# Priority Development Project (PDP)
# Storm Water Quality Management Plan (SWQMP)

Bella Mar Apartments

[Insert Permit Application Number]

[Insert Drawing Number (if applicable) and Internal Order Number (if applicable)]

☐ **Check if electing for offsite alternative compliance**

**Engineer of Work:**


Bryan D Smith, RCE 75822 Exp. 06/30/20

Provide Wet Signature and Stamp Above Line

**Prepared For:**

Red Tail Acquisitions, LLC

2082 Michelson Drive, 4th Floor

Irvine, CA 92612

(949) 433-5610

**Prepared By:**

FUSCOE ENGINEERING

Fuscoe Engineering, Inc.

6390 Greenwich Dr., Suite 170

San Diego, CA 92122

858-554-1500

**Date:**

November 25, 2020

Approved by: City of San Diego Date

The City of SAN DIEGO

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Project Name: Bella Mar Apartments

# Table of Contents

- Attachment 3: Structural BMP Maintenance Plan
    - Maintenance Agreement (Form DS-3247) (when applicable)
- Attachment 4: Copy of Plan Sheets Showing Permanent Storm Water BMPs
- Attachment 5: Project's Drainage Report
- Attachment 6: Project's Geotechnical and Groundwater Investigation Report

# 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:**
**Permit Application**

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

75822 — PE#

06/30/20 — Expiration Date

Bryan Smith

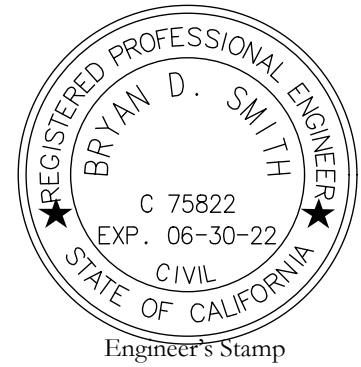
Print Name

Fuscoe Engineering

Company

11/25/20

Date




Engineer's Stamp

Project Name: Bella Mar Apartments

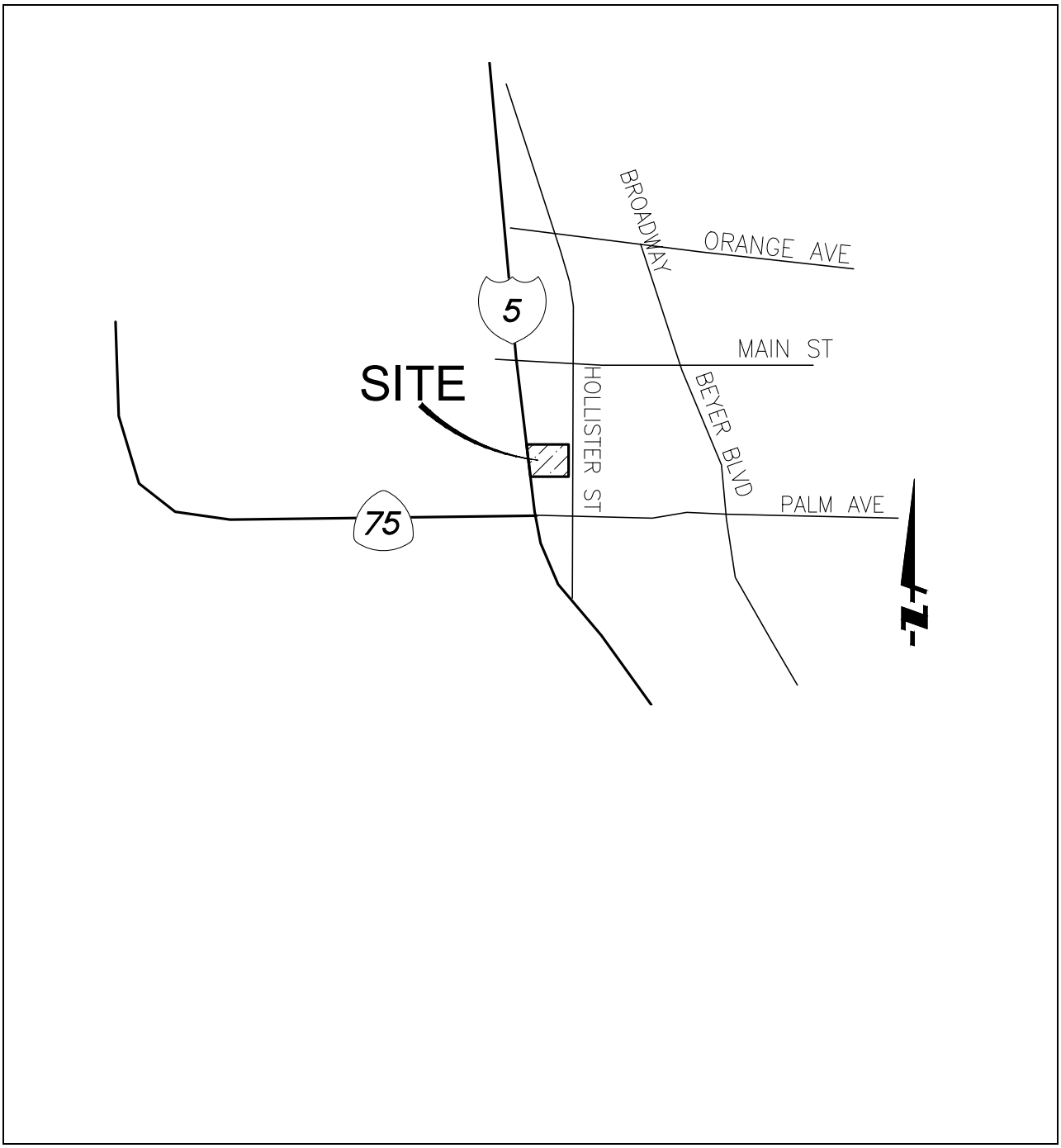
# Submittal Record

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 plancheck comments is included. When applicable, insert response to plancheck comments.

| Submittal Number | Date | Project Status | Changes |
|---|---|---|---|
| **1** | 02/15/19 | ☑ **Preliminary Design/Planning/CEQA**<br>☐ **Final Design** | **Initial Submittal** |
| **2** | 10/15/19 | ☑ **Preliminary Design/Planning/CEQA**<br>☐ **Final Design** | Appendix B Worksheetsadded |
| **3** | 11/25/20 | ☑ **Preliminary Design/Planning/CEQA**<br>☐ **Final Design** | Modified Green Streets |
| **4** | | ☐ **Preliminary Design/Planning/CEQA**<br>☐ **Final Design** | |

# Project Vicinity Map

**Project Name:** Bella Mar Apartments
**Permit Application**



# City of San Diego Form DS-560 Storm Water Requirements Applicability Checklist

Attach DS-560 form.

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

# Storm Water Requirements Applicability Checklist

**FORM**
**DS-560**
November 2018

| Project Address: 408 HOLLISTER STREET | Project Number: |
|---|---|

## 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 Regional Water Quality Control Board.

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

**PART A: Determine Construction Phase Storm Water Requirements.**

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

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

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

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

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

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

4. Does the project only include the following Permit types listed below?

- Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
- 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 below, 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 Priority

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

**Complete PART B and continued to Section 2**

**1.** ☐ **ASBS**

a. Projects located in the ASBS watershed.

**2.** ☐ **High Priority**

a. Projects that qualify as Risk Level 2 or Risk Level 3 per the Construction General Permit (CGP) and not located in the ASBS watershed.

b. Projects that qualify as LUP Type 2 or LUP Type 3 per the CGP and not located in the ASBS watershed.

**3.** ☐ **Medium Priority**

a. Projects that are not located in an ASBS watershed or designated as a High priority site.

b. Projects that qualify as Risk Level 1 or LUP Type 1 per the CGP and not located in an ASBS watershed.

c. WPCP projects (>5,000sf of ground disturbance) located within the Los Penasquitos watershed management area.

**4.** ☐ **Low Priority**

a. Projects not subject to a Medium or High site priority designation and are not located in an ASBS watershed.

## 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 |

Clear Page 2

**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.

**PART E: Determine if Project is a Priority Development Project (PDP).**

Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

**If "yes" is checked for any number in PART E, continue to PART F and check the box labeled "Priority Development Project".**

**If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard 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

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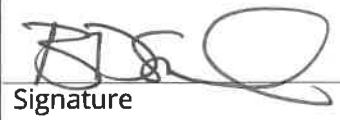
| | | |
|---|---|---|
| 7. | **New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "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 PERMANENT 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 | ☒ |

| | |
|---|---|
| Bryan D Smith | Civil Engineer |
| Name of Owner or Agent *(Please Print)* | Title |
|  | 3.4.19 |
| Signature | Date |

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 PERMANENT 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 ☐

| Bryan D Smith, PE | Civil Engineer |
|---|---|
| Name of Owner or Agent *(Please Print)* | Title |
| Signature | Date |

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Project Name: Bella Mar Apartments

| Applicability of Permanent, Post-Construction Storm Water BMP Requirements | | Form I-1 |
|---|---|---|
| **Project Identification** | | |
| Project Name: Bella Mar Apartments | | |
| Permit Application Number: | | Date: |
| **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.<br><br>Answer each step below, starting with **Step 1** and progressing through each step until reaching "Stop". Refer to the manual 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 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, PDP, or PDP Exempt?<br>To answer this item, see Section 1.4 of the manual in its entirety for guidance AND complete Form DS-560, 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: | | |

Project Name: Bella Mar Apartments

| Form I-1 Page 2 of 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 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 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:<br>The project discharges into the Otay River and ultimately San Diego Bay. Hydromod exempt because discharge point is at or below 10-yr base elevation. See supporting documentation in attachment 2 | | |
| **Step 5.** Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the 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:<br>There are no CCSYAs on site and the site does not impact any upstream CCSYAs. | | |

# HMP Exemption Exhibit

Attach a HMP Exemption Exhibit that shows direct storm water runoff discharge from the project site to HMP exempt area. Include project area, applicable underground storm drain line and/or concrete lined channels, outfall information and exempt waterbody.
Reference applicable drawing number(s).

**Exhibit must be provided on 11"x17" or larger paper.**

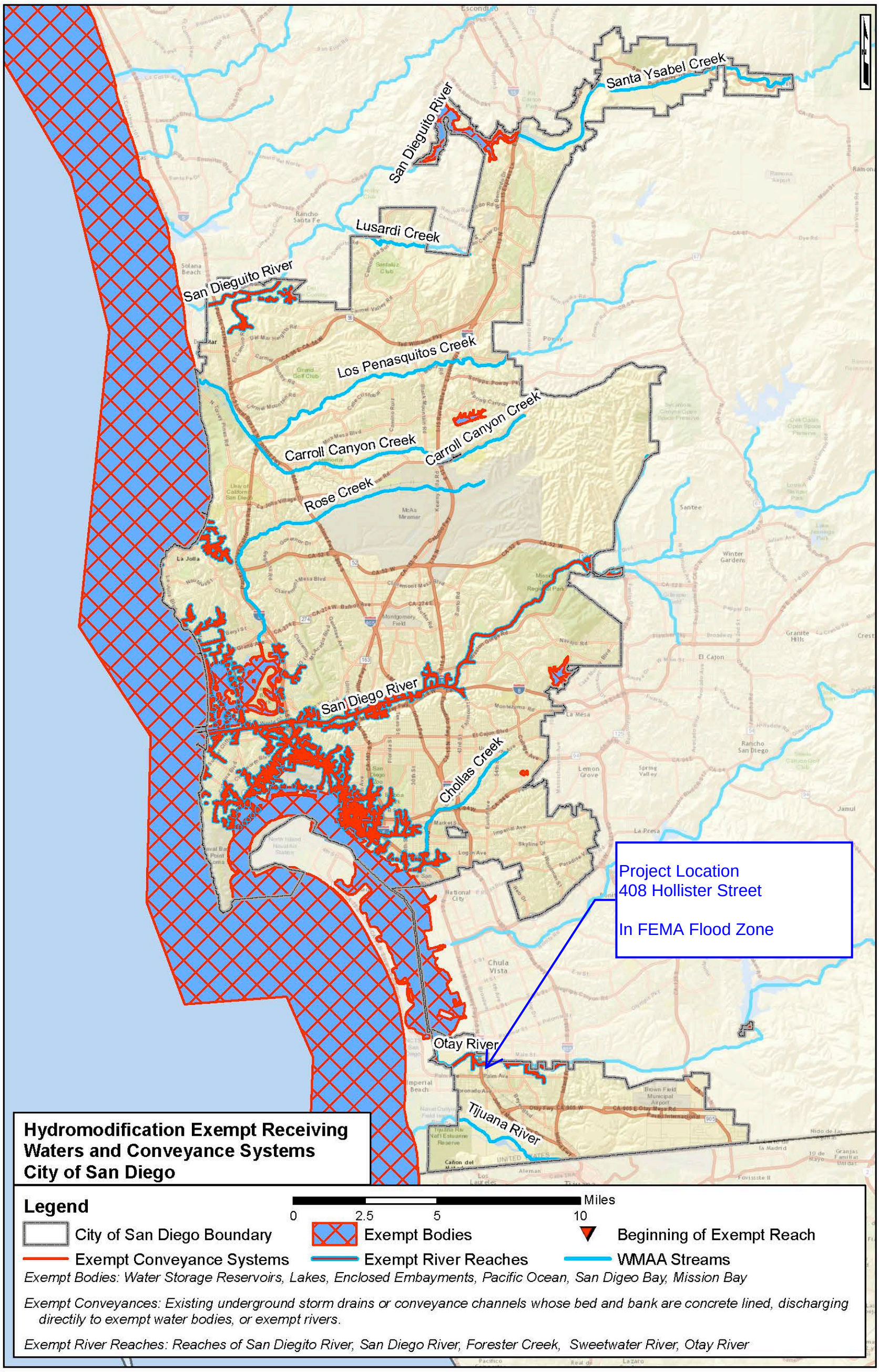


**Figure H.9-2 : Hydromodification Exempt Areas**

**From:** Gefrom, Walter <WGefrom@sandiego.gov>
**Sent:** Thursday, December 13, 2018 5:06 PM
**To:** Bryan Smith
**Cc:** Vera, Karen; Martin Jones; Mike Hoe
**Subject:** RE: Bella Mar HMP - PTS 598995
**Attachments:** Bella Mar Hydromod Exempt Memo.pdf

**Categories:** Filed by Newforma

Bryan,

My review of this and comments apply to the project once it comes through my group for Ministerial review/approval. Currently, it appears to be under review/approval through preliminary/discretionary. Also, keep in mind that any revisions to the State storm water permit before you acquire a grading/building permit may require me to void the memo.

Based on the exhibit and supporting documentation provided, the discharge of any storm water treated flows will not require HMP. You will need to revise the memo per my markups based on the updated Storm Water Standards Manual and also update the last page (Manual excerpt) with the newest language. Mike Hoe won't need to sign the memo if he sends the memo directly to me through e-mail instead of a cc. Or, he may acknowledge that he's seen it.

Thanks,

**Walter C. Gefrom, PE, QSD, CFM**
Deputy City Engineer

Development Services Department - Engineering Division
1222 First Avenue | San Diego | CA | 92101
MS 501

Visit OpenDSD for project info: https://www.sandiego.gov/development-services/opendsd

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**From:** Bryan Smith [mailto:bsmith@fuscoe.com]
**Sent:** Tuesday, December 11, 2018 7:59 AM
**To:** Gefrom, Walter <WGefrom@sandiego.gov>
**Cc:** Vera, Karen <KVera@sandiego.gov>
**Subject:** RE: Bella Mar HMP - PTS 598995

Hi Walter,

Just wanted to follow up on this. Can you please review and get back to me when you have the chance?

Thanks,

**BRYAN D. SMITH, PE** | *Project Manager*

**FUSCOE ENGINEERING, INC.**
*an employee owned company*

*full circle thinking®*

858.554.1500

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**From:** Bryan Smith
**Sent:** Friday, November 30, 2018 11:05 AM
**To:** 'Gefrom, Walter' <WGefrom@sandiego.gov>
**Cc:** 'Vera, Karen' <KVera@sandiego.gov>
**Subject:** Bella Mar HMP - PTS 598995

Walter,

Hope all is well with you. Over a year ago, we met and discussed this multifamily residential project in Otay Nestor at 408 Hollister. I don't expect that you recall the original meeting, but we discussed a possible HMP exemption for this site. The project went on hold for some time but has since been restarted. Most recently, we went through preliminary review and were assigned the above PTS number and also met with you to discuss stockpiling in the FEMA Floodplain, as you probably recall. The stockpiling idea has been put on hold but we are working toward an entitlement submittal for a Tentative Map.

Our discussion last year was based on the Hydromod exemption. The site discharges through a Caltrans culvert under the I-5 free and discharges to an unlined channel to the West. The unlined channel and culvert outlet is within the 10-year flood plain elevation associated with the Otay River (see attached Memo documenting this). According to our meeting, you believed this would qualify for an exemption from HMP requirements but you asked that we document it in a memo and send to you.

Please find the attached memo which we will include the SWQMP. If you could please take a quick review when you have the chance and confirm our understanding it would be much appreciated.

Best,

25 YEARS

**BRYAN D. SMITH, PE** | *Project Manager*
bsmith@fuscoe.com
CONNECT WITH ME

**FUSCOE ENGINEERING, INC.**
*an employee owned company*

6390 Greenwich Drive, Suite 170, San Diego, California 92122
858.554.1500 | fuscoe.com

IRVINE . **SAN DIEGO** . ONTARIO . LOS ANGELES . EL CENTRO . SAN RAMON . MISSION HILLS

# Hydromodification Exemption Memo - Bella Mar

To: Walter Gefrom, P.E., City of San Diego DSD

From: Michael Hoe, P.E., Fuscoe Engineering, Inc.

Date: May 17, 2017, Revision Date: December 14, 2018

The subject property is located at 408 Hollister Street in the City of San Diego, County of San Diego. The project site is bordered by private properties to the North and South, Hollister Street on the East and the Interstate 5 Freeway on the West. See the attached project site exhibit on the following sheet. Stormwater runoff on the subject property flows from east to west and discharges into an existing 24" storm drain culvert which runs below the I-5 Interchange bridge. The runoff eventually discharges into the Otay River and ultimately into the San Diego Bay.

Per City of San Diego Storm Water Standards Section 1.6, the Otay River is classified as a hydromodification exempt body of water.

"*Designated exempt river reaches within City of San Diego jurisdiction include the Otay River downstream of Lower Otay Reservoir Dam (Savage Dam). To qualify as a direct discharge to this exempt river reach, the invert elevation of the direct discharge conveyance system (at the point of discharge to the exempt river reach) should be equal to or below the 10-year floodplain elevation. The City Engineer may require additional analysis of the potential for erosion between the outfall and the 10-year floodplain elevation*."

The flowline elevation at the outlet of the existing 24" storm drain culvert is 12.7' NGVD29 or 14.9' NAVD 88 (see conversion table on the next sheet) per Caltrans As-built Drawing Document Number A-0002600. See the attached as-built drawing for reference.

Based on the most recent Flood Insurance Study (revised May 16, 2012), the 10-year water surface elevation below the Interstate 5 Bridge at the storm drain outlet is 14.9' (NAVD 88). See the flood profile for the Otay River in the following attachments. The storm drain outfall elevation is the same elevation as the 10-year base flood elevation therefore, the project should be considered exempt from Hydromodification Management requirements.

## Attachments:

1- Site Plan
2- Caltrans As-Built
3- Flood Insurance Study
4- BMP Manual Excerpt

ATTACHMENT 1
SITE PLAN

ATTACHMENT 2
CALTRANS AS-BUILT

| DIST. | COUNTY | ROUTE | POST MILES—TOTAL PROJECT | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 11 | SD | 5 | 4.4/9.0 | 42 | 437 |

DISTRICT DESIGN ENGINEER Henry R. Obrecht REGISTERED CIVIL ENGINEER No. 15768
DATE APPROVED July 27, 1970

14.9' IE-OUT (NAVD 88)

16.2' IE-IN (NAVD 88)

L0
Δ = 04° 36' 28"
R = 10,000'
T = 402.32'
L = 804.21'

275+59.38 EC L0

Otay Riv Br
Br. No. 57-246R/L

Otay Riv Overflow Br
Br. No. 57-263R/L

R/W

S Dike

Graded "V" Gutter 2:1 SS

N06°54'00"W 285

2693.09'

Profile Grade

Ground Line

-0.38%

NOTE
Profile Grade is 15' Lt & Rt of ℄ L0

U.S.C & G.S. Datum

"AS BUILT"
CONTRACT 122404
YEAR COMPLETED 8-1-73

# DRAINAGE DETAILS AND CONTOUR GRADING PLANS

| Project Engineer | Date | Design Engineer | Date | Approval Recommended By | Date |
|---|---|---|---|---|---|
| | | | | | |

AS BUILT PLANS
Contract No. 11-122404
Date Completed 07-70
Document No. 11-000260

FORM WH23A-PF

4

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 8-26-74 SIGNATURE [signature] TITLE [illegible]

SCALE 1"=50' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=20' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=10' or 1"=100' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=40' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM

ATTACHMENT 3 :
FLOOD INSURANCE
STUDY

CHARLES AVENUE

LOURET AVENUE

INTERSTATE HIGHWAY 5

INTERSTATE HIGHWAY 5

14.9' 10 YEAR FLOOD ELEVATION @ OUTLET

15.1' 10-YEAR FLOOD ELEVATION @ INLET

200'

ELEVATION IN FEET (NAVD)

30

20

10

0

2600 2800 3000 3200 3400 3600 3800 4000 4200 4400 4600 4800 5000 5200

STREAM DISTANCE IN FEET ABOVE CROSS SECTION A

D E F G

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

259P

## TABLE 12: FLOODING SOURCE DATUM SHIFT VALUES

| Stream Name | Elevation (feet NAVD above NGVD) |
|---|---|
| Moosa Creek (North Branch) | +2.3 |
| Moosa Creek (South Branch) | +2.3 |
| Murphy Canyon Creek | +2.1 |
| Murray Canyon Creek | +2.1 |
| Nestor Creek | +2.1 |
| North Avenue Tributary | +2.3 |
| North Branch Poway Creek | +2.1 |
| North Tributary to Santa Maria Creek | +2.2 |
| Olive Creek | +2.4 |
| Otay River | +2.2 |
| Pala Mesa Creek | +2.2 |
| Paradise Creek | +2.1 |
| Paradise Creek – Valley Road Branch | +2.1 |
| Pilgrim Creek | +2.3 |
| Poggi Canyon Creek | +2.2 |
| Pomerado Creek | +2.1 |
| Poway Creek | +2.1 |
| Rainbow Creek (Main Branch) | +2.3 |
| Rainbow Creek (West Branch) | +2.3 |
| Rattlesnake Creek | +2.1 |
| Rattlesnake Creek Split Flow at Heritage Hills | +2.1 |
| Rattlesnake Creek Split Flow at Midland Road | +2.1 |
| Reidy Creek | +2.3 |
| Reidy Creek Split Flow | +2.3 |
| Rice Canyon Creek | +2.1 |
| Rincon Avenue Tributary | +2.3 |
| Rose Canyon Creek | +2.1 |
| Samagutuma Creek | +2.4 |
| San Clemente Canyon Creek | +2.1 |
| San Diego Bay | +2.2 |
| San Diego River | +2.1 |
| San Dieguito River | +2.1 |
| San Elijo Creek | +2.2 |
| San Luis Rey River | +2.3 |
| San Marcos Creek | +2.3 |
| San Marcos Creek (Below Lake San Marcos) | +2.3 |
| San Marcos Creek Highway 78 Split Flow | +2.3 |

- This exemption is subject to the following conditions:
  (a) A properly sized energy dissipation system must be provided in accordance with the City design standards to mitigate outlet discharge velocity from the direct discharge to the water storage reservoir or lake for the ultimate condition peak design flow of the direct discharge,
  (b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the water storage reservoir or lake) should be equal to or below the lowest normal operating water surface elevation at the point of discharge, unless the outfall discharges to quay or other non-erodible shore protection. Normal operating water surface elevation may vary by season; contact the reservoir operator to determine the elevation. For cases in which the direct discharge conveyance system outlet invert elevation is above the lowest normal operating water surface elevation but below the reservoir spillway elevation, additional analysis is required to determine if energy dissipation should be extended between the conveyance system outlet and the elevation associated with the lowest normal operating water surface level.
- No exemption may be granted for conveyance system outlet invert elevations located above the reservoir spillway elevation.

- **Figure 1-2, Node 5** – As allowed by the MS4 Permit, projects discharging directly to an area identified as appropriate for an exemption in the WMAA for the watershed in which the project resides are exempt. Refer to the WMAA for any updates to exempt river reaches. Discharging directly refers to either a) existing underground storm drain systems; or b) conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to the designated area.
  - Designated exempt river reaches identified in the WMAA and approved by the RWQCB within City of San Diego jurisdiction:
    (a) San Dieguito River downstream of Lake Hodges
    (b) San Diego River downstream of confluence with San Vicente Creek
    (c) Sweetwater River downstream of Sweetwater Reservoir
    (d) Otay River downstream of Lower Otay Reservoir Dam
  - To qualify as a direct discharge to an exempt river reach:
    (a) A properly sized energy dissipation system must be provided to mitigate outlet discharge velocity from the direct discharge to the exempt river reach for the ultimate condition peak design flow of the direct discharge,
    (b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the exempt river reach) should be equal to or below the 10-year floodplain elevation. Exceptions may be made at the discretion of the City Engineer, but shall never exceed the 100-year floodplain elevation. The City Engineer may require additional analysis of the potential for erosion between the outfall and the 10-year floodplain elevation.
  - No exemption may be granted for conveyance system outlet invert elevations located above the 100-year floodplain elevation.

**General note regarding HMP:** New outfalls shall meet requirements for energy dissipation size in the Drainage Design Manual regardless of the addition of hydromodification controls. Existing outfalls that are insufficient to accommodate additional flows from proposed upstream development projects

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Project Name: Bella Mar Apartments

| Site Information Checklist For PDPs | Form I-3B |
|---|---|
| **Project Summary Information** | |
| Project Name | Bella Mar Apartments |
| Project Address | 408 Hollister Street<br>San Diego, CA 92154 |
| Assessor's Parcel Number(s) (APN(s)) | 627-100-09-00 |
| Permit Application Number | |
| Project Watershed | Select One:<br>☐ San Dieguito River<br>☐ Penasquitos<br>☐ Mission Bay<br>☐ San Diego River<br>☐ San Diego Bay<br>☐ Tijuana River |
| Hydrologic subarea name with Numeric Identifier up to two decimal places (9XX.XX) | Otay/Otay Valley, 910.20 |
| Project Area<br>(total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way) | 14.13 Acres (615,502 Square Feet) |
| Area to be disturbed by the project<br>(Project Footprint) | 12.2 Acres (529,270 Square Feet) |
| Project Proposed Impervious Area<br>(subset of Project Footprint) | 8.6 Acres (373,372 Square Feet) |
| Project Proposed Pervious Area<br>(subset of Project Footprint) | 3.6 Acres (155,898 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 | 3500 % |

Project Name: Bella Mar Apartments

| Form I-3B Page 2 of 11 |
|---|
| **Description of Existing Site Condition and Drainage Patterns** |
| Current Status of the Site (select all that apply):<br>☑ Existing development<br>☐ Previously graded but not built out<br>☐ Agricultural or other non-impervious use<br>☑ Vacant, undeveloped/natural<br>Description / Additional Information:<br>The existing site is vacant and mostly undeveloped. There is a small existing parking lot in the northeast corner. |
| Existing Land Cover Includes (select all that apply):<br>☑ Vegetative Cover<br>☐ Non-Vegetated Pervious Areas<br>☑ Impervious Areas<br>Description / Additional Information:<br>The existing land cover is mostly brush and grass. There is a small area with asphalt parking lot in the northeast corner of the site. |
| Underlying Soil belongs to Hydrologic Soil Group (select all that apply):<br>☑ NRCS Type A<br>☐ NRCS Type B<br>☐ NRCS Type C<br>☐ NRCS Type D |
| Approximate Depth to Groundwater:<br>☐ Groundwater Depth < 5 feet<br>☐ 5 feet < Groundwater Depth < 10 feet<br>☐ 10 feet < Groundwater Depth < 20 feet<br>☐ Groundwater Depth > 20 feet |
| Existing Natural Hydrologic Features (select all that apply):<br>☑ Watercourses<br>☐ Seeps<br>☐ Springs<br>☐ Wetlands<br>☐ None<br>Description / Additional Information:<br>The site is located in an existing flood plain. Per FEMA Flood Insurance Rate Map, the site is located in within the floodway boundary |

Project Name: Bella Mar Apartments

| Form I-3B Page 3 of 11 |
|---|
| **Description of Existing Site Topography and Drainage** |
| How is storm water runoff conveyed from the site? At a minimum, this description should answer:<br>1. Whether existing drainage conveyance is natural or urban;<br>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;<br>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;<br>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. |
| **Descriptions/Additional Information** |
| Overview:<br>The site is bounded by Otay River to the north, existing driving range to the south, Interstate 5 Freeway to the west, and Hollister Street to the east. Improvements within ROW are included in the Street Improvement Plans and improvements outside ROW are included in the Grading Plans. The existing site mostly vacant and undeveloped. The site generally drains west toward an existing 24-inch RCP storm drain that runs underneath the Interstate 5 Freeway.<br><br>1. Existing drainage conveyance is natural.<br>2. In existing conditions, the offsite runon from Hollister Street and the adjacent site on the south runs through the site. A portion of the undeveloped area drains towards Otay River.<br>3. There is an existing 24-inch RCP storm drain located on the near the west boundary of the site.<br>4. In existing conditions, there are 3 discharge points. One discharge point is in the northwest of the site and drains towards Otay River, the second discharge point is to the existing 24-inch RCP storm drain located in towards the middle of the west boundary, and the third location is located at the southeast corner of the site.<br><br>See the Existing Hydrology Map in the Drainage Study included in Attachment 5. |

## Form I-3B Page 4 of 11

### Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:

The proposed development consists of the construction of residential apartments and affordable housing, associated drive aisles, recreation facilities, hardscape, and landscaping.

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

The proposed impervious features include buildings, associated drive aisles, parking spaces, and hardscape.

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

The proposed pervious features include landscaped areas and planter areas.

Does the project include grading and changes to site topography?

☑ Yes

☐ No

Description / Additional Information:

The project proposes to raise the site above the flood plain. The site will still generally drain west to match existing conditions.

## Form I-3B Page 5 of 11

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☑ Yes

☐ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural and constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Description / Additional Information:

Runon from the offsite areas will be diverted around the site using curb and gutter and a vegetated swale. Runoff will be collected and conveyed by a series of area drains, drain inlets, and storm drain throughout the site and will connect to an existing 24-inch RCP storm drain system that runs west underneath Interstate 5 Freeway. The site eventually discharges into Nestor Creek and ultimately into San Diego Bay.

See the Proposed Hydrology Map in the Drainage Study included in Attachment 5.

Project Name: Bella Mar Apartments

## Form I-3B Page 6 of 11

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

- [x] Onsite storm drain inlets
- [ ] Interior floor drains and elevator shaft sump pumps
- [ ] Interior parking garages
- [x] Need for future indoor & structural pest control
- [x] Landscape/outdoor pesticide use
- [x] Pools, spas, ponds, decorative fountains, and other water features
- [ ] Food service
- [x] Refuse areas
- [ ] Industrial processes
- [x] Outdoor storage of equipment or materials
- [ ] Vehicle and equipment cleaning
- [ ] Vehicle/equipment repair and maintenance
- [ ] Fuel dispensing areas
- [ ] Loading docks
- [ ] Fire sprinkler test water
- [x] Miscellaneous drain or wash water
- [x] Plazas, sidewalks, and parking lots

Description/Additional Information:

Project Name: Bella Mar Apartments

| Form I-3B Page 7 of 11 |
| --- |
| **Identification and Narrative of Receiving Water** |
| Narrative describing flow path from discharge location(s), through urban storm conveyance system, to receiving creeks, rivers, and lagoons and ultimate discharge location to Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable)<br>The project site discharges into an existing 24-inch RCP storm drain on near the west boundary. The existing storm drain conveys flow to the west into the Otay River and ultimately into San Diego Bay and Pacific Ocean. |
| Provide a summary of all beneficial uses of receiving waters downstream of the project discharge locations<br>San Diego Bay - BIOL, COMM, EST, IND, MAR, MIGR, NAV, RARE, REC1, REC2, SHELL, WILD |
| Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations<br>N/A - No ASBS receiving waters downstream of project discharge. |
| Provide distance from project outfall location to impaired or sensitive receiving waters<br>The project site drains to an existing storm drain system that ultimately discharges into the Otay River less than a mile away, which is ultimately discharges into San Diego Bay, which is approximately 3 miles from the 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<br>Approximately 40% of the northern portion of the site is within the City's current MHPA limits. A proposed infiltration basin will encroach into the current MHPA limit. |

Project Name: Bella Mar Apartments

| Form I-3B Page 8 of 11 | | |
|---|---|---|
| **Identification of Receiving Water Pollutants of Concern** | | |
| List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies: | | |
| **303(d) Impaired Water Body (Refer to Appendix K)** | **Pollutant(s)/Stressor(s) (Refer to Appendix K)** | **TMDLs/WQIP Highest Priority Pollutant (Refer to Table 1-4 in Chapter 1)** |
| Poggi Canyon Creek | Nitrogen, Toxicity | TMDL Required |
| San Diego Bay | Mercury, PAHs, PCBs | TMDL Required |
| Lower Otay Reservoir | Ammonia, Color, Iron, Manganese, Nitrogen, high pH | TMDL Required |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

| **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)<br>Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see 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 | ☐ | ☑ | ☐ |

Project Name: Bella Mar Apartments

## Form I-3B Page 9 of 11

### Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6)?

☐ 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):

Project discharges into an existing culvert that discharges into the Otay River, which ultimately discharges into San Diego Bay and Pacific Ocean.

Note: If "No" answer has been selected the SWQMP must include an exhibit that shows the storm water conveyance system from the project site to an exempt water body. The exhibit should include details about the conveyance system and the outfall to the exempt water body.

### 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:

Project will not impact any areas determined to be CCSYAs.

Project Name: Bella Mar Apartments

| Form I-3B Page 10 of 11 |
| --- |
| **Flow Control for Post-Project Runoff*** <br> ***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. <br> N/A - Hydromodification exempt |
| Has a geomorphic assessment been performed for the receiving channel(s)? <br> ☐No, the low flow threshold is $0.1Q_2$ (default low flow threshold) <br> ☐Yes, the result is the low flow threshold is $0.1Q_2$ <br> ☐Yes, the result is the low flow threshold is $0.3Q_2$ <br> ☐Yes, the result is the low flow threshold is $0.5Q_2$ <br> If a geomorphic assessment has been performed, provide title, date, and preparer: <br> Hydromodification not required. |
| Discussion / Additional Information: (optional) <br> Hydromodification not required. |

Project Name: Bella Mar Apartments

| Form I-3B Page 11 of 11 |
| --- |
| **Other Site Requirements and Constraints** |
| When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.<br>The site is located in a flood plain. It is constrained by the existing freeway, Otay River, existing utilities, and adjacent private property. |
| **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. |

Project Name: Bella Mar Apartments

| Source Control BMP Checklist for PDPs | Form I-4B |
|---|---|

**Source Control BMPs**

All development projects must implement source control BMPs 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? | | |
|---|---|---|---|
| 4.2.1 Prevention of Illicit Discharges into the MS4 | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.2.1 not implemented: | | | |
| 4.2.2 Storm Drain Stenciling or Signage | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.2.2 not implemented: | | | |
| 4.2.3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal | ☐ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.2.3 not implemented: | | | |
| 4.2.4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal | ☐ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.2.4 not implemented: | | | |
| 4.2.5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.2.5 not implemented: | | | |

Project Name: Bella Mar Apartments

| Form I-4B Page 2 of 2 | | | |
|---|---|---|---|
| **Source Control Requirement** | **Applied?** | | |
| 4.2.6 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 Facilities | ☐ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.2.6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above. | | | |

Project Name: Bella Mar Apartments

| Site Design BMP Checklist for PDPs | Form I-5B |
|---|---|

**Site Design BMPs**

All development projects must implement site design BMPs 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? | | |
|---|---|---|---|
| 4.3.1 Maintain Natural Drainage Pathways and Hydrologic Features | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.1 not implemented: | | | |
| 1-1 Are existing natural drainage pathways and hydrologic features mapped on the site map? | ☑ Yes | ☐ No | ☐ N/A |
| 1-2 Are trees implemented? If yes, are they shown on the site map? | ☐ Yes | ☐ No | ☐ N/A |
| 1-3 Implemented trees meet the design criteria in 4.3.1 Fact Sheet (e.g. soil volume, maximum credit, etc.)? | ☐ Yes | ☐ No | ☐ N/A |
| 1-4 Is tree credit volume calculated using Appendix B.2.2.1 and SD-1 Fact Sheet in Appendix E? | ☐ Yes | ☐ No | ☐ N/A |
| 4.3.2 Have natural areas, soils and vegetation been conserved? | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.2 not implemented: | | | |

Project Name: Bella Mar Apartments

| Form I-5B Page 2 of 4 | | | |
|---|---|---|---|
| **Site Design Requirement** | **Applied?** | | |
| 4.3.3 Minimize Impervious Area | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.3 not implemented: | | | |
| 4.3.4 Minimize Soil Compaction | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.4 not implemented: | | | |
| 4.3.5 Impervious Area Dispersion | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.5 not implemented: | | | |
| 5-1 Is the pervious area receiving runon from impervious area identified on the site map? | ☑ Yes | ☐ No | ☐ N/A |
| 5-2 Does the pervious area satisfy the design criteria in 4.3.5 Fact Sheet in Appendix E (e.g. maximum slope, minimum length, etc.) | ☑ Yes | ☐ No | ☐ N/A |
| 5-3 Is impervious area dispersion credit volume calculated using Appendix B.2.1.1 and 4.3.5 Fact Sheet in Appendix E? | ☑ Yes | ☐ No | ☐ N/A |

Project Name: Bella Mar Apartments

| Form I-5B Page 3 of 4 | | | |
|---|---|---|---|
| **Site Design Requirement** | **Applied?** | | |
| 4.3.6 Runoff Collection | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.6 not implemented: | | | |
| 6a-1 Are green roofs implemented in accordance with design criteria in 4.3.6A Fact Sheet? If yes, are they shown on the site map? | ☐ Yes | ☐ No | ☐ N/A |
| 6a-2 Is the green roof credit volume calculated using Appendix B.2.1.2 and 4.3.6A Fact Sheet in Appendix E? | ☐ Yes | ☐ No | ☐ N/A |
| 6b-1 Are permeable pavements implemented in accordance with design criteria in 4.3.6B Fact Sheet? If yes, are they shown on the site map? | ☐ Yes | ☐ No | ☐ N/A |
| 6b-2 Is the permeable pavement credit volume calculated using Appendix B.2.1.3 and 4.3.6B Fact Sheet in Appendix E? | ☐ Yes | ☐ No | ☐ N/A |
| 4.3.7 Landscaping with Native or Drought Tolerant Species | ☑ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.7 not implemented: | | | |
| 4.3.8 Harvest and Use Precipitation | ☐ Yes | ☐ No | ☐ N/A |
| Discussion / justification if 4.3.8 not implemented:<br>Harvest and reuse was considered infeasible for the site per Worksheet B.3-1. | | | |
| 8-1 Are rain barrels implemented in accordance with design criteria in 4.3.8 Fact Sheet? If yes, are they shown on the site map? | ☐ Yes | ☐ No | ☐ N/A |
| 8-2 Is the rain barrel credit volume calculated using Appendix B.2.2.2 and 4.3.8 Fact Sheet in Appendix E? | ☐ Yes | ☐ No | ☐ N/A |

Project Name: Bella Mar Apartments

| Form I-5B Page 4 of 4 |
| --- |
| Insert Site Map with all site design BMPs identified: |
| |

Project Name: Bella Mar Apartments

| Summary of PDP Structural BMPs | Form I-6 |
|---|---|

**PDP Structural BMPs**

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

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

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

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

Step 1:
(A) DMA 2 will be self-treating. There are two small areas at the driveway entrances that will be considered "de minimus" and will be treated using permeable pavers.
(B) DCV is estimated for each delineated DMA; see calculations in Attachment 1.

Step 2:
Harvest and use is infeasible per Worksheet B3.1

Step 3:
(A) Form I-8A has been completed per the preliminary Geotechnical Report. Infiltration is infeasible.
(B) No Infiltration Condition.
(C) No Infiltration Condition per preliminary Geotechnical Report.

(continued on next page)

(Continue on page 2 as necessary.)

Form I-6 Page 2 of 8

(Continued from page 1)

Step 4:
DMA 1: MHPA area will be considered self-treating.

DMA 2: Biofiltration Basin (BF-1) will be used. Stormwater will be conveyed to BMP via sheet flow and storm drain.

DMA 3: Slopes will be considered self-treating

DMA 4: Permeable pavers (INF-3) will be used and considered self-retaining

DMA 5: Slope will be considered self-treating

DMA 6: Landscape area at base of wall considered self-treating

DMA 7: Bioclean MWS unit will be used. Stormwater will be conveyed to BMP via sheet flow and storm drain.

DMA 8: Permeable pavers (INF-3) will be used and considered self-retaining

DMA 9: Landscape area at base of wall considered de minimus.

Hollister St: Green street BMPs will be implemented to treat runoff from Hollister St.

Project is hydromodification exempt. All BMPs will provide pollutant control only.

Project Name: Bella Mar Apartments

| Form I-6 Page 1 of 8 (Copy as many as needed) | |
|---|---|
| **Structural BMP Summary Information** | |
| Structural BMP ID No. BMP 2 | |
| Construction Plan Sheet No. 3 | |
| Type of Structural BMP:<br>☐ Retention by harvest and use (e.g. HU-1, cistern)<br>☐ Retention by infiltration basin (INF-1)<br>☐ Retention by bioretention (INF-2)<br>☐ Retention by permeable pavement (INF-3)<br>☐ Partial retention by biofiltration with partial retention (PR-1)<br>☐ Biofiltration (BF-1)<br>☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)<br>☐ 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)<br>☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)<br>☐ Detention pond or vault for hydromodification management<br>☐ Other (describe in discussion section below) | |
| Purpose:<br>☐ Pollutant control only<br>☐ Hydromodification control only<br>☐ Combined pollutant control and hydromodification control<br>☐ Pre-treatment/forebay for another structural BMP<br>☐ 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 | Bryan Smith, PE<br>Fuscoe Engineering<br>858-554-1500 |
| Who will be the final owner of this BMP? | |
| Who will maintain this BMP into perpetuity? | |
| What is the funding mechanism for maintenance? | Private |

Project Name: Bella Mar Apartments

| Form I-6 Page 2 of 8 (Copy as many as needed) |
|---|
| Structural BMP ID No. BMP 2 |
| Construction Plan Sheet No. 3 |
| Discussion (as needed; must include worksheets showing BMP sizing calculations in the SWQMPs):<br>See Sizing calculation worksheets |

Project Name: Bella Mar Apartments

| Form I-6 Page 3 of 8 (Copy as many as needed) | |
|---|---|
| **Structural BMP Summary Information** | |
| Structural BMP ID No. BMP 4 | |
| Construction Plan Sheet No. 3 | |
| Type of Structural BMP:<br>☐ Retention by harvest and use (e.g. HU-1, cistern)<br>☐ Retention by infiltration basin (INF-1)<br>☐ Retention by bioretention (INF-2)<br>☐ Retention by permeable pavement (INF-3)<br>☐ Partial retention by biofiltration with partial retention (PR-1)<br>☐ Biofiltration (BF-1)<br>☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)<br>☐ 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)<br>☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)<br>☐ Detention pond or vault for hydromodification management<br>☐ Other (describe in discussion section below) | |
| Purpose:<br>☐ Pollutant control only<br>☐ Hydromodification control only<br>☐ Combined pollutant control and hydromodification control<br>☐ Pre-treatment/forebay for another structural BMP<br>☐ 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 | |
| Who will be the final owner of this BMP? | |
| Who will maintain this BMP into perpetuity? | |
| What is the funding mechanism for maintenance? | Private |

| Form I-6 Page 4 of 8 (Copy as many as needed) |
|---|
| Structural BMP ID No. BMP 4 |
| Construction Plan Sheet No. 3 |
| Discussion (as needed; must include worksheets showing BMP sizing calculations in the SWQMPs):<br>See Sizing calculation worksheets |

Project Name: Bella Mar Apartments

| Form I-6 Page 5 of 8 (Copy as many as needed) | |
|---|---|
| **Structural BMP Summary Information** | |
| Structural BMP ID No. BMP 7 | |
| Construction Plan Sheet No. 3 | |
| Type of Structural BMP:<br>☐ Retention by harvest and use (e.g. HU-1, cistern)<br>☐ Retention by infiltration basin (INF-1)<br>☐ Retention by bioretention (INF-2)<br>☐ Retention by permeable pavement (INF-3)<br>☐ Partial retention by biofiltration with partial retention (PR-1)<br>☐ Biofiltration (BF-1)<br>☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)<br>☐ 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)<br>☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)<br>☐ Detention pond or vault for hydromodification management<br>☐ Other (describe in discussion section below) | |
| Purpose:<br>☐ Pollutant control only<br>☐ Hydromodification control only<br>☐ Combined pollutant control and hydromodification control<br>☐ Pre-treatment/forebay for another structural BMP<br>☐ 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 | |
| Who will be the final owner of this BMP? | |
| Who will maintain this BMP into perpetuity? | |
| What is the funding mechanism for maintenance? | Private |

| Form I-6 Page 6 of 8 (Copy as many as needed) |
|---|
| Structural BMP ID No. BMP 7 |
| Construction Plan Sheet No. 3 |
| Discussion (as needed; must include worksheets showing BMP sizing calculations in the SWQMPs):<br>Bioclean MWS unit<br><br>See Sizing calculation worksheets |

Project Name: Bella Mar Apartments

| Form I-6 Page 7 of 8 (Copy as many as needed) | |
|---|---|
| **Structural BMP Summary Information** | |
| Structural BMP ID No. BMP 8 | |
| Construction Plan Sheet No. 3 | |
| Type of Structural BMP:<br>☐ Retention by harvest and use (e.g. HU-1, cistern)<br>☐ Retention by infiltration basin (INF-1)<br>☐ Retention by bioretention (INF-2)<br>☐ Retention by permeable pavement (INF-3)<br>☐ Partial retention by biofiltration with partial retention (PR-1)<br>☐ Biofiltration (BF-1)<br>☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)<br>☐ 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)<br>☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)<br>☐ Detention pond or vault for hydromodification management<br>☐ Other (describe in discussion section below) | |
| Purpose:<br>☐ Pollutant control only<br>☐ Hydromodification control only<br>☐ Combined pollutant control and hydromodification control<br>☐ Pre-treatment/forebay for another structural BMP<br>☐ 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 | |
| Who will be the final owner of this BMP? | |
| Who will maintain this BMP into perpetuity? | |
| What is the funding mechanism for maintenance? | Private |

Project Name: Bella Mar Apartments

| Form I-6 Page 8 of 8 (Copy as many as needed) |
| --- |
| Structural BMP ID No. BMP 8 |
| Construction Plan Sheet No. 3 |
| Discussion (as needed; must include worksheets showing BMP sizing calculations in the SWQMPs):<br>See Sizing calculation worksheets |

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# Attachment 1
# Backup For PDP Pollutant Control BMPs

This is the cover sheet for Attachment 1.

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Project Name: Bella Mar Apartments

**Indicate which Items are Included:**

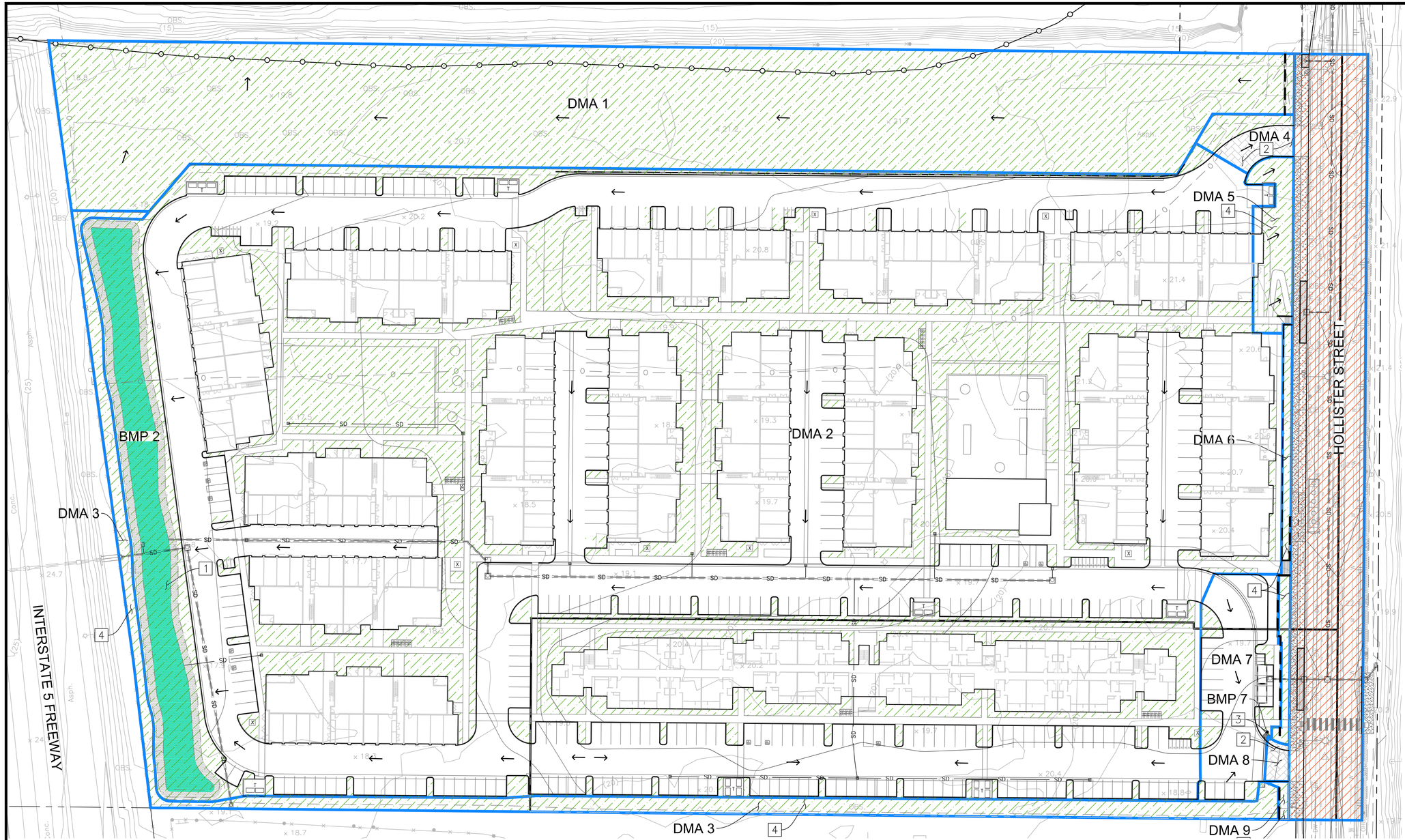
| Attachment Sequence | Contents | Checklist |
|---|---|---|
| **Attachment 1a** | DMA Exhibit (Required) See<br>DMA Exhibit Checklist. | ☑ Included |
| **Attachment 1b** | Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)*<br>*Provide table in this Attachment OR on DMA Exhibit in Attachment 1a | ☑ Included on DMA Exhibit in Attachment 1a<br>☐ 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)<br>Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7. | ☑ Included<br>☐ Not included because the entire project will use infiltration BMPs |
| **Attachment 1d** | Infiltration Feasibility Information. Contents of Attachment 1d depend on the infiltration condition:<br>• No Infiltration Condition:<br>○ Infiltration Feasibility Condition Letter (***Note: must be stamped and signed by licensed geotechnical engineer***)<br>○ Form I-8A (optional)<br>○ Form I-8B (optional)<br>• Partial Infiltration Condition:<br>○ Infiltration Feasibility Condition Letter (***Note: must be stamped and signed by licensed geotechnical engineer***)<br>○ Form I-8A<br>○ Form I-8B<br>• Full Infiltration Condition:<br>○ Form I-8A<br>○ Form I-8B<br>○ Worksheet C.4-3<br>○ Form I-9<br>Refer to Appendices C and D of the BMP Design Manual for guidance. | ☑ Included<br>☐ Not included because the entire project will use harvest and use BMPs |
| **Attachment 1e** | Pollutant Control BMP Design Worksheets / Calculations (Required)<br>Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines and site design credit calculations | ☑ Included |

Project Name: Bella Mar Apartments

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

The DMA Exhibit must identify:

- [x] Underlying hydrologic soil group
- [x] Approximate depth to groundwater
- [x] Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
- [ ] Critical coarse sediment yield areas to be protected
- [x] Existing topography and impervious areas
- [x] Existing and proposed site drainage network and connections to drainage offsite
- [x] Proposed grading
- [x] Proposed impervious features
- [x] Proposed design features and surface treatments used to minimize imperviousness
- [x] 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)
- [x] Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
- [x] Structural BMPs (identify location, type of BMP, size/detail, and include cross-section)




## LEGEND

- PROPERTY LINE
- EXISTING EASEMENT
- RIGHT-OF-WAY
- STREET CENTERLINE
- EXISTING STORM DRAIN
- DMA LIMITS
- DIRECTION OF FLOW
- PROPOSED BIOFILTRATION — BMP 1
- DMA DESIGNATION — DMA 1
- EXISTING CONTOUR — 260
- PROPOSED CONTOUR — 280
- PROPOSED STORM DRAIN
- PROPOSED PERVIOUS AREA
- PROPOSED IMPERVIOUS AREA
- GREEN STREET EXEMPTION

## PROJECT SITE INFO

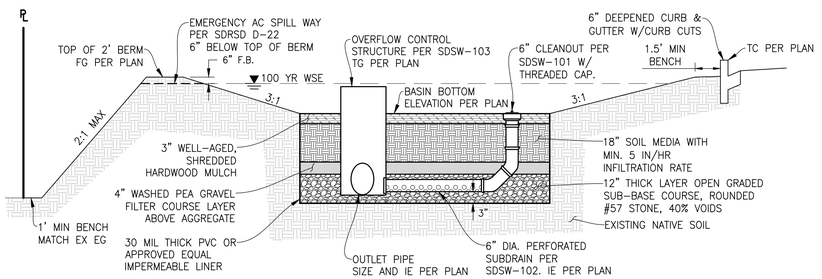
UNDERLYING HYDROLOGIC SOIL: A
APPROXIMATE DEPTH TO GROUNDWATER: 5 FT
EXISTING NATURAL HYDROLOGIC FEATURES (WATERCOURSES, SEEPS, SPRINGS, WETLANDS): NONE
CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED: NONE
EXISTING IMPERVIOUS AREA: 10,655 SF
DISTURBED AREA: 529,270 SF
PROPOSED/REPLACED IMPERVIOUS AREA: 373,372 SF
PROPOSED PERVIOUS AREA (INCLUDES LANDSCAPING & PERMEABLE PAVERS): 155,898 SF

## PERMANENT STORM WATER BMP NOTES

1. POLLUTANT CONTROL BMP (BF-1, BIOFILTRATION W/PARTIAL INFILTRATION)
2. POLLUTANT CONTROL BMP (INF-3, PERMEABLE PAVEMENT)
3. POLLUTANT CONTROL BMP (FT-5, PROPRIETARY FLOW-THRU TREATMENT)
4. POLLUTANT CONTROL BMP (SD-B, IMPERVIOUS AREA DISPERSION)

## SOURCE CONTROL BMPs

SC-1 PREVENTION OF ILLICIT DISCHARGES INTO THE MS4
SC-2 STORM DRAIN STENCILING OR SIGNAGE
SC-5 PROTECT TRASH STORAGE AREAS FROM RAINFALL, RUN-ON, RUNOFF, AND WIND DISPERSAL




## BIOFILTRATION BASIN DETAIL

NOT TO SCALE

## POLLUTANT CONTROL BMP SUMMARY TABLE

| DMA | TOTAL AREA (AC) | TOTAL AREA (SF) | PERVIOUS AREA (SF) | PERMEABLE PAVERS (SF) | IMPERVIOUS AREA - ROOFS, CONCRETE, ASPHALT (SF) | POLLUTANT CONTROL: METHOD OF TREATMENT | DCV (CF) | TREATMENT REQUIRED BASIN AREA (SF) OR FLOWRATE (CFS) | TREATMENT PROVIDED BASIN AREA (SF) OR FLOWRATE (CFS) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.31 | 100,570 | 100,570 | 0 | 0 | Self Mitigating | 0 | - | - |
| 2 | 10.85 | 472,658 | 111,331 | 0 | 361,326 | Drains to BMP-2 (Bio-filtration) | 14575 | 10,090 | 11,220 |
| 3 | 0.39 | 16,785 | 16,785 | 0 | 0 | Self Mitigating | 0 | - | - |
| 4 | 0.06 | 2,791 | 929 | 1,862 | 0 | Self Retaining | 21 | 21 | 186 |
| 5 | 0.11 | 4,693 | 3,318 | 0 | 1,375 | Self Mitigating | 0 | - | - |
| 6 | 0.06 | 2,739 | 2,450 | 0 | 289 | Self Mitigating | 0 | - | - |
| 7 | 0.26 | 11,296 | 915 | 0 | 10,381 | Drains to BMP-7 (MWS) | 409 | 0.065 | 0.073 |
| 8 | 0.01 | 619 | 0 | 619 | 0 | Self Retaining | 6 | 6 | 62 |
| 9 | 0.01 | 298 | 298 | 0 | 0 | Self Mitigating | 0 | - | - |

| NO. | DATE | REVISION |
|---|---|---|
| | | |

SCALE: 1" = 40'

BELLA MAR

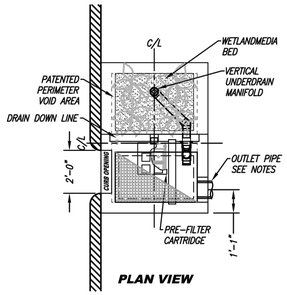
ATTACHMENT 1a & 1□ - DRAINAGE MANAGEMENT AREAS (DMA) EXHIBIT MAP

FUSCOE ENGINEERING
6390 Greenwich Dr., Suite 170
San Diego, California 92122
tel 858.554.1500 ◦ fax 858.597.0335
www.fuscoe.com

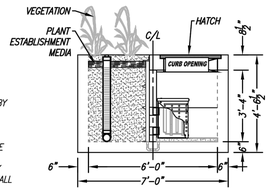
JOB NO. 1621-004
DRAWN BY: B.V.
SHEET 1 o□2

F:\Projects\1621\001_Support Files\Reports\SWQMP\DMA Exhibit.dwg (7/16/2019 2:37 PM) Plotted by: Brianne VanSonter

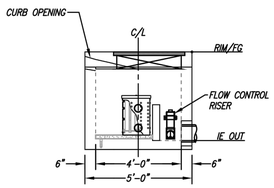
| SITE SPECIFIC DATA | | | |
|---|---|---|---|
| PROJECT NUMBER | | | |
| ORDER NUMBER | | | |
| PROJECT NAME | | | |
| PROJECT LOCATION | | | |
| STRUCTURE ID | | | |
| TREATMENT REQUIRED | | | |
| VOLUME BASED (CF) | | FLOW BASED (CFS) | |
| | | | |
| TREATMENT HGL AVAILABLE (FT) | | | |
| PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE | | | |
| PIPE DATA | I.E. | MATERIAL | DIAMETER |
| INLET PIPE 1 | | | |
| INLET PIPE 2 | | | |
| OUTLET PIPE | | | |
| | PRETREATMENT | BIOFILTRATION | DISCHARGE |
| RIM ELEVATION | | | |
| SURFACE LOAD | PEDESTRIAN | OPEN PLANTER | PEDESTRIAN |
| FRAME & COVER | 24" X 42" | N/A | N/A |
| WETLANDMEDIA VOLUME (CY) | | | TBD |
| ORIFICE SIZE (DIA. INCHES) | | | TBD |
| NOTES: PRELIMINARY NOT FOR CONSTRUCTION | | | |



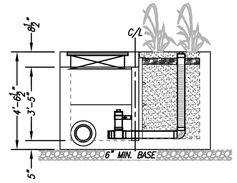

**PLAN VIEW**




**LEFT END VIEW**




**ELEVATION VIEW**




**RIGHT END VIEW**

## INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. DRIP OR SPRAY IRRIGATION REQUIRED ON ALL UNITS WITH VEGETATION.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING MODULAR WETLANDS FOR ACTIVATION OF UNIT. MANUFACTURES WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A MODULAR WETLANDS REPRESENTATNE.

## GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT MANUFACTURER.

| | |
|---|---|
| TREATMENT FLOW (CFS) | 0.073 |
| OPERATING HEAD (FT) | 3.4 |
| PRETREATMENT LOADING RATE (GPM/SF) | 2.6 |
| WETLAND MEDIA LOADING RATE (GPM/SF) | 1.0 |



Bio Clean — A Forterra Company

**MWS-L-4-6-C**
**STORMWATER BIOFILTRATION SYSTEM**
**STANDARD DETAIL**

## PROPRIETARY MODULAR WETLAND BIOFILTRATION BMP

NOT TO SCALE

| NO. | DATE | REVISION |
|---|---|---|
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| | | |


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BELLA MAR

ATTACHMENT 1a & 1□ - DRAINAGE MANAGEMENT AREAS (DMA) EXHIBIT MAP

JOB NO. 1621-004

DRAWN BY: B.V.

SHEET 2 o□2

# Attachment 1c

| Harvest and Use Feasibility Checklist | Worksheet B.3-1 : 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]
388 units x 1.5 residents/unit = approx 582 residents

582 residents x 9.3 gal/day (Table B.3-1) = 5413 gal/day = 901 cf/day
36 hr demand = 901 cf/day x 1.5 days = 1351 cf

3. Calculate the DCV using worksheet B-2.1.
DCV = 13,398 (cubic feet)
[Provide a summary of calculations here]
85th percentile 24-hr storm: d = 0.52 inches
Area tributary to BMP = 11.83 acres
Weighted runoff coefficient: C = 0.60
No tree credit or rain barrel credit

| 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 based on Geotechnical Conditions | Worksheet C.4-1: Form I-8A[10] |
|---|---|
| **Part 1 - Full Infiltration Feasibility Screening Criteria** | |
| **DMA(s) Being Analyzed:** | **Project Phase:** |
| Bella Mar – 408 Hollister Street | Design |
| **Criteria 1: Infiltration Rate Screening** | |
| 1A | Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[11]?<br>☒ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing.<br>☐ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B).<br>☐ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result.<br>☐ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B). |
| 1B | Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1?<br>☒ Yes; Continue to Step 1C.<br>☐ No; Skip to Step 1D. |
| 1C | Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour?<br>☐ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result.<br>☒ No; full infiltration is not required. Answer "No" to Criteria 1 Result. |
| 1D | **Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation.<br>☐ Yes; continue to Step 1E.<br>☐ No; select an appropriate infiltration testing method. |

Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[10] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[11] Available data include site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | Worksheet C.4-1: Form I- 8A[10] |
|---|---|
| 1E | **Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2?<br>☐ Yes; continue to Step 1F.<br>☐ No; conduct appropriate number of tests. |
| IF | **Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9).<br>☐ Yes; continue to Step 1G.<br>☐ No; select appropriate factor of safety. |
| 1G | **Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour?<br>☐ Yes; answer "Yes" to Criteria 1 Result.<br>☐ No; answer "No" to Criteria 1 Result. |
| Criteria 1 Result | Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP?<br>☐ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2.<br>☒ No; full infiltration is not required. Skip to Part 1 Result. |

Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.

Based on the USGS Soil Survey, the property possesses a Hydrologic Soil Group A classification. In addition, we encountered field infiltration rates of:

P-1: 0.30 inches/hour (0.15 with a FOS of 2.0)
P-2: 0.25 inches/hour (0.13 with a FOS of 2.0)
P-3: 0.14 inches/hour (0.07 with a FOS of 2.0)
P-4: 0.13 inches/hour (0.07 with a FOS of 2.0)
P-5: 0.20 inches/hour (0.10 with a FOS of 2.0)
P-6: 0.12 inches/hour (0.06 with a FOS of 2.0)

This results in an average infiltration rate of 0.19 inches/hour (0.10 with a FOS of 2.0).

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | | Worksheet C.4-1: Form I-8A[10] | |
|---|---|---|---|
| **Criteria 2: Geologic/Geotechnical Screening** | | | |
| 2A | If all questions in Step 2A are answered "Yes," continue to Step 2B.<br><br>For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP. | | |
| 2A–1 | Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface? | ☒ Yes | ☐ No |
| 2A-2 | Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls? | ☒ Yes | ☐ No |
| 2A-3 | Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope? | ☒ Yes | ☐ No |
| 2B | When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1.<br><br>If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C. | | |
| 2B–1 | **Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP.<br><br>Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks? | ☒ Yes | ☐ No |
| 2B-2 | **Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs.<br><br>Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks? | ☒ Yes | ☐ No |

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | | Worksheet C.4-1: Form I- 8A[10] | |
|---|---|---|---|
| 2B-3 | **Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities.<br><br>Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks? | ☐ Yes | ☒ No |
| 2B-4 | **Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required.<br><br>Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks? | ☒ Yes | ☐ No |
| 2B-5 | **Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1).<br><br>Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned? | ☒ Yes | ☐ No |
| 2B-6 | **Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report.<br><br>Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls? | ☒ Yes | ☐ No |

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | | Worksheet C.4-1: Form I- 8A[10] | |
|---|---|---|---|
| 2C | **Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures.<br><br>Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result.<br><br>If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result. | ☐ Yes | ☒ No |
| Criteria 2 Result | Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level? | ☐ Yes | ☒ No |

Summarize findings and basis; provide references to related reports or exhibits.

The site is underlain by fill soils, topsoil and alluvium to depths of approximately 35 feet overlying Old Paralic Deposits and San Diego Formation. We performed 6 infiltration tests within the alluvium and the results indicate rates less than 0.5 inches per hour (with an applied factor of safety of 2). Therefore, full infiltration is considered infeasible within the alluvium.

The project area is mapped within a liquefaction zone. In addition, our calculations show a potential for liquefaction exists within the alluvium underlying the property. Therefore, infiltration should be considered infeasible to help prevent an increased thickness of liquefiable soil. In addition, groundwater exists at depths ranging from approximately 8 and 16 feet below the existing ground surface (approximate elevations ranging from 4 and 12 feet MSL). The elevation where infiltration is feasible is limited to the required 10 feet above the groundwater elevation. There is likely not enough vertical space between planned bottom of basin elevations and 10 feet above the groundwater elevation. Therefore, full and partial infiltration devices should be considered infeasible for the property.

| Part 1 Result – Full Infiltration Geotechnical Screening[12] | Result |
|---|---|
| If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only.<br><br>If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required. | ☐ Full infiltration Condition<br><br>☒ Complete Part 2 |

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

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | Worksheet C.4-1: Form I-8A[10] |
|---|---|
| **Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria** | |
| **DMA(s) Being Analyzed:** | **Project Phase:** |
| Bella Mar – 408 Hollister Street | Design |

| **Criteria 3: Infiltration Rate Screening** | |
|---|---|
| 3A | **NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data?<br>☐ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result.<br>☐ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result.<br>☒ No; infiltration testing is conducted (refer to Table D.3–1), continue to Step 3B. |
| 3B | **Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr?<br>☒ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result.<br>☐ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result. |
| Criteria 3 Result | Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP?<br>☒ Yes; Continue to Criteria 4.<br>☐ No: Skip to Part 2 Result. |

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

Based on the USGS Soil Survey, the property possesses a Hydrologic Soil Group A classification. In addition, we encountered field infiltration rates of:

P-1: 0.30 inches/hour (0.15 with a FOS of 2.0)
P-2: 0.25 inches/hour (0.13 with a FOS of 2.0)
P-3: 0.14 inches/hour (0.07 with a FOS of 2.0)
P-4: 0.13 inches/hour (0.07 with a FOS of 2.0)
P-5: 0.20 inches/hour (0.10 with a FOS of 2.0)
P-6: 0.12 inches/hour (0.06 with a FOS of 2.0)

This results in an average infiltration rate of 0.19 inches/hour (0.10 with a FOS of 2.0).

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | | Worksheet C.4-1: Form I- 8A[10] | |
|---|---|---|---|
| **Criteria 4: Geologic/Geotechnical Screening** | | | |
| 4A | If all questions in Step 4A are answered "Yes," continue to Step 4B.<br><br>For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP. | | |
| 4A–1 | Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick? | ☒ Yes | ☐ No |
| 4A-2 | Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls? | ☒ Yes | ☐ No |
| 4A-3 | Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope? | ☒ Yes | ☐ No |
| 4B | When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1<br><br>If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C. | | |
| 4B–1 | **Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP.<br><br>Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks? | ☒ Yes | ☐ No |
| 4B-2 | **Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs.<br><br>Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks? | ☒ Yes | ☐ No |

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | | Worksheet C.4-1: Form I-8A[10] | |
|---|---|---|---|
| 4B-3 | **Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities.<br><br>Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks? | ☐ Yes | ☒ No |
| 4B-4 | **Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required.<br><br>Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks? | ☒ Yes | ☐ No |
| 4B-5 | **Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1).<br><br>Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned? | ☒ Yes | ☐ No |
| 4B-6 | **Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report.<br><br>Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls? | ☒ Yes | ☐ No |
| 4C | **Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures.<br><br>Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result.<br><br>If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result. | ☒ Yes | ☐ No |

| Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions | | Worksheet C.4-1: Form I- 8A[10] | |
|---|---|---|---|
| Criteria 4 Result | Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level? | ☐ Yes | ☒ No |

Summarize findings and basis; provide references to related reports or exhibits.

The site is underlain by fill soils, topsoil and alluvium to depths of approximately 35 feet overlying Old Paralic Deposits and San Diego Formation. We performed 6 infiltration tests within the alluvium and the results indicate rates less than 0.5 inches per hour (with an applied factor of safety of 2). Therefore, full infiltration is considered infeasible within the alluvium.

The project area is mapped within a liquefaction zone. In addition, our calculations show a potential for liquefaction exists within the alluvium underlying the property. Therefore, infiltration should be considered infeasible to help prevent an increased thickness of liquefiable soil. In addition, groundwater exists at depths ranging from approximately 8 and 16 feet below the existing ground surface (approximate elevations ranging from 4 and 12 feet MSL). The elevation where infiltration is feasible is limited to the required 10 feet above the groundwater elevation. There is likely not enough vertical space between planned bottom of basin elevations and 10 feet above the groundwater elevation. Therefore, full and partial infiltration devices should be considered infeasible for the property.

| Part 2 – Partial Infiltration Geotechnical Screening Result[13] | Result |
|---|---|
| If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only.<br><br>If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site. | ☐ Partial Infiltration Condition<br><br>☒ No Infiltration Condition |

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

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | | Worksheet C.4-2: Form I-8B[2] |
|---|---|---|
| Part 1 - Full Infiltration Feasibility Screening Criteria | | |
| DMA(s) Being Analyzed: | | Project Phase: |
| BMPs 2, 4, 7, 8 | | TM |
| Criteria 1: Groundwater Screening | | |
| 1A | **Groundwater Depth.** Is the depth to seasonally high groundwater tables (normal high depth during the wet season) beneath the base of any full infiltration BMP greater than 10 feet?<br>◯ Yes; continue to Step 1B.<br>◯ No; The depth to groundwater is less than or equal to 10 feet, but site layout changes or reasonable mitigation measures can be proposed to support full infiltration BMPs. Continue to step 1B.<br>◯ No; The depth to groundwater is less than or equal to 10 feet and site layout changes or reasonable mitigation measures cannot be proposed to support full infiltration BMPs. Answer "No" for Criteria 1 Result. | |
| 1B | **Contaminated Soil/Groundwater.** Are proposed full infiltration BMPs at least 250 feet away from contaminated soil or groundwater sites? This can be confirmed using GeoTracker (geotracker.waterboards.ca.gov) to identify open contaminated sites. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.<br>◯ Yes; continue to Step 1C.<br>◯ No; However, site layout changes or reasonable mitigation measures can be proposed to support full infiltration BMPs. Continue to Step 1C.<br>◯ No; Site layout changes or reasonable mitigation measures cannot be proposed to support full infiltration BMPs. Answer "No" to Criteria 1 Result. | |

[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | Worksheet C.4-2: Form I-8B[2] |
|---|---|
| 1C | **Inadequate Soil Treatment Capacity.** Are full infiltration BMPs proposed in DMA soils that have adequate soil treatment capacity?<br>The DMA has adequate soil treatment capacity if **ALL** of the following criteria (detailed in C.2.2.1) for all soil layers beneath the infiltrating surface are met:<br>• USDA texture class is sandy loam or loam or silt loam or silt or sandy clay loam or clay loam or silty clay loam or sandy clay or silty clay or clay; and<br>• Cation Exchange Capacity (CEC) greater than 5 milliequivalents/100g; and<br>• Soil organic matter is greater than 1%; and<br>• Groundwater table is equal to or greater than 10 feet beneath the base of the full infiltration BMP.<br>○ Yes; continue to Step 1D.<br>○ No; However, site layout changes or reasonable mitigation measures can be proposed to support full infiltration BMPs. Continue to Step 1D.<br>○ No; Site layout changes or reasonable mitigation measures cannot be proposed to support full infiltration BMPs. Answer "No" to Criteria 1 Result. |
| 1D | **Other Groundwater Contamination Hazards.** Are there site-specific groundwater contamination hazards not already mentioned (refer to Appendix C.2.2) that can be reasonably mitigated to support full infiltration BMPs?<br>○ Yes; there are other contamination hazards identified that can be mitigated. Answer "Yes" to Criteria 1 Result.<br>○ No; there are other contamination hazards identified that cannot be mitigated. Answer "No" to Criteria 1 Result.<br>○ N/A; no contamination hazards are identified. Answer "Yes" to Criteria 1 Result. |
| Criteria 1 Result | Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination that cannot be reasonably mitigated to an acceptable level? See Appendix C.2.2.8 for a list of typically reasonable and typically unreasonable mitigation measures.<br>○ Yes; Continue to Part 1, Criteria 2.<br>○ No; Continue to Part 1 Result. |

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | Worksheet C.4-2: Form I-8B[2] |
|---|---|

Summarize groundwater quality and any mitigation measures proposed. Documentation should focus on groundwater table, mapped soil types and contaminated site locations.

The SWS indicates that the depth to the groundwater table beneath an infiltration BMP must be at least 10 feet for infiltration to be allowed. CWE encountered groundwater at depths ranging from approximately 8 to 13 feet at the subject property Partial infiltration would be feasible within the alluvium at an elevation of at least 14 feet MSL.

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | Worksheet C.4-2: Form I-8B[2] |
|---|---|
| **Criteria 2: Water Balance Screening** | |
| 2A | **Ephemeral Stream Setback.** Does the proposed full infiltration BMP meet both the following?<br>• The full infiltration BMP is located at least 250 feet away from an ephemeral stream; **AND**<br>• The bottom surface of the full infiltration BMP is at a depth 20 feet or greater from seasonally high groundwater tables.<br>○ Yes; Answer "Yes" to Criteria 2 Result.<br>○ No; Continue to Step 2B. |
| 2B | **Mitigation Measures.** Can site layout changes be proposed to support full infiltration BMPs?<br>○ Yes; the site can be reconfigured to mitigate potential water balance issues. Answer "Yes" to Criteria 2 Result.<br>○ No; the site cannot be reconfigured to mitigate potential water balance issues. Continue to Step 2C and provide discussion. |
| 2C | **Additional studies.** Do additional studies support full infiltration BMPs?<br>In the event that water balance effects are used to reject full infiltration (anticipated to be rare), additional analysis shall be completed and documented by a qualified professional indicating the site-specific information evaluated and the technical basis for this finding.<br>○ Yes; Answer "Yes" to Criteria 2 Result.<br>○ No; Answer "No" to Criteria 2 Result. |
| Criteria 2 Result | 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?<br>○ Yes; Continue to Part 1 Result.<br>○ No; Continue to Part 1 Result. |

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | Worksheet C.4-2: Form I-8B[2] |
|---|---|

Summarize potential water balance effects. Documentation should focus on mapping and soil data regarding proximity to ephemeral streams and groundwater depth.

The SWS indicates that the depth to the groundwater table beneath an infiltration BMP must be at least 10 feet for infiltration to be allowed. CWE encountered groundwater at depths ranging from approximately 8 to 13 feet at the subject property Partial infiltration would be feasible within the alluvium at an elevation of at least 14 feet MSL.

We do not expect full infiltration would cause water balance issues including change of ephemeral streams or discharge of contaminated water to surface waters.

| Part 1 – Full Infiltration Groundwater and Water Balance Screening Result[3] | Result |
|---|---|
| If answers to Criteria 1 and 2 are "Yes", a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration based on groundwater conditions. | |
| If answer to Criteria 1 or Criteria 2 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design based on groundwater conditions. Proceed to Part 2. | ○ Full Infiltration<br>○ Complete Part 2 |

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

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | Worksheet C.4-2: Form I-8B[2] |
|---|---|
| Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria | |
| DMA(s) Being Analyzed: | Project Phase: |
| BMPs 2, 4, 7, 8 | TM |
| Criteria 3: Groundwater Screening | |
| **Contaminated Soil/Groundwater.** Are partial infiltration BMPs proposed at least 100 feet away from contaminated soil or groundwater sites? This can be confirmed using GeoTracker (geotracker.waterboards.ca.gov) to identify open contaminated sites. This criterion is intentionally a smaller radius than full infiltration, as the potential quantity of infiltration from partial infiltration BMPs is smaller.<br>○ Yes; Answer "Yes" to Criteria 3 Result.<br>○ No; However, site layout changes can be proposed to avoid contaminated soils or soils that lack adequate treatment capacity. Select "Yes" to Criteria 3 Result. It is a requirement for the SWQMP preparer to identify potential mitigation measures.<br>○ No; Contaminated soils or soils that lack adequate treatment capacity cannot be avoided and partial infiltration BMPs are not feasible. Select "No" to Criteria 3 Result. | |
| Criteria 3 Result: Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing risk of groundwater contamination that cannot be reasonably mitigated to an acceptable level?<br>○ Yes; Continue to Part 2, Criteria 4.<br>○ No; Skip to Part 2 Result. | |
| Summarize findings and basis. Documentation should focus on mapped soil types and contaminated site locations. | |

| Categorization of Infiltration Feasibility Condition based on Groundwater and Water Balance Conditions | Worksheet C.4-2: Form I-8B[2] |
|---|---|

**Criteria 4: Water Balance Screening**

**Additional studies.** In the event that water balance effects are used to reject partial infiltration (anticipated to be rare), a qualified professional must provide an analysis of the incremental effects of partial infiltration BMPs on the water balance compared to incidental infiltration under a no infiltration scenario (e.g. precipitation, irrigation, etc.).

Criteria 4 Result: Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams?

○ Yes: Continue to Part 2 Result.

○ No: Continue to Part 2 Result.

Summarize potential water balance effects. Documentation should focus on mapping and soil data regarding proximity to ephemeral streams and groundwater depth.

The SWS indicates that the depth to the groundwater table beneath an infiltration BMP must be at least 10 feet for infiltration to be allowed. CWE encountered groundwater at depths ranging from approximately 8 to 13 feet at the subject property Partial infiltration would be feasible within the alluvium at an elevation of at least 14 feet MSL.

| Part 2 – Partial Infiltration Groundwater and Water Balance Screening Result[4] | Result |
|---|---|
| If answers to Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration based on groundwater and water balance conditions.<br><br>If answer to Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site. The feasibility screening category is No Infiltration based on groundwater or water balance condition. | ◉ Partial Infiltration Condition<br><br>○ No Infiltration Condition |

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

Attachment 1e

# DMA 2 - BMP 2 (BIO-FILTRATION)

| 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= | 10.85 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.71 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 14,541 | cubic-feet |

BMP 2 (DMA 2) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 472,658 sf

Pervious Area = 111,331 sf

Impervious Area = 361,326 sf

Weighted Area = (111,331 x 0.10) + (361,326 x 0.90) = 336,327 sf

C = weighted area / total area

C = 336,327 / 427,658

C = 0.71

# DMA 2 - BMP 2 (BIO-FILTRATION)

**Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria**

| Sizing Method for Pollutant Removal Criteria | | Worksheet B.5-1 | |
|---|---|---|---|
| 1 | Area draining to the BMP | 472,658 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.71 | |
| 3 | 85th percentile 24-hour rainfall depth | 0.52 | inches |
| 4 | Design capture volume [Line 1 x Line 2 x (Line 3/12)] | 14,541 | cu. ft. |
| **BMP Parameters** | | | |
| 5 | Surface ponding [6 inch minimum, 12 inch maximum] | 12 | inches |
| 6 | Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations | 25 | inches |
| 7 | Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area | 12 | inches |
| 8 | Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area | 3 | inches |
| 9 | Freely drained pore storage of the media | 0.2 | in/in |
| 10 | Porosity of aggregate storage | 0.4 | in/in |
| 11 | Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.) | 0.19 | in/hr. |
| **Baseline Calculations** | | | |
| 12 | Allowable routing time for sizing | 6 | hours |
| 13 | Depth filtered during storm [ Line 11 x Line 12] | 1.14 | inches |
| 14 | Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)] | 23 | inches |
| 15 | Total Depth Treated [Line 13 + Line 14] | 24.14 | inches |
| **Option 1 – Biofilter 1.5 times the DCV** | | | |
| 16 | Required biofiltered volume [1.5 x Line 4] | 21,813 | cu. ft. |
| 17 | Required Footprint [Line 16/ Line 15] x 12 | 10,843 | sq. ft. |
| **Option 2 - Store 0.75 of remaining DCV in pores and ponding** | | | |
| 18 | Required Storage (surface + pores) Volume [0.75 x Line 4] | 10,907 | cu. ft. |
| 19 | Required Footprint [Line 18/ Line 14] x 12 | 7,699 | sq. ft. |
| **Footprint of the BMP** | | | |
| 20 | BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4) | 0.03 | |
| 21 | Minimum BMP Footprint [Line 1 x Line 2 x Line 20] | 10,068 | sq. ft. |
| 22 | Footprint of the BMP = Maximum (Minimum (Line 17, Line 19), Line 21) | 10,843 | sq. ft. |
| 23 | Provided BMP Footprint | 11,220 | sq. ft. |
| 24 | Is Line 23 ≥ Line 22?<br>If Yes, then footprint criterion is met.<br>If No, increase the footprint of the BMP. | ☑ Yes | ☐ No |

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | |
|---|---|---|---|
| | BMP ID | BMP 2 (Biofiltration Basin) | |
| **Sizing Method for Volume Retention Criteria** | | **Worksheet B.5-2** | |
| 1 | Area draining to the BMP | 472658 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.71 | |
| 3 | 85th percentile 24-hour rainfall depth | 0.52 | inches |
| 4 | Design capture volume [Line 1 x Line 2 x (Line 3/12)] | 14542 | cu. ft. |
| **Volume Retention Requirement** | | | |
| 5 | Measured infiltration rate in the DMA<br><br>Note:<br><br>When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30<br><br>When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05 | 0.19 | in/hr. |
| 6 | Factor of safety | 2 | |
| 7 | Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6] | 0.095 | in/hr. |
| 8 | Average annual volume reduction target (Figure B.5-2)<br>When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62)<br><br>When Line 7 ≤ 0.01 in/hr. = 3.5% | 22.5 | % |
| 9 | Fraction of DCV to be retained (Figure B.5-3)<br>When Line 8 > 8% =<br>$0.0000013 \times \text{Line } 8^3 - 0.000057 \times \text{Line } 8^2 + 0.0086 \times \text{Line } 8 - 0.014$<br><br>When Line 8 ≤ 8% = 0.023 | 0.165 | |
| 10 | Target volume retention [Line 9 x Line 4] | 2399 | cu. ft. |

| The City of SAN DIEGO | Project Name | Bella Mar Apartments |
|---|---|---|
| | BMP ID | BMP 2 (Biofiltration Basin) |

| Volume Retention for No Infiltration Condition | | | Worksheet B.5-6 | |
|---|---|---|---|---|
| 1 | Area draining to the biofiltration BMP | 472658 | | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.71 | | |
| 3 | Effective impervious area draining to the BMP [Line 1 x Line 2] | 335587 | | sq. ft. |
| 4 | Required area for Evapotranspiration [Line 3 x 0.03] | 10068 | | sq. ft. |
| 5 | Biofiltration BMP Footprint | 11220 | | sq. ft. |

**Landscape Area (must be identified on DS-3247)**

| | | Identification | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 6 | Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.) | | 11220 | | | | |
| 7 | Impervious area draining to the landscape area (sq. ft.) | | 361326 | | | | |
| 8 | Impervious to Pervious Area ratio [Line 7/Line 6] | | 32.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9 | Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5] | | 11220 | 0 | 0 | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| 10 | Sum of Landscape area [sum of Line 9 Id's 1 to 5] | 11220 | | sq. ft. |
| 11 | Provided footprint for evapotranspiration [Line 5 + Line 10] | 22440 | | sq. ft. |

**Volume Retention Performance Standard**

| | | | | |
|---|---|---|---|---|
| 12 | Is Line 11 ≥ Line 4? | Volume Retention Performance Standard is Met | | |
| 13 | Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4] | 2.23 | | |
| 14 | Target Volume Retention [Line 10 from Worksheet B.5.2] | 2399 | | cu. ft. |
| 15 | Volume retention required from other site design BMPs [(1-Line 13) x Line 14] | -2950.77 | | cu. ft. |

**Site Design BMP**

| | Identification | Site Design Type | Credit | |
|---|---|---|---|---|
| 16 | 1 | | | cu. ft. |
| | 2 | | | cu. ft. |
| | 3 | | | cu. ft. |
| | 4 | | | cu. ft. |
| | 5 | | | cu. ft. |
| | Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP. | | 0 | cu. ft. |
| 17 | Is Line 16 ≥ Line 15? | Volume Retention Performance Standard is Met | | |

# DMA 4 - BMP 4 (PERMEABLE PAVERS)

| 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= | 0.06 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.10 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 21 | cubic-feet |

BMP 4 (DMA 4) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 2,791 sf

Pervious Area = 2,791 sf

Impervious Area = 0 sf

Weighted Area = (2,791 x 0.10) + (0 x 0.90) = 279 sf

C = weighted area / total area

C = 279 / 2,791

C = 0.10

PROVIDED BMP VOLUME:

(40%)x(A)x(3in)=(40%)x(1862sf)(.25ft)=186 CF >DCV

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | |
|---|---|---|---|
| | BMP ID | BMP 4 (Permeable Pavers) | |
| **Sizing Method for Volume Retention Criteria** | | **Worksheet B.5-2** | |
| 1 | Area draining to the BMP | 2791 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.1 | |
| 3 | 85th percentile 24-hour rainfall depth | 0.52 | inches |
| 4 | Design capture volume [Line 1 x Line 2 x (Line 3/12)] | 12 | cu. ft. |
| **Volume Retention Requirement** | | | |
| 5 | Measured infiltration rate in the DMA<br><br>Note:<br><br>When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30<br><br>When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05 | 0.19 | in/hr. |
| 6 | Factor of safety | 2 | |
| 7 | Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6] | 0.095 | in/hr. |
| 8 | Average annual volume reduction target (Figure B.5-2)<br>When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62)<br><br>When Line 7 ≤ 0.01 in/hr. = 3.5% | 22.5 | % |
| 9 | Fraction of DCV to be retained (Figure B.5-3)<br>When Line 8 > 8% =<br>$0.0000013 \times \text{Line } 8^3 - 0.000057 \times \text{Line } 8^2 + 0.0086 \times \text{Line } 8 - 0.014$<br><br>When Line 8 ≤ 8% = 0.023 | 0.165 | |
| 10 | Target volume retention [Line 9 x Line 4] | 2 | cu. ft. |

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | | | | | |
|---|---|---|---|---|---|---|---|
| | BMP ID | BMP 4 (Permeable Pavers) | | | | | |
| **Volume Retention for No Infiltration Condition** | | | | | **Worksheet B.5-6** | | |
| 1 | Area draining to the biofiltration BMP | | | | 2791 | sq. ft. | |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | | | | 0.1 | | |
| 3 | Effective impervious area draining to the BMP [Line 1 x Line 2] | | | | 279 | sq. ft. | |
| 4 | Required area for Evapotranspiration [Line 3 x 0.03] | | | | 8 | sq. ft. | |
| 5 | Biofiltration BMP Footprint | | | | 186 | sq. ft. | |
| **Landscape Area (must be identified on DS-3247)** | | | | | | | |
| | | **Identification** | **1** | **2** | **3** | **4** | **5** |
| 6 | Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.) | | 929 | | | | |
| 7 | Impervious area draining to the landscape area (sq. ft.) | | 0 | | | | |
| 8 | Impervious to Pervious Area ratio [Line 7/Line 6] | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9 | Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5] | | 0 | 0 | 0 | 0 | 0 |
| 10 | Sum of Landscape area [sum of Line 9 Id's 1 to 5] | | | | 0 | sq. ft. | |
| 11 | Provided footprint for evapotranspiration [Line 5 + Line 10] | | | | 186 | sq. ft. | |
| **Volume Retention Performance Standard** | | | | | | | |
| 12 | Is Line 11 ≥ Line 4? | | Volume Retention Performance Standard is Met | | | | |
| 13 | Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4] | | | | 22.21 | | |
| 14 | Target Volume Retention [Line 10 from Worksheet B.5.2] | | | | 2 | cu. ft. | |
| 15 | Volume retention required from other site design BMPs [(1-Line 13) x Line 14] | | | | -42.32593365 | cu. ft. | |
| **Site Design BMP** | | | | | | | |
| | **Identification** | **Site Design Type** | | | **Credit** | | |
| 16 | **1** | | | | | cu. ft. | |
| | **2** | | | | | cu. ft. | |
| | **3** | | | | | cu. ft. | |
| | **4** | | | | | cu. ft. | |
| | **5** | | | | | cu. ft. | |
| | Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP. | | | | 0 | cu. ft. | |
| 17 | Is Line 16 ≥ Line 15? | | Volume Retention Performance Standard is Met | | | | |

# DMA 7 - BMP 7 (MWS UNIT)

| 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= | 0.26 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.84 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 409 | cubic-feet |

BMP 7 (DMA 7) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 11,296 sf

Pervious Area = 915 sf

Impervious Area = 10,381 sf

Weighted Area = (915 x 0.10) + (10,381 x 0.90) = 9,435 sf

C = weighted area / total area

C = 9,435 / 11,296

C = 0.84

# DMA 7 - BMP 7 (MWS UNIT)

**Worksheet B.6-1: Flow-Thru Design Flows**

| Flow-thru Design Flows | | Worksheet B.6-1 | | |
|---|---|---|---|---|
| 1 | DCV | DCV | 409 | cubic-feet |
| 2 | DCV retained | $DCV_{retained}$ | 0 | cubic-feet |
| 3 | DCV biofiltered | $DCV_{biofiltered}$ | 0 | cubic-feet |
| 4 | DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3) | $DCV_{flow-thru}$ | 409 | cubic-feet |
| 5 | Adjustment factor (Line 4 / Line 1) | AF= | 1.5 | unitless |
| 6 | Design rainfall intensity | i= | 0.20 | in/hr. |
| 7 | Area tributary to BMP (s) | A= | 0.26 | acres |
| 8 | Area-weighted runoff factor (estimate using Appendix B.2) | C= | 0.84 | unitless |
| 9 | Calculate Flow Rate = AF x (C x i x A) | Q= | 0.065 | cfs |

1. Adjustment factor shall be estimated considering only retention and biofiltration BMPs located upstream of flow-thru BMPs. That is, if the flow-thru BMP is upstream of the project's retention and biofiltration BMPs then the flow-thru BMP shall be sized using an adjustment factor of 1.
2. Volume based (e.g., dry extended detention basin) flow-thru treatment control BMPs shall be sized to the volume in Line 4 and flow based (e.g., vegetated swales) shall be sized to flow rate in Line 9. Sand filter and media filter can be designed either by volume in Line 4 or flow rate in Line 9.
3. Proprietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the calculated flow rate in Line 9; certified treatment capacity per unit shall be consistent with third party certifications.

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | |
|---|---|---|---|
| | BMP ID | BMP 7 (MWS Unit) | |
| **Sizing Method for Volume Retention Criteria** | | **Worksheet B.5-2** | |
| 1 | Area draining to the BMP | 11296 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.84 | |
| 3 | 85$^{th}$ percentile 24-hour rainfall depth | 0.52 | inches |
| 4 | Design capture volume [Line 1 x Line 2 x (Line 3/12)] | 411 | cu. ft. |
| **Volume Retention Requirement** | | | |
| 5 | Measured infiltration rate in the DMA<br><br>Note:<br><br>When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30<br><br>When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05 | 0.19 | in/hr. |
| 6 | Factor of safety | 2 | |
| 7 | Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6] | 0.095 | in/hr. |
| 8 | Average annual volume reduction target (Figure B.5-2)<br>When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62)<br><br>When Line 7 ≤ 0.01 in/hr. = 3.5% | 22.5 | % |
| 9 | Fraction of DCV to be retained (Figure B.5-3)<br>When Line 8 > 8% =<br>0.0000013 x Line 8$^3$ - 0.000057 x Line 8$^2$ + 0.0086 x Line 8 - 0.014<br><br>When Line 8 ≤ 8% = 0.023 | 0.165 | |
| 10 | Target volume retention [Line 9 x Line 4] | 68 | cu. ft. |

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | |
|---|---|---|---|
| | BMP ID | BMP 7 (MWS Unit) | |
| Volume Retention From Amended Soils | | Worksheet B.5-7 | |
| 1 | Impervious area draining to the pervious area | 2295 | sq. ft. |
| 2 | Pervious area (must meet the requirements in SD-B and SD-F Fact Sheets) | 349 | sq. ft. |
| 3 | Dispersion Ratio [Line 1/Line 2]<br>Note: This worksheet is not applicable when Line 3 > 50 or Line 3 < 0.25 | 6.58 | |
| 4 | Adjusted runoff factor [(Line 1 * 0.9 + Line 2 * 0.1) / (Line 1 + Line 2)] | 0.79 | |
| 5 | 85th percentile 24-hour rainfall depth | 0.52 | inches |
| 6 | Design capture volume [(Line 1 + Line 2) x Line 4 x (Line 5/12)] | 91 | cu. ft. |
| 7 | Amendment Depth (Choose from 3", 6", 9", 12", 15" and 18") | 18 | inches |
| 8 | Storage [(porosity – field capacity) + 0.5 * (field capacity – wilting point)] | 0.25 | in./in. |
| 9 | Pervious Storage [Line 2 * (Line 7/12) * Line 8] | 131 | cu. ft. |
| 10 | Fraction of DCV [Line 9 / Line 6] | 1.44 | |
| 11 | Measured Infiltration Rate<br><br>When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30<br><br>When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05 | 0.19 | in/hr. |
| 12 | Factor of Safety | 2 | |
| 13 | Reliable Infiltration Rate [Line 11/Line 12] | 0.095 | in/hr. |
| 14 | Dispersion Credit (Based on Figures B.5.6 to B.5.11; Line 10 and Line 13) | 0.698 | |
| 15 | Volume retention due to amendment [Line 1 * (Line 5/12) * Line 14] | 69 | cu. ft. |

# DMA 8 - BMP 8 (PERMEABLE PAVERS)

| 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= | 0.01 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.10 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 6 | cubic-feet |

BMP 8 (DMA 8) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 619 sf

Pervious Area = 619 sf

Impervious Area = 0 sf

Weighted Area = (619 x 0.10) + (0 x 0.90) = 61.9 sf

C = weighted area / total area

C = 61.9 / 619

C = 0.10

PROVIDED BMP VOLUME:

(40%)x(A)x(3in)=(40%)x(619sf)(.25ft)=62 CF >DCV

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | |
|---|---|---|---|
| | BMP ID | BMP 8 (Permeable Pavers) | |
| **Sizing Method for Volume Retention Criteria** | | **Worksheet B.5-2** | |
| 1 | Area draining to the BMP | 619 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.1 | |
| 3 | 85th percentile 24-hour rainfall depth | 0.52 | inches |
| 4 | Design capture volume [Line 1 x Line 2 x (Line 3/12)] | 3 | cu. ft. |
| **Volume Retention Requirement** | | | |
| 5 | Measured infiltration rate in the DMA<br><br>Note:<br><br>When mapped hydrologic soil groups are used enter 0.10 for NRCS Type D soils and for NRCS Type C soils enter 0.30<br><br>When in no infiltration condition and the actual measured infiltration rate is unknown enter 0.0 if there are geotechnical and/or groundwater hazards identified in Appendix C or enter 0.05 | 0.19 | in/hr. |
| 6 | Factor of safety | 2 | |
| 7 | Reliable infiltration rate, for biofiltration BMP sizing [Line 5 / Line 6] | 0.095 | in/hr. |
| 8 | Average annual volume reduction target (Figure B.5-2)<br>When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62)<br><br>When Line 7 ≤ 0.01 in/hr. = 3.5% | 22.5 | % |
| 9 | Fraction of DCV to be retained (Figure B.5-3)<br>When Line 8 > 8% =<br>$0.0000013 \times \text{Line } 8^3 - 0.000057 \times \text{Line } 8^2 + 0.0086 \times \text{Line } 8 - 0.014$<br><br>When Line 8 ≤ 8% = 0.023 | 0.165 | |
| 10 | Target volume retention [Line 9 x Line 4] | 0 | cu. ft. |

| The City of SAN DIEGO | Project Name | Bella Mar Apartments | | | | | |
|---|---|---|---|---|---|---|---|
| | BMP ID | BMP 8 (Permeable Pavers) | | | | | |
| **Volume Retention for No Infiltration Condition** | | | | | **Worksheet B.5-6** | | |
| 1 | Area draining to the biofiltration BMP | | | | | 619 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | | | | | 0.1 | |
| 3 | Effective impervious area draining to the BMP [Line 1 x Line 2] | | | | | 62 | sq. ft. |
| 4 | Required area for Evapotranspiration [Line 3 x 0.03] | | | | | 2 | sq. ft. |
| 5 | Biofiltration BMP Footprint | | | | | 619 | sq. ft. |
| **Landscape Area (must be identified on DS-3247)** | | | | | | | |
| | | **Identification** | **1** | **2** | **3** | **4** | **5** |
| 6 | Landscape area that meet the requirements in SD-B and SD-F Fact Sheet (sq. ft.) | | | | | | |
| 7 | Impervious area draining to the landscape area (sq. ft.) | | | | | | |
| 8 | Impervious to Pervious Area ratio [Line 7/Line 6] | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9 | Effective Credit Area If (Line 8 >1.5, Line 6, Line 7/1.5] | | 0 | 0 | 0 | 0 | 0 |
| 10 | Sum of Landscape area [sum of Line 9 Id's 1 to 5] | | | | | 0 | sq. ft. |
| 11 | Provided footprint for evapotranspiration [Line 5 + Line 10] | | | | | 619 | sq. ft. |
| **Volume Retention Performance Standard** | | | | | | | |
| 12 | Is Line 11 ≥ Line 4? | | Volume Retention Performance Standard is Met | | | | |
| 13 | Fraction of the performance standard met through the BMP footprint and/or landscaping [Line 11/Line 4] | | | | | 333.33 | |
| 14 | Target Volume Retention [Line 10 from Worksheet B.5.2] | | | | | 0 | cu. ft. |
| 15 | Volume retention required from other site design BMPs [(1-Line 13) x Line 14] | | | | | -147.0842731 | cu. ft. |
| **Site Design BMP** | | | | | | | |
| | **Identification** | **Site Design Type** | | | | **Credit** | |
| 16 | **1** | | | | | | cu. ft. |
| | **2** | | | | | | cu. ft. |
| | **3** | | | | | | cu. ft. |
| | **4** | | | | | | cu. ft. |
| | **5** | | | | | | cu. ft. |
| | Sum of volume retention benefits from other site design BMPs (e.g. trees; rain barrels etc.). [sum of Line 16 Credits for Id's 1 to 5] Provide documentation of how the site design credit is calculated in the PDP SWQMP. | | | | | 0 | cu. ft. |
| 17 | Is Line 16 ≥ Line 15? | | Volume Retention Performance Standard is Met | | | | |

# HOLLISTER STREET - GREEN STREET EXEMPTION

| BMP Applicability and Selection for Green Street Exemption | Form J-1 |
|---|---|
| **Project Identification** | |
| Project Name: BELLA MAR | |
| Permit Application Number: | Date: |
| **Project Characterization and Selection Synopsis** | |
| The purpose of this form is to guide the selection of BMPs, given project specific constraints to meet the Green Streets exemption as defined in Appendix J.2 of the BMP Design Manual. In order to qualify for a PDP exemption, the project must incorporate all applicable Green Street BMP elements described in Appendix J.2, based on the applicability guidance provided in Appendix J.2.<br><br>Complete the sections below providing detailed justification for each selection. | |
| **Step 1: Does this project include retrofitting or redevelopment of an existing alley, street, or roadway criteria?** Exemptions do not apply for projects that construct new alleys, streets, or roadways. See Appendix J for additional guidance on distinguishing between redevelopment of a street and new development.<br>☑ Yes ☐ No (if No is selected, the Green Street exemption is not applicable) | |
| Provide a brief overview of the project, key details, and site-specific opportunities and constraints:<br>The project improvements include street improvements, new storm drain, buildings, hardscape, and landscape. | |
| **Step 2: Complete the BMP-specific applicability checklists on the following pages and attach them to this form. Complete forms for all BMPs, including those that were used and those that were not used.** | |
| **Step 3: Summarize the BMP(s) that were selected through the guidance process (Select all that apply):** | |

| BMP Type | Applicable? | Used? | Summary of justification for Inclusion or Finding of Non-applicability |
|---|---|---|---|
| Vegetated Swales | ☐ | ☐ | inadequate width, not applicable. |
| Sidewalk Planters | ☑ | ☑ | Portion of proposed planter adjacent to our project to include a sidewalk planter |
| Curb Extensions | ☐ | ☐ | Not applicable (inadequate width) |
| Permeable Surfaces | ☑ | ☑ | parkway planter and 4' bench along Eastern edge of street to be a non-erodible permeable strip |
| Green Gutters | ☐ | ☐ | not applicable |
| Rain Gardens | ☐ | ☐ | Not applicable, inadequate width |
| Trees | ☑ | ☑ | Trees to be planted along property frontage |
| Other_____ | ☐ | ☐ | |

## Form J-1 Page 2 of 8: Vegetated Swale

**Brief Description**: Vegetated Swales are shallow, open channels that are designed to remove storm water pollutants by physically straining/filtering runoff through vegetation in the channel.

| | | | |
|---|---|---|---|
| Site Type (Check all that apply): | Street Type | Rating[1] | Present in Project? |
| | Residential Streets | ◉ | ☐ |
| | Commercial Street/ Business District | ○ | ☐ |
| | Collector Street | ◉ | ☑ |
| | Arterial and Boulevard | ◉ | ☐ |
| | Alleys | ○ | ☐ |
| | Parking Areas | ◉ | ☐ |
| Key Opportunities for Vegetated Swales (Check all that apply): | Parkway strips | | ☑ |
| | Medians | | ☐ |
| | Long, mostly continuous space | | ☑ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | **Favorable Conditions for Vegetated Swales** | | |
| | Slope > 1% and <3% | | ☑ |
| | Conveying run-on to a site | | ☐ |
| | Infiltration is partially feasible or not feasible | | ☐ |
| | Long continuous segments available | | ☑ |
| | More parkway width | | ☑ |
| | **Unfavorable Conditions for Vegetated Swales** | | |
| | Available width is < 8 feet | | ☑ |
| | Frequent driveway interruption | | ☐ |
| | ROW width too limited | | ☐ |

**Summary of Findings:**

| | |
|---|---|
| Were Vegetated Swales determined to be applicable as part of the Green Streets BMP plan? ☐ Yes ☐ No | If yes, were they used? ☐ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:
the parkway width is not wide enough for a vegetated swale.

[1] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

## Form J-1 Page 3 of 8: Sidewalk Planters

**Brief Description**: A planter imbedded in the sidewalk designed to manage storm water runoff from the adjacent roadway and sidewalk.

| | Street Type | Rating[2] | Present in Project? |
|---|---|---|---|
| Site Type (Check all that apply): | Residential Streets | ◉ | ☐ |
| | Commercial Street/ Business District | ◉ | ☐ |
| | Collector Street | ● | ☑ |
| | Arterial and Boulevard | ● | ☐ |
| | Alleys | ○ | ☐ |
| | Parking Areas | ◉ | ☐ |
| Key Opportunities for Sidewalk Planters (Check all that apply): | Parkway strips | | ☑ |
| | Medians | | ☐ |
| | Between driveways | | ☐ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | **Favorable Conditions for Sidewalk Planters** | | |
| | Slope <4% | | ☑ |
| | Wide sidewalks | | ☐ |
| | More parkway width | | ☐ |
| | **Unfavorable Conditions for Sidewalk Planters** | | |
| | Conflicts with car egress | | ☐ |
| | ROW width too limited | | ☐ |

**Summary of Findings:**

| Were Sidewalk Planters determined to be applicable as part of the Green Streets BMP plan? | If yes, were they used? |
|---|---|
| ☑ Yes ☐ No | ☑ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:

drainage from sidewalk will flow over sidewalk planters before entering curb and gutter.

[2] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

## Form J-1 Page 4 of 8: Curb Extensions

**Brief Description**: Curb extensions expand the edge of the sidewalk into the roadway or parking area and allow storm water runoff to collect and infiltrate through a detention area of porous media.

| | Street Type | Rating[3] | Present in Project? |
|---|---|---|---|
| Site Type (Check all that apply): | Residential Streets | ● | ☐ |
| | Commercial Street/ Business District | ● | ☐ |
| | Collector Street | ◉ | ☑ |
| | Arterial and Boulevard | ◉ | ☐ |
| | Alleys | ○ | ☐ |
| | Parking Areas | ◉ | ☐ |
| Key Opportunities for Curb Extensions (Check all that apply): | Intersections | | ☐ |
| | Parking area | | ☐ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | **Favorable Conditions for Curb Extensions** | | |
| | Slope <4% | | ☑ |
| | Traffic calming needed | | ☐ |
| | **Unfavorable Conditions for Curb Extensions** | | |
| | Conflicts with bike lanes | | ☑ |
| | Site distance issues at intersection | | ☐ |

**Summary of Findings:**

| Were Curb Extensions determined to be applicable as part of the Green Streets BMP plan? | If yes, were they used? |
|---|---|
| ☐ Yes ☐ No | ☐ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:
inadequate right of way width. curb extensions would obstruct bike lane.

[3] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

## Form J-1 Page 5 of 8: Permeable Surfaces

**Brief Description**: Permeable surfaces are pavement that allows for percolation through void spaces into subsurface layers.

| Site Type (Check all that apply): | Street Type | Rating[4] | Present in Project? |
|---|---|---|---|
| | Residential Streets | ● | ☐ |
| | Commercial Street/ Business District | ● | ☐ |
| | Collector Street | ◉ | ☑ |
| | Arterial and Boulevard | ◉ | ☐ |
| | Alleys | ● | ☐ |
| | Parking Areas | ◉ | ☐ |
| Key Opportunities for Permeable Surfaces (Check all that apply): | Sidewalks | | ☑ |
| | Parking strips | | ☑ |
| | Shoulders | | ☑ |
| | Low traffic roadways | | ☐ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | **Favorable Conditions for Permeable Surfaces** | | |
| | Slope < 2-3% | | ☑ |
| | Conveying limited run-on to a site | | ☑ |
| | Low traffic area | | ☐ |
| | **Unfavorable Conditions for Permeable Surfaces** | | |
| | High traffic area | | ☐ |
| | Run-on has high sediment load | | ☐ |

**Summary of Findings:**

| Were Permeable Surfaces determined to be applicable as part of the Green Streets BMP plan? | If yes, were they used? |
|---|---|
| ☑ Yes ☐ No | ☑ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:

4' wide bench along Eastern edge of street to have non-erodible strip of open graded rock.

[4] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

## Form J-1 Page 6 of 8: Green Gutters

**Brief Description**: Green Gutters are shallow and narrow strips of landscaping in a typical curb and gutter location with a lower elevation than the street gutter elevation to allow capture of storm water from the sidewalk and street.

| | | | |
|---|---|---|---|
| Site Type (Check all that apply): | Street Type | Rating[5] | Present in Project? |
| | Residential Streets | ○ | ☐ |
| | Commercial Street/ Business District | ◉ | ☐ |
| | Collector Street | ● | ☑ |
| | Arterial and Boulevard | ● | ☐ |
| | Alleys | ◉ | ☐ |
| | Parking Areas | ○ | ☐ |
| Key Opportunities for Green Gutters (Check all that apply): | Parkway strips | | ☑ |
| | Medians | | ☐ |
| | Long, mostly continuous space | | ☑ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | Favorable Conditions for Green Gutters | | |
| | Slope > 1% and <3% | | ☑ |
| | Conveying run-on to a site | | ☐ |
| | Infiltration is partially feasible or not feasible | | ☐ |
| | Long continuous segments available | | ☑ |
| | Narrower spaces (as little as 2 to 3 feet) | | ☐ |
| | Unfavorable Conditions for Green Gutters | | |
| | Frequent driveway interruption | | ☑ |
| | ROW width too limited | | ☑ |

**Summary of Findings:**

| | |
|---|---|
| Were Green Gutters determined to be applicable as part of the Green Streets BMP plan?<br>☑ Yes ☐ No | If yes, were they used?<br>☐ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:
frequent driveway interruption preclude the use of this BMP

[5] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

## Form J-1 Page 7 of 8: Rain Gardens

**Brief Description**: Rain Gardens are shallow detention basins with vegetation that temporarily store water to allow for infiltration of the stored volume. Rain Gardens could be bioretention or biofiltration with partial retention or a biofiltration BMP.

| | | | |
|---|---|---|---|
| Site Type (Check all that apply): | Street Type | Rating[6] | Present in Project? |
| | Residential Streets | ◉ | ☐ |
| | Commercial Street/ Business District | ◉ | ☐ |
| | Collector Street | ◉ | ☑ |
| | Arterial and Boulevard | ◉ | ☐ |
| | Alleys | ○ | ☐ |
| | Parking Areas | ● | ☐ |
| Key Opportunities for Rain Gardens (Check all that apply): | Irregularly shaped areas in ROW | | ☐ |
| | Broad and flat areas | | ☐ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | Favorable Conditions for Rain Gardens | | |
| | Slope <2% | | ☑ |
| | Infiltration is partially feasible or not feasible | | ☐ |
| | Large area available | | |
| | Unfavorable Conditions for Rain Gardens | | |
| | Slope > 2% | | ☐ |
| | ROW too limited | | ☑ |

**Summary of Findings:**

| | |
|---|---|
| Were Rain Gardens determined to be applicable as part of the Green Streets BMP plan?<br>☐ Yes ☐ No | If yes, were they used?<br>☐ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:
inadequate right of way width.

[6] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

## Form J-1 Page 8 of 8: Trees

**Brief Description**: Trees planted in the sidewalk right-of-way provide rainfall interception and infiltration benefits and typically supplement other storm water management tools.

| | | | |
|---|---|---|---|
| Site Type (Check all that apply): | Street Type | Rating[7] | Present in Project? |
| | Residential Streets | ● | ☐ |
| | Commercial Street/ Business District | ◉ | ☐ |
| | Collector Street | ◉ | ☑ |
| | Arterial and Boulevard | ◉ | ☐ |
| | Alleys | ◉ | ☐ |
| | Parking Areas | ● | ☐ |
| Key Opportunities for Trees (Check all that apply): | Parkway strips | | ☑ |
| | Medians | | ☐ |
| | Irregularly shaped areas | | ☐ |
| | Extra ROW on back side of sidewalk | | ☐ |
| | Other (must justify below) | | ☐ |
| Site-Specific Factors (Check all that apply): | Favorable Conditions for Trees | | |
| | Located outside of clear zone | | ☑ |
| | Infiltration is feasible | | ☑ |
| | ROW not limiting | | |
| | Unfavorable Conditions for Trees | | |
| | Limited space for root growth | | ☐ |
| | Clear zone issues | | ☐ |

**Summary of Findings:**

| | |
|---|---|
| Were Trees determined to be applicable as part of the Green Streets BMP plan? ☑ Yes ☐ No | If yes, were they used? ☑ Yes ☐ No |

Provide discussion/justifications for selections and decisions above:
Trees are proposed in the parkway.

[7] ● High applicability within this category, however may still be limited by site-specific factors
◉ Generally applicable in this category; largely dependent on site-specific factors
○ Limited applicability within this category; may still be applicable in some cases; should be considered

# DMA 2 - BMP 2 (BIO-FILTRATION)

**Worksheet B.5-1: Sizing Method for Pollutant Removal Criteria**

| Sizing Method for Pollutant Removal Criteria | | Worksheet B.5-1 | |
|---|---|---|---|
| 1 | Area draining to the BMP | 472,658 | sq. ft. |
| 2 | Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2) | 0.71 | |
| 3 | 85th percentile 24-hour rainfall depth | 0.52 | inches |
| 4 | Design capture volume [Line 1 x Line 2 x (Line 3/12)] | 14,541 | cu. ft. |
| **BMP Parameters** | | | |
| 5 | Surface ponding [6 inch minimum, 12 inch maximum] | 12 | inches |
| 6 | Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations | 25 | inches |
| 7 | Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area | 12 | inches |
| 8 | Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area | 3 | inches |
| 9 | Freely drained pore storage of the media | 0.2 | in/in |
| 10 | Porosity of aggregate storage | 0.4 | in/in |
| 11 | Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.) | 0.19 | in/hr. |
| **Baseline Calculations** | | | |
| 12 | Allowable routing time for sizing | 6 | hours |
| 13 | Depth filtered during storm [ Line 11 x Line 12] | 1.14 | inches |
| 14 | Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)] | 23 | inches |
| 15 | Total Depth Treated [Line 13 + Line 14] | 24.14 | inches |
| **Option 1 – Biofilter 1.5 times the DCV** | | | |
| 16 | Required biofiltered volume [1.5 x Line 4] | 21,813 | cu. ft. |
| 17 | Required Footprint [Line 16/ Line 15] x 12 | 10,843 | sq. ft. |
| **Option 2 - Store 0.75 of remaining DCV in pores and ponding** | | | |
| 18 | Required Storage (surface + pores) Volume [0.75 x Line 4] | 10,907 | cu. ft. |
| 19 | Required Footprint [Line 18/ Line 14] x 12 | 7,699 | sq. ft. |
| **Footprint of the BMP** | | | |
| 20 | BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-4) | 0.03 | |
| 21 | Minimum BMP Footprint [Line 1 x Line 2 x Line 20] | 10,068 | sq. ft. |
| 22 | Footprint of the BMP = Maximum (Minimum (Line 17, Line 19), Line 21) | 10,843 | sq. ft. |
| 23 | Provided BMP Footprint | 11,220 | sq. ft. |
| 24 | Is Line 23 ≥ Line 22?<br>If Yes, then footprint criterion is met.<br>If No, increase the footprint of the BMP. | ☑ Yes | ☐ No |

# DMA 4 - BMP 4 (PERMEABLE PAVERS)

| 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= | 0.06 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.10 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 21 | cubic-feet |

BMP 4 (DMA 4) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 2,791 sf

Pervious Area = 2,791 sf

Impervious Area = 0 sf

Weighted Area = (2,791 x 0.10) + (0 x 0.90) = 279 sf

C = weighted area / total area

C = 279 / 2,791

C = 0.10

PROVIDED BMP VOLUME:

(40%)x(A)x(3in)=(40%)x(1862sf)(.25ft)=186 CF >DCV THEREFORE SELF-RETAINING

# DMA 7 - BMP 7 (MWS UNIT)

| 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= | 0.26 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.84 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 409 | cubic-feet |

BMP 7 (DMA 7) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 11,296 sf

Pervious Area = 915 sf

Impervious Area = 10,381 sf

Weighted Area = (915 x 0.10) + (10,381 x 0.90) = 9,435 sf

C = weighted area / total area

C = 9,435 / 11,296

C = 0.84

# DMA 7 - BMP 7 (MWS UNIT)

**Worksheet B.6-1: Flow-Thru Design Flows**

| Flow-thru Design Flows | | Worksheet B.6-1 | | |
|---|---|---|---|---|
| 1 | DCV | DCV | 409 | cubic-feet |
| 2 | DCV retained | $DCV_{retained}$ | 0 | cubic-feet |
| 3 | DCV biofiltered | $DCV_{biofiltered}$ | 0 | cubic-feet |
| 4 | DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3) | $DCV_{flow-thru}$ | 409 | cubic-feet |
| 5 | Adjustment factor (Line 4 / Line 1) | AF= | 1.5 * | unitless |
| 6 | Design rainfall intensity | i= | 0.20 | in/hr. |
| 7 | Area tributary to BMP (s) | A= | 0.26 | acres |
| 8 | Area-weighted runoff factor (estimate using Appendix B.2) | C= | 0.84 | unitless |
| 9 | Calculate Flow Rate = AF x (C x i x A) | Q= | 0.065 | cfs |

1. Adjustment factor shall be estimated considering only retention and biofiltration BMPs located upstream of flow-thru BMPs. That is, if the flow-thru BMP is upstream of the project's retention and biofiltration BMPs then the flow-thru BMP shall be sized using an adjustment factor of 1.
2. Volume based (e.g., dry extended detention basin) flow-thru treatment control BMPs shall be sized to the volume in Line 4 and flow based (e.g., vegetated swales) shall be sized to flow rate in Line 9. Sand filter and media filter can be designed either by volume in Line 4 or flow rate in Line 9.
3. Proprietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the calculated flow rate in Line 9; certified treatment capacity per unit shall be consistent with third party certifications.

* Use 1.5 for proprietary biofiltration

# DMA 8 - BMP 8 (PERMEABLE PAVERS)

| 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= | 0.01 | acres |
| 3 | Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1) | C= | 0.10 | unitless |
| 4 | Trees Credit Volume<br><br>Note: In the SWQMP list the number of trees, size of each tree, amount of soil volume installed for each tree, contributing area to each tree and the inlet opening dimension for each tree. | TCV= | 0 | cubic-feet |
| 5 | Rain barrels Credit Volume<br><br>Note: In the SWQMP list the number of rain barrels, size of each rain barrel and the use of the captured storm water runoff. | RCV= | 0 | cubic-feet |
| 6 | Calculate DCV = (3630 x C x d x A) – TCV - RCV | DCV= | 6 | cubic-feet |

BMP 8 (DMA 8) - C runoff Factor Calculations:

C roofs = 0.90

C landscape = 0.10

Total Area = 619 sf

Pervious Area = 619 sf

Impervious Area = 0 sf

Weighted Area = (619 x 0.10) + (0 x 0.90) = 61.9 sf

C = weighted area / total area

C = 61.9 / 619

C = 0.10

PROVIDED BMP VOLUME:

(40%)x(A)x(3in)=(40%)x(619sf)(.25ft)=62 CF >DCV

THEREFORE SELF-RETAINING

Project Name: Bella Mar Apartments

| Tabular Summary of DMAs | | | | | | | | Worksheet B-1 | |
|---|---|---|---|---|---|---|---|---|---|
| DMA Unique Identifier | Area (acres) | Impervious Area (acres) | % Imp | HSG | Area Weighted Runoff Coefficient | DCV (cubic feet) | Treated By (BMP ID) | Pollutant Control Type | Drains to (POC ID) |
| DMA 1 | 2.31 | 0 | 0 | A | 0.10 | 436 | - | SD-B | 2 |
| DMA 2 | 10.85 | 361,326 | 76 | A | 0.71 | 14575 | BMP 2 | BF-1 | 1 |
| DMA 3 | 0.39 | 0 | 0 | A | 0.10 | 73 | - | SD-B | 1 |
| DMA 4 | 0.06 | 0 | 0 | A | 0.10 | 21 | BMP 4 | INF-3 | 1 |
| DMA 5 | 0.11 | 1,375 | 29 | A | 0.33 | 69 | - | SD-B | 1 |
| DMA 6 | 0.06 | 289 | 11 | A | 0.18 | 22 | - | SD-B | 1 |
| DMA 7 | 0.26 | 10,381 | 92 | A | 0.84 | 409 | BMP 7 | FT-5 | 2 |
| DMA 8 | 0.01 | 0 | 0 | A | 0.10 | 4 | - | SD-B | 2 |
| DMA 9 | 0.01 | 0 | 0 | A | 0.10 | 1 | - | SD-B | 2 |
| | | | | | | | | | |
| **Summary of DMA Information (Must match project description and SWQMP Narrative)** | | | | | | | | | |
| No. of DMAs | Total DMA Area (acres) | Total Impervious Area (acres) | % Imp | | Area Weighted Runoff Coefficient | Total DCV (cubic feet) | Total Area Treated (acres) | | No. of POCs |
| 9 | 14.06 | 8.57 | 61 | | 0.69 | 18,354 | 11,468 | | 2 |

**Where**: DMA = Drainage Management Area; Imp = Imperviousness; HSG = Hydrologic Soil Group; DCV= Design Capture Volume; BMP = Best Management Practice; POC = Point of Compliance; ID = identifier; No. = Number

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# 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.

**From:** Gefrom, Walter <WGefrom@sandiego.gov>
**Sent:** Thursday, December 13, 2018 5:06 PM
**To:** Bryan Smith
**Cc:** Vera, Karen; Martin Jones; Mike Hoe
**Subject:** RE: Bella Mar HMP - PTS 598995
**Attachments:** Bella Mar Hydromod Exempt Memo.pdf

**Categories:** Filed by Newforma

Bryan,

My review of this and comments apply to the project once it comes through my group for Ministerial review/approval. Currently, it appears to be under review/approval through preliminary/discretionary. Also, keep in mind that any revisions to the State storm water permit before you acquire a grading/building permit may require me to void the memo.

Based on the exhibit and supporting documentation provided, the discharge of any storm water treated flows will not require HMP. You will need to revise the memo per my markups based on the updated Storm Water Standards Manual and also update the last page (Manual excerpt) with the newest language. Mike Hoe won't need to sign the memo if he sends the memo directly to me through e-mail instead of a cc. Or, he may acknowledge that he's seen it.

Thanks,

**Walter C. Gefrom, PE, QSD, CFM**
Deputy City Engineer

Development Services Department - Engineering Division
1222 First Avenue | San Diego | CA | 92101
MS 501

Visit OpenDSD for project info: https://www.sandiego.gov/development-services/opendsd

---

**From:** Bryan Smith [mailto:bsmith@fuscoe.com]
**Sent:** Tuesday, December 11, 2018 7:59 AM
**To:** Gefrom, Walter <WGefrom@sandiego.gov>
**Cc:** Vera, Karen <KVera@sandiego.gov>
**Subject:** RE: Bella Mar HMP - PTS 598995

Hi Walter,

Just wanted to follow up on this. Can you please review and get back to me when you have the chance?

Thanks,

**BRYAN D. SMITH, PE** | *Project Manager*

**FUSCOE ENGINEERING, INC.**
*an employee owned company*

*full circle thinking®*

858.554.1500

---

**From:** Bryan Smith
**Sent:** Friday, November 30, 2018 11:05 AM
**To:** 'Gefrom, Walter' <WGefrom@sandiego.gov>
**Cc:** 'Vera, Karen' <KVera@sandiego.gov>
**Subject:** Bella Mar HMP - PTS 598995

Walter,

Hope all is well with you. Over a year ago, we met and discussed this multifamily residential project in Otay Nestor at 408 Hollister. I don't expect that you recall the original meeting, but we discussed a possible HMP exemption for this site. The project went on hold for some time but has since been restarted. Most recently, we went through preliminary review and were assigned the above PTS number and also met with you to discuss stockpiling in the FEMA Floodplain, as you probably recall. The stockpiling idea has been put on hold but we are working toward an entitlement submittal for a Tentative Map.

Our discussion last year was based on the Hydromod exemption. The site discharges through a Caltrans culvert under the I-5 free and discharges to an unlined channel to the West. The unlined channel and culvert outlet is within the 10-year flood plain elevation associated with the Otay River (see attached Memo documenting this). According to our meeting, you believed this would qualify for an exemption from HMP requirements but you asked that we document it in a memo and send to you.

Please find the attached memo which we will include the SWQMP. If you could please take a quick review when you have the chance and confirm our understanding it would be much appreciated.

Best,

25 YEARS

**BRYAN D. SMITH, PE** | *Project Manager*
bsmith@fuscoe.com
CONNECT WITH ME

**FUSCOE ENGINEERING, INC.**
*an employee owned company*

6390 Greenwich Drive, Suite 170, San Diego, California 92122
858.554.1500 | fuscoe.com

IRVINE . **SAN DIEGO** . ONTARIO . LOS ANGELES . EL CENTRO . SAN RAMON . MISSION HILLS

# Hydromodification Exemption Memo - Bella Mar

To: Walter Gefrom, P.E., City of San Diego DSD

From: Michael Hoe, P.E., Fuscoe Engineering, Inc.

Date: May 17, 2017, Revision Date: December 14, 2018

The subject property is located at 408 Hollister Street in the City of San Diego, County of San Diego. The project site is bordered by private properties to the North and South, Hollister Street on the East and the Interstate 5 Freeway on the West. See the attached project site exhibit on the following sheet. Stormwater runoff on the subject property flows from east to west and discharges into an existing 24" storm drain culvert which runs below the I-5 Interchange bridge. The runoff eventually discharges into the Otay River and ultimately into the San Diego Bay.

Per City of San Diego Storm Water Standards Section 1.6, the Otay River is classified as a hydromodification exempt body of water.

"*Designated exempt river reaches within City of San Diego jurisdiction include the Otay River downstream of Lower Otay Reservoir Dam (Savage Dam). To qualify as a direct discharge to this exempt river reach, the invert elevation of the direct discharge conveyance system (at the point of discharge to the exempt river reach) should be equal to or below the 10-year floodplain elevation. The City Engineer may require additional analysis of the potential for erosion between the outfall and the 10-year floodplain elevation*."

The flowline elevation at the outlet of the existing 24" storm drain culvert is 12.7' NGVD29 or 14.9' NAVD 88 (see conversion table on the next sheet) per Caltrans As-built Drawing Document Number A-0002600. See the attached as-built drawing for reference.

Based on the most recent Flood Insurance Study (revised May 16, 2012), the 10-year water surface elevation below the Interstate 5 Bridge at the storm drain outlet is 14.9' (NAVD 88). See the flood profile for the Otay River in the following attachments. The storm drain outfall elevation is the same elevation as the 10-year base flood elevation therefore, the project should be considered exempt from Hydromodification Management requirements.

## Attachments:

1- Site Plan
2- Caltrans As-Built
3- Flood Insurance Study
4- BMP Manual Excerpt

ATTACHMENT 1
SITE PLAN

ATTACHMENT 2
CALTRANS AS-BUILT

| DIST. | COUNTY | ROUTE | POST MILES—TOTAL PROJECT | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 11 | SD | 5 | 4.4/9.0 | 42 | 437 |

DISTRICT DESIGN ENGINEER Henry R. Obrecht REGISTERED CIVIL ENGINEER No. 15768
DATE APPROVED July 27, 1970

14.9' IE-OUT (NAVD 88)

16.2' IE-IN (NAVD 88)

L0
Δ = 04° 36' 28"
R = 10,000'
T = 402.32'
L = 804.21'

275+59.38 EC L0

Otay Riv Br
Br. No. 57-246R/L

Otay Riv Overflow Br
Br. No. 57-263R/L

R/W

S Dike

Graded "V" Gutter 2:1 SS

N06°54'00"W 285

2693.09'

Profile Grade

Ground Line

-0.38%

NOTE
Profile Grade is 15' Lt & Rt of ℄ L0

U.S.C & G.S. Datum

"AS BUILT"
CONTRACT 122404
YEAR COMPLETED 8-1-73

# DRAINAGE DETAILS AND CONTOUR GRADING PLANS

| Project Engineer | Date | Design Engineer | Date | Approval Recommended By | Date |
|---|---|---|---|---|---|
| | | | | | |

AS BUILT PLANS
Contract No. 11-122404
Date Completed 07-70
Document No. 11-000260

FORM WH23A-PF

4

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 8-26-74 SIGNATURE [signature] TITLE [illegible]

SCALE 1"=50' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=20' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=10' or 1"=100' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=40' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM

ATTACHMENT 3 :
FLOOD INSURANCE
STUDY

CHARLES AVENUE

LOURET AVENUE

INTERSTATE HIGHWAY 5

INTERSTATE HIGHWAY 5

14.9' 10 YEAR FLOOD ELEVATION @ OUTLET

15.1' 10-YEAR FLOOD ELEVATION @ INLET

200'

ELEVATION IN FEET (NAVD)

30

20

10

0

2600 2800 3000 3200 3400 3600 3800 4000 4200 4400 4600 4800 5000 5200

STREAM DISTANCE IN FEET ABOVE CROSS SECTION A

D E F G

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

259P

## TABLE 12: FLOODING SOURCE DATUM SHIFT VALUES

| Stream Name | Elevation (feet NAVD above NGVD) |
|---|---|
| Moosa Creek (North Branch) | +2.3 |
| Moosa Creek (South Branch) | +2.3 |
| Murphy Canyon Creek | +2.1 |
| Murray Canyon Creek | +2.1 |
| Nestor Creek | +2.1 |
| North Avenue Tributary | +2.3 |
| North Branch Poway Creek | +2.1 |
| North Tributary to Santa Maria Creek | +2.2 |
| Olive Creek | +2.4 |
| Otay River | +2.2 |
| Pala Mesa Creek | +2.2 |
| Paradise Creek | +2.1 |
| Paradise Creek – Valley Road Branch | +2.1 |
| Pilgrim Creek | +2.3 |
| Poggi Canyon Creek | +2.2 |
| Pomerado Creek | +2.1 |
| Poway Creek | +2.1 |
| Rainbow Creek (Main Branch) | +2.3 |
| Rainbow Creek (West Branch) | +2.3 |
| Rattlesnake Creek | +2.1 |
| Rattlesnake Creek Split Flow at Heritage Hills | +2.1 |
| Rattlesnake Creek Split Flow at Midland Road | +2.1 |
| Reidy Creek | +2.3 |
| Reidy Creek Split Flow | +2.3 |
| Rice Canyon Creek | +2.1 |
| Rincon Avenue Tributary | +2.3 |
| Rose Canyon Creek | +2.1 |
| Samagutuma Creek | +2.4 |
| San Clemente Canyon Creek | +2.1 |
| San Diego Bay | +2.2 |
| San Diego River | +2.1 |
| San Dieguito River | +2.1 |
| San Elijo Creek | +2.2 |
| San Luis Rey River | +2.3 |
| San Marcos Creek | +2.3 |
| San Marcos Creek (Below Lake San Marcos) | +2.3 |
| San Marcos Creek Highway 78 Split Flow | +2.3 |

- This exemption is subject to the following conditions:
  (a) A properly sized energy dissipation system must be provided in accordance with the City design standards to mitigate outlet discharge velocity from the direct discharge to the water storage reservoir or lake for the ultimate condition peak design flow of the direct discharge,
  (b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the water storage reservoir or lake) should be equal to or below the lowest normal operating water surface elevation at the point of discharge, unless the outfall discharges to quay or other non-erodible shore protection. Normal operating water surface elevation may vary by season; contact the reservoir operator to determine the elevation. For cases in which the direct discharge conveyance system outlet invert elevation is above the lowest normal operating water surface elevation but below the reservoir spillway elevation, additional analysis is required to determine if energy dissipation should be extended between the conveyance system outlet and the elevation associated with the lowest normal operating water surface level.
- No exemption may be granted for conveyance system outlet invert elevations located above the reservoir spillway elevation.

- **Figure 1-2, Node 5** – As allowed by the MS4 Permit, projects discharging directly to an area identified as appropriate for an exemption in the WMAA for the watershed in which the project resides are exempt. Refer to the WMAA for any updates to exempt river reaches. Discharging directly refers to either a) existing underground storm drain systems; or b) conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to the designated area.
  - Designated exempt river reaches identified in the WMAA and approved by the RWQCB within City of San Diego jurisdiction:
    (a) San Dieguito River downstream of Lake Hodges
    (b) San Diego River downstream of confluence with San Vicente Creek
    (c) Sweetwater River downstream of Sweetwater Reservoir
    (d) Otay River downstream of Lower Otay Reservoir Dam
  - To qualify as a direct discharge to an exempt river reach:
    (a) A properly sized energy dissipation system must be provided to mitigate outlet discharge velocity from the direct discharge to the exempt river reach for the ultimate condition peak design flow of the direct discharge,
    (b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the exempt river reach) should be equal to or below the 10-year floodplain elevation. Exceptions may be made at the discretion of the City Engineer, but shall never exceed the 100-year floodplain elevation. The City Engineer may require additional analysis of the potential for erosion between the outfall and the 10-year floodplain elevation.
  - No exemption may be granted for conveyance system outlet invert elevations located above the 100-year floodplain elevation.

**General note regarding HMP:** New outfalls shall meet requirements for energy dissipation size in the Drainage Design Manual regardless of the addition of hydromodification controls. Existing outfalls that are insufficient to accommodate additional flows from proposed upstream development projects

Project Name: Bella Mar Apartments

**Indicate which Items are Included:**

| Attachment Sequence | Contents | Checklist |
|---|---|---|
| **Attachment 2a** | Hydromodification Management Exhibit (Required) | ☐ Included<br>See Hydromodification Management Exhibit Checklist. |
| **Attachment 2b** | Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional)<br><br>See Section 6.2 of the BMP Design Manual. | ☑ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required)<br><br>Optional analyses for Critical Coarse Sediment Yield Area Determination<br>☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite<br>☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment<br>☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite |
| **Attachment 2c** | Geomorphic Assessment of Receiving Channels (Optional)<br><br>See Section 6.3.4 of the BMP Design Manual. | ☐ Not Performed<br>☐ Included<br>☐ Submitted as separate stand-alone document |
| **Attachment 2d** | Flow Control Facility Design and Structural BMP Drawdown Calculations (Required)<br><br>Overflow Design Summary for each structural BMP<br><br>See Chapter 6 and Appendix G of the BMP Design Manual | ☐ Included<br>☐ Submitted as separate stand-alone document |

## LEGEND

CRITICAL COURSE SEDIMENT YIELD AREAS


# BELLA MAR

## ATTACHMENT 2b - CRITICAL COURSE SEDIMENT YEILD AREAS EXHIBIT

FUSCOE ENGINEERING
6390 Greenwich Dr., Suite 170, San Diego, California 92122
tel 858.554.1500 • fax 858.597.0335 • www.fuscoe.com

F:\PROJECTS\1621\001_SUPPORT FILES\REPORTS\SWQMP\ATTACHMENTS\CRITICAL COURSE SEDIMENT YIELD AREAS MAP EXHIBIT.DWG (02-20-2019 2:02:19PM) Plotted by: Brianne VanGorder

Project Name: Bella Mar Apartments

**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)
- [x] Critical coarse sediment yield areas to be protected OR provide a separate map showing that the project site is outside of any critical coarse sediment yield areas
- [ ] 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).

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# Attachment 3
# Structural BMP Maintenance Information

This is the cover sheet for Attachment 3.

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**Project Name:** Bella Mar Apartments

**Indicate which Items are Included:**

| Attachment Sequence | Contents | Checklist |
|---|---|---|
| **Attachment 3** | Maintenance Agreement (Form DS-3247) (when applicable) | ☐ Included<br>☐ Not applicable |

WILL PROVIDE AT FINAL SUBMITTAL

Project Name: Bella Mar Apartments

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

**Attachment 3**: For private entity operation and maintenance, Attachment 3 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).

# Attachment 4
# Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 4.

Project Name: Bella Mar Apartments

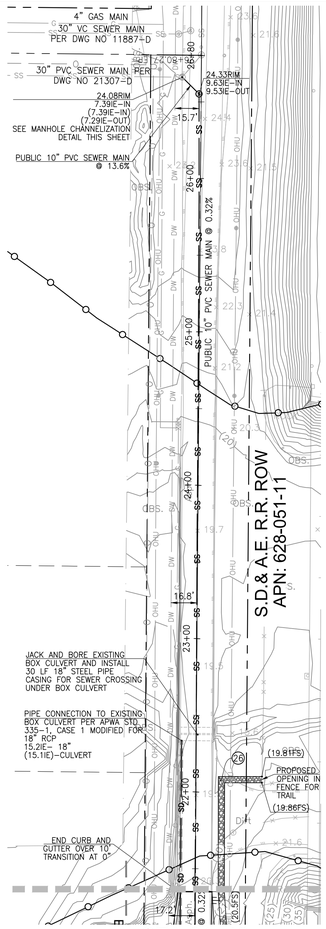
**Use this checklist to ensure the required information has been included on the plans:**

The plans must identify:

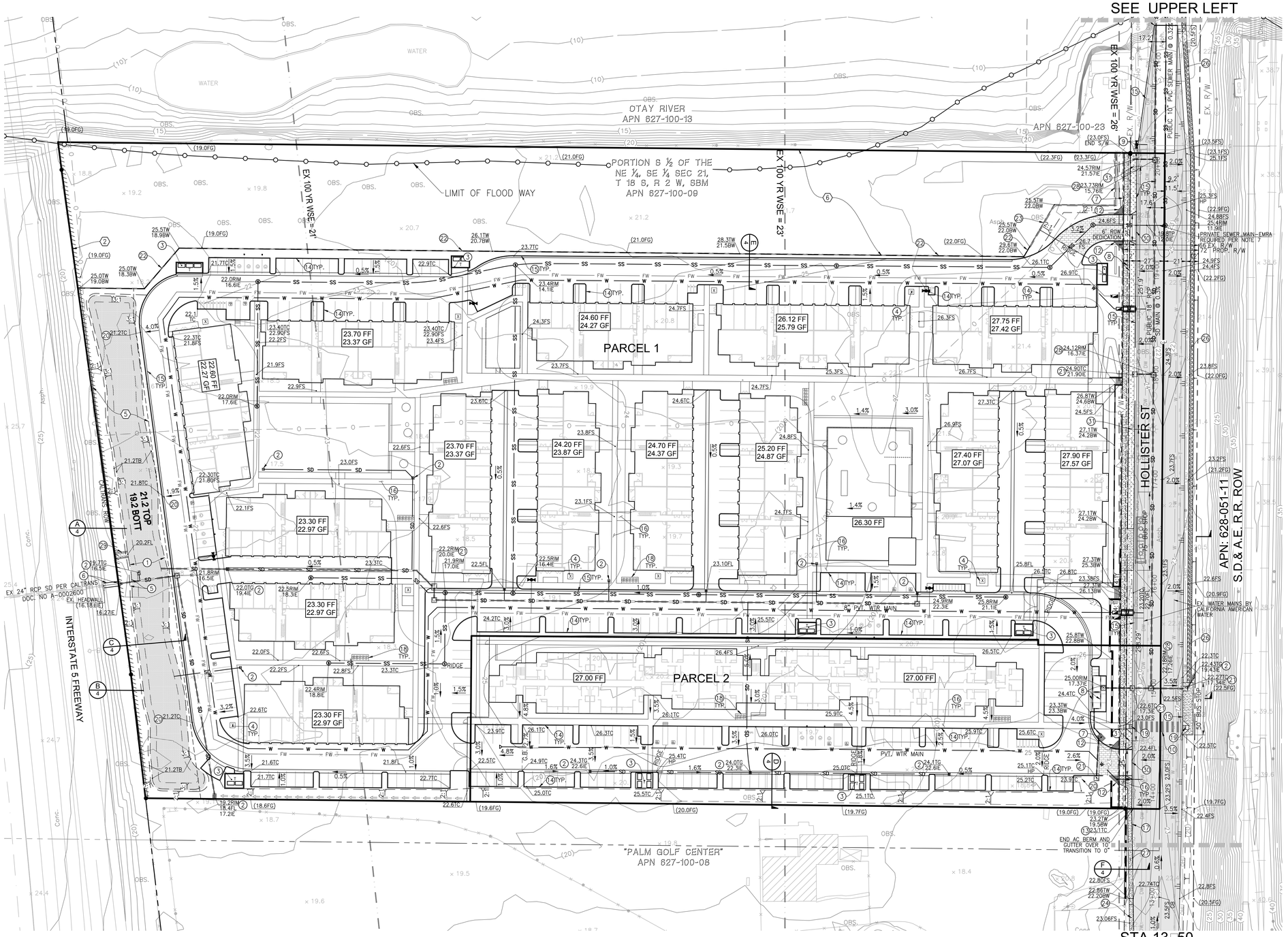
- ☐ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- ☐ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- ☐ Details and specifications for construction of structural BMP(s)
- ☐ Signage indicating 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.



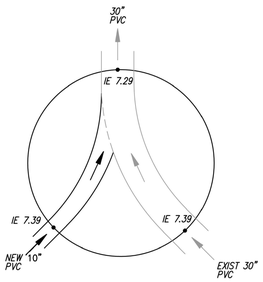

STA 21□40
SEE RIGHT




STA 13□50
SEE SHEET 4 OF 5

## CONSTRUCTION NOTES

1. BIOFILTRATION BASIN PER DETAIL C/4
2. CATCH BASIN PER RSD D-8
3. TRASH ENCLOSURE
4. ELECTRICAL TRANSFORMER
5. SPILLWAY PER DETAIL C/4
6. HEADWALL TO DISCHARGE TO 4.5' WIDE CONCRETE DRAINAGE DITCH TO EX. CULVERT (CALTRANS ENCROACHMENT)
7. PROPRIETARY MODULAR WETLAND BIOFILTRATION BMP
8. UNDERGROUND DETENTION VAULTS
9. RELOCATE EX. FH
10. MID BLOCK CROSSWALK PER SDM-116
12. VISIBILITY AREA TRIANGLES. NO OBSTRUCTION INCLUDING SOLID WALLS IN THE VISIBILITY AREA SHALL EXCEED 3FT IN HEIGHT
13. TRANSITION FROM C&G TO TEMP AC BERM
14. 6" CURB PER SDG-150
15. 6" CURB AND GUTTER PER SDG-151
16. 4" PCC SIDEWALK PER SDG-155
17. TEMPORARY 6" TYPE 'A' AC BERM PER G-05
18. BIKE RACKS PER LANDSCAPE PLANS
19. CURB RAMP TYPE 'B' PER SDG-133
20. 3' CURB OPENING
21. CURB INLET PER RSD D-1
22. RETAINING WALL WITH 3' FREESTANDING WALL AND FENCING PER DETAIL E/4
23. 3' FREESTANDING WALL AND FENCING PER LANDSCAPE ARCH PLANS
24. EXISTING 35' DRIVEWAY TO BE MODIFIED PER SDG-162
25. CURB RAMP TYPE 'C' PER G-29
26. 4' WIDE MULTI-USE DG PATH PER DETAIL H/4
27. TEMPORARY 4" AC SIDEWALK PER SDG-155
28. STORM DRAIN CLEANOUT PER RSD D-9
29. CONCRETE SPILLWAY (6' WIDE X 6" DEEP) FOR EMERGENCY/SECONDARY OVERFLOW
30. 25' DRIVEWAY PER SDG-161
31. PROPOSED STREET LIGHT INSTALLED PER STREET DESIGN MANUAL




*MANHOLE RECHANNELIZATION DETAIL*
*NO SCALE*

## EASEMENT NOTES

2. ABUTTER'S RIGHTS OF INGRESS AND EGRESS TO OR FROM THE STREET, HIGHWAY, OR FREEWAY ABUTTING THE WESTERLY BOUNDARY OF SAID PROPERTY RECORDED IN BOOK 3918, PAGE 199 O.R. RECORDED JANUARY 3, 1951.
5. AN EASEMENT, OF VARIABLE WIDTH, GRANTED TO THE CITY OF SAN DIEGO FOR STORAGE OF FLOOD WATERS PER DOC. REC. SEP. 22, 2010 AS DOC. NO. 2010-0503414 O.R.
6. AN EASEMENT, OF VARIABLE WIDTH, GRANTED TO THE CITY OF SAN DIEGO FOR CONSERVATION PURPOSES WITH THE RIGHT OF INGRESS AND EGRESS PER DOC. REC. SEP. 22, 2010 AS DOC. NO. 2010-0503415 O.R.
7. A 5.0' EASEMENT GRANTED TO THE CITY OF SAN DIEGO FOR PUBLIC UTILITIES PER DOC. REC. SEP. 22, 2010 AS DOC. NO. 2010-0503416 O.R. TO BE VACATED.
8. AN IRREVOCABLE OFFER TO DEDICATE AN EASEMENT OVER A PORTION OF LAND FOR PUBLIC STREET PER DOC. REC. SEP. 22, 2010 AS DOC. NO. 2010-0503417 O.R.
9. AN EASEMENT GRANTED TO SPRINT COMMUNICATIONS COMPANY L.P., FOR PERMANENT TELECOMMUNICATIONS EASEMENT AND INCIDENTAL PURPOSES PER DOC. REC. DECEMBER 12, 2013 AS DOC. NO. 2013-0717457 O.R. (NON PLOTTABLE)

## NOTE:

1. ALL FINISHED FLOORS DESIGNED 2' ABOVE EXISTING 100 YEAR WSE
2. NO PERMITS SHALL BE ISSUED FOR GRADING OR OTHER WORK IN THE FLOODPLAIN OF THE OTAY RIVER UNTIL THE PERMITTEE OBTAINS AN APPROVED NO RISE CERTIFICATION PER THE CITY OF SAN DIEGO
3. WHEN AS-BUILT GRADING AND PUBLIC IMPROVEMENT PLANS ARE AVAILABLE, THE PERMITTEE MUST SUBMIT A REQUEST FOR THE FINAL LOMA OR FINAL LOMR TO FEMA VIA THE FLOODPLAIN MANAGEMENT SECTION OF THE DEVELOPMENT SERVICES DEPARTMENT. THE PERMITTEE MUST PROVIDE ALL DOCUMENTATION, ENGINEERING CALCULATIONS, AND FEES WHICH ARE REQUIRED BY FEMA
4. THE BOND FOR THIS PROJECT WILL NOT BE RELEASED UNTIL THE FINAL LOMA OR FINAL LOMR IS ISSUED BY FEMA. THE FLOODPLAIN MANAGEMENT SECTION OF THE CITY OF SAN DIEGO'S PUBLIC WORKS/ENGINEERING AND CAPITAL PROJECTS WILL NOTIFY THE DEVELOPMENT SERVICES DEPARTMENT OF SUCH ISSUANCE AS SOON AS IT IS INFORMED BY FEMA
5. THE PROPOSED PROJECT WILL COMPLY WITH ALL THE REQUIREMENTS OF THE CURRENT CITY OF SAN DIEGO STORM WATER STANDARDS MANUAL BEFORE A GRADING OR BUILDING PERMIT IS ISSUED. IT IS THE RESPONSIBILITY OF THE OWNER/DESIGNER/APPLICANT TO ENSURE THAT THE CURRENT STORM WATER PERMANENT BMP DESIGN STANDARDS ARE INCORPORATED INTO THE PROJECT
6. ALL PRIVATE ENCROACHMENTS IN THE ROW WILL REQUIRE AN EMRA WITH PUBLIC IMPROVEMENT PLANS
7. ALL PROPOSED IMPROVEMENTS WITHIN THE ROW SHALL BE CONSTRUCTED PER CURRENT CITY OF SAN DIEGO STANDARDS.
8. WATER PURVEYOR IS CALIFORNIA AMERICAN WATER.
9. THE SUBDIVIDER SHALL UNDERGROUND EXISTING AND/OR PROPOSED PUBLIC UTILITY SYSTEMS AND SERVICE FACILITIES IN ACCORDANCE WITH THE SAN DIEGO MUNICIPAL CODE.
10. THE SUBDIVIDER SHALL ENSURE THAT ALL ONSITE UTILITIES SERVING THE SUBDIVISION SHALL BE UNDERGROUNDED WITH THE APPROPRIATE PERMITS. THE SUBDIVIDER SHALL PROVIDE WRITTEN CONFIRMATION FROM APPLICABLE UTILITIES THAT THE CONVERSION HAS TAKEN PLACE, OR PROVIDE OTHER MEANS TO ASSURE THE UNDERGROUNDING, SATISFACTORY TO THE CITY ENGINEER.

REGISTERED PROFESSIONAL ENGINEER BRIAN D. SMITH C 75822 EXP. 06-30-22 CIVIL STATE OF CALIFORNIA

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www.fuscoe.com

40' 0' 20' 40'
SCALE: 1" = 40'

TENTATIVE PARCEL MAP NO. 2361780

# BELLA MAR

## CONCEPTUAL GRADING & UTILITIES

SHEET 3 OF 5 SHEETS

| DESCRIPTION | BY | DATE |
|---|---|---|
| | | |
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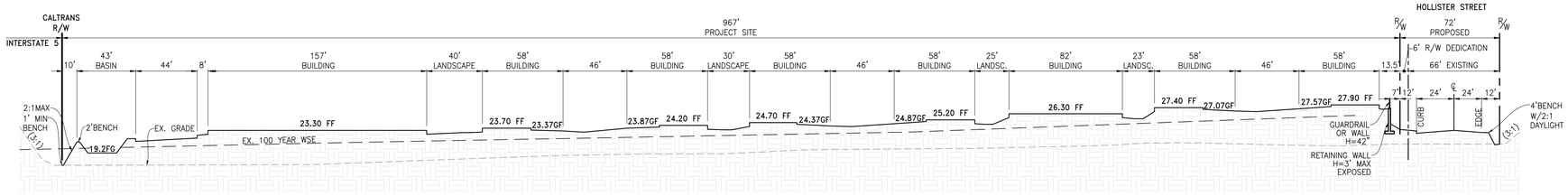
|---|---|
| I.O. NO. | 24007769 |
| PTS NO. | 631240 |
| T.P.M. NO. | 2361780 |
| 1794-6299 | NAD83 COORDINATES |
| 154-1739 | LAMBERT COORDINATES |

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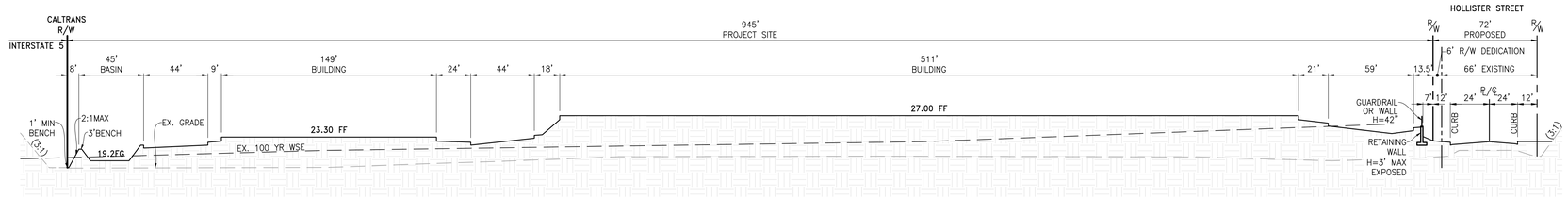


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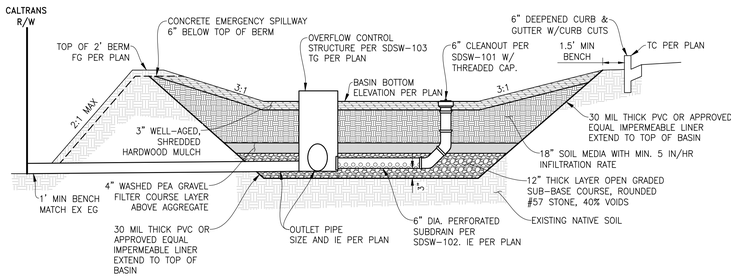


BIOFILTRATION BASIN DETAIL
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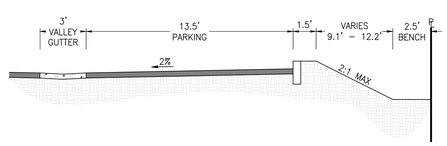


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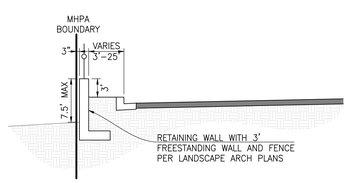


CROSS SECTION
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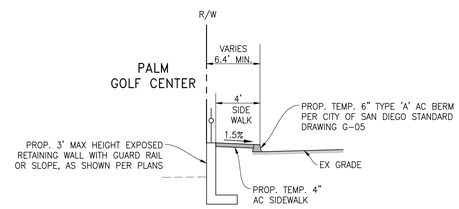
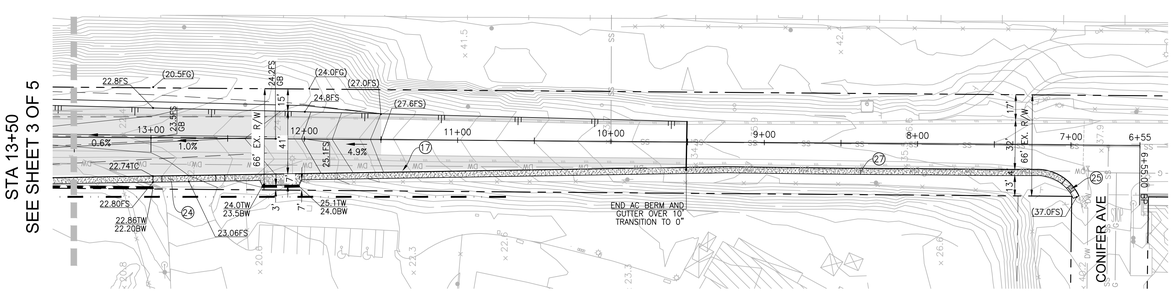


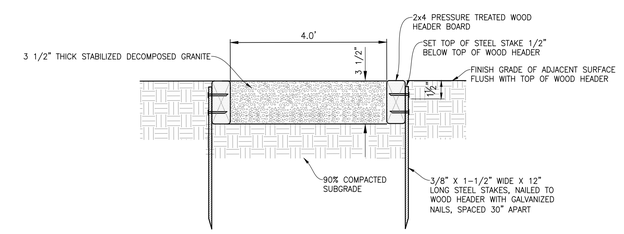

HOLLISTER ST TEMPORARY SIDEWALK CROSS SECTION
FROM STA 7+3.35 - 14+8.19
NOT TO SCALE
F
4




HOLLISTER AVE STA 6+55 TO STA 13+50
SCALE: 1"=40'
G
4

CONSTRUCTION NOTES

(17) TEMPORARY 6" TYPE 'A' AC BERM PER G-05
(24) EXISTING 35' DRIVEWAY TO BE MODIFIED PER SDG-162
(25) CURB RAMP TYPE 'C' PER G-29
(27) TEMPORARY 4" AC SIDEWALK PER SDG-155




MULTI-USE DG PATH
NOT TO SCALE
H
4

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C 75822
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TENTATIVE PARCEL MAP NO. 2361780

# BELLA MAR

## CONCEPTUAL CROSS SECTIONS

SHEET 4 OF 5 SHEETS

| DESCRIPTION | BY | DATE |
|---|---|---|
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|---|---|
| J.O. NO. | 24007769 |
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| | NAD83 COORDINATES |
| | 154-1739 |
| | LAMBERT COORDINATES |

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FUSCOE ENGINEERING

PRELIMINARY DRAINAGE STUDY

# BELLA MAR

PREPARED FOR

RED TAIL ACQUISITIONS, LLC
2082 MICHELSON DRIVE, 4TH FLOOR
IRVINE, CA 92612

FUSCOE ENGINEERING, INC
6390 GREENWICH DR. STE 170
SAN DIEGO, CA 92122

PROJECT MANAGER:
BRYAN D. SMITH , P.E.

DATE PREPARED: FEBRUARY 2019
FEI# 1621-001-01

*full circle thinking®*

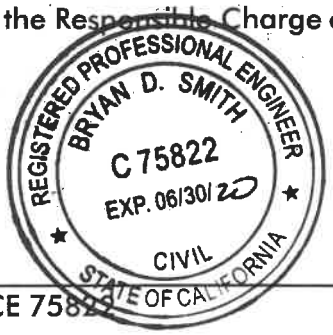
# PRELIMINARY DRAINAGE STUDY

## BELLA MAR APARTMENTS

408 HOLLISTER STREET
SAN DIEGO, CA 92154

APN#627-100-09-00

Prepared by Jesus Garcia Under the Responsible Charge of:

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For

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FEBRUARY 2019

# TABLE OF CONTENTS

# 1. INTRODUCTION

The purpose of this preliminary drainage study is to present the preliminary drainage design for the Bella Mar Entitlements Project (Project) and to demonstrate that the project will comply with the City of San Diego Drainage Design Manual (SDDDM) 2017 Criteria.

## 1.1 Project Description

The project proposes entitlements including a rezone and Tentative Map to support a medium density residential development including 380 units on approximately 14.1 acres located at 408 Hollister Street, San Diego, California. The site is bordered by Hollister Street on the east, Interstate 5 on the west, Otay River on the north, and an existing driving range on the south.

The project does not propose to dredge or fill any waters of the U.S.; therefore, the project is not required to obtain approval from the Regional Water Quality Board under Federal Clean Water Act Section 401 or 404.

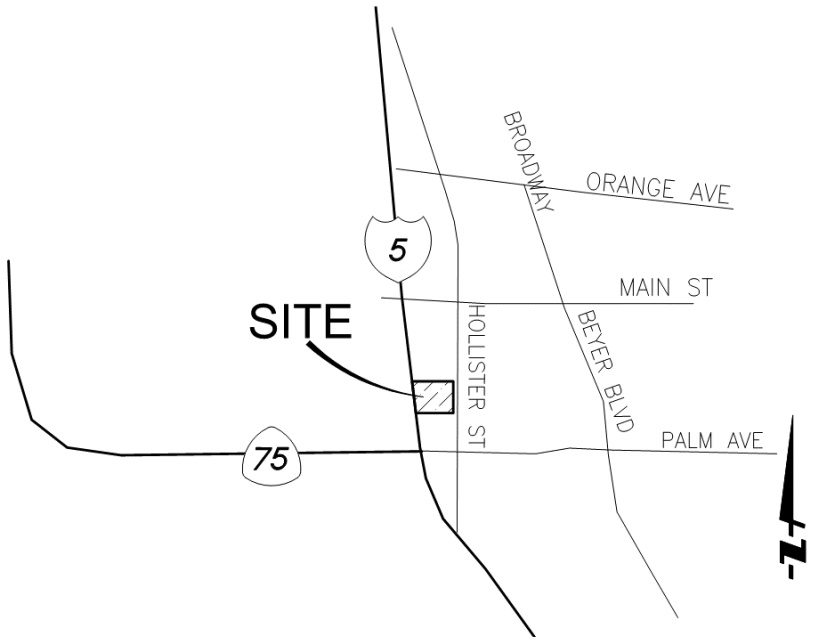


Figure 1. Vicinity Map

## 1.2 Existing Conditions

The existing project site is a vacant rural lot south of the Otay River which was previously developed as a go-kart race track. The site is mostly pervious and is covered by light vegetation with mild slopes averaging less than 1%. Refer to the Existing Conditions Drainage Map in Appendix 1.

Most of the site (Basin A) flows west towards I-5 to an existing 24" culvert, designated as Point of Compliance (POC)-1, prior to discharging into the Otay River west of I-5. Portions of the south neighboring property drains through the site (Basin B) and are tributary to POC-1. A smaller area along the northern boundary (Basin C) sheet flows into the Otay River at POC-2. The remainder of the site fronting Hollister Street (Basin D) combines with public street runoff and surface flows through the adjacent private property to the south toward an existing 36" RCP culvert which crosses the I-5 prior to discharging toward the Otay River. The analysis point for the limits of basin disturbance that contribute to the existing 36" RCP culvert is designated as POC-3.

Hollister Street (Basins E & F) does not have a defined storm drainage system. The street is crowned with low points along the project frontage. Runoff ponds on the East side of Hollister adjacent to the MTS right of way until it overtops the crown and drains through the neighboring south property into POC-3. The north end of Hollister Street (Basin G) surface flows north into the Otay River crossing on Hollister identified as POC-4.

## 1.3 Proposed Conditions

The project proposes to entitle the site for mixed use residential (RM-2-5) with 380 units over 15 buildings with associated recreation facilities, parking, and infrastructure as shown in the Tentative Parcel Map (TPM) included in Appendix 2. The project also includes modifications to Hollister to widen the road to a two-lane collector along the project frontage.

The project is located within the FEMA Floodplain and will fill the site to provide 2 feet of freeboard above the 100-year flood base elevations per City of San Diego Municipal Code requirements. A CLOMR-F will be required to be processed with FEMA.

The Project will maintain existing drainage patterns to the maximum extend practical. Basins A-1 through A-5 will be collected and conveyed west to a biofiltration basin which will provide treatment and peak flow attenuation before discharging into POC-1. Basin B includes portions of the adjacent site to the south and will be collected via a catch basin and bypass the proposed basin to discharge at POC 1. Basin C, which sheet flows directly into the Otay River at POC-2, will be increased in area by approximately 1 acre to maintain a drainage delineation for the MHPA area.

Runoff from Hollister Street (Basins E, F, and G) will be rerouted into a proposed storm drain and will tie into a culvert in Hollister Street to eliminate the conveyance of the public street drainage through private property. Basin H includes the private driveway which is routed through the proposed storm drain in Hollister Street and contributes to POC-4. The onsite Basin D tributary to POC-3 will be reduced (over 95%) to an isolated slope that runs off through the neighboring south property.

### 1.4 Proposed Green Street Improvements for Hollister Street

The improvements to Hollister Street include the road widening to a two-lane collector along the project frontage, installing curb & gutter, sidewalk, public storm drain system, and implementing Green Street BMP's to meet the PDP Exemption Category 2 for redevelopment of existing paved streets under The City of San Diego Storm Water Standards BMP Design Manual, October 2018 Edition. ~~Bioretention basins have been sized to treat the entire street frontage area and proposed to be installed in the parkway with pop-outs in the parking lanes. Opposite the site frontage, impervious area dispersion is being implemented for redundancy by allowing half the street to sheet flow into hydrologic type A soils for 10-year storm runoff events, while higher flows are collected into a catch basin~~. See the separate preliminary SQWMP report for this project.

## 2. METHODOLOGY

### 2.1 Rational Method

The site is inundated for the 100-year storm event of the Otay River, however for the period before the Otay River's peak time of concentration, this report analyses the proposed developed storm runoff for the site's relatively smaller time of concentration. Runoff was calculated using the Modified Rational Method equation below:

$Q = C \times I \times A$

Where:
Q = Flow rate in cubic feet per second (cfs)
C = Runoff coefficient
I = Rainfall Intensity in inches per hour (in/hr)
A = Drainage basin area in acres, (ac)

Modified Rational Method calculations were performed using the Advanced Engineering Software AES 2014) computer program. To perform the hydrology routing, the total watershed area was divided into sub-areas which discharge at designated nodes. The procedure for the sub-area summation model is as follows:

(1) Subdivide the watershed into an initial sub-area (generally 1 lot) and subsequent sub-areas, which are generally less than 10 acres in size. Assign upstream and downstream node numbers to each sub-area.

(2) Estimate an initial $T_c$ by using the appropriate nomograph or overland flow velocity estimation. The minimum $T_c$ considered is 5.0 minutes.

(3) Using the initial $T_c$, determine the corresponding values of I. Then Q = CIA.

(4) Using Q, estimate the travel time between this node and the next by Manning's equation as applied to particular channel or conduit linking the two nodes. Then, repeat the calculation for Q based on the revised intensity (which is a function of the revised time of concentration)

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The AES 2014 computer software sub-area menu is as follows:

SUBAREA HYDROLOGIC PROCESS

1. Confluence analysis at node.
2. Initial sub-area analysis (including time of concentration calculation).
3. Pipe flow travel time (computer estimated).
4. Pipe flow travel time (user specified).
5. Trapezoidal channel travel time.
6. Street flow analysis through sub-area.
7. User-specified information at node.
8. Addition of sub-area runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence main stream data with a memory bank
12. Clear a memory bank

At the confluence point of two or more basins, the following procedure is used to combine peak flow rates to account for differences in the basin's times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$$Q_p = Q_a + Q_b;\ T_p = T_a = T_b$$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by a ratio of rainfall intensities.

$$Q_p = Q_b + Q_a\,(I_b/I_a);\ T_p = T_a$$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

$$Q_p = Q_b + Q_a\,(T_b/T_a);\ T_p = T_b$$

## 2.2 Runoff Coefficient

A weighted runoff coefficient was determined for both existing and proposed conditions based on the Table A-1 in the SDDDM. In existing conditions, the site is mostly vacant and undeveloped. The rural runoff coefficient C=0.45 was used for existing conditions for onsite conditions and the offsite area just south of the site (Basin B). A runoff design coefficient of C=0.50 was used for the existing and proposed conditions as a minimum set limit for the Hollister Street (Basin E, F, and H) since actual impervious calculations for pre- and post-development deviated significantly and both weighted C values resulted lower than the allowed (impervious) minimum per the SDDM. The proposed conditions, the site is considered multi-unit residential corresponding to an equivalent percentage of impervious. Therefore, the onsite runoff coefficient of C=0.70 was used per Table 1 in the SDDDM. The runoff coefficient for the northern portion of the site (Basin C) and southern portion adjacent to the site (Basin B) will remain the same as existing conditions C=0.45. See Appendix 3 for runoff coefficient calculations.

## 2.3 Rainfall Intensity

Rainfall intensity was determined by AES using the Intensity-Duration Chart per Figure A-1 of the SDDDM.

## 2.4 Tributary Areas

Drainage basins are delineated on the Existing and Proposed Hydrology Condition Maps in Appendix 1. Bold lines graphically portray the tributary area for the drainage basin.

## 2.5 Hydraulic Calculations

Autodesk Hydraflow Hydrographs was used to design & analyze the proposed detention basin and its outlet control structure in order to attenuate the developed onsite runoff conditions for the 100-year, 6-hour storm event. The detention basin is a dual purpose design providing mitigation for the increased onsite runoff and storm water treatment for the proposed development. For the analysis results see section 3.1.

A hydraulic analysis using FlowMaster was performed to check the capacity of the proposed public storm drain in Hollister Street. For the analysis results see section 3.2.

# 3. CALCULATIONS/RESULTS

## 3.1 Peak Flow Comparison

The project results in a decrease of the total 100-year storm runoff by 2.24 cfs by implementing a private onsite detention basin and installing a public storm drain system in Hollister Street. The Hollister drainage improvements will eliminate the long-term ponding along Hollister and the uncontrolled conveyance of public drainage through private property.

Tables 1 & 2 summarize the existing and proposed peak flow rates at each point of compliance (POC). Table 2 presents the mitigated conditions flowrate. The detention basin results are summarized in Table 3.

Table 1. EXISTING CONDITIONS HYDROLOGY SUMMARY FOR 100-YR STORM EVENT

| **POC** | **NODE** | **BASIN (Description)** | **AREA (ac)** | **Q100 (cfs)** |
|---|---|---|---|---|
| POC-1 (24″ Culvert under I-5) | 100 | A +B (Onsite + South Offsite) | 11.11 | 17.75 |
| POC-2 (Otay River) | 300 | C (Site Along Otay River) | 1.22 | 1.88 |
| POC-3 (36″ Culvert under I-5) | 400 | D+E+F (Site Frontage + Hollister) | 5.44 | 8.42 |
| POC-4 (Hollister & Otay River Culvert) | 600 | G (Hollister) | 0.31 | 0.63 |
| PROJECT TOTAL | | | 18.08 | 28.68 |

Table 2. PROPOSED CONDITIONS HYDROLOGY SUMMARY FOR 100-YR STORM EVENT

| **POC** | **NODE** | **BASIN (Description)** | **AREA (ac)** | **Q100 (cfs)** |
|---|---|---|---|---|
| POC-1 (24″ Culvert under I-5) | 100 | A +B (Onsite + South Offsite) | 12.07 | 17.52 (Mitigated) |
| POC-2 (Otay River) | 300 | C (Site Along Otay River) | 2.29 | 3.52 |
| POC-3 (36″ Culvert under I-5) | 400 | D (South Site Slope) | 0.09 | 0.15 |
| POC-4 (Hollister & Otay River Culvert) | 600 | E+F+G+H (Site Frontage + Hollister) | 3.63 | 5.25 |
| PROJECT TOTAL | | | 18.08 | 26.44 |
| DIFFERENCE FROM EXISTING | | | 0 | - 2.24 |

The drainage improvements require a minor re-routing of drainage area to direct portions of Hollister Ave to the box culvert at the Otay River crossing. The increase of 100-year storm runoff at POC-4 equates to less than a 0.02% of the existing flowrate in the Otay River at this location of 22,000 cfs per the FEMA floodway studies. Therefore, this impact is considered de-minimus

## 3.2 Private Detention Basin

The private detention basin is designed to provide stormwater treatment and attenuate the 100-year storm runoff for the proposed development. The total basin depth provided is 2 feet from bottom elevation of 19.2 feet. The bottom 6" of the basin are reserved to meet the ponding requirement for water quality treatment, therefore outlet riser/control structure is raised a minimum of 6" from the basin bottom. The remaining 18" of the basin stores 100-year storm runoff volume and mitigate the proposed flowrate below existing conditions. Per the routing analysis the detention basins fills about 12" above the grate and leaves about 6" of freeboard. The basin storage volume used is 8,446 cf.

Table 3. DETENTION BASIN ATTENUATION FOR 100-YR STORM EVENT AT POC-1

| POC | NODE | BASIN (Description) | EXISTING AREA (ac) | PROPOSED AREA (ac) | EXISTING Q100 (cfs) | UNMITIGATED Q100 (cfs) | MITIGATED Q100 (cfs) |
|---|---|---|---|---|---|---|---|
| POC-1 (24" Culvert under I-5) | 105 | A (Onsite) | 10.20 | 10.97 | 16.53 | 21.95 | 15.86 |
| POC-1 (24" Culvert under I-5) | 200 | B (South Slope + Offsite) | 0.91 | 1.10 | 1.39 | 1.68 | 1.68 (no attenuation) |
| POC-1 CONFLUENCE TOTAL | 100 | A +B (Onsite + South Offsite) | 11.11 | 12.07 | 17.75 | 23.61 | 17.52 |
| DIFFERENCE FROM EXISTING | | | | +0.96 | | +5.69 | - 0.40 |

Basin attenuation occurs at Node 105 of the hydrology analysis for proposed conditions. Per table 3, at Node 105 the acreage is increased by 0.77 acres but the proposed runoff is mitigated down by 6.09 cfs. At Node 100 (representing POC-1), the mitigated basin outlet flow (for Basins A1-A4) is confluence with the offsite Basin B and additional south slopes. When compared to existing conditions, the development results (at POC-1) is an increase of 0.96 acres but a decreased flowrate by 0.40 cfs.

## 3.3 Public Storm Drain

A hydraulic analysis using FlowMaster was performed to check the capacity of the proposed public storm drain in Hollister Street. At a minimum slope of 0.3% an 18" RCP pipe is 84% full with the project's proposed flow rates. See Appendix 7 for the results.

# 4. CONCLUSION

The project will match existing drainage patterns to the maximum extent feasible. The project will result in a total net decrease of 2.24 cfs in the 100-year peak runoff from the studied area of 18.08 acres by providing an onsite private detention system and installing a public storm drain in Hollister. The buildings will be elevated a minimum 2ft above the FEMA 100-year water surface elevation. A CLOMR-F will be processed to document the fill within the flood plain.

The project is anticipated to improve the drainage conditions of the site by reducing the peak flowrate through the detention basins, alleviating long term ponding along Hollister Ave, and eliminating the uncontrolled public drainage flowing through private property.

# APPENDIX 1

# EXISTING HYDROLOGY MAP

# PROPOSED HYDROLOGY MAP

OTAY RIVER

INTERSTATE 5

HOLLISTER ST

MHPA LINE

NODE 600/POC-4:
A=0.31ac
Tc=6.95MIN
$Q_{100}$=0.63CFS

NODE 300/POC-2:
A=1.22ac
Tc=10.57MIN
$Q_{100}$=1.88CFS

NODE 100:
A=10.20ac
Tc=14.27MIN
$Q_{100}$=16.53CFS

POC-1:
A=11.11ac
Tc=14.27MIN
$Q_{100}$=17.75CFS

NODE 200:
A=0.91ac
Tc=11.83MIN
$Q_{100}$=1.39CFS

NODE 400:
A=2.73ac
Tc=14.76MIN
$Q_{100}$=4.34CFS

NODE 500:
A=2.71ac
Tc=13.56
$Q_{100}$=4.12CFS

POC-3:
A=5.44ac
Tc=15.07MIN
$Q_{100}$=8.42CFS

BASIN A
10.20 AC

BASIN B
0.91 AC

BASIN C
1.22 AC

BASIN D
2.73 AC

BASIN E
1.55 AC

BASIN F
1.16 AC

BASIN G
0.31 AC

EX 24" RCP SD
PER CALTRANS
CONTRACT NO. 122404
DOCUMENT NO. A-0002600

EX 36" RCP SD

L=50'
A=1.02ac

L=155'
A=0.20ac

L=100'
A=0.40ac

L=730'
A=9.8ac

L=360'

L=90'
A=0.71ac

A=0.20ac L=180'

L=460'
A=2.13ac

L=350' A=0.93ac

L=75'
A=0.21ac

L=100'
A=0.25ac

L=170'
A=0.60ac

L=500' A=1.30ac

L=100'
A=0.23ac

LEGEND

EXISTING CONTOURS
BASIN LIMITS
SUB-BASIN LIMITS
INTIAL AREA LIMITS
FLOW PATH
FLOW DIRECTION
HYDROLOGY NODE
EXISTING STORM DRAIN

60' 0' 30' 60'
SCALE: 1" = 60'

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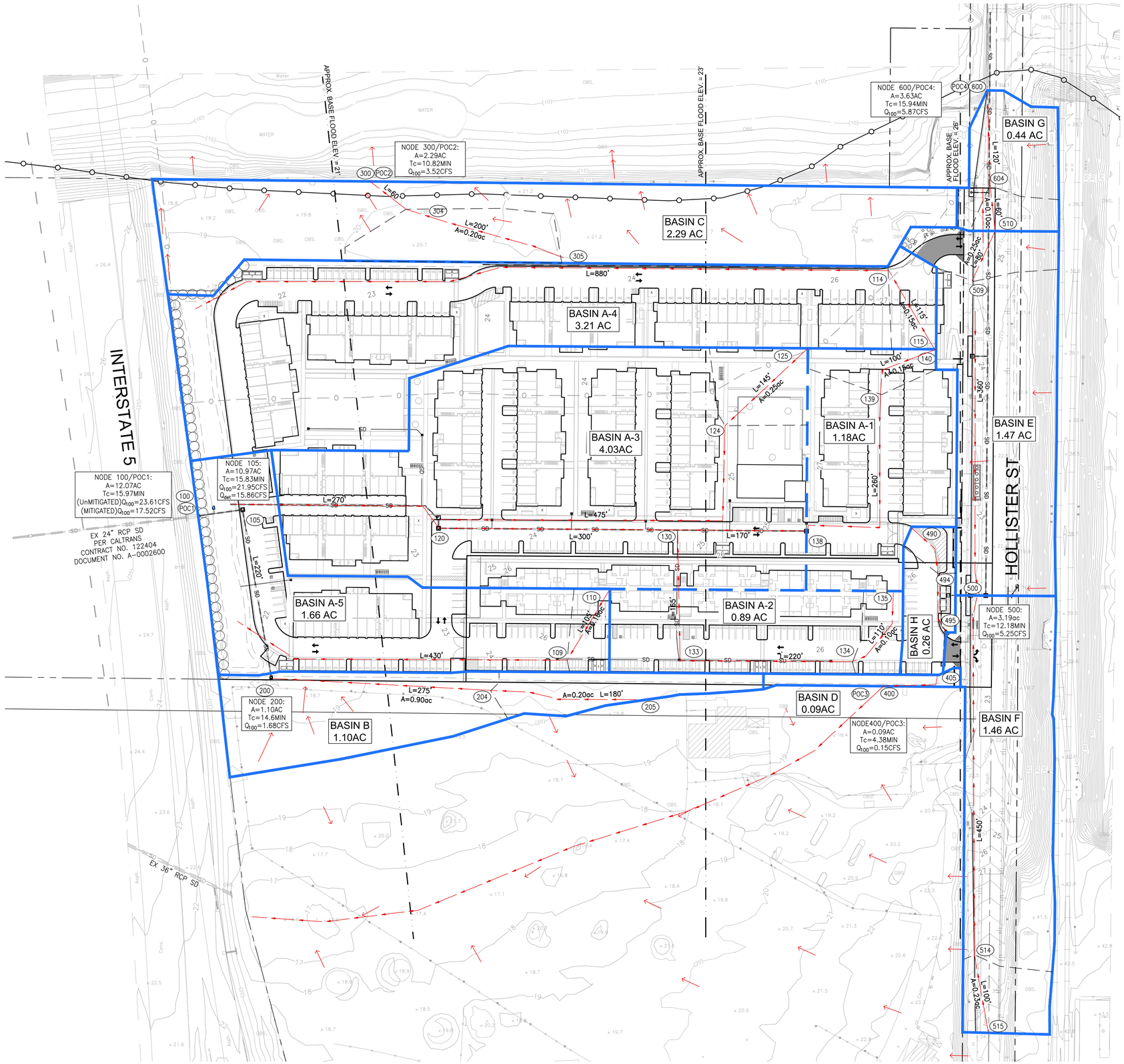
# EXISTING HYDROLOGY MAP

BELLA MAR
FEBRUARY 2019




LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- BASIN LIMITS
- SUB-BASIN LIMITS
- INTIAL AREA LIMITS
- FLOW PATH
- FLOW DIRECTION
- HYDROLOGY NODE
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN

60' 0' 30' 60'

SCALE: 1" = 60'

FUSCOE ENGINEERING
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tel 858.554.1500 ◦ fax 858.597.0335 ◦ www.fuscoe.com

# PROPOSED HYDROLOGY MAP

BELLA MAR
FEBRUARY 2019

F:\Projects\1621\001_Support Files\Reports\Hydrology\Figures\Proposed Hydrology.dwg (7/16/2019 11:25 AM) Plotted by: Brianna VanGorder

# APPENDIX 2

# RUNOFF COEFFICIENT CALCULATIONS

FUSCOE ENGINEERING

Job Name: BELLA MAR
Job #: 1621-001
Date: 2/12/2019

Runoff Coefficient Calculations

## Runoff Coefficent Variables Per City of San Diego Drainage Design Manual (January '17)

**Assumptions:** D soils per City Drainage Manual

### EXISTING CONDITIONS: RURAL (ONSITE)

| | | |
|---|---|---|
| Rural C = | 0.45 | Per Drainage Design Manual Appendix A Table A-1 |

### EXISTING CONDITIONS: RURAL (OFFSITE (SOUTH))

| | | |
|---|---|---|
| Rural C = | 0.45 | Per Drainage Design Manual Appendix A Table A-1 |

### EXISTING CONDITIONS: HOLLISTER ST (OFFSITE)

| | | | |
|---|---|---|---|
| Area Impervious = | 32620 | sf | 25% |
| Area Pervious = | 98980 | sf | 75% |
| Total Area = | 131600 | sf | |

| | | |
|---|---|---|
| Industrial C = | 0.95 | Per Drainage Design Manual Appendix A Table A-1 |
| Tabulated % Impervious = | 90% | |
| Acutal % Impervious = | 25% | |
| Calculated Cweighted = | 0.26 | |
| **Design C = | 0.50 | |

** Per Note (2) of Table A-1, no weighed C for commerical or industrial shall be less than C=0.5

### PROPOSED CONDITIONS: MULTI-USE RESIDENTIAL (ONSITE)

| | | | |
|---|---|---|---|
| Area Impervious = | 373370 | sf | 73% |
| Area Pervious = | 138210 | sf | 27% |
| Total Area = | 511580 | sf | |

| | | |
|---|---|---|
| Multi-Use Residential C= | 0.70 | Per Drainage Design Manual Appendix A Table A-1 |
| Acutal % Impervious = | 73% | |
| Design C= | 0.70 | |

### PROPOSED CONDITIONS: RURAL (OFFSITE)

| | | |
|---|---|---|
| Rural C = | 0.45 | Per Drainage Design Manual Appendix A Table A-1 |

### PROPOSED CONDITIONS: HOLLISTER ST (OFFSITE)

| | | | |
|---|---|---|---|
| Area Impervious = | 55540 | sf | 38% |
| Area Pervious = | 91120 | sf | 62% |
| Total Area = | 146660 | sf | |

| | | |
|---|---|---|
| Industrial C = | 0.95 | Per Drainage Design Manual Appendix A Table A-1 |
| Tabulated % Impervious = | 90% | |
| Acutal % Impervious = | 38% | |
| Calculated Cweighted = | 0.40 | |
| **Design C = | 0.50 | |

** Per Note (2) of Table A-1, no weighed C for commerical or industrial shall be less than C=0.5

# APPENDIX 3

# EXISTING HYDROLOGY CALCULATIONS

FUSCOE ENGINEERING

**Job Name:** BELLA MAR
**Job #:** 1621-001
**Run Name:** BMEX
**Date:** 11/13/2018

EXISTING HYDROLOGY - 100 YR

| Node to Node | | Code | Elev 1 (feet) | Elev 2 (feet) | Length (feet) | Runoff Coeff. | Area (ac.) | Comments | BANK | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1 | 2 | 3 |
| 105 | 104 | 2 | 22.9 | 21.9 | 100.0 | 0.45 | 0.10 | Basin A: Initial Area | | | |
| 104 | 100 | 5 | 21.9 | 16.7 | 801.0 | 0.45 | 9.83 | Sheet Flow | | | |
| 100 | 100 | 1 | | | | | | Node 100 Confluence: 1 of 2 | | | |
| 205 | 204 | 2 | 19.5 | 19.1 | 100.0 | 0.45 | 0.13 | Basin B: Initial Area (offsite) | | | |
| 204 | 200 | 5 | 19.1 | 18.9 | 154.0 | 0.45 | 0.41 | Sheet Flow (offsite) | | | |
| 200 | 100 | 5 | 18.9 | 16.7 | 240.0 | 0.00 | 0.00 | Sheet Flow | | | |
| 100 | 100 | 1 | | | | | | Node 100 Confluence: 2 of 2 | | | |
| 305 | 304 | 2 | 23.0 | 21.9 | 216.0 | 0.45 | 0.07 | Basin C: Initial Area | | | |
| 304 | 300 | 5 | 21.9 | 18.8 | 803.0 | 0.45 | 1.11 | Sheet Flow (flows offsite) | | | |
| 405 | 404 | 2 | 23.0 | 22.5 | 75.0 | 0.45 | 0.09 | Basin D: Initial Area | | | |
| 404 | 400 | 5 | 22.5 | 18.7 | 597.0 | 0.45 | 2.95 | Sheet Flow (flows offsite) | | | |
| 400 | 400 | 1 | | | | | | Confluence 400: 1 of 3 | | | |
| 505 | 504 | 2 | 23.8 | 23.0 | 60.0 | 0.50 | 0.09 | Basin E: Initial Area (Hollister St) | | | |
| 504 | 500 | 5 | 23.0 | 19.5 | 396.0 | 0.50 | 1.08 | Sheet Flow (road) | | | |
| 500 | 400 | 5 | 19.5 | 18.7 | 202.0 | 0.45 | 0.00 | Sheet Flow | | | |
| 400 | 400 | 1 | | | | | | Confluence 400: 2 of 3 | | | |
| 605 | 604 | 2 | 31.5 | 28.5 | 65.0 | 0.50 | 0.09 | Basin F: Initial Area (Hollister St) | | | |
| 604 | 600 | 5 | 28.5 | 19.0 | 286.0 | 0.50 | 1.20 | | | | |
| 600 | 400 | 5 | 19.0 | 18.7 | 106.0 | 0.45 | 0.00 | | | | |

```
******************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0 Release Date: 06/01/2014  License ID 1355

                              Analysis prepared by:

                                Fuscoe Engineering
                           6390 Greenwich Drive, Suite 170
                                 San Diego, CA 92122


 ************************* DESCRIPTION OF STUDY *************************
* BELLA MAR                                                             *
* EXISTING CONDITIONS - 100 YR                                          *
*                                                                       *
 *************************************************************************

  FILE NAME: BMEX.DAT
  TIME/DATE OF STUDY: 14:39 11/21/2018
-------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS = 10
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  20.000;  2.500
   4)  30.000;  2.000
   5)  40.000;  1.700
   6)  50.000;  1.500
   7)  60.000;  1.310
   8) 120.000;  0.860
   9) 180.000;  0.660
  10) 240.000;  0.560
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
```

| NO. | (FT) | (FT) | SIDE / SIDE/ WAY | (FT) | (FT) | (FT) | (FT) | (n) |
|---|---|---|---|---|---|---|---|---|
| 1 | 30.0 | 20.0 | 0.018/0.018/0.020 | 0.67 | 2.00 | 0.0313 | 0.167 | 0.0150 |

```
  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     22.90
  DOWNSTREAM ELEVATION(FEET) =     21.90
  ELEVATION DIFFERENCE(FEET) =      1.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.789
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.490
  SUBAREA RUNOFF(CFS) =      0.16
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    100.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     21.90  DOWNSTREAM(FEET) =     16.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   801.00   CHANNEL SLOPE =  0.0065
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.278
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.37
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.91
```

```
 AVERAGE FLOW DEPTH(FEET) =   0.16   TRAVEL TIME(MIN.) =  14.64
 Tc(MIN.) =   24.43
 SUBAREA AREA(ACRES) =     9.83       SUBAREA RUNOFF(CFS) =   10.08
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.450
 TOTAL AREA(ACRES) =        9.9         PEAK FLOW RATE(CFS) =      10.18

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   1.12
 LONGEST FLOWPATH FROM NODE    105.00 TO NODE    100.00 =     901.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   24.43
 RAINFALL INTENSITY(INCH/HR) =   2.28
 TOTAL STREAM AREA(ACRES) =     9.93
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.18

****************************************************************************
 FLOW PROCESS FROM NODE    205.00 TO NODE    204.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     19.50
 DOWNSTREAM ELEVATION(FEET) =     19.10
 ELEVATION DIFFERENCE(FEET) =      0.40
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.423
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.410
 SUBAREA RUNOFF(CFS) =      0.20
 TOTAL AREA(ACRES) =      0.13   TOTAL RUNOFF(CFS) =      0.20

****************************************************************************
 FLOW PROCESS FROM NODE    204.00 TO NODE    200.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     19.10  DOWNSTREAM(FEET) =     18.90
  CHANNEL LENGTH THRU SUBAREA(FEET) =   154.00   CHANNEL SLOPE =  0.0013
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.458
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.43
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.25
  AVERAGE FLOW DEPTH(FEET) =   0.07   TRAVEL TIME(MIN.) =  10.42
  Tc(MIN.) =   20.85
  SUBAREA AREA(ACRES) =     0.41       SUBAREA RUNOFF(CFS) =    0.45
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.450
  TOTAL AREA(ACRES) =        0.5         PEAK FLOW RATE(CFS) =       0.60

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOW VELOCITY(FEET/SEC.) =   0.27
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    200.00 =     254.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    100.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     19.00  DOWNSTREAM(FEET) =     16.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   240.00   CHANNEL SLOPE =  0.0096
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.60
  FLOW VELOCITY(FEET/SEC.) =   0.57   FLOW DEPTH(FEET) =   0.04
  TRAVEL TIME(MIN.) =   6.97   Tc(MIN.) =   27.82
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    100.00 =     494.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   27.82
  RAINFALL INTENSITY(INCH/HR) =   2.11
  TOTAL STREAM AREA(ACRES) =     0.54
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.60
```

```
  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       10.18    24.43        2.278          9.93
      2        0.60    27.82        2.109          0.54

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       10.71    24.43       2.278
      2       10.02    27.82       2.109

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.71   Tc(MIN.) =   24.43
  TOTAL AREA(ACRES) =       10.5
  LONGEST FLOWPATH FROM NODE    105.00 TO NODE    100.00 =     901.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    304.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   216.00
  UPSTREAM ELEVATION(FEET) =     23.00
  DOWNSTREAM ELEVATION(FEET) =     21.90
  ELEVATION DIFFERENCE(FEET) =      1.10
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.398
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.37
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.412
  SUBAREA RUNOFF(CFS) =      0.11
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.11

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    300.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =     21.90  DOWNSTREAM(FEET) =     18.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   803.00   CHANNEL SLOPE =  0.0039
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.300   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.599
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.29
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.06
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) = 206.31
  Tc(MIN.) =  216.71
  SUBAREA AREA(ACRES) =     1.11       SUBAREA RUNOFF(CFS) =    0.30
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.450
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       0.32

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.14   FLOW VELOCITY(FEET/SEC.) =   0.07
  LONGEST FLOWPATH FROM NODE    305.00 TO NODE    300.00 =    1019.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    404.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    75.00
  UPSTREAM ELEVATION(FEET) =     23.00
  DOWNSTREAM ELEVATION(FEET) =     22.50
  ELEVATION DIFFERENCE(FEET) =      0.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.082
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    56.67
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.442
  SUBAREA RUNOFF(CFS) =      0.14
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.14

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    400.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     22.50  DOWNSTREAM(FEET) =     18.70
```

```
 CHANNEL LENGTH THRU SUBAREA(FEET) =   597.00   CHANNEL SLOPE =  0.0064
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
 MANNING'S FACTOR = 0.300   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.978
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.90
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.11
 AVERAGE FLOW DEPTH(FEET) =   0.21   TRAVEL TIME(MIN.) =  94.20
 Tc(MIN.) =  104.28
 SUBAREA AREA(ACRES) =     2.95       SUBAREA RUNOFF(CFS) =    1.30
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.450
 TOTAL AREA(ACRES) =        3.0         PEAK FLOW RATE(CFS) =       1.34

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.25   FLOW VELOCITY(FEET/SEC.) =   0.12
 LONGEST FLOWPATH FROM NODE    405.00 TO NODE    400.00 =     672.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    400.00 TO NODE    400.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  104.28
 RAINFALL INTENSITY(INCH/HR) =   0.98
 TOTAL STREAM AREA(ACRES) =     3.04
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.34

****************************************************************************
 FLOW PROCESS FROM NODE    505.00 TO NODE    504.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
 UPSTREAM ELEVATION(FEET) =     23.80
 DOWNSTREAM ELEVATION(FEET) =     23.00
 ELEVATION DIFFERENCE(FEET) =      0.80
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.601
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.906
 SUBAREA RUNOFF(CFS) =      0.18
 TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.18
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    500.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     23.00  DOWNSTREAM(FEET) =     19.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   396.00   CHANNEL SLOPE =  0.0088
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.300   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.345
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.58
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.13
  AVERAGE FLOW DEPTH(FEET) =   0.28   TRAVEL TIME(MIN.) =  50.58
  Tc(MIN.) =   58.18
  SUBAREA AREA(ACRES) =     1.08       SUBAREA RUNOFF(CFS) =    0.73
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       0.79

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.32   FLOW VELOCITY(FEET/SEC.) =   0.14
  LONGEST FLOWPATH FROM NODE    505.00 TO NODE    500.00 =     456.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    400.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     19.50  DOWNSTREAM(FEET) =     18.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   202.00   CHANNEL SLOPE =  0.0040
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       0.79
  FLOW VELOCITY(FEET/SEC.) =   0.45   FLOW DEPTH(FEET) =   0.07
  TRAVEL TIME(MIN.) =   7.47   Tc(MIN.) =   65.65
  LONGEST FLOWPATH FROM NODE    505.00 TO NODE    400.00 =     658.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    400.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =   65.65
  RAINFALL INTENSITY(INCH/HR) =   1.27
  TOTAL STREAM AREA(ACRES) =     1.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.79

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    604.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
  UPSTREAM ELEVATION(FEET) =     31.50
  DOWNSTREAM ELEVATION(FEET) =     28.50
  ELEVATION DIFFERENCE(FEET) =      3.00
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.230
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.356
  SUBAREA RUNOFF(CFS) =      0.20
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.20

****************************************************************************
  FLOW PROCESS FROM NODE    604.00 TO NODE    600.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     28.50  DOWNSTREAM(FEET) =     19.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   286.00   CHANNEL SLOPE =  0.0315
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.722
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.32
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.43
  AVERAGE FLOW DEPTH(FEET) =   0.12   TRAVEL TIME(MIN.) =   3.34
  Tc(MIN.) =    8.57
  SUBAREA AREA(ACRES) =     1.20       SUBAREA RUNOFF(CFS) =    2.23
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       2.40

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.15   FLOW VELOCITY(FEET/SEC.) =   1.69
  LONGEST FLOWPATH FROM NODE    605.00 TO NODE    600.00 =     351.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    400.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     19.00  DOWNSTREAM(FEET) =     18.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   406.00   CHANNEL SLOPE =  0.0007
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.40
  FLOW VELOCITY(FEET/SEC.) =   0.34   FLOW DEPTH(FEET) =   0.19
  TRAVEL TIME(MIN.) =  20.14   Tc(MIN.) =   28.71
  LONGEST FLOWPATH FROM NODE    605.00 TO NODE    400.00 =     757.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    400.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   28.71
  RAINFALL INTENSITY(INCH/HR) =   2.06
  TOTAL STREAM AREA(ACRES) =     1.29
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.40

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        1.34   104.28        0.978          3.04
      2        0.79    65.65        1.268          1.17
      3        2.40    28.71        2.065          1.29

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        3.11    28.71       2.065
      2        3.10    65.65       1.268
      3        3.08   104.28       0.978

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.11   Tc(MIN.) =   28.71
  TOTAL AREA(ACRES) =        5.5
```

```
                                        BMEX
  LONGEST FLOWPATH FROM NODE    605.00 TO NODE    400.00 =     757.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =         5.5  TC(MIN.) =     28.71
  PEAK FLOW RATE(CFS)   =       3.11
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

# APPENDIX 4

# PROPOSED HYDROLOGY CALCULATIONS

FUSCOE ENGINEERING

**Job Name:** BELLA MAR
**Job #:** 1621-001
**Run Name:** BMPR
**Date:** 2/11/2019

## UNMITIGATED PROPOSED HYDROLOGY - 100 YR

| Node to Node | | Code | Elev 1 (feet) | Elev 2 (feet) | Length (feet) | Runoff Coeff. | Area (ac.) | Comments | BANK 1 | BANK 2 | BANK 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 | 139 | 2 | 27.4 | 27.3 | 100.0 | 0.70 | 0.15 | Basin A-1: Initial Area | | | |
| 139 | 138 | 5 | 27.3 | 24.7 | 260.0 | 0.70 | 1.03 | Open Channel Flow | | | |
| 138 | 130 | 3 | 22.3 | 20.0 | 170.0 | | | Pipe Flow | | | |
| 130 | 130 | 1 | | | | | | Confluence: 1 of 2 | | | |
| | | | | | | | | | | | |
| 135 | 134 | 2 | 26.3 | 25.8 | 110.0 | 0.70 | 0.10 | Basin A-2: Initial Area | | | |
| 134 | 133 | 5 | 25.8 | 24.7 | 220.0 | 0.70 | 0.79 | Open Channel Flow | | | |
| 133 | 130 | 3 | 22.3 | 21.5 | 168.0 | | | Pipe Flow | | | |
| 130 | 130 | 1 | | | | | | Confluence: 2 of 2 | | | |
| | | | | | | | | | | | |
| 130 | 120 | 3 | 21.5 | 20.0 | 300.0 | | | Pipe Flow | | | |
| 120 | 120 | 1 | | | | | | Confluence: 1 of 2 | | | |
| | | | | | | | | | | | |
| 125 | 124 | 2 | 25.6 | 24.5 | 145.0 | 0.70 | 0.25 | Basin A-3: Initial Area | | | |
| 124 | 120 | 5 | 24.5 | 22.2 | 475.0 | 0.70 | 3.78 | Open Channel Flow | | | |
| 120 | 120 | 1 | | | | | | Confluence: 2 of 2 | | | |
| | | | | | | | | | | | |
| 120 | 105 | 3 | 20.0 | 16.5 | 270.0 | | | Pipe Flow | | | |
| 105 | 105 | 1 | | | | | | Confluence: 1 of 3 | | | |
| | | | | | | | | | | | |
| 115 | 114 | 2 | 27.0 | 26.1 | 115.0 | 0.70 | 0.15 | Basin A-4: Initial Area | | | |
| 114 | 105 | 5 | 26.1 | 21.7 | 880.0 | 0.70 | 3.06 | Open Channel Flow | | | |
| 105 | 105 | 1 | | | | | | Confluence: 2 of 3 | | | |
| | | | | | | | | | | | |
| 110 | 109 | 2 | 26.3 | 25.6 | 105.0 | 0.70 | 0.10 | Basin A-5: Initial Area | | | |
| 109 | 105 | 5 | 25.6 | 21.7 | 430.0 | 0.70 | 1.56 | Open Channel Flow | | | |
| 105 | 105 | 1 | | | | | | Confluence: 3 of 3 | | | |
| | | | | | | | 10.97 | Total Tributary Area to Basin | | | |
| 105 | 100 | 3 | 16.5 | 16.3 | 50.0 | | | Pipe Flow | | | |
| 100 | 100 | 1 | | | | | | Confluence: 1 of 2 | | | |
| | | | | | | | | | | | |
| 205 | 204 | 2 | 20.0 | 19.8 | 180.0 | 0.45 | 0.20 | Basin B: Initial Area | | | |
| 204 | 204 | 8 | | | | 0.45 | 0.90 | Addition Subarea | | | |
| 204 | 200 | 5 | 19.8 | 18.6 | 275.0 | | | Open Channel Flow | | | |
| 200 | 100 | 3 | 17.1 | 16.3 | 220.0 | | | Pipe Flow | | | |
| 100 | 100 | 1 | | | | | | Confluence: 2 of 2: POC1 | | | |
| | | | | | | | 12.07 | Total Tributary Area to POC1 | | | |
| 305 | 304 | 2 | 21.0 | 20.1 | 200.0 | 0.45 | 0.20 | Basin C: Initial Area | | | |
| 304 | 304 | 8 | | | | 0.45 | 2.09 | Addition Subarea | | | |
| 304 | 300 | 5 | 20.1 | 19.1 | 60.0 | | | Open Channel Flow: POC2 | | | |

**Job Name:** BELLA MAR
**Job #:** 1621-001
**Run Name:** BMPR
**Date:** 2/11/2019

## UNMITIGATED PROPOSED HYDROLOGY - 100 YR

| Node to Node | | Code | Elev 1 (feet) | Elev 2 (feet) | Length (feet) | Runoff Coeff. | Area (ac.) | Comments | BANK 1 | BANK 2 | BANK 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| 405 | 400 | 2 | 24.0 | 18.7 | 60.0 | 0.45 | 0.09 | Basin D: Initial Area : POC3 | | | |
| | | | | | | | | | | | |
| 490 | 494 | 2 | 26.8 | 25.4 | 70.0 | 0.70 | 0.10 | Basin H: Initial Area | | | |
| 494 | 495 | 5 | 25.4 | 23.2 | 75.0 | 0.70 | 0.16 | Open Channel Flow | | | |
| 495 | 500 | 3 | 18.3 | 17.5 | 80.0 | | | Pipe Flow | | | |
| 500 | 500 | 1 | | | | | | Confluence: 1 of 3 | | | |
| | | | | | | | | | | | |
| 510 | 509 | 2 | 25.0 | 23.4 | 80.0 | 0.58 | 0.25 | Basin E: Initial Area | | | |
| 509 | 500 | 6 | 23.4 | 22.1 | 360.0 | 0.58 | 1.22 | Street Flow | | | |
| 500 | 500 | 1 | | | | | | Confluence: 2 of 3 | | | |
| | | | | | | | | | | | |
| 515 | 514 | 2 | 34.8 | 31.4 | 100.0 | 0.58 | 0.23 | Basin F: Initial Area | | | |
| 514 | 500 | 6 | 31.4 | 22.1 | 450.0 | 0.58 | 1.23 | Street Flow | | | |
| 500 | 500 | 1 | | | | | | Confluence: 3 of 3 | | | |
| | | | | | | | | | | | |
| 500 | 600 | 3 | 17.2 | 15.4 | 750.0 | | | Pipe Flow | | | |
| 600 | 600 | 1 | | | | | | Confluence: 1 of 2 | | | |
| | | | | | | | | | | | |
| 510 | 604 | 2 | 25.0 | 23.5 | 60.0 | 0.58 | 0.10 | Basin G: Initial Area | | | |
| 604 | 600 | 5 | 23.5 | 20.3 | 120.0 | 0.58 | 0.34 | Open Channel Flow | | | |
| 600 | 600 | 1 | | | | | | Confluence: 2 of 2 | | | |
| | | | | | | | 3.63 | Total Tributary Area to POC2 | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0 Release Date: 06/01/2014  License ID 1355

                              Analysis prepared by:

                                Fuscoe Engineering
                               6390 Greenwich Drive
                                    Suite 170
                               San Diego, CA 92122

 ************************* DESCRIPTION OF STUDY *************************
* BELLA MAR                                                             *
* UNMITIGATED DEVELOPED CONDITIONS - 100 YR                             *
*                                                                       *
 *************************************************************************

  FILE NAME: BMPR.DAT
  TIME/DATE OF STUDY: 08:11 02/12/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS = 20
   1)   5.000;  4.400
   2)   6.000;  4.200
   3)   7.000;  3.900
   4)   8.000;  3.750
   5)   9.000;  3.600
   6)  10.000;  3.450
   7)  11.000;  3.300
   8)  12.000;  3.200
   9)  14.000;  3.000
  10)  15.000;  2.900
  11)  16.000;  2.800
  12)  17.000;  2.700
  13)  19.000;  2.600
  14)  20.000;  2.550
  15)  25.000;  2.230
```

```
  16)  30.000;  2.000
  17)  40.000;  1.700
  18)  50.000;  1.500
  19)  60.000;  1.310
  20) 120.000;  0.860
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   27.0     22.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    140.00 TO NODE    139.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     27.40
  DOWNSTREAM ELEVATION(FEET) =     27.30
  ELEVATION DIFFERENCE(FEET) =      0.10
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.414
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.076
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.43

****************************************************************************
  FLOW PROCESS FROM NODE    139.00 TO NODE    138.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
 ELEVATION DATA: UPSTREAM(FEET) =     27.30  DOWNSTREAM(FEET) =     24.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.0100
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.431
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.68
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.17
 AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   3.71
 Tc(MIN.) =   10.12
 SUBAREA AREA(ACRES) =     1.03       SUBAREA RUNOFF(CFS) =    2.47
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
 TOTAL AREA(ACRES) =        1.2         PEAK FLOW RATE(CFS) =       2.83

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   1.46
 LONGEST FLOWPATH FROM NODE    140.00 TO NODE    138.00 =     360.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    138.00 TO NODE    130.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    22.30  DOWNSTREAM(FEET) =    20.00
 FLOW LENGTH(FEET) =   170.00   MANNING'S N =  0.011
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.21
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.83
 PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =   10.58
 LONGEST FLOWPATH FROM NODE    140.00 TO NODE    130.00 =     530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   10.58
 RAINFALL INTENSITY(INCH/HR) =   3.36
 TOTAL STREAM AREA(ACRES) =     1.18
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.83

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    135.00 TO NODE    134.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   110.00
 UPSTREAM ELEVATION(FEET) =     26.30
 DOWNSTREAM ELEVATION(FEET) =     25.80
 ELEVATION DIFFERENCE(FEET) =      0.50
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.414
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.076
 SUBAREA RUNOFF(CFS) =      0.29
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
 FLOW PROCESS FROM NODE    134.00 TO NODE    133.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     25.80  DOWNSTREAM(FEET) =     24.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =   220.00   CHANNEL SLOPE =  0.0050
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.343
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.23
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.85
 AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   4.30
 Tc(MIN.) =   10.72
 SUBAREA AREA(ACRES) =     0.79       SUBAREA RUNOFF(CFS) =    1.85
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
 TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       2.08

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.07   FLOW VELOCITY(FEET/SEC.) =   1.04
 LONGEST FLOWPATH FROM NODE    135.00 TO NODE    133.00 =     330.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    133.00 TO NODE    130.00 IS CODE =  31
```

```
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    22.30  DOWNSTREAM(FEET) =    21.50
  FLOW LENGTH(FEET) =   168.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.85
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.08
  PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =   11.44
  LONGEST FLOWPATH FROM NODE    135.00 TO NODE    130.00 =     498.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    130.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.44
  RAINFALL INTENSITY(INCH/HR) =   3.26
  TOTAL STREAM AREA(ACRES) =     0.89
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.08

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.83    10.58        3.363          1.18
      2        2.08    11.44        3.256          0.89

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        4.76    10.58       3.363
      2        4.83    11.44       3.256

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.83   Tc(MIN.) =   11.44
  TOTAL AREA(ACRES) =        2.1
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    130.00 =     530.00 FEET.

************************************************************************
  FLOW PROCESS FROM NODE    130.00 TO NODE    120.00 IS CODE =  31
```

```
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    21.50  DOWNSTREAM(FEET) =    20.00
  FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.74
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.83
  PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =   12.50
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    120.00 =     830.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.50
  RAINFALL INTENSITY(INCH/HR) =   3.15
  TOTAL STREAM AREA(ACRES) =     2.07
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.83

****************************************************************************
  FLOW PROCESS FROM NODE    125.00 TO NODE    124.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   145.00
  UPSTREAM ELEVATION(FEET) =     25.60
  DOWNSTREAM ELEVATION(FEET) =     24.50
  ELEVATION DIFFERENCE(FEET) =      1.10
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.000
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    57.76
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.600
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    124.00 TO NODE    120.00 IS CODE =  51
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     24.50  DOWNSTREAM(FEET) =     22.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   475.00   CHANNEL SLOPE =  0.0048
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.869
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =  45
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.25
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.25
  AVERAGE FLOW DEPTH(FEET) =   0.11   TRAVEL TIME(MIN.) =   6.31
  Tc(MIN.) =   15.31
  SUBAREA AREA(ACRES) =     3.78       SUBAREA RUNOFF(CFS) =    7.59
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.688
  TOTAL AREA(ACRES) =        4.0         PEAK FLOW RATE(CFS) =       7.95

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.15   FLOW VELOCITY(FEET/SEC.) =   1.52
  LONGEST FLOWPATH FROM NODE    125.00 TO NODE    120.00 =     620.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    120.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.31
  RAINFALL INTENSITY(INCH/HR) =   2.87
  TOTAL STREAM AREA(ACRES) =     4.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.95

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.83    12.50        3.150          2.07
      2        7.95    15.31        2.869          4.03

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       11.31    12.50       3.150
      2       12.35    15.31       2.869

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      12.35   Tc(MIN.) =   15.31
  TOTAL AREA(ACRES) =        6.1
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    120.00 =     830.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    120.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    20.00  DOWNSTREAM(FEET) =    16.50
  FLOW LENGTH(FEET) =   270.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.61
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.35
  PIPE TRAVEL TIME(MIN.) =   0.52    Tc(MIN.) =   15.83
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    105.00 =    1100.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.83
  RAINFALL INTENSITY(INCH/HR) =   2.82
  TOTAL STREAM AREA(ACRES) =     6.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     12.35

****************************************************************************
  FLOW PROCESS FROM NODE    115.00 TO NODE    114.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   115.00
  UPSTREAM ELEVATION(FEET) =     27.00
  DOWNSTREAM ELEVATION(FEET) =     26.10
  ELEVATION DIFFERENCE(FEET) =      0.90
```

```
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    5.975
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    58.48
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.205
 SUBAREA RUNOFF(CFS) =      0.44
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
 FLOW PROCESS FROM NODE    114.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     26.10  DOWNSTREAM(FEET) =     21.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =   880.00   CHANNEL SLOPE =  0.0050
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
 MANNING'S FACTOR = 0.011   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.880
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.61
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.59
 AVERAGE FLOW DEPTH(FEET) =   0.08   TRAVEL TIME(MIN.) =   9.23
 Tc(MIN.) =   15.20
 SUBAREA AREA(ACRES) =     3.06       SUBAREA RUNOFF(CFS) =    6.17
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
 TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =       6.47

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.11   FLOW VELOCITY(FEET/SEC.) =   1.87
 LONGEST FLOWPATH FROM NODE    115.00 TO NODE    105.00 =     995.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.20
 RAINFALL INTENSITY(INCH/HR) =   2.88
 TOTAL STREAM AREA(ACRES) =     3.21
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.47

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    110.00 TO NODE    109.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   105.00
 UPSTREAM ELEVATION(FEET) =     26.30
 DOWNSTREAM ELEVATION(FEET) =     25.60
 ELEVATION DIFFERENCE(FEET) =      0.70
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.112
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    55.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.166
 SUBAREA RUNOFF(CFS) =      0.29
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
 FLOW PROCESS FROM NODE    109.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     25.60  DOWNSTREAM(FEET) =     21.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =   430.00   CHANNEL SLOPE =  0.0091
 CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
 MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.205
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.06
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.23
 AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   5.84
 Tc(MIN.) =   11.95
 SUBAREA AREA(ACRES) =     1.56       SUBAREA RUNOFF(CFS) =    3.50
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
 TOTAL AREA(ACRES) =        1.7         PEAK FLOW RATE(CFS) =       3.72

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   1.50
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    105.00 =     535.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   1
```

```
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.95
  RAINFALL INTENSITY(INCH/HR) =   3.20
  TOTAL STREAM AREA(ACRES) =     1.66
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.72

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       12.35    15.83        2.817          6.10
      2        6.47    15.20        2.880          3.21
      3        3.72    11.95        3.205          1.66

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       19.66    11.95       3.205
      2       21.89    15.20       2.880
      3       21.95    15.83       2.817

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      21.95   Tc(MIN.) =   15.83
  TOTAL AREA(ACRES) =       11.0
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    105.00 =    1100.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    100.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.50  DOWNSTREAM(FEET) =    16.30
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.30
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      21.95
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =   15.97
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    100.00 =    1150.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.97
  RAINFALL INTENSITY(INCH/HR) =   2.80
  TOTAL STREAM AREA(ACRES) =    10.97
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     21.95

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    204.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   180.00
  UPSTREAM ELEVATION(FEET) =     20.00
  DOWNSTREAM ELEVATION(FEET) =     19.80
  ELEVATION DIFFERENCE(FEET) =      0.20
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.423
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.387
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.387
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =  45
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4500
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    1.37
  TOTAL AREA(ACRES) =        1.1   TOTAL RUNOFF(CFS) =       1.68
  TC(MIN.) =   10.42

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    204.00 TO NODE    200.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     19.80  DOWNSTREAM(FEET) =     18.60
 CHANNEL LENGTH THRU SUBAREA(FEET) =   275.00   CHANNEL SLOPE =  0.0044
 CHANNEL FLOW THRU SUBAREA(CFS) =       1.68
 FLOW VELOCITY(FEET/SEC) =   1.10 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   4.18   Tc(MIN.) =   14.60
 LONGEST FLOWPATH FROM NODE    205.00 TO NODE    200.00 =     455.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    100.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    17.10  DOWNSTREAM(FEET) =    16.30
 FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.011
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.32
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.68
 PIPE TRAVEL TIME(MIN.) =   1.11    Tc(MIN.) =   15.71
 LONGEST FLOWPATH FROM NODE    205.00 TO NODE    100.00 =     675.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.71
 RAINFALL INTENSITY(INCH/HR) =   2.83
 TOTAL STREAM AREA(ACRES) =     1.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.68

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       21.95    15.97        2.803         10.97
     2        1.68    15.71        2.829          1.10

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.
```

```
  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       23.43    15.71       2.829
      2       23.61    15.97       2.803

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      23.61   Tc(MIN.) =   15.97
  TOTAL AREA(ACRES) =       12.1
  LONGEST FLOWPATH FROM NODE    140.00 TO NODE    100.00 =    1150.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    304.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   200.00
  UPSTREAM ELEVATION(FEET) =     21.00
  DOWNSTREAM ELEVATION(FEET) =     20.10
  ELEVATION DIFFERENCE(FEET) =      0.90
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.423
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.387
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.387
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =  45
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4500
  SUBAREA AREA(ACRES) =    2.09   SUBAREA RUNOFF(CFS) =    3.22
  TOTAL AREA(ACRES) =        2.3   TOTAL RUNOFF(CFS) =       3.52
  TC(MIN.) =   10.42

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    304.00 TO NODE    300.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     20.10  DOWNSTREAM(FEET) =     19.10
 CHANNEL LENGTH THRU SUBAREA(FEET) =    60.00   CHANNEL SLOPE =  0.0167
 CHANNEL FLOW THRU SUBAREA(CFS) =       3.52
 FLOW VELOCITY(FEET/SEC) =   2.51 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.40   Tc(MIN.) =   10.82
 LONGEST FLOWPATH FROM NODE    305.00 TO NODE    300.00 =     260.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    405.00 TO NODE    400.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =  45
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
 UPSTREAM ELEVATION(FEET) =     24.00
 DOWNSTREAM ELEVATION(FEET) =     18.70
 ELEVATION DIFFERENCE(FEET) =      5.30
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.384
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.400
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.18
 TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.18

****************************************************************************
 FLOW PROCESS FROM NODE    490.00 TO NODE    494.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
 S.C.S. CURVE NUMBER (AMC II) =  45
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    70.00
 UPSTREAM ELEVATION(FEET) =     26.80
 DOWNSTREAM ELEVATION(FEET) =     25.40
 ELEVATION DIFFERENCE(FEET) =      1.40
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.781
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.400
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.31
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.31
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    494.00 TO NODE    495.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     25.40  DOWNSTREAM(FEET) =     23.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =    75.00   CHANNEL SLOPE =  0.0293
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  99.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   1.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.242
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (24. DU/AC OR LESS) RUNOFF COEFFICIENT = .7000
  S.C.S. CURVE NUMBER (AMC II) =  45
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.55
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.24
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   1.01
  Tc(MIN.) =    5.79
  SUBAREA AREA(ACRES) =     0.16       SUBAREA RUNOFF(CFS) =    0.48
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.700
  TOTAL AREA(ACRES) =        0.3         PEAK FLOW RATE(CFS) =       0.77

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.33
  LONGEST FLOWPATH FROM NODE    490.00 TO NODE    495.00 =     145.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    495.00 TO NODE    500.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    18.30  DOWNSTREAM(FEET) =    17.50
  FLOW LENGTH(FEET) =    80.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.02
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.77
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    6.12
  LONGEST FLOWPATH FROM NODE    490.00 TO NODE    500.00 =     225.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
```

```
  TIME OF CONCENTRATION(MIN.) =    6.12
  RAINFALL INTENSITY(INCH/HR) =   4.16
  TOTAL STREAM AREA(ACRES) =     0.26
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.77

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    509.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
  UPSTREAM ELEVATION(FEET) =     25.00
  DOWNSTREAM ELEVATION(FEET) =     23.40
  ELEVATION DIFFERENCE(FEET) =      1.60
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.667
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.800
  SUBAREA RUNOFF(CFS) =      0.47
  TOTAL AREA(ACRES) =      0.25   TOTAL RUNOFF(CFS) =      0.47

****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    500.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   23.40  DOWNSTREAM ELEVATION(FEET) =   22.10
  STREET LENGTH(FEET) =   360.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 27.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.45
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
    HALFSTREET FLOOD WIDTH(FEET) =    9.86
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.33
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.43
  STREET FLOW TRAVEL TIME(MIN.) =   4.51   Tc(MIN.) =   12.18
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.182
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =  45
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
 SUBAREA AREA(ACRES) =    1.22      SUBAREA RUNOFF(CFS) =    1.94
 TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       2.34

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.00
 FLOW VELOCITY(FEET/SEC.) =  1.50   DEPTH*VELOCITY(FT*FT/SEC.) =   0.55
 LONGEST FLOWPATH FROM NODE    510.00 TO NODE    500.00 =     440.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   12.18
 RAINFALL INTENSITY(INCH/HR) =   3.18
 TOTAL STREAM AREA(ACRES) =     1.47
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.34

****************************************************************************
 FLOW PROCESS FROM NODE    515.00 TO NODE    514.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
 S.C.S. CURVE NUMBER (AMC II) =  45
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     34.80
 DOWNSTREAM ELEVATION(FEET) =     31.40
 ELEVATION DIFFERENCE(FEET) =      3.40
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.889
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    92.00
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.933
 SUBAREA RUNOFF(CFS) =      0.45
 TOTAL AREA(ACRES) =      0.23   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
 FLOW PROCESS FROM NODE    514.00 TO NODE    500.00 IS CODE =  62
```

```
------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
========================================================================
  UPSTREAM ELEVATION(FEET) =   31.40  DOWNSTREAM ELEVATION(FEET) =   22.10
  STREET LENGTH(FEET) =   450.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 27.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  22.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    6.76
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.66
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.82   Tc(MIN.) =    9.71
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.493
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  45
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  SUBAREA AREA(ACRES) =    1.23      SUBAREA RUNOFF(CFS) =    2.15
  TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       2.55

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.57
  FLOW VELOCITY(FEET/SEC.) =  2.99   DEPTH*VELOCITY(FT*FT/SEC.) =   0.89
  LONGEST FLOWPATH FROM NODE    515.00 TO NODE    500.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    500.00 IS CODE =   1
------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
========================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.71
  RAINFALL INTENSITY(INCH/HR) =   3.49
  TOTAL STREAM AREA(ACRES) =     1.46
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.55

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        0.77     6.12        4.164          0.26
      2        2.34    12.18        3.182          1.47
      3        2.55     9.71        3.493          1.46

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        3.56     6.12       4.164
      2        5.06     9.71       3.493
      3        5.25    12.18       3.182

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.25   Tc(MIN.) =   12.18
  TOTAL AREA(ACRES) =        3.2
  LONGEST FLOWPATH FROM NODE    515.00 TO NODE    500.00 =     550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    600.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    17.20  DOWNSTREAM(FEET) =    15.40
  FLOW LENGTH(FEET) =   750.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.33
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.25
  PIPE TRAVEL TIME(MIN.) =   3.76    Tc(MIN.) =   15.94
  LONGEST FLOWPATH FROM NODE    515.00 TO NODE    600.00 =    1300.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    600.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.94
  RAINFALL INTENSITY(INCH/HR) =   2.81
```

```
  TOTAL STREAM AREA(ACRES) =     3.19
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.25

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    604.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  45
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    60.00
  UPSTREAM ELEVATION(FEET) =     25.00
  DOWNSTREAM ELEVATION(FEET) =     23.50
  ELEVATION DIFFERENCE(FEET) =      1.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.164
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.151
  SUBAREA RUNOFF(CFS) =      0.21
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.21

****************************************************************************
  FLOW PROCESS FROM NODE    604.00 TO NODE    600.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     23.50  DOWNSTREAM(FEET) =     20.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   120.00   CHANNEL SLOPE =  0.0267
  CHANNEL BASE(FEET) =   20.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.015   MAXIMUM DEPTH(FEET) =   0.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.788
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (14.5 DU/AC OR LESS) RUNOFF COEFFICIENT = .5000
  S.C.S. CURVE NUMBER (AMC II) =  45
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.53
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.26
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   1.59
  Tc(MIN.) =    7.75
  SUBAREA AREA(ACRES) =     0.34       SUBAREA RUNOFF(CFS) =    0.64
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.500
  TOTAL AREA(ACRES) =        0.4         PEAK FLOW RATE(CFS) =       0.83

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   1.41
  LONGEST FLOWPATH FROM NODE    510.00 TO NODE    600.00 =     180.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    600.00 IS CODE =   1
```

```
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.75
  RAINFALL INTENSITY(INCH/HR) =   3.79
  TOTAL STREAM AREA(ACRES) =     0.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.83

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.25    15.94        2.806          3.19
      2        0.83     7.75        3.788          0.44

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        4.72     7.75       3.788
      2        5.87    15.94       2.806

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       5.87   Tc(MIN.) =   15.94
  TOTAL AREA(ACRES) =        3.6
  LONGEST FLOWPATH FROM NODE    515.00 TO NODE    600.00 =    1300.00 FEET.
==========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.6  TC(MIN.) =     15.94
  PEAK FLOW RATE(CFS)   =       5.87
==========================================================================
==========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

# APPENDIX 5

# PROPOSED MITIGATED HYDROLOGY CALCULATIONS

**Job Name:** BELLA MAR
**Job #:** 1621-001
**Run Name:** BMPR
**Date:** 2/11/2019

MITIGATED PROPOSED HYDROLOGY - 100 YR

| Node to Node | | Code | Elev 1 (feet) | Elev 2 (feet) | Length (feet) | Runoff Coeff. | Area (ac.) | Comments | BANK 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 105 | 105 | 7 | A=10.97 | Tc=15.83 | Q=15.86 | | **10.97** | **Detention Basin Outflow** | | | |
| 105 | 100 | 3 | 16.5 | 16.3 | 50.0 | | | Pipe Flow | | | |
| 100 | 100 | 1 | | | | | | Confluence: 1 of 2 | | | |
| | | | | | | | | | | | |
| 205 | 204 | 2 | 20.0 | 19.8 | 180.0 | 0.45 | 0.20 | Basin B: Initial Area | | | |
| 204 | 204 | 8 | | | | 0.45 | 0.90 | Addition Subarea | | | |
| 204 | 200 | 5 | 19.8 | 18.6 | 275.0 | | | Open Channel Flow | | | |
| 200 | 100 | 3 | 17.1 | 16.3 | 220.0 | | | Pipe Flow | | | |
| 100 | 100 | 1 | | | | | | Confluence: 2 of 2: POC1 | | | |
| | | | | | | | **12.07** | **Total Tributary Area to POC1** | | | |

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2014 Advanced Engineering Software (aes)
              Ver. 21.0 Release Date: 06/01/2014  License ID 1355

                              Analysis prepared by:

                                Fuscoe Engineering
                               6390 Greenwich Drive
                                    Suite 170
                               San Diego, CA 92122

 ************************* DESCRIPTION OF STUDY *************************
* BELLA MAR                                                             *
* MITIGATED DEVELOPED CONDITIONS - 100 YR                               *
* DETENTION AT NODE 105                                                 *
 *************************************************************************

  FILE NAME: BMPRMIT.DAT
  TIME/DATE OF STUDY: 07:38 02/13/2019
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS = 20
   1)   5.000;  4.400
   2)   6.000;  4.200
   3)   7.000;  3.900
   4)   8.000;  3.750
   5)   9.000;  3.600
   6)  10.000;  3.450
   7)  11.000;  3.300
   8)  12.000;  3.200
   9)  14.000;  3.000
  10)  15.000;  2.900
  11)  16.000;  2.800
  12)  17.000;  2.700
  13)  19.000;  2.600
  14)  20.000;  2.550
  15)  25.000;  2.230
```

```
  16)  30.000;  2.000
  17)  40.000;  1.700
  18)  50.000;  1.500
  19)  60.000;  1.310
  20) 120.000;  0.860
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   27.0     22.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  15.83   RAIN INTENSITY(INCH/HOUR) =  2.82
  TOTAL AREA(ACRES) =    10.97   TOTAL RUNOFF(CFS) =     15.86

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    100.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    16.50  DOWNSTREAM(FEET) =    16.30
  FLOW LENGTH(FEET) =    50.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.82
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.86
  PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   15.97
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    100.00 =      50.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.97
  RAINFALL INTENSITY(INCH/HR) =   2.80
  TOTAL STREAM AREA(ACRES) =    10.97
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.86

******************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    204.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   180.00
  UPSTREAM ELEVATION(FEET) =     20.00
  DOWNSTREAM ELEVATION(FEET) =     19.80
  ELEVATION DIFFERENCE(FEET) =      0.20
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.423
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    50.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.387
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.30

******************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.387
  *USER SPECIFIED(SUBAREA):
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4500
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.4500
  SUBAREA AREA(ACRES) =    0.90   SUBAREA RUNOFF(CFS) =    1.37
  TOTAL AREA(ACRES) =        1.1   TOTAL RUNOFF(CFS) =       1.68
  TC(MIN.) =   10.42

******************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    200.00 IS CODE =  52
------------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
```

```
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     19.80  DOWNSTREAM(FEET) =     18.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   275.00   CHANNEL SLOPE =  0.0044
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.68
  FLOW VELOCITY(FEET/SEC) =   1.10 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.18   Tc(MIN.) =   14.60
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    200.00 =     455.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    100.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    17.10  DOWNSTREAM(FEET) =    16.30
  FLOW LENGTH(FEET) =   220.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.32
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.68
  PIPE TRAVEL TIME(MIN.) =   1.11    Tc(MIN.) =   15.71
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    100.00 =     675.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    100.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.71
  RAINFALL INTENSITY(INCH/HR) =   2.83
  TOTAL STREAM AREA(ACRES) =     1.10
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.68

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1       15.86    15.97        2.803         10.97
      2        1.68    15.71        2.829          1.10

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       17.27    15.71       2.829
      2       17.52    15.97       2.803

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      17.52   Tc(MIN.) =   15.97
  TOTAL AREA(ACRES) =       12.1
  LONGEST FLOWPATH FROM NODE    205.00 TO NODE    100.00 =     675.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       12.1  TC(MIN.) =     15.97
  PEAK FLOW RATE(CFS)   =      17.52
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

# APPENDIX 6

# HYDRAULIC CALCULATIONS

## DETENTION BASIN ATTENUATION

## HOLLISTER PUBLIC STORM DRAIN PIPE

DETENTION BASIN 100-YR STORM ATTENUATION

DETENTION BASIN INFLOW HYDROGRAPH

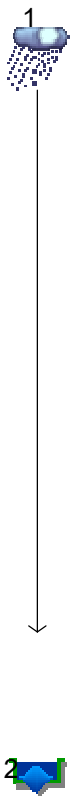
RATIONAL METHOD HYDROGRAPH PROGRAM


RUN DATE 2/12/2019
HYDROGRAPH FILE NAME Text1
TIME OF CONCENTRATION 16 MIN.
6 HOUR RAINFALL 2.5 INCHES
BASIN AREA 10.97 ACRES
RUNOFF COEFFICIENT 0.7
PEAK DISCHARGE 21.95 CFS

| | |
|---|---|
| TIME (MIN) = 0 | DISCHARGE (CFS) = 0 |
| TIME (MIN) = 16 | DISCHARGE (CFS) = 1.1 |
| TIME (MIN) = 32 | DISCHARGE (CFS) = 1.2 |
| TIME (MIN) = 48 | DISCHARGE (CFS) = 1.2 |
| TIME (MIN) = 64 | DISCHARGE (CFS) = 1.3 |
| TIME (MIN) = 80 | DISCHARGE (CFS) = 1.4 |
| TIME (MIN) = 96 | DISCHARGE (CFS) = 1.5 |
| TIME (MIN) = 112 | DISCHARGE (CFS) = 1.6 |
| TIME (MIN) = 128 | DISCHARGE (CFS) = 1.8 |
| TIME (MIN) = 144 | DISCHARGE (CFS) = 1.9 |
| TIME (MIN) = 160 | DISCHARGE (CFS) = 2.1 |
| TIME (MIN) = 176 | DISCHARGE (CFS) = 2.3 |
| TIME (MIN) = 192 | DISCHARGE (CFS) = 2.8 |
| TIME (MIN) = 208 | DISCHARGE (CFS) = 3.2 |
| TIME (MIN) = 224 | DISCHARGE (CFS) = 4.7 |
| TIME (MIN) = 240 | DISCHARGE (CFS) = 8.6 |
| TIME (MIN) = 256 | DISCHARGE (CFS) = 21.95 |
| TIME (MIN) = 272 | DISCHARGE (CFS) = 3.8 |
| TIME (MIN) = 288 | DISCHARGE (CFS) = 2.5 |
| TIME (MIN) = 304 | DISCHARGE (CFS) = 2 |
| TIME (MIN) = 320 | DISCHARGE (CFS) = 1.7 |
| TIME (MIN) = 336 | DISCHARGE (CFS) = 1.4 |
| TIME (MIN) = 352 | DISCHARGE (CFS) = 1.3 |
| TIME (MIN) = 368 | DISCHARGE (CFS) = 1.2 |
| TIME (MIN) = 384 | DISCHARGE (CFS) = 0 |

# Watershed Model Schematic






## Legend

| Hyd. | Origin | Description |
|---|---|---|
| 1 | Manual | Unmitigated Inflow |
| 2 | Reservoir | Mitigated |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Manual | 21.95 | 16 | 256 | 69,648 | ------ | ------ | ------ | Unmitigated Inflow |
| 2 | Reservoir | 15.86 | 16 | 256 | 69,644 | 1 | 20.51 | 8,446 | Mitigated |

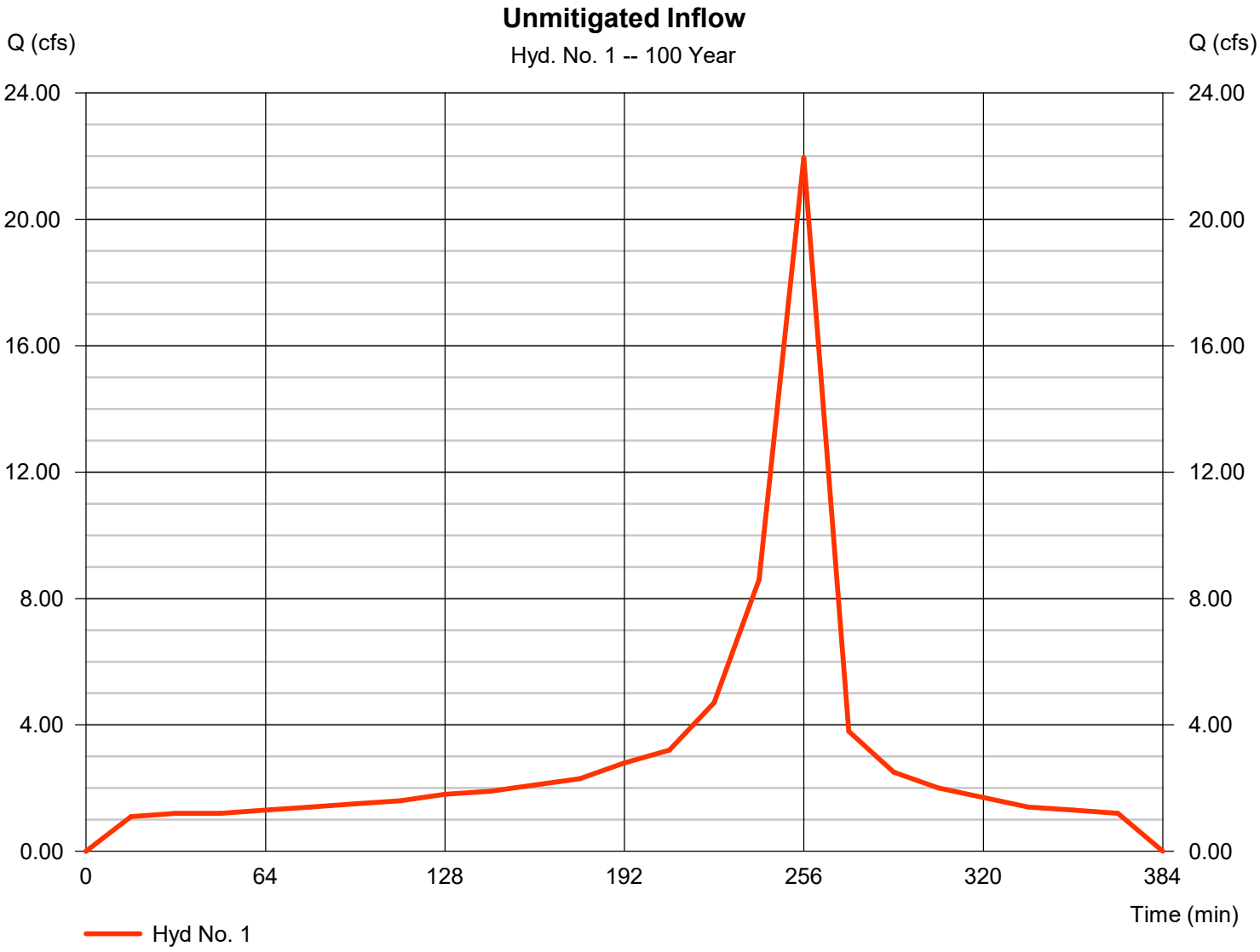
# Hydrograph Report



## Hyd. No. 1

Unmitigated Inflow

| | | | |
|---|---|---|---|
| Hydrograph type | = Manual | Peak discharge | = 21.95 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 256 min |
| Time interval | = 16 min | Hyd. volume | = 69,648 cuft |



# Hydrograph Report

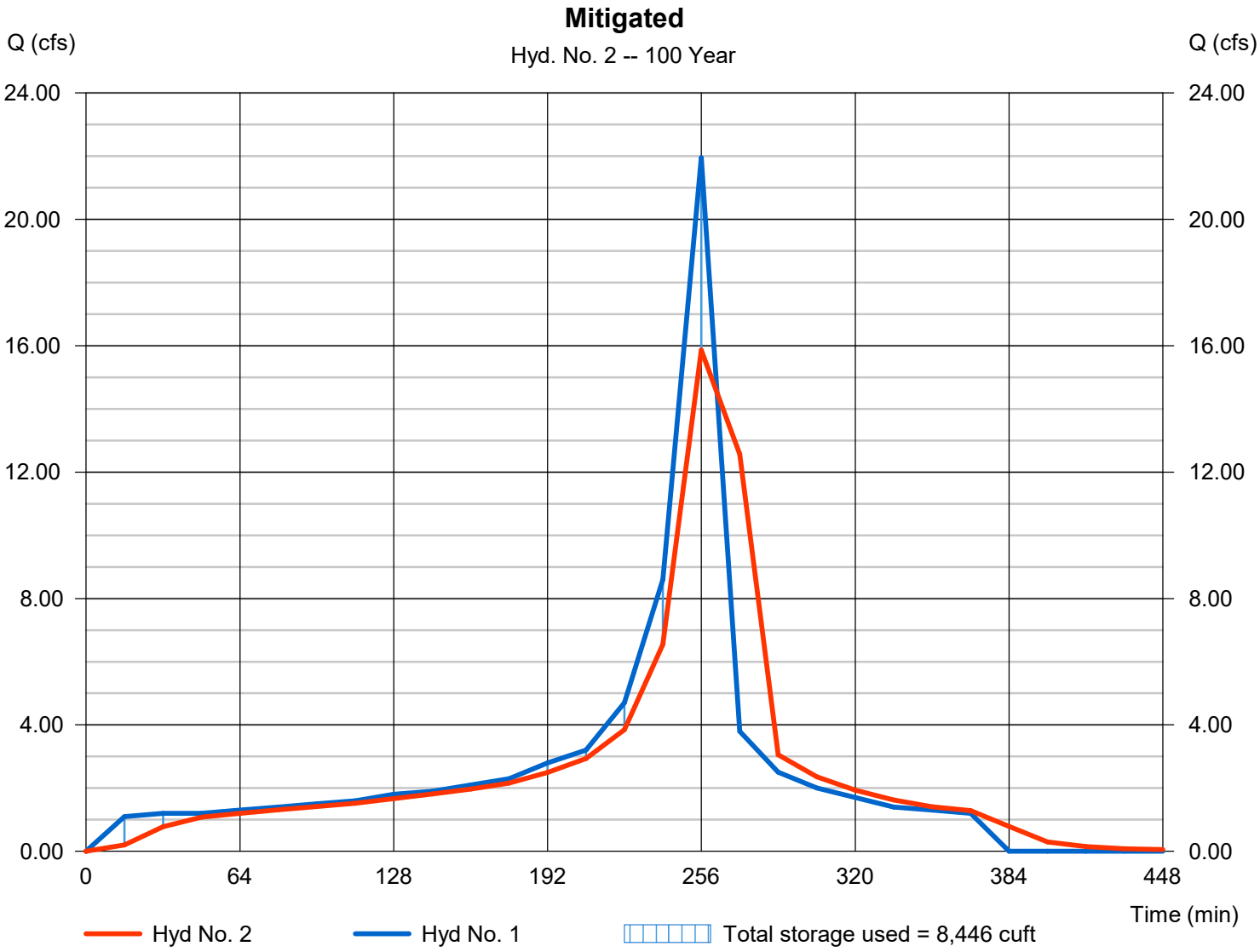


## Hyd. No. 2

Mitigated

| | | | | | |
|---|---|---|---|---|---|
| Hydrograph type | = | Reservoir | Peak discharge | = | 15.86 cfs |
| Storm frequency | = | 100 yrs | Time to peak | = | 256 min |
| Time interval | = | 16 min | Hyd. volume | = | 69,644 cuft |
| Inflow hyd. No. | = | 1 - Unmitigated Inflow | Max. Elevation | = | 20.51 ft |
| Reservoir name | = | Detention | Max. Storage | = | 8,446 cuft |

Storage Indication method used.



## Pond No. 2 - Detention

### Pond Data

**Contours -**User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 19.70 ft

### Stage / Storage Table

| Stage (ft) | Elevation (ft) | Contour area (sqft) | Incr. Storage (cuft) | Total storage (cuft) |
|---|---|---|---|---|
| 0.00 | 19.70 | 12,740 | 0 | 0 |
| 0.10 | 19.80 | 13,045 | 1,289 | 1,289 |
| 0.20 | 19.90 | 13,350 | 1,320 | 2,609 |
| 0.30 | 20.00 | 13,660 | 1,351 | 3,960 |
| 0.40 | 20.10 | 13,965 | 1,381 | 5,341 |
| 0.50 | 20.20 | 14,273 | 1,412 | 6,753 |
| 0.60 | 20.30 | 14,581 | 1,443 | 8,195 |
| 0.70 | 20.40 | 14,890 | 1,474 | 9,669 |
| 0.80 | 20.50 | 15,200 | 1,505 | 11,173 |
| 0.90 | 20.60 | 15,510 | 1,536 | 12,709 |
| 1.00 | 20.70 | 15,820 | 1,567 | 14,275 |
| 1.10 | 20.80 | 16,132 | 1,598 | 15,873 |
| 1.20 | 20.90 | 16,444 | 1,629 | 17,502 |
| 1.30 | 21.00 | 16,756 | 1,660 | 19,162 |
| 1.40 | 21.10 | 17,069 | 1,691 | 20,853 |
| 1.50 | 21.20 | 17,382 | 1,723 | 22,576 |

### Culvert / Orifice Structures

| | [A] | [B] | [C] | [PrfRsr] |
|---|---|---|---|---|
| **Rise (in)** | = 24.00 | 0.00 | 0.00 | 0.00 |
| **Span (in)** | = 24.00 | 0.00 | 0.00 | 0.00 |
| **No. Barrels** | = 1 | 0 | 0 | 0 |
| **Invert El. (ft)** | = 16.35 | 0.00 | 0.00 | 0.00 |
| **Length (ft)** | = 10.00 | 0.00 | 0.00 | 0.00 |
| **Slope (%)** | = 0.50 | 0.00 | 0.00 | n/a |
| **N-Value** | = .013 | .013 | .013 | n/a |
| **Orifice Coeff.** | = 0.60 | 0.60 | 0.60 | 0.60 |
| **Multi-Stage** | = n/a | No | No | No |

### Weir Structures

| | [A] | [B] | [C] | [D] |
|---|---|---|---|---|
| **Crest Len (ft)** | = 9.83 | 0.00 | 0.00 | 0.00 |
| **Crest El. (ft)** | = 19.70 | 0.00 | 0.00 | 0.00 |
| **Weir Coeff.** | = 3.33 | 3.33 | 3.33 | 3.33 |
| **Weir Type** | = 1 | --- | --- | --- |
| **Multi-Stage** | = Yes | No | No | No |

**Exfil.(in/hr)** = 0.000 (by Wet area)

**TW Elev. (ft)** = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

### Stage / Storage / Discharge Table

| Stage ft | Storage cuft | Elevation ft | Clv A cfs | Clv B cfs | Clv C cfs | PrfRsr cfs | Wr A cfs | Wr B cfs | Wr C cfs | Wr D cfs | Exfil cfs | User cfs | Total cfs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0 | 19.70 | 0.00 | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | 0.000 |
| 0.10 | 1,289 | 19.80 | 23.19 ic | --- | --- | --- | 1.04 | --- | --- | --- | --- | --- | 1.035 |
| 0.20 | 2,609 | 19.90 | 23.19 ic | --- | --- | --- | 2.93 | --- | --- | --- | --- | --- | 2.928 |
| 0.30 | 3,960 | 20.00 | 23.19 ic | --- | --- | --- | 5.38 | --- | --- | --- | --- | --- | 5.379 |
| 0.40 | 5,341 | 20.10 | 23.19 ic | --- | --- | --- | 8.28 | --- | --- | --- | --- | --- | 8.281 |
| 0.50 | 6,753 | 20.20 | 23.19 ic | --- | --- | --- | 11.57 | --- | --- | --- | --- | --- | 11.57 |
| 0.60 | 8,195 | 20.30 | 23.19 ic | --- | --- | --- | 15.21 | --- | --- | --- | --- | --- | 15.21 |
| 0.70 | 9,669 | 20.40 | 23.19 ic | --- | --- | --- | 19.17 | --- | --- | --- | --- | --- | 19.17 |
| 0.80 | 11,173 | 20.50 | 23.35 ic | --- | --- | --- | 23.35 s | --- | --- | --- | --- | --- | 23.35 |
| 0.90 | 12,709 | 20.60 | 24.92 ic | --- | --- | --- | 24.92 s | --- | --- | --- | --- | --- | 24.92 |
| 1.00 | 14,275 | 20.70 | 25.94 ic | --- | --- | --- | 25.93 s | --- | --- | --- | --- | --- | 25.93 |
| 1.10 | 15,873 | 20.80 | 26.74 ic | --- | --- | --- | 26.74 s | --- | --- | --- | --- | --- | 26.74 |
| 1.20 | 17,502 | 20.90 | 27.42 ic | --- | --- | --- | 27.42 s | --- | --- | --- | --- | --- | 27.42 |
| 1.30 | 19,162 | 21.00 | 28.02 ic | --- | --- | --- | 28.02 s | --- | --- | --- | --- | --- | 28.02 |
| 1.40 | 20,853 | 21.10 | 28.57 ic | --- | --- | --- | 28.56 s | --- | --- | --- | --- | --- | 28.56 |
| 1.50 | 22,576 | 21.20 | 29.07 ic | --- | --- | --- | 29.07 s | --- | --- | --- | --- | --- | 29.07 |

# Hydraflow Table of Contents

# Hydraulic Calculation for Public 18" RCP SD in Hollister

## Project Description

| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.013 | |
| Channel Slope | 0.00300 | ft/ft |
| Diameter | 1.50 | ft |
| Discharge | 5.87 | ft³/s |

## Results

| | | |
|---|---|---|
| Normal Depth | 1.26 | ft |
| Flow Area | 1.58 | ft² |
| Wetted Perimeter | 3.47 | ft |
| Hydraulic Radius | 0.46 | ft |
| Top Width | 1.10 | ft |
| Critical Depth | 0.94 | ft |
| Percent Full | 83.9 | % |
| Critical Slope | 0.00616 | ft/ft |
| Velocity | 3.71 | ft/s |
| Velocity Head | 0.21 | ft |
| Specific Energy | 1.47 | ft |
| Froude Number | 0.55 | |
| Maximum Discharge | 6.19 | ft³/s |
| Discharge Full | 5.75 | ft³/s |
| Slope Full | 0.00312 | ft/ft |
| Flow Type | SubCritical | |

## GVF Input Data

| | | |
|---|---|---|
| Downstream Depth | 0.00 | ft |
| Length | 0.00 | ft |
| Number Of Steps | 0 | |

## GVF Output Data

| | | |
|---|---|---|
| Upstream Depth | 0.00 | ft |
| Profile Description | | |
| Profile Headloss | 0.00 | ft |
| Average End Depth Over Rise | 0.00 | % |
| Normal Depth Over Rise | 83.92 | % |
| Downstream Velocity | Infinity | ft/s |

# Hydraulic Calculation for Public 18" RCP SD in Hollister

## GVF Output Data

| | | |
|---|---|---|
| Upstream Velocity | Infinity | ft/s |
| Normal Depth | 1.26 | ft |
| Critical Depth | 0.94 | ft |
| Channel Slope | 0.00300 | ft/ft |
| Critical Slope | 0.00616 | ft/ft |

# Cross Section for Public 18" RCP SD in Hollister

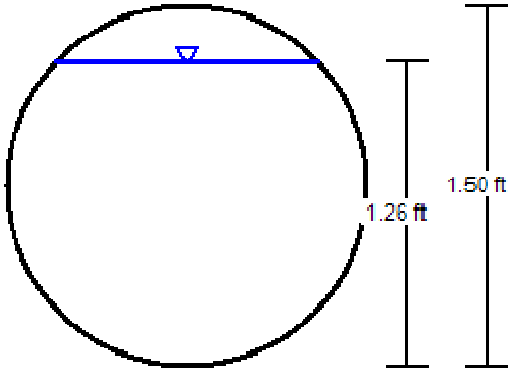
## Project Description

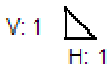
| | |
|---|---|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |

## Input Data

| | | |
|---|---|---|
| Roughness Coefficient | 0.013 | |
| Channel Slope | 0.00300 | ft/ft |
| Normal Depth | 1.26 | ft |
| Diameter | 1.50 | ft |
| Discharge | 5.87 | ft³/s |

## Cross Section Image



# APPENDIX 7

# AS-BUILT REFERENCES

ATTACHMENT 1
SITE PLAN

ATTACHMENT 2
CALTRANS AS-BUILT

| DIST. | COUNTY | ROUTE | POST MILES—TOTAL PROJECT | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 11 | SD | 5 | 4.4/9.0 | 42 | 437 |

DISTRICT DESIGN ENGINEER Henry R. Obrecht REGISTERED CIVIL ENGINEER No. 15768
DATE APPROVED July 27, 1970

14.9' IE-OUT (NAVD 88)

16.2' IE-IN (NAVD 88)

L0
Δ = 04° 36' 28"
R = 10,000'
T = 402.32'
L = 804.21'

275+59.38 EC L0

Otay Riv Br
Br. No. 57-246R/L

Otay Riv Overflow Br
Br. No. 57-263R/L

R/W

S Dike

Graded "V" Gutter 2:1 SS

N06°54'00"W 285

2693.09'

Profile Grade

Ground Line

-0.38%

NOTE
Profile Grade is 15' Lt & Rt of ℄ L0

U.S.C & G.S. Datum

"AS BUILT"
CONTRACT 122404
YEAR COMPLETED 8-1-73

# DRAINAGE DETAILS AND CONTOUR GRADING PLANS

| Project Engineer | Date | Design Engineer | Date | Approval Recommended By | Date |
|---|---|---|---|---|---|
| | | | | | |

AS BUILT PLANS
Contract No. 11-122404
Date Completed 07-70
Document No. 11-000260

FORM WH23A-PF

4

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 8-26-74 SIGNATURE [signature] TITLE [illegible]

SCALE 1"=50' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=20' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=10' or 1"=100' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM
SCALE 1"=40' MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF PUBLIC WORKS - MICROFILM

ATTACHMENT 3 :
FLOOD INSURANCE
STUDY

CHARLES AVENUE

LOURET AVENUE

INTERSTATE HIGHWAY 5

INTERSTATE HIGHWAY 5

14.9' 10 YEAR FLOOD ELEVATION @ OUTLET

15.1' 10-YEAR FLOOD ELEVATION @ INLET

200'

ELEVATION IN FEET (NAVD)

30

20

10

0

2600 2800 3000 3200 3400 3600 3800 4000 4200 4400 4600 4800 5000 5200

STREAM DISTANCE IN FEET ABOVE CROSS SECTION A

D E F G

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

259P

# APPENDIX 8

# FEMA FLOOD MAP

# NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations (BFEs)** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

**Base map** information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). this information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

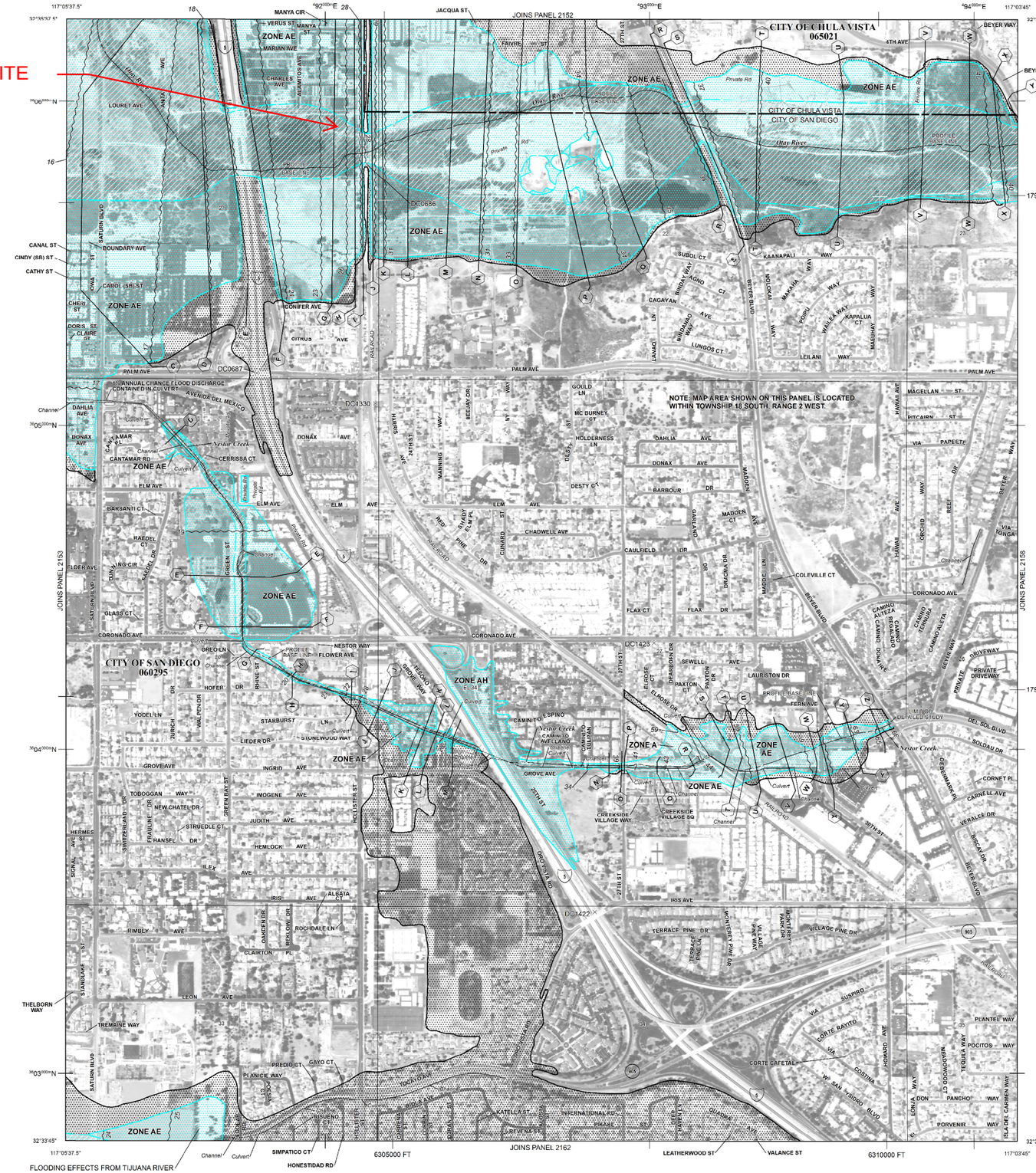
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.




# LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.

**ZONE AE** Base Flood Elevations determined.

**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

**ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

**ZONE A99** Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.

**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities

513 (EL 987) Base Flood Elevation line and value; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

Cross section line

Transect line

97°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

4275000mE 1000-meter Universal Transverse Mercator grid ticks, zone 11

6000000 FT 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection

DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
May 16, 2012 - to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to update map elevations to North American Vertical Datum of 1988.
April 5, 2016 - to remove Provisionally Accredited Levee note

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 200 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2154H

# FIRM

## FLOOD INSURANCE RATE MAP

## SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

**PANEL 2154 OF 2375**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| CHULA VISTA, CITY OF | 065021 | 2154 | H |
| SAN DIEGO, CITY OF | 060295 | 2154 | H |

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER 06073C2154H**

**MAP REVISED APRIL 5, 2016**

Federal Emergency Management Agency

# APPENDIX 9

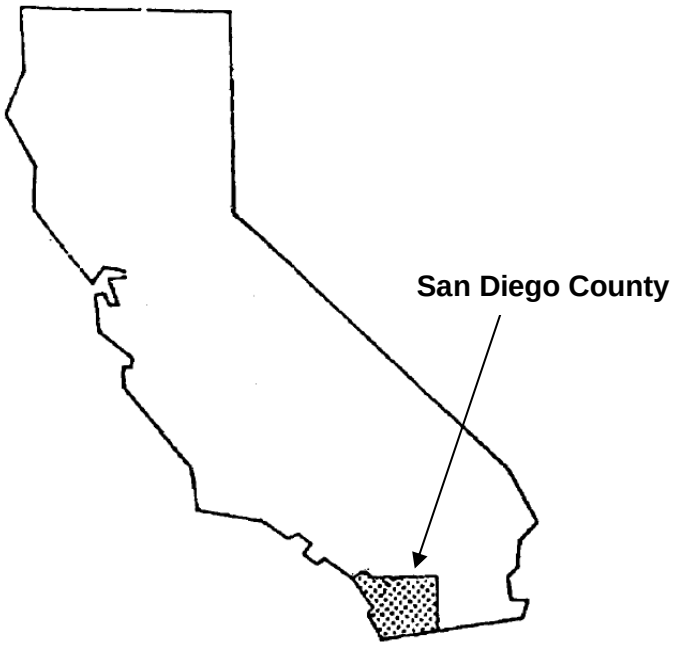
# FEMA FLOOD STUDIES

# FLOOD INSURANCE STUDY

# SAN DIEGO COUNTY, CALIFORNIA
## AND INCORPORATED AREAS

### VOLUME 1 OF 11

| Community Name | Community Number |
|---|---|
| SAN DIEGO COUNTY, UNINCORPORATED AREAS | 060284 |
| CARLSBAD, CITY OF | 060285 |
| CHULA VISTA, CITY OF | 065021 |
| CORONADO, CITY OF | 060287 |
| DEL MAR, CITY OF | 060288 |
| EL CAJON, CITY OF | 060289 |
| ENCINITAS, CITY OF | 060726 |
| ESCONDIDO, CITY OF | 060290 |
| IMPERIAL BEACH, CITY OF | 060291 |
| LA MESA, CITY OF | 060292 |
| LEMON GROVE, CITY OF | 060723 |
| NATIONAL CITY, CITY OF | 060293 |
| OCEANSIDE, CITY OF | 060294 |
| POWAY, CITY OF | 060702 |
| SAN DIEGO, CITY OF | 060295 |
| SAN MARCOS, CITY OF | 060296 |
| SANTEE, CITY OF | 060703 |
| SOLANA BEACH, CITY OF | 060725 |
| VISTA, CITY OF | 060297 |




REVISED
4/5/2016

## Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
06073CV001D

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*Table of Contents – Volumes 1 & 2 – continued*

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EXHIBITS

EXHIBIT 1 – FLOOD PROFILES



*Table of Contents – Volume 7*

EXHIBITS

EXHIBIT 1 – FLOOD PROFILES



*Table of Contents – Volume 8*

EXHIBITS

EXHIBIT 1 – FLOOD PROFILES

## TABLE 8: SUMMARY OF PEAK DISCHARGES

| Flooding Source and Location | Drainage Area (sq. miles) | Peak Discharges (cubic feet per second) 10% Annual-Chance | 2% Annual-Chance | 1% Annual-Chance | 0.2% Annual-Chance |
|---|---|---|---|---|---|
| At 19th Street | -- | -- | -- | 864[4] | -- |
| At Elm Avenue | 2.45 | -- | -- | 796[4] | -- |
| At Coronado Avenue | 2.33 | -- | -- | 698[4] | -- |
| At Hollister Street | 1.99 | -- | -- | 496[4] | -- |
| At 25th Street/Interstate 5 | 1.71 | -- | -- | 456[4] | -- |
| At San Diego and Arizona Eastern Railroad | 1.40 | 555 | 860 | 1,015 | 2,295 |
| North Avenue Tributary | | | | | |
| Approximately 1,730 feet upstream of North Broadway | 0.5 | -- | -- | 440 | -- |
| North Branch Poway Creek | | | | | |
| At Sycamore Canyon Road | 4.5 | 650 | 2,000 | 3,000 | 7,200 |
| North Tributary to Santa Maria | | | | | |
| At Mouth | 1.6 | 100 | 600 | 1,100 | 2,900 |
| Olive Creek | | | | | |
| At Mouth | 1.0 | -- | -- | 1,370 | -- |

-- Data Not Available

[4] Decrease Due to Construction of "Lot 6 Detention Basin" Upstream of Railroad

| FLOODING SOURCE | | FLOODWAY | | | 1-PERCENT-ANNUAL-CHANCE FLOOD WATER-SURFACE ELEVATION (FEET NAVD) | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| Otay River | | | | | | | | |
| A | 0 | 2,533 | 4,688 | 4.7 | 13.2 | 13.2 | 13.2 | 0.0 |
| B | 1,390 | 2,110 | 9,474 | 2.3 | 15.2 | 15.2 | 16.1 | 0.9 |
| C | 2,490 | 2,300 | 4,084 | 5.4 | 16.3 | 16.3 | 16.8 | 0.5 |
| D | 3,720 | 1,662 | 7,917 | 2.8 | 18.2 | 18.2 | 18.9 | 0.7 |
| E | 4,040 | 642 | 1,928 | 11.4 | 19.3 | 19.3 | 19.4 | 0.1 |
| F | 4,270 | 722 | 3,819 | 5.8 | 20.6 | 20.6 | 20.6 | 0.0 |
| G | 5,100 | 641 | 2,883 | 7.6 | 24.0 | 24.0 | 24.0 | 0.0 |
| H | 5,350 | 360 | 1,767 | 12.4 | 25.7 | 25.7 | 25.7 | 0.0 |
| I | 5,390 | 320 | 2,711 | 8.1 | 28.0 | 28.0 | 28.0 | 0.0 |
| J | 5,500 | 304 | 2,359 | 9.3 | 28.9 | 28.9 | 28.9 | 0.0 |
| K | 5,600 | 440 | 4,010 | 5.5 | 30.8 | 30.8 | 30.8 | 0.0 |
| L | 5,880 | 740 | 4,511 | 4.9 | 30.8 | 30.8 | 30.9 | 0.1 |
| M | 6,280 | 1,020 | 7,451 | 2.9 | 30.9 | 30.9 | 31.5 | 0.6 |
| N | 6,610 | 1,225 | 7,933 | 2.8 | 30.9 | 30.9 | 31.7 | 0.8 |
| O | 7,012 | 1,243 | 4,824 | 4.6 | 32.8 | 32.8 | 32.9 | 0.1 |
| P | 7,330 | 1,035 | 3,833 | 5.7 | 33.3 | 33.3 | 33.8 | 0.5 |
| Q | 7,670 | 1,204 | 6,208 | 3.5 | 34.3 | 34.3 | 35.3 | 1.0 |
| R | 8,780 | 451 | 3,132 | 7.0 | 36.4 | 36.4 | 37.3 | 0.9 |
| S | 8,875 | 432 | 2,553 | 8.6 | 36.6 | 36.6 | 37.6 | 1.0 |
| T | 9,525 | 1,060 | 7,231 | 3.0 | 39.7 | 39.7 | 39.9 | 0.2 |
| U | 10,375 | 1,110 | 9,424 | 2.3 | 40.1 | 40.1 | 40.3 | 0.2 |
| V | 11,275 | 935 | 8,841 | 2.5 | 40.3 | 40.3 | 40.5 | 0.2 |
| W | 11,825 | 917 | 8,300 | 2.6 | 40.3 | 40.3 | 40.6 | 0.3 |
| X | 12,085 | 670 | 6,494 | 3.4 | 40.4 | 40.4 | 40.7 | 0.3 |
| Y | 12,395 | 403 | 1,798 | 12.2 | 42.9 | 42.9 | 42.9 | 0.0 |
| Z | 12,579 | 476 | 3,279 | 6.8 | 45.4 | 45.4 | 45.4 | 0.0 |

[1] Feet above Cross Section A

## 3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum in use for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the finalization of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are being prepared using NAVD as the referenced vertical datum.

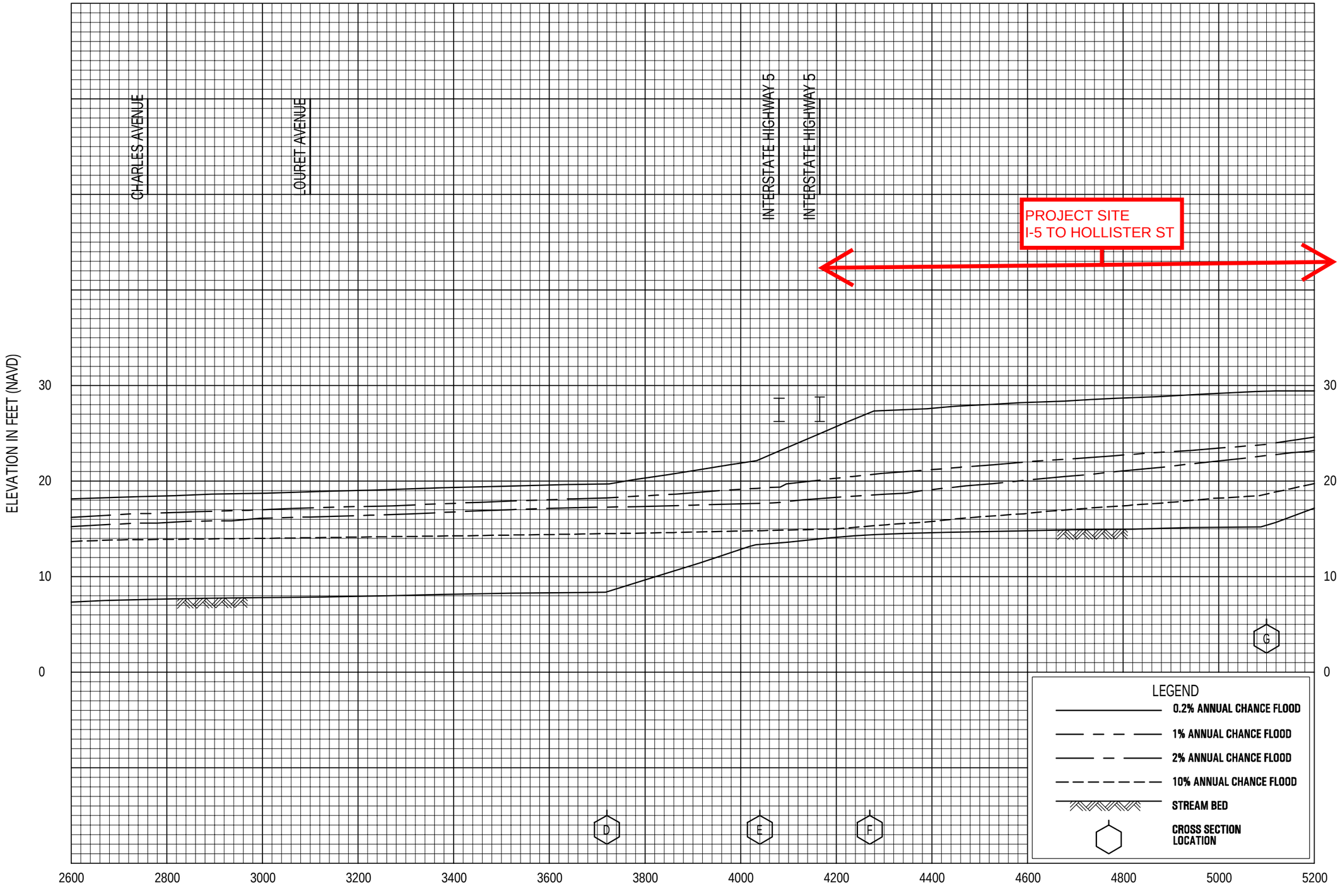
All flood elevations shown in this FIS report and on the FIRM are referenced to NAVD, with exception of two panels: 06073C2151F and 06073C2152F. These panels were not updated with this revision and are referenced to NGVD. Flooding sources on the non-updated FIRMs include Nestor Creek, Otay River, San Diego Bay, Telegraph Canyon Creek, and Tijuana River. The profile panels and floodway data tables that contain information corresponding with the non-updated panels have been included in NGVD, in addition to all of the data being presented in NAVD. Structure and ground elevations in the community must, therefore, be referenced to NAVD. It is important to note that adjacent communities may be referenced to NGVD. This may result in differences in Base (1-percent-annual-chance) Flood Elevations (BFEs) across the corporate limits between the communities. The conversion factor for each flooding source studied by detailed methods is shown below in Table 12 "Flooding Source Conversion Factor."

**TABLE 12: FLOODING SOURCE DATUM SHIFT VALUES**

| Stream Name | Elevation (feet NAVD above NGVD) |
|---|---|
| Adobe Creek | +2.2 |
| Agua Hedionda Creek | +2.2 |
| Agua Hedionda Creek (At City of Carlsbad) | +2.2 |
| Agua Hedionda Creek (At City of Vista) | +2.3 |
| Alvarado Creek | +2.1 |
| Beaver Hollow Creek | +2.2 |
| Beeler Creek | +2.1 |
| Broadway Creek | +2.1 |
| Buena Creek | +2.3 |
| Buena Vista Creek | +2.3 |
| Buena Vista Creek Tributary 1 | +2.3 |
| Buena Vista Creek Tributary 3 | +2.3 |
| Calavera Creek | +2.2 |
| Carmel Valley Creek | +2.1 |
| Carroll Canyon Creek | +2.1 |
| Coleman Creek | +2.5 |
| County Ditch Creek | +2.1 |

## TABLE 12: FLOODING SOURCE DATUM SHIFT VALUES

| Stream Name | Elevation (feet NAVD above NGVD) |
|---|---|
| Moosa Creek (North Branch) | +2.3 |
| Moosa Creek (South Branch) | +2.3 |
| Murphy Canyon Creek | +2.1 |
| Murray Canyon Creek | +2.1 |
| Nestor Creek | +2.1 |
| North Avenue Tributary | +2.3 |
| North Branch Poway Creek | +2.1 |
| North Tributary to Santa Maria Creek | +2.2 |
| Olive Creek | +2.4 |
| Otay River | +2.2 |
| Pala Mesa Creek | +2.2 |
| Paradise Creek | +2.1 |
| Paradise Creek – Valley Road Branch | +2.1 |
| Pilgrim Creek | +2.3 |
| Poggi Canyon Creek | +2.2 |
| Pomerado Creek | +2.1 |
| Poway Creek | +2.1 |
| Rainbow Creek (Main Branch) | +2.3 |
| Rainbow Creek (West Branch) | +2.3 |
| Rattlesnake Creek | +2.1 |
| Rattlesnake Creek Split Flow at Heritage Hills | +2.1 |
| Rattlesnake Creek Split Flow at Midland Road | +2.1 |
| Reidy Creek | +2.3 |
| Reidy Creek Split Flow | +2.3 |
| Rice Canyon Creek | +2.1 |
| Rincon Avenue Tributary | +2.3 |
| Rose Canyon Creek | +2.1 |
| Samagutuma Creek | +2.4 |
| San Clemente Canyon Creek | +2.1 |
| San Diego Bay | +2.2 |
| San Diego River | +2.1 |
| San Dieguito River | +2.1 |
| San Elijo Creek | +2.2 |
| San Luis Rey River | +2.3 |
| San Marcos Creek | +2.3 |
| San Marcos Creek (Below Lake San Marcos) | +2.3 |
| San Marcos Creek Highway 78 Split Flow | +2.3 |



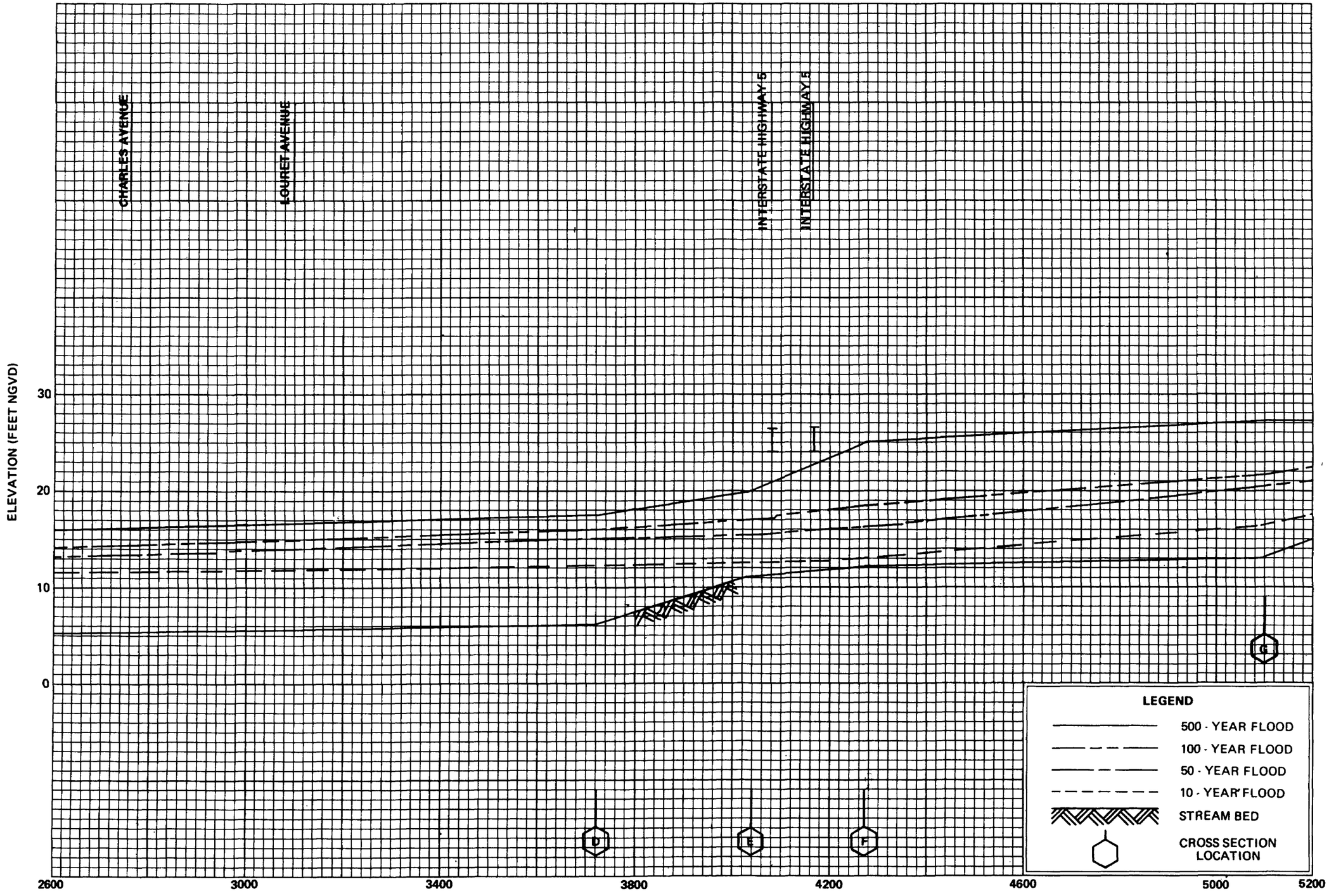

# FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

259AP



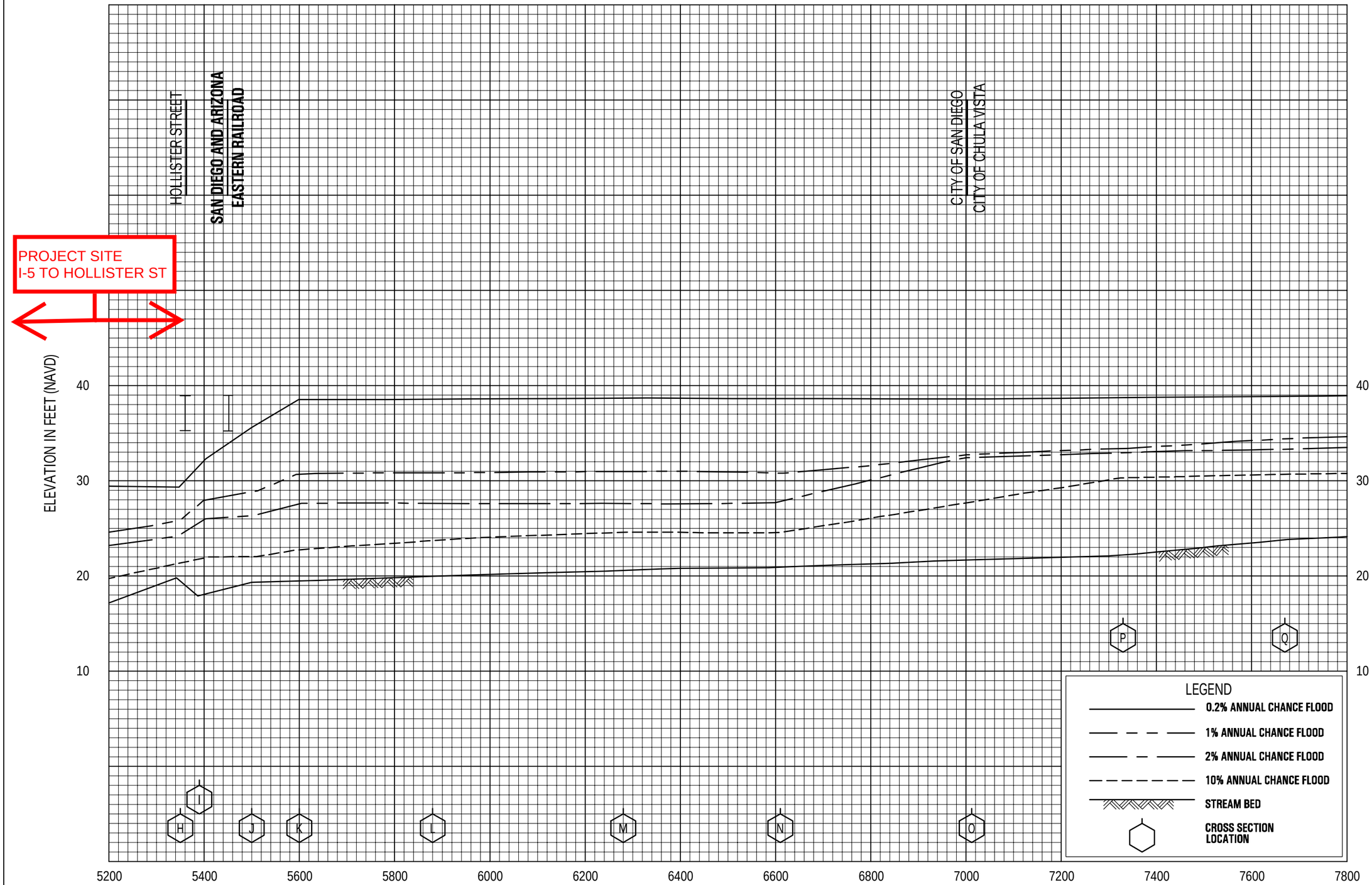

# FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

**SAN DIEGO COUNTY, CA AND INCORPORATED AREAS**

259BP



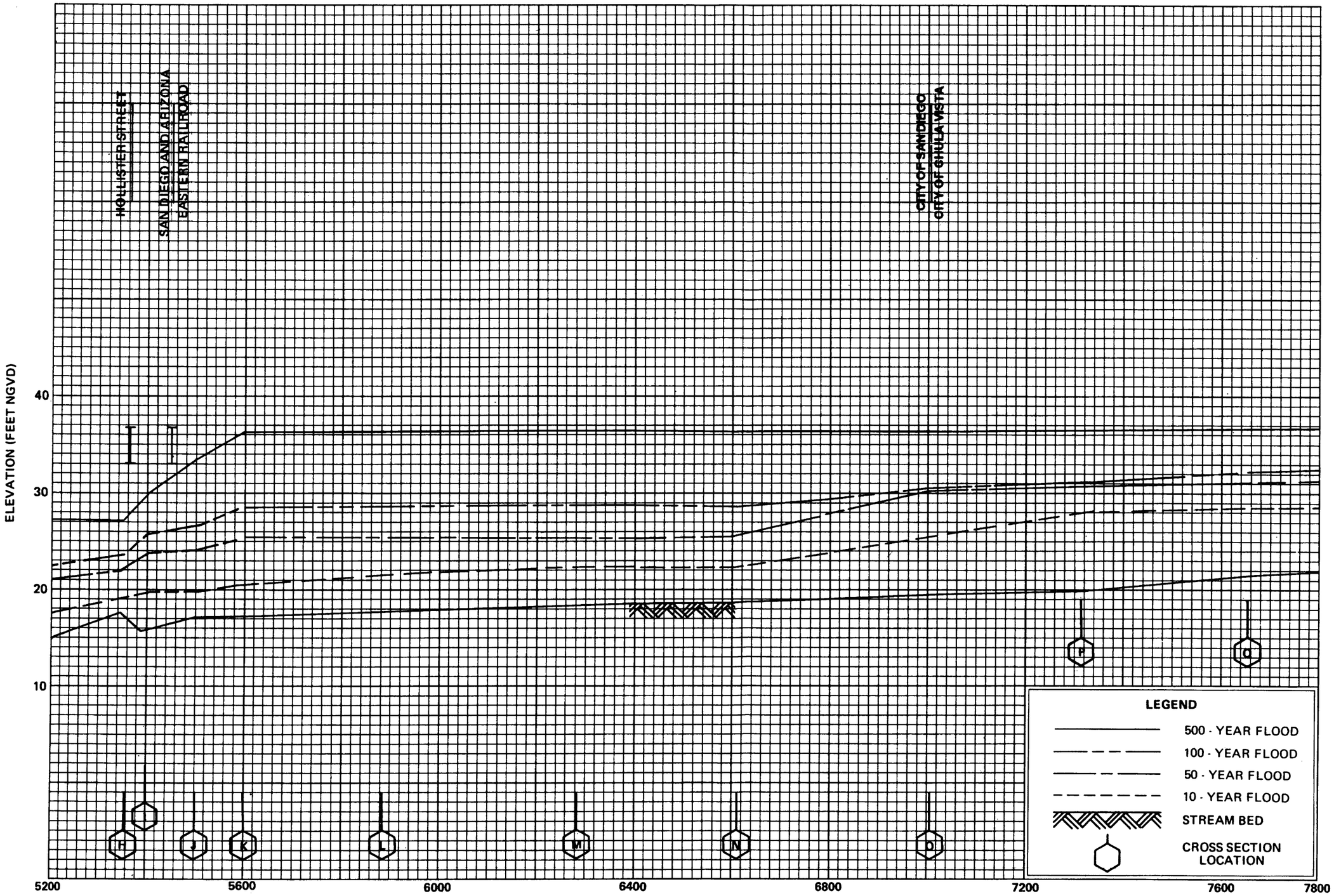

FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

260AP




# FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

**SAN DIEGO COUNTY, CA AND INCORPORATED AREAS**

260BP

# FEMA Engineering Library
## Digitized Data Index

CID:060284

Community:SAN DIEGO COUNTY *

County:SAN DIEGO COUNTY

State:CALIFORNIA

0250976

Box:

Doc:

Case Number/ Study ID:060284-19780223

Description:1d. Type 15 Study

Revision Status:

Flooding Source(s):Otay River

Effective Date:10/20/1981

Contents:17. Misc. ref.: Other reference materials 24. Final FIS/FIRM/FHBM

Notes:060284-19780223_FIS

Scanned by:

Scan Date:

QC Staff:

QC Date: