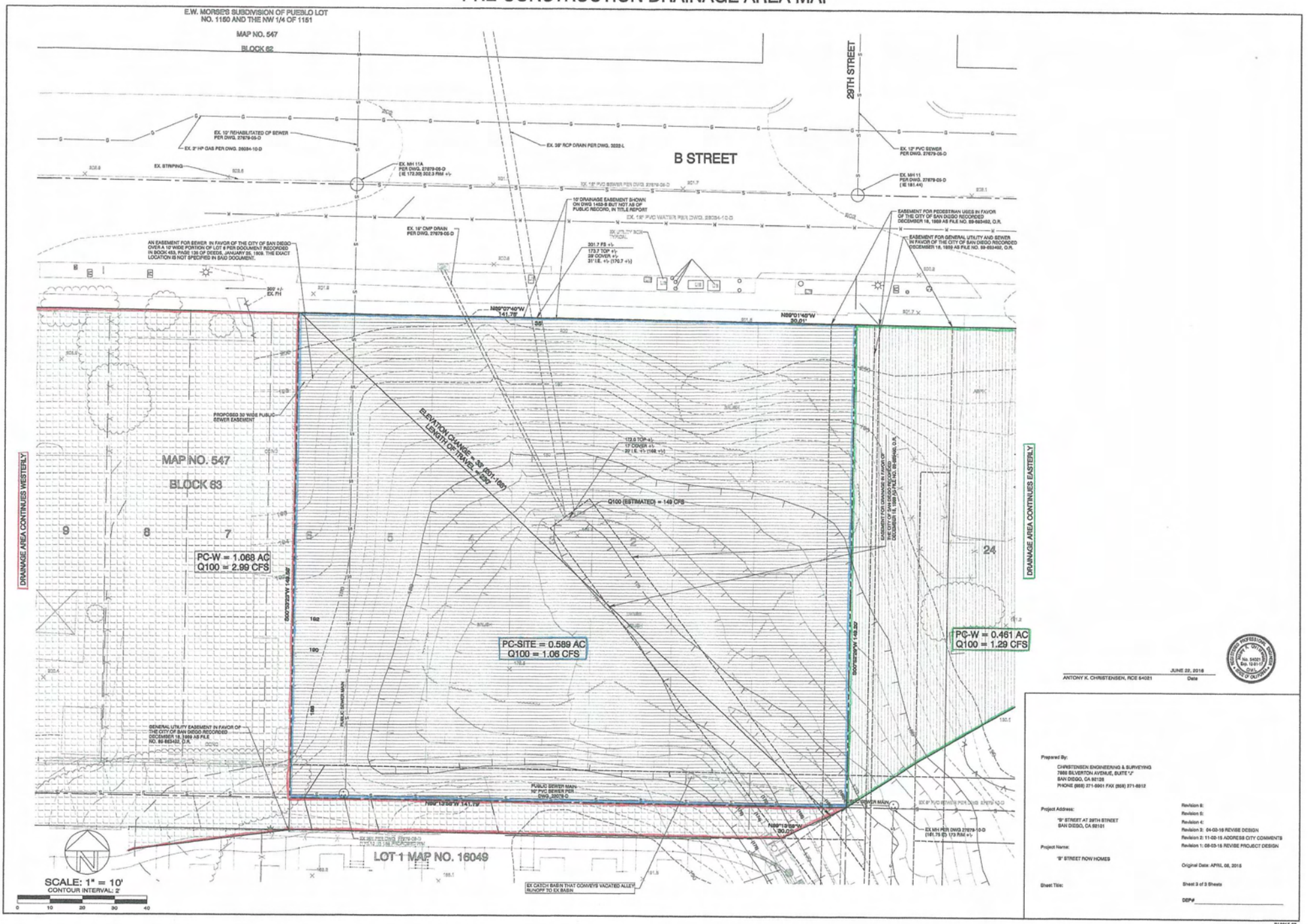
h* (ft)	H/D-low -	H/D-mid -	Qlow-orif (cfs)	Qlow-weir (cfs)	Qtot-low (cfs)	Qmid-orif (cfs)	Qmid-weir (cfs)	Qtot-med (cfs)	Qslot-low (cfs)	Qslot-upp (cfs)	Qlweir (cfs)	Quweir (cfs)	Qemerg (cfs)	Qtot (cfs)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.042	0.500	0.200	0.000	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006
0.083	1.000	0.400	0.022	0.021	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021
0.125	1.500	0.600	0.031	0.037	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031
0.167	2.000	0.800	0.038	0.050	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038
0.208	2.500	1.000	0.044	0.056	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044
0.250	3.000	1.200	0.049	0.057	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049
0.292	3.500	1.400	0.053	0.063	0.053	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.053
0.333	4.000	1.600	0.058	0.095	0.058	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.055	0.113
0.375	4.500	1.800	0.062	0.185	0.062	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.156	0.218
0.417	5.000	2.000	0.065	0.382	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.287	0.352
0.458	5.500	2.200	0.069	0.689	0.069	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.442	0.511
0.500	6.000	2.400	0.072	0.723	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.617	0.690

ATTACHMENT 5

Pre & Post-Developed Maps, Project Plan and Detention

Section Sketches

PRE-CONSTRUCTION DRAINAGE AREA MAP



JUNE 22, 2016

ANTONY K. CHRISTENSEN, RCE 54021 Date

Prepared By:
CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-5901 FAX (858) 271-6912

Project Address:
"B" STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:
"B" STREET ROW HOMES

Sheet Title:

Revision 8:
Revision 6:
Revision 4:
Revision 3: 04-03-16 REVISE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

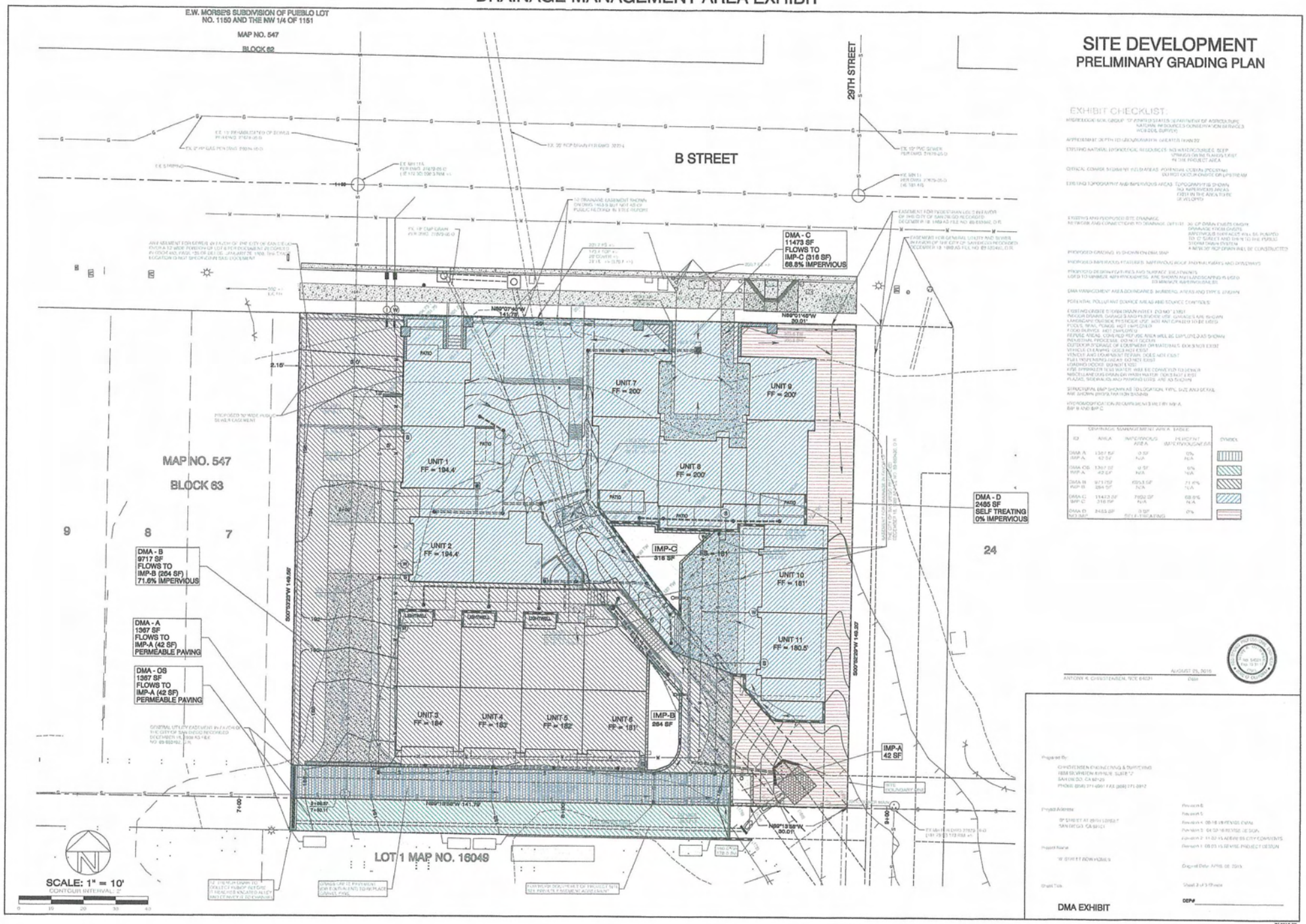
Original Date: APRIL 08, 2015

Sheet 3 of 3 Sheets

DEP#

JN 2015-07

DRAINAGE MANAGEMENT AREA EXHIBIT



SITE DEVELOPMENT
PRELIMINARY GRADING PLAN

EXHIBIT CHECKLIST:

DRAINAGE MANAGEMENT AREA TABLE

ID	AREA	IMPERVIOUS AREA	PERCENT IMPERVIOUS	SYMBOL
DMA A IMP A	1367 SF 42 SF	0 SF N/A	0% N/A	
DMA OS IMP A	1367 SF 42 SF	0 SF N/A	0% N/A	
DMA B IMP B	9717 SF 264 SF	6953 SF N/A	71.6% N/A	
DMA C IMP C	11473 SF 316 SF	7662 SF N/A	66.8% N/A	
DMA D NO IMP	2465 SF	0 SF SELF-TREATING	0%	

AUGUST 25, 2016
ANTONY R. CHRISTENSEN, RCE 64031 Date

Prepared By:
CHRISTENSEN ENGINEERING & SURVEYING
1934 SKYHAWK AVENUE, SUITE 12
SAN DIEGO, CA 92139
PHONE: (858) 271-4991 FAX: (858) 271-0912

Project Address:
9TH STREET AT 29TH STREET
SAN DIEGO, CA 92102

Project Name:
W. 9TH ST. ADU HOMES

Revision 6:
Revision 5:
Revision 4: 08-16-16 PER PDS COMM.
Revision 3: 04-29-16 PER SDGE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 SEWER PROJECT DESIGN

Original Date: APRIL 08, 2015

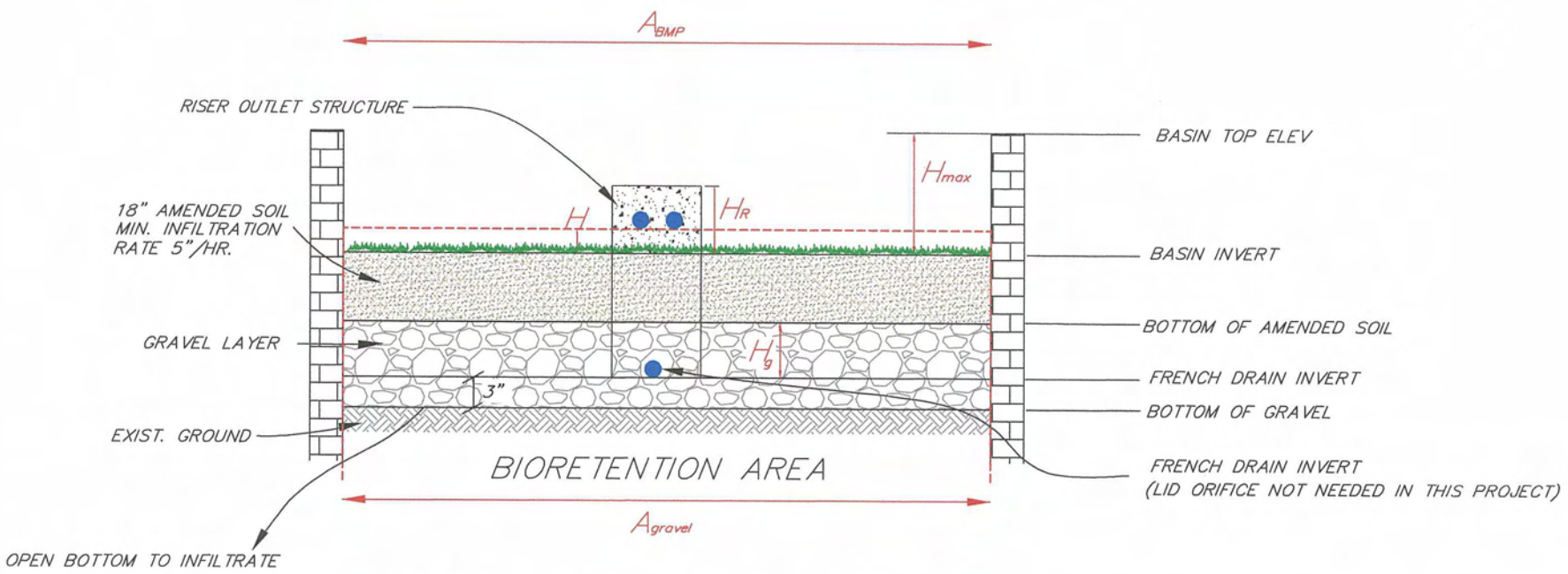
Sheet Title:
DMA EXHIBIT

Sheet 3 of 3 Sheets

DSF#

JN 2015-07


Project Location
N
0
4
8
SCALE IN MILES
Kearny Mesa
Sante
163
Lake Murra
Fashion Valley
La Me
Lindbergh Field
Bonita
5
Bo
Plaza Bonita
805

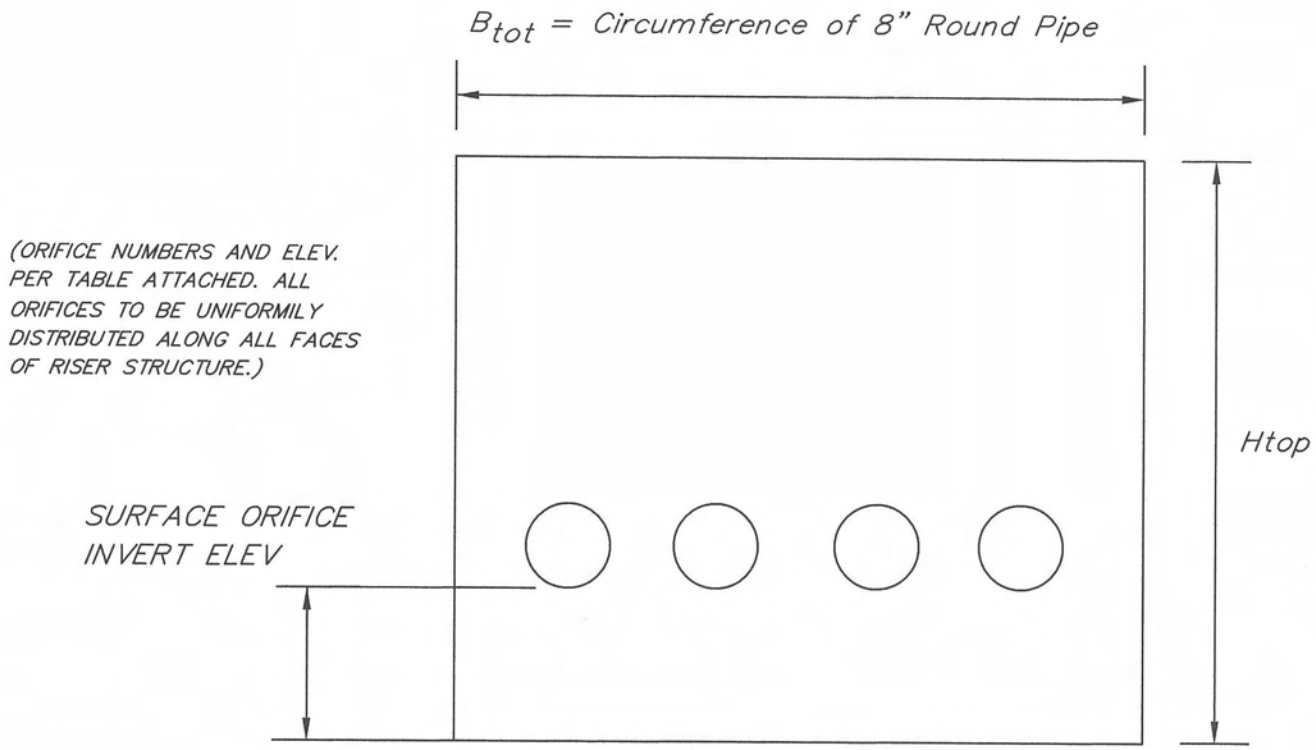


BIOFILRATION AREA CROSS SECTION (TYP)

NOT TO SCALE

BMP	H(ft)	H_{MAX} (ft)	Hg (ft)	French Drain (in)	$A_{BMP} = A_{gravel}$ (ft^2)	H_R (in)
A	n/a	1.00	1.25	8.0	42	9
B	0.50	1.00	1.25	8.0	264	9.5
C	0.50	1.00	1.25	8.0	316	9.5

Hg : 3 INCHES OF SAND (ASTM 33), 3 INCHES OF PEA GRAVEL (ASTM 8) & 9 INCHES OF GRAVEL (ASTM 57).
(measured from top to bottom)



BIO-RETENTION OUTLET STRUCTURE DETAIL BASINS A, B & C - SECTION (TYP)

NOT TO SCALE

BMP	SURFACE ORIFICE		SPILLWAY	
	#-DIAM*	ELEV (ft)	Btot (ft)	Htop (in)
A	N/A	N/A	2.09	9.00
B	4-1'	0.50	2.09	9.50
C	4-1'	0.50	2.09	9.50

*: Four (4) orifices distributed along the perimeter of the riser.

ATTACHMENT 6

SWMM Input Data in Input Format (Existing & Proposed Models)

PRE_DEV

```
[TITLE]

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           10/17/1948
START_TIME           00:00:00
REPORT_START_DATE    10/17/1948
REPORT_START_TIME    00:00:00
END_DATE             10/17/2005
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      0.06   0.08   0.12   0.16   0.17   0.19   0.18   0.17   0.14   0.11   0.08   0.06
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
LINDBERG         INTENSITY 1:00   1.0    TIMESERIES LINDBERG

[SUBCATCHMENTS]
;;                                                  Total     Pcnt.             Pcnt.     Curb
Snow
;;Name           Raingage         Outlet           Area      Imperv    Width     Slope     Length
Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- -
-------
DMA_1            LINDBERG         POC-1            0.621     0         225       26.7      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA_1            0.012      0.10       0.05       0.10       25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
DMA_1            9          0.025      0.33

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC-1            0          FREE                        NO

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
LINDBERG         FILE "LbergRain.prn"
```

```
[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 0.000 0.000 10000.000 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            2500.000           2700.000

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA_1            2427.184           5983.010
DMA_1            2427.184           5983.010

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
LINDBERG         1525.424           6864.407
```

POST_DEV

```
[TITLE]

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           10/17/1948
START_TIME           00:00:00
REPORT_START_DATE    10/17/1948
REPORT_START_TIME    00:00:00
END_DATE             10/17/2005
END_TIME             23:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          01:00:00
WET_STEP             00:15:00
DRY_STEP             04:00:00
ROUTING_STEP         0:01:00
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
MONTHLY      0.06   0.08   0.12   0.16   0.17   0.19   0.18   0.17   0.14   0.11   0.08   0.06
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
LINDBERG         INTENSITY 1:00   1.0    TIMESERIES LINDBERG

[SUBCATCHMENTS]
;;                                                  Total     Pcnt.             Pcnt.     Curb
Snow
;;Name           Raingage         Outlet           Area      Imperv    Width    Slope     Length
Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- -
-------
DMA_C            LINDBERG         IMP_C            0.263    68.79    75       3.3       0
IMP_C            LINDBERG         DIV_C            0.007254 0        10       0         0
DMA_A            LINDBERG         IMP_A            0.063    0        22       5.3       0
DMA_B            LINDBERG         IMP_B            0.223    71.56    73       3.3       0
DMA_D            LINDBERG         POC-1            0.057    0        17       4.2       0
IMP_A            LINDBERG         POC-1            0.000964 0        10       0         0
IMP_B            LINDBERG         DIV_B            0.006061 0        10       0         0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
DMA_C            0.012      0.10       0.05       0.10       25         OUTLET
IMP_C            0.012      0.10       0.05       0.10       25         PERVIOUS   100
DMA_A            0.012      0.10       0.05       0.10       25         OUTLET
DMA_B            0.012      0.10       0.05       0.10       25         OUTLET
DMA_D            0.012      0.10       0.05       0.10       25         PERVIOUS   100
IMP_A            0.012      0.10       0.05       0.10       25         PERVIOUS   100
IMP_B            0.012      0.10       0.05       0.10       25         PERVIOUS   100

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
```

```
DMA_C            9          0.01875    0.33
IMP_C            9          0.01875    0.33
DMA_A            9          0.01875    0.33
DMA_B            9          0.01875    0.33
DMA_D            9          0.01875    0.33
IMP_A            9          0.01875    0.33
IMP_B            9          0.01875    0.33

[LID_CONTROLS]
;;               Type/Layer Parameters
;;-------------- ---------- ----------
IMP-A            BC
IMP-A            SURFACE    9          0.05       0          0          5
IMP-A            SOIL       18         0.4        0.2        0.1        5          5          1.5
IMP-A            STORAGE    18         0.67       0.11       0
IMP-A            DRAIN      126.84     0.5        3          6

IMP-B            BC
IMP-B            SURFACE    6          0.05       0          0          5
IMP-B            SOIL       18         0.4        0.2        0.1        5          5          1.5
IMP-B            STORAGE    18         0.67       0.085      0
IMP-B            DRAIN      20.18      0.5        3          6

IMP-C            BC
IMP-C            SURFACE    6          0.05       0          0          5
IMP-C            SOIL       18         0.4        0.2        0.1        5          5          1.5
IMP-C            STORAGE    18         0.67       0.085      0
IMP-C            DRAIN      16.86      0.5        3          6

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv
Report File
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ----------
----------
IMP_C            IMP-C            1       316        0          0          100        0
IMP_A            IMP-A            1       42         0          0          100        0
IMP_B            IMP-B            1       264        0          0          100        0

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC-1            0          FREE                        NO

[DIVIDERS]
;;               Invert     Diverted         Divider
;;Name           Elev.      Link             Type       Parameters
;;-------------- ---------- ---------------- ---------- ----------
DIV_B            0          BYPASS_B         CUTOFF     0.0234     0          0          0
0
DIV_C            0          BYPASS_C         CUTOFF     0.0280     0          0          0
0

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                    Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                   Area     Frac.
Infiltration Parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- ------
-- ------------------------
BASIN_B          0        0.5      0        TABULAR    BASIN_B                   264      1
BASIN_C          0        0.5      0        TABULAR    BASIN_C                   316      1

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet      Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset     Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ----
------
BYPASS_C         DIV_C            BASIN_C          10         0.01       0          0          0          0
UDRAIN_C         DIV_C            POC-1            10         0.01       0          0          0          0
BYPASS_B         DIV_B            BASIN_B          10         0.01       0          0          0          0
UDRAIN_B         DIV_B            POC-1            10         0.01       0          0          0          0
```

POST_DEV

```
[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet           Qcoeff/                    Flap
;;Name           Node             Node             Height     Type             QTable           Qexpon    Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- ----
OUTLET_B         BASIN_B          POC-1            0          TABULAR/HEAD     OUT_B                       NO
OUTLET_C         BASIN_C          POC-1            0          TABULAR/HEAD     OUT_C                       NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
BYPASS_C         DUMMY        0                0          0          0          1
UDRAIN_C         DUMMY        0                0          0          0          1
BYPASS_B         DUMMY        0                0          0          0          1
UDRAIN_B         DUMMY        0                0          0          0          1

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate
;;-------------- ---------- ---------- ---------- ----------

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
OUT_B            Rating     0.000      0.000
OUT_B                       0.042      0.006
OUT_B                       0.083      0.021
OUT_B                       0.125      0.031
OUT_B                       0.167      0.038
OUT_B                       0.208      0.044
OUT_B                       0.250      0.049
OUT_B                       0.292      0.053
OUT_B                       0.333      0.113
OUT_B                       0.375      0.218
OUT_B                       0.417      0.352
OUT_B                       0.458      0.511
OUT_B                       0.500      0.690

OUT_C            Rating     0.000      0.000
OUT_C                       0.042      0.006
OUT_C                       0.083      0.021
OUT_C                       0.125      0.031
OUT_C                       0.167      0.038
OUT_C                       0.208      0.044
OUT_C                       0.250      0.049
OUT_C                       0.292      0.053
OUT_C                       0.333      0.113
OUT_C                       0.375      0.218
OUT_C                       0.417      0.352
OUT_C                       0.458      0.511
OUT_C                       0.500      0.690

BASIN_B          Storage    0          264
BASIN_B                     0.5        264

BASIN_C          Storage    0          316
BASIN_C                     0.5        316

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
LINDBERG         FILE "LbergRain.prn"

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
```

POST_DEV

```
[MAP]
DIMENSIONS 140.000 4703.029 1460.000 5736.393
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
POC-1            1200.000           4750.000
DIV_B            650.000            5200.000
DIV_C            1201.257           5200.000
BASIN_B          650.000            5000.000
BASIN_C          959.289            5200.000

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[Polygons]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
DMA_C            1200.000           5600.000
DMA_C            1200.000           5600.000
IMP_C            1200.000           5400.000
DMA_A            200.000            4750.000
DMA_B            200.000            5600.000
DMA_D            1400.000           5200.000
IMP_A            650.000            4750.000
IMP_B            426.714            5400.000

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
LINDBERG         764.741            5689.422
```

ATTACHMENT 7

EPA SWMM FIGURES AND EXPLANATIONS

Per the attached, the reader can see the screens associated with the EPA-SWMM Model in both pre-development and post-development conditions. Each portion, i.e., sub-catchments, outfalls, storage units, weir as a discharge, and outfalls (point of compliance), are also shown.

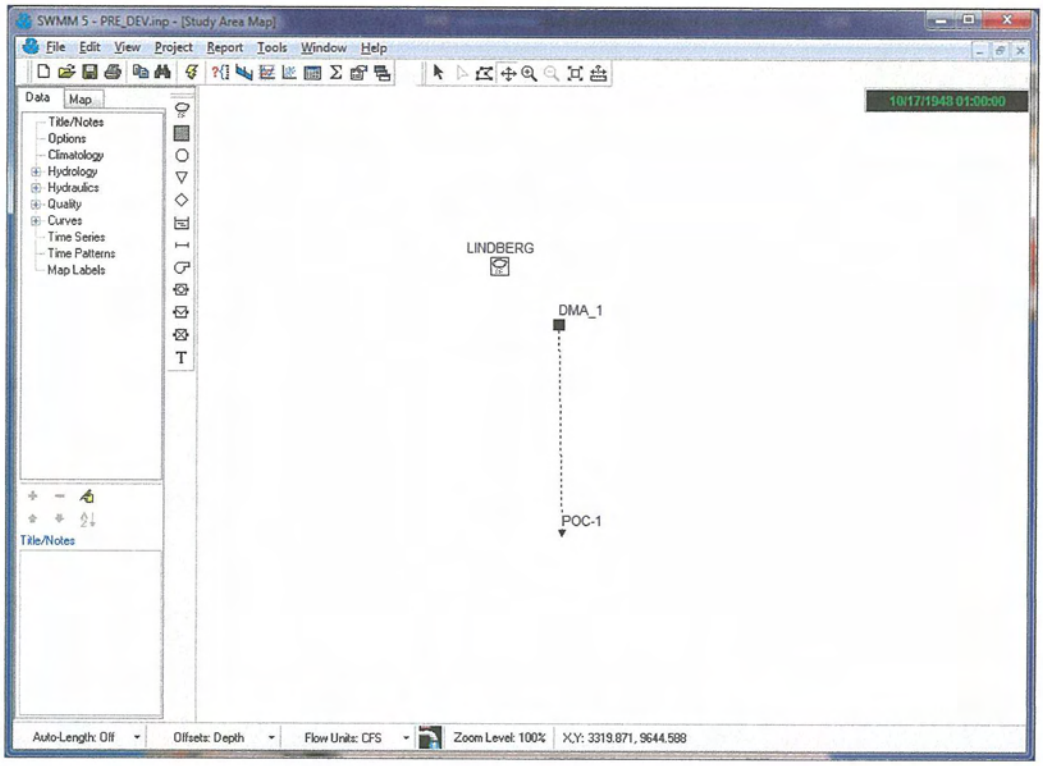
Variables for modeling are associated with typical recommended values by the EPA-SWMM model, typical values found in technical literature (such as Maidment's Handbook of Hydrology). Recommended values for the SWMM model have been attained from the interim Orange County criteria established for their SWMM calibration. Currently, no recommended values have been established by the San Diego County HMP Permit for the SWMM Model.

Soil characteristics of the existing soils were assumed from the available data obtained from the NRCS Web Soil Survey (both located in Attachment 8 of this report).

Some values incorporated within the SWMM model have been determined from the professional experience of REC using conservative assumptions that have a tendency to increase the size of the needed BMP and also generate a long-term runoff as a percentage of rainfall similar to those measured in gage stations in Southern California by the USGS.

A technical document prepared by Tory R Walker Engineering for the Cities of San Marcos, Oceanside and Vista (Reference [1]) can also be consulted for additional information regarding typical values for SWMM parameters.

PRE-DEVELOPED CONDITION



Rain Gage LINDBERG

Property	Value
Name	LINDBERG
X-Coordinate	1525.424
Y-Coordinate	6864.407
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	LINDBERG
DATA FILE:	
- File Name	*
- Station ID	*
- Rain Units	IN

User-assigned name of rain gage

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	2500.000
Y-Coordinate	2700.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

User-assigned name of outfall

Subcatchment DMA_1

Property	Value
Name	DMA_1
X-Coordinate	2427.184
Y-Coordinate	5983.010
Description	
Tag	
Rain Gage	LINDBERG
Outlet	POC-1
Area	0.621
Width	225
% Slope	26.7
% Imperv	0
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

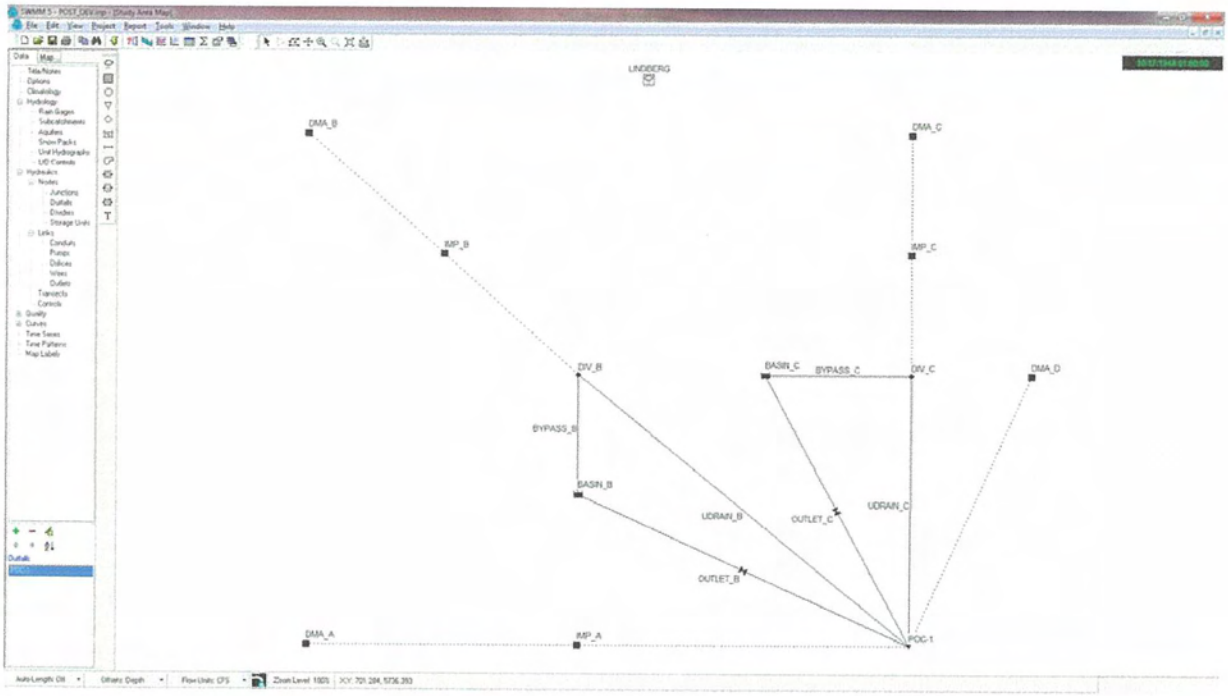
Optional category or classification

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.025
Initial Deficit	0.33

POST-DEVELOPED CONDITION



Rain Gage LINDBERG

Property	Value
Name	LINDBERG
X-Coordinate	764.741
Y-Coordinate	5689.422
Description	
Tag	
Rain Format	INTENSITY
Time Interval	1:00
Snow Catch Factor	1.0
Data Source	TIMESERIES
TIME SERIES:	
- Series Name	LINDBERG
DATA FILE:	
- File Name	* ...
- Station ID	*
- Rain Units	IN

Name of rainfall data file

Outfall POC-1

Property	Value
Name	POC-1
X-Coordinate	1200.000
Y-Coordinate	4750.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Tide Gate	NO
Type	FREE
Fixed Outfall	
Fixed Stage	0
Tidal Outfall	
Curve Name	*
Time Series Outfall	
Series Name	*

Subcatchment DMA_A

Property	Value
Name	DMA_A
X-Coordinate	200.000
Y-Coordinate	4750.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	IMP_A
Area	0.063
Width	22
% Slope	5.3
% Imperv	0
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Name of node or another subcatchment that receives runoff

Subcatchment IMP_A

Property	Value
Name	IMP_A
X-Coordinate	650.000
Y-Coordinate	4750.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	POC-1
Area	0.000964
Width	10
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	PERVIOUS
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Subcatchment DMA_B

Property	Value
Name	DMA_B
X-Coordinate	200.000
Y-Coordinate	5600.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	IMP_B
Area	0.223
Width	73
% Slope	3.3
% Imperv	71.56
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Subcatchment IMP_B

Property	Value
Name	IMP_B
X-Coordinate	426.714
Y-Coordinate	5400.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	DIV_B
Area	0.006061
Width	10
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	PERVIOUS
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Subcatchment DMA_C

Property	Value
Name	DMA_C
X-Coordinate	1200.000
Y-Coordinate	5600.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	IMP_C
Area	0.263
Width	75
% Slope	3.3
% Imperv	68.79
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Subcatchment IMP_C

Property	Value
Name	IMP_C
X-Coordinate	1200.000
Y-Coordinate	5400.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	DIV_C
Area	0.007254
Width	10
% Slope	0
% Imperv	0
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	PERVIOUS
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	1
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

Subcatchment DMA_D

Property	Value
Name	DMA_D
X-Coordinate	1400.000
Y-Coordinate	5200.000
Description	
Tag	
Rain Gage	LINDBERG
Outlet	POC-1
Area	0.057
Width	17
% Slope	4.2
% Imperv	0
N-Imperv	0.012
N-Perv	0.10
Dstore-Imperv	0.05
Dstore-Perv	0.10
%Zero-Imperv	25
Subarea Routing	PERVIOUS
Percent Routed	100
Infiltration	GREEN_AMPT ...
Groundwater	NO
Snow Pack	
LID Controls	0
Land Uses	0
Initial Buildup	NONE
Curb Length	0

Infiltration parameters (click to edit)

Infiltration Editor

Infiltration Method: GREEN_AMPT

Property	Value
Suction Head	9
Conductivity	0.01875
Initial Deficit	0.33

EXPLANATION OF SELECTED VARIABLES

Sub-Catchment Areas:

Please refer to the attached diagrams that indicate the DMA and Bio-Retention BMP (BMP) sub areas modeled within the project site at both the pre and post developed conditions draining to the POC.

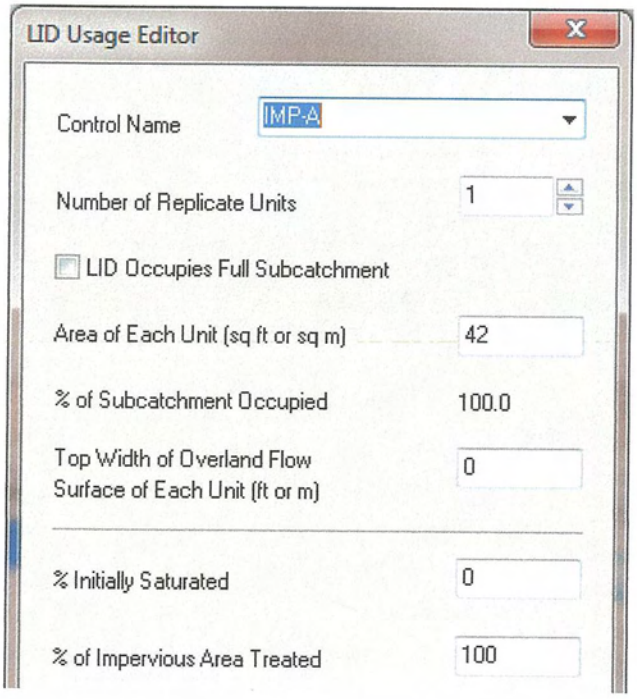
Parameters for the pre- and post-developed models include soil type D as estimated from the Web Soil Survey information for areas near the site. Suction head, conductivity and initial deficit corresponds to average values expected for these soils types, according to sources consulted, professional experience, and approximate values obtained by the interim Orange County modeling approach.

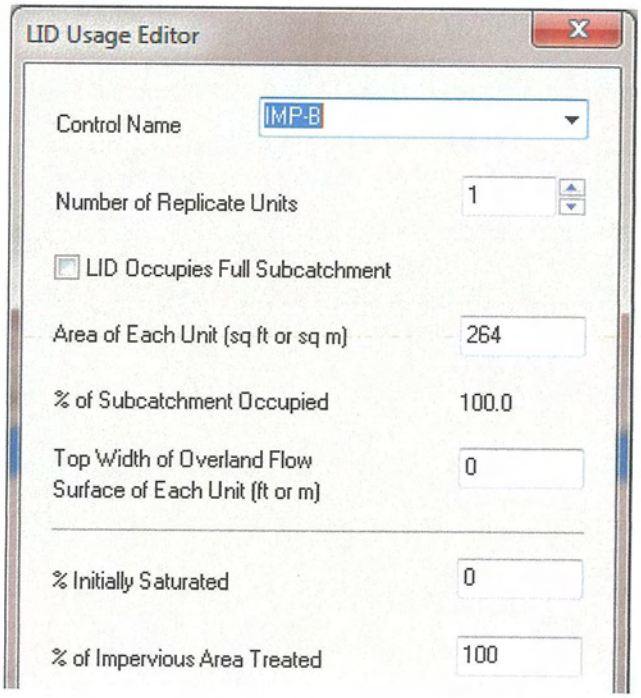
REC selected infiltration values, such that the percentage of total precipitation that becomes runoff, is realistic for the soil types and slightly smaller than measured values for Southern California watersheds.

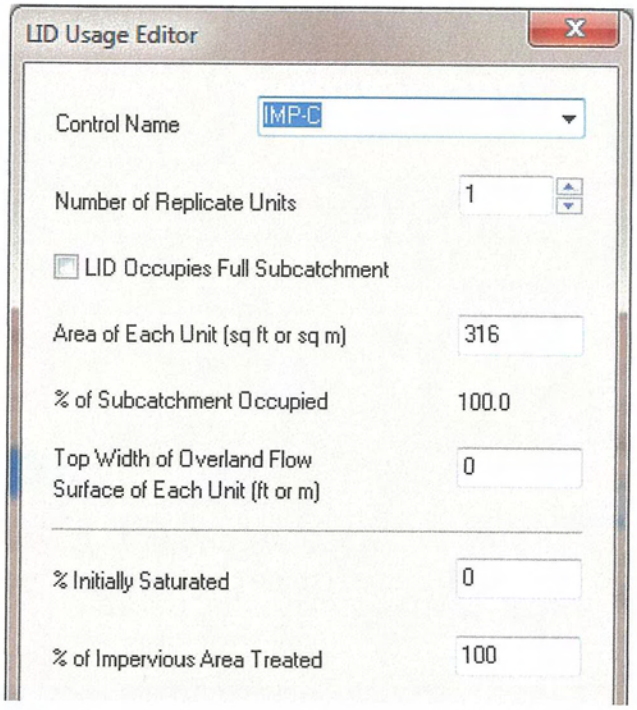
Selection of a Kinematic Approach: As the continuous model is based on hourly rainfall, and the time of concentration for the pre-development and post-development conditions is significantly smaller than 60 minutes, precise routing of the flows through the impervious surfaces, the underdrain pipe system, and the discharge pipe was considered unnecessary. The truncation error of the precipitation into hourly steps is much more significant than the precise routing in a system where the time of concentration is much smaller than 1 hour.

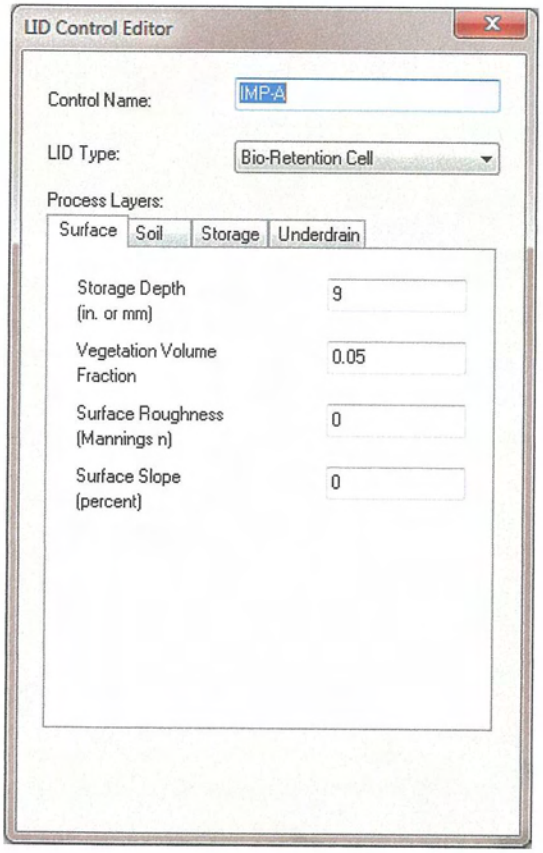
Sub-Catchment BMP:

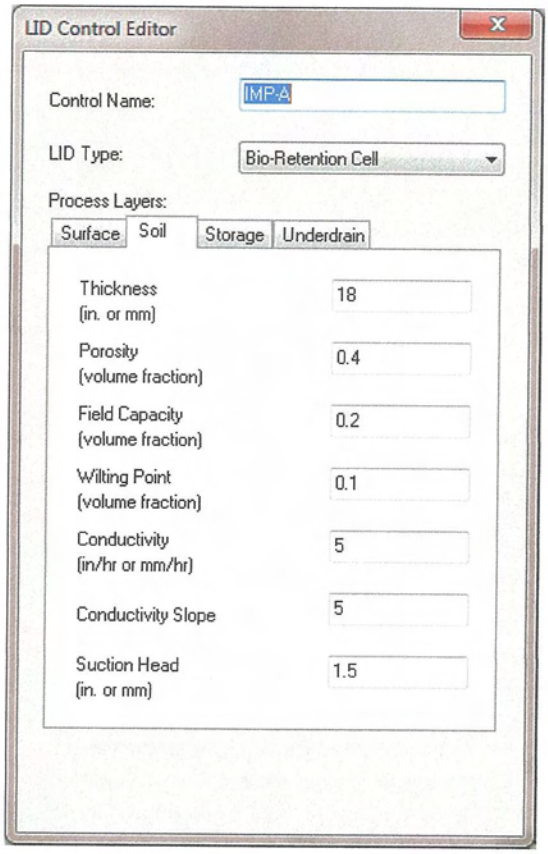
The area of bio-filtration must be equal to the area of the development tributary to the bioretention facility (area that drains into the biofiltration, equal external area plus bio-filtration itself). Five (5) decimal places were given regarding the areas of the bio-filtration to insure that the area used by the program for the LI D subroutine corresponds exactly with this tributary.

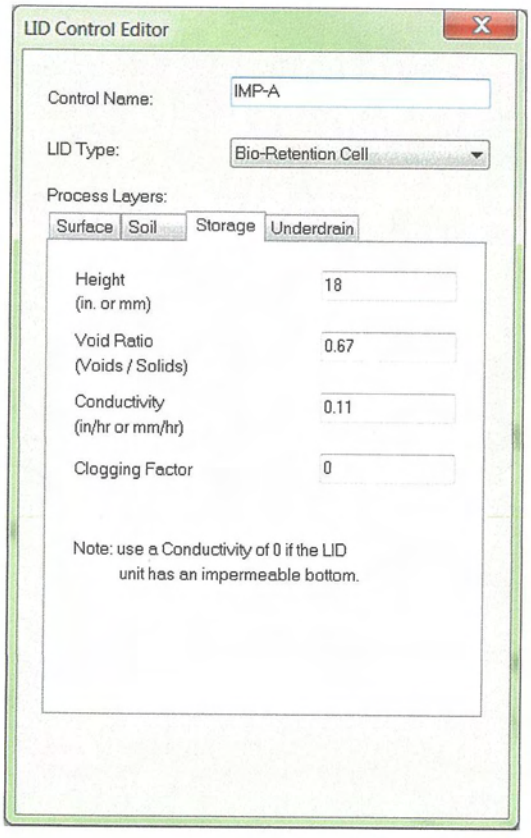


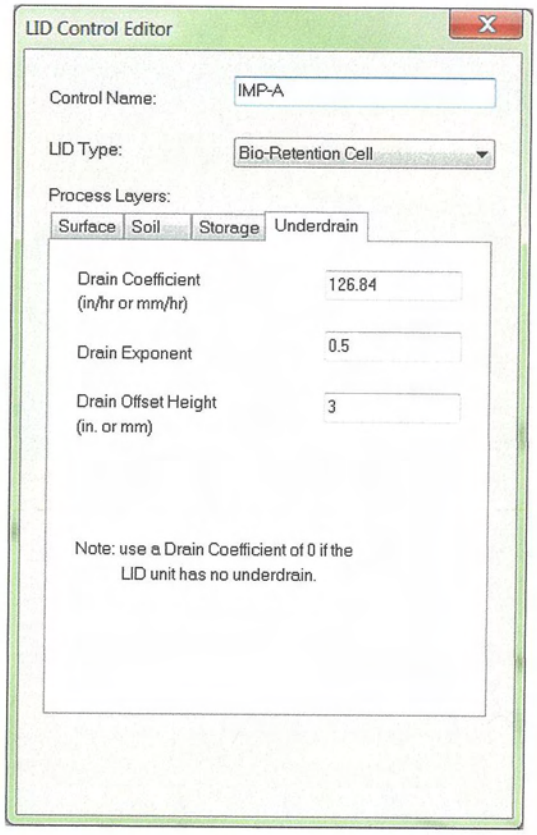


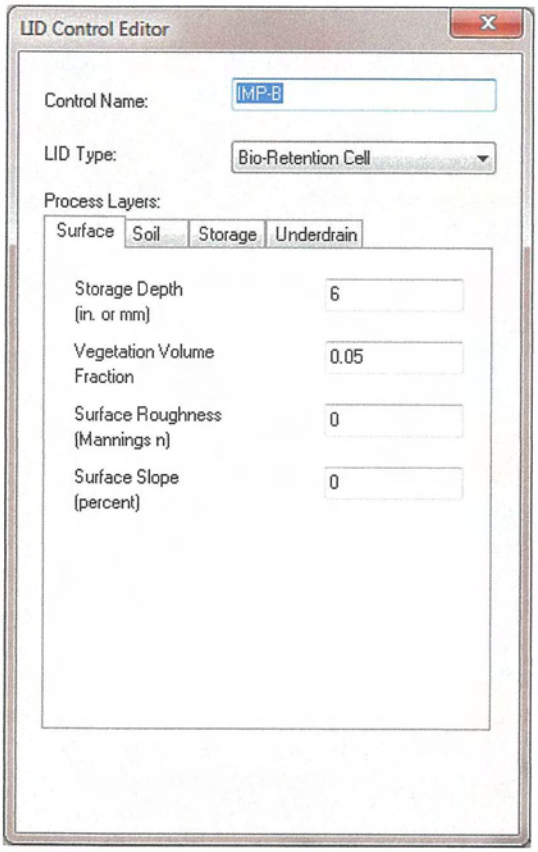

LID Usage Editor
Control Name
IMP-C
Number of Replicate Units
1
LID Occupies Full Subcatchment
Area of Each Unit (sq ft or sq m)
316
% of Subcatchment Occupied
100.0
Top Width of Overland Flow Surface of Each Unit (ft or m)
0
% Initially Saturated
0
% of Impervious Area Treated
100

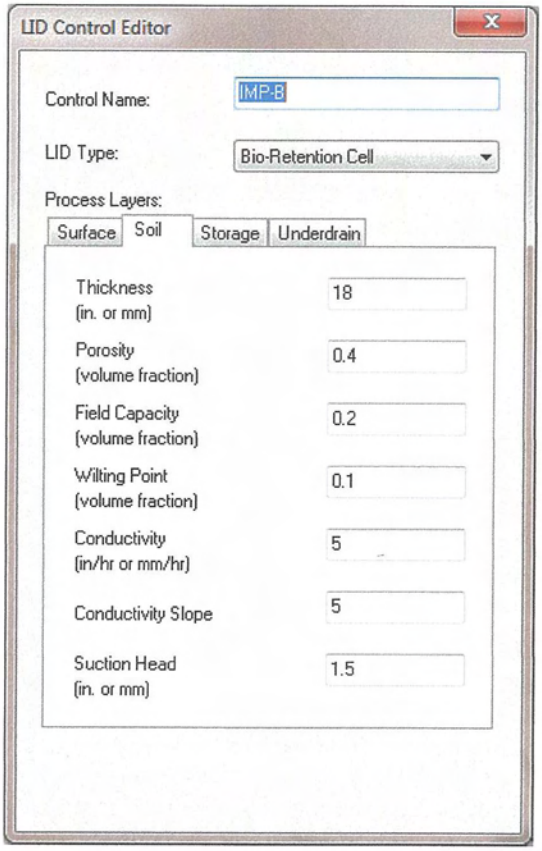

LID Control Editor
Control Name:
IMP-A
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
9
Vegetation Volume
Fraction
0.05
Surface Roughness
(Mannings n)
0
Surface Slope
(percent)
0

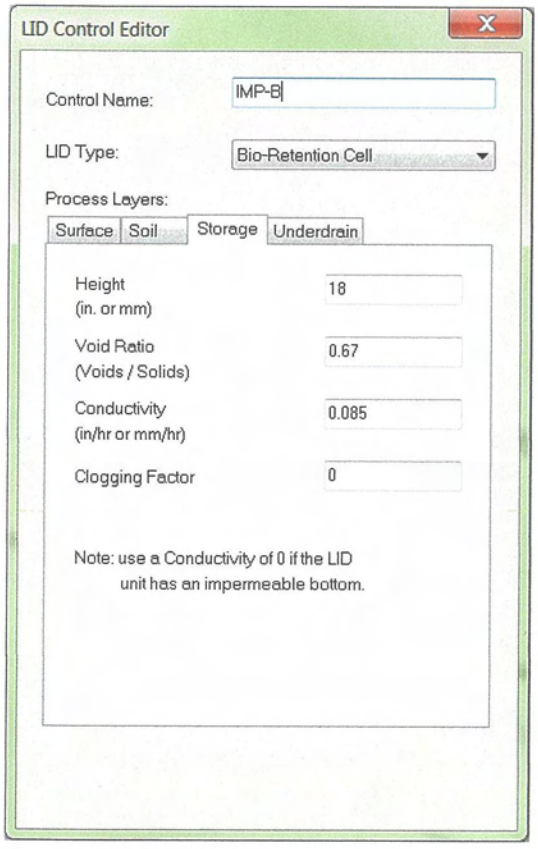

LID Control Editor
Control Name:
IMP-A
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
18
Porosity
(volume fraction)
0.4
Field Capacity
(volume fraction)
0.2
Wilting Point
(volume fraction)
0.1
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5

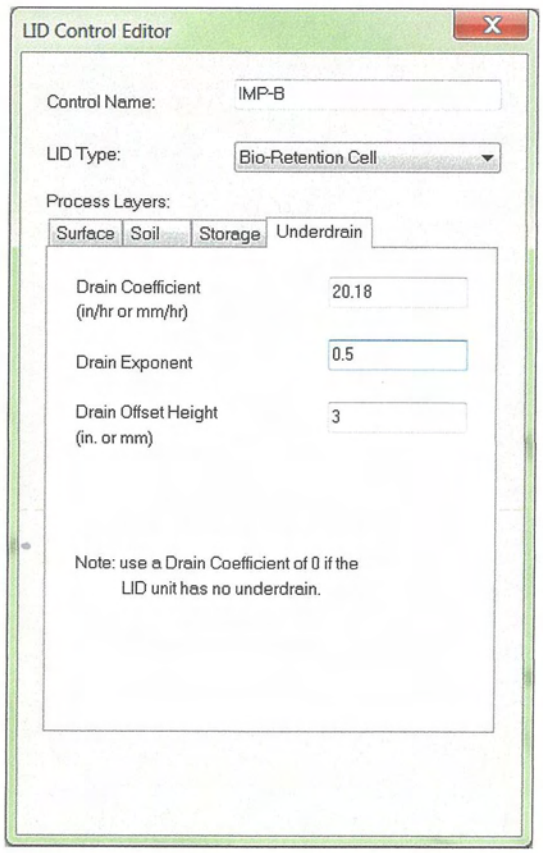

LID Control Editor
Control Name:
IMP-A
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
18
Void Ratio
(Voids / Solids)
0.67
Conductivity
(in/hr or mm/hr)
0.11
Clogging Factor
0
Note: use a Conductivity of 0 if the LID
unit has an impermeable bottom.

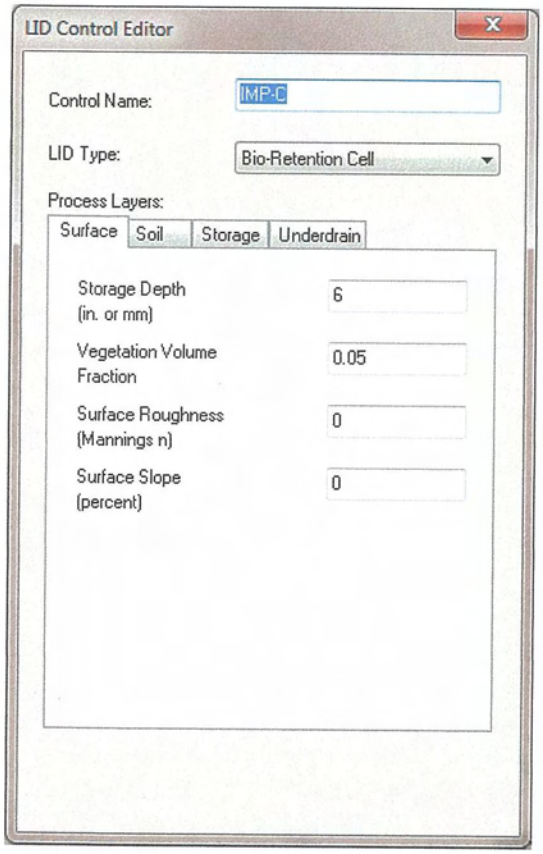

LID Control Editor
Control Name:
IMP-A
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
(in/hr or mm/hr)
126.84
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
3
Note: use a Drain Coefficient of 0 if the
LID unit has no underdrain.

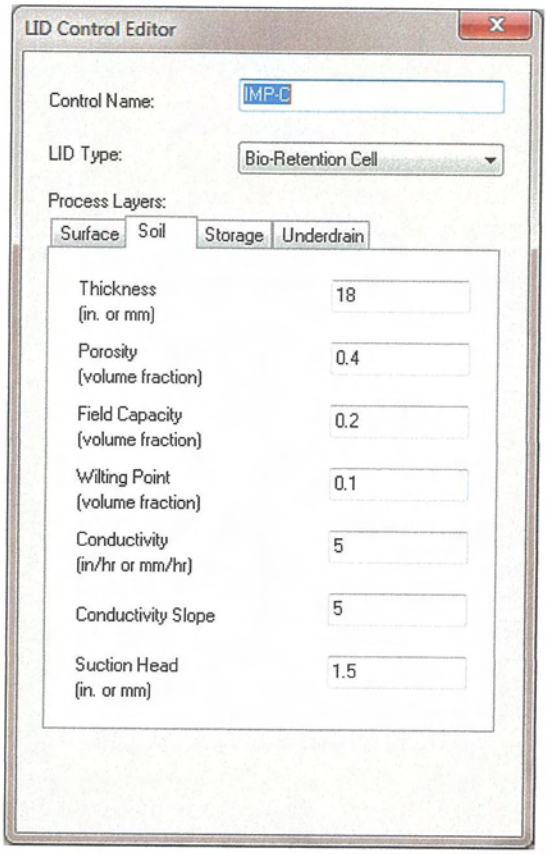

LID Control Editor
Control Name:
IMP-B
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
6
Vegetation Volume
Fraction
0.05
Surface Roughness
(Mannings n)
0
Surface Slope
(percent)
0

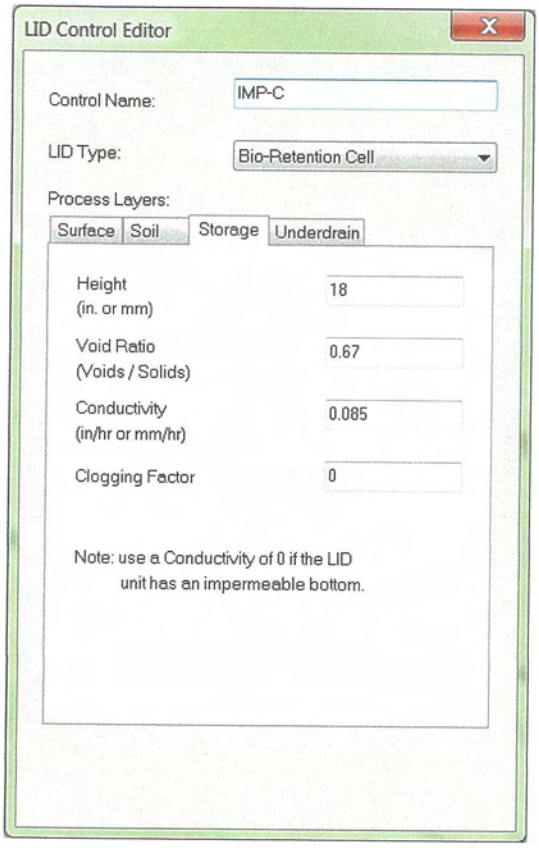

LID Control Editor
Control Name:
IMP-B
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
18
Porosity
(volume fraction)
0.4
Field Capacity
(volume fraction)
0.2
Wilting Point
(volume fraction)
0.1
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5

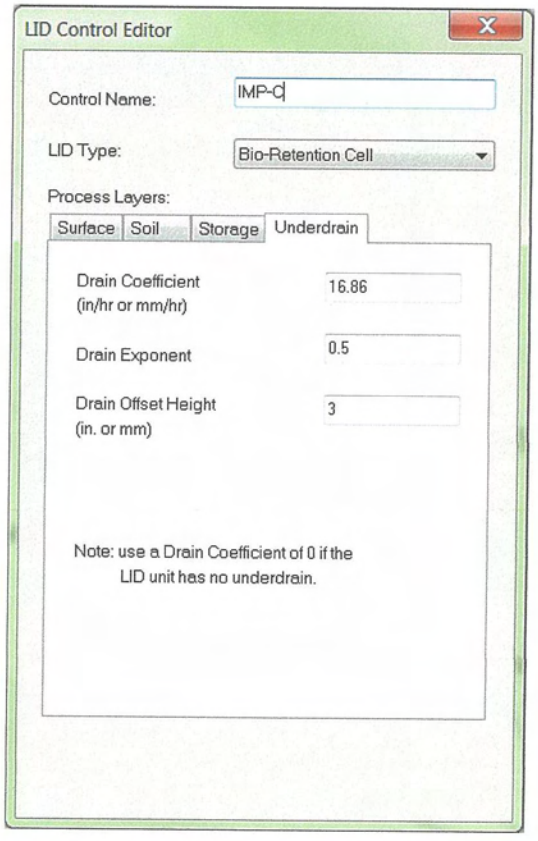

LID Control Editor
Control Name:
IMP-B
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
18
Void Ratio
(Voids / Solids)
0.67
Conductivity
(in/hr or mm/hr)
0.085
Clogging Factor
0
Note: use a Conductivity of 0 if the LID
unit has an impermeable bottom.


LID Control Editor
Control Name:
IMP-B
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
(in/hr or mm/hr)
20.18
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
3
Note: use a Drain Coefficient of 0 if the
LID unit has no underdrain.


LID Control Editor
Control Name:
IMP-C
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Storage Depth
(in. or mm)
6
Vegetation Volume
Fraction
0.05
Surface Roughness
(Mannings n)
0
Surface Slope
(percent)
0


LID Control Editor
Control Name:
IMP-C
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Thickness
(in. or mm)
18
Porosity
(volume fraction)
0.4
Field Capacity
(volume fraction)
0.2
Wilting Point
(volume fraction)
0.1
Conductivity
(in/hr or mm/hr)
5
Conductivity Slope
5
Suction Head
(in. or mm)
1.5


LID Control Editor
Control Name:
IMP-C
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Height
(in. or mm)
18
Void Ratio
(Voids / Solids)
0.67
Conductivity
(in/hr or mm/hr)
0.085
Clogging Factor
0
Note: use a Conductivity of 0 if the LID
unit has an impermeable bottom.


LID Control Editor
Control Name:
IMP-C
LID Type:
Bio-Retention Cell
Process Layers:
Surface
Soil
Storage
Underdrain
Drain Coefficient
(in/hr or mm/hr)
16.86
Drain Exponent
0.5
Drain Offset Height
(in. or mm)
3
Note: use a Drain Coefficient of 0 if the
LID unit has no underdrain.

LID Control Editor: Explanation of Significant Variables

Storage Depth:

The storage depth variable within the SWMM model is representative of the storage volume provided beneath the first surface riser outlet and the engineered soil and mulch components of the bioretention facility.

In those cases where the surface storage has a variable area that is also different to the area of the gravel and amended soil, the SWMM model needs to be calibrated as the LID module will use the storage depth multiplied by the BMP area as the amount of volume stored at the surface.

Let A_{BMP} be the area of the BMP (area of amended soil and area of gravel). The proper value of the storage depth S_D to be included in the LID module can be calculated by using geometric properties of the surface volume. Let A_0 be the surface area at the bottom of the surface pond, and let A_i be the surface area at the elevation of the invert of the first row of orifices (or at the invert of the riser if not surface orifices are included). Finally, let h_i be the difference in elevation between A_0 and A_i. By volumetric definition:

$$A_{BMP} \cdot S_D = \frac{(A_0 + A_i)}{2} h_i \qquad (1)$$

Equation (1) allows the determination of S_D to be included as Storage Depth in the LID module.

Porosity: A porosity value of 0.4 has been selected for the model. The amended soil is to be highly sandy in content in order to have a saturated hydraulic conductivity of approximately 5 in/hr.

REC considers such a value to be slightly high; however, in order to comply with the HMP Permit, the value recommended by the Copermittees for the porosity of amended soil is 0.4, per Appendix A of the Final Hydromodification Management Plan by Brown & Caldwell, dated March 2011. Such porosity is equal to the porosity of the gravel per the same document.

Void Ratio: The ratio of the void volume divided by the soil volume is directly related to porosity as n/(1-n). As the underdrain layer is composed of gravel, a porosity value of 0.4 has been selected (also per Appendix A of the Final HMP document), which results in a void ratio of 0.4/(1-0.4) = 0.67 for the gravel detention layer.

Conductivity: All BMPs will be lined to prevent infiltration due to geotechnical concerns. Therefore the model was set to have a conductivity of 0.0 in/hr.

Clogging factor: A clogging factor was not used (0 indicates that there is no clogging assumed within the model). The reason for this is related to the fairness of a comparison with the SDHM model and the HMP sizing tables: a clogging factor was not considered, and instead, a conservative value of infiltration was recommended.

Drain (Flow) coefficient: The flow coefficient C in the SWMM Model is the coefficient needed to transform the orifice equation into a general power law equation of the form:

$$q = C(H - H_D)^n \quad (2)$$

where q is the peak flow in in/hr, n is the exponent (typically 0.5 for orifice equation), H_D is the elevation of the centroid of the orifice in inches (assumed equal to the invert of the orifice for small orifices and in our design equal to 0) and H is the depth of the water in inches.

The general orifice equation can be expressed as:

$$Q = \frac{\pi}{4} c_g \frac{D^2}{144} \sqrt{2g \frac{(H-H_D)}{12}} \quad (3)$$

where Q is the peak flow in cfs, D is the diameter in inches, c_g is the typical discharge coefficient for orifices (0.61-0.63 for thin walls and around 0.75-0.8 for thick walls), g is the acceleration of gravity in ft/s^2, and H and H_D are defined above and are also used in inches in Equation (3).

It is clear that:

$$q \left(\frac{in}{hr}\right) X \frac{A_{BMP}}{12 \, X \, 3600} = Q \; (cfs) \quad (4)$$

Note: The diameter D is equal to the French Drain diameter in this case; therefore, flow is controlled by infiltration capacity of BMPs, and the precise determination of C is irrelevant to the results as gravel layer is never saturated.

Stage Storage and Discharge

Storage Unit BASIN_B

Property	Value
Name	BASIN_B
X-Coordinate	650.000
Y-Coordinate	5000.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	0.5
Initial Depth	0
Ponded Area	264
Evap. Factor	1
Infiltration	NO
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	BASIN_B

User-assigned name of storage unit

Storage Curve Editor

Curve Name: BASIN_B

Description:

	Depth (ft)	Area (ft2)
1	0	264
2	0.5	264
3		
4		
5		
6		
7		
8		
9		

Outlet OUTLET_B

Property	Value
Name	OUTLET_B
Inlet Node	BASIN_B
Outlet Node	POC-1
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/HEAD
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OUT_B

User-assigned name of outlet

Rating Curve Editor

Curve Name: OUT_B

Description:

	Head (ft)	Outflow (CFS)
1	0.000	0.000
2	0.042	0.006
3	0.083	0.021
4	0.125	0.031
5	0.167	0.038
6	0.208	0.044
7	0.250	0.049
8	0.292	0.053
9	0.333	0.113

Storage Unit BASIN_C

Property	Value
Name	BASIN_C
X-Coordinate	959.289
Y-Coordinate	5200.000
Description	
Tag	
Inflows	NO
Treatment	NO
Invert El.	0
Max. Depth	0.5
Initial Depth	0
Ponded Area	316
Evap. Factor	1
Infiltration	NO ...
Storage Curve	TABULAR
Functional Curve	
Coefficient	1000
Exponent	0
Constant	0
Tabular Curve	
Curve Name	BASIN_C

Click to specify infiltration through the bottom of the storage unit

Storage Curve Editor

Curve Name: BASIN_C

Description:

	Depth (ft)	Area (ft2)
1	0	316
2	0.5	316
3		
4		
5		
6		
7		
8		
9		

Outlet OUTLET_C

Property	Value
Name	OUTLET_C
Inlet Node	BASIN_C
Outlet Node	POC-1
Description	
Tag	
Inlet Offset	0
Flap Gate	NO
Rating Curve	TABULAR/HEAD
Functional Curve	
Coefficient	10.0
Exponent	0.5
Tabular Curve	
Curve Name	OUT_C

User-assigned name of outlet

Rating Curve Editor

Curve Name: OUT_C

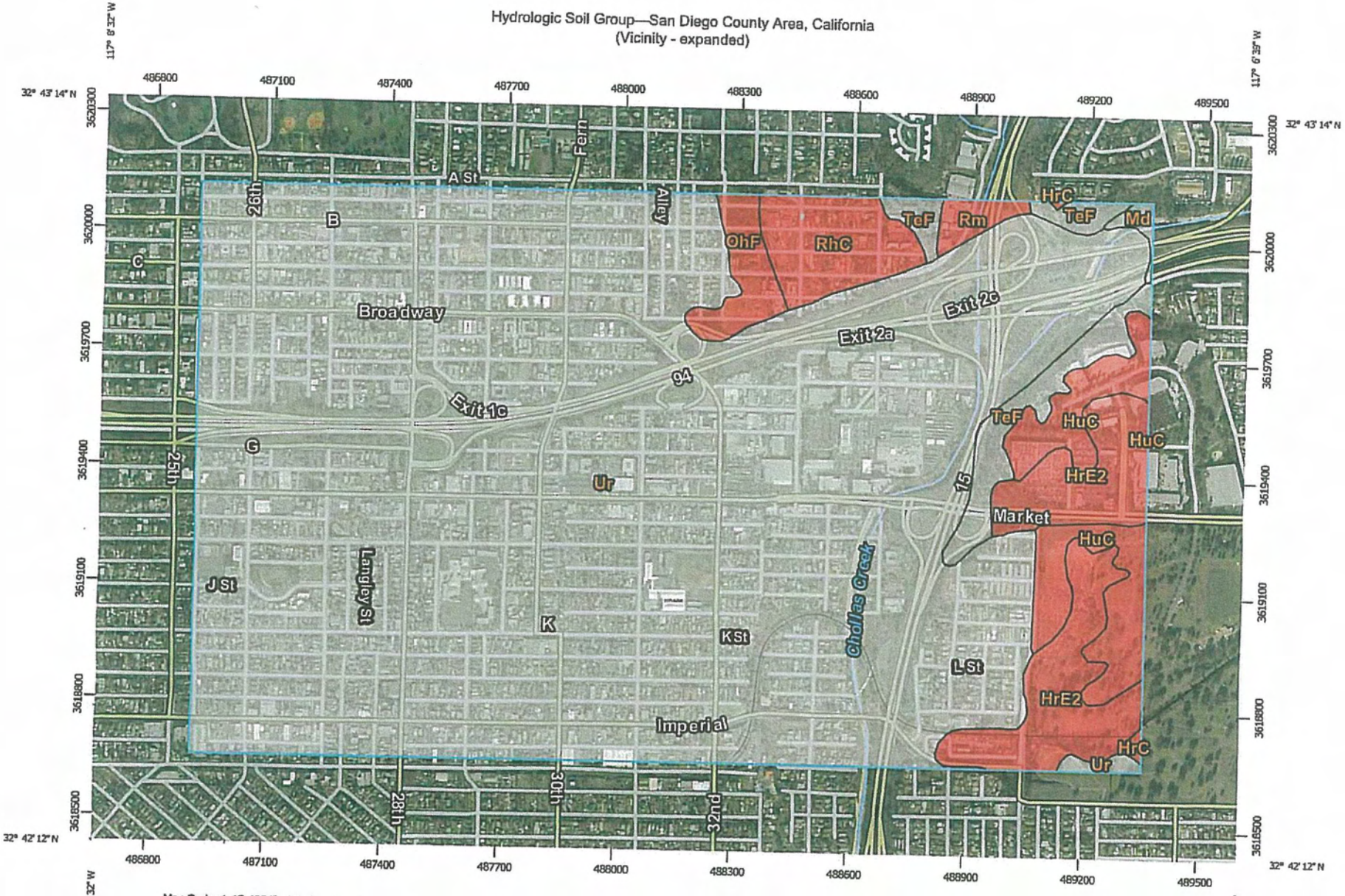
Description:

	Head (ft)	Outflow (CFS)
1	0.000	0.000
2	0.042	0.006
3	0.083	0.021
4	0.125	0.031
5	0.167	0.038
6	0.208	0.044
7	0.250	0.049
8	0.292	0.053
9	0.333	0.113

ATTACHMENT 8

Soils Maps

Hydrologic Soil Group—San Diego County Area, California
(Vicinity - expanded)



USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HrC	Huerhuero loam, 2 to 9 percent slopes	D	0.8	0.1%
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded	D	51.3	5.8%
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes	D	33.6	3.8%
Md	Made land		1.9	0.2%
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes	D	11.4	1.3%
RhC	Redding-Urban land complex, 2 to 9 percent slopes	D	21.7	2.4%
Rm	Riverwash	D	4.7	0.5%
TeF	Terrace escarpments		22.5	2.5%
Ur	Urban land		739.5	83.3%
Totals for Area of Interest			**887.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

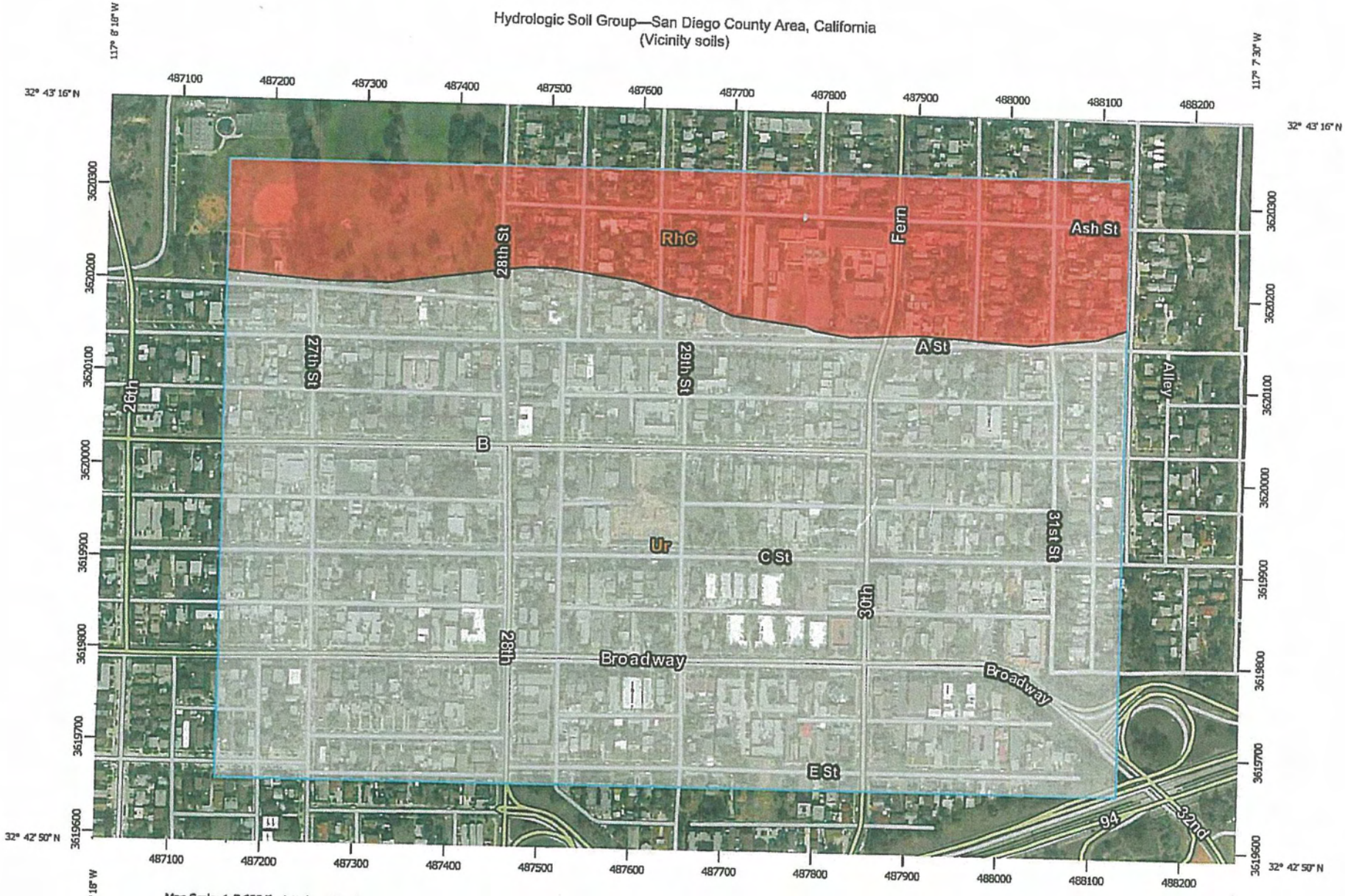
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Hydrologic Soil Group—San Diego County Area, California
(Vicinity soils)



Map Scale: 1:5,680 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 9, Sep 17, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 7, 2014—Jan 4, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
RhC	Redding-Urban land complex, 2 to 9 percent slopes	D	35.4	21.8%
Ur	Urban land		127.3	78.2%
Totals for Area of Interest			162.7	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

ATTACHMENT 9

Summary Files from the SWMM Model

PRE_DEV

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... NO
  Water Quality ..... NO
Infiltration Method ..... GREEN_AMPT
Starting Date OCT-17-1948 00:00:00
Ending Date OCT-17-2005 23:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:15:00
Dry Time Step 04:00:00

Runoff Quantity Continuity	Volume acre-feet	Depth inches
Total Precipitation	29.155	563.372
Evaporation Loss	0.927	17.913
Infiltration Loss	23.284	449.932
Surface Runoff	5.522	106.703
Final Surface Storage	0.000	0.000
Continuity Error (%)	-1.984	

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	5.522	1.799
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	5.522	1.799
Internal Outflow	0.000	0.000
Storage Losses	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA_1	563.37	0.00	17.91	449.93	106.70	1.80	0.81	0.189

Analysis begun on: Wed Aug 24 11:23:54 2016
Analysis ended on: Wed Aug 24 11:24:10 2016
Total elapsed time: 00:00:16

POST_DEV

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)
--------------------------------------------------------------

***********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
***********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Infiltration Method ...... GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date ............ OCT-17-1948 00:00:00
Ending Date .............. OCT-17-2005 23:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 01:00:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 04:00:00
Routing Time Step ........ 60.00 sec


WARNING 04: minimum elevation drop used for Conduit BYPASS_C

WARNING 04: minimum elevation drop used for Conduit UDRAIN_C

WARNING 04: minimum elevation drop used for Conduit BYPASS_B

WARNING 04: minimum elevation drop used for Conduit UDRAIN_B

**************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
**************************     ---------       -------
Total Precipitation ......        29.121       563.372
Evaporation Loss .........         4.495        86.965
Infiltration Loss ........        11.671       225.792
Surface Runoff ...........        13.425       259.728
Final Surface Storage ....         0.003         0.063
Continuity Error (%) .....        -1.629


**************************        Volume         Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......        13.423         4.374
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........        13.417         4.372
Internal Outflow .........         0.000         0.000
Storage Losses ...........         0.003         0.001
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....         0.025


******************************
Highest Flow Instability Indexes
```

****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
DMA_C	563.37	0.00	79.68	133.02	358.64	2.56	0.36	0.637
IMP_C	563.37	13002.88	891.78	1931.27	10809.79	2.13	0.35	0.797
DMA_A	563.37	0.00	19.07	428.88	121.49	0.21	0.08	0.216
DMA_B	563.37	0.00	81.95	121.03	368.61	2.23	0.30	0.654
DMA_D	563.37	0.00	19.29	430.20	119.61	0.19	0.08	0.212
IMP_A	563.37	7940.02	539.46	692.99	7367.36	0.19	0.08	0.866
IMP_B	563.37	13562.16	894.91	1956.92	11346.33	1.87	0.30	0.803

****
LID Performance Summary
****

Subcatchment	LID Control	Total Inflow in	Evap Loss in	Infil Loss in	Surface Outflow in	Drain Outflow in	Init. Storage in	Final Storage in	Pcnt. Error
IMP_C	IMP-C	13566.25	891.77	1931.24	1223.08	9586.57	0.00	2.36	-0.51
IMP_A	IMP-A	8503.39	539.38	692.88	2212.83	5153.37	0.00	0.28	-1.12
IMP_B	IMP-B	14125.53	895.00	1957.12	1328.63	10018.86	0.00	2.36	-0.54

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days	hr:min
POC-1	OUTFALL	0.00	0.00	0.00	0	00:00
DIV_B	DIVIDER	0.00	0.00	0.00	0	00:00
DIV_C	DIVIDER	0.00	0.00	0.00	0	00:00
BASIN_B	STORAGE	0.00	0.39	0.39	6263	09:15
BASIN_C	STORAGE	0.00	0.41	0.41	6263	09:15

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal
POC-1	OUTFALL	0.16	0.80	6263	09:00	0.378	4.372

DIV_B	DIVIDER	0.30	0.30	6263	09:15	1.867	1.867
DIV_C	DIVIDER	0.35	0.35	6263	09:15	2.129	2.129
BASIN_B	STORAGE	0.00	0.28	6263	09:15	0.000	0.206
BASIN_C	STORAGE	0.00	0.33	6263	09:15	0.000	0.227

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
DIV_B	DIVIDER	499679.02	0.000	0.000
DIV_C	DIVIDER	499679.02	0.000	0.000
BASIN_B	STORAGE	499679.02	0.394	0.106
BASIN_C	STORAGE	499679.02	0.409	0.091

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	E&I Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
BASIN_B	0.000	0	0	0.104	79	6263 09:15	0.28
BASIN_C	0.000	0	0	0.129	82	6263 09:15	0.33

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
POC-1	1.17	0.03	0.80	4.372
System	1.17	0.03	0.80	4.372

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
BYPASS_C	DUMMY	0.33	6263 09:15			
UDRAIN_C	DUMMY	0.03	6263 08:43			
BYPASS_B	DUMMY	0.28	6263 09:15			
UDRAIN_B	DUMMY	0.02	389 12:02			
OUTLET_B	DUMMY	0.28	6263 09:15			
OUTLET_C	DUMMY	0.33	6263 09:15			

****
Conduit Surcharge Summary
****

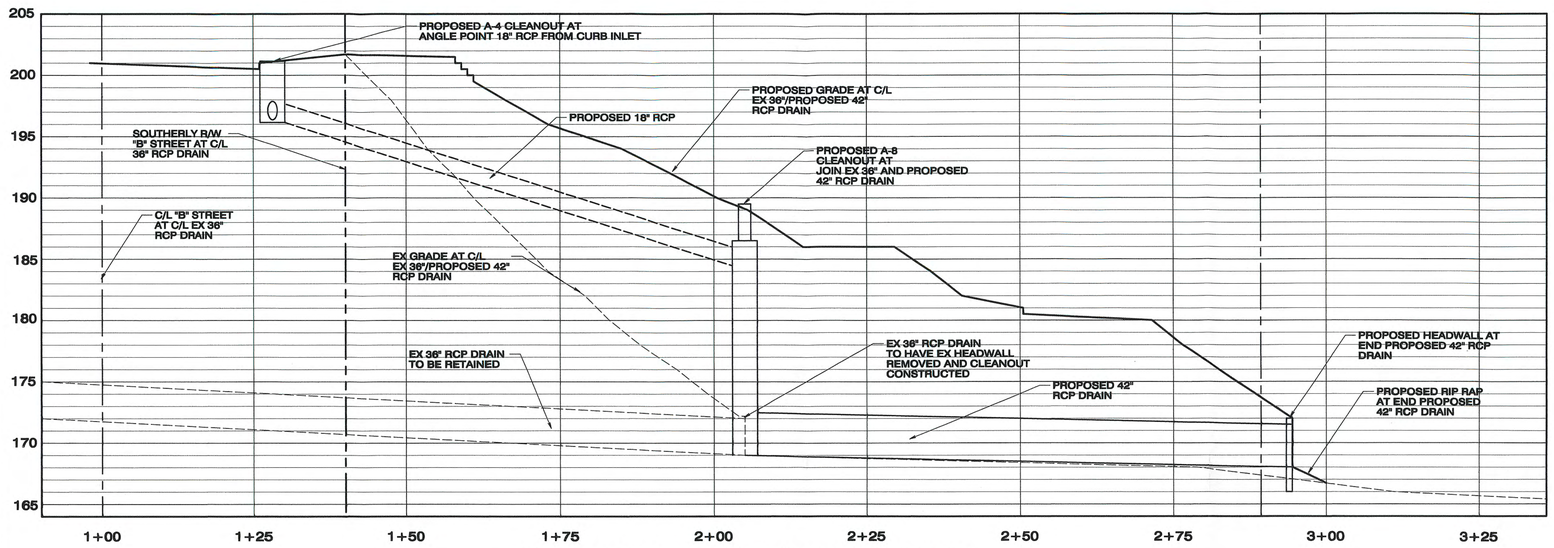
Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
BYPASS_C	0.01	0.01	0.01	499679.02	0.01
UDRAIN_C	0.01	0.01	0.01	499679.02	0.01
BYPASS_B	0.01	0.01	0.01	499679.02	0.01
UDRAIN_B	0.01	0.01	0.01	499679.02	0.01

Analysis begun on: Wed Aug 24 11:22:32 2016
Analysis ended on: Wed Aug 24 11:23:20 2016
Total elapsed time: 00:00:48

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE INFORMATION

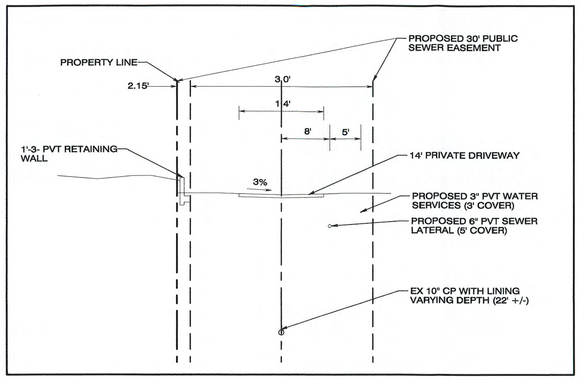
This is the cover sheet for Attachment 3.

SITE DEVELOPMENT



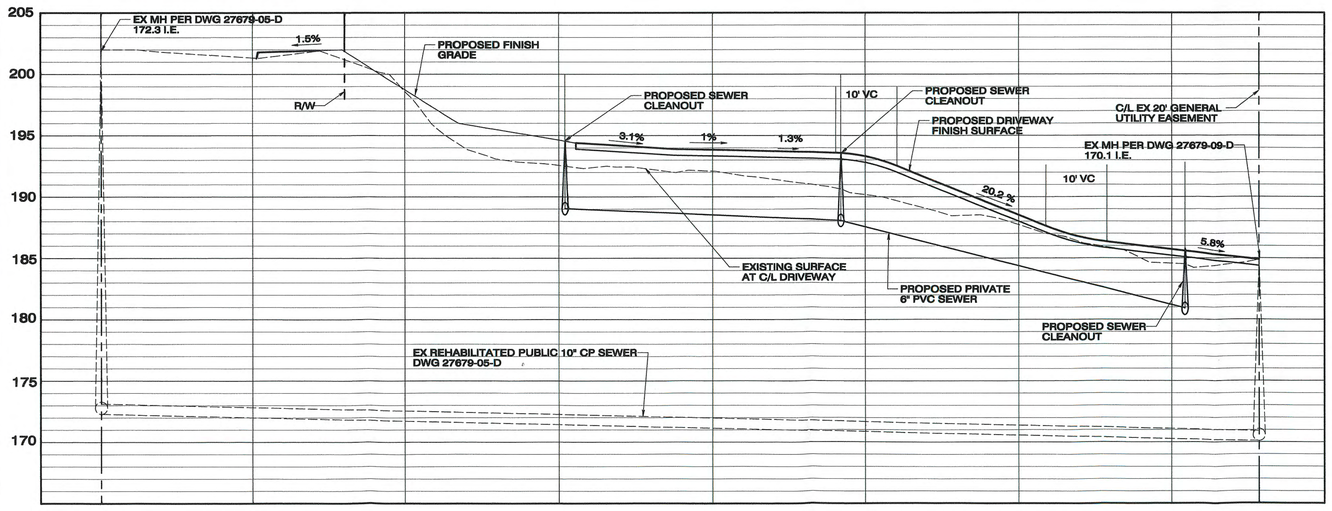
EXISTING 36"/PROPOSED 42" RCP DRAIN PROFILE

SCALE:
1" = 10' HORIZONTAL
1" = 5' VERTICAL



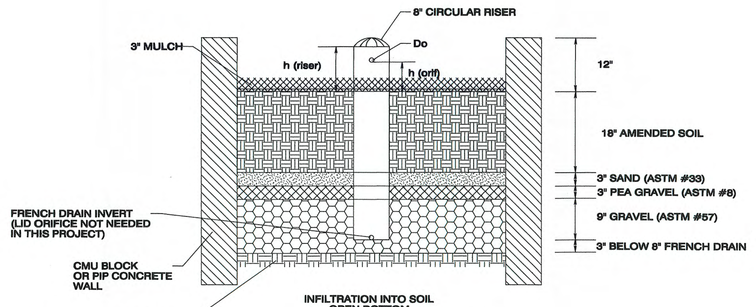
30' PUBLIC SEWER EASEMENT SECTION

NOT TO SCALE



WESTERLY DRIVEWAY PROFILE

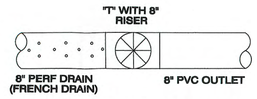
SCALE:
1" = 10' HORIZONTAL
1" = 5' VERTICAL



BIOFILTRATION BASIN DETAIL

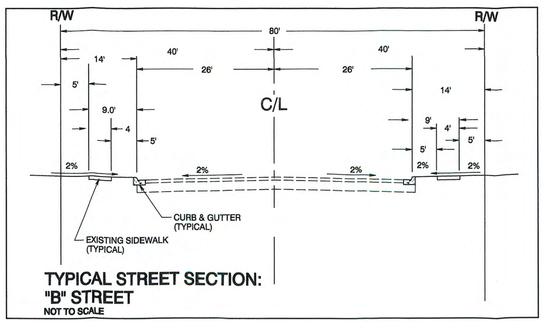
NOT TO SCALE

BASIN DATA TABLE					
BMP ID	AREA OF BMP	h(riser)	h(orif)	# ORIFICES	FRENCH DRAIN (in)
IMP A	42 SF	9"	N/A	0	8"
IMP B	264 SF	9-1/2"	6"	4	8"
IMP B	316 SF	9-1/2"	6"	4	8"



BASIN OUTLET DETAIL

NOT TO SCALE



TYPICAL STREET SECTION: "B" STREET

NOT TO SCALE

CHRISTENSEN ENGINEERING & SURVEYING
CIVIL ENGINEERS LAND SURVEYORS PLANNERS
7888 SILVERTON AVENUE, SUITE "J", SAN DIEGO, CALIFORNIA 92126
TELEPHONE: (858) 271-9901 FAX: (858) 271-8912

ANTONY K. CHRISTENSEN, RCE 54021 — SEPTEMBER 29, 2016 Date

REGISTERED PROFESSIONAL ENGINEER — ANTONY K. CHRISTENSEN — No. 54021 — Exp. 12-31-15 — CIVIL — STATE OF CALIFORNIA

Prepared By:

CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-9901 FAX (858) 271-8912

Project Address:

"B" STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:

"B" STREET ROW HOMES

Revision 6: 09-29-16 REVISE BMP DETAIL
Revision 5:08-25-16 REVISE BMP DETAIL
Revision 4: 07-18-16 REVISE DESIGN
Revision 3: 04-02-16 REVISE DESIGN
Revision 2: 10-15-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

Original Date: APRIL 06, 2015

Sheet Title:

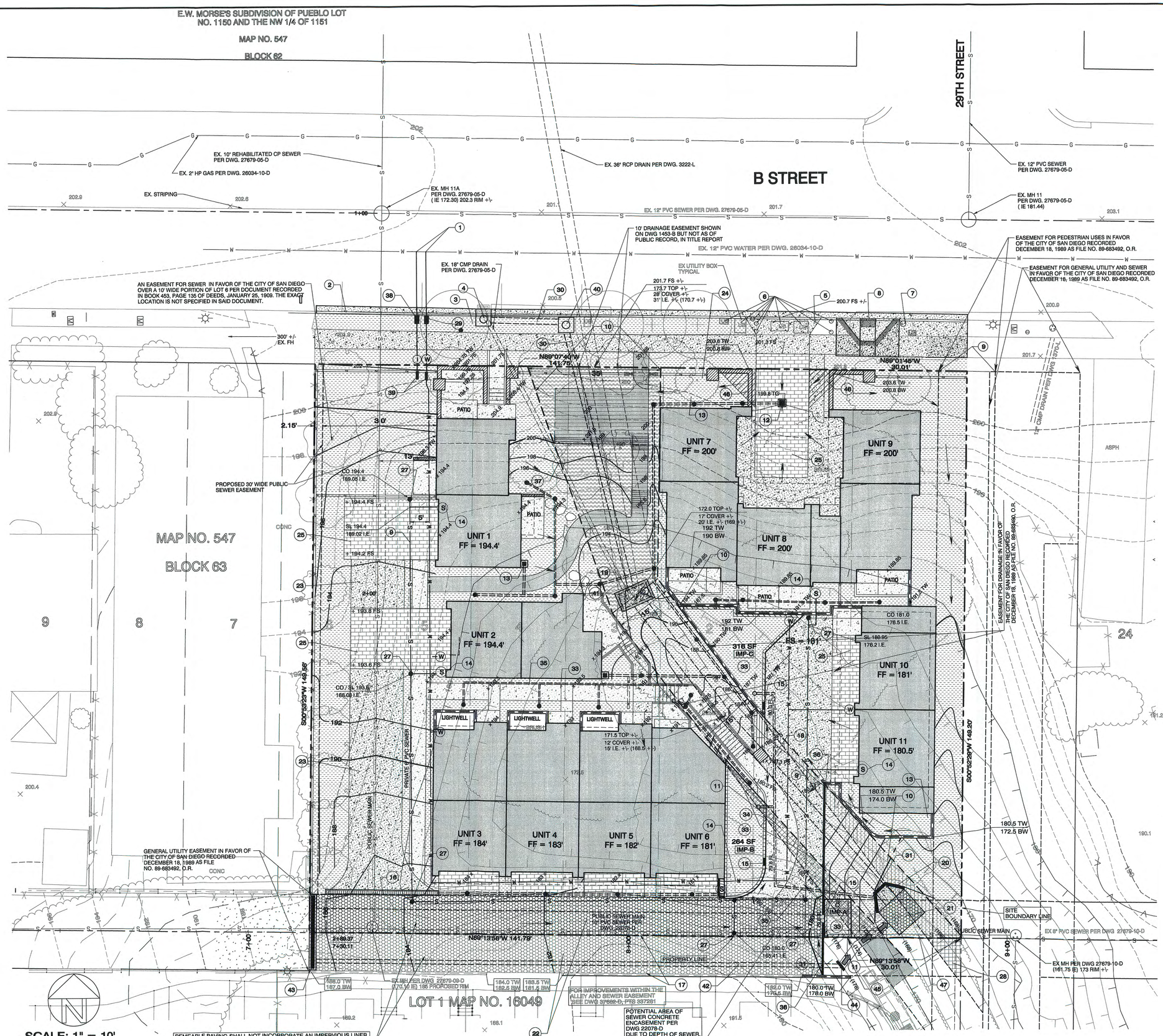
Sheet 2 of 3 Sheets

DEP#

PRELIMINARY GRADING PLAN

JN 2015-07

SITE DEVELOPMENT
PRELIMINARY GRADING PLAN



CONSTRUCTION NOTES

1. NEW WATER SERVICE (TYPICAL)
2. REMOVE & REPLACE CURB & GUTTER PER SDG-151
3. REMOVE AND REPLACE SIDEWALK PER SDG-155
4. REMOVE EX CATCH BASIN REPLACE WITH CURB INLET PER SDD-116
5. C/L 20' D/W PER SDG-160
6. RELOCATE EX UTILITY IMPROVEMENTS
7. PROTECT EX UTILITY POLE IN PLACE
8. REMOVE AND REPLACE EX PED RAMP PER SDG-133
9. PROPOSED 6" PRIVATE SEWER MAIN
10. PROPOSED NEW/ADDITIONAL DRAIN EASEMENT
11. PORTION OF EX DRAINAGE EASEMENT TO BE VACATED
12. PROPOSED CATCH BASIN FOR D/W AND ROOF RUNOFF UNITS 7-9
13. PROPOSED 1212 CATCH BASIN FOR BUILDING ROOF DRAIN
14. PROPOSED PRIVATE SEWER LATERAL TO PRIVATE 6" MAIN
15. PROPOSED OPENING IN BASIN WALL FOR SURFACE FLOW TO ENTER
16. TRENCH DRAIN TO COLLECT RUNOFF FROM WESTERLY D/W
17. PROPOSED PVT EASEMENT OVER PORTION OF LOT 1 OF MAP NO. 16049
18. PROPOSED 42" RCP DRAIN
19. REMOVE EX HEADWALL , BEGIN NEW 42" RCP DRAIN AT A-8 CLEANOUT
20. PROPOSED WING HEADWALL PER D-34
21. PROPOSED RIP RAP PER SDD-104
22. PERMEABLE PAVING PER DWG 37682-D. TO BE REPLACED WITH GRASS-CRETE OR EQUIV.
23. PROPOSED 5.5' PCC DRIVEWAY
24. PROPOSED LANDSCAPE AREA (TYPICAL)
25. PROPOSED STAMPED PAVERS (TYPICAL)
26. SEWER CLEANOUT FOR PRIVATE 6" SEWER MAIN
27. AREA OF DRAINAGE EASEMENT TO BE DEDICATED (OFFSITE)
28. PROPOSED 2" WATER SERVICE METER BOX
29. PROPOSED 18" RCP DRAIN
30. POINT OF CONNECTION OF BIOFILTRATION BASINS
31. BIOFILTRATION BASIN (TYPICAL) (SEE DETAIL ON SHEET 2)
32. DRAIN FROM BIOFILTRATION BASIN
33. PVC DRAIN (TYPICAL)
34. 6" CURB, DEEPENED FOOTING (TYPICAL)
35. EX 18" CMP DRAIN AND EX HEADWALL TO BE REMOVED
36. 1" IRRIGATION SERVICE WATER METER BOX
37. BACKFLOW PREVENTER (TYPICAL)
38. A-4 CLEANOUT
39. A-8 CLEANOUT
40. 12" PVC DRAIN FROM TRENCH DRAIN TO OUTLET INTO BASIN
41. 12" TRENCH DRAIN WITH TRAFFIC COVER TO CONVEY ALLEY RUNOFF TO BASIN
42. HEADWALL PER D-30
43. CONCRETE DITCH PER D-106
44. VISIBILITY TRIANGLE. NOTHING GREATER THAN 36" IN HEIGHT ALLOWED IN THIS AREA
45. EX CONC PIPE TO BE REMOVED FROM STA 8+70 TO 9+00 AND REPLACED WITH VCP WITH CONCRETE ENCASEMENT
46.

NOTE: CITY RECORDS INDICATE A SEWER LATERAL EXISTS BETWEEN SMH 348 AND 495, THIS LATERAL (IF IT EXISTS) WILL BE ABANDONED AND CAPPED.

GRADING DATA

AREA OF SITE - 25,664 S.F.
AREA OF SITE TO BE GRADED 25,364 SF (DOES NOT INCLUDE OFFSITE GRADING 131 SF)
PERCENT OF SITE TO BE GRADED 98.8%
AREA OF SITE WITH SLOPES GREATER THEN 25% - 15,535 SF
PERCENT OF SITE WITH SLOPES GREATER THEN 25% - 60.5%
AMOUNT OF SITE WITH 25% SLOPES OR GREATER: AREA - 0 SF, PERCENT OF TOTAL SITE - 0%.
AMOUNT OF CUT - 100 C.Y.
AMOUNT OF FILL - 6,700 C.Y.
AMOUNT OF IMPORT - 6,600 C.Y.
MAXIMUM HEIGHT OF FILL SLOPE - 14 FEET
MAXIMUM DEPTH OF CUT - 10 FEET
RETAINING WALL: 11 FEET MAX. HT. 100 FEET TOTAL LENGTH (OTHERS, PART OF STRUCTURES)

REGISTERED PROFESSIONAL ENGINEER ANTONY K. CHRISTENSEN No. 54021 Exp. 12-31-17 CIVIL STATE OF CALIFORNIA

ANTONY K. CHRISTENSEN, RCE 54021

SEPTEMBER 29, 2015
Date

Prepared By:

CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-9901 FAX (858) 271-8912

Project Address:

"B" STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:

"B" STREET ROW HOMES

Sheet Title:

PRELIMINARY GRADING PLAN

Revision 6:
Revision 5: 09-29-16 ADDED PAVEMENT NOTE
Revision 4: 07-18-16 REVISE DESIGN
Revision 3: 04-02-16 REVISE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

Original Date: APRIL 06, 2015

Sheet 3 of 3 Sheets

DEP# _____

JN 2015-07

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

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 biofiltration 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).

Table 7-2. Maintenance Indicators and Actions for Vegetated BMPs

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.	

Biofiltration Basin Maintenance Plan
for
B Street Apartments

July 15, 2016

Project Address and Cross Streets 29th and B Streets

Assessor's Parcel No.: 539-521-01,02

BMP Owner: Janco, LLC Phone No.: 619-572-3556

Designated Contact: Matthew Gordon Phone No.: 619-572-3556

Mailing Address: P.O. BOX 231446, ENCINITAS, CA 92023

The property contains three Biofiltration Basin, located as described below and as shown in the attached site plan[1].

Biofiltration Basin No. A, B & C: Are located in the southeasterly portion of the project site.

I. Routine Maintenance Activities

The principal maintenance objectives are to ensure that water flows unimpeded into the Biofiltration Basin and landscaping remains attractive in appearance. Table 1 shows the routine maintenance activities, and the frequency at which they will be conducted.

Table 1
Routine Maintenance Activities for Biofiltration Basins

No.	Maintenance Task	Frequency of Task
1	Evaluate health of vegetation. Remove and replace all dead and diseased vegetation. Treat vegetation using preventative and low-toxic methods.	Twice a year
2	Maintain the vegetation and irrigation system. Prune and weed to keep flow-through basin neat and orderly in appearance.	As needed
4	Check that there is sufficient biotreatment soil media (depth as shown on plan). Check that soil is at the appropriate level to allow water to temporarily pond above soil surface (depth as shown on plan).	Before wet season and as necessary
5	Remove accumulated sediment, litter and debris from Biofiltration Basin and dispose of properly. Replenish mulch as needed.	Before wet season and as necessary
6	Inspect Biofiltration Basin to ensure that there are no clogs.	Monthly during the wet season, and as needed after storm events
7	Inspect downspouts from rooftops and sheet flow from paved areas to ensure flow to basin is unimpeded. Remove debris and repair damaged pipes. Check splash blocks or rocks and repair, replace and replenish as necessary.	Monthly during the wet season, and as needed after storm events
8	Inspect overflow pipe to ensure that it will safely convey excess flows to storm drain. Repair or replace any damaged or disconnected piping.	Before the wet season, and as necessary
9	Inspect Biofiltration Basin to ensure that it is structurally sound (no cracks or leaks). Repair as necessary.	Monthly during the wet season, and as needed after storm events
10	Inspect Biofiltration Basin using the attached inspection checklist.	Monthly, or after large storm events, and after removal of accumulated debris or material

[1] See Project Exhibit

II. Use of Pesticides

The use of pesticides and quick release fertilizers shall be minimized, and the principles of integrated pest management (IPM) followed:

1. Employ non-chemical controls (biological, physical and cultural controls) before using chemicals to treat a pest problem.
2. Prune plants properly and at the appropriate time of year.
3. Provide adequate irrigation for landscape plants. Do not over water.
4. Limit fertilizer use unless soil testing indicates a deficiency. Slow-release or organic fertilizer is preferable. Check with municipality for specific requirements.
5. Pest control should avoid harming non-target organisms, or negatively affecting air and water quality and public health. Apply chemical controls only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, apply the least toxic and the least persistent pesticide that will provide adequate pest control. Do not apply pesticides on a prescheduled basis.
6. Sweep up spilled fertilizer and pesticides. Do not wash away or bury such spills.
7. Do not over apply pesticide. Spray only where the infestation exists. Follow the manufacturer's instructions for mixing and applying materials.
8. Only licensed, trained pesticide applicators shall apply pesticides.
9. Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging pesticides into runoff. With the exception of pre-emergent pesticides, avoid application if rain is expected.
10. Unwanted/unused pesticides shall be disposed as hazardous waste.

III. Vector Control

Standing water shall not remain in the treatment measures for more than four days, to prevent mosquito generation. Should any mosquito issues arise, contact San Diego County Vector Control. Mosquito larvicides shall be applied only when absolutely necessary, as indicated by the District, and then only by a licensed professional or contractor.

IV. Inspections

The attached Biofiltration Basin Inspection and Maintenance Checklist shall be used to conduct inspections monthly (or as needed), identify needed maintenance, and record maintenance that is conducted.

V. Access, Observation and Soil Media Replacement

The Basin can be accessed by the driveway to the telecommunication facility. There is a separate capped pipe to be used to drain ponding area should the drain or orifice clog. Otherwise the basin is typical in design. Soil media is to be assessed every five years for possible replacement. Soil not replaced at five years should be reassessed every year thereafter. Should soil need to be replaced it should be removed and replaced using hand tools or small excavators. A firm specializing in BMP construction/ maintenance shall be employed to maintain the basin.

Biofiltration Basin
Inspection and Maintenance Checklist

Property Address: 29th and B Streets BMP Owner: Janco, LLC

Treatment Measure No.: _____ Date of Inspection: _____ Type of Inspection: Monthly Pre-Wet Season
After heavy runoff End of Wet Season

Inspector(s): _____ Other: _____

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Results Expected When Maintenance Is Performed**
1. Vegetation	Vegetation is dead, diseased and/or overgrown.			Vegetation is healthy and attractive in appearance.
2. Soil	Soil too deep or too shallow.			Soil is at proper depth (per soil specifications) for optimum filtration and flow.
3. Mulch	Mulch is missing or patchy in appearance.			Mulch is even in appearance.
4. Sediment, Trash and Debris Accumulation	Sediment, trash and debris accumulated in the Biofiltration basin. Basin does not drain within 3-4 hours.			Sediment, trash and debris removed from Biofiltration Basin and disposed of properly. Basin drains within 24 hours.
5. Clogs/Drainage	Basin does not drain within 24 hours after rainfall.			Basin drains per design specifications.
6. Downspouts and Sheet Flow	Flow to basin is impeded. Downspouts are clogged or pipes are damaged. Splash blocks and rocks in need of repair, replacement or replenishment.			Downspouts and sheet flow is conveyed efficiently to the basin.
7. Overflow Pipe	Does not safely convey excess flows to storm drain. Piping damaged or disconnected.			Overflow pipe conveys excess flow to storm drain efficiently.
8. Structural Soundness	Basin is cracked, leaking or falling apart.			Cracks and leaks are repaired and basin is structurally sound.
9. Miscellaneous	Any condition not covered above that needs attention in order for the flow-through basin to function as designed.			Meet the design specifications.

THE CITY OF SAN DIEGO
RECORDING REQUESTED BY:
THE CITY OF SAN DIEGO
AND WHEN RECORDED MAIL TO:

(THIS SPACE IS FOR THE RECORDER'S USE ONLY)

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPROVAL NUMBER:	ASSESSOR'S PARCEL NUMBER:	PROJECT NUMBER:

This agreement is made by and between the City of San Diego, a municipal corporation [City] and

the owner or duly authorized representative of the owner [Property Owner] of property located at:

(PROPERTY ADDRESS)

and more particularly described as:

(LEGAL DESCRIPTION OF PROPERTY)

in the City of San Diego, County of San Diego, State of California.

Property Owner is required pursuant to the City of San Diego Municipal Code, Chapter 4, Article 3, Division 3, Chapter 14, Article 2, Division 2, and the Land Development Manual, Storm Water Standards to enter into a Storm Water Management and Discharge Control Maintenance Agreement [Maintenance Agreement] for the installation and maintenance of Permanent Storm Water Best Management Practices [Permanent Storm Water BMP's] prior to the issuance of construction permits. The Maintenance Agreement is intended to ensure the establishment and maintenance of Permanent Storm Water BMP's onsite, as described in the attached exhibit(s), the project's Storm Water Quality Management Plan [SWQMP] and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s):

_____

Property Owner wishes to obtain a building or engineering permit according to the Grading and/or Improvement Plan Drawing No(s) or Building Plan Project No(s):

Continued on Page 2

NOW, THEREFORE, the parties agree as follows:

1. Property Owner shall have prepared, or if qualified, shall prepare an Operation and Maintenance Procedure [OMP] for Permanent Storm Water BMP's, satisfactory to the City, according to the attached exhibit(s), consistent with the Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s):_____

2. Property Owner shall install, maintain and repair or replace all Permanent Storm Water BMP's within their property, according to the OMP guidelines as described in the attached exhibit(s), the project's WQTR and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s)_____.

3. Property Owner shall maintain operation and maintenance records for at least five (5) years. These records shall be made available to the City for inspection upon request at any time.

This Maintenance Agreement shall commence upon execution of this document by all parties named hereon, and shall run with the land.

Executed by the City of San Diego and by Property Owner in San Diego, California.

See Attached Exhibits(s):

_____
(Owner Signature)

_____
(Print Name and Title)

_____
(Company/Organization Name)

_____
(Date)

THE CITY OF SAN DIEGO

APPROVED:

_____
(City Control engineer Signature

_____
(Print Name)

_____
(Date)

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDMENTS PER CIVIL CODE SEC. 1180 ET.SEQ

ATTACHMENT 4
COPY OF PLAN SHEETS SHOWING PERMANENT STORM WATER BMPS

This is the cover sheet for Attachment 4.

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. Broucher photocopies are not allowed.

ATTACHMENT 5
DRAINAGE REPORT

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

Drainage Study
"B" Street Site Development

Portion of Block 63, Morse's Subdivision of Pueblo Lot 1150 and a Portion of Pueblo Lot 1151
Map No. 547

Prepared for:
Janco, LLC
P.O. Box 231446
Encinitas, CA 92023

Prepared by:
Christensen Engineering & Surveying
7888 Silverton Avenue, Suite "J"
San Diego, CA 92126
(858) 271-9901

PTS No. 422242

April 26, 2015
Revised August 03, 2015
Revised October 13, 2015
Revised April 02, 2016
Revised July 14, 2016

TABLE OF CONTENTS

Introduction

This project involves the creation of 11 single-family apartments on a portion of Block 63, Morse's Subdivision of Pueblo Lot 1150 and a portion of the vacated alley in Block 63 and a portion of vacated 29th Street adjacent to it, all according to Map No. 547, in the City of San Diego. It involves the extension of an existing 36" concrete pipe drain with a 42" RCP drain, southeasterly into a portion of the existing drainage basin and re-routing of an existing 18" RCP drain to join the existing 36" drain, in "B" Street, along with the construction of apartments and appurtenances, including sewer, water and storm drain facilities as well as hardscape and landscaping associated with the project. It also will include the reconstruction of the curb, gutter and sidewalk and improvement of a portion of a reserved sewer easement resulting from the vacation of the alley, in Block 63.

Appendix "A" contains drainage area maps from a topographic survey by Christensen Engineering and Surveying, prepared in July 2004 and City of San Diego topographic maps. Runoff from the area of the project and a large area northerly and westerly of the site is conveyed to a basin that is located adjacent to the project. The basin is located easterly and southerly of the site. Following construction this drainage pattern will persist. Drainage from the alley westerly of the site will be picked up by a proposed 12" trench drain and conveyed to the basin to prevent run-on from flowing over the vacated alley portion of the site and the property southerly. The appendices include studies that document the expected highest water surface elevation in the channel southerly and easterly of the site based on runoff from the area northerly, easterly and westerly of the site.

This neighborhood is primarily improved with multi-family residences but the project site itself is unimproved so the runoff coefficient selected for the pre-construction site evaluation is C=0.45. Post-construction the entire area is evaluated using a runoff coefficient of C = 0.70. The area of the pre and post-construction analysis is the same and the runoff coefficient changes resulting in a change in runoff from 1.06 cfs pre-construction to 1.65 cfs post-construction.

As stated above, this study determines the expected upper water surface elevation expected by the 100-yr return frequency storm. It uses updated rainfall intensity data (specifically from NOAA for San Diego) that is part of the HydroCAD program used to evaluate the water surface elevation for

the site. Attached, in Appendix "B", is the result of these calculations. The highest water surface elevation is determined to be 171.41' and the new development will not encroach into the area impacted by that water surface elevation. There will be no loss in basin volume, which could affect the water surface elevation. The basin will overflow if the level of runoff ever reaches an elevation of 180.0 by overtopping the sidewalk, curb and gutter at "C" Street and no properties surrounding this or the project southerly of this project would be affected by a such an incident.

Runoff to the public storm drain system in and beyond the "C" Street will increase slightly by 0.59 cfs (1.65-1.06 cfs). The pipe that will convey the additional runoff is described as either a 30" steel insert or 36" RCP drain. Conservatively assuming the pipe is the 30" steel insert with a slope of 1.5% (dwg 18321-D) the capacity of the pipe is 54 cfs (not under pressure). This increase is less than 1.1% of the calculated capacity of the drain. There will be no adverse effect to the public storm drain.

Section 404 of CWA regulates the discharge of dredged or fill material into waters of the United States. Section 404 is regulated by the Army Corps of Engineers. Section 401 of CWA requires that the State provide certification that any activity authorized under Section 404 is in compliance with effluent limits, the state's water quality standards, and any other appropriate requirements of state law. Section 401 is administered by the State Regional Water Quality Control Board. The project does not require a Federal CWA Section 404 permit nor Section 401 Certification because it does not cause dredging or filling in waters of the United States and is in compliance with the State Water Quality Standards. See separate SWQMP.

The Rational Method was used to calculate the anticipated flow for the 100-year storm return frequency event using the method outlined in the City of San Diego Drainage Design Manual.

Antony K. Christensen
RCE 54021 Exp. 12-31-17

07-14-16
Date

JN A2015-07

Calculations

1. *Intensity Calculation*

(From the City of San Diego Drainage Design Manual, Page 86)
Tc = Time of concentration (site disturbed currently)

$Tc = 1.8\ (1.1\text{-}C)\ (D)^{1/2}/(S)^{1/3}$

For Pre-Construction C=0.45
For Post-Construction C=0.70

Since the difference in elevation is 33' (201'-168') and the distance traveled is 230' (pre-construction) and 320' (post-construction)

.

$Tc_{\text{pre-construction}}$ = 7.3 minutes

$Tc_{\text{post-construction}}$ = 5.9 minutes

From table on Page 83

$I_{100\ \text{pre-construction}}$ = 4.0 inches/hr
(used for both pre- and post-construction for areas W & X since they are offsite and are not affected by proposed development. Their Time of Concentration will not change.
$I_{100\ \text{post-construction}}$ = 4.1 inches/hr

2. *Coefficient Determination*

Pre-Construction:
From Page 82 for Multi-Family Residence

C= 0.70 (for developed areas offsite east and west)

C= 0.45 (onsite)

Post construction:
From Page 82 for Multi-Family Residence

C = 0.70

3. *Volume calculations*

Q = CIA

Areas of Drainage

The area of this study is set to the same location occupied by the proposed improvements because the rest of the area will remain unchanged and will not affect runoff. Runoff from the area northerly of the site, conveyed to it by the 18" and 36" drain will not change.

Pre-Construction

Area offsite westerly draining to basin	PC-W = 1.068 Ac
Area offsite easterly draining to basin	PC-E = 0.461 Ac
Area onsite draining to basin	PC-SITE = 0.589 Ac

Post-Construction

Area offsite westerly draining to 12" alley trench drain and then to basin	PC-W = 1.068 Ac
Area offsite easterly draining to basin	PC-E = 0.461 Ac
Area of southerly driveway draining IMP A and then to basin	A = 0.032 Ac
Area onsite draining to IMP-B	B = 0.229 Ac
Area onsite draining to IMP-C	C = 0.271 Ac
Area onsite draining to basin	D = 0.057 Ac

Pre-Construction

$Q_{100PC-W}$ = (0.70) (4.0) (1.068)
$Q_{100PC-E}$ = (0.70) (4.0 (0.461)
$Q_{100PC-SITE}$ = (0.45) (4.0) (0.589)

$Q_{100PC-W}$ = 2.99 cfs
$Q_{100PC-E}$ = 1.29 cfs
$Q_{100PC-SITE}$ = 1.06 cfs

Post-Construction

$Q_{100PC-W}$ = (0.70) (4.0) (1.068) (not affected by development)
$Q_{100PC-E}$ = (0.70) (4.0) (0.461) (not affected by development)
Q_{100A} = (0.70) (4.1) (0.032)
Q_{100B} = (0.70) (4.1) (0.229)
Q_{100C} = (0.70) (4.1) (0.271)
Q_{100D} = (0.70) (4.1) (0.057)

$Q_{100PC-W}$ = 2.99 cfs
$Q_{100PC-E}$ = 1.29 cfs
Q_{100A} = 0.09 cfs
Q_{100B} = 0.64 cfs
Q_{100C} = 0.76 cfs
Q_{100D} = 0.16 cfs

4. Discussion

The entire site currently conveys its runoff to the public storm drain basin located southeasterly before continuing under "C" Street, within the public storm drain. There exists run-on from the area westerly and easterly of the project and that runoff quantity will not change with the development of the site. The site runoff will continue to flow to the basin. Runoff from impervious surfaces will be conveyed to biofiltration basins (IMP-A, B & C) and continue to flow to the existing storm drain basin, where it will enter the same public storm drain system it does before development.

The extension of the 36" drain with a 42" RCP drain will have no adverse effect on the public storm drain system as there will be no change in total runoff from the outlet of the drain. For the outlet from the basin it is assumed that it is conveyed by a 30" steel insert in a 36 concrete pipe with a slope of 1.5% (dwg 18321-D) the capacity of the pipe is 54 cfs (not under pressure). This increase of 0.59 cfs is less than 1.1% of the calculated capacity of the drain. There will be no adverse effect to the public storm drain.

APPENDIX "A"

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

Land Use	Coefficient, C Soil Type (1)
	D
Residential:	
Single Family	.55
Multi-Units	.70
Mobile Homes	.65
Rural (lots greater than 1/2 acre)	.45
Commercial (2) 80% Impervious	.85
Industrial (2) 90% Impervious	.95

NOTES:

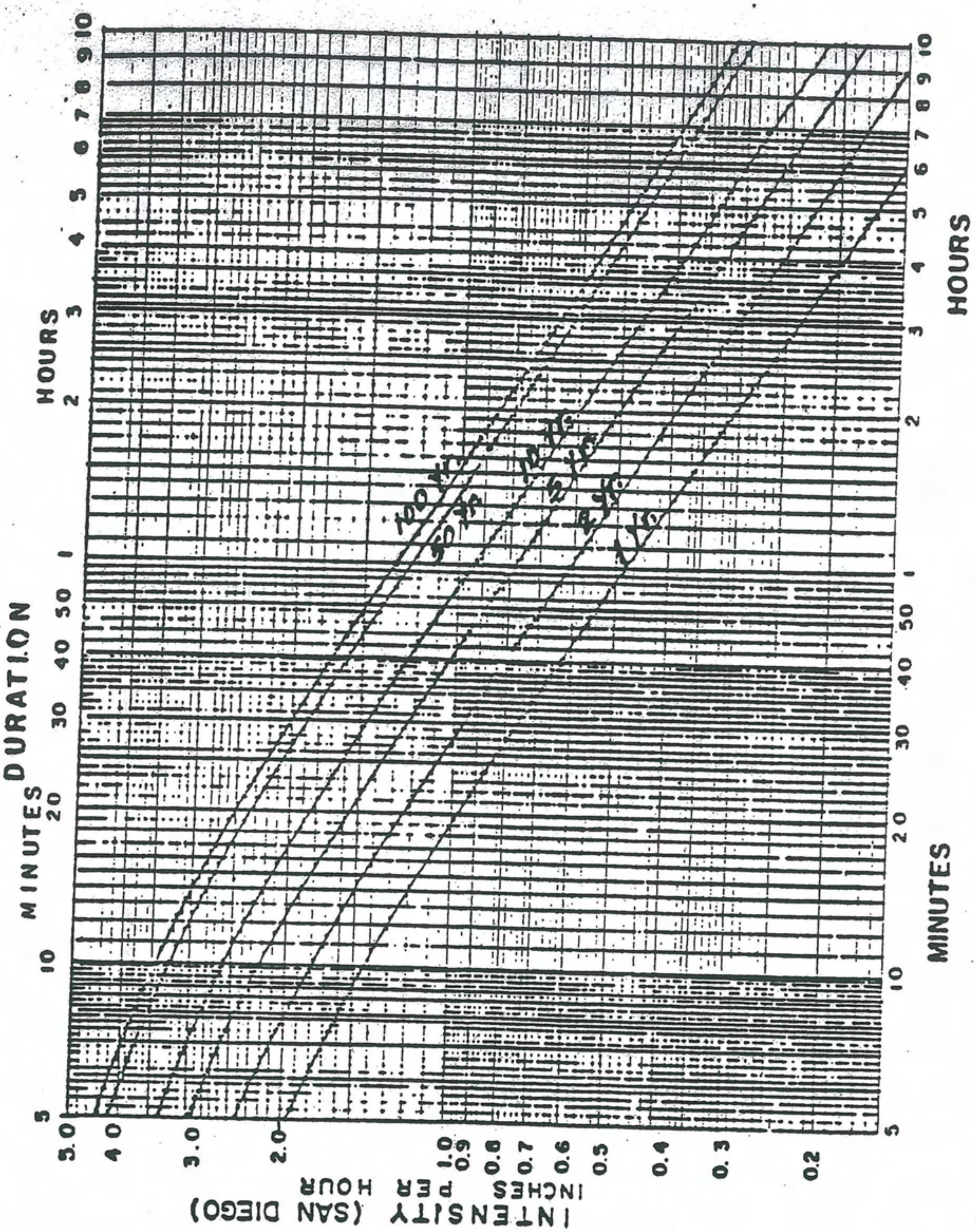
(1) Type D soil to be used for all areas.

(2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%

Tabulated imperviousness = 80%

Revised C = $\frac{50}{80}$ x 0.85 = 0.53



ELEV.	FACTOR
0–1500	1.00
1500–3000	1.25
3000–4000	1.42
4000–5000	1.60
5000–6000	1.70
DESERT	1.25

To obtain correct intensity, multiply intensity on chart by factor for design elevation.

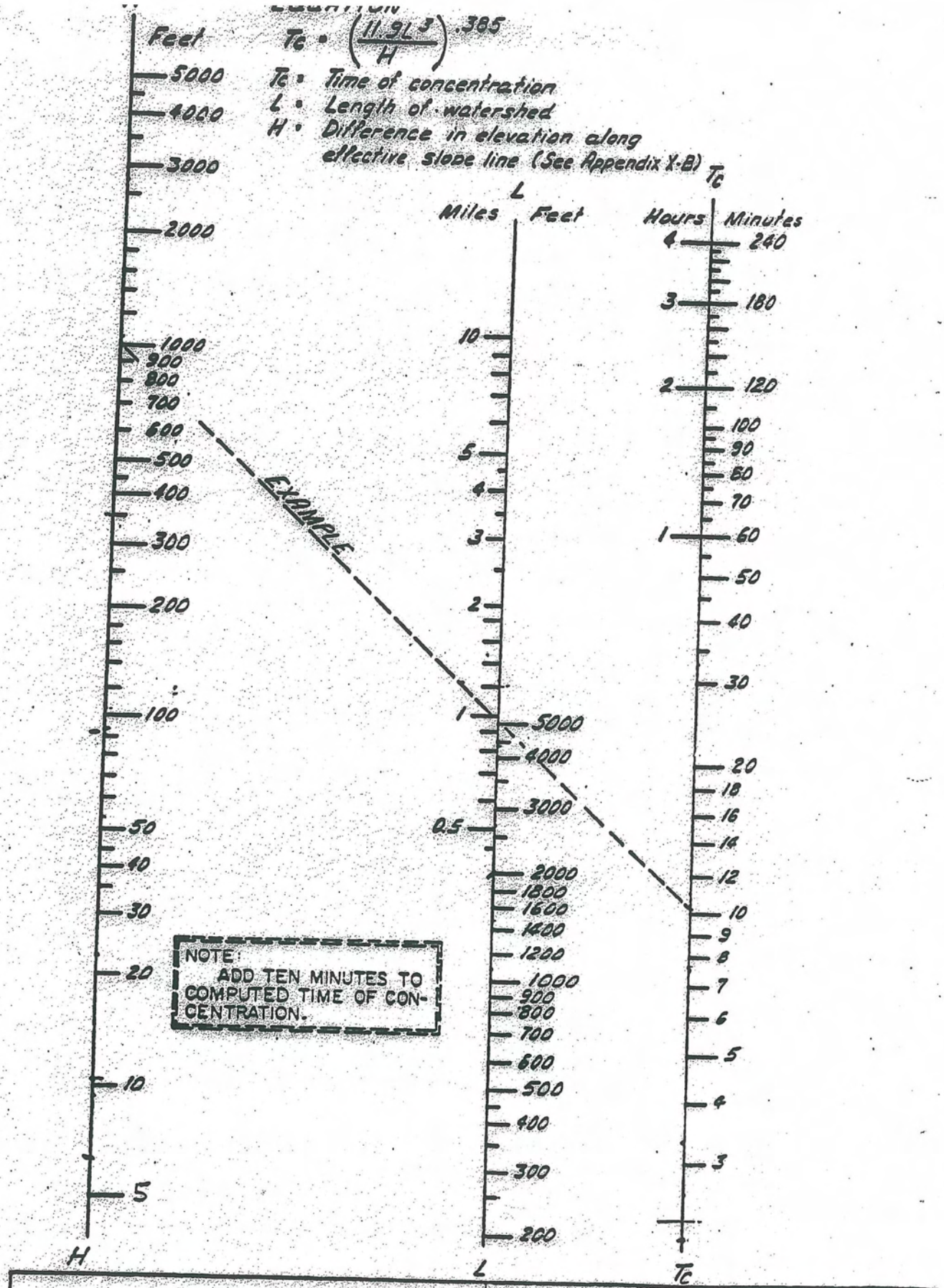
RAINFALL
INTENSITY – DURATION – FREQUENC'
CURVES
for
COUNTY OF SAN DIEGO

APPENDIX I-

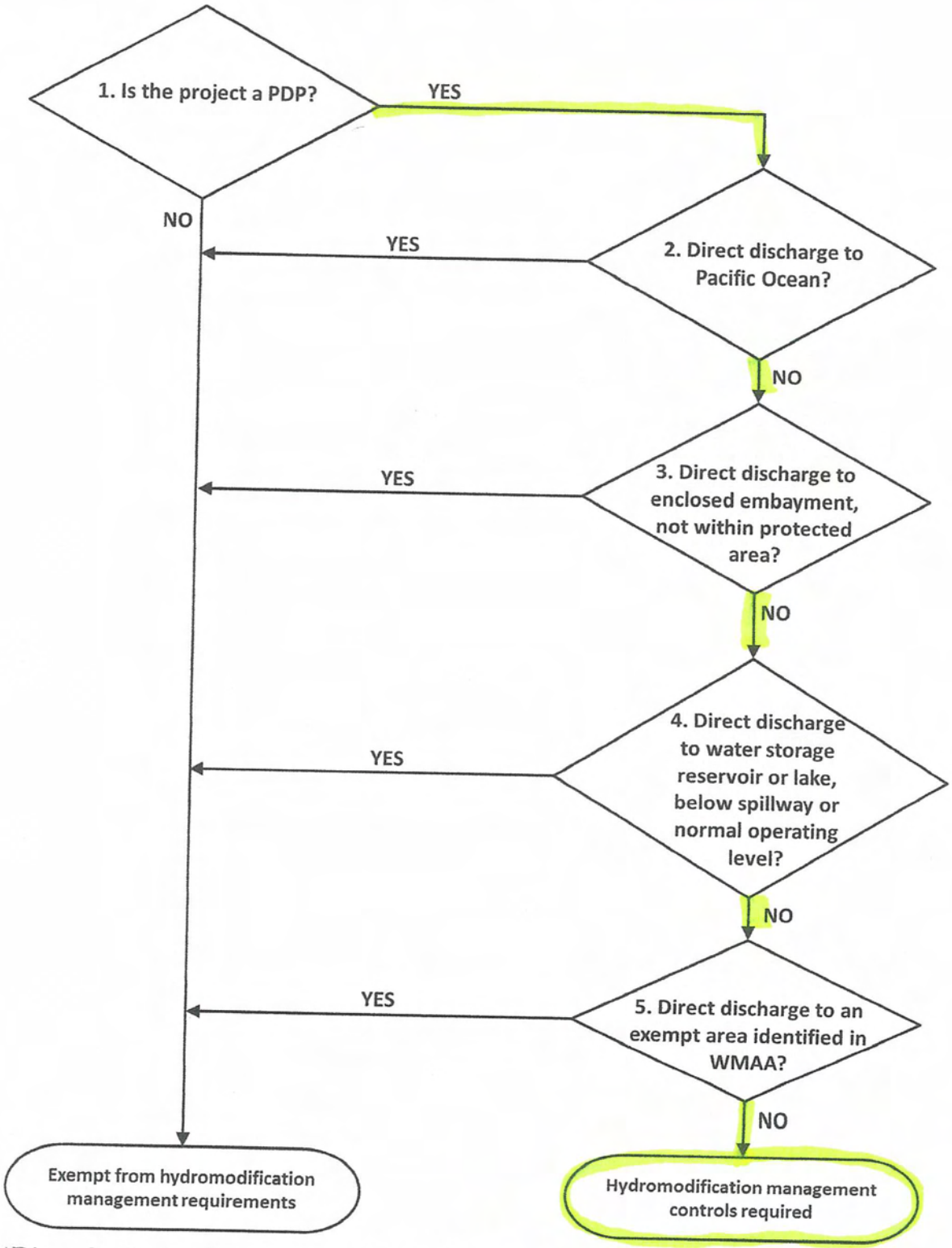
Equation

$$T_c = \left(\frac{11.9L^3}{H}\right)^{.385}$$

T_c = Time of concentration
L = Length of watershed
H = Difference in elevation along effective slope line (See Appendix X-B)



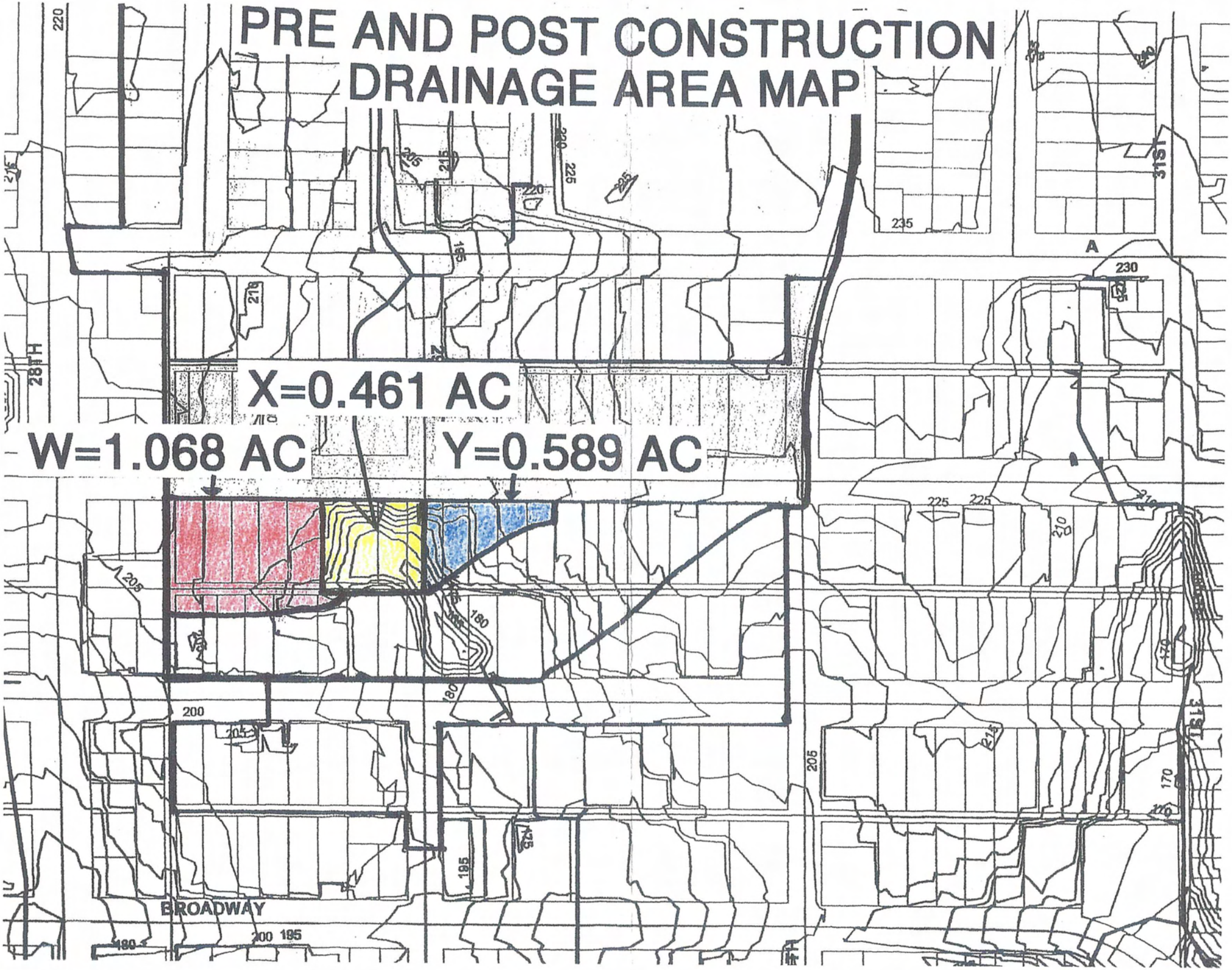
SAN DIEGO COUNTY DEPARTMENT OF SPECIAL DISTRICT SERVICES DESIGN MANUAL	NOMOGRAPH FOR DETERMINATION OF TIME OF CONCENTRATION (T_c) FOR NATURAL WATERSHEDS
APPROVED _____	DATE _____ APPENDIX

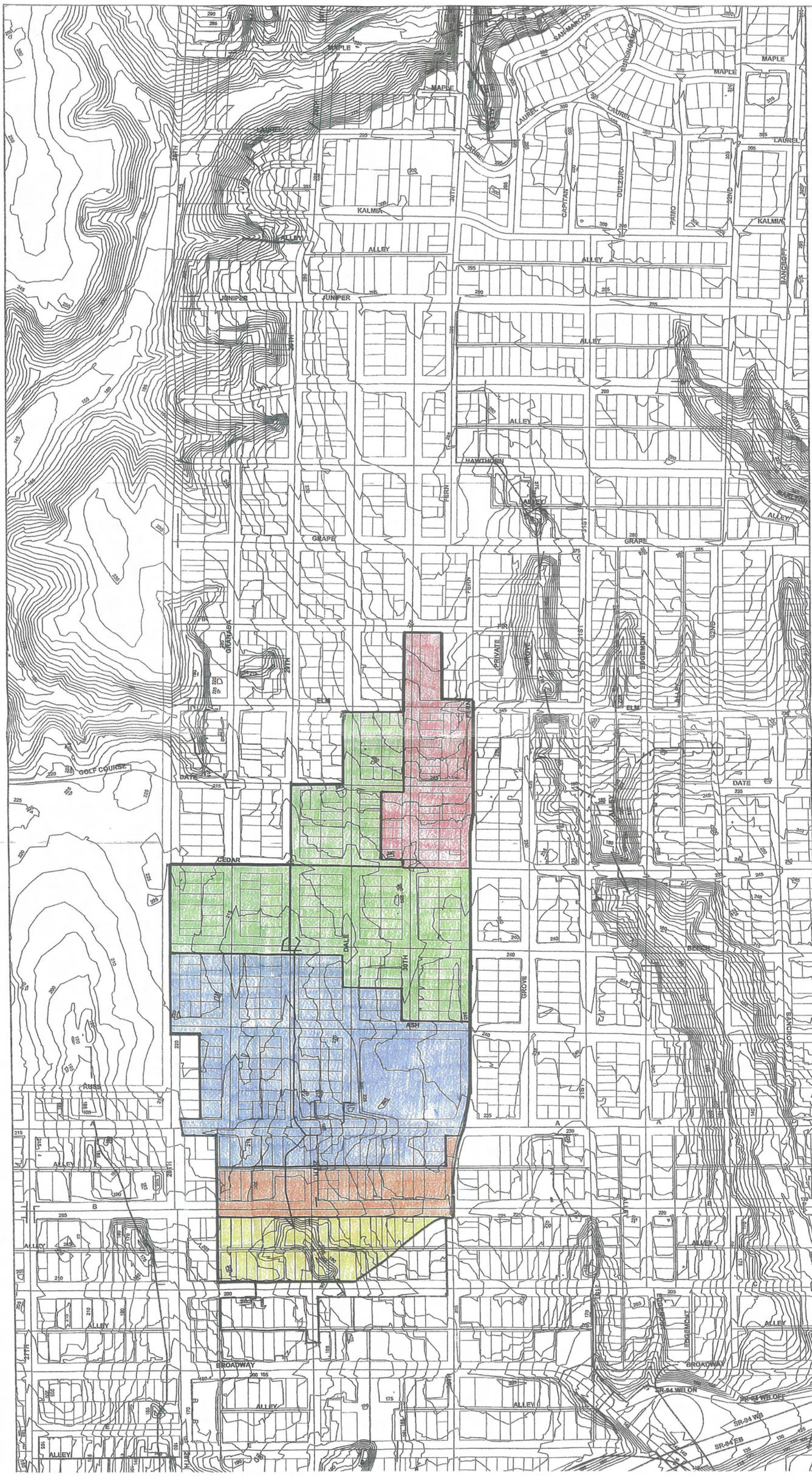


*Direct discharge refers to an uninterrupted hardened conveyance system; Note to be used in conjunction with Node Descriptions.

Figure 1-2. Applicability of Hydromodification Management BMP Requirements

DRAINAGE STUDY ATTACHMENTS


PRE AND POST CONSTRUCTION
DRAINAGE AREA MAP
X=0.461 AC
W=1.068 AC
Y=0.589 AC
BROADWAY
28TH
31ST
A



Legend

- Freeways
- Roads
- Parcels
- Storm Drains
- 5 Foot Topo

BASIN	AREA
A	7.952 AC
B	22.994 AC
C	25.886 AC
D	6.446 AC
E	5.675 AC

BASIN	DRAINS TO
A	CEDAR & 30TH
B	BEECH & 29TH
C	"A" & 29TH
D	"B" & 29TH
E	CULVERT IN BLK 63

N
W E
S

1 inch equals 200 feet

Vicinity Map

SanGIS
We Have San Diego Covered!

Plot Date: 10/14/04

PRE-CONSTRUCTION DRAINAGE AREA MAP

E.W. MORSE'S SUBDIVISION OF PUEBLO LOT NO. 1150 AND THE NW 1/4 OF 1151

MAP NO. 547

BLOCK 62

29TH STREET

B STREET

EX. 10" REHABILITATED CP SEWER PER DWG. 27679-05-D

EX. 2" HP GAS PER DWG. 26034-10-D

EX. 36" RCP DRAIN PER DWG. 3222-L

EX. 12" PVC SEWER PER DWG. 27679-05-D

EX. STRIPING

EX. MH 11A PER DWG. 27679-05-D (IE 172.30) 202.3 RIM +\-

EX. MH 11 PER DWG. 27679-05-D (IE 181.44)

10' DRAINAGE EASEMENT SHOWN ON DWG 1453-B BUT NOT AS OF PUBLIC RECORD, IN TITLE REPORT

EASEMENT FOR PEDESTRIAN USES IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EASEMENT FOR GENERAL UTILITY AND SEWER IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EX. 18" CMP DRAIN PER DWG. 27679-05-D

AN EASEMENT FOR SEWER IN FAVOR OF THE CITY OF SAN DIEGO OVER A 10' WIDE PORTION OF LOT 6 PER DOCUMENT RECORDED IN BOOK 453, PAGE 135 OF DEEDS, JANUARY 25, 1909. THE EXACT LOCATION IS NOT SPECIFIED IN SAID DOCUMENT.

201.7 FS +\-
173.7 TOP +\-
28' COVER +\-
31" I.E. +\- (170.7 +\-)

300 +/- EX. FH

N89°07'40"W 141.75'

N89°01'45"W 30.01'

35

PROPOSED 10' WIDE PUBLIC SEWER EASEMENT

ELEVATION CHANGE = 39' (201-166')
LENGTH OF TRAVEL = 290'

172.0 TOP +\-
12' COVER +\-
20 I.E. +\- (159 +\-)

Q100 (ESTIMATED) = 149 CFS

DRAINAGE AREA CONTINUES WESTERLY

MAP NO. 547

BLOCK 63

9 8 7

PC-W = 1.068 AC
Q100 = 2.99 CFS

S00°53'23"W 149.56'

192

190

188

PUBLIC SEWER MAIN

PC-SITE = 0.589 AC
Q100 = 1.06 CFS

S00°53'23"W 181.22'

PC-E = 0.461 AC
Q100 = 1.29 CFS

24

DRAINAGE AREA CONTINUES EASTERLY

GENERAL UTILITY EASEMENT IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

PUBLIC SEWER MAIN 10" PVC SEWER PER DWG. 26078-D

N89°13'58"W 141.79'

N89°13'58"W 30.01'

PUBLIC SEWER MAIN

EX MH PER DWG 27679-10-D (161.75 IE) 173 RIM +\-

LOT 1 MAP NO. 16049

EX CATCH BASIN THAT CONVEYS VACATED ALLEY RUNOFF TO EX BASIN

SCALE: 1" = 10'
CONTOUR INTERVAL: 2'

0 10 20 30 40

ANTONY K. CHRISTENSEN, RCE 54021 — JUNE 22, 2016
Date

REGISTERED PROFESSIONAL ENGINEER — ANTONY K. CHRISTENSEN — No. 54021 — Exp. 12-31-17 — CIVIL — STATE OF CALIFORNIA

Prepared By:

CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-9901 FAX (858) 271-8912

Project Address:

'B' STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:

'B' STREET ROW HOMES

Sheet Title:

Revision 6:
Revision 5:
Revision 4:
Revision 3: 04-02-16 REVISE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

Original Date: APRIL 06, 2015

Sheet 3 of 3 Sheets

DEP#_____

JN 2015-07

POST CONSTRUCTION DRAINAGE AREA MAP

SITE DEVELOPMENT
PRELIMINARY GRADING PLAN

E.W. MORSE'S SUBDIVISION OF PUEBLO LOT NO. 1150 AND THE NW 1/4 OF 1151

MAP NO. 547

BLOCK 62

29TH STREET

B STREET

EX. 10" REHABILITATED CP SEWER PER DWG. 27679-05-D

EX. 2" HP GAS PER DWG. 28034-10-D

EX. 36" RCP DRAIN PER DWG. 3222-L

EX. 12" PVC SEWER PER DWG. 27679-05-D

EX. STRIPING

EX. MH 11A PER DWG. 27679-05-D (IE 172.30) 202.3 RIM +\-

EX. MH 11 PER DWG. 27679-05-D (IE 181.44)

10' DRAINAGE EASEMENT SHOWN ON DWG 1453-B BUT NOT AS OF PUBLIC RECORD, IN TITLE REPORT

EASEMENT FOR PEDESTRIAN USES IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EASEMENT FOR GENERAL UTILITY AND SEWER IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

EX. 18" CMP DRAIN PER DWG. 27679-05-D

AN EASEMENT FOR SEWER IN FAVOR OF THE CITY OF SAN DIEGO OVER A 10' WIDE PORTION OF LOT 6 PER DOCUMENT RECORDED IN BOOK 453, PAGE 135 OF DEEDS, JANUARY 25, 1909. THE EXACT LOCATION IS NOT SPECIFIED IN SAID DOCUMENT.

300' +/- EX. PH

AREA "C" 0.271 AC FLOWS TO IMP-B

201.7 FS +\-
173.7 TOP +\-
28' COVER +\-
31' I.E. +\- (170.7 +\-)

200.7 FS +\-

N89°07'40"W 141.75'

N89°01'45"W 30.01'

PATIO

UNIT 7 FF = 200'

UNIT 9 FF = 200'

UNIT 1 FF = 194.4'

UNIT 8 FF = 200'

UNIT 2 FF = 194.4'

IMP-C 316 SF

FS = 181'

UNIT 10 FF = 181'

UNIT 11 FF = 180.5'

LIGHTWELL

UNIT 3 FF = 184'

UNIT 4 FF = 183'

UNIT 5 FF = 182'

UNIT 6 FF = 181'

IMP-B 264 SF

AREA "D" 0.057 AC FLOWS TO BASIN

AREA PC-E 0.461 AC

IMP-A FLOWS TO BASIN

PROPOSED 30' WIDE PUBLIC SEWER EASEMENT

MAP NO. 547

BLOCK 63

9 8 7 24

AREA PC-W 1.068 AC

AREA "B" 0.229 AC FLOWS TO IMP-B

AREA "A" 0.032 AC FLOWS TO IMP-A

S00°53'23"W 140.56'

S00°52'58"W 181.26'

GENERAL UTILITY EASEMENT IN FAVOR OF THE CITY OF SAN DIEGO RECORDED DECEMBER 18, 1989 AS FILE NO. 89-683492, O.R.

N89°13'58"W 141.79'

2+89.97
7+30.11

7+00

8+00

9+00

CO 180.0
185.41 I.E.

PROPERTY LINE

SITE BOUNDARY LINE

SEWER MAIN

EX MH PER DWG 27679-05-D (161.75 I.E.) 173 RIM +\-

N89°13'58"W 30.01'

180.6 TW
178.0 BW

LOT 1 MAP NO. 16049

12" TRENCH DRAIN TO COLLECT RUNOF BEFORE IT REACHES VACATED ALLEY AND CONVEY IT TO CHANNEL

GRASS-CRETE PAVEMENT (OR EQUIVALENT) TO REPLACE GRAVEL-PAVE

FOR WORK SOUTHERLY OF PROJECT SITE SEE EASEMENT AGREEMENT

SCALE: 1" = 10'
CONTOUR INTERVAL: 2'
0 10 20 30 40

REGISTERED PROFESSIONAL ENGINEER ANTONY K. CHRISTENSEN No. 54021 (exp. 12-31-17) CIVIL STATE OF CALIFORNIA

ANTONY K. CHRISTENSEN, RCE 54021 — JUNE 22, 2016 Date

Prepared By:

CHRISTENSEN ENGINEERING & SURVEYING
7888 SILVERTON AVENUE, SUITE "J"
SAN DIEGO, CA 92126
PHONE (858) 271-9901 FAX (858) 271-8912

Project Address:

'B' STREET AT 29TH STREET
SAN DIEGO, CA 92101

Project Name:

'B' STREET ROW HOMES

Revision 6:
Revision 5:
Revision 4:
Revision 3: 04-02-16 REVISE DESIGN
Revision 2: 11-02-15 ADDRESS CITY COMMENTS
Revision 1: 08-03-15 REVISE PROJECT DESIGN

Original Date: APRIL 06, 2015

Sheet Title:

PRELIMINARY GRADING PLAN

Sheet 3 of 3 Sheets

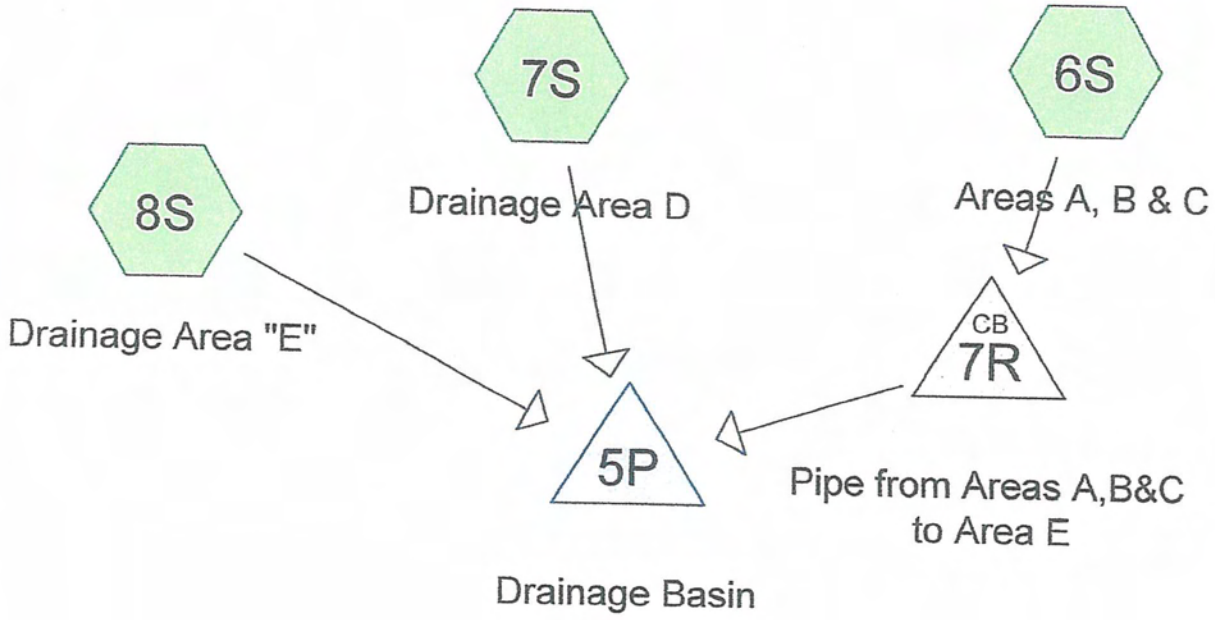
DEP# _____

JN 2015-07

APPENDIX "B"

DATA SUPPORTING FLOW TO SITE BASIN AND WATER SURFACE ELEVATION DETERMINATION

CURRENT HYDROCAD RESULTS



Subcat Reach Pond Link

Routing Diagram for Golden Hill 19 min
Prepared by Christensen Engineering & Surveying, Printed 4/26/2015

Area Listing (all nodes)

Area (acres)	C	Description (subcatchment-numbers)
68.953	0.79	(6S, 7S, 8S)
68.953	**0.79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
68.953	Other	6S, 7S, 8S
68.953		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	68.953	68.953		6S, 7S, 8S
0.000	**0.000**	**0.000**	**0.000**	**68.953**	**68.953**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	5P	158.00	155.53	139.0	0.0178	0.012	30.0	0.0	0.0
2	7R	174.20	169.20	200.0	0.0250	0.013	36.0	0.0	0.0

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 6S: Areas A, B & C Runoff Area=56.832 ac Runoff Depth=0.64"
Tc=19.2 min C=0.79 Runoff=115.33 cfs 3.046 af

Subcatchment 7S: Drainage Area D Runoff Area=6.446 ac Runoff Depth=0.65"
Tc=10.7 min C=0.79 Runoff=13.34 cfs 0.349 af

Subcatchment 8S: Drainage Area "E" Runoff Area=5.675 ac Runoff Depth=0.65"
Tc=8.3 min C=0.79 Runoff=11.75 cfs 0.307 af

Pond 5P: Drainage Basin Peak Elev=171.41' Storage=0.930 af Inflow=140.18 cfs 3.703 af
30.0" Round Culvert n=0.012 L=139.0' S=0.0178 '/' Outflow=82.42 cfs 3.704 af

Pond 7R: Pipe from Areas A,B&C to Area E Peak Elev=187.18' Inflow=115.33 cfs 3.046 af
36.0" Round Culvert n=0.013 L=200.0' S=0.0250 '/' Outflow=115.33 cfs 3.046 af

Total Runoff Area = 68.953 ac Runoff Volume = 3.703 af Average Runoff Depth = 0.64"

Summary for Subcatchment 6S: Areas A, B & C

[48] Hint: Peak<CiA due to short duration

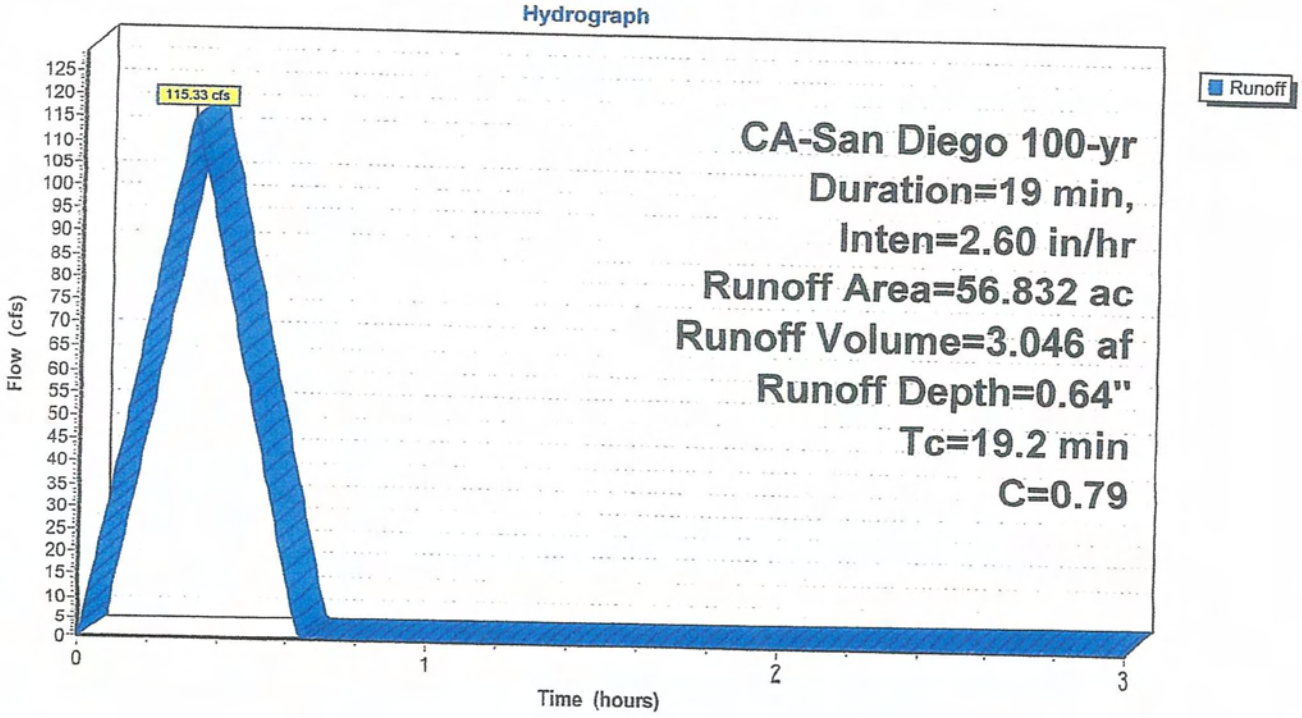
Runoff = 115.33 cfs @ 0.32 hrs, Volume= 3.046 af, Depth= 0.64"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
CA-San Diego 100-yr Duration=19 min, Inten=2.60 in/hr

Area (ac)	C	Description
56.832	0.79	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2					Direct Entry,

Subcatchment 6S: Areas A, B & C



Summary for Subcatchment 7S: Drainage Area D

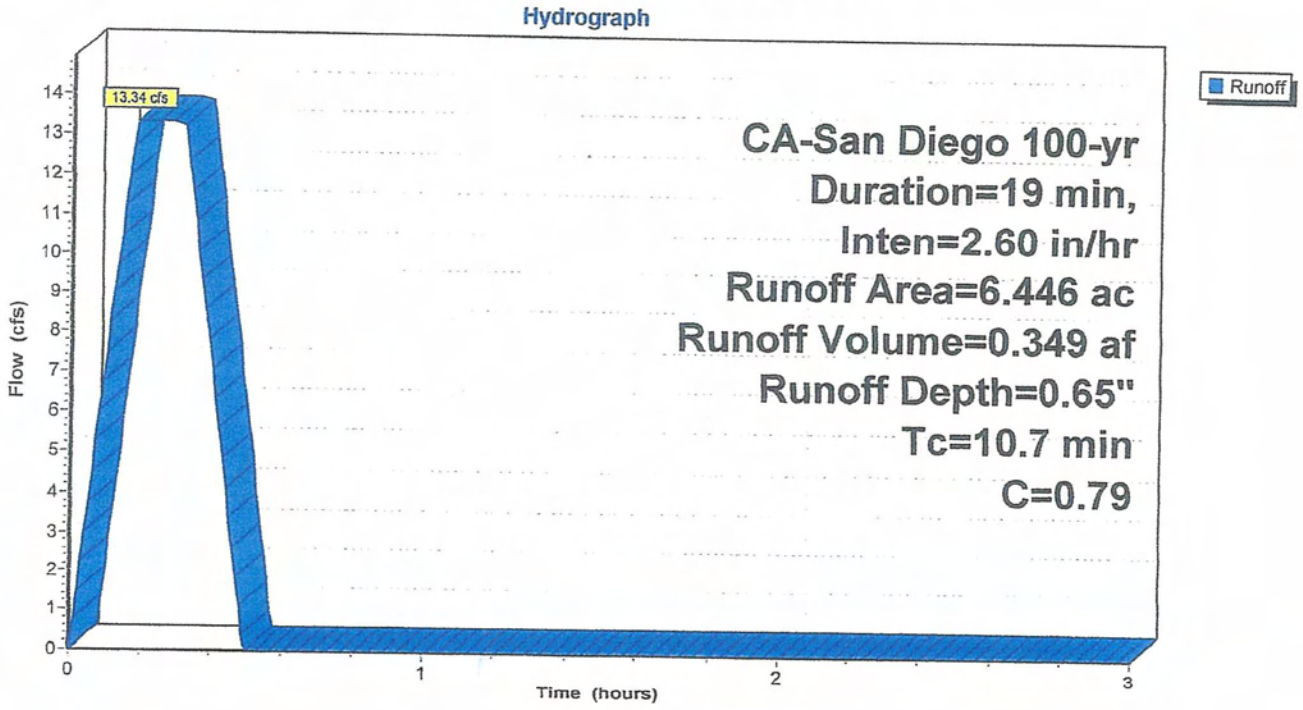
Runoff = 13.34 cfs @ 0.18 hrs, Volume= 0.349 af, Depth= 0.65"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
CA-San Diego 100-yr Duration=19 min, Inten=2.60 in/hr

Area (ac)	C	Description
6.446	0.79	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7					Direct Entry,

Subcatchment 7S: Drainage Area D



Summary for Subcatchment 8S: Drainage Area "E"

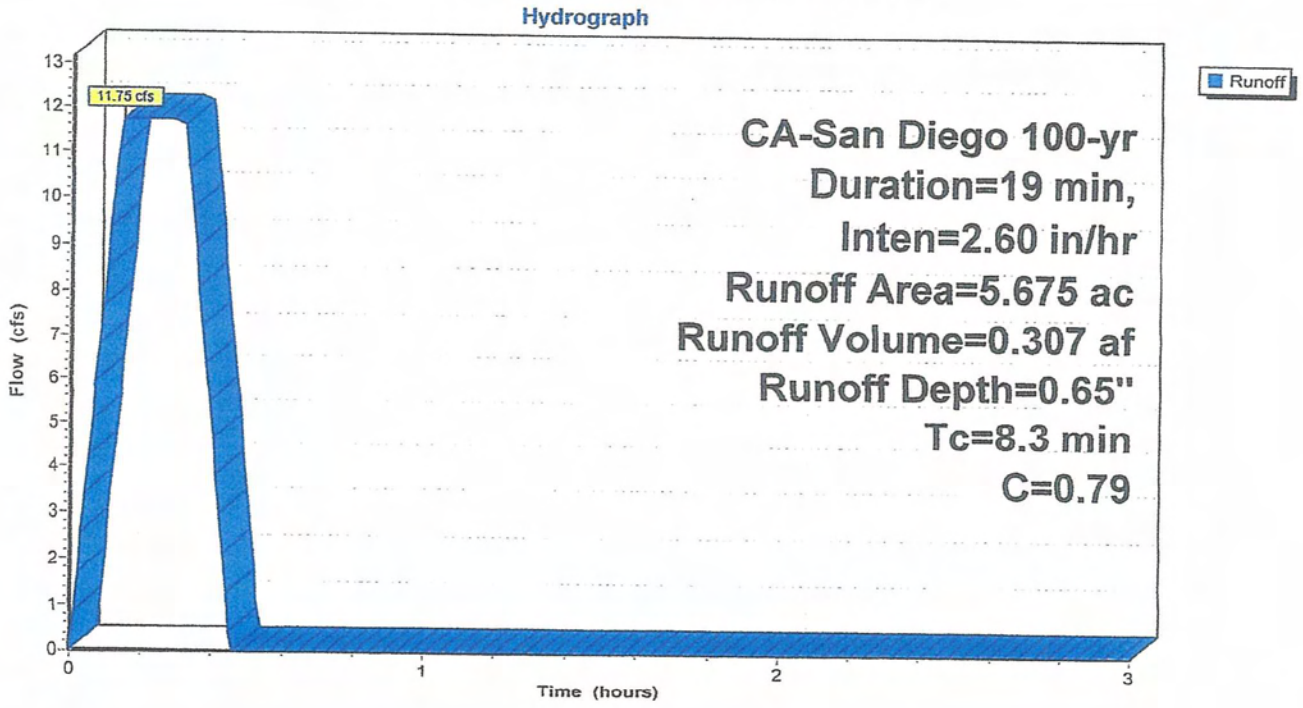
Runoff = 11.75 cfs @ 0.14 hrs, Volume= 0.307 af, Depth= 0.65"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
CA-San Diego 100-yr Duration=19 min, Inten=2.60 in/hr

Area (ac)	C	Description
5.675	0.79	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3					Direct Entry,

Subcatchment 8S: Drainage Area "E"



Summary for Pond 5P: Drainage Basin

Inflow Area = 68.953 ac, Inflow Depth = 0.64" for 100-yr event
Inflow = 140.18 cfs @ 0.32 hrs, Volume= 3.703 af
Outflow = 82.42 cfs @ 0.43 hrs, Volume= 3.704 af, Atten= 41%, Lag= 6.8 min
Primary = 82.42 cfs @ 0.43 hrs, Volume= 3.704 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 171.41' @ 0.43 hrs Surf.Area= 0.257 ac Storage= 0.930 af
Flood Elev= 180.00' Surf.Area= 0.634 ac Storage= 4.797 af

Plug-Flow detention time= 4.8 min calculated for 3.692 af (100% of inflow)
Center-of-Mass det. time= 4.8 min (22.9 - 18.2)

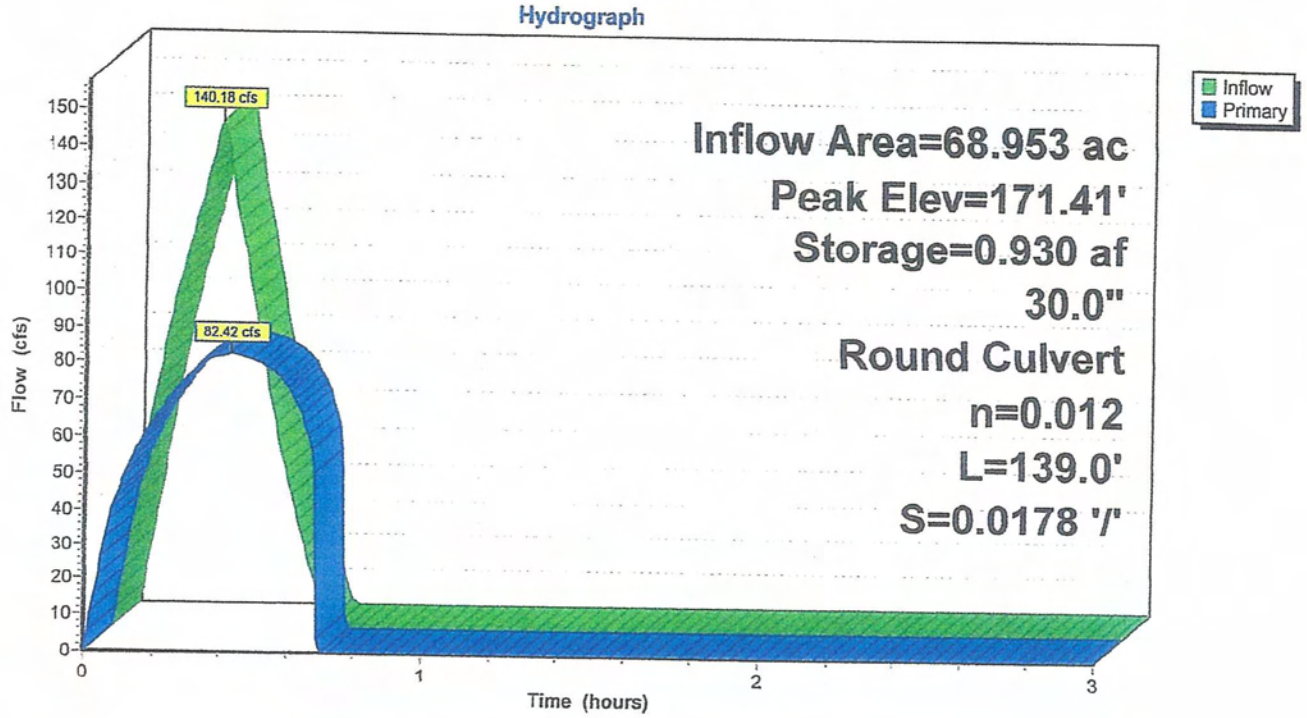
Volume	Invert	Avail.Storage	Storage Description
#1	162.00'	4.797 af	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Perim. (feet)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
162.00	0.004	62.0	0.000	0.000	0.004
164.00	0.026	177.0	0.027	0.027	0.055
166.00	0.072	359.0	0.094	0.121	0.233
168.00	0.115	444.0	0.185	0.306	0.359
170.00	0.195	639.0	0.306	0.613	0.746
172.00	0.285	666.0	0.477	1.090	0.817
174.00	0.384	722.0	0.667	1.757	0.962
176.00	0.464	774.0	0.847	2.603	1.109
178.00	0.549	817.0	1.012	3.615	1.239
180.00	0.634	850.0	1.182	4.797	1.346

Device	Routing	Invert	Outlet Devices
#1	Primary	158.00'	**30.0" Round Culvert** L= 139.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 158.00' / 155.53' S= 0.0178 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf

Primary OutFlow Max=82.42 cfs @ 0.43 hrs HW=171.41' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 82.42 cfs @ 16.79 fps)

Pond 5P: Drainage Basin



Summary for Pond 7R: Pipe from Areas A,B&C to Area E

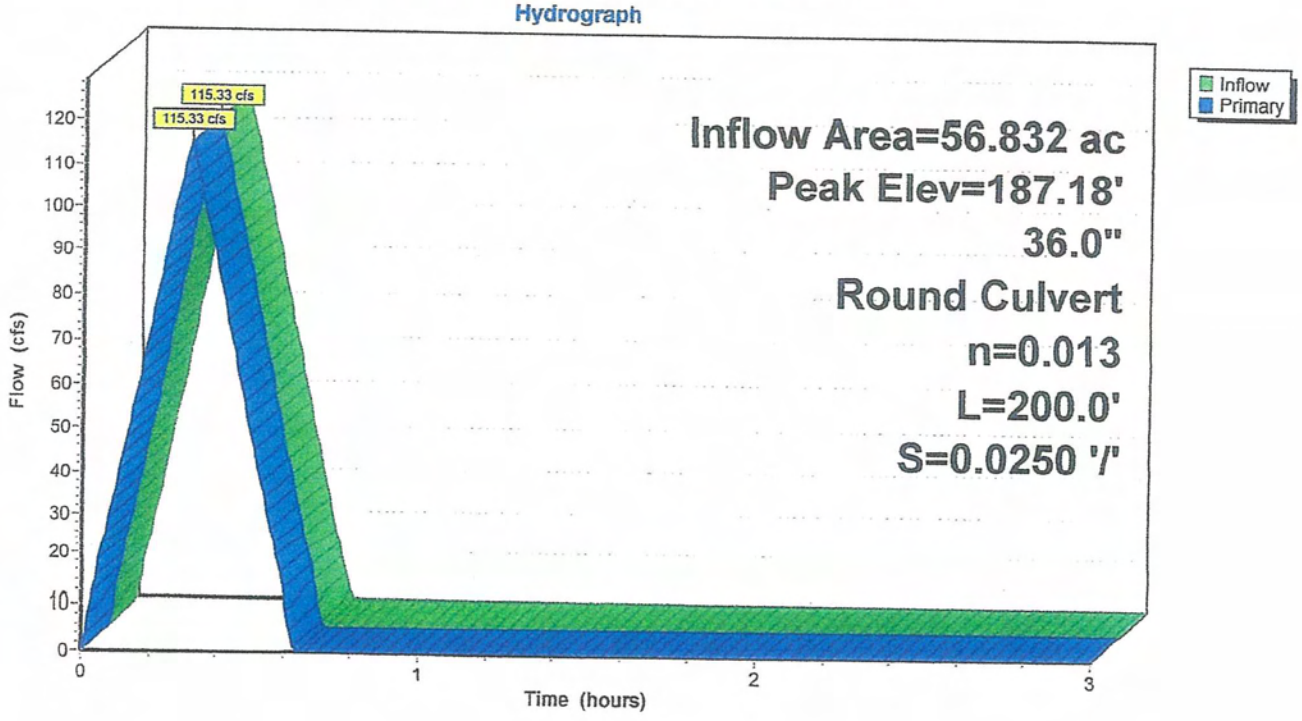
Inflow Area = 56.832 ac, Inflow Depth = 0.64" for 100-yr event
Inflow = 115.33 cfs @ 0.32 hrs, Volume= 3.046 af
Outflow = 115.33 cfs @ 0.32 hrs, Volume= 3.046 af, Atten= 0%, Lag= 0.0 min
Primary = 115.33 cfs @ 0.32 hrs, Volume= 3.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 187.18' @ 0.32 hrs
Flood Elev= 200.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	174.20'	**36.0" Round Culvert** L= 200.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 174.20' / 169.20' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf

Primary OutFlow Max=114.88 cfs @ 0.32 hrs HW=187.09' TW=170.18' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 114.88 cfs @ 16.25 fps)

Pond 7R: Pipe from Areas A,B&C to Area E



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 6S: Areas A, B & C Runoff Area=56.832 ac Runoff Depth=0.64"
Tc=19.2 min C=0.79 Runoff=115.33 cfs 3.046 af

Subcatchment 7S: Drainage Area D Runoff Area=6.446 ac Runoff Depth=0.65"
Tc=10.7 min C=0.79 Runoff=13.34 cfs 0.349 af

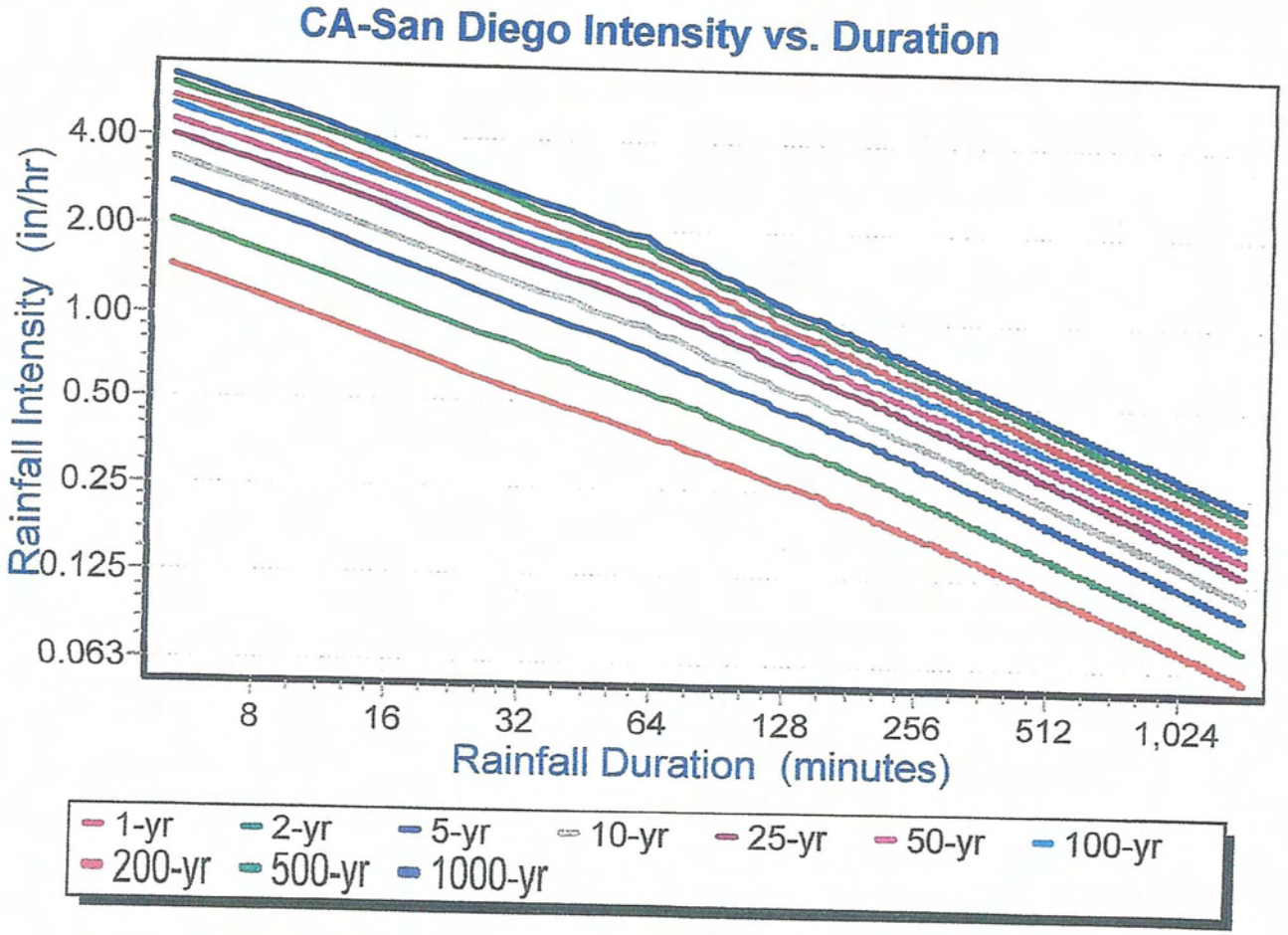
Subcatchment 8S: Drainage Area "E" Runoff Area=5.675 ac Runoff Depth=0.65"
Tc=8.3 min C=0.79 Runoff=11.75 cfs 0.307 af

Pond 5P: Drainage Basin Peak Elev=171.41' Storage=0.930 af Inflow=140.18 cfs 3.703 af
30.0" Round Culvert n=0.012 L=139.0' S=0.0178 '/' Outflow=82.42 cfs 3.704 af

Pond 7R: Pipe from Areas A,B&C to Area E Peak Elev=187.18' Inflow=115.33 cfs 3.046 af
36.0" Round Culvert n=0.013 L=200.0' S=0.0250 '/' Outflow=115.33 cfs 3.046 af

Total Runoff Area = 68.953 ac Runoff Volume = 3.703 af Average Runoff Depth = 0.64"

IDF Curve Report



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

HETHERINGTON ENGINEERING, INC.
SOIL & FOUNDATION ENGINEERING • ENGINEERING GEOLOGY • HYDROGEOLOGY

September 27, 2016
Project No. 7603.1
Log No. 18538

Janco, LLC
P.O. Box 231446
Encinitas, California 92033

Attention: Mr. Matthew Gordon

Subject: RESPONSE TO CITY OF SAN DIEGO GEOLOGY REVIEW
Proposed Townhomes
Golden Hill "B" Street
San Diego, California

References: Attached

Dear Mr. Gordon:

In response to the request of Mr. David Hawkins, we are providing the following responses to the geotechnical comments included in the geology review (Reference 9). Our numbering corresponds to that utilized by the reviewer.

8. Acknowledged, we will review the construction plans (grading plans and foundation plan and details) when provided.

9. Acknowledged, we will prepare an as-graded geotechnical report when grading is completed.

16. Cut and fill slopes are recommended to be inclined at 2:1 (horizontal to vertical) to mitigate the potential for slope instability. Removal and replacement as compacted fill and/or compaction grouting of the existing undocumented fill and undifferentiated alluvium/colluvium is recommended to mitigate the potential for differential settlement. Foundation and slab recommendations including reinforcement are recommended to mitigate the potential for distress to improvements due to heave of expansive soils.

17. A revised copy of Form I-8 is attached with each yes/no box checked.

5365 Avenida Encinas, Suite A • Carlsbad, CA 92008-4369 • (760) 931-1917 • Fax (760) 931-0545
333 Third Street, Suite 2 • Laguna Beach, CA 92651-2306 • (949) 715-5440 • Fax (760) 931-0545
www.hetheringtonengineering.com

This opportunity to be of service is sincerely appreciated. If you have any questions, please call this office.

Sincerely,

HETHERINGTON ENGINEERING, INC.

Mark D. Hetherington
Civil Engineer 30488
Geotechnical Engineer 397
(expires 3/31/18)

REGISTERED PROFESSIONAL ENGINEER
MARK D. HETHERINGTON
No. 397
Exp. Date
GEOTECHNICAL
STATE OF CALIFORNIA

Paul A. Bogseth
Professional Geologist 3772
Certified Engineering Geologist 1153
Certified Hydrogeologist 5
(expires 3/31/18)

CERTIFIED ENGINEERING GEOLOGIST
PAUL A. BOGSETH
E.G. 1153
Exp.
STATE OF CALIFORNIA

Attachment: Revised I-8 Form

Distribution: 1-via e-mail (Gordon.matthew0@gmail.com)
1-via e-mail (david@h2asandiego.com)
1-via e-mail (Luis@rec-consultants.com)
1-via e-mail (CEandS@aol.com)

REFERENCES

1. "Geotechnical Update, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated April 24, 2015.

2. "Addendum to Geotechnical Update, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated May 21, 2015.

3. "East Property Line Geotechnical Exploration, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated January 8, 2016.

4. "City of San Diego, Transportation and Storm Water, Storm Water Standards, Part 1: BMP Design Manual, January 2016 Edition".

5. "Drainage Management Area Exhibit, Site Development, Preliminary Grading Plan, "B" Street Row Homes," by Christensen Engineering and Surveying, original date April 6, 2015.

6. "Infiltration Testing, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated July 13, 2016.

7. "LDR-Geology Review," by the City of San Diego, Development Services, L644-003A, dated August 1, 2016.

8. "Response to City of San Diego Geology Review, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated August 15, 2016.

9. "LDR-Geology Review," by the City of San Diego, Development Services, Project Nbr: 422242, dated September 22, 2016.

Categorization of Infiltration Feasibility Condition	Form I-8

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?

Criteria	Screening Question	Yes	No
1	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.		X

Provide basis: Infiltration testing of the compacted fill in the previously graded alley at the rear of the site has been performed (see attached "Infiltration Testing..."). The remainder of the site has not been graded and requires import (source unknown) to achieve finished grades. We recommend that the import have infiltration rates no less than 0.17 in/hr (average of infiltration rates in alley) and that infiltration testing of the import be performed when the import source is known to confirm the infiltration rates.

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

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.	X	

Provide basis: Geotechnical recommendations to mitigate potential geotechnical hazards due to storm water infiltration to acceptable levels are provided in the attached "Geotechnical Update..." and "Addendum to Geotechnical Update...".

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

Form I-8 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	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.		X
Provide basis: No infiltration rates greater than 0.5 in/hr have been measured at the site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	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.		X
Provide basis: No infiltration rates greater than 0.5 in/hr have been measured at the site. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	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		Possible Partial 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

Form I-8 Page 3 of 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?			
Criteria	Screening Question	Yes	No
5	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.	X	
Provide basis: Two tests using Open Pit Falling Head test method have been performed. Results were 0.22 in/hr and 0.12 in/hr without safety factors. For design considerations, the following infiltration values will be used: 0.11 in/hr for IMP-A (as 0.22 in/hr test is closest to IMP-A and a Safety Factor of 2 is used); an average value of 0.17 in/hr divided by 2 = 0.085 in/hr will be used for IMP-B and IMP-C. As both are located in fill conditions, a requirement to use soils with an infiltration capacity no less than 0.17 in/hr will be included. 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.			
6	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.	X	
Provide basis: Geotechnical recommendations to mitigate potential geotechnical hazards due to storm water infiltration to acceptable levels are provided in the attached "Geotechnical Update..." and "Addendum to Geotechnical Update...". Please refer to answer 5. A gravel layer under the french drain with a thickness calculated in accordance to the requirements of the BLP Manual and in accordance to the infiltration results displayed in answer 5 will be included. A french drain is also added above that gravel thickness for safety reasons, in case the soil does not infiltrate as expected. 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.			

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.	X	
Provide basis: Mounding concerns should be minor as a french drain system is added in the IMPs once the water exceeds a certain minimum depth in the gravel layer. Storm water pollutant concerns are unknown at this time but the expected little infiltration has a low risk of mobilizing potential pollutants that could be present in the soil, especially considering the depth of the ground water as a boring with a depth of 35 ft failed to find the water table. Infiltrated water will travel at least 35 ft before reaching the water table, so the water will be filtered by then. In addition we are not aware of any known soil contamination present at the site. 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.	X	
Provide basis: It is not known at this point the status of the downstream water rights. In addition, this question requires the expertise of water-rights lawyers to determine if any violation can be expected downstream by reducing the runoff slightly via infiltration of the water into the IMPs. Due to the location of the project in a highly urbanized area, it is unlikely that violation of water rights might occur; however, the Civil Team is not responsible for potential violations in water rights that could occur. Infiltration has been included on the project as part of the Water Board strategy of reducing runoff, and as a request of the City. 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.			
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.	Partial 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

Factor of Safety and Design Infiltration Rate Worksheet				Form I-9	
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Level of pretreatment/ expected sediment loads	0.5	1	0.50
		Redundancy/resiliency	0.25	2	0.50
		Compaction during construction	0.25	3	0.75
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{total} = S_A \times S_B$					1.75 (use 2.0)
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					0.22 & 0.12
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					0.11 & 0.06
Supporting Data					
Briefly describe infiltration test and provide reference to test forms: Two open pit falling head tests were performed (see attached "Infiltration Testing...").					

HETHERINGTON ENGINEERING, INC.
SOIL & FOUNDATION ENGINEERING • ENGINEERING GEOLOGY • HYDROGEOLOGY

July 13, 2016
Project No. 7603.1
Log No. 18419

Janco, LLC
P.O. Box 231446
Encinitas, California 92033

Attention: Mr. Matthew Gordon

Subject: INFILTRATION TESTING
Proposed Townhomes
Golden Hill "B" Street
San Diego, California

References:
1. "Geotechnical Update, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated April 24, 2015.
2. "Addendum to Geotechnical Update, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated May 21, 2015.
3. "East Property Line Geotechnical Exploration, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated January 8, 2016.
4. "City of San Diego, Transportation and Storm Water, Storm Water Standards, Part 1: BMP Design Manual, January 2016 Edition".
5. "Drainage Management Area Exhibit, Site Development, Preliminary Grading Plan, "B" Street Row Homes," by Christensen Engineering and Surveying, original date April 6, 2015.

Dear Mr. Gordon:

In response to your request, we have performed infiltration testing of existing compacted fill at the subject site. Based on the results of our geotechnical investigative work (References 1 through 3) and review of the preliminary grading plan (Reference 4), the site will be underlain by compacted fill and undifferentiated alluvium/colluvium improved by compaction grouting at the conclusion of site grading. No groundwater was encountered to the maximum depth explored of 35.5-feet in the borings and test pits excavated at the site (see References 1 through 3).

Infiltration tests of compacted fill were performed by this office on May 23, and 24, 2016 in accordance with the Open Pit Falling Head test method (see Reference 4, Appendix C). The approximate locations of the infiltration tests are shown on the attached Plot Plan, Figure 1 and the test results are shown on the attached Infiltration Data Sheets, Figures 2 and 3. The infiltration rates based on the infiltration testing are 0.22-inches/hour and 0.12-inches/hour (without considering safety factors).

This opportunity to be of service is sincerely appreciated. If you have any questions, please call this office.

Sincerely,

HETHERINGTON ENGINEERING, INC.

Mark D. Hetherington
Civil Engineer 30488
Geotechnical Engineer 397
(expires 3/31/18)

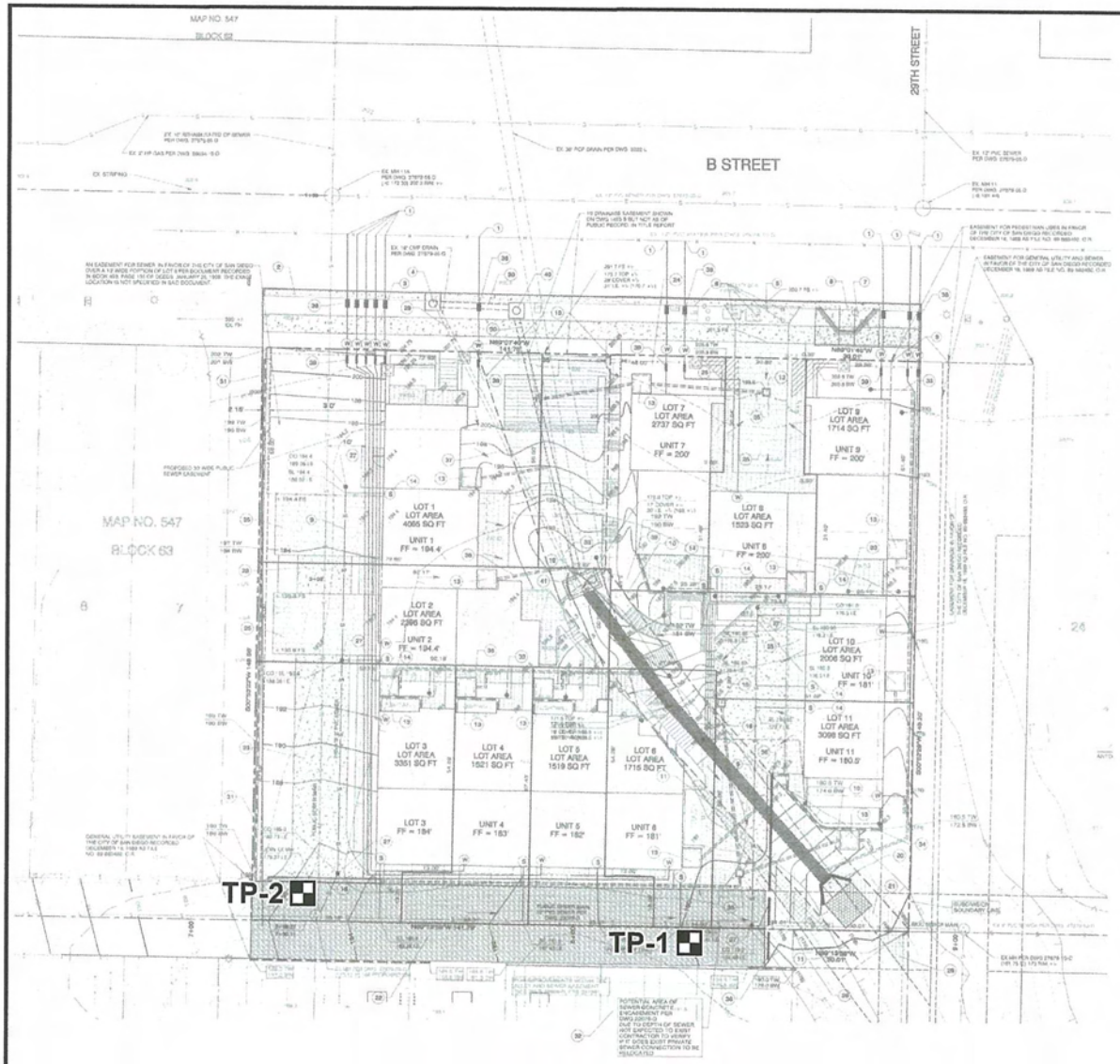
REGISTERED PROFESSIONAL ENGINEER
MARK D. HETHERINGTON
No. 397
Exp. Date
GEOTECHNICAL
STATE OF CALIFORNIA

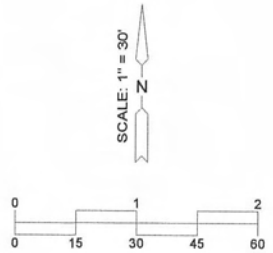
Paul A. Bogseth
Professional Geologist 3772
Certified Engineering Geologist 1153
Certified Hydrogeologist 591
(expires 3/31/18)

CERTIFIED ENGINEERING GEOLOGIST
PAUL A. BOGSETH
E.G. 1153
Exp.
STATE OF CALIFORNIA

Attachments: Plot Plan — Figure 1
Infiltration Data Sheets — Figures 2 and 3

Distribution: 1-via e-mail (Gordon.matthew0@gmail.com)
1-via e-mail (ceands@aol.com)
2-Addressee





LEGEND

TP-2 APPROXIMATE LOCATION OF INFILTRATION TEST

PLOT PLAN

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 1

INFILTRATION DATA SHEET

Project: Golden Hill	Job No.: 7603.1
Test Hole No.: 1	Soil Classification: Red brown clayey sand with cobbles, moist
Excavation by: Mansolf / CF	Date Excavated: 5/23/16
Pre-soak by: CF	Pre-soak Date: 5/23/16
Infiltration Testing by: CF	Infiltration Date: 5/24/16

Excavation and Pre-soak Data

Trench Width (ft)	Trench Length (ft)	Trench Depth (ft)	Pre-soak Time	Pre-soak Water Level (inches)
2	4	1	24 hrs.	12"

Infiltration Testing

Time	Time Interval (min)	Initial Water Level (inches)	Final Water Level (inches)	▲ in Water Level (inches)	Infiltration Rate (min/inch)	% Change from Previous
8:45 am 9:45 am	60	12.0	11.8125	0.1875	320	-
9:45 am 10:45 am	60	11.8125	11.6250	0.1875	320	0%
10:50 am 11:50 am	60	12.3750	12.15625	0.2187	274	-14%
11:50 am 12:50 pm	60	12.15625	11.9375	0.2187	274	0%

Figure 2
Project No. 7603.1
Log No. 18419

INFILTRATION DATA SHEET

Project: Golden Hill	Job No.: 7603.1
Test Hole No.: 2	Soil Classification: Red brown clayey sand to sandy clay with cobbles, moist
Excavation by: Mansolf / CF	Date Excavated: 5/23/16
Pre-soak by: CF	Pre-soak Date: 5/23/16
Infiltration Testing by: CF	Infiltration Date: 5/24/16

Excavation and Pre-soak Data

Trench Width (ft)	Trench Length (ft)	Trench Depth (ft)	Pre-soak Time	Pre-soak Water Level (inches)
2	4	1	24 hrs.	12"

Infiltration Testing

Time	Time Interval (min)	Initial Water Level (inches)	Final Water Level (inches)	▲ in Water Level (inches)	Infiltration Rate (min/inch)	% Change from Previous
8:48 am 9:48 am	60	12.00	11.16	0.84	71.43	-
9:48 am 10:48 am	60	11.16	10.92	0.24	250	+350
10:48 am 11:48 am	60	10.92	10.80	0.12	500	+100
11:53 am 12:53 pm	60	12.48	12.36	0.12	500	0

Figure 3
Project No. 7603.1
Log No. 18419

HETHERINGTON ENGINEERING, INC.
SOIL & FOUNDATION ENGINEERING • ENGINEERING GEOLOGY • HYDROGEOLOGY

May 21, 2015
Project 7603.1
Log No. 17697

Janco, LLC
P.O. Box 231446
Encinitas, California 92033

Attention: Mr. Matthew Gordon

Subject: ADDENDUM TO GEOTECHNICAL UPDATE
Proposed Townhomes
Golden Hill "B" Street
San Diego, California

Reference: "Geotechnical Update, Proposed Townhomes, Golden Hill "B" Street, San Diego, California," by Hetherington Engineering, Inc., dated April 24, 2015.

Dear Mr. Gordon:

In accordance with your request, Hetherington Engineering, Inc. has prepared this addendum to the referenced "Geotechnical Update…" for the subject site. Our work was performed in April and May 2015 and included subsurface exploration, laboratory testing, and the preparation of this addendum report. The purpose of the additional work was to investigate the undocumented fill and undifferentiated alluvium/colluvium in the vicinity of "B" Street and to revise, confirm or update the geotechnical recommendations provided in the "Geotechnical Update…". The "Geotechnical Update…" includes data not duplicated in this report.

FIELD EXPLORATION

One hollow-stem auger boring was drilled on April 27, 2015, adjacent to "B" Street, to obtain bulk and relatively undisturbed soil samples, to perform Standard Penetration tests (ASTM: D 1586), and for geologic logging. The approximate location of the boring is shown on the attached Updated Geologic Map, Plate 1.

The subsurface exploration was supervised by an Engineering Geologist from this office, who visually classified the soil and bedrock materials, and obtained bulk and relatively undisturbed samples for laboratory testing. The soils were visually classified according to the Unified Soil Classification System. Classifications are shown on the attached Boring Log, Figures 1 and 2.

LABORATORY TESTING

Laboratory testing was performed on samples obtained during the subsurface exploration. Tests performed consisted of the following:

- Dry Density/Moisture Content (ASTM: D 2216)
- One-Dimensional Swell or Collapse of Soils (ASTM: D 4546)

Results of the dry density and moisture content determinations are presented on the Boring Log, Figures 1 and 2. The remaining laboratory test results are presented on the attached Laboratory Test Results, Figure 3.

SUBSURFACE CONDITIONS

The boring confirmed the existence of undocumented fill as reported by others. The boring also confirmed the existence of undifferentiated alluvium/colluvium that, based on our laboratory testing, exhibits hydroconsolidation (collapse) potential. The bedrock encountered was consistent with San Diego Formation sandstone, consequently, the attached Updated Geologic Map, Plate 1 and Geologic Cross-Sections, Figures 4 through 7, have been modified to reflect this bedrock nomenclature and to reflect minor changes in geologic contacts.

No seepage was encountered in the boring to the total depth explored.

CONCLUSIONS AND RECOMMENDATIONS

Based on our field exploration and laboratory testing, the undifferentiated alluvium/colluvium exhibits hydroconsolidation (collapse) potential which could result in an estimated 6-inches (maximum) of settlement upon wetting.

We conclude that the recommendations for temporary slopes, removals, and compaction grouting presented in the "Geotechnical Update..." remain applicable. Geologic Cross-Sections B-B', C-C' and D-D' have been updated to reflect our recommendations adjacent to "B" Street.

LIMITATIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our investigation and further assume the excavations to be representative of the subsurface conditions throughout the site. If different subsurface conditions from those encountered during our exploration are observed or appear to be present in excavations, the Geotechnical Consultant should be promptly notified for review and reconsideration of recommendations.

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the conclusions and professional advice included in this report.

This opportunity to be of service is sincerely appreciated. If you have any questions, please call this office.

Sincerely,

HETHERINGTON ENGINEERING, INC.

Paul A. Bogseth
Professional Geologist 3772
Certified Engineering Geologist 1153
Certified Hydrogeologist 721
(expires 3/31/16)

CERTIFIED ENGINEERING GEOLOGIST
PAUL A. BOGSETH
E.G. 1153
Exp.
STATE OF CALIFORNIA

Mark D. Hetherington
Civil Engineer 30488
Geotechnical Engineer 397
(expires 3/31/16)

REGISTERED PROFESSIONAL ENGINEER
MARK D. HETHERINGTON
No. 397
Exp. Date
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments:

Boring Logs	Figures 1 and 2
Laboratory Test Results	Figure 3
Updated Geologic Cross-Sections	Figures 4 through 7
Updated Geologic Map	Plate 1

Distribution: 6-Addressee
1-via e-mail (Gordon.matthew0@gmail.com)
1-via e-mail (chris@h2asandiego.com)

DRILLING COMPANY: **Scott's Drilling** RIG: **Hollow Stem Auger** DATE: **04/27/15**

BORING DIAMETER: **8"** DRIVE WEIGHT: **140 lbs.** DROP: **30"** ELEVATION: **' ±**

BORING NO. B-1

DEPTH (FEET)	BULK SAMPLE	DRIVE SAMPLE	BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
0.0						GP SM	**FILL:** Brown silty sand with numerous gravel/cobbles; dry to damp, loose, difficult drilling @ 0 to 4'; asphalt concrete fragments
			17 (SPT) 3/6" 6/6" 7/6"	102	5.1		@ 4': Less gravel and cobbles, damp, medium dense
5.0							
			18 (SPT) 3/6" 4/6" 3/6"	112	5.1	SM ML	**ALLUVIUM/COLLUVIUM:** Red brown silty sand; damp, loose, easy drilling
10.0							@ 10 - 12': Gravelly layer
			12 (SPT) 1/6" 2/6" 3/6"				@ 12': Sample on rock - no recovery
15.0							@ 14': Red brown sandy silt/silty sand, moist, soft to firm/loose
			9 (SPT) 2/6" 2/6" 2/6"	99	6.3		@ 18': Red brown sandy silt/silty sand, soft/loose
20.0							
			11 (SPT) 6/6" 7/6" 10/6"	111	6.9		@ 22': Thin gravel layer in SPT
							@ 23': Drilling tighter
			17	105	11.1	CL SC	Brown to tan gravelly sandy clay to clayey sand; moist, stiff/medium dense
25.0							

BORING LOG

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. **7603.1** FIGURE NO. **1**

DRILLING COMPANY: **Scott's Drilling** RIG: **Hollow Stem Auger** DATE: **04/27/15**

BORING DIAMETER: **8"** DRIVE WEIGHT: **140 lbs.** DROP: **30"** ELEVATION: **' ±**

BORING NO. B-1

DEPTH (FEET)	BULK SAMPLE	DRIVE SAMPLE	BLOWS/FOOT	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
25.0			(SPT) 4/6" 5/6" 8/6"				
			20	101	13.5		@ 28': Brown gravelly clay; moist; firm, rock in tip of sampler
30.0			(SPT) 13/6" 10/6" 14/6"				@ 30': Not much recovery, rock in sampler
			85/9"	108	9.1		**BEDROCK (San Diego Formation):** Light brown sandstone; moist, very dense
35.0			(SPT) 17/6" 25/6" 40/6"				
							Total depth 35.5-feet No seepage
40.0							
45.0							
50.0							

BORING LOG

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

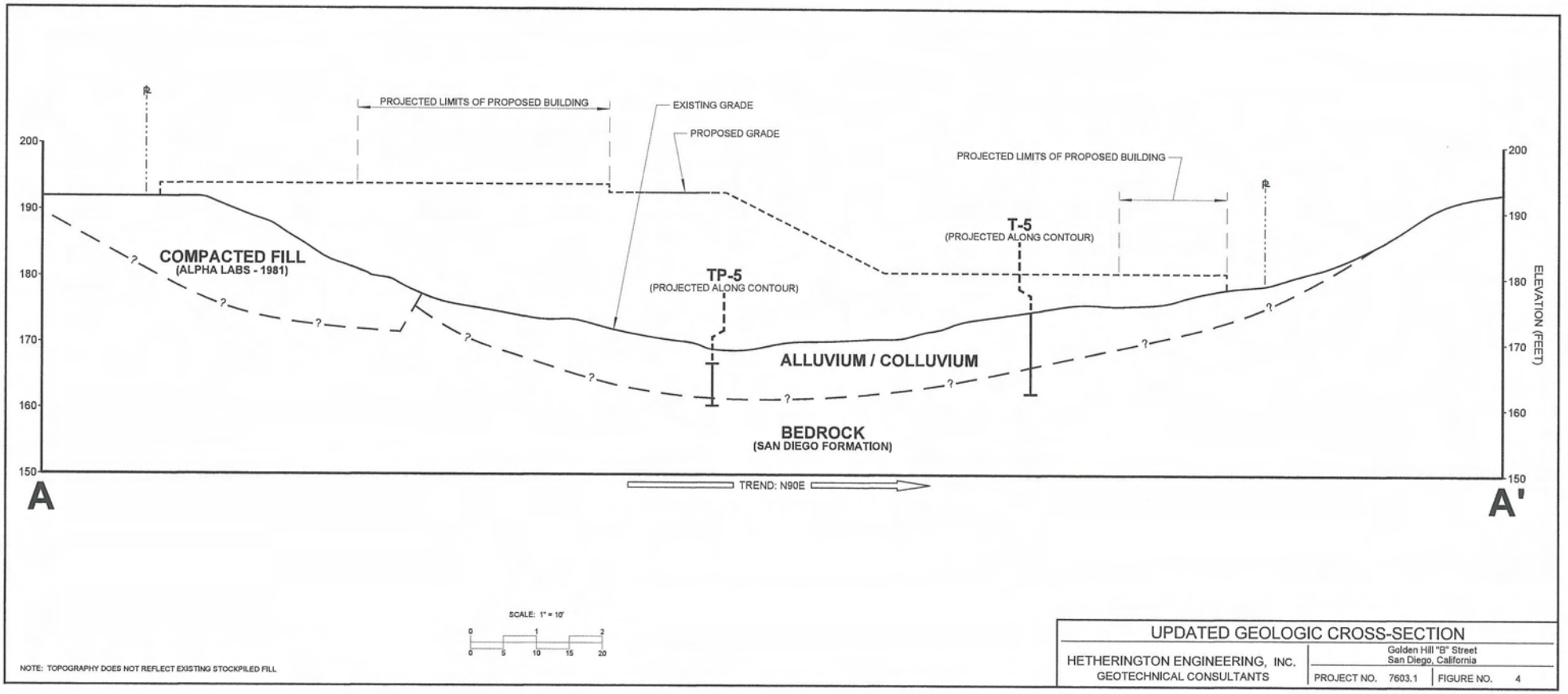
Golden Hill "B" Street
San Diego, California

PROJECT NO. **7603.1** FIGURE NO. **2**

LABORATORY TEST RESULTS

ONE-DIMENSIONAL SWELL OR COLLAPSE OF SOILS (ASTM: D 4546)		
Sample Location	**Normal Stress at Saturation (psf)**	**% Swell (+) or % Consolidation (-) When Water Added**
B-1 @ 4'	429	-1.63
B-1 @ 8'	901	-1.22
B-1 @ 16	1760	-4.16
B-1 @ 20'	2243	-2.84
B-1 @ 24'	2716	-2.09
B-1 @ 28'	3176	-1.15

FIGURE 3
Project No. 7603.1
Log No. 17697



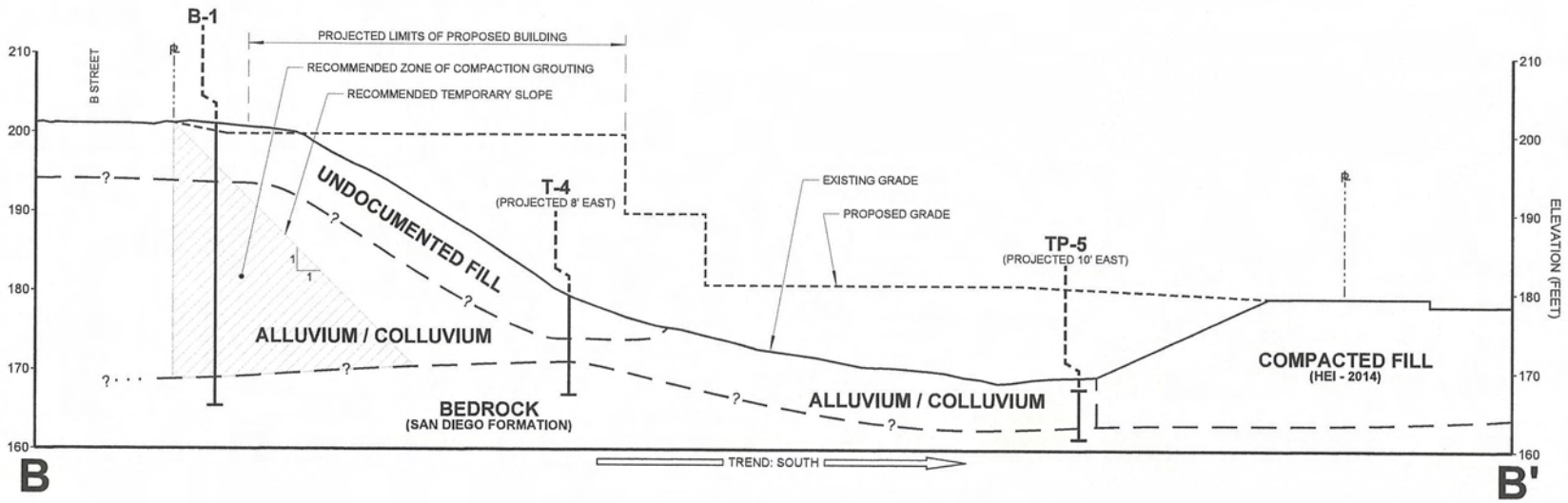
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

UPDATED GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 4



SCALE: 1" = 10'

0 1 2
0 5 10 15 20

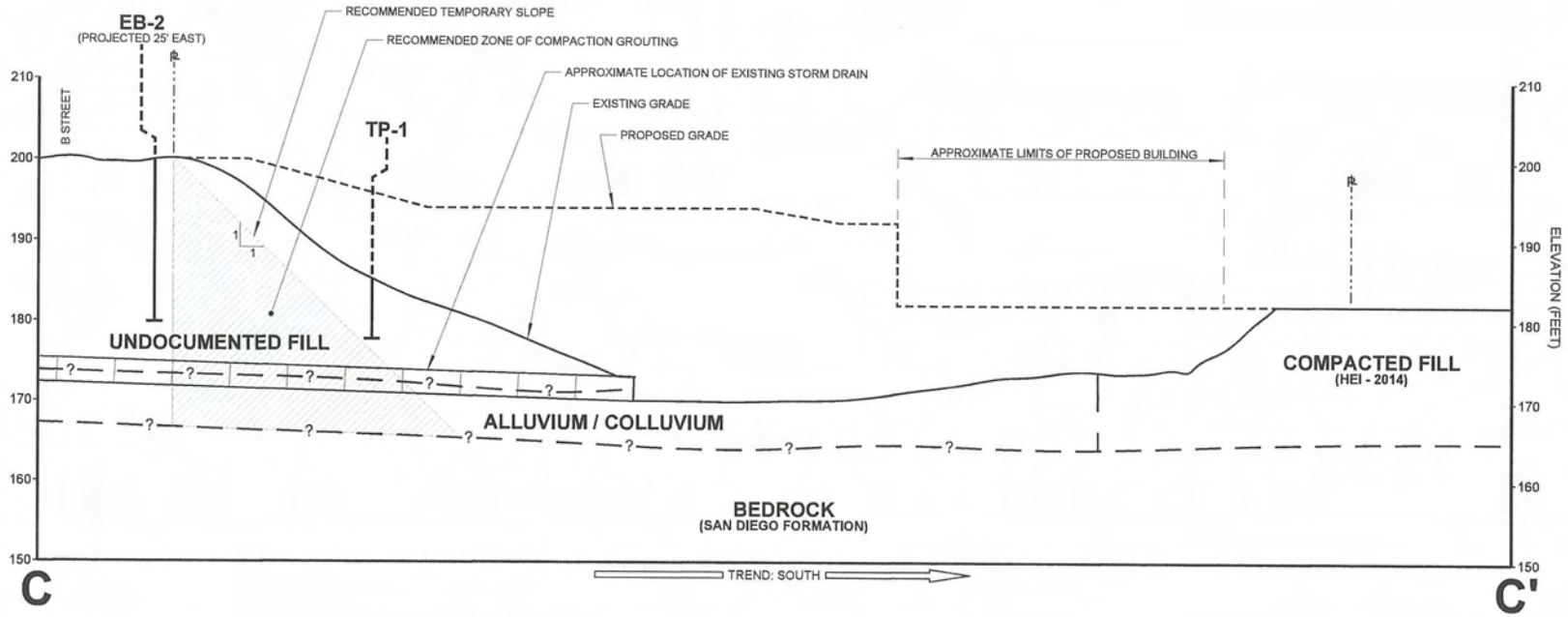
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

UPDATED GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 5



SCALE: 1" = 10'

0 1 2
0 5 10 15 20

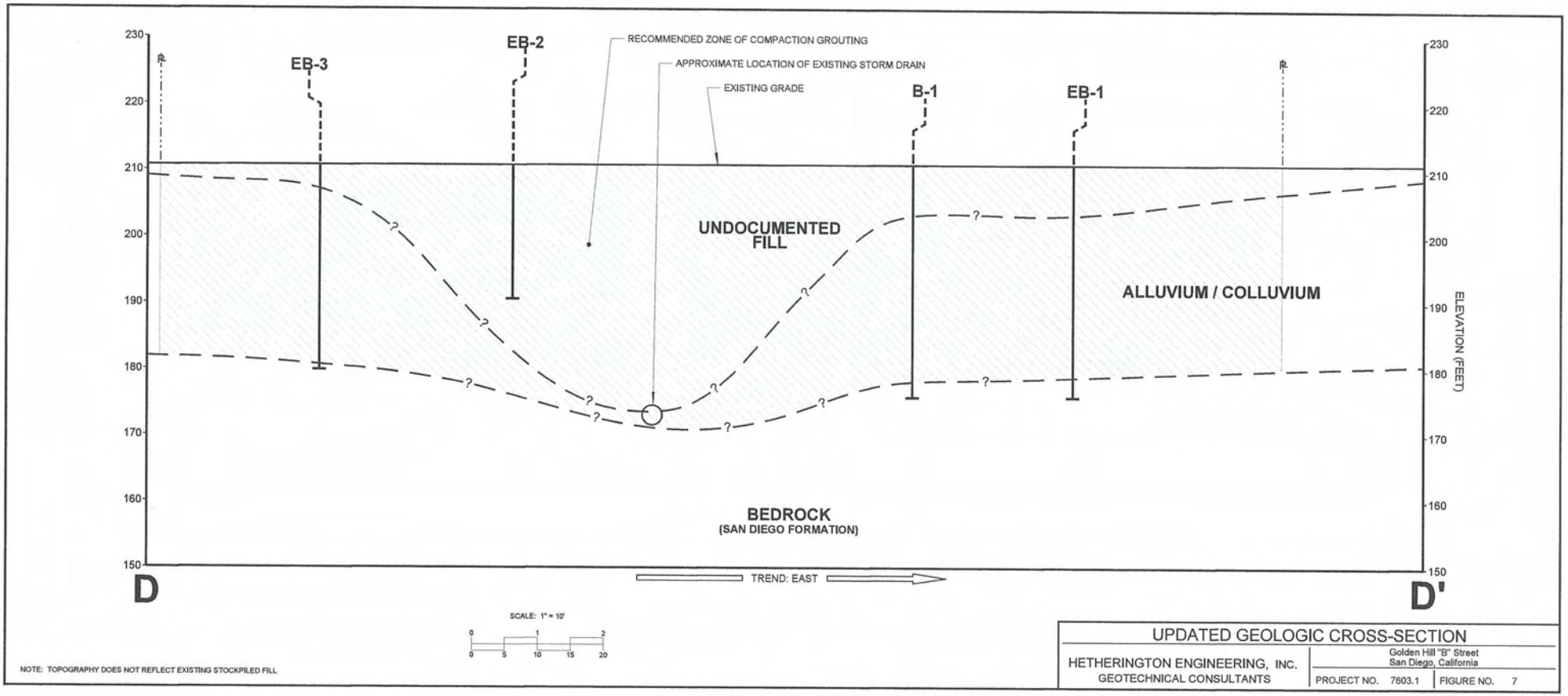
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

UPDATED GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 6



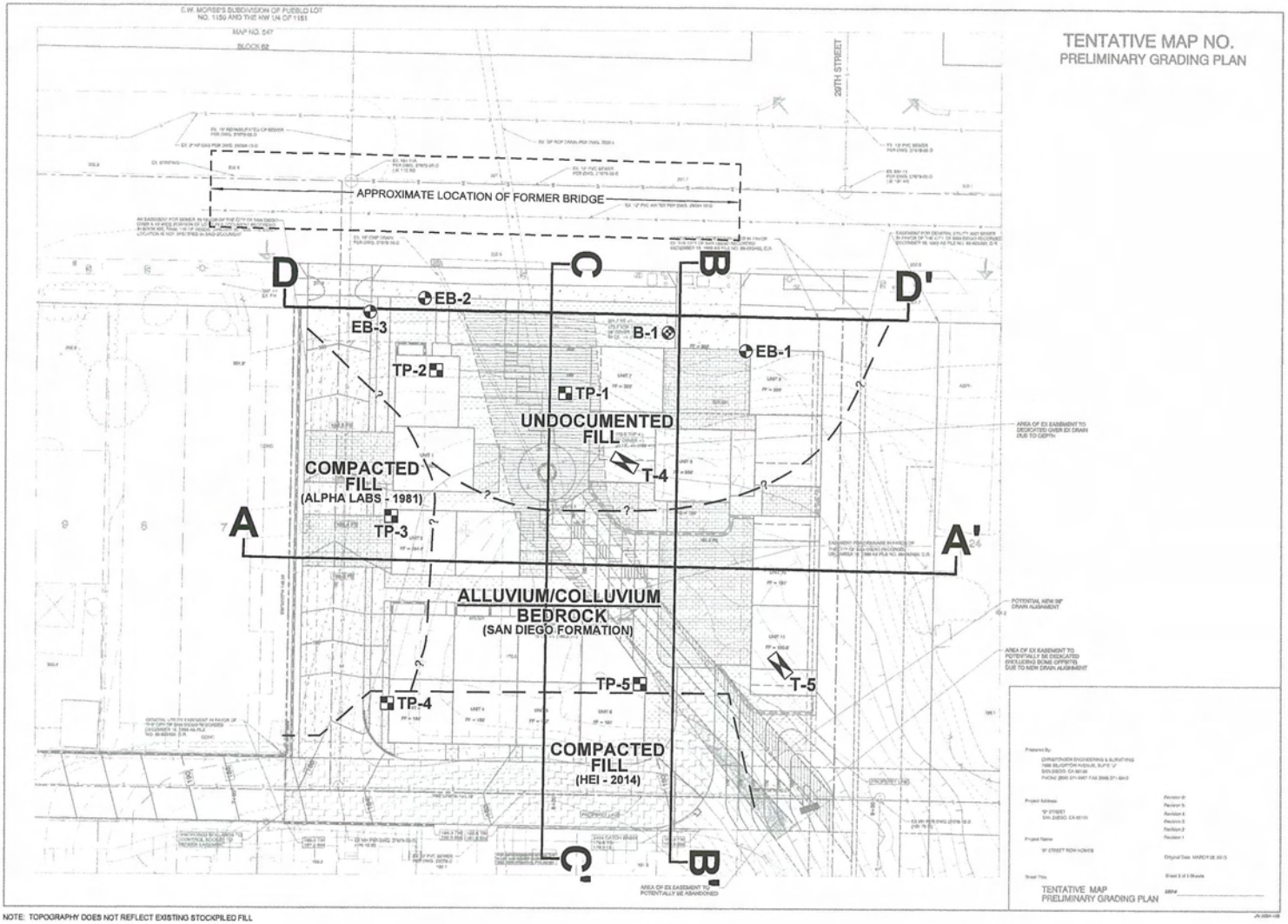
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

UPDATED GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 7



NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

LEGEND

T-5	APPROXIMATE LOCATION OF TEST PIT BY ALLIED EARTH TECHNOLOGY (2001)
EB-3	APPROXIMATE LOCATION OF BORING BY ROBERT PRATER ASSOCIATES (1980)
TP-5	APPROXIMATE LOCATION OF TEST PIT BY ROBERT PRATER ASSOCIATES (1980)
B-1	APPROXIMATE LOCATION OF BORING BY HETHERINGTON ENGINEERING, INC. (2015)
?	APPROXIMATE LOCATION OF GEOLOGIC CONTACT (QUERRIED WHERE UNCERTAIN)
B B'	GEOLOGIC CROSS-SECTION

SCALE: 1" = 20'

0 10 20 30 40

UPDATED GEOLOGIC MAP

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | PLATE NO. 1

GEOTECHNICAL UPDATE
Proposed Townhomes
Golden Hill "B" Street
San Diego, California

HETHERINGTON ENGINEERING, INC.

HETHERINGTON ENGINEERING, INC.

SOIL & FOUNDATION ENGINEERING • ENGINEERING GEOLOGY • HYDROGEOLOGY

April 24, 2015
Project 7603.1
Log No. 17400

Janco, LLC
P.O. Box 231446
Encinitas, California 92033

Attention: Mr. Matthew Gordon

Subject: GEOTECHNICAL UPDATE
Proposed Townhomes
Golden Hill "B" Street
San Diego, California

References: Attached

Dear Mr. Gordon:

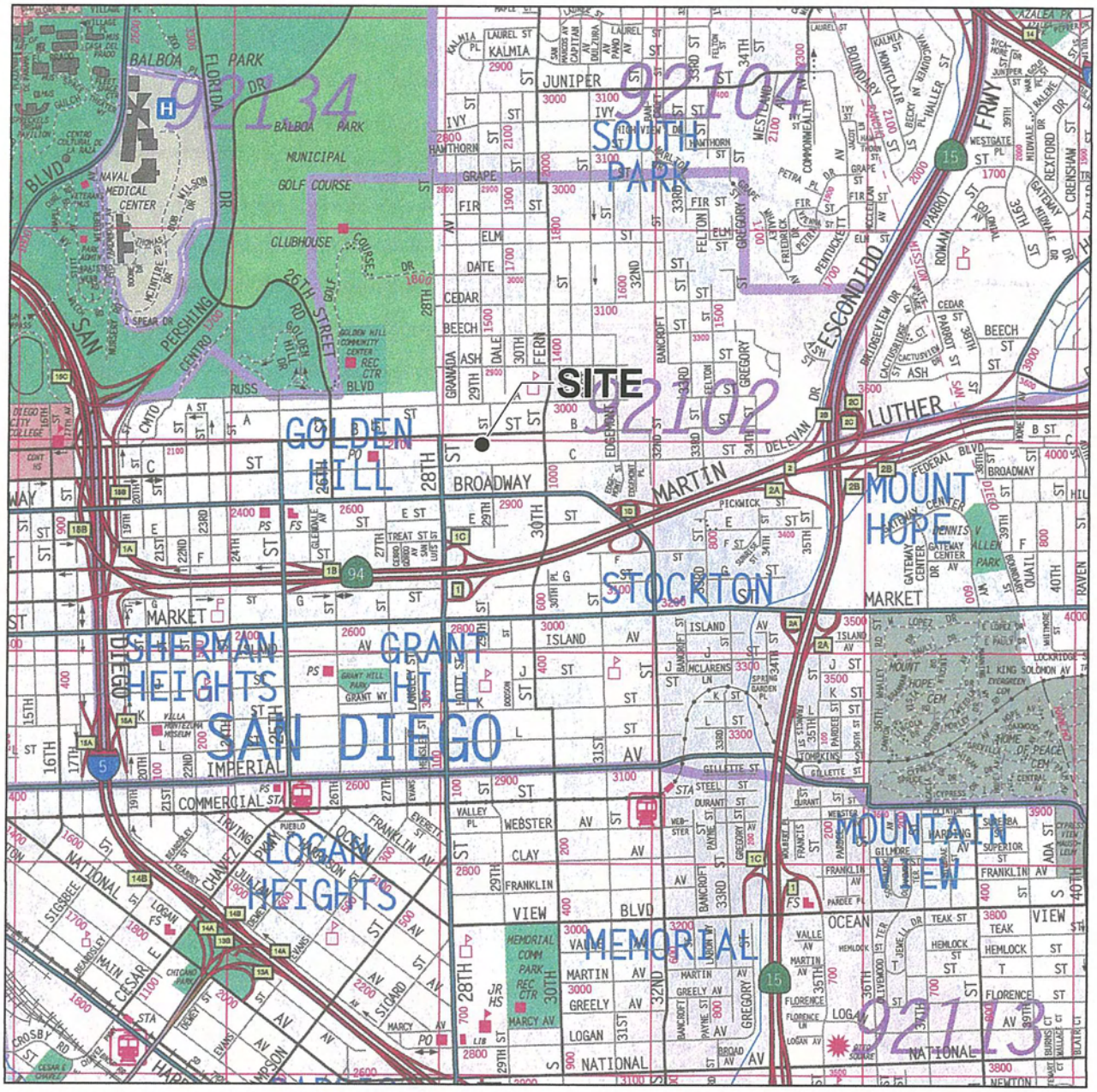
In accordance with your request, Hetherington Engineering, Inc. has prepared this geotechnical update for the subject site. Our work was performed in March and April 2015. The purpose of the geotechnical update was to evaluate the reported geologic and soil conditions at the site, and to provide updated grading and foundation recommendations for the proposed development. We were provided with a "Tentative Map, Preliminary Grading Plan…" (Reference 11) that has been used as the base map for the attached Geologic Map, Plate 1. With the above in mind, our scope of work included the following:

- Research and review of available plans, reports and geologic literature pertinent to the subject site and vicinity (see References).
- Engineering and geologic analysis.
- Preparation of this report providing our findings, conclusions and recommendations.

SITE DESCRIPTION

The subject site is located on the south side of "B" Street and west of 29th Street in the City of San Diego, California (see Location Map, Figure 1). The site consists of an unimproved rectangular shaped property. Soil stockpiles currently exist along the northwest, west and south sides of the site.

Topographically, the site consists of a southeasterly trending unnamed drainage, with ascending slopes on all sides. The drainage has been modified by prior grading and the



ADAPTED FROM: The Thomas Guide, San Diego County, 2006 Edition, Page 1289

N

SCALE: 1" - 2000'
(1 Grid = 0.5 x 0.5 miles)

LOCATION MAP

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 1

construction of "B" Street in the mid 1920's that filled a portion of the drainage and included a storm drain that outlets at approximately mid-property (Reference 13). Prior grading to the west included a fill slope that descends from the adjacent multi-family residential building to the subject property (Reference 5). Grading of the parcel to the south was completed in 2014 (References 14 and 15). Remedial grading for the property to the south partially extended onto the subject site.

The site is bounded by an existing multi-family residential structure to the west, by an unimproved parcel to the east, by "B" Street to the north, and by the Golden Hill Rowhomes on "C" Street to the south (currently under construction).

PROPOSED DEVELOPMENT

The referenced "Tentative Map, Preliminary Grading Plan…" indicates that the proposed development consists of eleven, single-family residential townhomes in five buildings. The buildings will be three-story with partial subterranean lower levels that will incorporate retaining walls up to 10-feet high to facilitate grade changes within the building footprint. Appurtenant improvements include retaining walls to a maximum height of approximately 10-feet, concrete driveways and flatwork, and landscaping. The existing storm drain will be extended from the current outlet to the southeast portion of the site.

Building loads are expected to be typical for this type of relatively light construction. Proposed site grading includes fill to a maximum designed depth of 18-feet. Import soil will be required. New slopes are proposed to a maximum height of approximately 14-feet at 2:1 (horizontal to vertical) slope ratios.

PREVIOUS GEOTECHNICAL INVESTIGATIONS

Robert Prater Associates performed a geotechnical investigation of the subject property in 1980 (Reference 22). The scope of work included three borings, five test pits and laboratory testing. The approximate locations of the exploratory borings and test pits are indicated on the attached Geologic Map, Plate 1. The Exploratory Boring Logs, Exploratory Test Pit Logs and laboratory test data are included in the attached Appendix A.

Allied Earth Technology performed a geotechnical investigation on the subject and adjacent property to the south in 2001 (Reference 2). The scope of work included exploratory test pits and laboratory testing. The approximate locations of the exploratory test pits are indicated on the attached Geologic Map, Plate 1. The Trench Log Sheets by

Allied Earth Technology are included in the attached Appendix B. No laboratory testing was performed on soils from the two test pits on the subject site.

SOIL AND GEOLOGIC CONDITIONS

1. Geologic Setting

The subject site is located near the western margin of the coastal plain region of the Peninsular Ranges Geomorphic Province in San Diego, California, within an elevated level plateau, located approximately 2-miles east of San Diego Bay. The site is located within the northeast portion of the USGS Point Loma 7-1/2 minute quadrangle.

This region of San Diego is characterized mainly by elevated plateaus cut by south trending drainage channels into Pleistocene and Pliocene, marine and non-marine sediments, discharging ultimately into San Diego Bay.

Based on the results of the prior investigations and our recent grading observations on the property to the south, the subject site is underlain by undocumented and compacted fill, undifferentiated alluvium/colluvium and bedrock of the Linda Vista Formation. The approximate limits of these geologic units are depicted on the attached Geologic Map, Plate 1 and Geologic Cross-Sections, Figures 2 through 5.

2. Geologic Units

a. Undocumented Fill - The site is immediately underlain by several generations of fill. Recently stockpiled fill soils exists along the northwest, west, and south sides of the site. The topography on the attached Geologic Map, Plate 1 does not reflect the stockpiled fill.

Fill associated with the construction of "B" Street underlies the northern portion of the site to depths that likely approach 25±-feet along the north property line. Undocumented fill is not considered suitable to support new fill or proposed improvements.

b. Compacted Fill - Fill observed and tested by Alpha Laboratories, Inc. extends onto the west side of the subject site to estimated depths of 5 to 10-feet (Reference 5).

Fill observed and tested by Hetherington Engineering, Inc. exists along the southern portion of the property (References 14 and 15). These fill soils consist of silty to clayey sand. The compacted fill is considered suitable to support new fill and proposed improvements.

c. Undifferentiated Alluvium/Colluvium - Undifferentiated alluvium/colluvium was encountered in the Robert Prater Associates borings EB-1 and EB-3 and test pits TP-1, TP-2, TP-3, TP-4 and TP-5; and in the Allied Earth Technology Trench Nos. 4 and 5. These soils consist of silty to clayey sand with gravel and cobbles. The thickness of these soils is expected to vary from 3-feet on the side slopes to 25-feet or more under the undocumented fill. Previous removals of alluvium/colluvium along the southern portion of the property extended to elevation 159.4-feet near the southeast corner to 169.3-feet near the southwest corner of the site. These soils are not considered suitable to support new fill or proposed improvements.

d. Bedrock (Linda Vista Formation) - Bedrock underlies the fill and alluvium/colluvium at depths estimated to vary from approximately 10 to 30-feet below existing site grades and consists generally of silty fine to coarse sandstone, which is moist, dense to very dense, poorly cemented, slightly friable and massive.

3. Groundwater

Groundwater was not encountered in the prior exploratory borings and test pits to the maximum depths explored. Fluctuations in the amount and level of groundwater are expected to occur due to the existing drainage channel and variations in rainfall, irrigation, and other factors that might not have been evident at the time of our field investigation.

SEISMICITY

The site is located within the seismically active southern California region. There are, however, no known active or potentially active faults presently mapped that pass through the site nor is the site located within the presently defined limits of an Alquist-Priolo Earthquake Fault Zone. Active or potentially active fault zones within the site region include the Rose Canyon, Coronado Bank and Elsinore (Julian Segment). Strong ground motion could also be expected from earthquakes occurring along the San Jacinto and San Andreas fault zones, which lie northeast of the site at greater distances, as well as a

number of other offshore faults. The Texas Street Fault is mapped by the city of San Diego approximately 300-feet west of the site.

The following table lists the known active faults that would have the most significant impact on the site.

Fault	Maximum Probable Earthquake (Moment Magnitude)	Slip Rate (mm/year)
Rose Canyon (1-mile/1.6 kilometers) SW	7.0	1.5
Coronado Bank (14-miles/22.5 kilometers) SW	7.3	3.0
Elsinore (Julian Segment) (32-miles/51.5 kilometers) NE	7.3	3.0

SEISMIC EFFECTS

1. Ground Accelerations

   The most significant probable earthquake to effect the site would be a 7.0 magnitude earthquake on the Rose Canyon fault zone. Based on Section 1803.5.12 of the 2013 California Building Code, peak ground accelerations of about 0.505g are possible for the design earthquake.

2. Ground Cracks

   The risk of fault surface rupture due to active faulting is considered low due to the absence of known active faulting on site. Ground cracks due to shaking from seismic events in the region are possible, as with all of southern California.

3. Landsliding

   At the completion of site grading, slopes will consist of compacted fill slopes to a maximum height of approximately 15-feet inclined at 2:1 (horizontal to vertical) slope ratios. The risk of seismically induced landsliding is considered negligible.

4. Liquefaction

Liquefaction is a phenomenon in which earthquake induced cyclic stresses generate excess pore water pressure in cohesionless soils, causing a temporary loss of shear strength. Due to the dense underlying Linda Vista formation, proposed compacted fill and lack of shallow groundwater, liquefaction is not considered a site hazard.

5. Tsunamis

Due to the site elevation and distance from the coast, tsunami inundation is not considered a site hazard.

CONCLUSIONS AND RECOMMENDATIONS

1. General

The proposed development is considered feasible from a geotechnical standpoint. Grading and foundation plans should take into account the appropriate geotechnical features of the site. The proposed construction is not anticipated to adversely impact the adjacent properties from a geotechnical standpoint, provided the recommendations presented in this report and good construction practices are implemented during design and construction.

2. Seismic Parameters for Structural Design

Seismic considerations that may be used for structural design at the site include the following:

a. Ground Motion - The proposed structures should be designed and constructed to resist the effects of seismic ground motions as provided in Section 1613 of the 2013 California Building Code.

Site Address: "B" Street at 29th Street, San Diego, California

Latitude: 32.717°

Longitude: -117.132°

b. Spectral Response Accelerations - Using the location of the property and data obtained from the U.S.G.S. Earthquake Hazard Program, short period Spectral Response Accelerations S_s (0.2 second period) and S_1 (1.0 second period) are:

$S_s = 1.151g$
$S_1 = 0.442g$

c. Site Class - In accordance with Chapter 20 of ASCE 7-10, a Site Class D is considered appropriate for the subject property.

d. Site Coefficients F_a and F_v - In accordance with Tables 1613.3.3 and considering the values of S_s and S_1, Site Coefficients for a Class D site are:

$F_a = 1.04$
$F_v = 1.558$

e. Spectral Response Acceleration Parameters Sm_s and Sm_1 - In accordance with Section 1613.3.3 and considering the values of S_s and S_1, and F_a and F_v, Spectral Response Acceleration Parameters for Maximum Considered Earthquake are:

$Sm_s = (F_a)(S_s) = 1.196g$
$Sm_1 = (F_v)(S_1) = 0.689g$

f. Design Spectral Response Acceleration Parameters Sd_s and Sd_1 - In accordance with Section 1613.3.4 and considering the values of Sm_s and Sm_1, Design Spectral Response Acceleration Parameters for Maximum Considered Earthquake are:

$Sd_s = 2/3\ Sms = 0.798g$
$Sd_1 = 2/3\ Sm_1 = 0.459g$

g. Long Period Transition Period - A Long Period Transitional Period of TL = 8 seconds is provided for use in San Diego County.

h. Seismic Design Category – In accordance with Tables 1604.5, 1613.3.5 and ASCE 7-10, a Risk Category II and a Seismic Design Category D are considered appropriate for the subject site.

3. Slope Stability

Cut and fill slopes should be constructed at a slope ratio of 2:1 (horizontal to vertical) or flatter.

4. Site Grading

Prior to grading, existing improvements, vegetation and miscellaneous debris within the limits of the proposed grading and construction should be removed to an appropriate offsite disposal area. Holes resulting from the removal of buried obstructions, which extend below finished site grades, should be replaced with compacted fill. In the event that abandoned cesspools, septic tanks or storage tanks are discovered during the excavation of the site, they should be removed and backfilled in accordance with local regulations. Existing utility lines to be abandoned should be removed and capped in accordance with the local requirements.

In the areas proposed for grading, the existing undocumented fill, undifferentiated alluvium/colluvium and other material deemed unsuitable by the Geotechnical Consultant should be removed to expose approved compacted fill or bedrock. Removals of 5 to 35-feet (or more) below existing grades are anticipated. If a bedrock/fill transition exists within the footprint of any building pad, additional removals should be performed to provide a minimum depth of compacted fill of 5-feet below proposed grades. The Geotechnical Consultant should determine final removal depths during site grading.

Due to the required removals, "B" Street improvements will require shoring to facilitate removals. Alternatively, the existing undocumented fill and undifferentiated alluvium/colluvium can be entirely removed down to a 1:1 (horizontal to vertical) projection extended downward from the "B" Street property line to the bedrock contact, and the remaining undocumented fill and undifferentiated alluvium/colluvium densified in-place by compaction grouting. Additionally, the existing storm drain may require removals below the existing flow line. This will require excavation in sections, protecting the storm drain in place or removal and replacement of the storm drain. Actual depths of removals in the vicinity of the existing storm drain are not known.

After the removal of unsuitable soils and any additional required over excavation have been made, all areas to receive fill should be scarified to a depth of 6 to 8-inches, brought to near optimum moisture conditions and compacted to at least 90-percent relative compaction (ASTM: D 1557).

Fill soils should be moisture conditioned to about optimum moisture content and compacted by mechanical means in uniform horizontal lifts of 6 to 8-inches in thickness. All fill should be compacted to a minimum relative compaction of 90-percent (ASTM: D 1557). The on-site materials are considered suitable for use as compacted fill. Rock fragments over 6-inches in dimension and other perishable or unsuitable materials should be excluded from the fill. All grading and compaction should be observed and tested as necessary by the Geotechnical Consultant.

Any import soil should be approved by the Geotechnical Consultant prior to import. Any imported soil to be used as structural fill should have an expansion index of 20 or less and the expansion index should be verified by the Geotechnical Consultant prior to site delivery.

5. Shoring

If the entire removal of the undocumented fill and undifferentiated alluvium/colluvium is planned to the "B" Street property line, shoring will be necessary to protect off-site property and create a safe condition for workers during construction. The design, installation, and performance of the shoring system are considered the responsibility of the contractor and designer. Geotechnical recommendations necessary for the shoring design are included under the "Foundations and Slabs" section of this report. The shoring plan should be reviewed by the Geotechnical Consultant to confirm conformance with the recommendations presented herein and to provide additional comments as necessary.

6. Foundations and Slabs

The following recommendations are considered geotechnical minimums and may be increased by structural requirements or by the soils conditions exposed at the completion of grading.

The proposed structures may be supported by conventional continuous/spread footings founded at least 18-inches into compacted fill or bedrock. Continuous footings should be at least 12-inches wide and reinforced with a minimum of four #5 bars, two top and two bottom. Foundations located adjacent to utility trenches should extend below a 1:1 plane projected upward from the bottom of the trench. Foundations located on or adjacent to slopes should provide a horizontal distance of at least H/3, where H is the slope height, from the bottom of the footing to the face of the slope. Foundations bearing as recommended may be designed for a dead plus live load bearing value of 2000-pounds-per-square-foot. This value may be increased by

one-third for loads including wind and seismic forces. A lateral bearing value of 150-pounds-per-square-foot per foot of depth to a maximum value of 2000-pounds-per-square-foot and a coefficient of friction between foundation soil and concrete of 0.25 may be assumed. These values assume that footings will be placed neat against the foundation soils. Footing excavations should be observed by the Geotechnical Consultant prior to the placement of reinforcing steel in order to verify that they are founded in suitable bearing materials.

Total and differential settlement of the proposed structures due to foundation loads is considered to be less than 3/4 and 3/8-inch, respectively, for footings founded as recommended.

Drilled piers associated with the shoring should extend at least 5-feet into approved bedrock and should have a minimum diameter of 24-inches. Drilled piers founded as recommended may be designed for a dead plus live load end bearing capacity of 4000-pounds-per-square-foot. This value may be increased by one-third for wind and seismic forces. A skin friction value of 150-pounds-per-square-foot may be assumed in bedrock. Piers may resist lateral loads by a passive pressure of 400-pounds-per-square-foot per foot of depth in bedrock to a maximum value of 4000-pounds-per-square-foot. The passive resistance may be calculated over two pier diameters.

Drilled piers should be observed by the Geotechnical Consultant at the time of drilling to ensure that the appropriate bearing materials have been encountered.

Slab-on-grade floors should have a minimum thickness of 5-inches and should be reinforced with #4 bars spaced at 18-inches, center-to-center, in two directions, and supported on chairs so that the reinforcement is at mid-height in the slab. A 4-inch layer of clean sand should underlie slabs with at least a 10-mil polyvinyl chloride moisture vapor retarder placed at mid-height in the sand. The vapor retarder should be placed in accordance with ASTM: E 1643. Slab subgrade soils should be thoroughly moistened prior to vapor retarder placement.

Vapor retarders are not intended to provide a waterproofing function. Should moisture vapor sensitive floor coverings be planned, a qualified consultant/contractor should be consulted to evaluate moisture vapor transmission rates and to provide recommendations to mitigate potential adverse impacts of moisture vapor transmissions on the proposed flooring.

7. Retaining Walls

Retaining wall foundations supported in compacted fill or bedrock should be designed in accordance with the previous building foundation recommendations provided in this report. Retaining walls free to rotate (cantilevered walls) should be designed for an active earth pressure of 35-pounds-per-cubic-foot (equivalent fluid pressure) assuming level backfill consisting of the on-site soils. Walls restrained from movement at the top should be designed for an at-rest earth pressure of 60-pounds-per-cubic-foot (equivalent fluid pressure) assuming level backfill consisting of the on-site soils. Any additional surcharge pressures behind the walls should be added to these values.

Retaining walls should be provided with adequate drainage to prevent buildup of hydrostatic pressure and should be adequately waterproofed. The subdrain system behind retaining walls should consist at a minimum of 4-inch diameter Schedule 40 (or equivalent) perforated (perforations down) PVC pipe embedded in at least 1-cubic-foot of 3/4-inch crushed rock per lineal foot of pipe all wrapped in approved filter fabric. Other subdrain systems that may be contemplated for use behind retaining walls due to the ultimate wall designs and construction methodology will be addressed on a case-by-case basis. Recommendations for wall waterproofing should be provided by the Project Architect and/or Structural Engineer consistent with Section 1805.3 of the 2013 California Building Code. Unrestrained (cantilever) retaining walls should be anticipated to experience some minor rotation and improvements placed behind the walls should be designed and constructed to accommodate this movement.

The lateral pressure on retaining walls due to earthquake motions (dynamic lateral force) should be calculated as $P_A = 3/8\ \gamma\ H^2 k_h$ where

P_A	=	dynamic lateral force (lbs/ft)
γ	=	unit weight = 130 pcf
H	=	height of wall (feet)
k_h	=	seismic coefficient = 0.17g

The dynamic lateral force is in addition to the static force and should be applied using a triangular distribution with the resultant applied at 0.3H above the base of the retaining wall. Any retaining walls that are less than 6-feet high do not require design to resist the additional earth pressure caused by seismic ground shaking.

8. Concrete Flatwork

Concrete flatwork should be at least 5-inches thick (actual) and reinforced with No. 4 bars spaced at 18-inches on-center (two directions) and placed on chairs so that the reinforcement is in the center of the slab. Slab subgrade should be maintained at or slightly above optimum moisture content prior to placement of concrete. Contraction joints should be provided at 10-feet spacing (maximum). Joints should create square panels where possible. For rectangular panels (where necessary) the long dimension should be no more than 1.5 times the short dimension. Joint depth should be at least 0.25 times the flatwork thickness. Expansion joints should be thoroughly sealed to prevent the infiltration of water into the underlying soils.

9. Corrosivity Testing

Due to the need for import soils at the site, corrosivity testing should be performed at the completion of grading. Pending the results of this testing, the onsite soils should be considered severely corrosive to concrete and buried metals.

10. Temporary Slopes

Temporary slopes may be excavated vertically up to 5-feet and at a slope ratio no steeper than 1:1 (horizontal to vertical) over 5-feet in height. Field observations by the Engineering Geologist during grading of temporary slopes are recommended and considered necessary to confirm anticipated conditions and provide revised recommendations if necessary.

11. Retaining Wall and Utility Trench Backfill

All retaining wall and utility trench backfill should be compacted to at least 90-percent relative compaction (ASTM: D 1557). Backfill should be tested and observed by the Geotechnical Consultant.

12. Site Drainage

The following recommendations are intended to minimize the potential adverse effects of water on the structures and appurtenances.

a. Consideration should be given to providing the structures with roof gutters and downspouts that discharge to an area drain system and/or to suitable locations away from the structure.

b. All site drainage should be directed away from the structures and not be allowed to flow over slopes.

c. No landscaping should be allowed against the structures. Moisture accumulation or watering adjacent to foundations can result in deterioration of building materials and may effect foundation performance.

d. Irrigated areas should not be over-watered. Irrigation should be limited to that required to maintain the vegetation. Additionally, automatic systems must be seasonally adjusted to minimize over-saturation potential particularly in the winter (rainy) season.

e. All yard and roof drains should be periodically checked to verify they are not blocked and flow properly. This may be accomplished either visually or, in the case of subsurface drains, by placing a hose at the inlet and checking the outlet for flow.

13. Recommended Observation and Testing During Construction

The following tests and/or observations by the Geotechnical Consultant are recommended:

a. Observation and testing of grading.

b. Shoring installation.

b. Foundation excavations prior to placement of forms and reinforcement.

c. Utility trench backfill.

d. Retaining wall subdrains and backfill.

e. Concrete flatwork subgrade.

14. Grading and Foundation Plan Review

Grading and foundation plans should be reviewed by the Geotechnical Consultant to confirm conformance with the recommendations presented herein or to modify the recommendations as necessary.

LIMITATIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our investigation and further assume the excavations to be representative of the subsurface conditions throughout the site. If different subsurface conditions from those encountered during our exploration are observed or appear to be present in excavations, the Geotechnical Consultant should be promptly notified for review and reconsideration of recommendations.

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the conclusions and professional advice included in this report.

This opportunity to be of service is sincerely appreciated. If you have any questions, please call this office.

Sincerely,

HETHERINGTON ENGINEERING, INC.

Paul A. Bogseth
Professional Geologist 3772
Certified Engineering Geologist 1153
Certified Hydrogeologist
(expires 3/31/16)

CERTIFIED ENGINEERING GEOLOGIST
PAUL A. BOGSETH
E.G. 1153
Exp.
STATE OF CALIFORNIA

Mark D. Hetherington
Civil Engineer 30488
Geotechnical Engineer 397
(expires 3/31/16)

REGISTERED PROFESSIONAL ENGINEER
MARK D. HETHERINGTON
No. 397
Exp. Date
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments:

Location Map	Figure 1
Geologic Cross-Sections	Figures 2 through 5
Geologic Map	Plate 1
Robert Prater Associates Data	Appendix A
Allied Earth Technology Data	Appendix B

Distribution: 6-Addressee
1-via e-mail (Gordon.matthew0@gmail.com)
1-via e-mail (chris@h2asandiego.com)

REFERENCES

1. Albert & Hoy Engineering, Inc., "Grading Plan for 8-Unit Condominium Project on South Side of "B" Street Between 28th and 29th Street (2861 "B" Street)," dated "AsBuilt" December 2, 1981.

2. Allied Earth Technology, "Geotechnical Investigation, Proposed 46-Unit Townhome Site, West Side of 29th Street Between B Street and C Street, San Diego, California," dated May 10, 2001.

3. Allied Earth Technology, "Update of Geotechnical Investigation Report, Proposed Golden Hills Rowhomes Site, West Side of 29th Street, Between B Street and C Street, San Diego, California," dated May 15, 2013.

4. Alpha Laboratories, Inc., "Report of Preliminary Soils Investigation for 2861 B Street, San Diego, California," dated January 28, 1980.

5. Alpha Laboratories, Inc., "Report of Compacted Fill for 2861 "B" Street, San Diego, California," dated September 23, 1981.

6. American Society of Civil Engineers, "Minimum Design Loads for Buildings and other Structures, ASCE 7-10," dated 2010.

7. California Building Standards Commission, "California Building Code," 2013 Edition.

8. California Division of Mines and Geology, "Planning Scenario for a Major Earthquake, San Diego – Tijuana Metropolitan Area," Special Publication 100, dated 1990.

9. California Emergency Agency, "Tsunami Inundation Map for Emergency Planning, National City Quadrangle," dated June 1, 2009.

10. Cao, Tianging, et al, "The Revised 2002 California Probabilistic Seismic Hazard Maps," dated June 2003.

11. Christensen Engineering and Surveying, "Tentative Map, Preliminary Grading Plan, B Street Rowhomes, San Diego, CA," undated.

12. City of San Diego Development Services, "Seismic Safety Study, Geologic Hazards and Faults, Grid Tile 17," dated April 3, 2008.

13. City of San Diego Operating Department, "Plans for the improvement of B St. between the east line of 29th St and a line parallel to and distant 200' west from the west line of 29th St...," dated March 26, 1928.

REFERENCES

14. Hetherington Engineering, Inc., "Supplemental Geotechnical Investigation, Golden Hill Rowhomes, North Side of C Street, West of 29th Street, San Diego, California," dated January 7, 2014.

15. Hetherington Engineering, Inc., "As-Graded Geotechnical Report, Golden Hill Rowhomes, North Side of C Street, West of 29th Street, San Diego, California, PTS No. 339446," dated September 23, 2014.

16. ICBO, "Maps of Known Active Faults Near-Source Zones in California and Adjacent Portions of Nevada," dated February 1998.

17. Jennings, Charles W., "Fault Activity Map of California and Adjacent Areas," California Data Map Series, Map No. 6, dated 1994.

18. Kennedy, Michael P., "Geology of the San Diego Metropolitan Area, California," California Division of Mines and Geology, Bulletin 200, dated 1975.

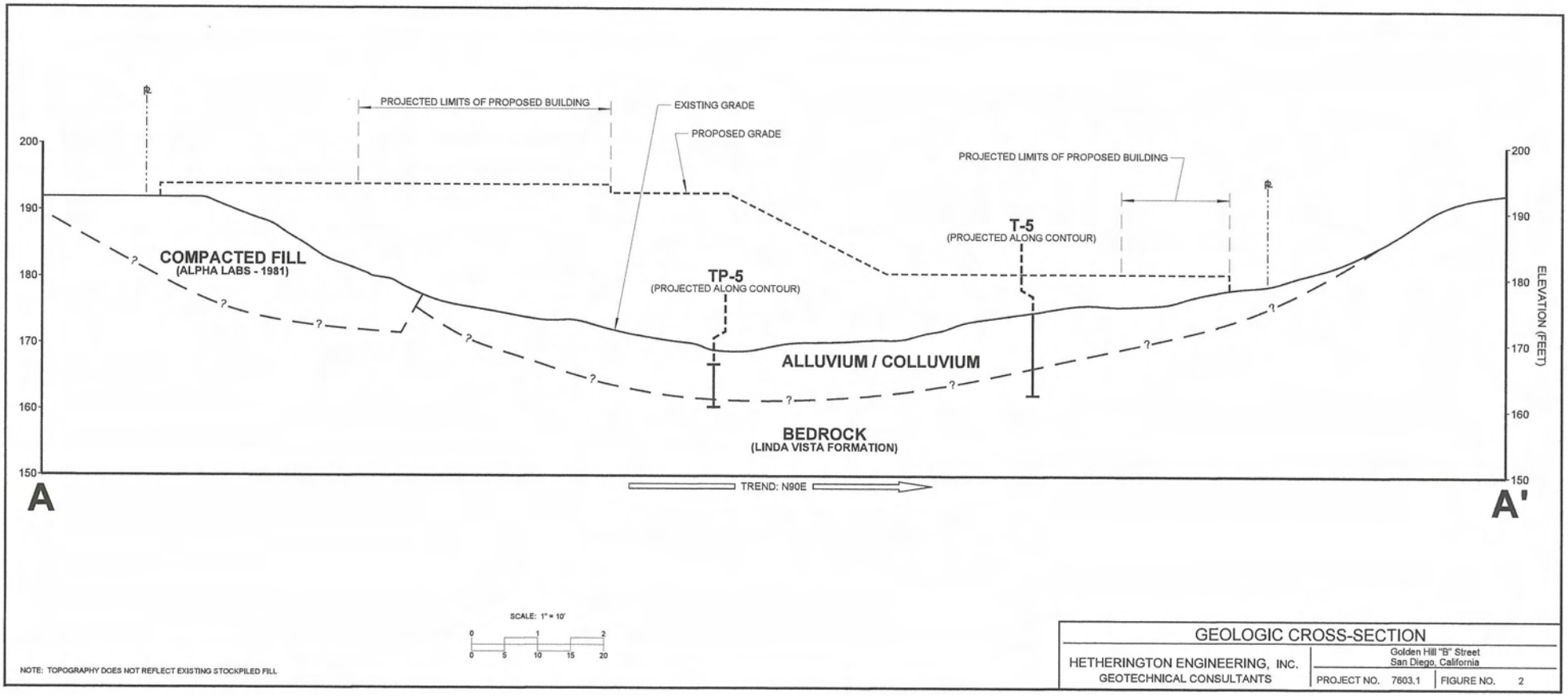
19. Kennedy, Michael P., et al., "Character and Recency of Faulting, San Diego Metropolitan Area, California," Special Report 123, dated 1975.

20. Peterson, M., Beeby, W., Bryant, W., et al., "Seismic Shaking Hazard Maps of California," California Division of Mines and Geology, Map Sheet 48, dated 1999.

21. Petersen, Mark P., "Documentation for the 2008 Update of the United States National Seismic Hazards Maps," USGS Open File Report 2008-1128, dated 2008.

22. Robert Prater Associates, "Soil Investigation, 29th & B Streets Condominiums, San Diego, California," dated December 30, 1980.

23. 2007 Working Group on California Earthquake Probability, "The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF-2)," USGS Open File Report 2007-1437 and CGS Special Report 203, dated 2008.



SCALE: 1" = 10'

0 1 2
0 5 10 15 20

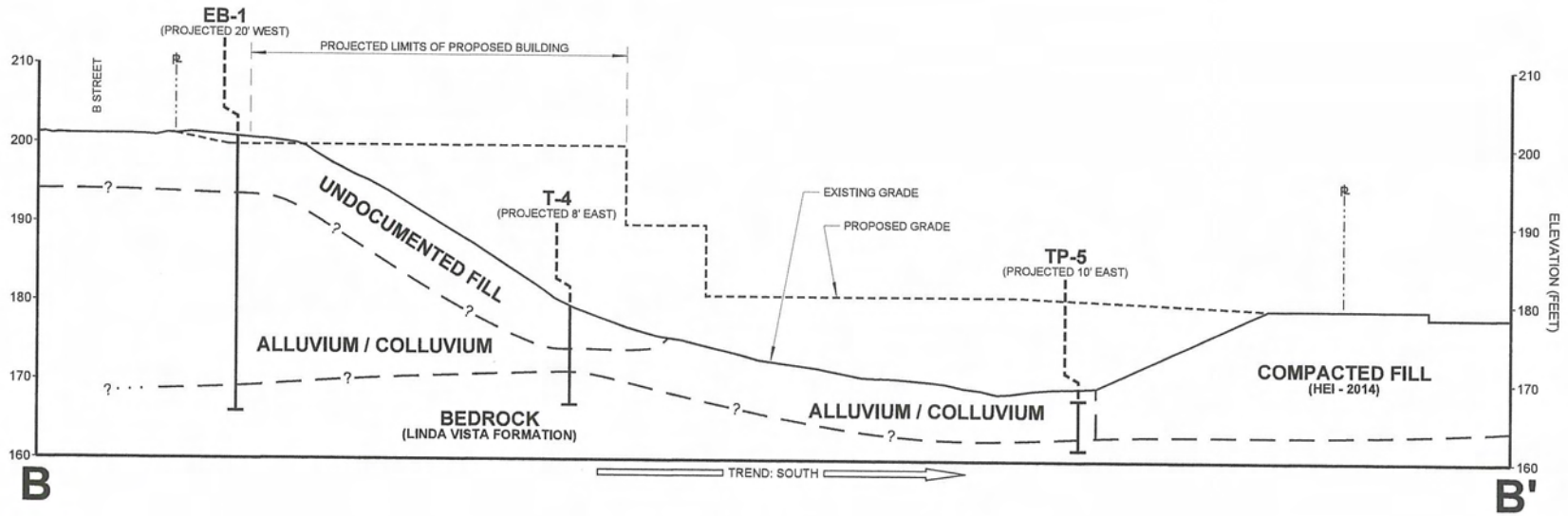
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 2



SCALE: 1" = 10'

0 1 2
0 5 10 15 20

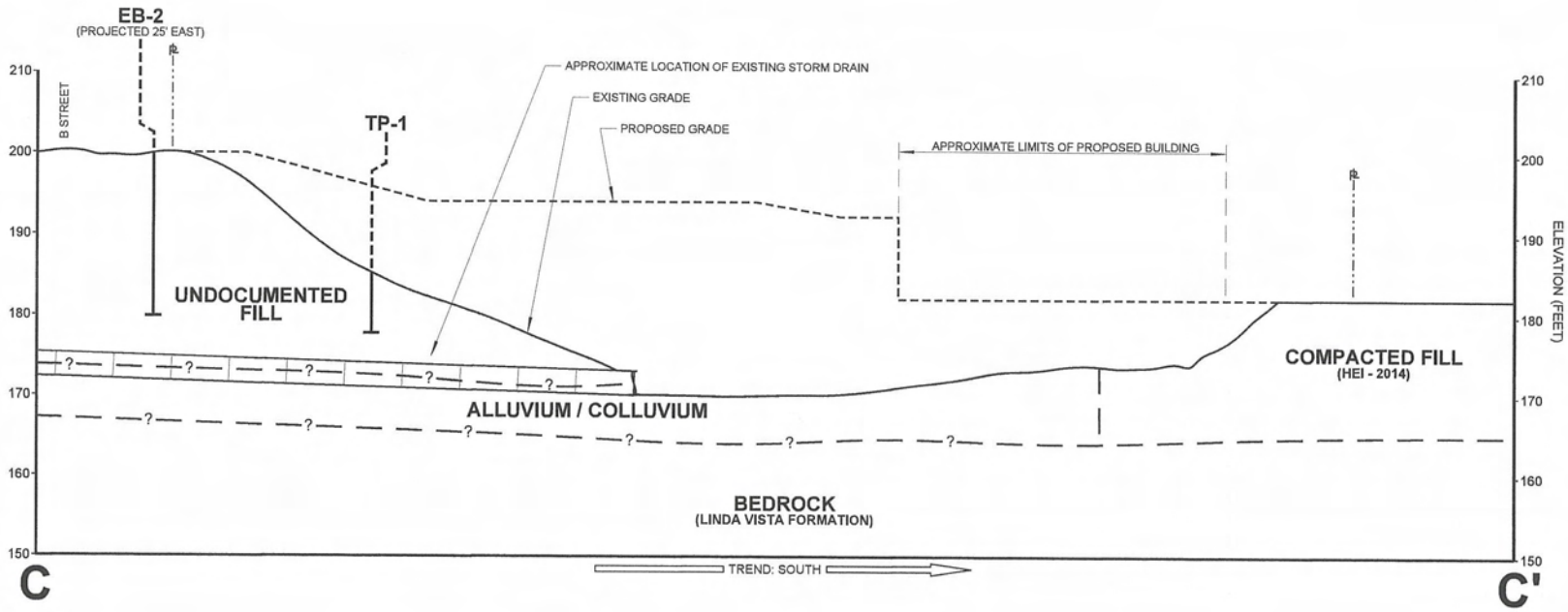
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 3



SCALE: 1" = 10'

0 1 2
0 5 10 15 20

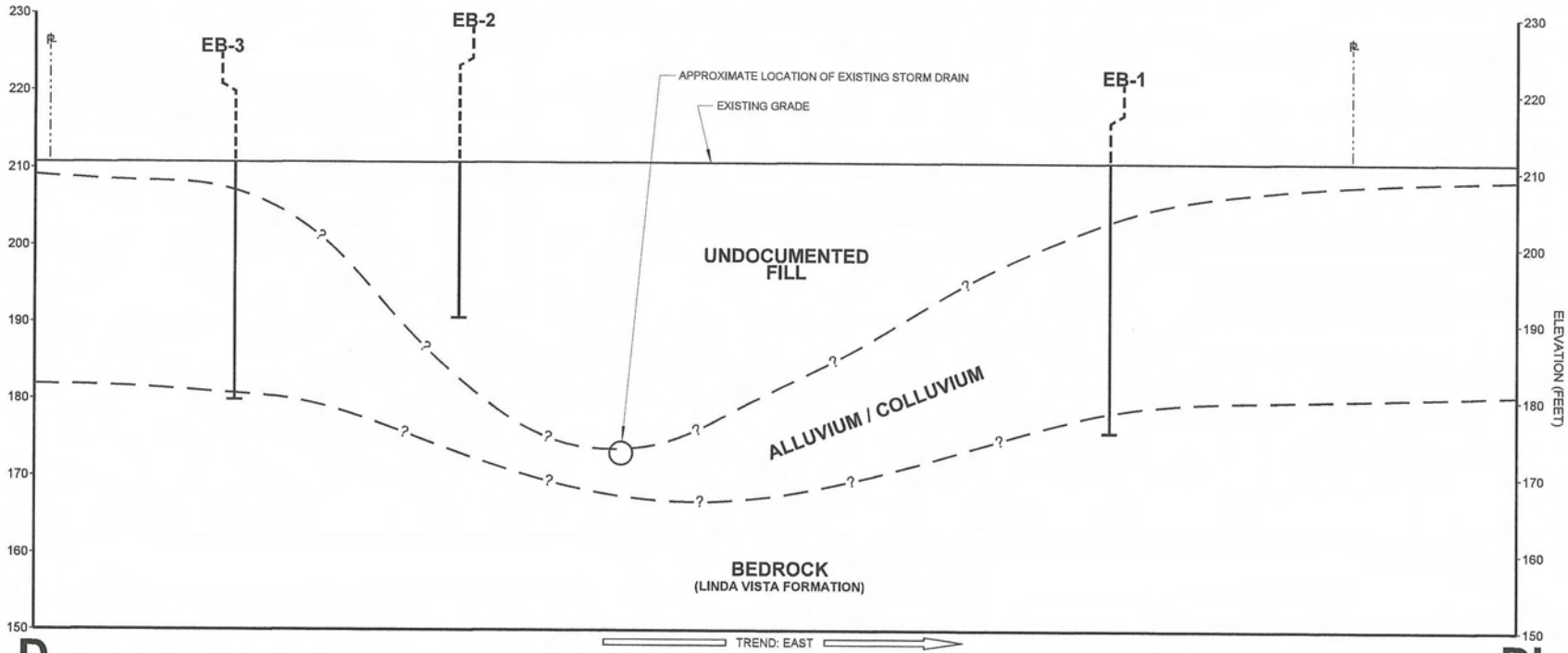
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 4



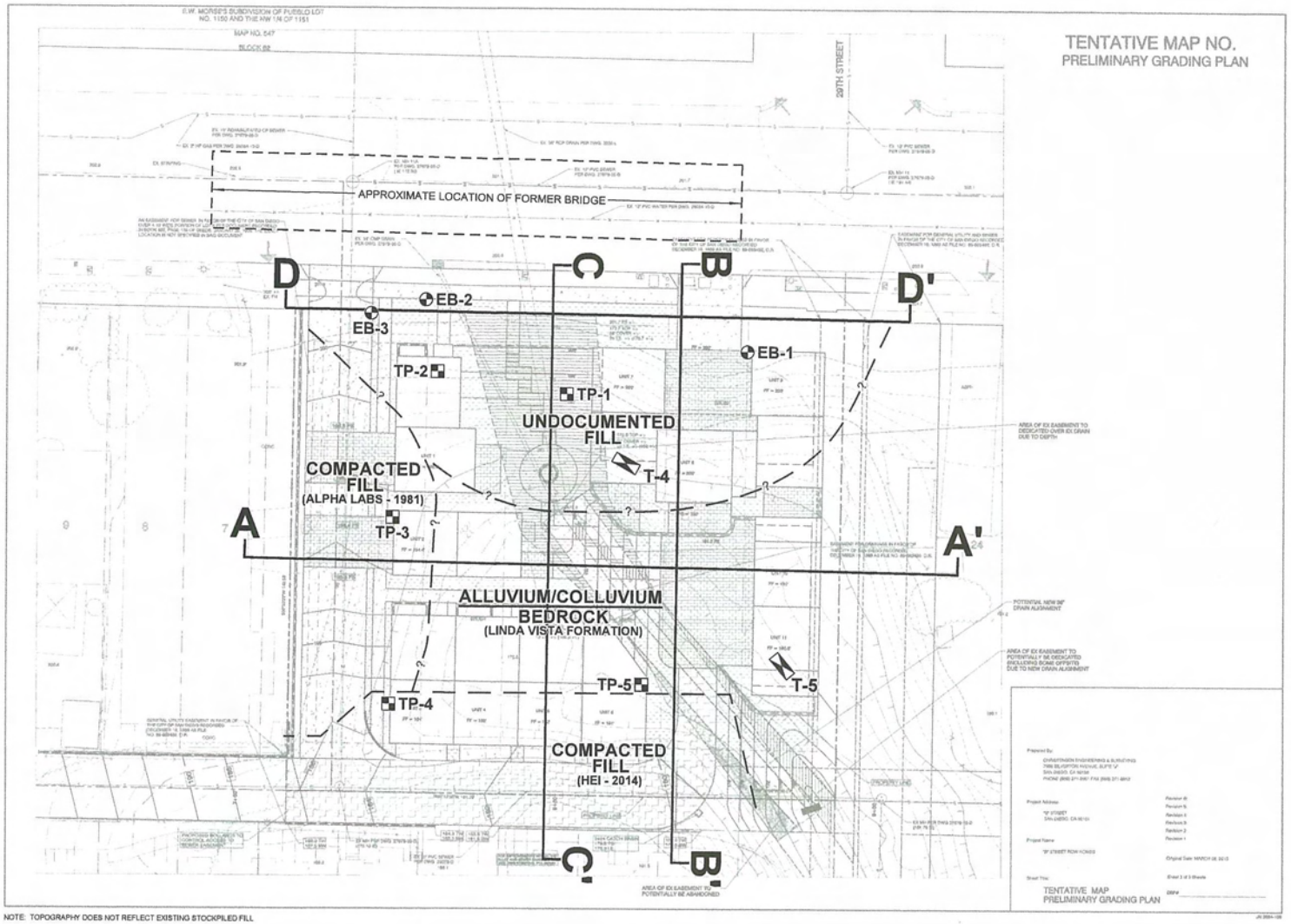
NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

GEOLOGIC CROSS-SECTION

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | FIGURE NO. 5



NOTE: TOPOGRAPHY DOES NOT REFLECT EXISTING STOCKPILED FILL

LEGEND

T-5	APPROXIMATE LOCATION OF TEST PIT BY ALLIED EARTH TECHNOLOGY (2001)
EB-3	APPROXIMATE LOCATION OF BORING BY ROBERT PRATER ASSOCIATES (1980)
TP-5	APPROXIMATE LOCATION OF TEST PIT BY ROBERT PRATER ASSOCIATES (1980)
?	APPROXIMATE LOCATION OF GEOLOGIC CONTACT (QUERRIED WHERE UNCERTAIN)
B B'	GEOLOGIC CROSS-SECTION

SCALE: 1" = 20'

0 10 20 30 40

0 1 2

GEOLOGIC MAP

HETHERINGTON ENGINEERING, INC.
GEOTECHNICAL CONSULTANTS

Golden Hill "B" Street
San Diego, California

PROJECT NO. 7603.1 | PLATE NO. 1

APPENDIX A
Robert Prater Associates Data

02 11 2000

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 196 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER None	BORING DIAMETER 6 Inches	DATE DRILLED 11/19/80

DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
GRAVEL AND COBBLES, with pieces of asphalt and concrete rubble Note: "x" denotes jar sample taken from auger cuttings. FILL		grayish brown	loose	GP	1 2 3 4 5 6	x				
INTERBEDDED SILTY AND CLAYEY SAND, with lenses of gravel and cobbles		reddish & gray-ish brown	medium dense	SM/SC	7 8 9	x	21	6		
					10 11 12 13 14 15		16	7		
					16 17 18 19 20	x	27			
(continued)										

ROBERT PRATER ASSOCIATES
Consulting Soil, Foundation & Geological Engineers

EXPLORATORY BORING LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	BORING NO.
132-34	December 1980	1 (pg. 1)

02 11 2000

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 196 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER None	BORING DIAMETER 6 Inches	DATE DRILLED 11/19/80

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
INTERBEDDED SILTY AND CLAYEY SAND, with lenses of gravel and cobbles		reddish & grayish brown	medium dense	SM/SC	21 22 23 24 25 26 27 28 29 30	X	67	13		
					31 32					
SILTY SAND, formational sandstone		grayish brown	very dense	SM	33 34 35		50/6"			
Bottom of Boring = 35 Feet										

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil, Foundation & Geological Engineers

EXPLORATORY BORING LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	BORING NO
132-34	December 1980	1 (Pg. 2)

02 11 2000

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 195 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER None	BORING DIAMETER 6 Inches	DATE DRILLED 11/19/80

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST	SOIL TYPE						
SILTY SAND, with occasional gravel and cobbles (FILL)		yellowish brown	loose	SM	1					
					2					
Note: "x" denotes jar sample taken from auger cuttings.					3	x				
					4					
					5					
					6					
					7					
					8	x		5		
					9					
CLAYEY SAND (FILL)		grayish brown	loose-medium dense	SC	10					
					11					
					12					
					13					
					14					
					15	x		14		
					16					
					17					
					18					
Bottom of Boring = 20 Feet					19					
					20					

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil, Foundation & Geological Engineers

EXPLORATORY BORING LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	BORING NO.
132-34	December 1980	2

02 11 2000

DRILL RIG Continuous Flight Auger	SURFACE ELEVATION 195 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER None	BORING DIAMETER 6 Inches	DATE DRILLED 11/19/80

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SILTY SAND		yellowish brown	loose	SM	1					
FILL					2	x		7		
CLAYEY SAND		reddish brown	medium dense	SC	3					
					4					
					5					
					6					
					7					
					8	x		6		
					9					
					10					
					11		10			
					12					
					13					
					14					
		dark reddish brown			15	s				
					16					
					17					
					18					
					19					
					20					

Notes: 1) "x" denotes jar sample taken from auger cuttings.
2) "s" denotes sack sample taken from auger cuttings.

(continued)

ROBERT PRATER ASSOCIATES
Consulting Soil, Foundation & Geological Engineers

EXPLORATORY BORING LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	BORING NO
132-34	December 1980	3 (pg. 1)

DRILL RIG	Continuous Flight Auger	SURFACE ELEVATION	195 (approx.)	LOGGED BY	LTJ
DEPTH TO GROUNDWATER	None	BORING DIAMETER	6 Inches	DATE DRILLED	11/19/80

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
CLAYEY SAND		dark reddish brown	medium dense	SC	21		14			
					22					
					23					
					24					
					25					
					26					
					27					
					28					
SILTY SAND, formational sandstone		grayish brown	very dense	SM	29		40			
Bottom of Boring = 30 Feet					30					

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

EXPLORATORY BORING LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO	DATE	BORING NO
132-34	December 1980	3 (pg. 2)

02 11 2000

RIG	Case 580-C Backhoe	SURFACE ELEVATION 185 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER	None	Test pit excavated with a 24-inch bucket on 11/19/80	

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	Dry Density (pcf)
DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST.	SOIL TYPE						
SILTY AND CLAYEY SAND with gravel, cobbles, asphalt, and concrete rubble		brown	loose	SM/SC	1	x				
					2					
Notes: 1) "x" denotes jar sample taken from cuttings.		yellowish brown			3	x				
2) "s" denotes sack sample taken from cuttings.					4	s		9		98.3
FILL					5			8		100.3
SILTY SAND-POORLY GRADED SAND, with gravel and cobbles		light grayish brown	medium dense	SM-SP	6					
					7	x		2		
					8					
Bottom of Test Pit = 8 Feet										

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

EXPLORATORY TEST PIT LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	TEST PIT NO.
132-34	December 1980	1

02 11 2000

RIG	Case 580-C backhoe	SURFACE ELEVATION 180 (approx.)	LOGGED BY	LTJ
DEPTH TO GROUNDWATER	None	Test pit excavated with a 24-inch bucket on 11/19/80		

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	Dry Density (pcf)
SILTY AND CLAYEY SAND, with asphalt and concrete rubble		brown	loose	SM/SC	1					
Notes: 1) "x" denotes jar sample taken from cuttings.					2	x		8		101.1
2) "s" denotes sack sample taken from cuttings.		yellowish brown and brown			3			9		87.0
3) "⊠" denotes hand driven tube sample.					4					
					5	x		5		
					6					
					7	s				
					8					
					9	x				
FILL					10					
CLAYEY SAND-POORLY GRADED SAND		reddish brown	medium dense	SC-SP	11	x		6		
					12					
SILTY SAND, formational sandstone		yellowish brown	dense	SM	13	⊠				
					14	x				
					15					
Bottom of Test Pit = 15 Feet										

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

EXPLORATORY TEST PIT LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	TEST PIT NO.
132-34	December 1980	2

02 11 2000

RIG Case 580-C Backhoe	SURFACE ELEVATION 177 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER None	Test excavated with a 24-inch bucket on 11/19/80	

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SILTY AND CLAYEY SAND Note: "x" denotes jar sample taken from cuttings.		grayish brown	loose	SM/SC	1	x				
SILTY SAND, with some scattered gravel and cobbles		reddish brown	medium dense	SM	2 3 4 5	x				
POORLY GRADED SAND AND GRAVEL		yellow-ish gray	medium dense	SP/GP	6 7 8	x		2		
SILTY SAND, formational sand-stone		yellow-ish brown	dense	SM	9	x		7		
Bottom of Test Pit = 10 Feet					10					

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

EXPLORATORY TEST PIT LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	TEST PIT NO.
132-34	December 1980	3

02 11 2000

RIG Case 580-C Backhoe	SURFACE ELEVATION 168 (approx.)	LOGGED BY LTJ
DEPTH TO GROUNDWATER None	Test pit excavated with a 24-inch bucket on 11/19/80	

DESCRIPTION AND REMARKS	SYMBOL	COLOR	CONSIST	SOIL TYPE	DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT)	WATER CONTENT (%)	SHEAR STRENGTH BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
SILTY AND CLAYEY SAND Note: "x" denotes jar sample taken from cuttings.		grayish brown	loose	SM/SC	1 2	x				
SILTY SAND		reddish brown	medium dense	SM	3 4 5 6	x		10		
SILTY SAND, formational sandstone		yellowish brown	dense	SM	7 8	x				
Bottom of Test Pit = 8 Feet										

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

EXPLORATORY TEST PIT LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO.	DATE	TEST PIT NO.
132-34	December 1980	4

02 11 2000

RIG	Case 580-C Backhoe	SURFACE ELEVATION	161 (approx.)	LOGGED BY	LTJ
DEPTH TO GROUNDWATER	None	Test Pit excavated with a 24-inch bucket on 11/19/80			

DESCRIPTION AND CLASSIFICATION					DEPTH (FEET)	SAMPLER	PENETRATION RESISTANCE (BLOWS/FT.)	WATER CONTENT (%)	SHEAR STR. BY TORVANE (KSF)	UNCONFINED COMPRESSIVE STRENGTH (KSF)
DESCRIPTION AND REMARKS	SYM-BOL	COLOR	CONSIST.	SOIL TYPE						
SILTY AND CLAYEY SAND, with some scattered cobbles		dark grayish brown	loose	SM/SC	1					
					2					
Notes: 1) "s" denotes sack sample taken from cuttings. 2) "x" denotes jar sample taken from cuttings.					3	s				
					4					
SILTY SAND-POORLY GRADED SAND, formational sandstone		yellowish brown	dense	SM-SP	5	x		12		
					6					
Bottom of Test Pit = 6 Feet										

Note: The stratification lines represent the approximate boundary between material types and the transition may be gradual.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

EXPLORATORY TEST PIT LOG

29TH & B STREETS CONDOMINIUMS
San Diego, California

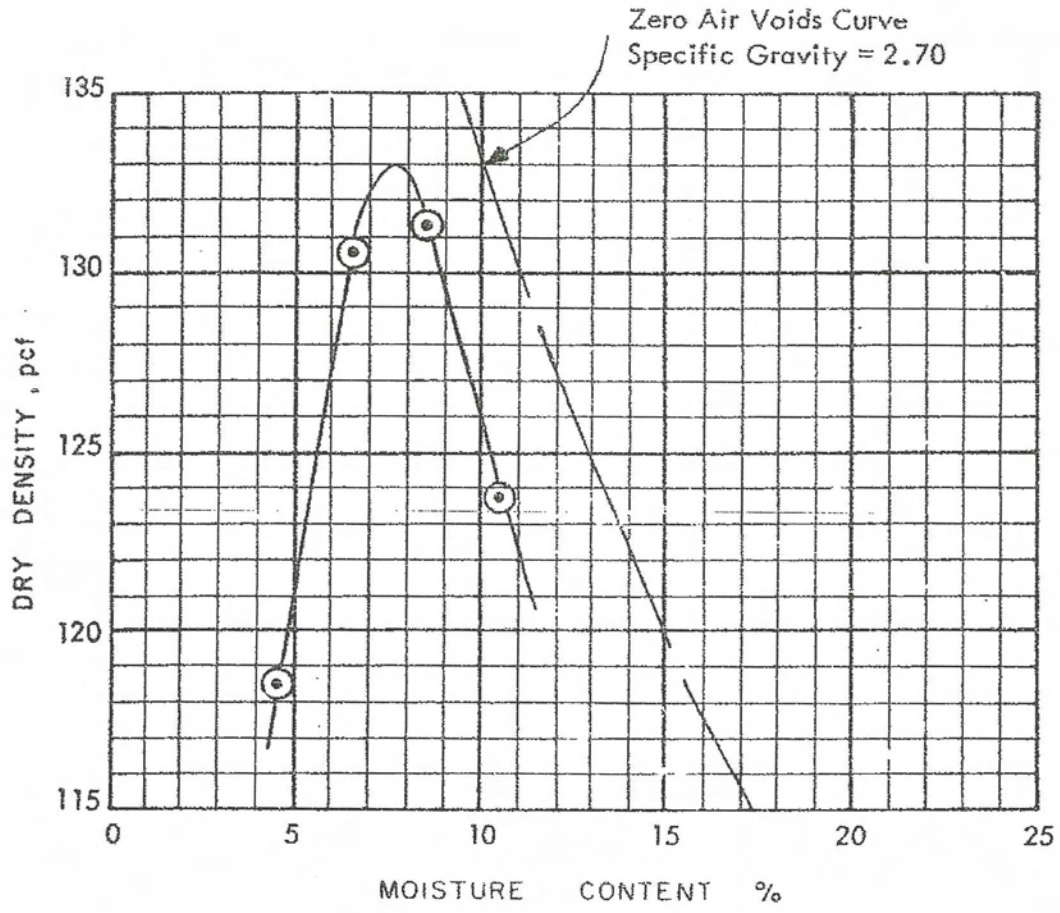
PROJECT NO.	DATE	TEST PIT NO.
132-34	December 1980	5

TABLE B-1

RESULTS OF NO. 200 SIEVE TESTS

Exploratory Boring/Test Pit No.	Sample Depth (Feet)	Sample Description	Percent Passing No. 200 Sieve
EB-1	9	SILTY SAND (SM), reddish brown	24
EB-1	29	CLAYEY SAND (SC), grayish brown	20
EB-3	15	CLAYEY SAND (SC), dark brown	32
TP-1	7	SILTY SAND-POORLY GRADED SAND (SM-SP), light grayish brown	8
TP-2	11	CLAYEY SAND-POORLY GRADED SAND (SC-SP), reddish brown	8
TP-3	8	POORLY GRADED SAND (SP), yellowish gray	4
TP-3	9	SILTY SAND (SM), yellowish brown	17
TP-5	5-1/2	SILTY SAND-POORLY GRADED SAND (SM-SP), yellowish brown	8

SAMPLE NO	DEPTH (FT.)	SAMPLE DESCRIPTION	SPECIFIC GRAVITY	LIQUID LIMIT (%)	PLASTIC INDEX
EB-3	15	CLAYEY SAND (SC), dark reddish brown	---	---	---



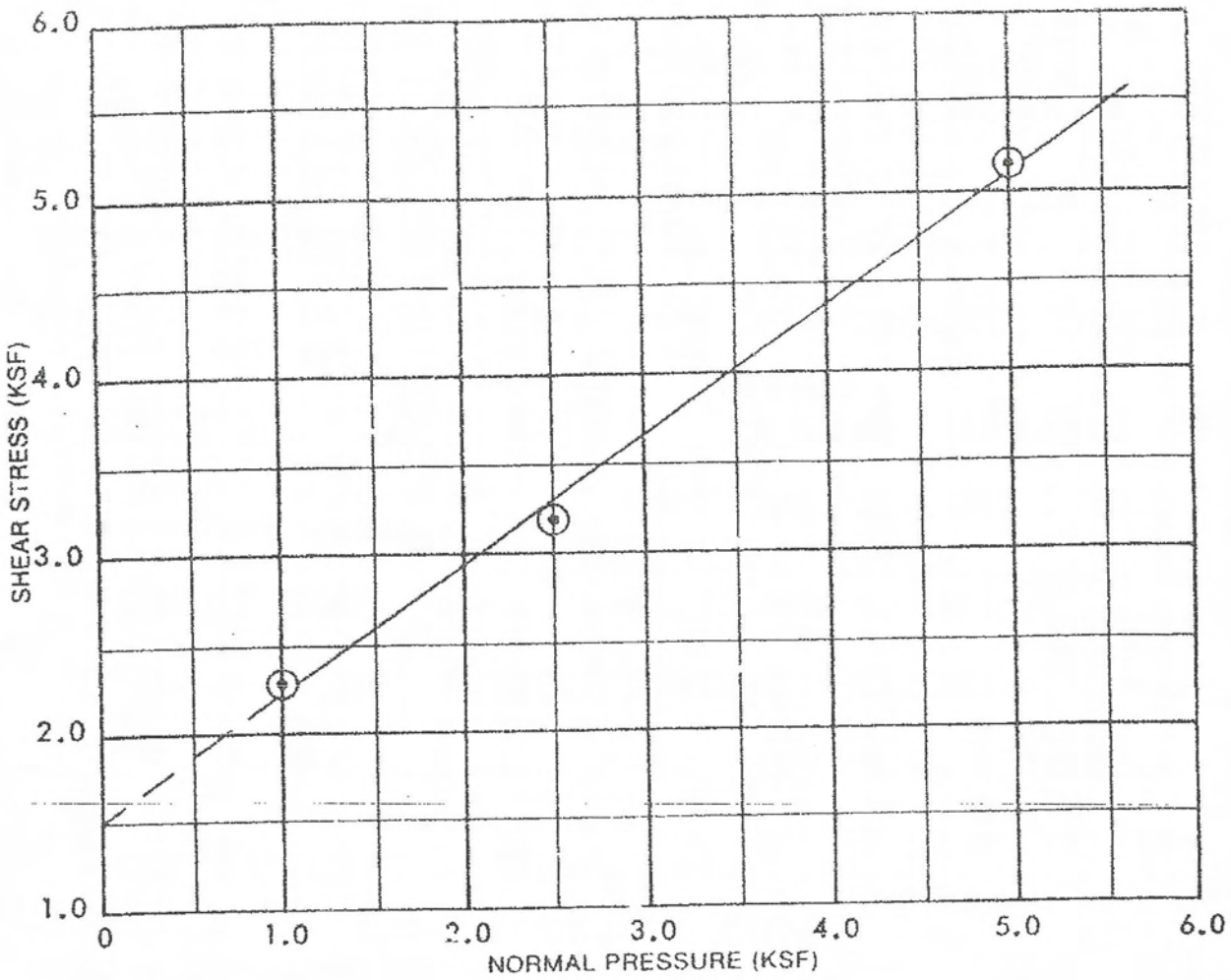
OPTIMUM WATER CONTENT %	7.7
MAXIMUM DRY DENSITY, pcf	133.0
TEST DESIGNATION	ASTM D 1557-78

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

COMPACTION TEST RESULTS

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO	DATE	FIGURE
132-34	December 1980	B-1



SAMPLE DATA	
DESCRIPTION	SILTY SAND (SM), reddish brown
BORING NO	1
DEPTH (ft)	9
ELEVATION (ft)	---

TEST RESULTS	
APPARENT COHESION (C)	1.50 ksf
APPARENT ANGLE OF INTERNAL FRICTION (Φ)	35°

TEST DATA				
TEST NUMBER	1	2	3	4
NORMAL PRESSURE (KSF)	1.00	2.50	5.00	
SHEAR STRENGTH (KSF)	2.28	3.19	5.15	
INITIAL H$_2$O CONTENT (%)	6	6	6	
FINAL H$_2$O CONTENT (%)	---	---	---	
INITIAL DRY DENSITY (PCF)	111.5	111.5	111.5	
FINAL DRY DENSITY (PCF)	---	---	---	
STRAIN RATE	0.02 inches/minute (approx.)			

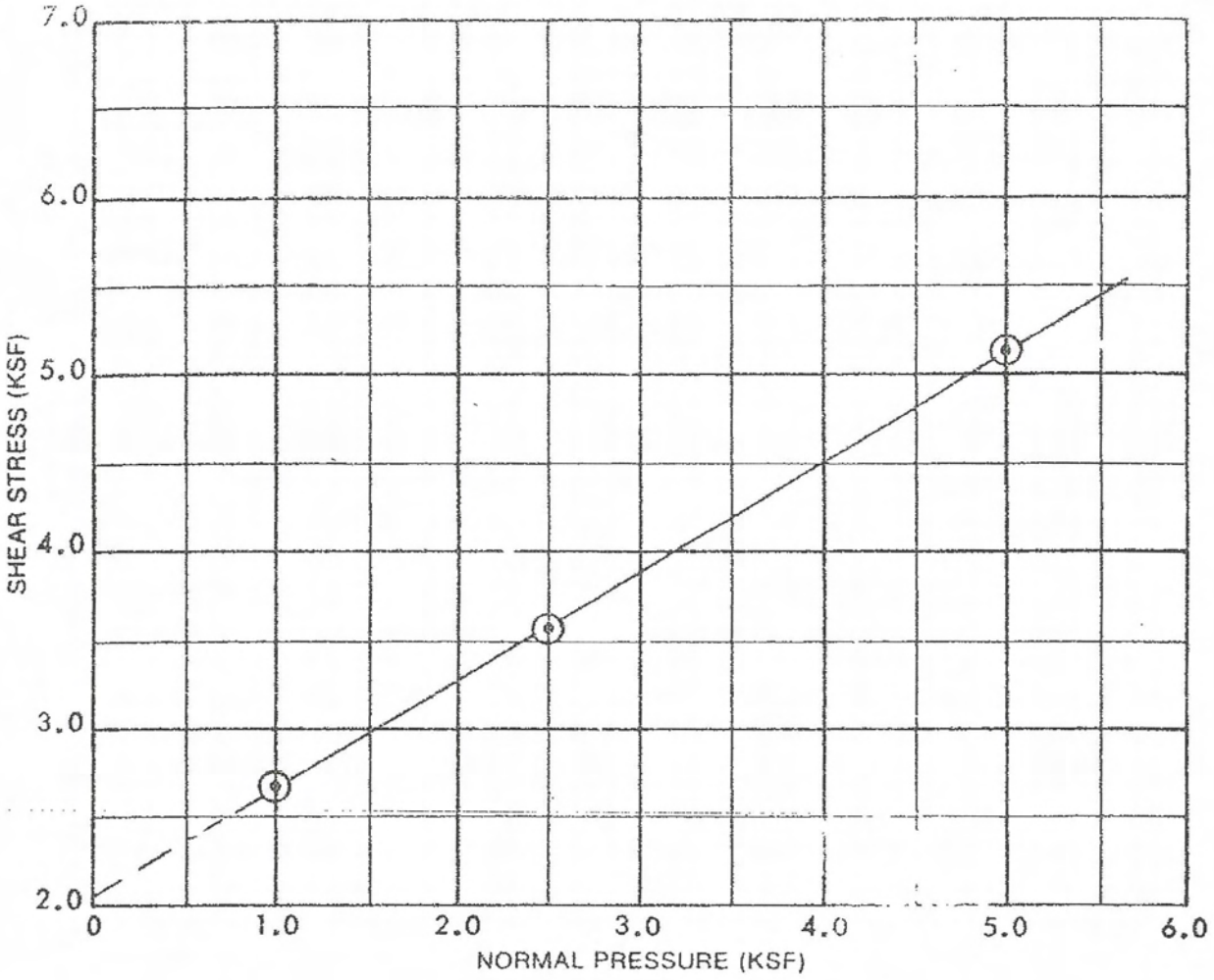
Note: Test was performed on a sample recovered with a California sampler.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

DIRECT SHEAR TEST DATA

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO	DATE	
132-34	December 1980	Figure B-2



SAMPLE DATA	
DESCRIPTION	CLAYEY SAND (SC), grayish brown
BORING NO	1
DEPTH (ft.)	29
ELEVATION (ft)	---
TEST RESULTS	
APPARENT COHESION (C)	2.05 ksf
APPARENT ANGLE OF INTERNAL FRICTION (Φ)	31°

TEST DATA				
TEST NUMBER	1	2	3	4
NORMAL PRESSURE (KSF)	1.00	2.50	5.00	
SHEAR STRENGTH (KSF)	2.69	3.57	5.12	
INITIAL H_2O CONTENT (%)	13	13	13	
FINAL H_2O CONTENT (%)	---	---	---	
INITIAL DRY DENSITY (PCF)	119.3	119.3	119.3	
FINAL DRY DENSITY (PCF)	---	---	---	
STRAIN RATE	0.02 inches/minute (approx.)			

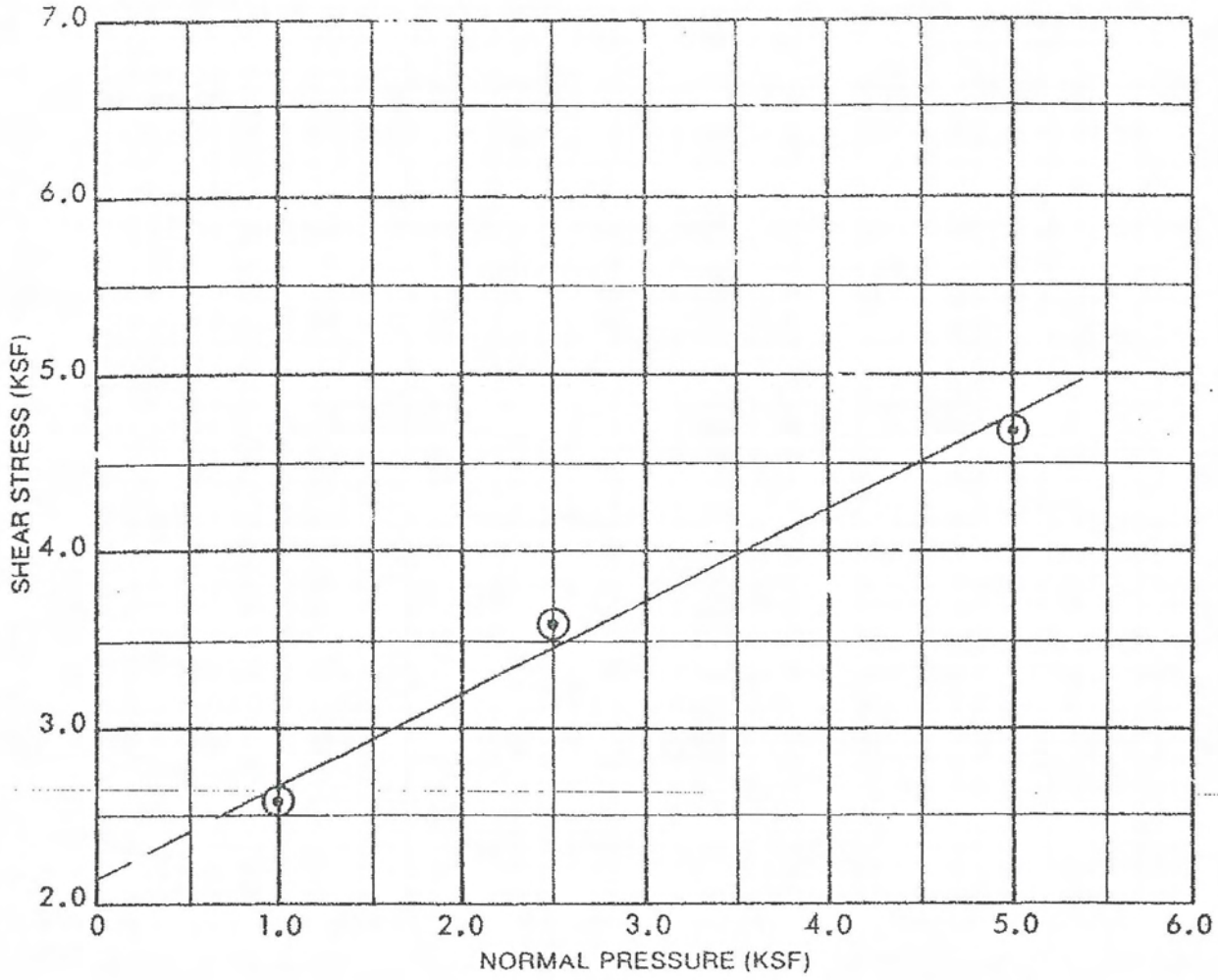
Note: Test was performed on a sampler recovered with a California sampler.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

DIRECT SHEAR TEST DATA

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO	DATE	
132-34	December 1980	Figure B-3



SAMPLE DATA	
DESCRIPTION:	CLAYEY SAND (SC), dark reddish brown
BORING NO.	3
DEPTH (ft.)	15
ELEVATION (ft)	---
TEST RESULTS	
APPARENT COHESION (C)	2.15 ksf
APPARENT ANGLE OF INTERNAL FRICTION (Φ)	27°

TEST DATA				
TEST NUMBER	1	2	3	4
NORMAL PRESSURE (KSF)	1.00	2.50	5.00	
SHEAR STRENGTH (KSF)	2.58	3.60	4.66	
INITIAL H_2O CONTENT (%)	9	9	9	
FINAL H_2O CONTENT (%)	---	---	---	
INITIAL DRY DENSITY (PCF)	119.0	119.0	119.0	
FINAL DRY DENSITY (PCF)	---	---	---	
STRAIN RATE	0.02 inches/minute (approx.)			

Note: Test was performed on a sample remolded to approximately 90 percent of the laboratory maximum density.

ROBERT PRATER ASSOCIATES
Consulting Soil Foundation & Geological Engineers

DIRECT SHEAR TEST DATA

29TH & B STREETS CONDOMINIUMS
San Diego, California

PROJECT NO	DATE	
132-34	December 1980	Figure B-4

APPENDIX B
Allied Earth Technology Data

TRENCH LOG SHEET

TRENCH NO. 4

FT	DESCRIPTION	SOIL TYPE
0 1 2 3 4 5	Brown, damp, loose (undocumented fill) Broken pieces of concrete and asphalt, pebbles to 4" dia. Pockets of clayey sand	SILTY FINE SAND (SM)
6 7 8	Light grayish brown, moist. Loose to slightly dense Gravel and cobbles (alluvium/colluvium)	SILTY SAND (SM)
9 10 11 12	Yellowish brown, moist, dense Slightly cemented (San Diego Formation)	SILTY SAND (SM)

BOTTOM OF TRENCH (No Refusal)

Project No. 01-1289E3

Figure No. 6

TRENCH LOG SHEET

TRENCH NO. 5

FT	DESCRIPTION	SOIL TYPE
0 1 2 3 4 5	Dark grayish brown, damp, loose Some scattered cobbles Pockets of clayey sand (alluvium/colluvium) ①	SILTY FINE SAND (SM)
6 7 8	Yellowish brown, moist, dense Gravel and cobbles (alluvium/colluvium)	SILTY SAND (SM)
9 10 11 12	Yellowish brown, moist, dense Slightly cemented (San Diego Formation)	SILTY SAND (SM)

BOTTOM OF TRENCH (No Refusal)

Project No. 01-1289E3

Figure No. 7