APPENDIX 6C

Preliminary Water Quality Management Plan

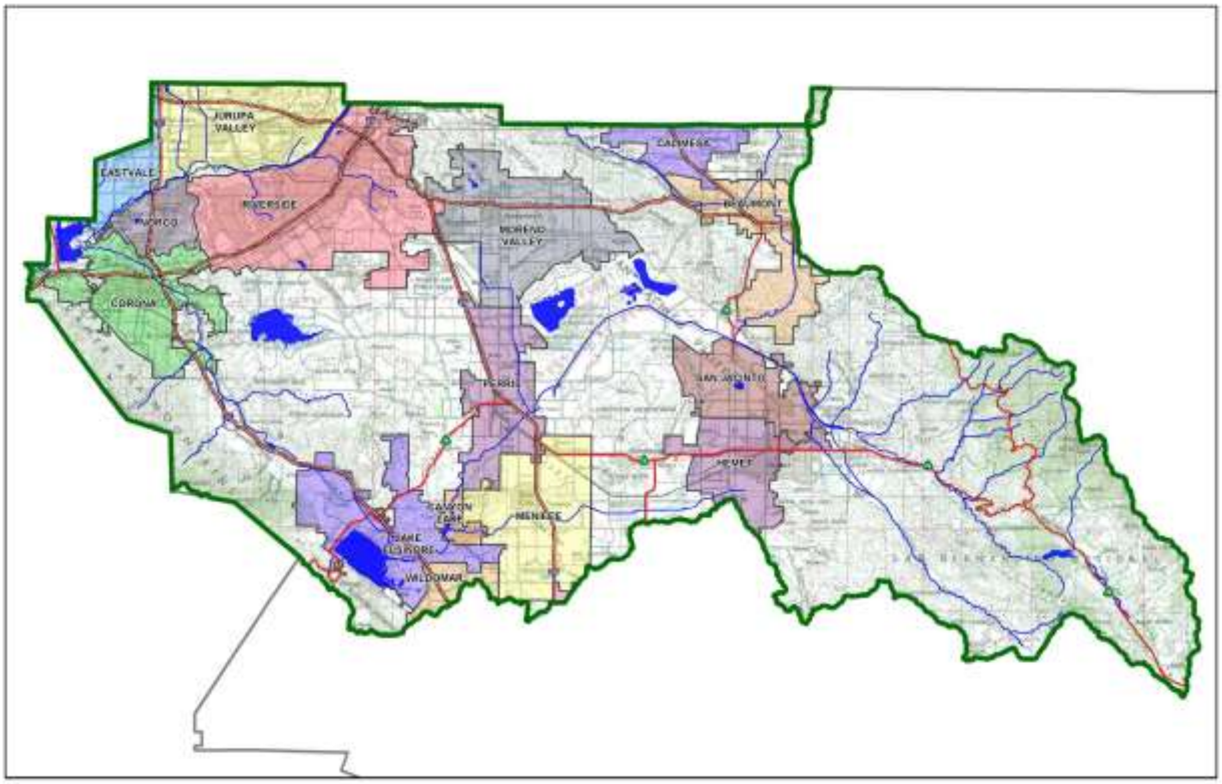
Project Specific Water Quality Management Plan

A Template for Projects located within the ***Santa Ana Watershed*** *Region of Riverside County*

Project Title: Mill Creek Promenade

Development No: PP2017-167

Design Review/Case No: WQ-199



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☒ **Preliminary**
☐ **Final**

Original Date Prepared: November 18, 2016

Revision Date(s): January 30, 2018

Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**

Prepared by: Pacific Coast Land Consultants, Inc.
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OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Sherman & Haun, LLC by Pacific Coast Land Consultants, Inc. for the Mill Creek Promenade project.

This WQMP is intended to comply with the requirements of City of Menifee for <Insert Ordinance No.> which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under City of Menifee Water Quality Ordinance (Municipal Code Section).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature

Date

Nicholas Brose
Owner's Printed Name

Project Manager
Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

Preparer's Signature

11/18/2016
Date

Benjamin Dela Cruz, P.E.
Preparer's Printed Name

Project Manager
Preparer's Title/Position

Preparer's Licensure: 34821

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Mixed Use: Commercial, Multi-Family Residential
Planning Area:	N/A
Community Name:	N/A
Development Name:	Millcreek Promenade
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°39'19.37", 117°10'37.42"	
Project Watershed and Sub-Watershed: Santa Ana River, San Jacinto Watershed	
APN(s): 360-350-006, 360-350-011, 360-350-017	
Map Book and Page No.: Thomas Guide 868 E1	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Mixed use commercial and multi family
Proposed or Potential SIC Code(s)	--
Area of Impervious Project Footprint (SF)	2,482,465
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	1,704,834
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	49,500
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	--
Are there any natural hydrologic features on the project site?	☒ Y ☐ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	--
What is the Water Quality Design Storm Depth for the project?	0.60"

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
SALT CREEK	NONE	REC1, REC2, WARM, WILD	NOT ASSIGNING
CANYON LAKE HUS 802.11,.12	NUTRIENTS PATHOGENS	MUN, AGR, GWR, REC1, REC2, WARM, WILD	NOT ASSIGNED; AS RARE
SAN JACINTO RIVER HUS 802.14	NONE	MUN, AGR, GWR, REC1, REC2, WARM, WILD	NOT ASSIGNED; AS RARE
LAKE ELSINORE HUS 802.31	NUTRIENTS, LOW DISSOLVED OXYGEN, SEDIMENT, TOXICITY, PCBS	MUN, REC1, REC2, WARM, WILD	NOT ASSIGNED; AS RARE

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* City of Menifee	☒ Y	☐ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

Yes, the existing site generally street flows northeasterly across the site. This pattern is maintained throughout the project with streets and storm drain. An existing creek enters this site on the southerly property line, flows diagonally, southwest to southeast and across the southerly portion of the site, and then travels northerly along Haun Road. The creek will be retained in its natural condition until it reaches Haun Road, where it will transition into an earthen channel, with a 10 foot bottom and a four foot depth, 3' of flow and 1 foot of free board with 4:1 side slopes and will parallel Haun Road northerly to its existing crossings of Haun Road. Offsite sheet flows from the west will be intercepted by a storm drain Sherman Road and conveyed northerly to an existing earthen channel on the south side of Garbani Road, which will be replaced with a storm drain.

Did you identify and protect existing vegetation? If so, how? If not, why?

Yes, there are existing trees in the creek entering the site from the south. These trees are in the area to be maintained in its existing condition. The balance of the site is periodically farmed and will be replaced by the development. Required parking will be kept to a minimum to promote the landscape area.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

The site is underlain by bed rock at a depth of approximately 4 – 5 feet and not suitable for infiltration. Landscape areas shall be depressed to promote natural infiltration.

Did you identify and minimize impervious area? If so, how? If not, why?

The impervious area was minimized to the extent possible in developing to the minimum required parking and street widths by the City.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Where possible flows will be directed to landscape areas prior to entering the streets and storm drain system. All onsite streets and storm drains are directed to treatment areas that will also mitigate peak flows.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA A			D
1	Roof	289,699	
2	Concrete/AC	266,989	
3	Landscaping	321,046	
DMA B			D
1	Roof	17,564	
2	Concrete/AC	23,196	
3	Landscaping	2,800	
DMA C			D
1	Roof	278,274	
2	Concrete/AC	300,710	
3	Landscaping	143,990	
DMA D			D
1	Roof	7,744	
2	Concrete/AC	32,808	
3	Landscaping	11,809	
DMA E			D
1	Roof	51,231	
2	Concrete/AC	127,986	
3	Landscaping	42,939	
DMA F			D
1	Roof	43,559	
2	Concrete/AC	170,282	
3	Landscaping	44,905	
DMA G			D
1	Concrete/AC	41,291	
2	Decomposed Granite	11,838	
3	Landscaping	10,208	
DMA H			D
1	Concrete/AC	51,429	
2	Decomposed Granite	7,654	
3	Landscaping	19,426	
DMA J			D
1	Concrete/AC	47,641	
2	Decomposed Granite	5,457	

3	Landscaping	2,142	
DMA K			D
1	Concrete/AC	59,242	
2	Decomposed Granite	9,627	
3	Landscaping	4,581	
DMA L			D
1	Concrete/AC	25,851	
2	Decomposed Granite	3,788	
3	Landscaping	6,561	
DMA M			D
1	Concrete/AC	11,352	
2	Decomposed Granite	2,368	
3	Landscaping	1,245	
DMA N			D
1	Concrete/AC	9,033	
2	Decomposed Granite	1,150	
3	Landscaping	939	

[1]Reference Table 2-1 in the WQMP Guidance Document to populate this column

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)

Table C.3 Type 'B', Self-Retaining Areas

Self-Retaining Area				**Type 'C' DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Runoff factor	Product	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA-A	BMP 1
DMA-B	BMP 2
DMA-C	BMP 3
DMA D	BMP 4a
DMA E	BMP 4
DMA F	BMP 5
DMA G	BMP 6
DMA H	BMP 11
DMA J	BMP 7
DMA K	BMP8
DMA L	BMP 9
DMA M	BMP10
DMA N	BMP 12

<u>Note</u>: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for storm water runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site. If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		✓
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		✓
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		✓
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	✓	
If Yes, list affected DMAs:		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		✓
If Yes, list affected DMAs: ALL		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?	✓	
Describe here: Bedrock is generally at 5’± below surface.		

If you answered “Yes” to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

For DMAs C, B, D, and E, infiltration rates lower than 1.6 in/hr. For all other DMAs, bedrock is generally 5’ below the surface precluding the use of infiltration.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If neither of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting storm water runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: 15.9 acres

Type of Landscaping (Conservation Design or Active Turf): Conservative Design

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 34.5 (Acres)

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: EIATIA Factor= 0.79

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: 27.3 (Acres)

Step 5: Determine if harvesting storm water runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
27.3 (Acres)	15.9 (Acres)

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting storm water runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users: 2600

Project Type: 'Commercial', 'Apartments & Condo units'

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 34.5 (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-1 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: TUTIA Factor=101

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: Required number of toilet users=3484

Step 5: Determine if harvesting storm water runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
3484	2600

Other Non-Potable Use Feasibility

Are there other non-potable uses for storm water runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

N/A

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand: Projected Average Daily Use (gpd)

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-3 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-3: Enter Value

Step 4: Multiply the unit value obtained from Step 4 by the total of impervious areas from Step 3 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: Minimum use required (gpd)

Step 5: Determine if harvesting storm water runoff for other non-potable use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
Minimum use required (gpd)	Projected Average Daily Use (gpd)

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA A	☐	☐	☐	☒	☐
DMA B	☐	☐	☒	☐	☐
DMA C	☐	☐	☐	☒	☐
DMA D	☐	☐	☒	☐	☐
DMA E	☐	☐	☒	☐	☐
DMA F	☐	☐	☐	☒	☐
DMA G	☐	☐	☐	☒	☒
DMA H	☐	☐	☐	☒	☒
DMA J	☐	☐	☐	☒	☒
DMA K	☐	☐	☐	☒	☒
DMA L	☐	☐	☐	☒	☒
DMA M	☐	☐	☐	☒	☒
DMA N	☐	☐	☐	☒	☒

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

Bioretention BMPs were not feasible for DMAs A, C, and F-N, due to insufficient areas, in the approved layout received by the City Staff, Planning Commission and Council. Therefore biotreatement will be utilized for those areas. DMA A utilizes and Extended Dry Detension Basin. DMAs C and F utilize an underground sand filter. All three BMPs will also operate for storm mitigation, HCOC.

DMAs G-N utilize Treatment Control BMPs, since there is not sufficient area in the street right of way for bioretention. The Treatment Control will be Storm Tree by Storm Tech.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First**,** calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	***DMA "A"***		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Volume, **V_{BMP}** (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Roofs	*289,699*	*Conc./Tiles*	*1.0*	*0.892*	*258412*			
Roads	*162,000*	*Conc./Asphlt*	*1.0*	*0.892*	*144,504*			
Lndscpng	*321,046*	*Ldnscpng*	*0.1*	*0.11*	*35,462*			
Cnc. Wlk	*104,989*	*Concrete*	*1.0*	*0.892*	*93,650*			
	A_T = *877,734*				Σ=532,028	0.60	26,601.4	***64,469***

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	***DMA "B"***		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Volume, **V_{BMP}** (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Roofs	*17,564*	*Conc./Tiles*	*1.0*	*0.892*	*15,667*			
Parking	*23,196*	*Conc./Asphlt*	*1.0*	*0.892*	*20,691*			
Lndscpng	*2,800*	*Ldnscpng*	*0.1*	*0.11*	*309*			
	A_T =43,560				Σ=36,667	0.60	1833.4	***2,883***

Table D.4 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	DMA "C"		
	[A]		[B]	[C]	[A] x [C]			
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Roofs	*278,274*	*Conc/Tiles*	*1.0*	*0.892*	*248,220*			
Parking	*253,710*	*Conc/Asphlt*	*1.0*	*0.892*	*226,309*			
Lndscpng	*143,990*	*Landscaping*	*0.1*	*0.11046*	*15,905*			
Cnc. Wlk	*47,000*	*Concrete*	*1.0*	*0.892*	*41,924*			
	A_T =722,974				Σ=532,358	0.60	26,617.9	***30,960***

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	DMA "D"		
	[A]		[B]	[C]	[A] x [C]			
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Roofs	*7,744*	*Conc/Tiles*	*1.0*	*0.892*	*6908*			
Parking	*32,808*	*Conc/Asphlt*	*1.0*	*0.892*	*29,265*			
Lndspng	*11,809*	*Landscaping*	*0.1*	*0.11*	*1,304*			
	A_T =52,361				Σ=37,477	0.60	1,874	***3,606***

Table D.5 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA "E"*		
	[A]		[B]	[C]	[A] x [C]			
						Design Storm Depth (in)	*Design Capture Volume, **V_{BMP}** (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Roofs	*51,231*	*Conc/Tiles*	*1.000*	*0.892*	*45,698*			
Parking	*115,181*	*Conc/Asphlt*	*1.0*	*0.892*	*102,742*			
Lndscpng	*42,939*	*Landscaping*	*0.1*	*0.11*	*4,743*			
C-walk	*12,805*	*Concrete*	*1.0*	*0.892*	*11,422*			
	A_T=222,156				Σ=164,605	0.60	8,230.2	***8,347***

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA "F"*		
	[A]		[B]	[C]	[A] x [C]			
						Design Storm Depth (in)	*Design Capture Volume, **V_{BMP}** (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
Roofs	*43,559*	*Conc/Tiles*	*1.0*	*0.892*	*38,855*			
Parking	*160,482*	*Conc/Asphlt*	*1.0*	*0.892*	*143,150*			
Lndscpng	*44,905*	*Landscaping*	*0.1*	*0.11*	*4,960*			
C-walk	*9,800*	*Concrete*	*1.0*	*0.892*	*8,742*			
	A_T =258,746				Σ=195,707	0.60	9,785	***14,850***

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☒ Attached Residential Development	P	N	P	P	N	P	P	P(2)
☒ Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐ Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐ Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐ Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☐ Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☐ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☒	☒	☒	☒	☒	☒	☒	☒

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]

[1]*Cannot Exceed 50%*
[2]*Obtain corresponding data from Table 3-8 in the WQMP Guidance Document*

E.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**		***Enter BMP Name / Identifier Here*** ***DMA G/BMP-6***		
	[A]		[B]	[C]	[A] x [C]				
						Design Storm Depth (in)	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Roads Drivwys	41,291	Asphalt/ Conc	1	0.89	36,831				
Trails	11,838	Dcmpsd Granite	0.4	0.28	3311				
Ldspng	10,208	Lndsp	.1	0.11	1128				
	63,337				41,270	0.6	0.2		0.2

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor		*Enter BMP Name / Identifier Here* *DMA H/BMP-11*		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Roads Drivwys	43,693	Asphalt/ Conc	1	0.892	38,974				
Trails	5,746	Dcmpsd Granite	0.4	0.28	1,607				
Ldspng	5,801	Lndsp	.1	0.11	641				
	78,509				41,222	0.6	0.2		0.2

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor		*Enter BMP Name / Identifier Here* *DMA J/BMP-7*		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Roads Drivwys	43,693	Asphalt/ Conc	1	0.892	39,325				
Trails	9,865	Dcmpsd Granite	0.4	0.28	2,759				
Ldspng	4,534	Lndsp	.1	0.11	501				
	55,240				42,585	0.6	0.2		0.2

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor		Enter BMP Name / Identifier Here DMA K/BMP-8		
	[A]		[B]	[C]	[A] x [C]				
Roads Drivwys	47,890	Asphalt/ Conc	1	0.892	39,025	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Trails	9,865	Dcmpsd Granite	0.4	0.28	2,759				
Ldspng	4,534	Lndsp	.1	0.11	501				
	58,485				42,285	0.6	0.2		0.2

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor		Enter BMP Name / Identifier Here DMA L/BMP-9		
	[A]		[B]	[C]	[A] x [C]				
Roads Drivwys	16,818	Asphalt/ Conc	1	0.892	15,002	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Trails	2,638	Dcmpsd Granite	0.4	0.28	738				
Ldspng	5,622	Lndsp	.1	0.11	621				
	25,078				16,361	0.6	0.1		0.1

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor	*Enter BMP Name / Identifier Here* *DMA M/BMP-10*			
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Roads Drivwys	11,352	Asphalt/ Conc	1	0.892	10,126				
Trails	1,245	Dcmpsd Granite	0.4	0.28	662				
Ldspng	2,368	Lndsp	.1	0.11	138				
	14,965				10,926	0.2	0.1		0.1

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor	*Enter BMP Name / Identifier Here* *DMA N/BMP-12*			
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
Roads Drivwys	9,033	Asphalt/ Conc	1	0.892	8,057				
Trails	1,150	Dcmpsd Granite	0.4	0.28	322				
Ldspng	939	Lndsp	.1	0.11	104				
	11,122				8,483	0.2	0.1		0.1

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
(DMA-G) BMP-6 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%
(DMA-J) BMP-7 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%
(DMA K) BMP-8 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%
(DMA L) BMP-9 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%
(DMA M) BMP-10 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%
(DMA H) BMP-11 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%
(DMA N) BMP-12 [StormTree ST-15x4 system]	Trash, Debris, Oil & Grease, Metals, nutrients, pesticides	Medium-High 40%-85%

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.
[2] Cross Reference Table E.1 above to populate this column.
[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration			
Volume (Cubic Feet)			

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis
b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.
c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

The HCOC is mitigated per F.2 c), as shown by report in Appendix 7. The following table reflects results from studies in Appendix 7. The following is the summary of the pre develop or existing condition:

Mark	Acreage (acres)	Q (flow) 2yr 24hr – cfs
Area ABCDE	**30.44**	**3.307**
Area FGHJ	**24.40**	**2.674**
Total	**54.84**	**5.981**

The following is the summary of the post or ultimate developed condition:

Mark	Acreage (acres)	Q (flow) 2yr 24hr – cfs
Area A	**20.15**	**0.393**
Area B	**1.00**	**0.064**
Area C	**16.60**	**1.861**
Area D	**1.20**	**0.064**
Area E	**5.10**	**0.393**
Area F	**5.34**	**0.393**
Total	**49.99**	**3.17**

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources***: Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit***: Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative***: Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Landscaping	Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. Consider using pest-resistant plants, especially adjacent to hardscape.	SC-73 (Landscaped Maintenance) See other applicable BMPs at http://rcflood.org/stormwater_/downloads/LandscapeGardenBrochure.pdf SD-12 (Efficient Irrigation) Maintain landscaping using minimum or no pesticides.
Parking Areas and Sidewalks	Parking Areas and Concrete walks	SC-43(Parking/Storage Area Maintenance)

Decorative Fountains / Water Pools	Water Features – Pools, Garden Fountains Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	See Guidelines for Maintaining Swimming Pools, Jacuzzi and Garden Fountain at http://rsflood.org/stormwater/
Fire sprinkler tests	Fire Sprinkler Test-provide means to divert flow to sanitary sewer	See SC-41(Building and Grounds Maintainance)CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
On-site storm drain inlets	Location of inlets Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. CATCH Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951 955 1200 to verify	-Maintain and periodically repaint or replace inlet markings. -provide stormwater pollution prevention information to site owners -SC-44(Drainage-System Maintenance)CASQA Stormwater Quality Handboks at www.cabmphandbooks.com -Include the following in lease agreements:"Tenant shall not allow anyone to discharge anything to storm drains or to deposit materials so as to create a potential discharge to storm drains
Refuse/Trash	Dumpsters and Recyclable material containers Show where site refuse and recycled material will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. State how site refuse will be handled and provide supporting detail to what is shown on plans.	-Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "No Hazardous Materials " signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. -SC-34 – (Waste Handling and Disposal)

	State that signs will be posted on or near dumpsters with the words “Do not dump hazardous materials here” or similar.	
Miscellaneous Drain or Wash Water or other sources Rooftop Equipment Drainage Sumps Roofing, gutters, and trim	Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. Avoid roofing, gutters and trim made of copper or other unprotected metals that may leach into runoff. Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. Include controls for other sources as specified by local reviewer	SD-11 (Roof Runoff control)
Plazas, sidewalks and parking lots	Parking Lots, Sidewalks	Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect wash water containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
DMA A/BMP-1	Extended Detention Basin	WQMP EXHIBIT
DMA B/BMP-2	Bioretention	WQMP EXHIBIT
DMA C/BMP-3	Subsurface Sand Filter	WQMP EXHIBIT
DMA D/BMP4a	Bioretention	WQMP EXHIBIT
DMA E/BMP-4	Bioretention	WQMP EXHIBIT
DMA F/BMP-5	Subsurface Sand Filter	WQMP EXHIBIT
DMA G/BMP-6	StormTree Model ST – 5 x 16 system	WQMP EXHIBIT
DMA H/BMP-11	StormTree Model ST – 5 x 16 system	WQMP EXHIBIT
DMA J/BMP-7	StormTree Model ST – 5 x 16 system	WQMP EXHIBIT
DMA K/BMP-8	StormTree Model ST – 5 x 16 system	WQMP EXHIBIT
DMA L/BMP-9	StormTree Model ST – 5 x 5 system	WQMP EXHIBIT
DMA M/BMP-10	StormTree Model ST – 5 x 5 system	WQMP EXHIBIT
DMA N/BMP-12	StormTree Model ST – 5 x 5 system	WQMP EXHIBIT

Note that the updated table — or Construction Plan WQMP Checklist — is only a reference tool to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: City of Menifee Stormwater BMP Maintenance Agreement

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☒ Y ☐ N

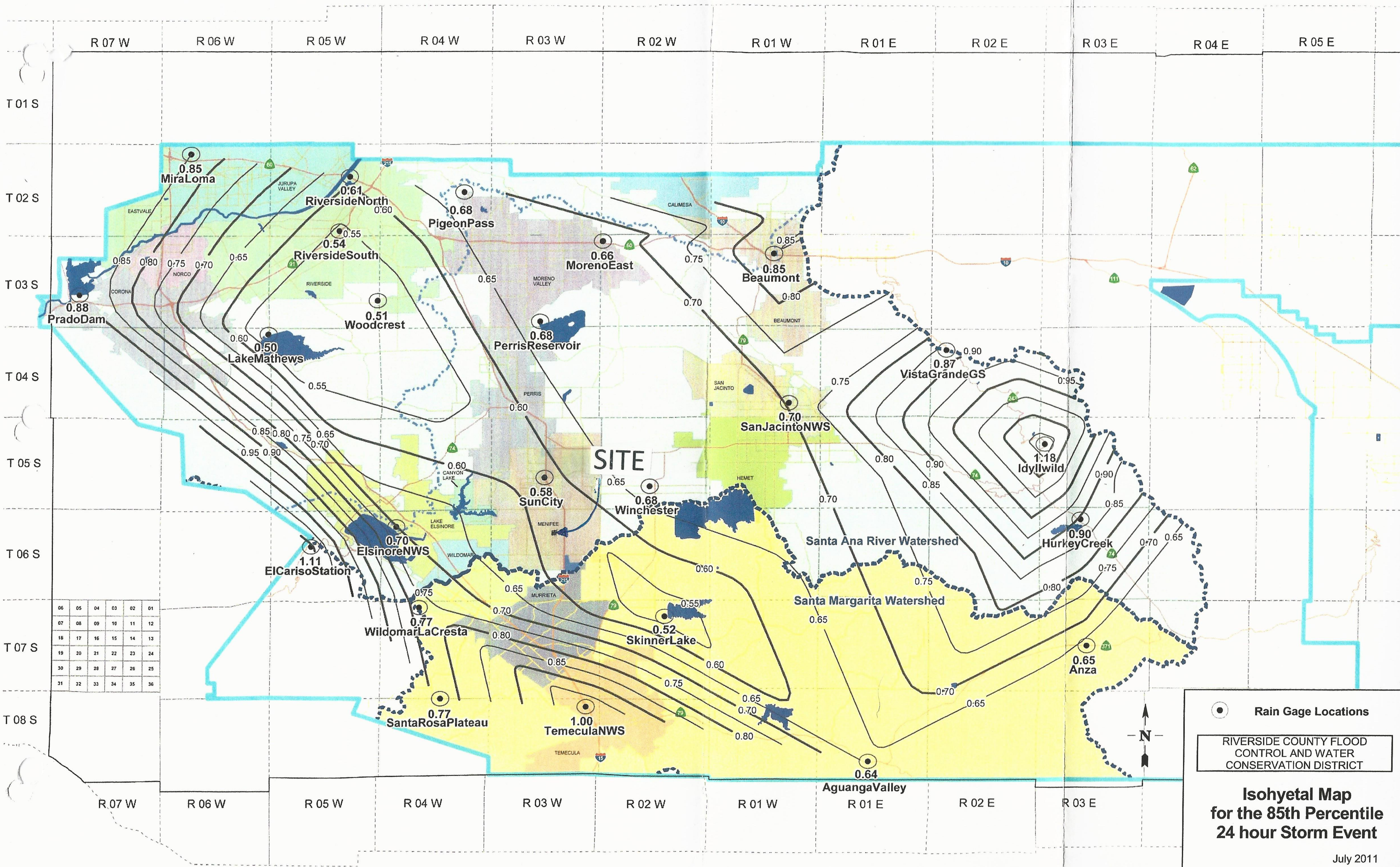
Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Proposed BMPs 1-5 will be maintained the property owner, Sherman and Haun, LLC, its successors or assigns, in accordance with the City of Menifee Maintenance Agreement, and the Operations and Maintenance Plan included in Appendix 10 of this Preliminary Water Quality Management Plan.

BMPs 6-12 will be maintained by the City of Menifee through a Community Facility District (CFD). The owner agrees to cooperate with annexation into a CFD.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map



Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011
N
SITE
Santa Ana River Watershed
Santa Margarita Watershed
0.85 MiraLoma
0.61 RiversideNorth
0.54 RiversideSouth
0.88 PradoDam
0.50 LakeMathews
0.51 Woodcrest
0.68 PigeonPass
0.66 MorenoEast
0.68 PerrisReservoir
0.85 Beaumont
0.70 SanJacintoNWS
0.87 VistaGrandeGS
1.18 Idyllwild
0.90 HurkeyCreek
0.65 Anza
0.58 SunCity
0.68 Winchester
0.52 SkinnerLake
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.77 WildomarLaCresta
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley
R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
R 02 E
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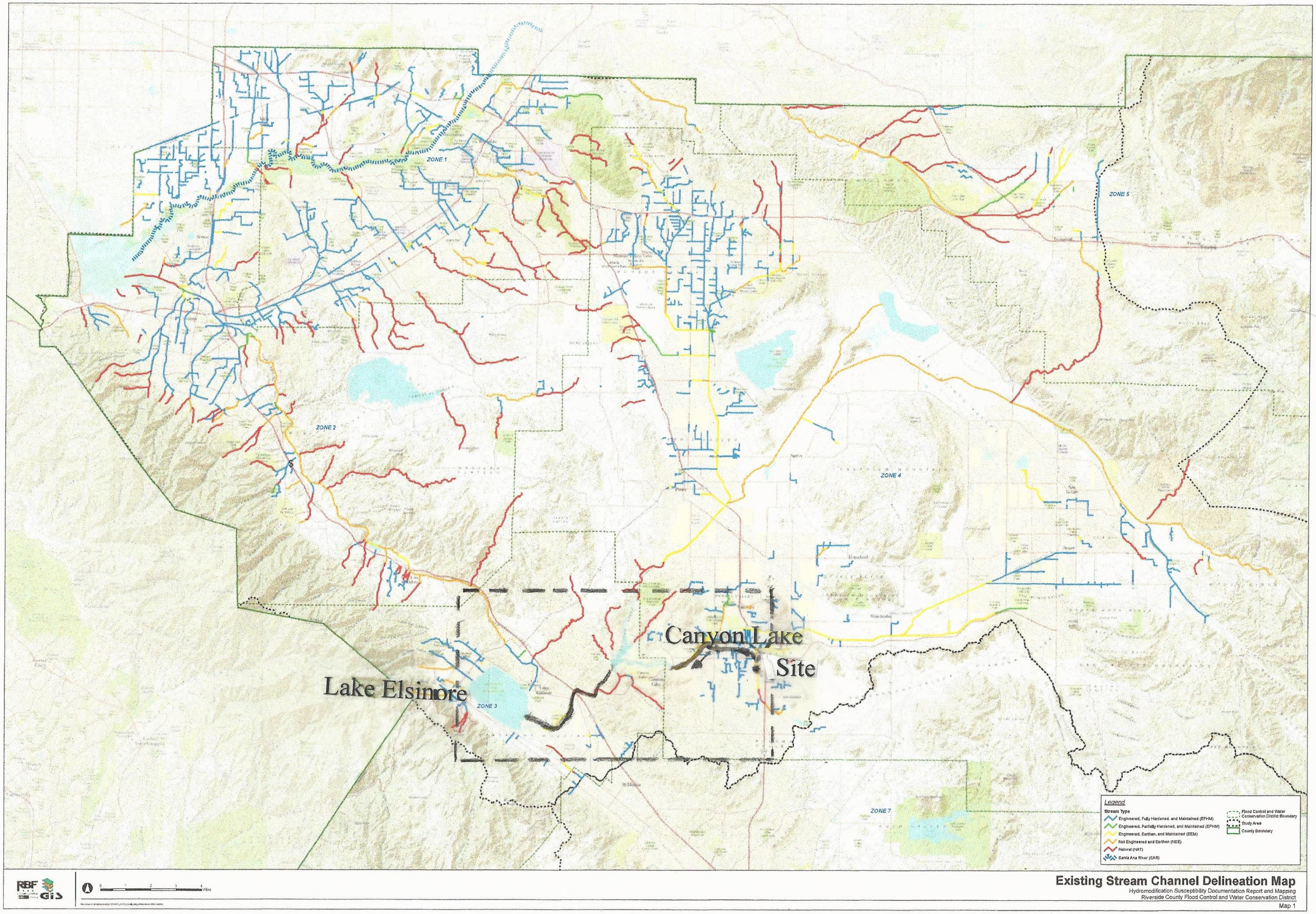
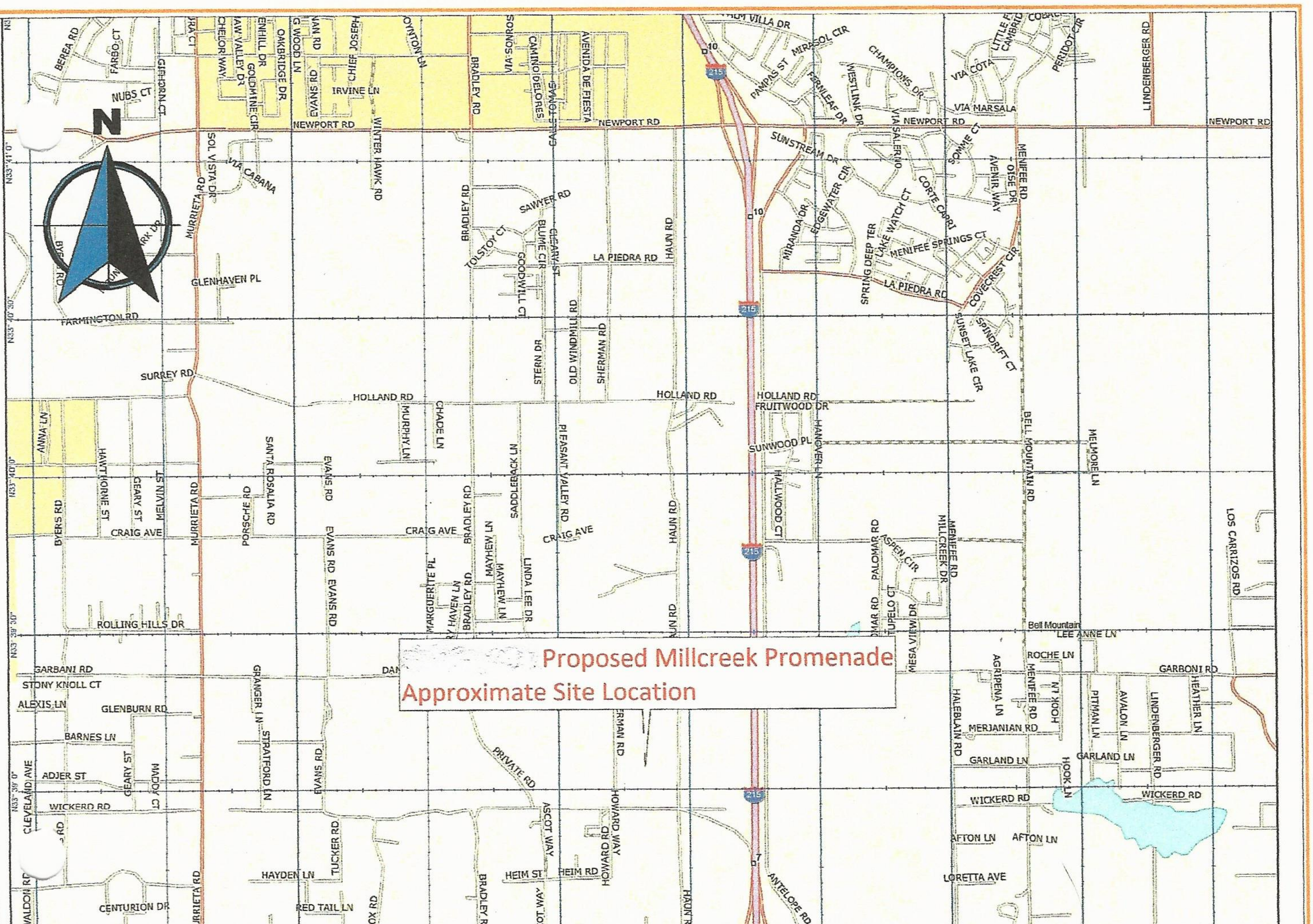
T 06 S
T 07 S
T 08 S



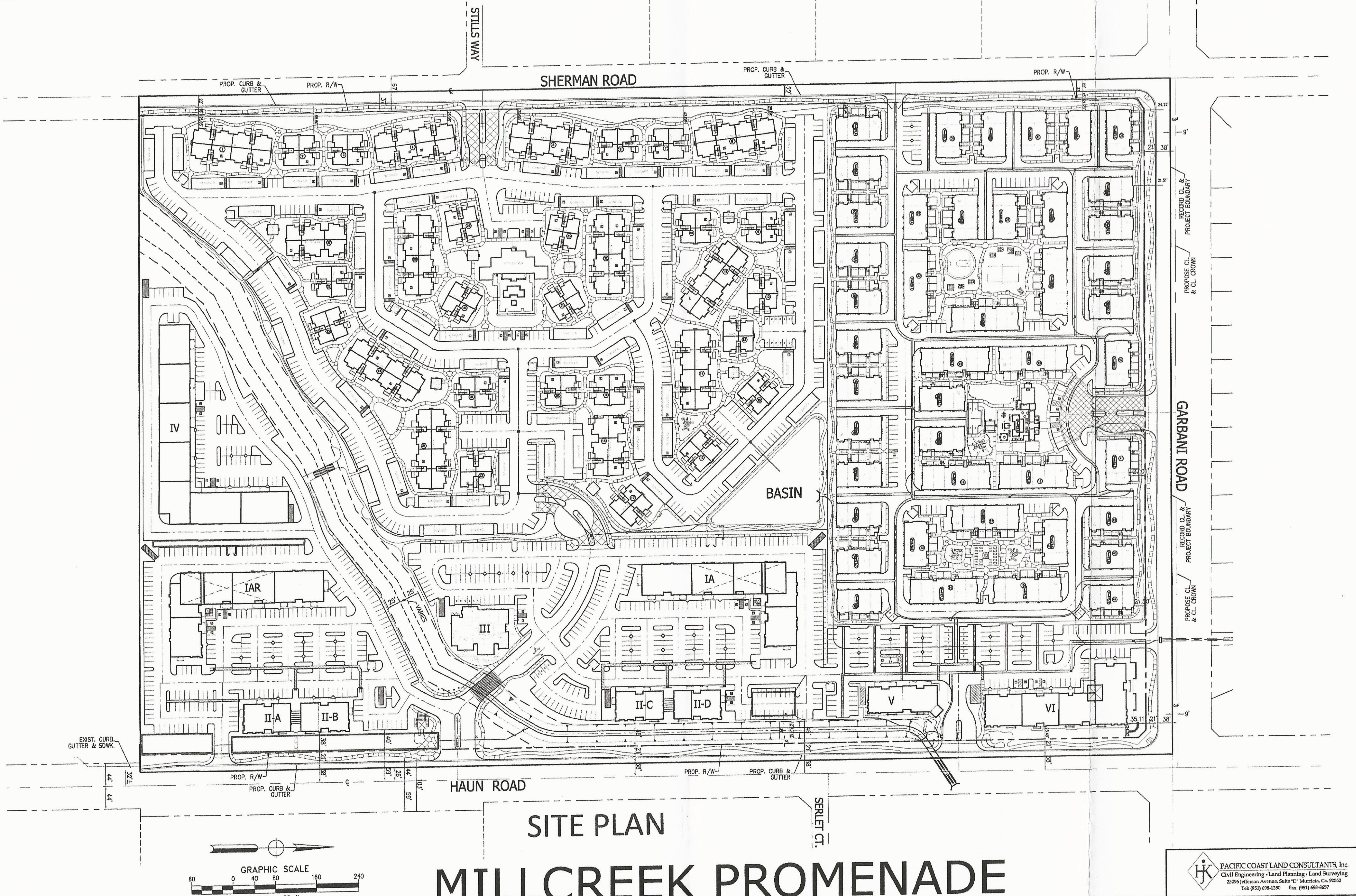
Receiving Waters Map

(Except from Hydromodification Susceptibility Documentation Report & Mapping) – RCFCWCD Map 1



"© 2007 DeLorme (www.delorme.com) Topo USA®".

PROPOSED MILLCREEK PROMENADE	
VICINITY MAP	SCALE 1:40,625
	FIGURE 1



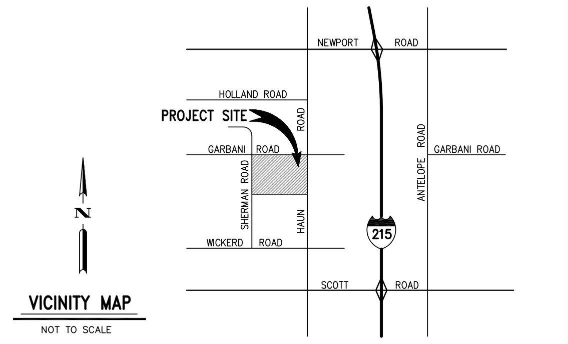
SITE PLAN

MILLCREEK PROMENADE

PACIFIC COAST LAND CONSULTANTS, Inc.
Civil Engineering • Land Planning • Land Surveying
25096 Jefferson Avenue, Suite "D" Murrieta, Ca. 92562
Tel: (951) 698-1350 Fax: (951) 698-8657

Appendix 2: Construction Plans

PRELIMINARY GRADING PLAN



VICINITY MAP

NOT TO SCALE

DEVELOPER/APPLICANT

SHERMAN & GARBANI, LLC
31103 RANCHO VIEJO ROAD, #535
SAN JUAN CAPISTRANO, CA. 92675
CONTACT : DANNY BROSE
EMAIL : dannybrose@live.com
TELEPHONE : (949) 874-7474

SHERMAN & HAUN, LP (NEVADA LTD. PARTNERSHIP)
31103 RANCHO VIEJO ROAD, #535
SAN JUAN CAPISTRANO, CA. 92675
CONTACT : DANNY BROSE
EMAIL : dannybrose@live.com
TELEPHONE : (949) 874-7474

LAND OWNERS

BEACON ENTERPRISES, LLC
25740 WASHINGTON AVENUE
MURRIETA, CA. 92562
CONTACT : GILBERT G. LYNCH
EMAIL : gilbert.lynch@sbcglobal.net
TELEPHONE : (951) 757-4821
APN 360-350-006

HAUN RD. PROPERTIES, A CA. LTD. PARTNERSHIP
1570 LINDA VISTA DRIVE
SAN MARCOS, CA. 92078
CONTACT :
EMAIL :
TELEPHONE : (760) 744-9382
APN 360-350-011 & 360-350-017

ENGINEER

PACIFIC COAST LAND CONSULTANTS, INC.
25096 JEFFERSON AVENUE, SUITE "D"
MURRIETA, CA. 92562
CONTACT : JEI KIM
EMAIL : jkim@pclc-hjk.net
TELEPHONE : (951) 698-1350
FAX : (951) 698-8657

ASSESSOR PARCEL NUMBER

360-350-006, 360-350-011 & 360-350-017

LEGAL DESCRIPTION

PARCELS 1, 2 & 3 OF PARCEL MAP 13523, IN THE CITY OF MENIFEE, AS SHOWN BY MAP ON FILE IN MB. 87/9-10, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

GENERAL NOTES

1. PREPARED: APRIL 05, 2017
2. THOMAS BROTHERS: 2006, PG. 868, D6 & E6
3. EXISTING ZONING: I-P
4. PROPOSED ZONING: SP (SPECIFIC PLAN)
5. PROPOSED LAND USE: SP (SPECIFIC PLAN)
6. EXISTING LAND USE: EDC (ECONOMIC DEVELOPMENT CORRIDOR)
7. F.E.M.A FLOOD ZONE: ZONE "X", MAP NO. 06065C2070G
8. PROJECT ACREAGE: 58.51 AC GROSS / 53.66 AC NET
9. SPECIFIC PLAN PLANNING AREA: SP2016-246
10. PROPOSED IMPROVEMENTS SCHEDULE: SCHEDULE "A"
11. EXISTING WELL: NONE
12. PROJECT IS NOT WITHIN A SPECIAL STUDIES ZONE.
13. PROJECT IS NOT SUBJECT TO OVERFLOW, INUNDATION, LIQUEFACTION, GEOLOGIC HAZARDS OR FLOOD HAZARDS.
14. TENTATIVE MAP IS A CONTIGUOUS OWNERSHIP OF THE LAND DIVIDER.
15. SUFFICIENT FIRE HYDRANTS TO BE PROVIDED ALONG ALL STREETS TO MEET FIRE DEPARTMENT SPACING STANDARDS.
16. BASIS OF BEARING IS THE CENTERLINE OF HAUN ROAD BEING N00°19'36"W PER PM13523 MB. 87/9-10.
17. CONSTRUCTION OF PUBLIC STREET LIGHTS ON ALL STREET WITHIN THE PROJECT PRONTAGE TO MEET CITY SPACING STANDARD.
18. STREET LIGHTS REQUIRED ON GARBANI & SHERMAN ROADS. SPACING PER CITY REQUIREMENTS.
19. ALL STORM DRAINS WITHIN PUBLIC RIGHT OF WAY TO BE MAINTAINED BY CITY OF MENIFEE (36" OR SMALLER) OR R.C.F.C. & W.C.D.(39" OR LARGER).

UTILITY PURVEYORS:

SCHOOL: MENIFEE UNION SCHOOL DISTRICT/PERRIS UNION H.S. DISTRICT
SEWER: EASTERN MUNICIPAL WATER DISTRICT
WATER: EASTERN MUNICIPAL WATER DISTRICT
GAS: SOUTHERN CALIFORNIA GAS COMPANY
TELEPHONE: TIME WARNER/VERIZON
ELECTRIC: SOUTHERN CALIFORNIA EDISON COMPANY
CABLE TV: TIME WARNER/VERIZON

EASEMENT NOTES

(1) AN EASEMENT FOR PIPELINE OR PIPELINES FOR WATER AND RECLAIMED WATER TRANSMISSION AND DISTRIBUTION, AS WELL AS SEWAGE TRANSMISSION AND COLLECTION FACILITIES, INCLUDING BUT NOT LIMITED TO, GRAVITY PIPELINES, PRESSURE PIPELINES, MANHOLES, CONNECTIONS, AND APPURTENANT EQUIPMENT FOR THE COLLECTION AND TRANSMISSION OF SEWAGE AND INCIDENTAL PURPOSES IN FAVOR OF EASTERN MUNICIPAL WATER DISTRICT PER DOCUMENT RECORDED NOVEMBER OCTOBER 23, 2008 AS INSTRUMENT NO. 2008-0567911, OF OFFICIAL RECORDS.

(2) AN EASEMENT FOR PUBLIC UTILITIES AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION PER DOCUMENT RECORDED JANUARY 18, 1973 AS INSTRUMENT NO. 73-7494 OF OFFICIAL RECORDS.

(A) ACCESS EASEMENT TO POA, MAINTAINED BY POA

LEGEND:

- PROJECT BOUNDARY
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- —W— PROPOSED WATER
- —SS— PROPOSED SEWER
- —SD— PROPOSED STORM DRAIN
- POD/PLANNING BOUNDARY
- FLOW DIRECTION
- (PP) REMOVE EXISTING POWER POLE, LINE TO BE PUT UNDERGROUND
- (P=XXX.X) PAD ELEVATION
- (X) BUILDING NUMBER
- (XX) PARKING COUNT
- T.E. TRASH ENCLOSURE
- (4R) BUILDING PLAN/TYPE

EARTHWORK QUANTITIES:

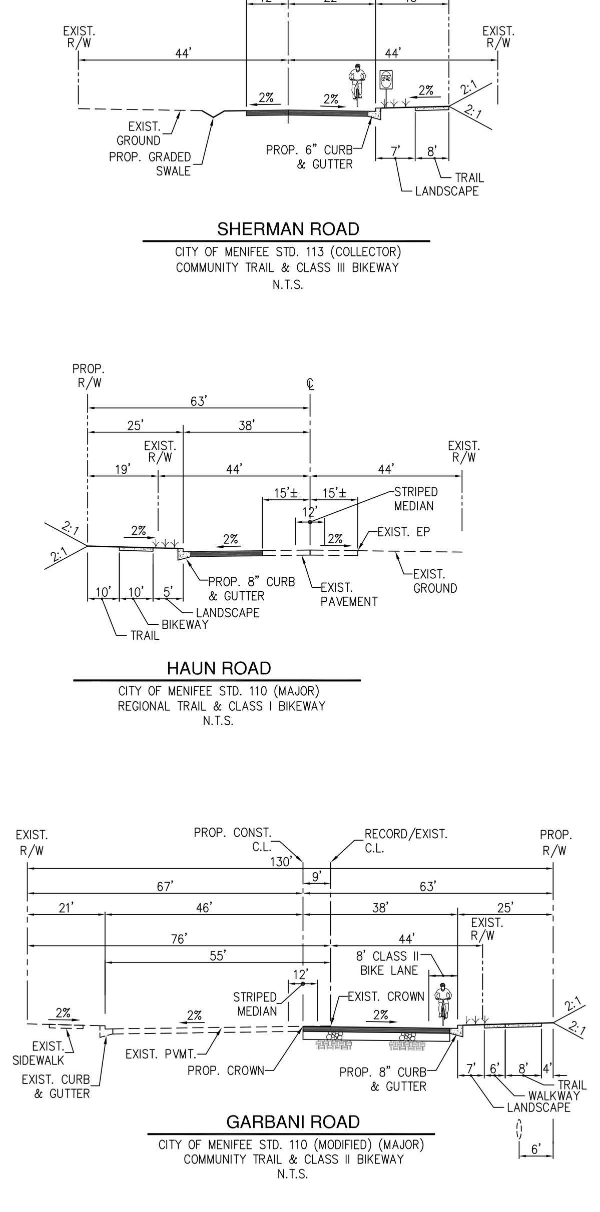
PA/POD NO.	RAW CUT/CY	RAW FILL/CY	IMPORT/EXPORT/CY
1	10,230	44,160	33,930 IMPORT FROM PA/POD 2, 3, & 4
2	53,700	39,510	14,190 EXPORT TO PA/POD 1
3	34,160	20,620	13,540 EXPORT TO PA/POD 1
4	8,260	2,060	6,200 EXPORT TO PA/POD 1
TOTAL	106,350	106,350	

BENCH MARK

RIVERSIDE COUNTY BM # 600-22-68

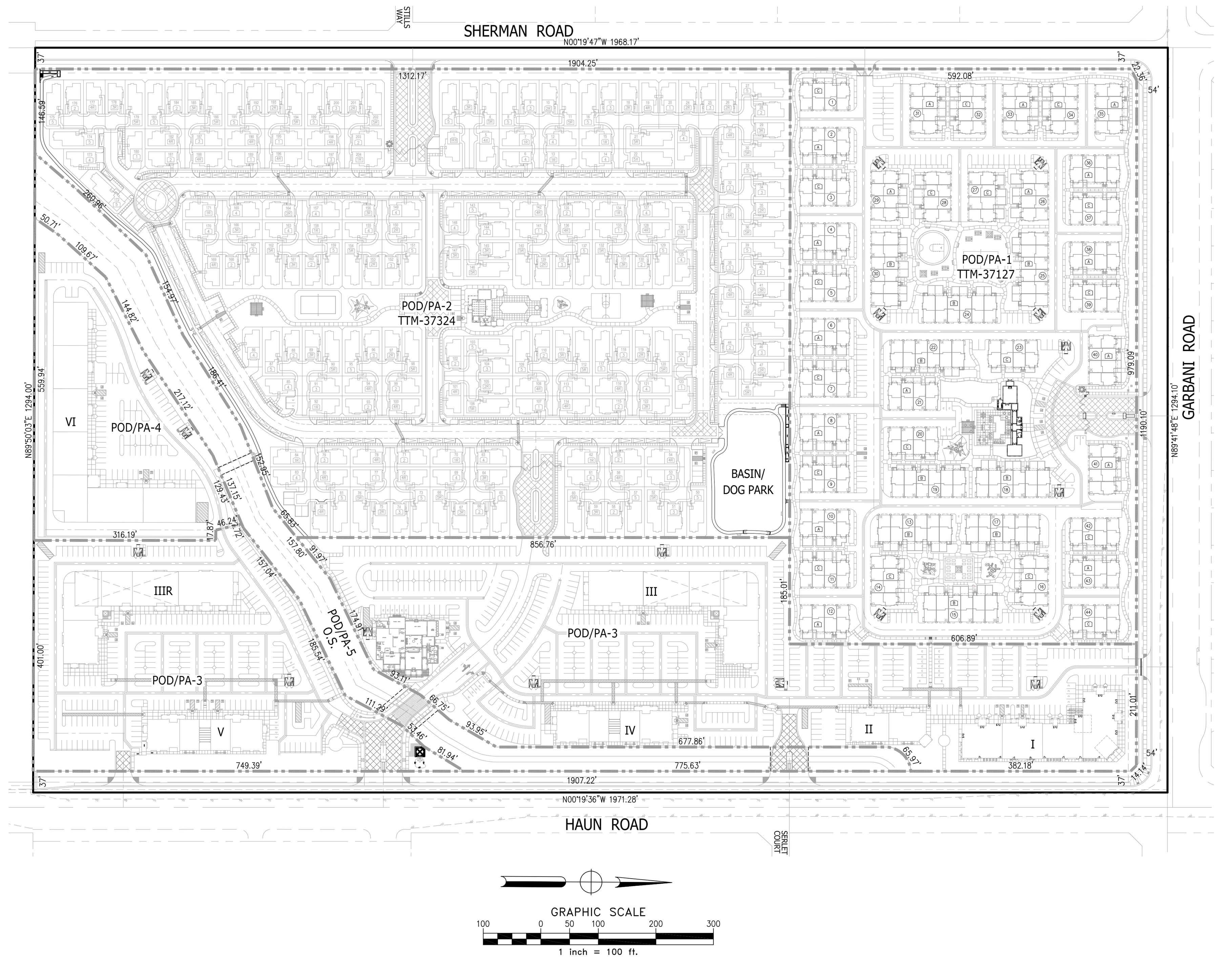
4.1 MILES SOUTH ON MURRIETA RD., FROM THE CATHOLIC CHURCH AT SUN CITY, 0.5 MILE EAST ON GARBONI RD., 0.5 MILE SOUTH OF WICKARD RD., 0.2 MILE EAST ON WICKARD RD., 330 FT EAST OF COX RD., 108 FT NORTH OF POWER POLE (NO NUMBER), 90 FT SOUTH OF POWER POLE #1623617E 90 WEST OF A 36 INCH EUCALYPTUS TREE, IN THE TOP OF A 3x5x10 FT BOULDER IN A MOUND OF ROCK 3x10x20 FT SET A BRASS DISK.

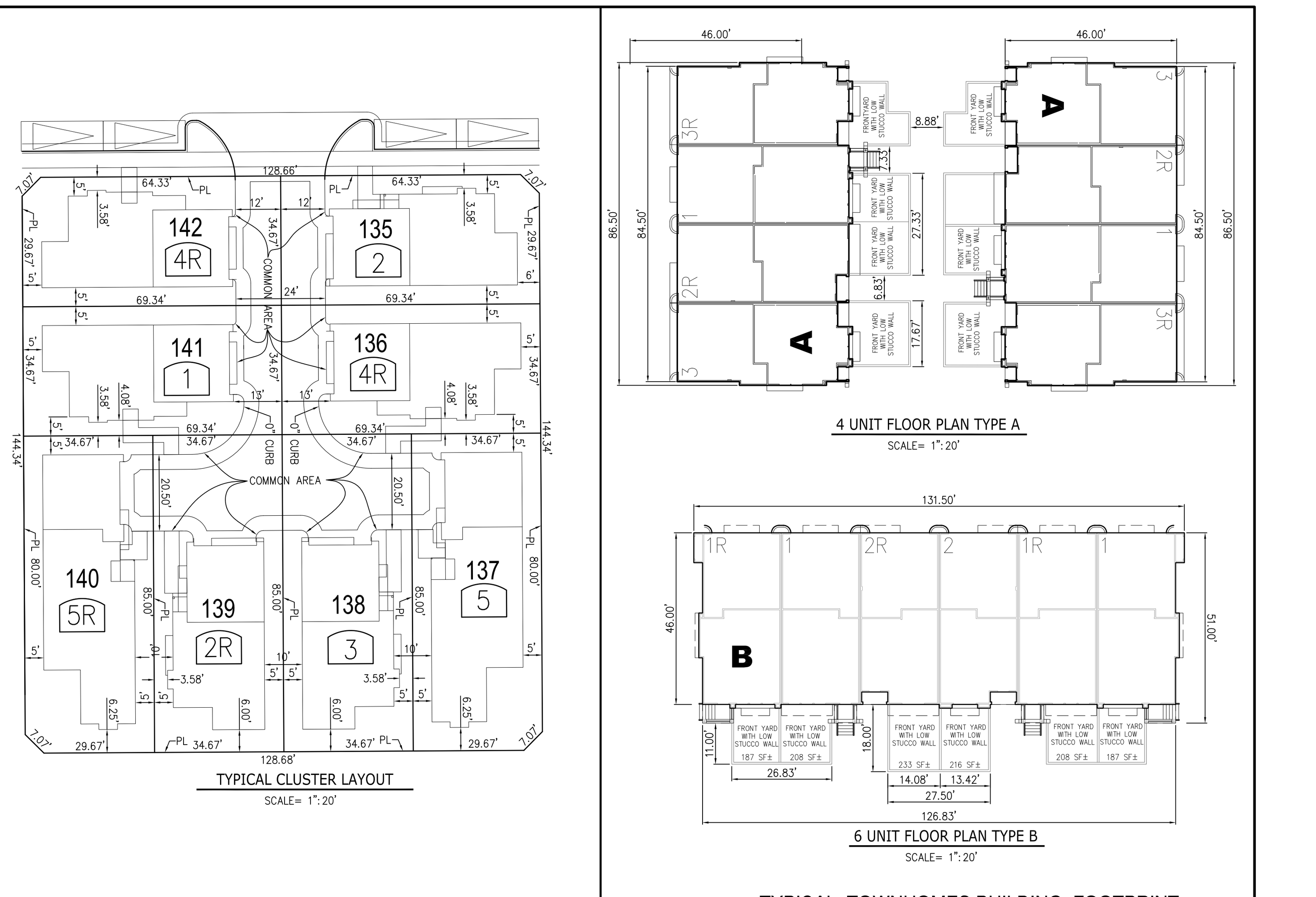
ELEVATION: 1538.537 DATED: 1970



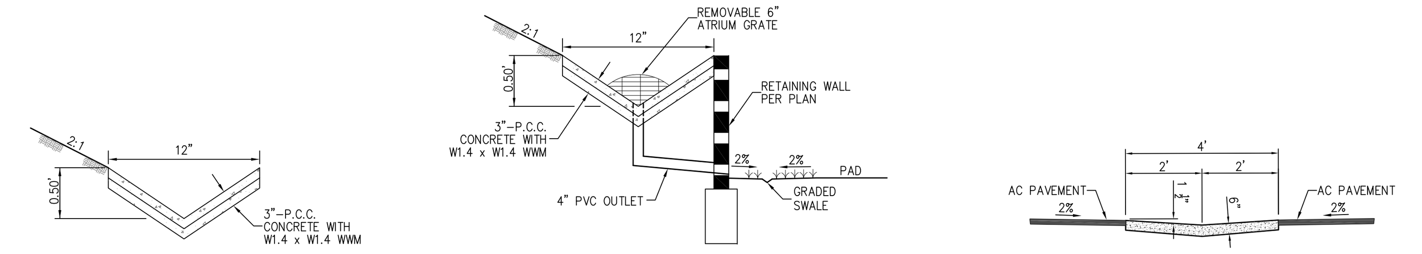
CITY MAINTAINED ROADS

N.T.S.





TYPICAL TOWNHOMES BUILDING FOOTPRINT



INTERIOR STREETS

PRIVATELY MAINTAINED
N.T.S.

SEE PRELIMINARY WQMP DATED ___________, AND APPROVED BY THE CITY ON ___________.

Call before you Dig. Avoid cutting underground utility lines. It's costly. Call 811 or 1-800-227-2600

REVISIONS					
	SHT.	DESCRIPTION	DATE	BY	APRD

PACIFIC COAST LAND CONSULTANTS, Inc.
Civil Engineering • Land Planning • Land Surveying
25096 Jefferson Avenue, Suite "D" Murrieta, Ca. 92562
Tel: (951) 698-1350 Fax: (951) 698-8657

PREPARED BY:
CHRIS D. HOPPER RCE NO. 34821 DATE
Benjie

SEAL: REGISTERED PROFESSIONAL ENGINEER CHRIS D. HOPPER No. 34821 Exp. 9/30/19 CIVIL STATE OF CALIFORNIA

SCALE: SEE ABOVE
DESIGN: BAM/TM
DRAWN: BENJIE
CHECKED: HJK/BAM
APPROVED: HJK/CDH
DATE: APRIL 05, 2017

CITY OF MENIFEE ENGINEERING DEPARTMENT
JONATHAN G. SMITH RCE 61253 EXP. 6/30/18 DATE
DIRECTOR OF PUBLIC WORKS/ CITY ENGINEER
RECOMMENDED BY: DATE

CITY OF MENIFEE
PRELIMINARY GRADING PLAN
MILL CREEK PROMENADE
TITLE SHEET

SHEET NO. 1 OF 3

PROJECT NO:

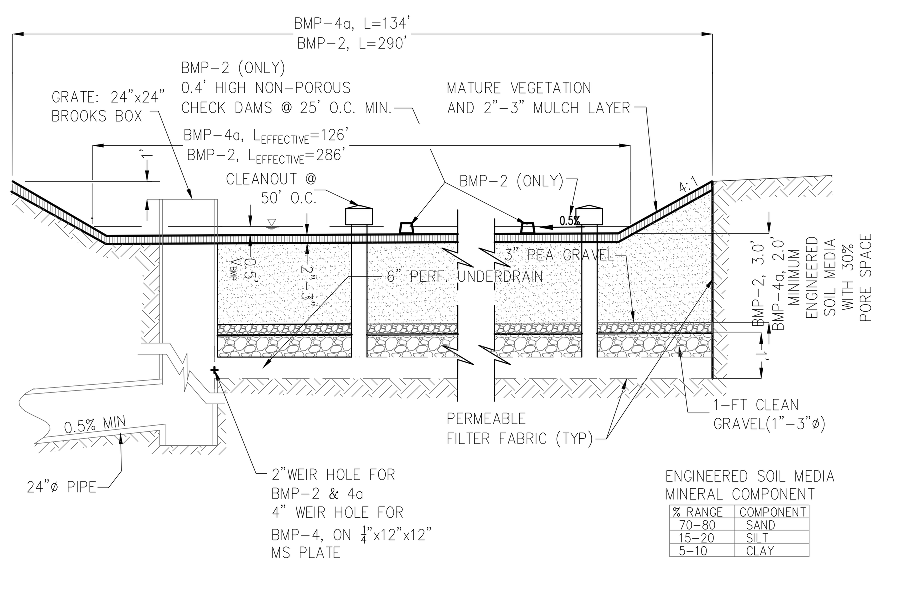
WATER QUALITY MANAGEMENT PLAN

LEGEND:

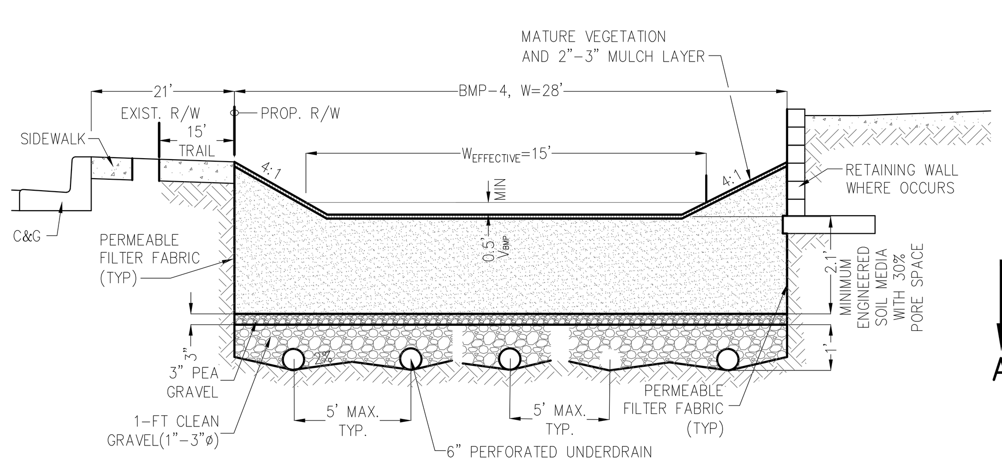
- PROJECT BOUNDARY
- EXISTING RIGHT OF WAY
- EXISTING/PROPOSED CENTERLINE
- DMA DRAINAGE BOUNDARY
- BMP
- GRASS/LANDSCAPING

GENERAL NOTES:

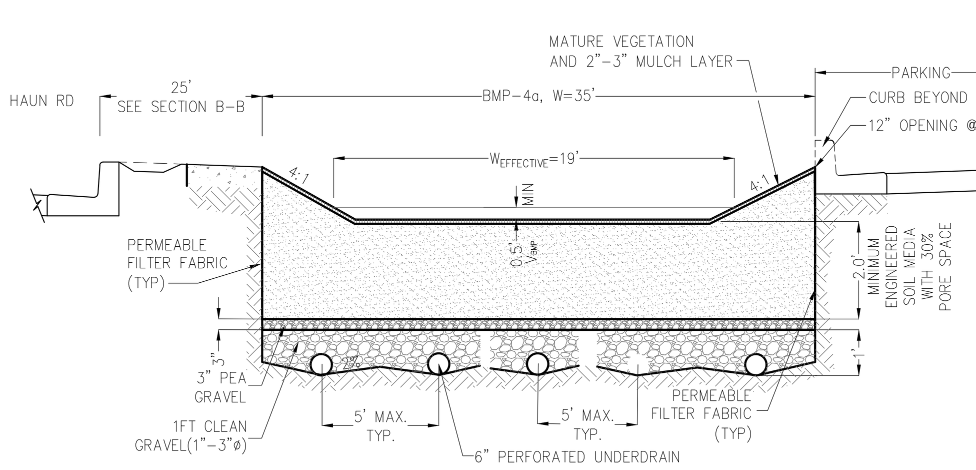
1. STENCIL CATCH BASINS, INSTALL INLET FILTERS, SD-13
2. TRASH ENCLOSURES TO RECEIVE PROTECTIVE COVER, SC-34 AND PER CITY OF MENIFEE STD. DWG. NO. 13011.11
3. BIORETENTION WITH UNDERDRAIN, TC-32
4. LANDSCAPED AREAS TO BE PROPERLY MAINTAINED AND IRRIGATED, SC-73
5. PARKING & STORAGE MAINTENANCE, SC-43
6. ROOF RUNOFF CONTROL, SD-11
7. EFFICIENT IRRIGATION, SD-12
8. EXTENDED DETENTION BASIN, TC-22
9. SAND FILTER



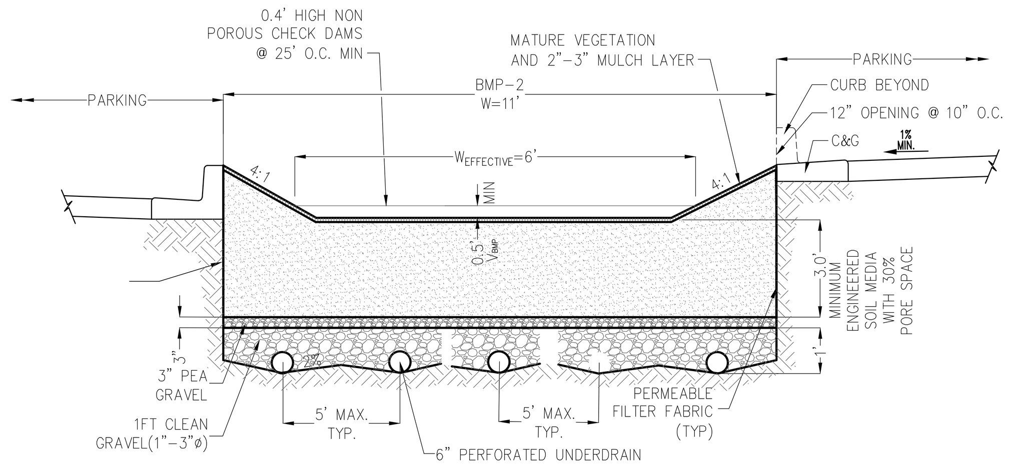
BMP-2, & BMP4a
A-A BIORETENTION FACILITY WITH UNDERDRAIN
NOT TO SCALE



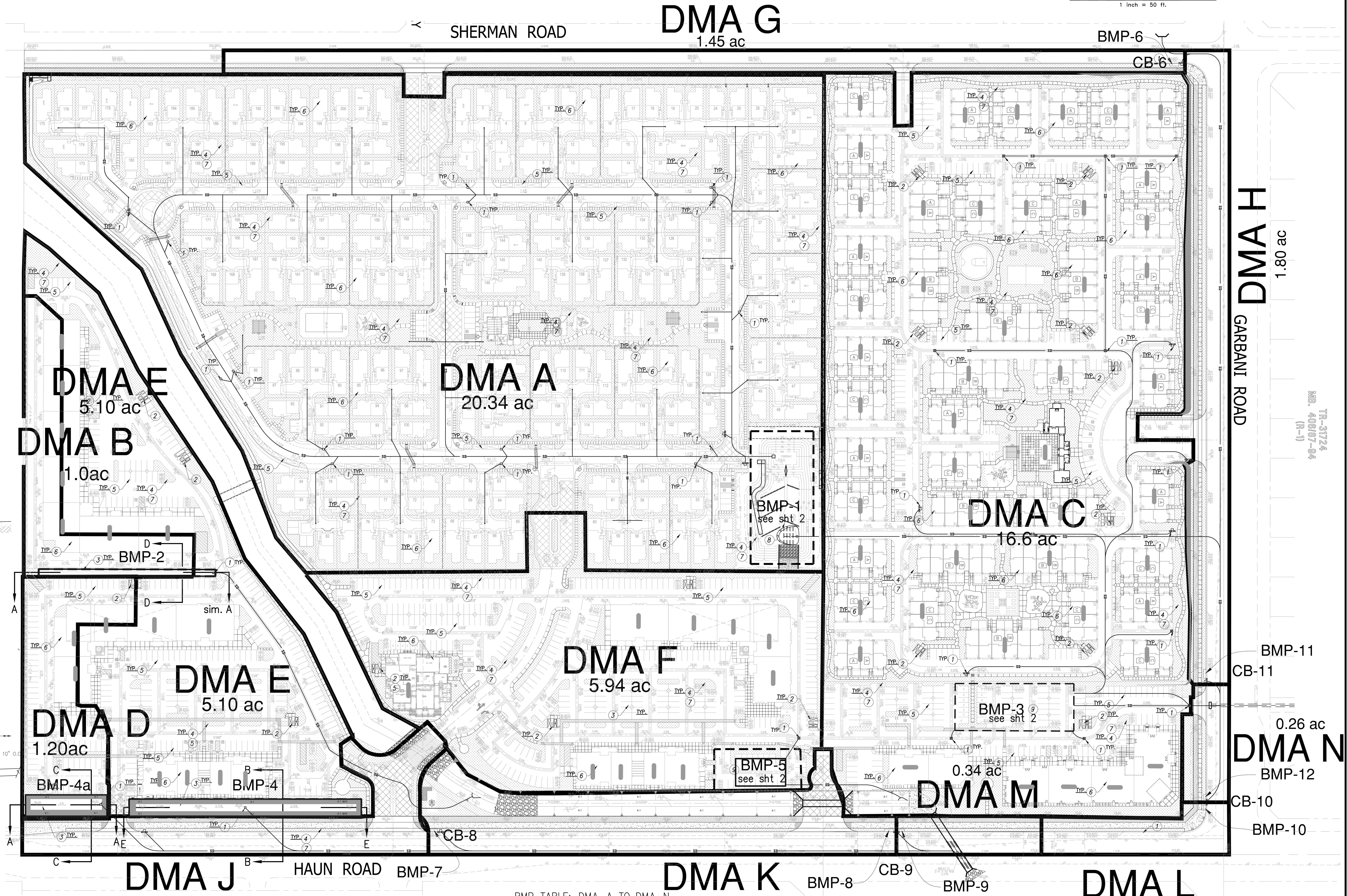
B-B BMP4-BIORETENTION FACILITY WITH UNDERDRAIN
NOT TO SCALE



C-C BMP4A-BIORETENTION FACILITY WITH UNDERDRAIN
NOT TO SCALE

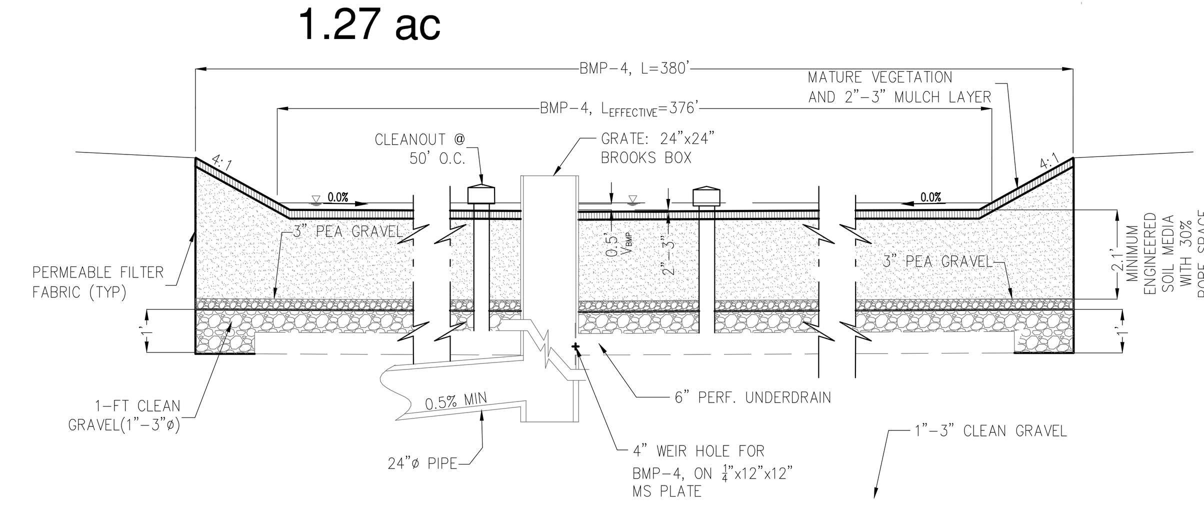


D-D BMP2-BIORETENTION FACILITY WITH UNDERDRAIN
NOT TO SCALE



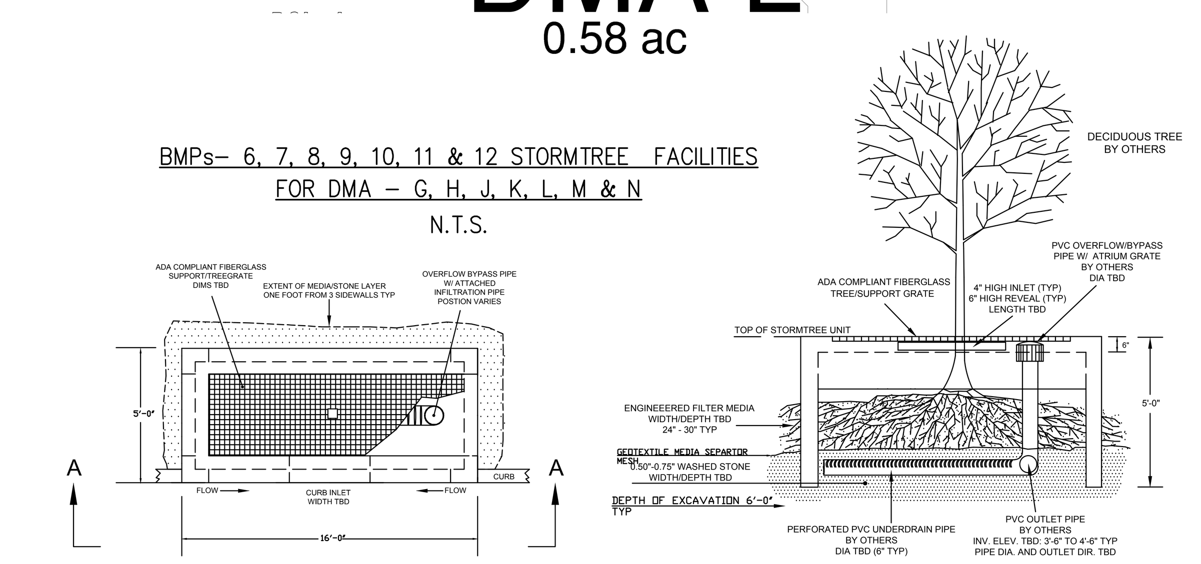
BMP TABLE: DMA-A TO DMA-N

AREA NO.	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	TOTAL AREA (SF)	TOTAL AREA (AC)	IMPERVIOUS AREA (%)	STORM TREE SIZE (FT X FT)	BMP VOL/FLOW REQUIRED (CF)	BMP VOL/FLOW PROVIDED (CF)	BMP USED
DMA-A	556,688	321,046	877,734	20.15	63	–	24,151	69,856	BMP-1 : DETENTION BASIN
DMA-B	40,760	2,800	43,560	1.00	94	–	1,834	2,883	BMP-2 BIORETENTION FACILITY
DMA-C	587,984	143,990	722,974	16.60	80	–	22,642	23,220	BMP-3 SAND FILTER FACILITY
DMA-D	40,552	11,809	52,361	1.22	77	–	1,874	3,606	BMP-4a BIORETENTION FACILITY
DMA-E	179,217	42,939	222,156	5.10	81	–	8,231	8,347	BMP-4 BIORETENTION FACILITY
DMA-F	213,841	44,905	258,746	5.94	83	–	9,898	9,900	BMP-5 SAND FILTER FACILITY
DMA-G	41,291	22,046	63,337	1.45	65	5 X 16	0.20	0.20	BMP-6 STORMTREE BY STORMTECH
DMA-H	51,429	27,080	78,509	1.80	66	5 X 16	0.20	0.20	BMP-11 STORMTREE BY STORMTECH
DMA-J	43,693	11,547	55,240	1.27	79	5 X 16	0.20	0.20	BMP-7 STORMTREE BY STORMTECH
DMA-K	44,086	14,399	58,485	1.34	75	5 X 16	0.20	0.20	BMP-8 STORMTREE BY STORMTECH
DMA-L	16,818	8,260	25,078	0.58	67	5 X 5	0.10	0.10	BMP-10 STORMTREE BY STORMTECH
DMA-M	11,353	3,613	14,965	0.34	76	5 X 5	0.10	0.10	BMP-9 STORMTREE BY STORMTECH
DMA-N	9,033	2,089	11,122	0.26	81	5 X 5	0.10	0.10	BMP-12 STORMTREE BY STORMTECH
TOTAL	1,827,744	656,523	2,484,267	57.03	74				



E-E BIORETENTION FACILITY WITH UNDERDRAIN - BMP-4
NOT TO SCALE

BMPs- 6, 7, 8, 9, 10, 11 & 12 STORMTREE FACILITIES FOR DMA - G, H, J, K, L, M & N
N.T.S.



PLAN VIEW
NOT TO SCALE

SECTION A-A
NOT TO SCALE

Call before you Dig — Call 811 — 1-800-227-2600

REVISIONS

SHT.	DESCRIPTION	DATE	BY	APRD

PACIFIC COAST LAND CONSULTANTS, Inc.
Civil Engineering • Land Planning • Land Surveying
25096 Jefferson Avenue, Suite "D" Murrieta, Ca. 92562
Tel: (951) 698-1350 Fax: (951) 698-8657

PREPARED BY: CHRIS D. HOPPER RCE NO. 34821

SEAL: REGISTERED PROFESSIONAL ENGINEER CHRIS D. HOPPER No. 34821 Exp. 9/30/17 CIVIL STATE OF CALIFORNIA

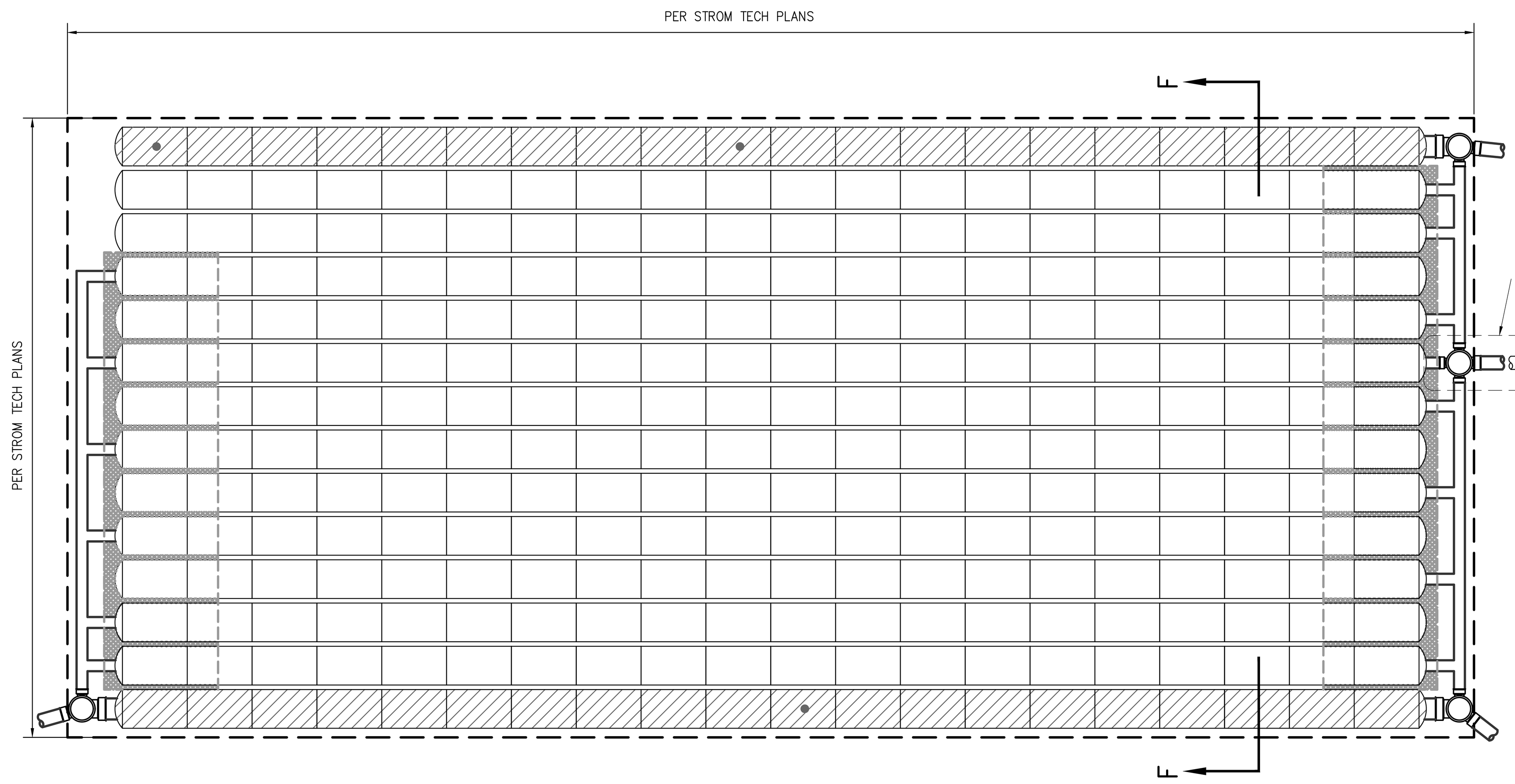
SCALE: 1" =60'
DESIGN: BAM/REK
DRAWN: BENJIE
CHECKED: HJK/BAM
APPROVED: HJK/CDH
DATE: NOVEMBER, 2016

CITY OF MENIFEE ENGINEERING DEPARTMENT
JONATHAN G. SMITH, DIRECTOR OF PUBLIC WORKS/ CITY ENGINEER — RCE 61253 EXP. 6/30/16 — DATE
RECOMMENDED BY: — DATE

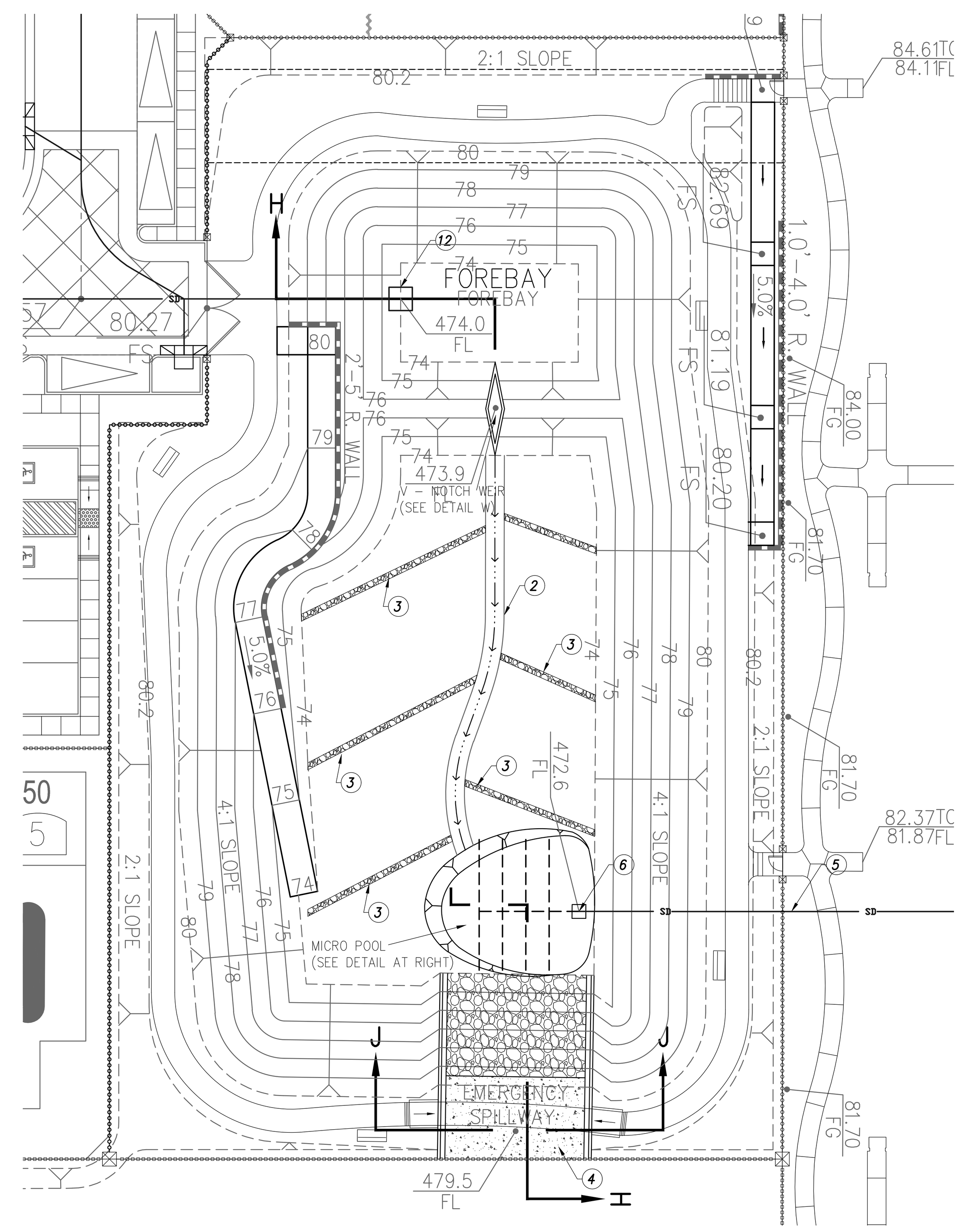
CITY OF MENIFEE
WATER QUALITY MANAGEMENT PLAN
MILL CREEK PROMENADE

SHEET NO. 1 OF 2
PROJECT NO.

WATER QUALITY MANAGEMENT PLAN

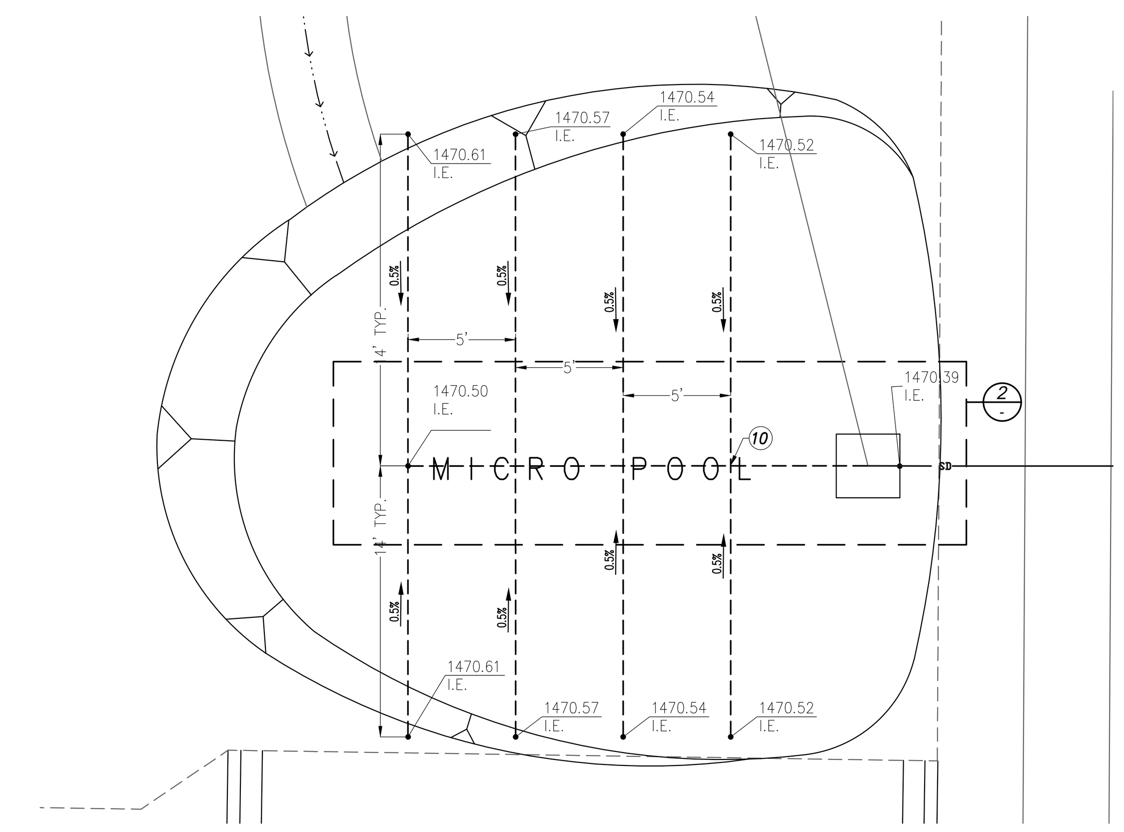


BMP- 3 & 5 UNDERGROUND BMP TREATMENT(SAND FILTER)/DETENTION SYSTEM SECTION
BY STORM TECH CHAMBERS (BMP-3 AREA=18,930 SF, BMP-5 AREA=11,253 SF)
N.T.S.

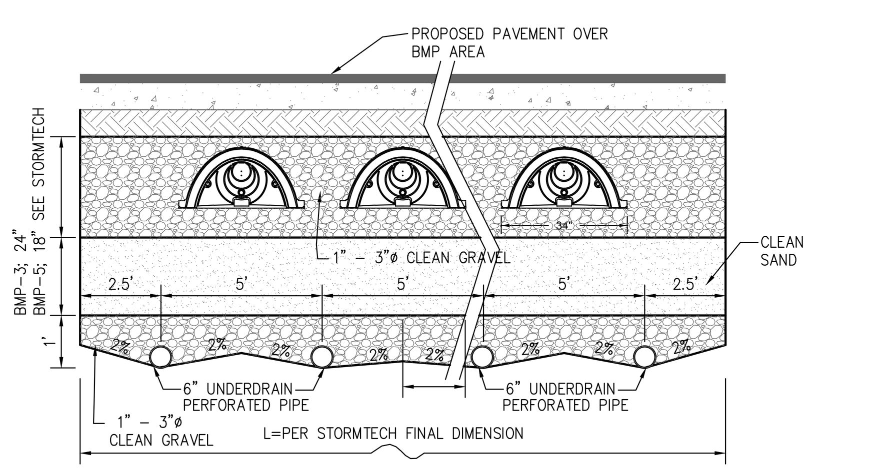


BASIN DETAIL
SCALE: 1" = 20'

GRAPHIC SCALE
1 inch = 20 ft.

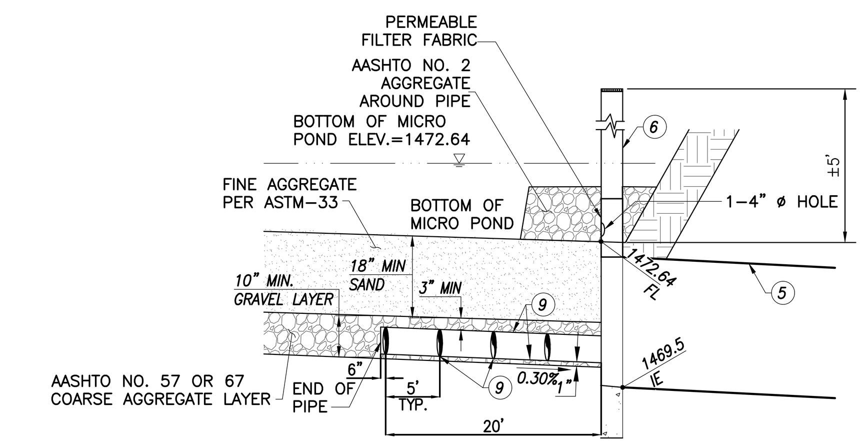


MICRO POOL DETAIL
SCALE: 1" = 5'

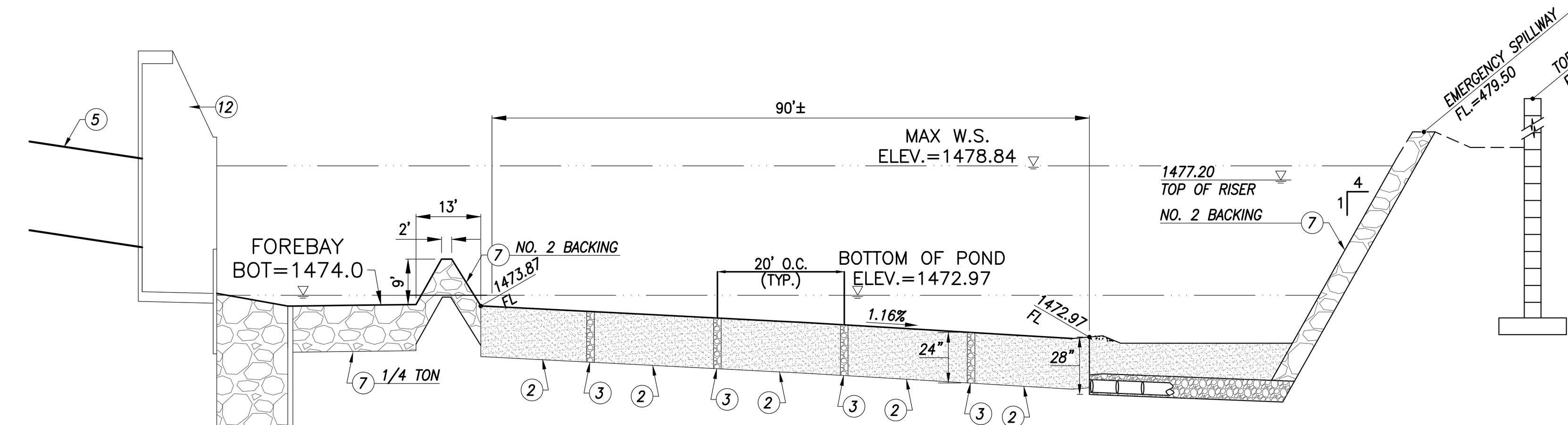


BMP- 3 & 5 UNDERGROUND BMP TREATMENT(SAND FILTER)/DETENTION SYSTEM SECTION
N.T.S.

F SECTION F-F
NOT TO SCALE

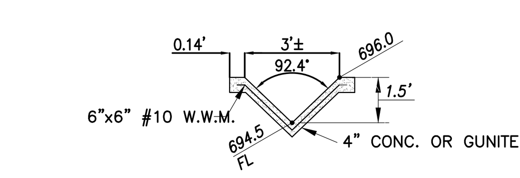


2 DETAIL No. 2
SCALE: 1"=20'



VBMP=64,500± C.F. @ ELEV.=1479.00

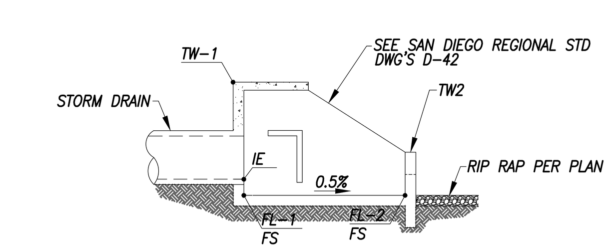
H SECTION H-H
NOT TO SCALE



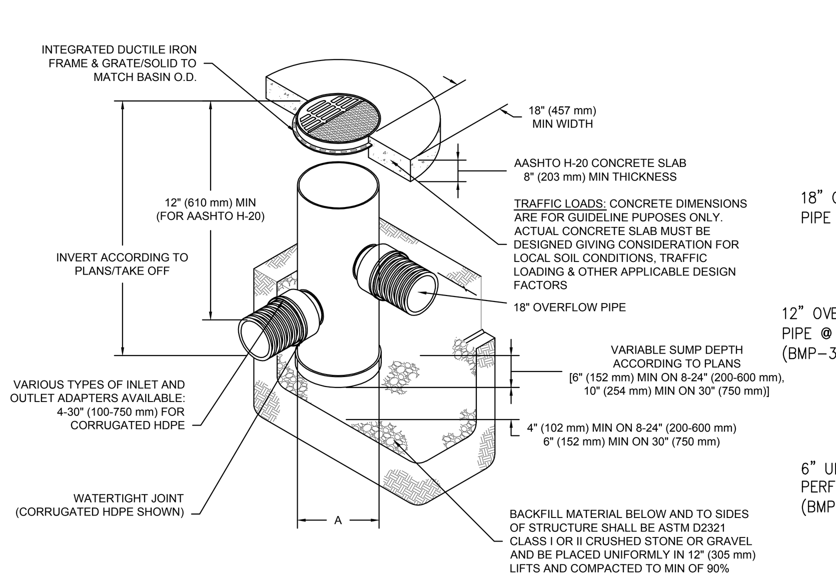
DETAIL "W"
V-NOTCH WEIR
NOT TO SCALE

CONCRETE ENERGY DISSIPATER SCHEDULE

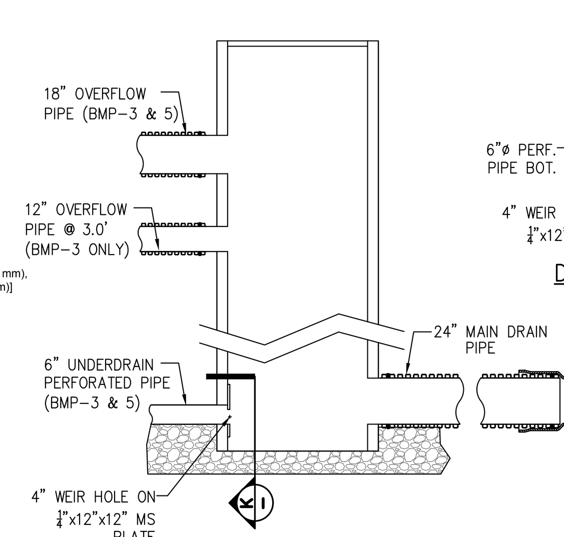
STRUCTURE I.D.	MAIN LINE SIZE	FL-1	FL-2	TW-1	TW-2
1	36 inch	474.1	474.0	478.0	475.75



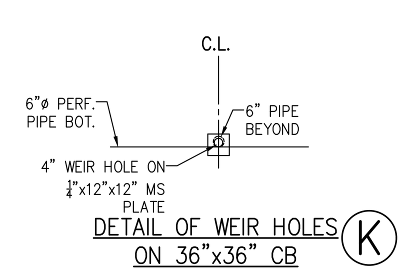
12 CONCRETE ENERGY DISSIPATER DETAIL
NTS



NYLOPLAST DRAIN BASIN
NTS



36" X 36" CATCH BASIN
NTS



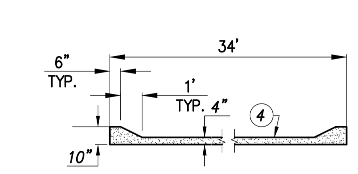
DETAIL OF WEIR HOLES ON 36"x36" CB (K)
N.T.S.

BMP- 3 & 5 UNDERGROUND BMP TREATMENT(SAND FILTER)/DETENTION SYSTEM SECTION
N.T.S.

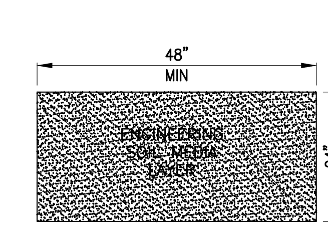
G DETAIL G
NOT TO SCALE

BMP-1: CONSTRUCTION NOTES:

1. CONSTRUCT 18" DEEP PCC V-NOTCH WEIR PER DETAIL "W" SHOWN HEREON.
2. CONSTRUCT LOW-FLOW TRENCH PER DETAIL "X" SHOWN HEREON.
3. CONSTRUCT COLLECTOR TRENCH PER DETAIL "Y" SHOWN HEREON.
4. CONSTRUCT GUNITE OVERFLOW SPILLWAY PER DETAILS SHOWN HEREON.
5. CONSTRUCT 36" HDPE STORM DRAIN (D-LOAD PER PLANS) IN TRENCH BEDDING
6. CONSTRUCT CONCRETE DROP INLET PER RCFC&WCD STD. PLAN CB110
7. CONSTRUCT RIP RAP PROTECTION TYPE 1 PER S.D.R. STD. PLAN NO. D-40
8. CONSTRUCT RIP RAP PROTECTION (FOR WQMP/FOREBAY) & OVERFLOW WEIR PER DETAILS/SECTIONS SHOWN HEREON.
9. CONSTRUCT 6" PERFORATED PVC (SCH. 40), WRAPPED IN PERMEABLE FILTER FABRIC
10. CONSTRUCT 6"x6"x6"x6" (SCH. 40) CROSS
11. CONSTRUCT CUT-OFF WALL PER S.D.R. STD. PLAN NO. D-40
12. CONCRETE ENERGY DISSIPATER SEE DETAIL ON THIS SHEET.



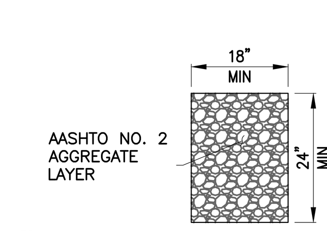
SECTION J-J
NTS



2 DETAIL "X"
LOW-FLOW TRENCH
NTS

ENGINEERED SOIL MEDIA
MINERAL COMPONENT

% RANGE	COMPONENT
70-80	SAND
15-20	SILT
5-10	CLAY



3 DETAIL "Y"
COLLECTOR TRENCH
NTS

Call before you Dig — Avoid cutting underground utility lines. It's costly. Call 811 or 1-800-227-2600

REVISIONS

SHT.	DESCRIPTION	DATE	BY	APRD

PACIFIC COAST LAND CONSULTANTS, Inc.
Civil Engineering • Land Planning • Land Surveying
25096 Jefferson Avenue, Suite "D" Murrieta, Ca. 92562
Tel: (951) 698-1350 Fax: (951) 698-8657

PREPARED BY: CHRIS D. HOPPER — RCE NO. 34821 — DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — CHRIS D. HOPPER — No. 34821 — Exp. 9/30/17 — CIVIL — STATE OF CALIFORNIA

SCALE:	1" =60'
DESIGN:	BAM/REK
DRAWN:	BENJIE
CHECKED:	HJK/BAM
APPROVED:	HJK/CDH
DATE:	NOVEMBER, 2016

CITY OF MENIFEE
ENGINEERING DEPARTMENT
JONATHAN G. SMITH — RCE 61253 — EXP. 6/30/16 — DATE
DIRECTOR OF PUBLIC WORKS/ CITY ENGINEER
RECOMMENDED BY: — DATE

CITY OF MENIFEE
WATER QUALITY MANAGEMENT PLAN
MILL CREEK PROMENADE

SHEET NO. 2 OF 2
PROJECT NO:

Appendix 3: Soils Information

Geotechnical Study and other Infiltration Testing Data

Earth Strata Geotechnical Service, Inc

EARTH STRATA GEOTECHNICAL SERVICES, INC.

May 16, 2016 Project No. 151064-12A

SHERMAN & HAUN, LLC
31103 Rancho Viejo Road
San Juan Capistrano, CA 92675

Subject: **Interpretive Report for Infiltration System Design, Proposed Millcreek Promenade, Assessor's Parcel Number 360-350-017, Located South of Garbani Road and on the West Side of Haun Road, City of Menifee, Riverside County, California**

Earth Strata Geotechnical Services, is pleased to present this interpretive report for the proposed commercial development, located South of Garbani Road and on the West Side of Haun Road, in the City of Menifee, Riverside County, California. The purpose of our study was to determine the infiltration rates and physical characteristics of the subsurface earth materials within the proposed development. We have provided guidelines for the design of onsite bio swale retention systems, where applicable. This study is intended to provide onsite infiltration rates for the earth materials at the approximate depth near the proposed retention basins.

PROPERTY DESCRIPTION

The subject property is located in the City of Menifee, Riverside County, California (see Figure 1). The subject property consists of an undeveloped parcel of land with relatively flat terrain. The subject property is underlain by alluvium and bedrock.

PROPOSED CONSTRUCTION

Based on information provided by you, the proposed development will consist of numerous 1 to 3 story buildings which includes interior driveways, utilities and on-site retention basins.

SUBSURFACE EXPLORATION AND INFILTRATION TESTING

SUBSURFACE EXPLORATION

Subsurface exploration of the subject site consisted of twelve (12) exploratory excavations to a depth of 15 feet, conducted on March 29, 2016. The exploratory holes were excavated to evaluate insitu permeability rates. The approximate locations of the exploratory excavations are shown on the attached Infiltration Location Map, Plate 1.

EARTH MATERIALS

A general description of the earth materials observed on site is provided below.

- Topsoil (no map symbol): Residual topsoil, encountered in the upper 1 to 3 feet, blankets the site and underlying bedrock. These materials were noted to be generally yellow brown, sandy clay and clayey sand which were very porous, slightly moist to moist and in a loose state.

- Quaternary Old Fan Deposits (map symbol Qof): Quaternary old fan deposits were encountered to a maximum depth of explored. These alluvial deposits consist predominately of interlayered reddish brown to gray brown, fine to coarse grained clayey sand, silty sand, sandy clay, and occasional sandy silt. These deposits were generally noted to be in a slightly moist to moist, medium dense to dense state.

- Cretaceous Gabbro (map symbol Kgb): Cretaceous age plutonic rock consisting of gabbro was mapped within the site. The gabbro was observed to be pinkish gray to medium gray, medium to very coarse grained, and in a moderately hard to very hard state. Typically, the upper 1 to 3 feet of this unit is more weathered and not as hard.

- Cretaceous Heterogeneous Granitic Rocks (map symbol Khg): Cretaceous age granitic rocks composed of a wide variety of compositions make up this unit. Rock types typically include monzogranite, granodiorite, tonalite and gabbro, with the most common being tonalite (Morton, 2004). This rock unit was mapped within the site. These granitic rocks were observed to be reddish yellow and yellowish brown, medium to coarse-grained, and in a moderately hard to very hard state. Typically, the upper 1 to 3 feet of this unit is more weathered and not as hard.

GROUNDWATER

Groundwater was not observed within the exploratory excavations.

INFILTRATION TESTING

The continuous presoak test method was utilized to perform a total of six (6) infiltration tests on April 11, 2016 to evaluate near surface infiltration rates in order to estimate the amount of storm water runoff that can percolate into the onsite bio swale retention basins. The infiltration tests were performed in general accordance with the requirements of insitu infiltration testing.

The infiltration tests were performed within 8 inch diameter holes, 6.8 to 7.5 feet deep. The locations of the infiltration test holes are indicated on the attached Infiltration Location Map, Plate 1. The infiltration test holes were located by property boundary measurement on the site plan and by using geographic features. For the continuous presoak testing method, the pipe was filled with water and allowed to stand.

After the presoak, testing was performed by adjusting the water level to near the top of the pipe. The drop in water level was measured from a fixed initial reference point for more reliable readings, with measurements having an accuracy of 1/8-inch. After each measurement, the water level was brought up to the original test level. Infiltration test data recorded in the field is summarized in the following table and is included within Appendix A.

INFILTRATION TEST SUMMARY

TEST NUMBER	INFILTRATION HOLE DEPTH (ft.)	PERCOLATION RATE (mpi)	INFILTRATION RATE (in/hr)	DESCRIPTION
P-1	6.8	10	0.89	Silty SAND
P-2	7.5	10	0.96	Silty SAND
P-3	6.8	10	0.96	Silty SAND
P-4	7	5	0.96	Silty SAND
P-5	7	10	0.96	Silty SAND
P-6	7.3	10	0.96	Silty SAND

The percolation test rates ranged from 5 to 10 minutes per inch (mpi).

CONCLUSIONS AND RECOMMENDATIONS

Based on the data presented in this report and the recommendations set forth herein, it is the opinion of Earth Strata that the retention basin can be designed for a percolation rate of 10 mpi.

The following equation was used in order to convert the infiltration rates to infiltration rates.

$$I_t = \frac{\Delta H \ (60) \ r}{\Delta t \ \ (r + 2Havg)}$$

The infiltration rate of 10 mpi is to be used for the design. This rate is used in the conversion equation utilizing the Porchet Method to obtain the infiltration rate of 0.96 inch/hour. See Attached Sheets

GRADING PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **SHERMAN & HAUN, LLC** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Earth Strata should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Earth Strata not be accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

Earth Strata should be retained to provide observations during construction to validate this report. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

Earth Strata should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property. The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Earth Strata during construction. This report is considered valid for a period of one year from the time the report was issued.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction, and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.

Respectfully submitted,

EARTH STRATA GEOTECHNICAL SERVICES, INC.

Stephen M. Poole, PE 40219
President
Principal Engineer

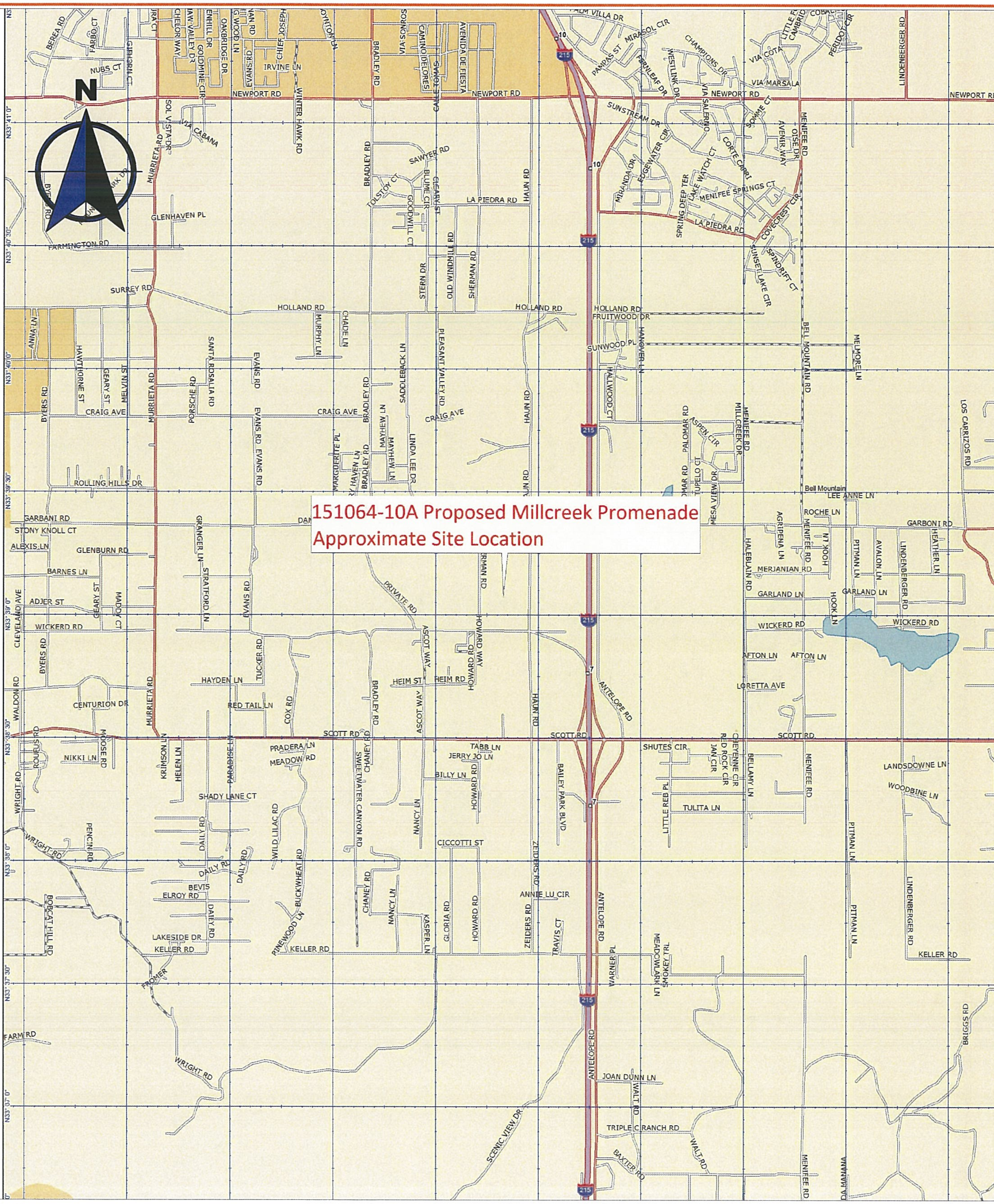
SMP/kp/mw

Distribution: (2) Addressee

Attachments: Figure 1 – Vicinity Map *(Rear of Text)*
Appendix A – Infiltration Test Sheets *(Rear of Text)*
Plate 1 – Infiltration Location Map *(Rear of Text)*

FIGURE 1

VICINITY MAP



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ESGS INC.
Geotechnical, Environmental, and Materials Testing Consultants

PROPOSED MILLCREEK PROMENADE		151064-10A
VICINITY MAP	SCALE 1:40,625	
	MAY 2016	FIGURE 1

APPENDIX A

INFILTRATION TEST SHEETS

Job No.: 151064

Job Name: Millcreek Promenade

Test Hole Number: P-1

Soil Classification: Silty SAND

Test Hole Depth (ft): 6.8

Tested By: RCG

Test Hole Diameter (inches): 8

Date Excavated: 4/11/2016

Date Tested: 4/12/2016

Time Interval of Presoak

24 hours

Date / Time

Start 4/11/16 10:50

Stop 4/12/16 10:50

Amount of Water Used / Comments

20

"It" is the tested infiltration rate.

Time interval, Δt Initial Depth to Water, D_0

Final Depth to Water, D_f Total Depth of Test Hole, D_T

2Test Hole Radius, r

The conversion equation is used:

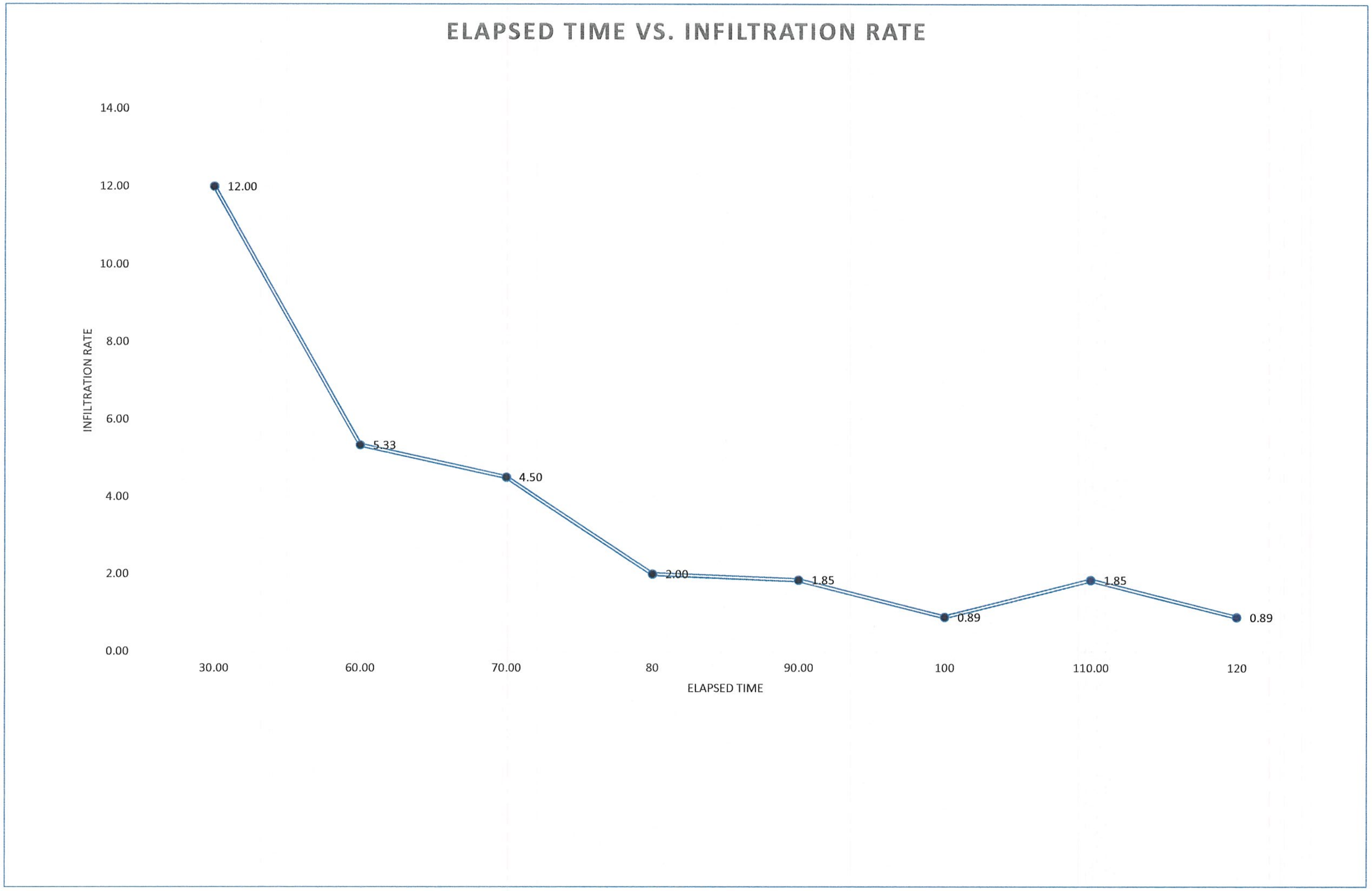
"Havg" is the average head height over the time interval.

$$It = \frac{\Delta H\ 60\ r}{\Delta t(r+2Havg)}$$

Time	Time Interval (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Water Level Drop (Inches)	Percolation Rate (Min./Inch)	Total Depth of Percolation Hole
10:53 11:23	30	70	82	12.00	3	78.00
11:23 11:53	30	70	78	8.00	4	78.00
11:53 12:03	10	66	60	6.00	2	77.00
12:03 12:13	10	66	68	2.00	5	77.00
12:13 12:23	10	65	67	2.00	5	77.00
12:23 12:33	10	65	66	1.00	10	77.00
12:33 12:43	10	65	67	2.00	5	77.00
12:43 12:53	10	65	66	1.00	10	77.00

Time interval Δt	Initial Water H_0	Final Water H_f	Total Depth of Test Hole D_t	Raduis of Perc Hole r	ΔH	H Avg		ΔH 60 r)/(Δt (r+2Havg)) It		ELAPSED TIME Δt
30.00	8.00	-4.00	78.00	4.00	12.00	2.00		12.00		30.00
30.00	8.00	0.00	78.00	4.00	8.00	4.00		5.33		60.00
10.00	11.00	17.00	77.00	4.00	6.00	14.00		4.50		70.00
10.00	11.00	9.00	77.00	4.00	2.00	10.00		2.00		80.00
10.00	12.00	10.00	77.00	4.00	2.00	11.00		1.85		90.00
10.00	12.00	11.00	77.00	4.00	1.00	11.50		0.89		100.00
10.00	12.00	10.00	77.00	4.00	2.00	11.00		1.85		110.00
10.00	12.00	11.00	77.00	4.00	1.00	11.50		0.89		120.00

Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-1



Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-2
Soil Classification: Silty SAND
Test Hole Depth (ft): 7.5

Tested By: RCG
Test Hole Diameter (inches): 8
Date Excavated: 4/11/2016
Date Tested: 4/12/2016

Time Interval of Presoak: 24 hours

Date / Time
Start: 4/11/16 10:50
Stop: 4/12/16 10:50

Amount of Water Used / Comments: 20

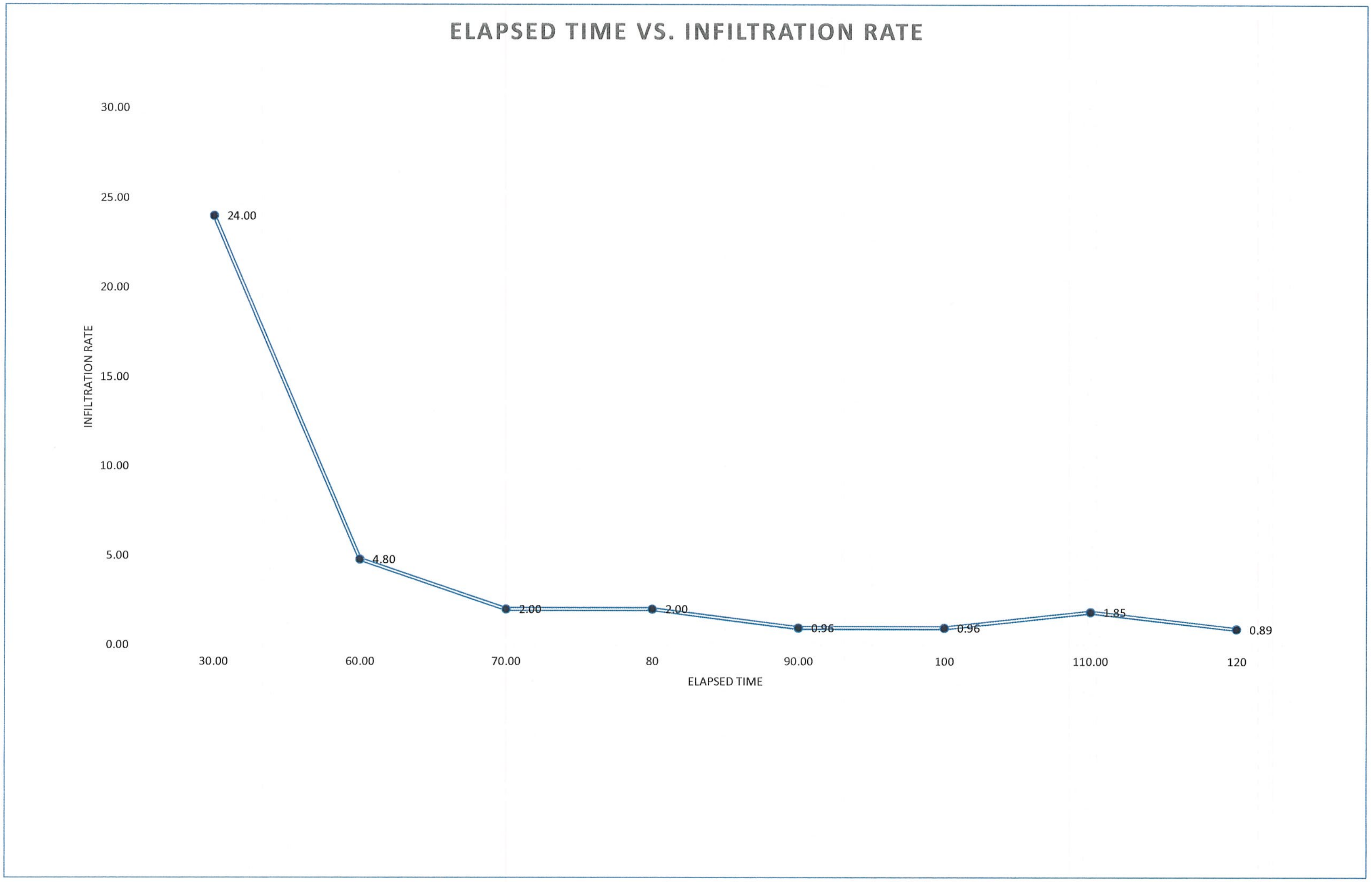
"It" is the tested infiltration rate.
Time interval, Δt Initial Depth to Water, D_0
Final Depth to Water, D_f Total Depth of Test Hole, D_T
2Test Hole Radius, r
The conversion equation is used:
"Havg" is the average head height over the time interval.

$$It = \frac{\Delta H \, 60 \, r}{\Delta t(r+2Havg)}$$

Time	Time Interval (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Water Level Drop (Inches)	Percolation Rate (Min./Inch)	Total Depth of Percolation Hole
10:54 11:24	30	81	93	12.00	3	87.00
11:24 11:54	30	81	87	6.00	5	87.00
11:54 12:04	10	75	77	2.00	5	86.00
12:04 12:14	10	75	77	2.00	5	86.00
12:14 12:24	10	74	75	1.00	10	85.00
12:24 12:34	10	74	75	1.00	10	85.00
12:34 12:44	10	73	75	2.00	5	85.00
12:44 12:54	10	73	74	1.00	10	85.00

Time interval Δt	Initial Water H_0	Final Water H_f	Total Depth of Test Hole D_T	Raduis of Perc Hole r	ΔH	H Avg	ΔH 60 r)/(Δt (r+2Havg)) It	ELAPSED TIME Δt
30.00	6.00	-6.00	87.00	4.00	12.00	0.00	24.00	30.00
30.00	6.00	0.00	87.00	4.00	6.00	3.00	4.80	60.00
10.00	11.00	9.00	86.00	4.00	2.00	10.00	2.00	70.00
10.00	11.00	9.00	86.00	4.00	2.00	10.00	2.00	80.00
10.00	11.00	10.00	85.00	4.00	1.00	10.50	0.96	90.00
10.00	11.00	10.00	85.00	4.00	1.00	10.50	0.96	100.00
10.00	12.00	10.00	85.00	4.00	2.00	11.00	1.85	110.00
10.00	12.00	11.00	85.00	4.00	1.00	11.50	0.89	120.00

Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-2



Job No.: 151064

Job Name: Millcreek Promenade

Test Hole Number: P-3

Soil Classification: Silty SAND

Test Hole Depth (ft): 6.8

Tested By: RCG

Test Hole Diameter (inches): 8

Date Excavated: 4/11/2016

Date Tested: 4/12/2016

Time Interval of Presoak

24 hours

Date / Time

Start 4/11/16 10:50

Stop 4/12/16 10:50

Amount of Water Used / Comments

20

"It" is the tested infiltration rate.

Time interval, Δt　Initial Depth to Water, D_0

Final Depth to Water, D_f　Total Depth of Test Hole, D_T

2Test Hole Radius, r

The conversion equation is used:

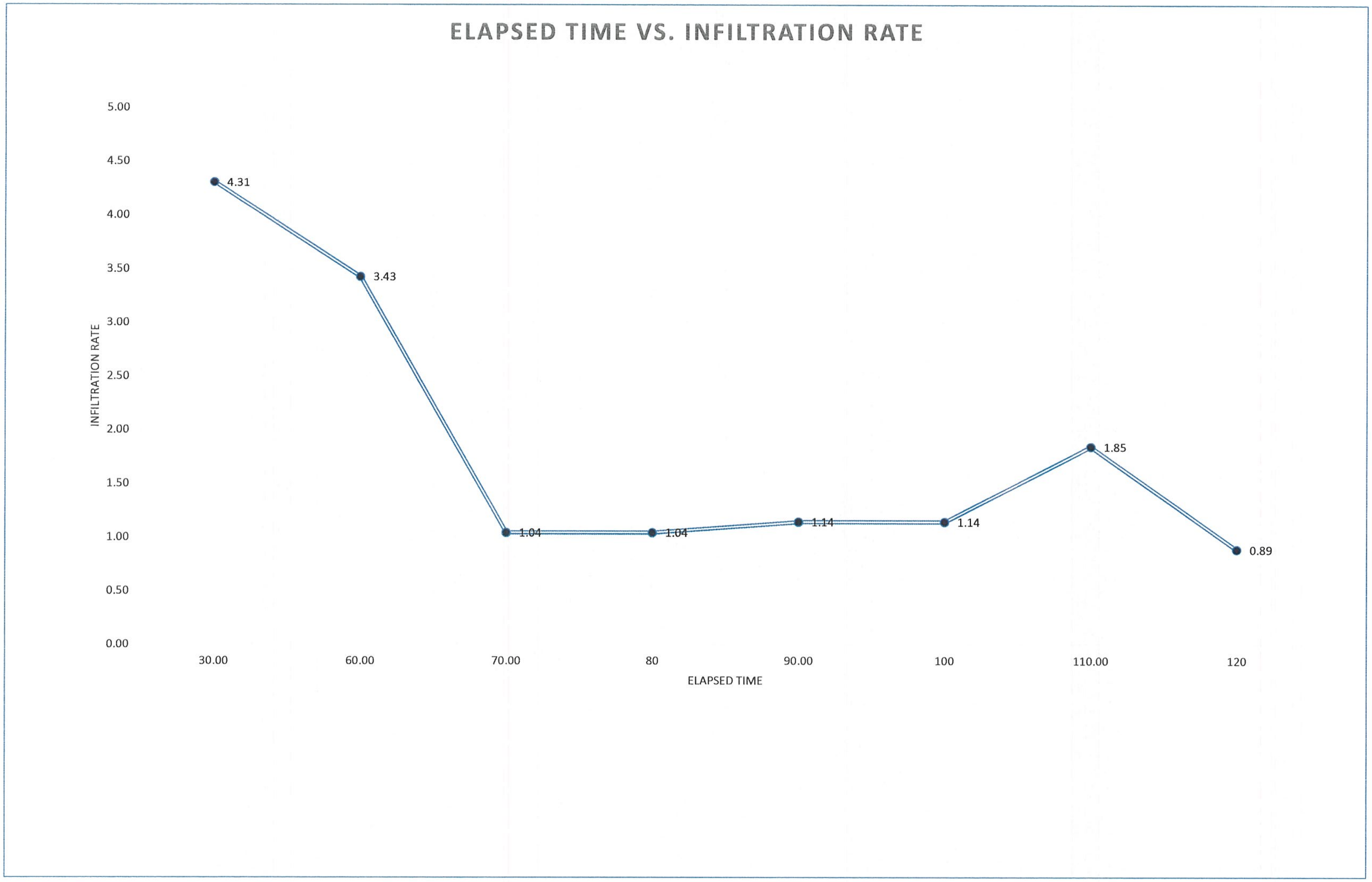
"Havg" is the average head height over the time interval.

$$It = \frac{\Delta H \, 60 \, r}{\Delta t (r + 2H_{avg})}$$

Time	Time Interval (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Water Level Drop (Inches)	Percolation Rate (Min./Inch)	Total Depth of Percolation Hole
10:55 11:25	30	70	77	7.00	5	78.00
11:25 11:55	30	70	76	6.00	5	78.00
11:55 12:05	10	66	67	1.00	10	76.00
12:05 12:15	10	66	67	1.00	10	76.00
12:15 12:25	10	64	65	1.00	10	73.00
12:25 12:35	10	64	65	1.00	10	73.00
12:35 12:45	10	61	63	2.00	5	73.00
12:45 12:55	10	61	62	1.00	10	73.00

Time interval Δt	Initial Water H_0	Final Water H_f	Total Depth of Test Hole D_T	Raduis of Perc Hole r	ΔH	H Avg		ΔH 60 r)/(Δt (r+2Havg)) It		ELAPSED TIME Δt
30.00	8.00	1.00	78.00	4.00	7.00	4.50		4.31		30.00
30.00	8.00	2.00	78.00	4.00	6.00	5.00		3.43		60.00
10.00	10.00	9.00	76.00	4.00	1.00	9.50		1.04		70.00
10.00	10.00	9.00	76.00	4.00	1.00	9.50		1.04		80.00
10.00	9.00	8.00	73.00	4.00	1.00	8.50		1.14		90.00
10.00	9.00	8.00	73.00	4.00	1.00	8.50		1.14		100.00
10.00	12.00	10.00	73.00	4.00	2.00	11.00		1.85		110.00
10.00	12.00	11.00	73.00	4.00	1.00	11.50		0.89		120.00

Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-3



Job No.: 151064

Job Name: Millcreek Promenade

Test Hole Number: P-4

Soil Classification: Silty SAND

Test Hole Depth (ft): 7

Tested By: RCG

Test Hole Diameter (inches): 8

Date Excavated: 4/11/2016

Date Tested: 4/12/2016

Time Interval of Presoak: 24 hours

Amount of Water Used / Comments: 20

Date / Time

Start: 4/11/16 10:50

Stop: 4/12/16 10:50

"It" is the tested infiltration rate.

Time interval, Δt Initial Depth to Water, D_0

Final Depth to Water, D_f Total Depth of Test Hole, D_T

2Test Hole Radius, r

The conversion equation is used:

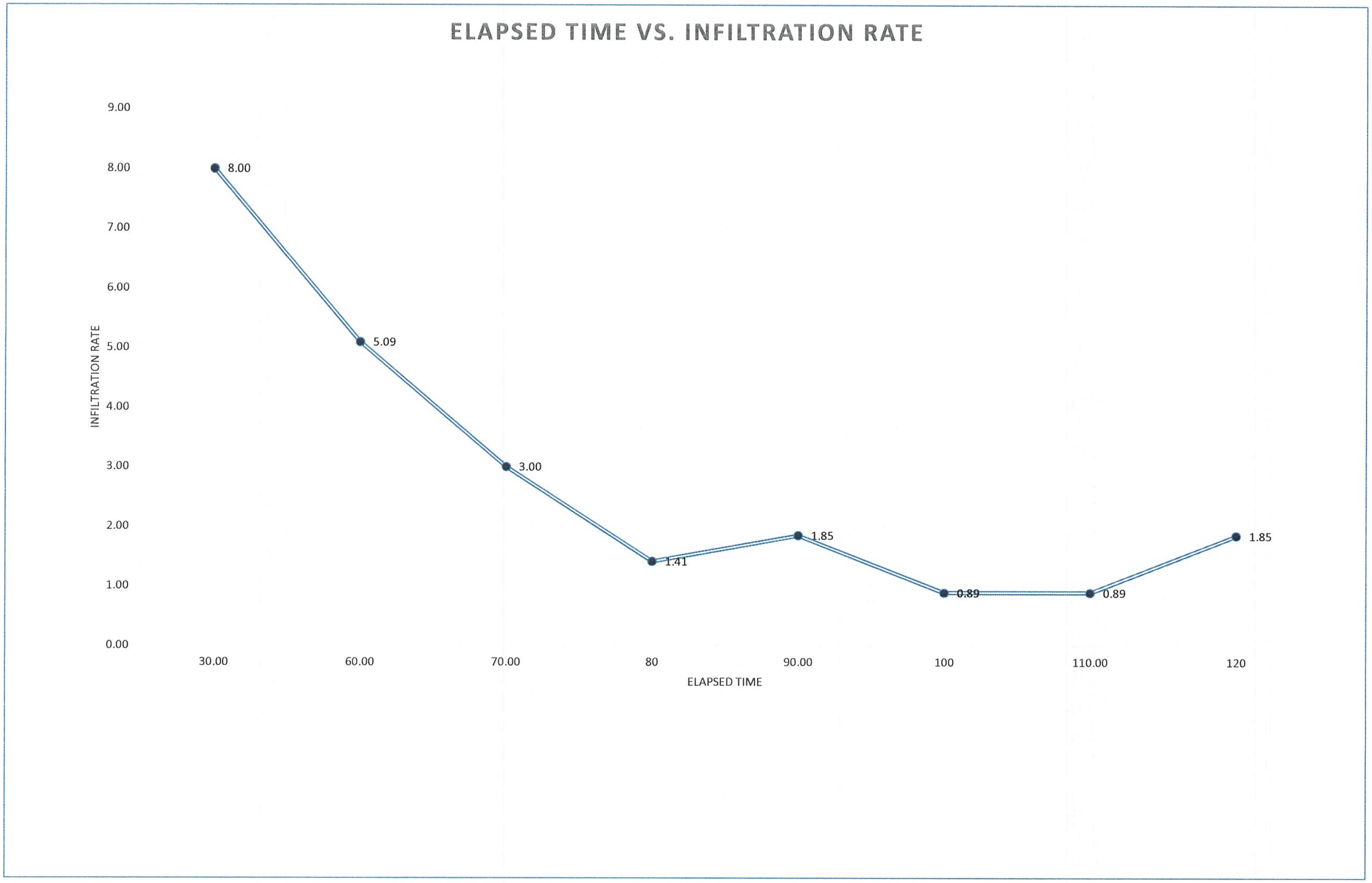
"Havg" is the average head height over the time interval.

$$It = \frac{\Delta H\ 60\ r}{\Delta t(r+2Havg)}$$

Time	Time Interval (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Water Level Drop (Inches)	Percolation Rate (Min./Inch)	Total Depth of Percolation Hole
10:56 – 11:26	30	72	81	9.00	4	79.00
11:26 – 11:56	30	72	79	7.00	5	79.00
11:56 – 12:06	10	67	69	2.00	5	74.00
12:06 – 12:16	10	67	68	1.00	10	74.00
12:16 – 12:26	10	62	64	2.00	5	74.00
12:26 – 12:36	10	62	63	1.00	10	74.00
12:36 – 12:46	10	62	63	1.00	10	74.00
12:46 – 12:56	10	62	64	2.00	5	74.00

Time interval Δt	Initial Water H_0	Final Water H_f	Total Depth of Test Hole D_t	Raduis of Perc Hole r	ΔH	H Avg	ΔH 60 r)/(Δt (r+2Havg)) It	ELAPSED TIME Δt
30.00	7.00	-2.00	79.00	4.00	9.00	2.50	8.00	30.00
30.00	7.00	0.00	79.00	4.00	7.00	3.50	5.09	60.00
10.00	7.00	5.00	74.00	4.00	2.00	6.00	3.00	70.00
10.00	7.00	6.00	74.00	4.00	1.00	6.50	1.41	80.00
10.00	12.00	10.00	74.00	4.00	2.00	11.00	1.85	90.00
10.00	12.00	11.00	74.00	4.00	1.00	11.50	0.89	100.00
10.00	12.00	11.00	74.00	4.00	1.00	11.50	0.89	110.00
10.00	12.00	10.00	74.00	4.00	2.00	11.00	1.85	120.00

Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-4



Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-5
Soil Classification: Silty SAND
Test Hole Depth (ft): 7

Tested By: RCG
Test Hole Diameter (inches): 8
Date Excavated: 4/11/2016
Date Tested: 4/12/2016

Time Interval of Presoak
24 hours

Amount of Water Used / Comments
20

Date / Time
Start 4/11/16 10:50
Stop 4/12/16 10:50

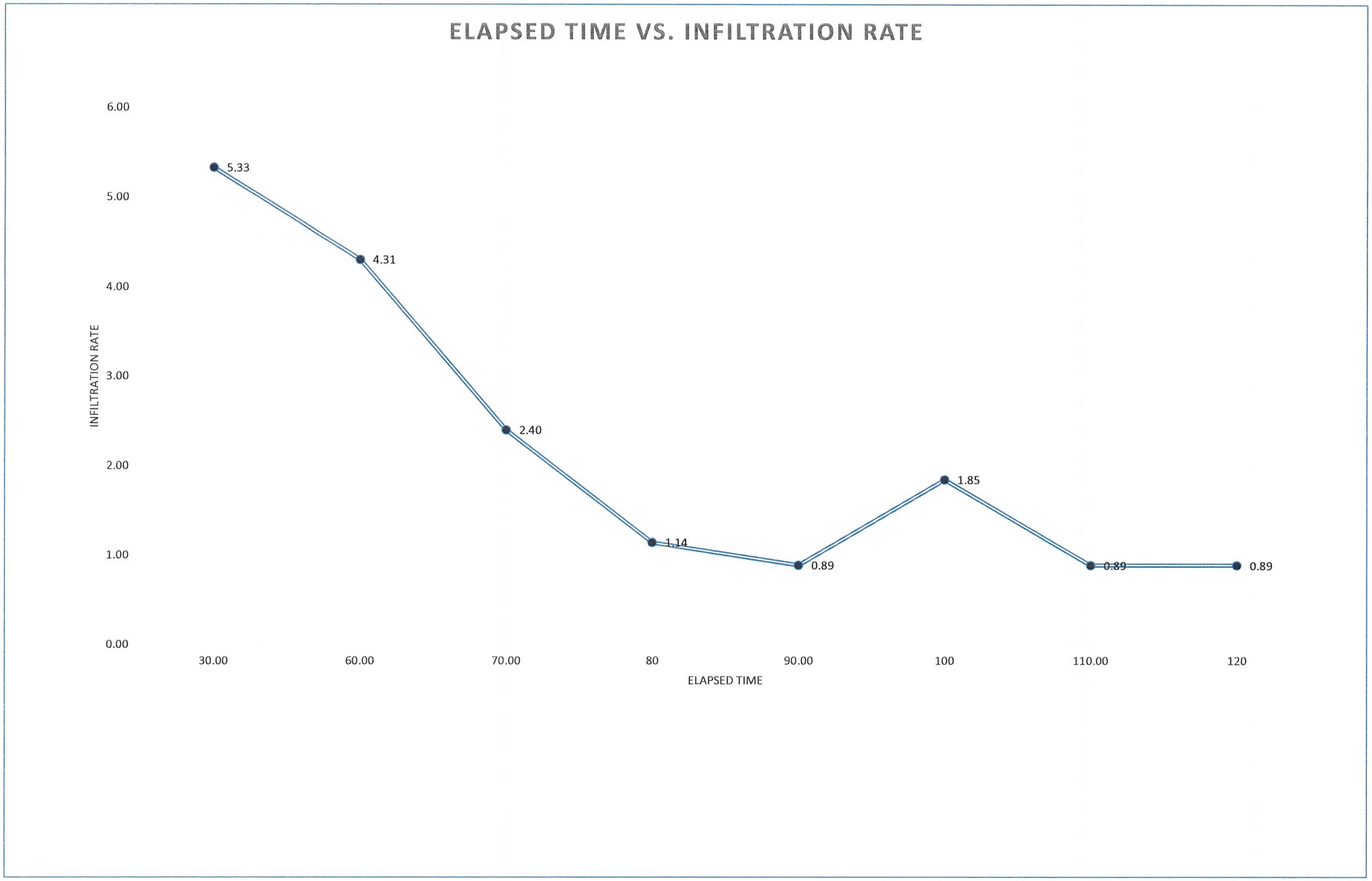
"It" is the tested infiltration rate.
Time interval, Δt Initial Depth to Water, D_0
Final Depth to Water, D_f Total Depth of Test Hole, D_T
2Test Hole Radius, r
The conversion equation is used:
"Havg" is the average head height over the time interval.

$$It = \frac{\Delta H\ 60\ r}{\Delta t(r+2Havg)}$$

Time	Time Interval (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Water Level Drop (Inches)	Percolation Rate (Min./Inch)	Total Depth of Percolation Hole
10:57 11:27	30	72	80	8.00	4	80.00
11:27 11:57	30	72	79	7.00	5	80.00
11:57 12:07	10	68	70	2.00	5	77.00
12:07 12:17	10	68	69	1.00	10	77.00
12:17 12:27	10	65	66	1.00	10	77.00
12:27 12:37	10	65	67	2.00	5	77.00
12:37 12:47	10	65	66	1.00	10	77.00
12:47 12:57	10	65	66	1.00	10	77.00

Time interval Δt	Initial Water H_0	Final Water H_f	Total Depth of Test Hole D_T	Raduis of Perc Hole r	ΔH	H Avg	ΔH 60 r)/(Δt (r+2Havg)) It	ELAPSED TIME Δt
30.00	8.00	0.00	80.00	4.00	8.00	4.00	5.33	30.00
30.00	8.00	1.00	80.00	4.00	7.00	4.50	4.31	60.00
10.00	9.00	7.00	77.00	4.00	2.00	8.00	2.40	70.00
10.00	9.00	8.00	77.00	4.00	1.00	8.50	1.14	80.00
10.00	12.00	11.00	77.00	4.00	1.00	11.50	0.89	90.00
10.00	12.00	10.00	77.00	4.00	2.00	11.00	1.85	100.00
10.00	12.00	11.00	77.00	4.00	1.00	11.50	0.89	110.00
10.00	12.00	11.00	77.00	4.00	1.00	11.50	0.89	120.00

Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-5



Job No.: 151064

Job Name: Millcreek Promenade

Test Hole Number: P-6

Soil Classification: Silty SAND

Test Hole Depth (ft): 7.3

Tested By: RCG

Test Hole Diameter (inches): 8

Date Excavated: 4/11/2016

Date Tested: 4/12/2016

Time Interval of Presoak: 24 hours

Amount of Water Used / Comments: 20

Date / Time

Start: 4/11/16 10:50

Stop: 4/12/16 10:50

"It" is the tested infiltration rate.

Time interval, Δt

Initial Depth to Water, D_0

Final Depth to Water, D_f

Total Depth of Test Hole, D_T

2Test Hole Radius, r

The conversion equation is used:

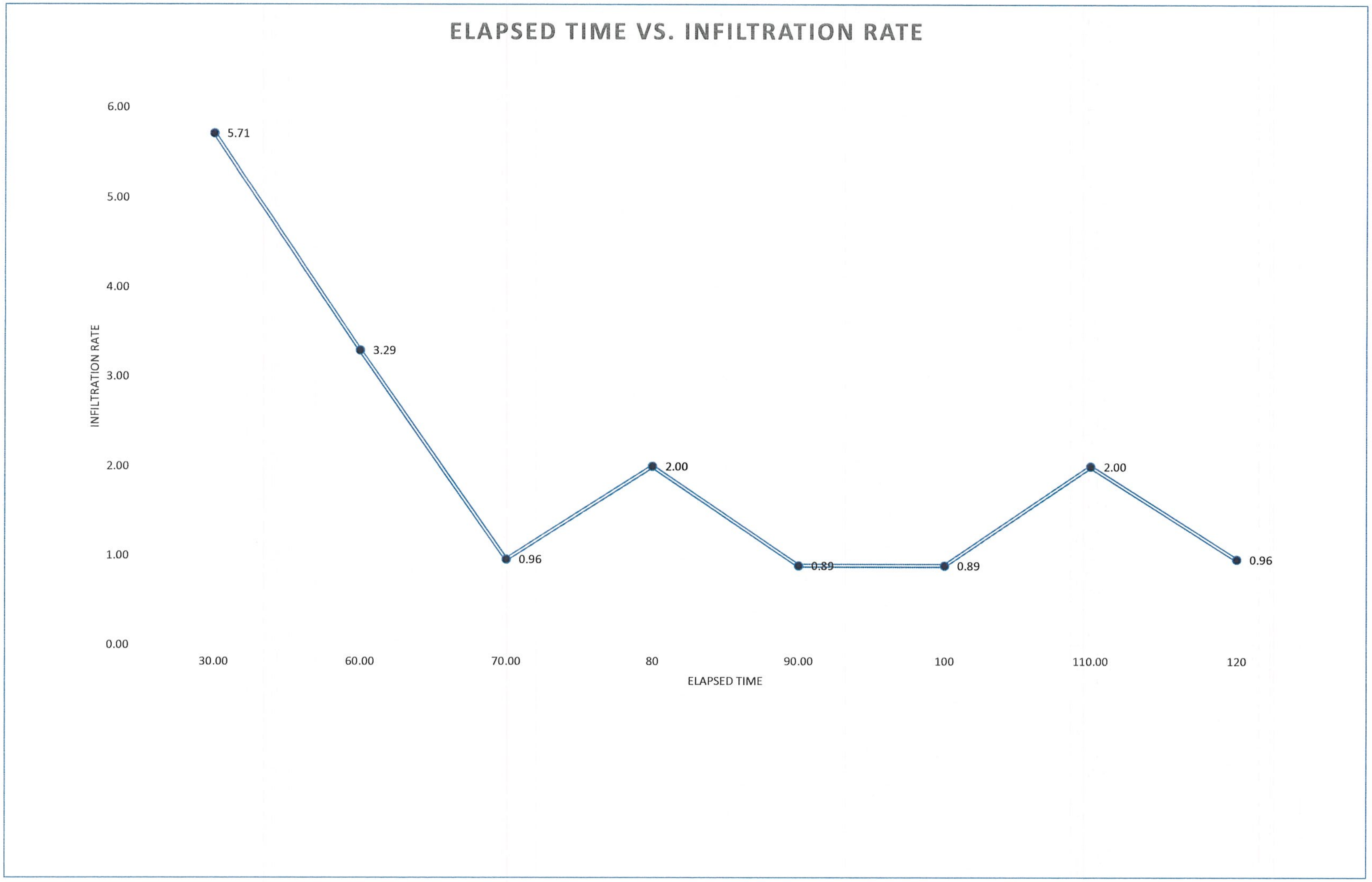
"Havg" is the average head height over the time interval.

$$It = \frac{\Delta H\ 60\ r}{\Delta t(r+2Havg)}$$

Time	Time Interval (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Water Level Drop (Inches)	Percolation Rate (Min./Inch)	Total Depth of Percolation Hole
10:58 – 11:28	30	76	86	10.00	3	86.00
11:28 – 11:58	30	76	83	7.00	5	86.00
11:58 – 12:08	10	74	75	1.00	10	85.00
12:08 – 12:18	10	74	76	2.00	5	85.00
12:18 – 12:28	10	73	74	1.00	10	85.00
12:28 – 12:38	10	73	74	1.00	10	85.00
12:38 – 12:48	10	73	75	2.00	5	84.00
12:48 – 12:58	10	73	74	1.00	10	84.00

Time interval Δt	Initial Water H_0	Final Water H_f	Total Depth of Test Hole D_T	Raduis of Perc Hole r	ΔH	H Avg	ΔH 60 r)/(Δt (r+2Havg)) It	ELAPSED TIME Δt
30.00	10.00	0.00	86.00	4.00	10.00	5.00	5.71	30.00
30.00	10.00	3.00	86.00	4.00	7.00	6.50	3.29	60.00
10.00	11.00	10.00	85.00	4.00	1.00	10.50	0.96	70.00
10.00	11.00	9.00	85.00	4.00	2.00	10.00	2.00	80.00
10.00	12.00	11.00	85.00	4.00	1.00	11.50	0.89	90.00
10.00	12.00	11.00	85.00	4.00	1.00	11.50	0.89	100.00
10.00	11.00	9.00	84.00	4.00	2.00	10.00	2.00	110.00
10.00	11.00	10.00	84.00	4.00	1.00	10.50	0.96	120.00

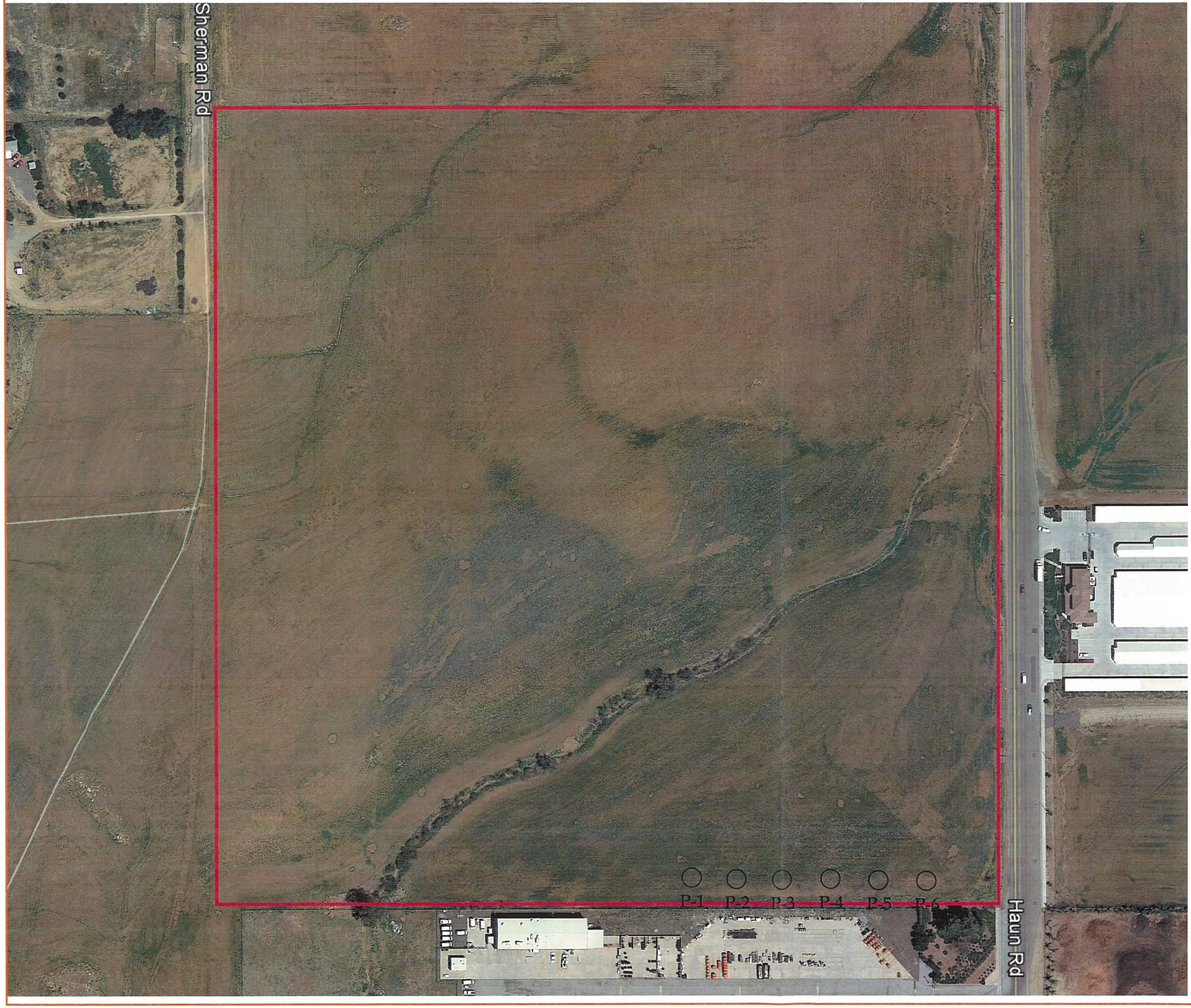
Job No.: 151064
Job Name: Millcreek Promenade
Test Hole Number: P-6



Geotechnical Boring Log MW-1

Date: March 16, 2016	Project Name: Mill Creek Promenade — Page: 1 of 1
Project Number: 151064-11A	Logged By: SNJ
Drilling Company: Drilling It	Type of Rig: CME45B
Drive Weight (lbs): 140	Drop (in): 30 — Hole Diameter (in): 8
Top of Hole Elevation (ft): See Map	Hole Location: See Percolation Location Map

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Old Alluvial Deposits (Qof):**
					SM	Silty SAND; dark brown, dry, dense, some coarse sand, mostly fine and medium sand, fine gravel
5						Orange/reddish brown, trace clay
10						
					SC	Clayey SAND; reddish brown, slightly moist, fine sand and clay nodules, some medium sand, gravel
						Refusal
15						End of Boring 15 feet
						No Groundwater
20						
25						
30						



LEGEND

Locations are Approximate

Symbols

○ P-6 - infiltration Test Location

North

INFILTRATION LOCATION MAP

LOCATED SOUTHWEST OF GARBANI ROAD AND ON WEST SIDE OF HAUN ROAD

CITY OF MENIFEE, RIVERSIDE COUNTY, CALIFORNIA

APN 360-350-011 AND 360-350-017

PROJECT	PROPOSED MILLCREEK PROMENADE		
CLIENT	SHERMAN & HAUN, LLC		
PROJECT NO.	151064-12A		
DATE	JULY 2016		
SCALE	1:160		
DWG XREFS			
REVISION			
DRAWN BY	JDG	PLATE	1 OF 1

ESGS INC.

Geotechnical, Environmental, and Materials Testing Consultants

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

HISTORICAL/ARCHAEOLOGICAL RESOURCES SURVEY REPORT

RANCHO BONITA PROJECT

Citiy of Menifee
Riverside County, California

For Submittal to:

Community Development Department
City of Menifee
29995 Evans Road, West Annex
Menifee, CA 92586

Prepared for:

Sherman & Garbani, LLC
31103 Rancho Viejo Road, #535
San Juan Capistrano, CA 92675

Prepared by:

CRM TECH
1016 E. Cooley Drive, Suite A/B
Colton, CA 92324

Bai "Tom" Tang, Principal Investigator
Michael Hogan, Principal Investigator

January 7, 2016
CRM TECH Contract No. 2998

Title: Historical/Archaeological Resources Survey Report: Rancho Bonita Project, City of Menifee, Riverside County, California

Author(s): Bai "Tom" Tang, Principal Investigator/Historian
Ben Kerridge, Archaeologist/Report Writer
Nina Gallardo, Archaeologist/Native American Liaison

Consulting Firm: CRM TECH
1016 E. Cooley Drive, Suite A/B
Colton, CA 92324
(909) 824-6400

Date: January 7, 2016

For Submittal to: Community Development Department
City of Menifee
29995 Evans Road, West Annex
Menifee, CA 92586
(951) 723-3880

Prepared for: Nicholas Brose, Project Manager
Sherman & Garbani, LLC
31103 Rancho Viejo Road, #535
San Juan Capistrano, CA 92675
(949) 874-6164

USGS Quadrangle: Romoland, Calif., 7.5' quadrangle (Section 15, T6S R3W, San Bernardino Baseline and Meridian)

Project Size: Approximately 18 acres

Keywords: Menifee Valley, southwestern Riverside County; Assessor's Parcel Number 360-350-006; Phase I historical/archaeological resources survey; no "historical resources" under CEQA

MANAGEMENT SUMMARY

Between November 2015 and January 2016, at the request of Sherman & Garbani, LLC, CRM TECH performed a cultural resources study on 18 acres of vacant land in the City of Menifee, Riverside County, California. The subject property of the study consists of Assessor's Parcel Number 360-350-006, located on the south side of Garbani Road between Huan Road and Sherman Road, in the northeast quarter of Section 15, T4S R5E, San Bernardino Baseline and Meridian.

The study is part of the environmental review process for a proposed mixed-use development project known as Rancho Bonita, which entails the construction of a 210-unit townhome community and a neighborhood shopping center with two commercial buildings. The City of Menifee, as the lead agency for the project, required the study in compliance with the California Environmental Quality Act (CEQA). The purpose of the study is to provide the City with the necessary information and analysis to determine whether the proposed project would cause substantial adverse changes to any "historical resources," as defined by CEQA, that may exist in or around the project area.

In order to identify such resources, CRM TECH conducted a historical/archaeological resources records search, pursued historical background research, contacted Native American representatives, and carried out an intensive-level field survey. Through the various avenues of research, this study did not encounter any "historical resources" within or adjacent to the project area. Therefore, CRM TECH recommends to the City of Menifee a finding of *No Impact* regarding cultural resources.

No further cultural resources investigation is recommended for the project unless development plans undergo such changes as to include areas not covered by this study. However, if buried cultural materials are encountered during any earth-moving operations associated with the project, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the finds.

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LIST OF FIGURES

INTRODUCTION

Between November 2015 and January 2016, at the request of Sherman & Garbani, LLC, CRM TECH performed a cultural resources study on 18 acres of vacant land in the City of Menifee, Riverside County, California (Figure 1). The subject property of the study consists of Assessor's Parcel Number 360-350-006, located on the south side of Garbani Road between Huan Road and Sherman Road, in the northeast quarter of Section 15, T4S R5E, San Bernardino Baseline and Meridian (Figure 2).

The study is part of the environmental review process for a proposed mixed-use development project known as Rancho Bonita, which entails the construction of a 210-unit townhome community and a neighborhood shopping center with two commercial buildings. The City of Menifee, as the lead agency for the project, required the study in compliance with the California Environmental Quality Act (CEQA; PRC §21000, et seq.). The purpose of the study is to provide the City with the necessary information and analysis to determine whether the proposed project would cause substantial adverse changes to any "historical resources," as defined by CEQA, that may exist in or around the project area.

In order to identify such resources, CRM TECH conducted a historical/archaeological resources records search, pursued historical background research, contacted Native American representatives, and carried out an intensive-level field survey. The following report is a complete account of the methods, results, and final conclusion of the study. Personnel who participated in the study are named in the appropriate sections below, and their qualifications are provided in Appendix 1.

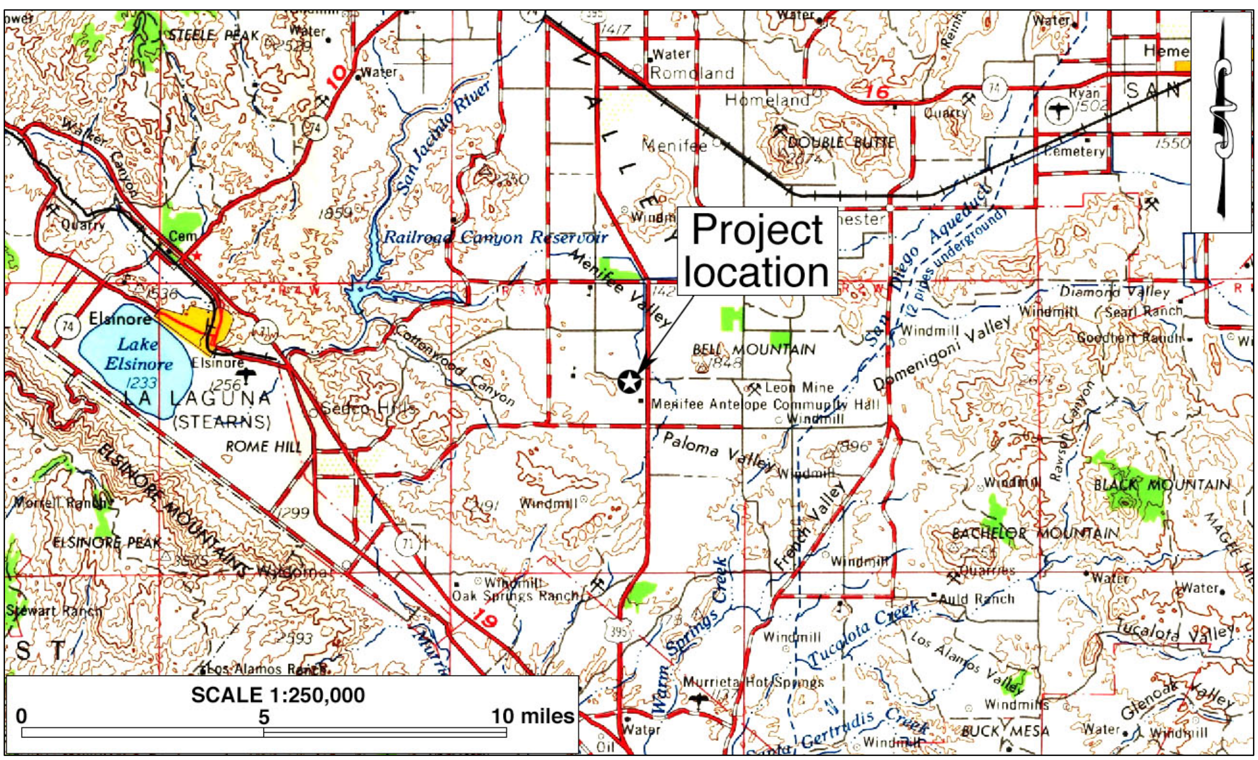


Figure 1. Project vicinity. (Based on USGS Santa Ana, Calif., 1:250,000 quadrangle [USGS 1979a])

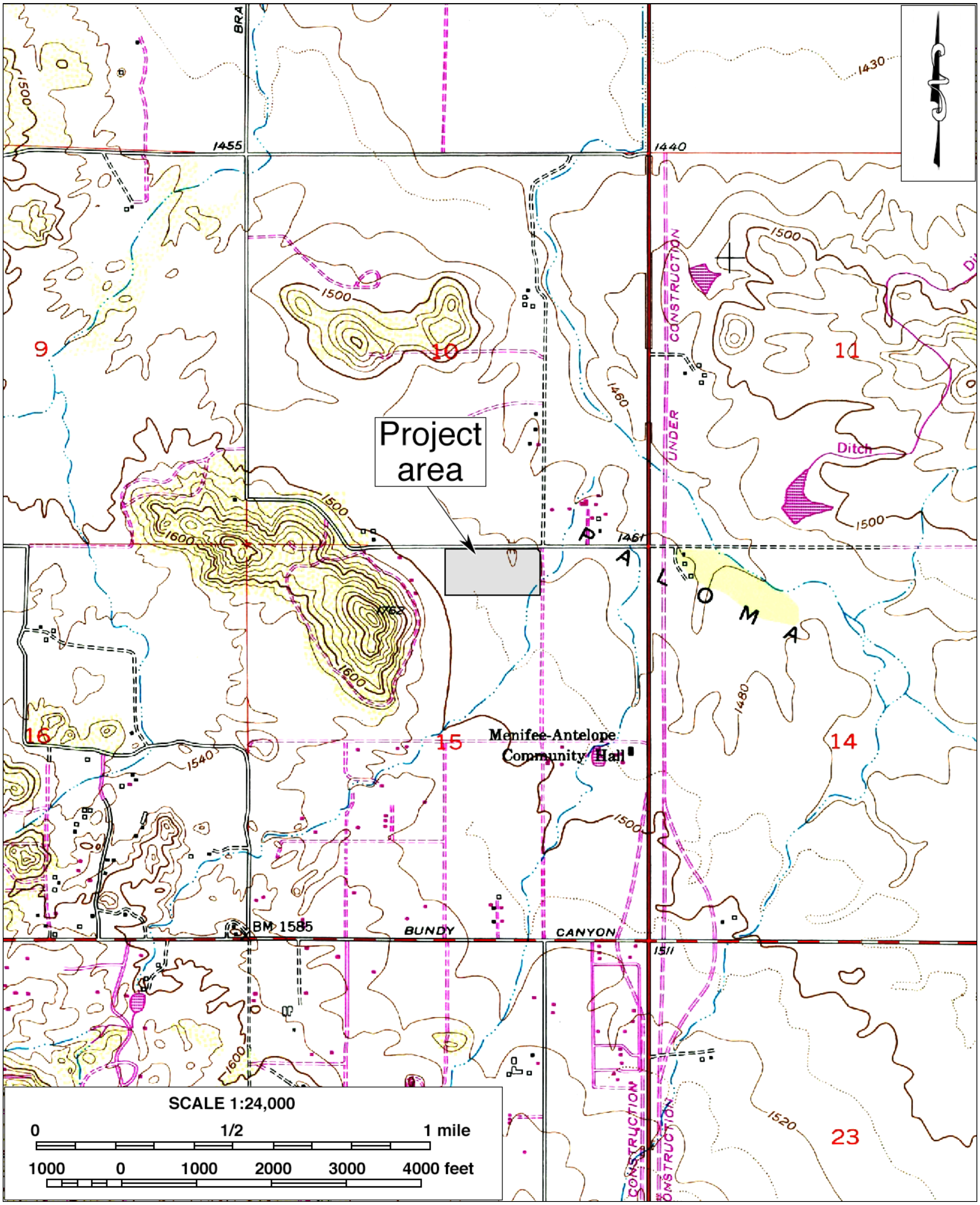


Figure 2. Project area. (Based on USGS Romoland, Calif., 1:24,000 quadrangle [USGS 1979b])

SETTING

CURRENT NATURAL SETTING

The City of Menifee is situated in the southern portion of the San Jacinto Subbasin of the Santa Ana Watershed, in a northeast-southwest trending, semi-arid inland alluvial valley complex bounded on the northeast by the San Jacinto Mountains and on the southwest by the Santa Ana Mountains. The climate and environment of the region are typical of southern California's inland valleys, with temperatures in the region reaching over 100 degrees Fahrenheit in summer and dipping to near freezing in winter. Average annual precipitation is approximately 12 inches (US Climate Data 2015).

The project area consists of rectangular-shaped parcel of agricultural land that is currently under fallow. It is surrounded mostly by other parcels of open land, but adjoins an existing residential neighborhood to the north, across Garbani Road (Figure 3). Elevations in the project area range approximately from 1,470 feet to 1,500 feet above mean sea level. The terrain is relatively level, with a gradual incline towards a large hill located approximately 450 feet to the west (Figure 3). The project area has been graded and its vegetation removed, leaving a light regrowth of Russian thistle and buckwheat. The soil contains a significant amount of small to large rocks, with the highest concentrations in the northeast corner.

Figure 3. Overview of the project area. (View to the west; photo taken on December 3, 2015)

CULTURAL SETTING

Prehistoric Context

The earliest evidence of human occupation in western Riverside County was discovered below the surface of an alluvial fan in the northern portion of the Lakeview Mountains, overlooking the San Jacinto Valley, with radiocarbon dates clustering around 9,500 B.P. (Horne and McDougall 2008). Another site found near the shoreline of Lake Elsinore, close to the confluence of Temescal Wash and the San Jacinto River, yielded radiocarbon dates between 8,000 and 9,000 B.P. (Grenda 1997). Additional sites with isolated Archaic dart points, bifaces, and other associated lithic artifacts from the same age range have been found in the nearby Cajon Pass area of San Bernardino County, typically atop knolls with good viewsheds (Basgall and True 1985; Goodman and McDonald 2001; Goodman 2002; Milburn et al. 2008).

The cultural prehistory of southern California has been summarized into numerous chronologies, including those developed by Chartkoff and Chartkoff (1984), Warren (1984), and others. Specifically, the prehistory of Riverside County has been addressed by O'Connell et al. (1974), McDonald et al. (1987), Keller and McCarthy (1989), Grenda (1993), Goldberg (2001), and Horne and McDougall (2008). Although the beginning and ending dates of different cultural horizons vary regionally, the general framework of the prehistory of western Riverside County can be broken into three primary periods:

- Paeloindian Period (ca. 18,000-9,000 B.P.): Native peoples of this period created fluted spearhead bases designed to be hafted to wooden shafts. The distinctive method of thinning bifaces and spearhead preforms by removing long, linear flakes leaves diagnostic Paleoindian markers at tool-making sites. Other artifacts associated with the Paleoindian toolkit include choppers, cutting tools, retouched flakes, and perforators. Sites from this period are very sparse across the landscape and most are deeply buried.
- Archaic Period (ca. 9,000-1,500 B.P.): Archaic sites are characterized by abundant lithic scatters of considerable size with many biface thinning flakes, bifacial preforms broken during manufacture, and well-made groundstone bowls and basin metates. As a consequence of making dart points, many biface thinning waste flakes were generated at individual production stations, which is a diagnostic feature of Archaic sites.
- Late Prehistoric Period (ca. 1,500 B.P.-contact): Sites from this period typically contain small lithic scatters from the manufacture of small arrow points, expedient groundstone tools such as tabular metates and unshaped manos, wooden mortars with stone pestles, acorn or mesquite bean granaries, ceramic vessels, shell beads suggestive of extensive trading networks, and steatite implements such as pipes and arrow shaft straighteners.

Ethnohistoric Context

According to most schemes, the present-day Menifee area belonged to the Late Prehistoric San Luis Rey Complex, which has been equated with the ethnohistoric Luiseño Indians (True 1966). The San Luis Rey Complex has been divided into San Luis Rey I and San Luis Rey II, dating to A.D. 1400-1750 and A.D. 1750-1850, respectively, overlapping the Protohistoric and early Historic Periods. Artifacts and features typical of the San Luis Rey Complex include triangular (e.g., Cottonwood series) projectile points, bone awls, stone and shell artifacts for adornment, groundstone, bedrock milling features, and human cremations.

The Luiseño is a Takic-speaking people whose territory extended from present-day Riverside to Escondido and Oceanside. The name of the group derived from Mission San Luis Rey, which held jurisdiction over most of the traditional Luiseño territory during the late 18th and early 19th centuries. Luiseño history, as recorded in traditional songs, tells the creation story from the birth of the first people, the *kaamalam*, to the sickness, death, and cremation of *Wiyoot*, the most powerful and wise one, at Lake Elsinore. In modern anthropological literature, the leading sources on Luiseño culture and history are Kroeber (1925), Strong (1929), and Bean and Shipek (1978).

Anthropologists have divided the Luiseño into several autonomous lineages or kin groups, which represented the basic political unit among most southern California Indians. According to Bean and Shipek (1978:551), each Luiseño lineage possessed a permanent base camp, or village, on the valley floor and another in the mountain regions for acorn collection. Luiseño villages were made up of family members and relatives, where chiefs of the village inherited their position and each village owned its own land. Villages were usually located in sheltered canyons or near year-round sources of freshwater, always near subsistence resources.

Nearly all resources of the environment were exploited by the Luiseño in a highly developed seasonal mobility system. The Luiseño people were primarily hunters and gatherers. They collected seeds, roots, wild berries, acorns, wild grapes, strawberries, wild onions, and prickly pear cacti, and hunted deer, elks, antelopes, rabbits, wood rats, and a variety of insects. Bows and arrows, atlatls or spear throwers, rabbit sticks, traps, nets, clubs, and slings were the main hunting tools. Each lineage had exclusive hunting and gathering rights in their procurement ranges. These boundaries were respected and only crossed with permission (Bean and Shipek 1978:551).

It is estimated that when Spanish colonization of Alta California began in 1769, the Luiseño had approximately 50 active villages with an average population of 200 each, although other estimates place the total Luiseño population at 4,000-5,000 (Bean and Shipek 1978:557). Some of the villages were forcefully moved to the Spanish missions, while others were largely left intact (*ibid.*:558). Ultimately, Luiseño population declined rapidly after European contact because of diseases such as small pox as well as harsh living conditions at the missions and, later, on the Mexican ranchos, where the Native people often worked as seasonal ranch hands.

After the American annexation of Alta California, the large number of non-Native settlers further eroded the foundation of the traditional Luiseño society. During the latter half of the 19th century, almost all of the remaining Luiseño villages were displaced, their occupants eventually removed to the various reservations. Today, the nearest Native American groups of Luiseño heritage live on the Soboba, Pechanga, and Pala Indian Reservations.

Historic Context

In California, the so-called "historic period" began in 1769, when an expedition sent by the Spanish authorities in Mexico founded Mission San Diego, the first European outpost in Alta California. For several decades after that, Spanish colonization activities were largely confined to the coastal regions, and left little impact on the arid hinterland of the territory. Although the first explorers, including Pedro Fages and Juan Bautista de Anza, traveled through the San Jacinto Subbasin as early as 1772-1774, no Europeans were known to have settled in the vicinity until the beginning of the 19th century (Gunther 1984).

Situated deep in the arid hinterland of Alta California, the San Jacinto Subbasin received little influence from the Spanish/Mexican colonization activities in the coastal regions, although the area was nominally under the control of Mission San Luis Rey, established near present-day Oceanside in

1798 (Gunther 1984). After secularization of the mission system in the 1830s, the Mexican government issued several large land grants in what is now southwestern Riverside County to various prominent citizens in the province. The Menifee area, however, was not included in any of them, and remained public land when California was annexed by the U.S. in 1848.

Around 1880, S. Menifee Wilson located a gold quartz mine about eight miles south of present-day Perris, and named it the Menifee Quartz Lode (Gunther 1984:320). The area around the mine thus came to be known as the Menifee Valley. Other miners began to arrive in the valley, and the Menifee Mining District was soon organized. By the time Riverside County was created in 1893, Menifee had also become an important grain- and hay-growing area (*ibid*). It remained a farming and mining community well into the 20th century, but in the most recent decades residential and commercial development has increasingly becoming the driving force in regional growth. As the ongoing urban expansion greatly transformed the socioeconomic landscape of the area, in October 2008 Menifee incorporated as the 26th city in Riverside County.

RESEARCH METHODS

RECORDS SEARCH

On November 13, 2015, CRM TECH archaeologist Nina Gallardo completed the records search at the Eastern Information Center (EIC), University of California, Riverside. During the records search, Gallardo examined maps and records on file at the EIC for previously identified cultural resources and existing cultural resources reports within a one-mile radius of the project area. Previously identified cultural resources include properties designated as California Historical Landmarks, Points of Historical Interest, or Riverside County Landmarks, as well as those listed in the National Register of Historic Places, the California Register of Historical Resources, or the California Historical Resources Inventory.

HISTORICAL RESEARCH

Historical background research for this study was conducted by CRM TECH principle investigator/ historian Bai "Tom" Tang. In addition to published literature in local and regional history, sources consulted during the research included the U.S. General Land Office (GLO) land survey plat map dated 1857, U.S. Geological Survey (USGS) topographic maps dated 1901-1979, and aerial photographs taken between 1938 and 2014. The historic maps are collected at the Science Library of the University of California, Riverside, and the California Desert District of the U.S. Bureau of Land Management, located in Moreno Valley. The aerial photographs are available at the NETR Online website and through the Google Earth software.

NATIVE AMERICAN PARTICIPATION

On November 12, 2015, CRM TECH submitted a written request to the State of California's Native American Heritage Commission (NAHC) for a records search in the commission's sacred lands file. In the meantime, CRM TECH notified the nearby Pechanga Band of Luiseño Indians of the upcoming archaeological fieldworks and invited tribal participation. Following the NAHC's recommendations, CRM TECH contacted 34 Native American representatives in the region in writing on December 11 to solicit local Native American input regarding any potential cultural resources concerns over the proposed project. Correspondence between CRM TECH and the Native American representatives are attached to this report in Appendix 2.

FIELD SURVEY

On December 3, 2015, CRM TECH archaeologists Ben Kerridge and John D. Goodman II carried out the intensive-level field survey of the project area with the assistance of Native American monitor Chris Yearyean from the Pechanga Band of Luiseño Indians. The survey was completed on foot by walking parallel north-south transects spaced 15 meters (approximately 50 feet) apart across the project area. In this way, the ground surface in the entire project area was systematically and carefully examined for any evidence of human activities dating to the prehistoric or historic period (i.e., 50 years ago or older). Ground visibility was good to excellent (80-90 percent) due to the lack of heavy vegetation growth.

RESULTS AND FINDINGS

RECORDS SEARCH

According to EIC records, the project area had not been surveyed for cultural resources prior to this study (Figure 4), and no cultural resources had been recorded on or adjacent to the property. Outside the project boundaries but within a one-mile radius, EIC records show more than 60 previous studies covering various tracts of land and linear features (Figure 4). In all, roughly half of the land within the scope of the records search has been surveyed, which resulted in the identification of 28 historical/archaeological sites within the one-mile radius (Table 1).

Of these 28 sites, 21 were of prehistoric—i.e., Native American—origin. These sites consist mainly of bedrock milling features, such as grinding slicks and mortars, although a few of them, located on or near an isolated hill about a half-mile to the north, have been characterized as habitation sites. Typically, the prehistoric sites were concentrated among granitic boulder outcrops in rolling hills or along intermittent creeks in the surrounding area, which is consistent to the established settlement pattern for the aboriginal hunter-gatherer population in inland southern California. The nearest prehistoric site, 33-000636 (CA-RIV-636), was located 0.2 mile to the east and consisted of a single grinding slick.

The other seven sites dated to the historic period and included single-family residences, structural foundations, and refuse deposits. None of these 28 sites was found in the immediate vicinity of the project area. Therefore, none of them requires further consideration during this study.

HISTORICAL RESEARCH

Historic maps consulted for this study indicate that in the 1850s, when the U.S. government conducted the first systematic land survey in the vicinity, no man-made features were found within or adjacent to the project area (Figure 5). The nearest man-made features at that time were a pair of roads, including one identified as "Road to San Bernardino," that ran within a half-mile from the project location and converged about a mile to the southeast (Figure 5). In the 1890s, the project

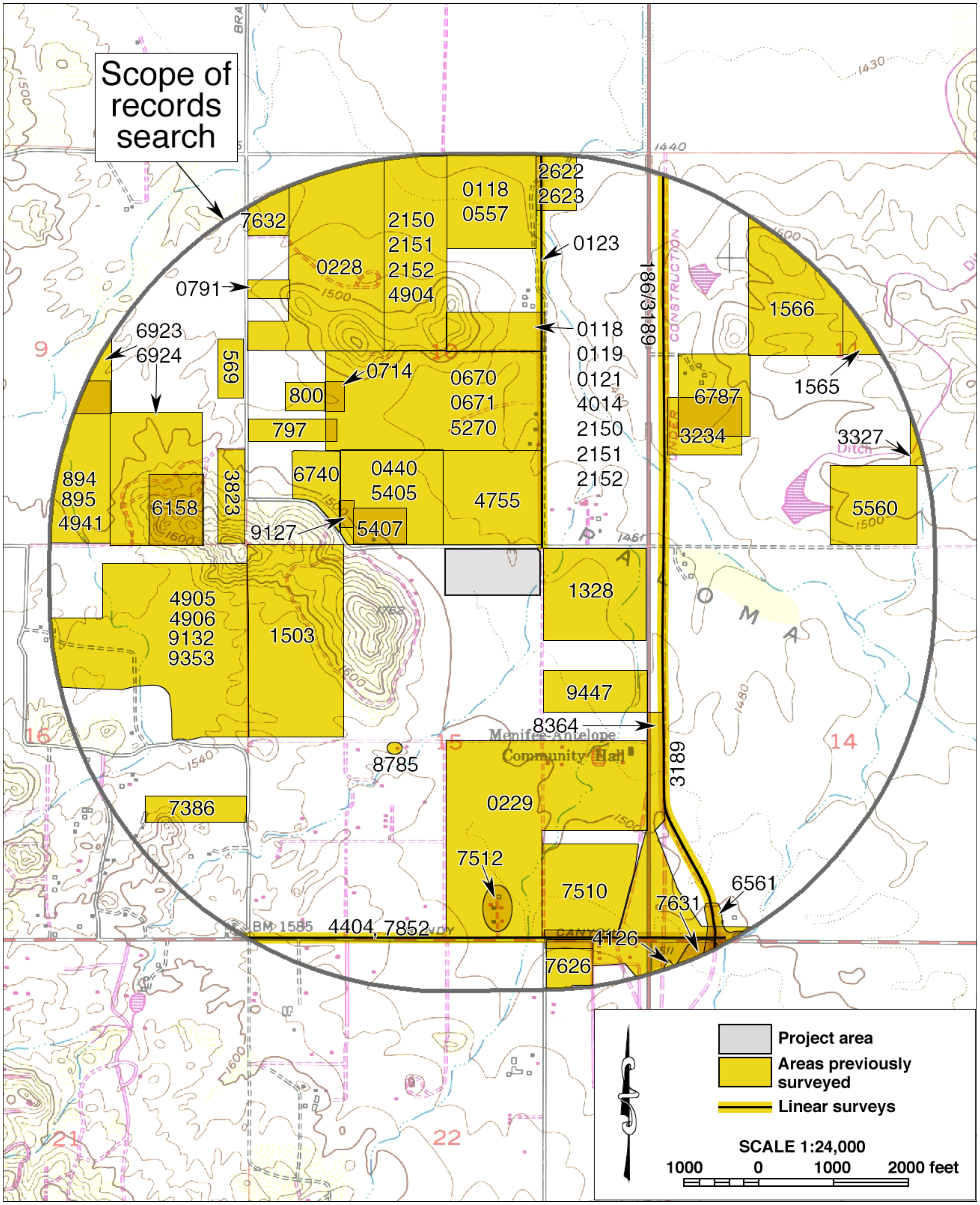


Figure 4. Previous cultural resources studies in the vicinity of the project area, listed by EIC file number. Locations of historical/archaeological sites are not shown as a protective measure.

Table 1. Previously Recorded Cultural Resources within the Scope of the Records Search		
Site No.	**Date Recorded**	**Description**
33-000332	Chace 1963	Camp site
33-000333	Hedges 1981	Village site
33-000337	Kowta 1964	House pit
33-000339	Kowta 1964	Village site
33-000340	Kowta 1964	Lithic scatter
33-000341	Kowta 1964	Rock wall feature
33-000631	Humbert and Hammond 1973	Resource-processing site
33-000632	Humbert 1973	Granitic boulder with mortars
33-000633	Humbert 1973	Granitic outcrop with grinding slicks
33-000634	Humbert and Hammond 1973	Bedrock metates and lithic scatter
33-000635	Humbert and Hammond 1973	Metate slicks
33-000636	Kroesen 1981	Bedrock grinding slick
33-001358	Morin and Waldron	Grinding slick
33-001724	Oxendine 1979	Bedrock mortars and lithic scatter
33-007698	Hedges 1982	Christensen Ranch storage silo
33-008851	Shepard 1997	Bedrock milling feature and lithic scatter
33-011203	McKenna 2001	Bedrock milling feature
33-011242	Sawyer and Braker 2001	Foundations and refuse scatters
33-012888	Bouscaren et al., 2003	Refuse deposits
33-012889	Bouscaren et al., 2003	Refuse scatter
33-014990	Brandman 2006	Bedrock milling features
33-014991	Brandman 2006	Bedrock milling features
33-015987	Ballester 2007	Bedrock milling feature
33-016712	Smith et al. 2007	Charlie Baily Farmstead
33-017046	Bholat 2008	Bedrock milling feature
33-017109	Smith et al. 2007	Single-family residence
33-021009	Schmidt 2012	Foundation
33-023814	Loren-Webb 2013	Refuse scatter

area apparently remained unoccupied and undeveloped, while a rural settlement pattern had emerged in the surrounding area, featuring a few widely scattered buildings linked by a crisscrossing web of roads, including the forerunners of today's Garbani Road and Sherman Road (Figure 6).

Although the surrounding area demonstrated evidence of gradual growth during the course of the 20th century, the project area has remained in use solely as agricultural fields to the present time, and was often under fallow in recent years (Figures 7, 8; NETR Online 1938-2012). Among the notable features in close proximity to the project area today, Garbani Road was present by the early 1950s, Huan Road was built between 1967 and 1978, Sherman Road in its current configuration dates to sometime between 1978 and 1996, and the residential neighborhood north of the project area was developed over the past ten years (Figure 8; NETR Online 1967-2012).

NATIVE AMERICAN PARTICIPATION

In response to CRM TECH's inquiry, the NAHC reported in a letter dated December 9, 2015, that the sacred lands record search identified no Native American cultural resources within the project area, but recommended that local Native American groups be contacted for further information. For that purpose, the NAHC provided a list of potential contacts in the region (see Appendix 2). Upon receiving the NAHC's response, on December 11 CRM TECH sent written requests for comments to

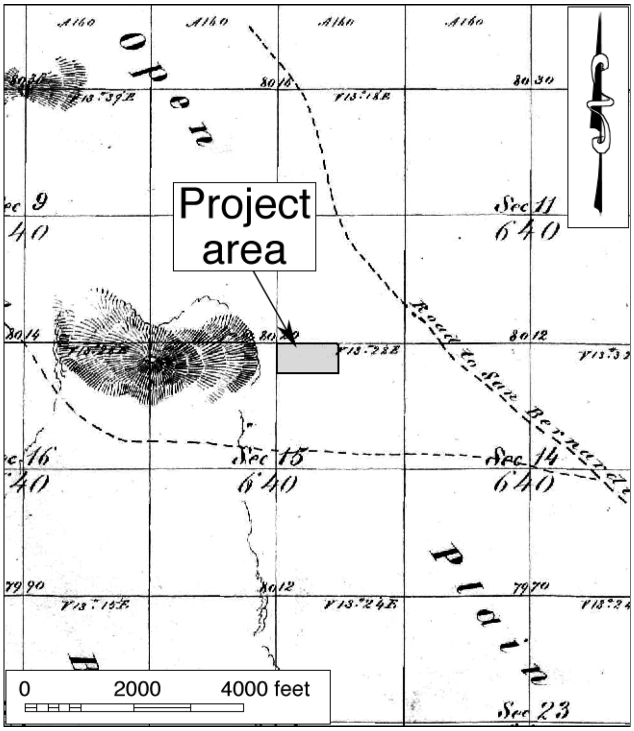


Figure 5. The project area and vicinity in 1855-1857. (Source: GLO 1857)

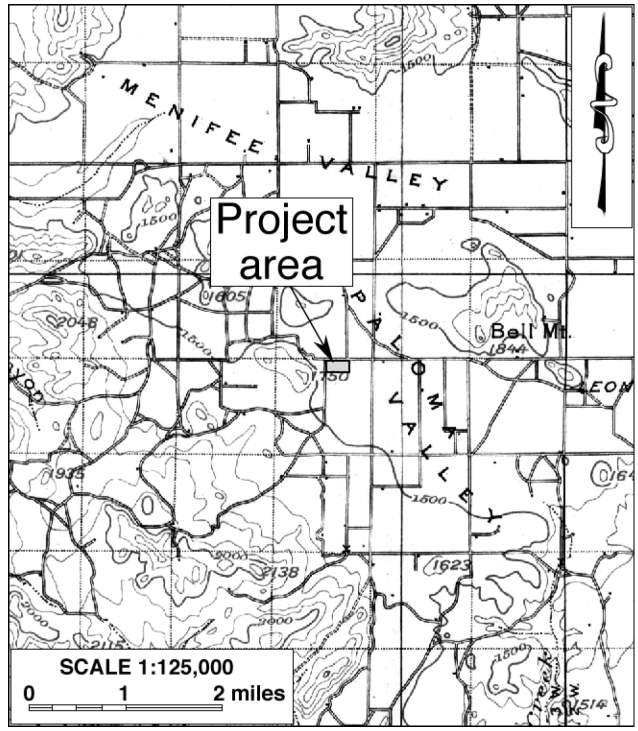


Figure 6. The project area and vicinity in 1897-1998. (Source: USGS 1901)

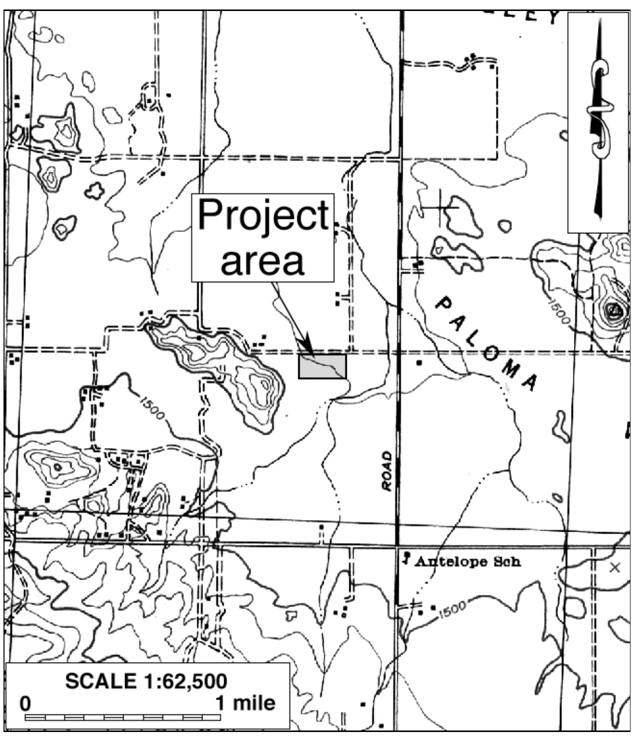


Figure 7. The project area and vicinity in 1939. (Source: USGS 1942)

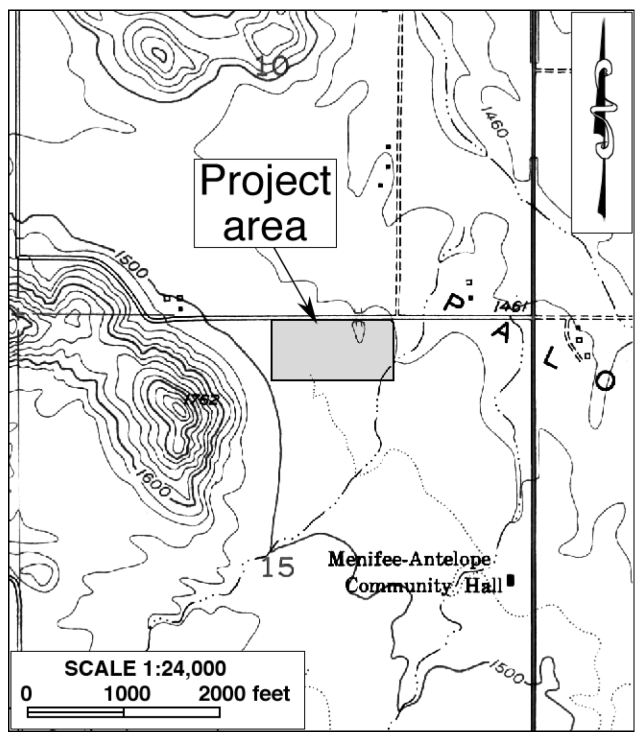


Figure 8. The project area and vicinity in 1951. (Source: USGS 1953)

all 26 individuals on the referral list and the organizations they represent (see Appendix 2). In addition, as referred by these tribal representatives or the appropriate tribal government staff, the following eight individuals were also contacted:

- David L. Saldivar, Tribal Government Affairs Manager, Augustine Band of Cahuilla Indians
- Judy Stapp, Director of Cultural Affairs, Cabazon Band of Mission Indians
- Andreas Heredia, Cultural Director, Cahuilla Band of Indians
- Rob Roy, Environmental Director, La Jolla Band of Luiseño Indians
- Raymond Huaute, Cultural Resources Specialist, Morongo Band of Mission Indians
- John Gomez, Jr., Cultural Resource Coordinator, Ramona Band of the Cahuilla Indians
- Gabriella Rubalcava, Environmental Director, Santa Rosa Band of Cahuilla Indians
- Michael Mirelez, Cultural Resource Coordinator, Torres Martinez Desert Cahuilla Indians

As of this time, four of the tribal representatives contacted have responded in writing (see Appendix 2). Among them, Vincent Whipple, Manager of the Rincon Cultural Resources Department, and Katie Croft, Archaeologist with the Agua Caliente Tribal Historic Preservation Office, indicated that they would defer to other tribes located in closer proximity to the project area, such as the Pechanga Band of Luiseño Indians or the Soboba Band of Luiseño Indians.

Chris Devers, Vice Chairman of the Pauma Band of Luiseño Indians, requested a copy of this report for tribal review. In addition to an opportunity to review this report when completed, Raymond Huaute of the Morongo Band further requested that the tribe's Standard Development Conditions be implemented to address any inadvertent discovery of Native American cultural resources, especially human remains (see Appendix 2).

FIELD SURVEY

The field survey of the project area yielded negative results for potential "historical resources," and no buildings, structures, objects, features, or artifacts of prehistoric or historical origin were encountered. Several piles of large rocks and small boulders were noted on the property, but none of them exhibited any evidence of prehistoric or historical human alteration, such as bedrock milling features.

DISCUSSION

The purpose of this study is to identify any cultural resources within or adjacent to the project area and to assist the City of Menifee in determining whether such resources meet the official definition of "historical resources," as provided in the California Public Resources Code, in particular CEQA. According to PRC §5020.1(j), "'historical resource' includes, but is not limited to, any object, building, site, area, place, record, or manuscript which is historically or archaeologically significant, or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California."

More specifically, CEQA guidelines state that the term "historical resources" applies to any such resources listed in or determined to be eligible for listing in the California Register of Historical

Resources, included in a local register of historical resources, or determined to be historically significant by the Lead Agency (Title 14 CCR §15064.5(a)(1)-(3)). Regarding the proper criteria for the evaluation of historical significance, CEQA guidelines mandate that “generally a resource shall be considered by the lead agency to be ‘historically significant’ if the resource meets the criteria for listing on the California Register of Historical Resources” (Title 14 CCR §15064.5(a)(3)). A resource may be listed in the California Register if it meets any of the following criteria:

(1) Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage.
(2) Is associated with the lives of persons important in our past.
(3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
(4) Has yielded, or may be likely to yield, information important in prehistory or history. (PRC §5024.1(c))

The results of this study have established that no potential historical resources were previously recorded within or adjacent to the project area, and none was encountered during the present survey. In addition, Native American input during this study did not identify any sites of traditional cultural value in the vicinity, and historic maps show no notable cultural features within the project area throughout the historic period. Based on these findings, and in light of the criteria listed above, the present study concludes that *no historical resources exist within or adjacent to the project area*.

CONCLUSION AND RECOMMENDATIONS

CEQA establishes that “a project that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment” (PRC §21084.1). “Substantial adverse change,” according to PRC §5020.1(q), “means demolition, destruction, relocation, or alteration such that the significance of a historical resource would be impaired.”

In summary of the research results outlined above, no “historical resources,” as defined by CEQA, were encountered throughout the course of this study. Therefore, CRM TECH presents the following recommendations to the City of Menifee:

- No historical resources exist within or adjacent to the project area, and thus the project as currently proposed will not cause a substantial adverse change to any known historical resources.
- No further cultural resources investigation is necessary for the proposed project unless development plans undergo such changes as to include areas not covered by this study.
- If buried cultural materials are discovered during any earth-moving operations associated with the project, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the finds.

REFERENCES

Basgall, Mark E., and D. L. True

1985 Archaeological Investigations in Crowder Canyon, 1973-1984: Excavations at Sites SBR-421B, SBR-421C, SBR-421D, and SBR-713, San Bernardino County, California. Report on file, South Central Coastal Information Center, California State University, Fullerton.

Bean, Lowell John, and Florence C. Shipek

1978 Luiseño. In Robert F. Heizer (ed.): *Handbook of North American Indians*, Vol. 8: *California*; pp. 550-563. Smithsonian Institution, Washington, D.C.

Chartkoff, Joseph L., and Kerry Kona Chartkoff

1984 *The Archaeology of California*. Stanford University Press, Stanford, California.

GLO (General Land Office, U.S. Department of the Interior)

1857 Plat Map: Township No. VI North Range No. III West, San Bernardino Meridian; surveyed in 1855-1857.

Goldberg, Susan K. (editor)

2001 Metropolitan Water District of Southern California Eastside Reservoir Project: Final Report of Archaeological Investigations. Report on file, Eastern information Center, University of California, Riverside.

Goodman, John D., II

2002 Archaeological Survey of the Charter Communications Cable Project, Mountaintop Ranger District, San Bernardino National Forest, California. San Bernardino National Forest Technical Report 05-12-BB-102. San Bernardino, California.

Goodman, John D., II, and Meg McDonald

2001 Archaeological Survey of the Southern California Trials Association Event Area, Little Pine Flats, Mountaintop Ranger District, San Bernardino National Forest, California. San Bernardino National Forest Technical Report 05-12-BB-106. San Bernardino, California.

Grenda, Donn

1993 Archaeological Treatment Plan for CA-RIV-2798/H, Lake Elsinore, Riverside County, California. Report on file, Eastern Information Center, University of California, Riverside.

1997 Continuity and Change: 8,500 Years of Lacustrine Adaptation on the Shores of Lake Elsinore. Statistical Research Technical Series 59. Statistical Research, Inc., Tucson, Arizona.

Gunther, Jane Davies

1984 *Riverside County, California, Place Names: Their Origins and Their Stories*. J. D. Gunther, Riverside.

Horne, Melinda C., and Dennis P. McDougall

2008 CA-RIV-6069: Early Archaic Settlement and Subsistence in the San Jacinto Valley, Western Riverside County, California. Report on file, Eastern Information Center, University of California, Riverside.

Keller, Jean S., and Daniel F. McCarthy

1989 Data Recovery at the Cole Canyon Site (CA-RIV-1139), Riverside County, California. *Pacific Coast Archeological Society Quarterly* 25.

Kroeber, Alfred L.

1925 *Handbook of the Indians of California*. Bureau of American Ethnology Bulletin 78. Government Printing Office, Washington, D.C.

McDonald, Meg, Philip J. Wilke, and Andrea Kauss
1987 McCue: An Elko Site in Riverside County. *Journal of California and Great Basin Anthropology* 9(1):46-73.

Milburn, Doug, U.K. Doan, and John D. Goodman, II
2008 Archaeological Investigation at Baldy Mesa-Cajon Divide for the Baldy Mesa Off-Highway-Vehicle Recreation Trails Project San Bernardino National Forest, San Bernardino County, California. San Bernardino National Forest Technical Report 05-12-53-091. San Bernardino, California.

NETR Online
1938-2012 Aerial photographs of the project vicinity. http://www.historicaerials.com.

O'Connell, James F., Philip J. Wilke, Thomas F. King, and Carol L. Mix (editors)
1974 Perris Reservoir Archaeology: Late Prehistoric Demographic Change in Southeastern California. Report on file, Eastern Information Center, University of California, Riverside.

Strong, William Duncan
1929 *Aboriginal Society in Southern California*. University of California Publications in American Archaeology and Ethnology, Vol. 26. Reprinted by Malki Museum Press, Banning, California, 1972.

True, D. L.
1966 Archaeological Differentiation of Shoshonean and Yuman Speaking Groups in Southern California. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Los Angeles.

US Climate Data
2015 Climate: Menifee, California. http://www.usclimatedata.com/climate/menifee/california/united-states/usca1717.

USGS (United States Geological Survey, U.S. Department of the Interior)
1901 Map: Elsinore, Calif. (30', 1:125,000); surveyed in 1897-1898.
1942 Map: Murrieta, Calif. (15', 1:62,500); aerial photographs taken in 1939.
1953 Map: Romoland, Calif. (7.5', 1:24,000); aerial photographs taken in 1951.
1979a Map: Santa Ana, Calif. (1:250,000); 1959 edition revised.
1979b Map: Romoland, Calif. (7.5', 1:24,000); 1953 edition photorevised in 1976.

Warren, Claude N.
1984 The Desert Region. In *California Archaeology*, edited by Michael J. Moratto; pp. 339-430. Academic Press, Orlando, Florida.

APPENDIX 1:
PERSONNEL QUALIFICATIONS

PRINCIPAL INVESTIGATOR/HISTORIAN
Bai "Tom" Tang, M.A.

Education

1988-1993	Graduate Program in Public History/Historic Preservation, UC Riverside.
1987	M.A., American History, Yale University, New Haven, Connecticut.
1982	B.A., History, Northwestern University, Xi'an, China.
2000	"Introduction to Section 106 Review," presented by the Advisory Council on Historic Preservation and the University of Nevada, Reno.
1994	"Assessing the Significance of Historic Archaeological Sites," presented by the Historic Preservation Program, University of Nevada, Reno.

Professional Experience

2002-	Principal Investigator, CRM TECH, Riverside/Colton, California.
1993-2002	Project Historian/Architectural Historian, CRM TECH, Riverside, California.
1993-1997	Project Historian, Greenwood and Associates, Pacific Palisades, California.
1991-1993	Project Historian, Archaeological Research Unit, UC Riverside.
1990	Intern Researcher, California State Office of Historic Preservation, Sacramento.
1990-1992	Teaching Assistant, History of Modern World, UC Riverside.
1988-1993	Research Assistant, American Social History, UC Riverside.
1985-1988	Research Assistant, Modern Chinese History, Yale University.
1985-1986	Teaching Assistant, Modern Chinese History, Yale University.
1982-1985	Lecturer, History, Xi'an Foreign Languages Institute, Xi'an, China.

Honors and Awards

1988-1990	University of California Graduate Fellowship, UC Riverside.
1985-1987	Yale University Fellowship, Yale University Graduate School.
1980, 1981	President's Honor List, Northwestern University, Xi'an, China.

Cultural Resources Management Reports

Preliminary Analyses and Recommendations Regarding California's Cultural Resources Inventory System (with Special Reference to Condition 14 of NPS 1990 Program Review Report). California State Office of Historic Preservation working paper, Sacramento, September 1990.

Numerous cultural resources management reports with the Archaeological Research Unit, Greenwood and Associates, and CRM TECH, since October 1991.

PRINCIPAL INVESTIGATOR/ARCHAEOLOGIST
Michael Hogan, Ph.D., RPA*

Education

1991	Ph.D., Anthropology, University of California, Riverside.
1981	B.S., Anthropology, University of California, Riverside; with honors.
1980-1981	Education Abroad Program, Lima, Peru.
2002	Section 106—National Historic Preservation Act: Federal Law at the Local Level. UCLA Extension Course #888.
2002	"Recognizing Historic Artifacts," workshop presented by Richard Norwood, Historical Archaeologist.
2002	"Wending Your Way through the Regulatory Maze," symposium presented by the Association of Environmental Professionals.
1992	"Southern California Ceramics Workshop," presented by Jerry Schaefer.
1992	"Historic Artifact Workshop," presented by Anne Duffield-Stoll.

Professional Experience

2002-	Principal Investigator, CRM TECH, Riverside/Colton, California.
1999-2002	Project Archaeologist/Field Director, CRM TECH, Riverside.
1996-1998	Project Director and Ethnographer, Statistical Research, Inc., Redlands.
1992-1998	Assistant Research Anthropologist, University of California, Riverside
1992-1995	Project Director, Archaeological Research Unit, U. C. Riverside.
1993-1994	Adjunct Professor, Riverside Community College, Mt. San Jacinto College, U.C. Riverside, Chapman University, and San Bernardino Valley College.
1991-1992	Crew Chief, Archaeological Research Unit, U. C. Riverside.
1984-1998	Archaeological Technician, Field Director, and Project Director for various southern California cultural resources management firms.

Research Interests

Cultural Resource Management, Southern Californian Archaeology, Settlement and Exchange Patterns, Specialization and Stratification, Culture Change, Native American Culture, Cultural Diversity.

Cultural Resources Management Reports

Author and co-author of, contributor to, and principal investigator for numerous cultural resources management study reports since 1986.

Memberships

* Register of Professional Archaeologists; Society for American Archaeology; Society for California Archaeology; Pacific Coast Archaeological Society; Coachella Valley Archaeological Society.

PROJECT ARCHAEOLOGIST/REPORT WRITER
Ben Kerridge, M.A.

Education

2014	Archaeological Field School, Institute for Field Research, Kephallenia, Greece.
2010	M.A., Anthropology, California State University, Fullerton.
2009	Project Management Training, Project Management Institute/CH2M HILL.
2004	B.A., Anthropology, California State University, Fullerton.

Professional Experience

2015-	Project Archaeologist/Report Writer, CRM TECH, Colton, California.
2015	Teaching Assistant, Institute for Field Research, Kephallenia, Greece.
2009-2014	Publications Delivery Manager, CH2M HILL, Santa Ana, California.
2010-	Naturalist, Newport Bay Conservancy, Newport Beach, California.
2009-2010	Senior Commentator, GameReplays.org.
2006-2009	Technical Publishing Specialist, CH2M HILL, Santa Ana, California.
2002-2007	Host and Head Writer, *The Rational Voice* Radio Program, Titan Radio, California State University, Fullerton.
2002-2006	English Composition/College Preparation Tutor, Various Locations, California.

Memberships

Society for California Archaeology; Pacific Coast Archaeological Society

PROJECT ARCHAEOLOGIST/NATIVE AMERICAN LIAISON
Nina Gallardo, B.A.

Education

2004	B.A., Anthropology/Law and Society, University of California, Riverside.

Honors and Awards

2000	Dean’s Honors List, University of California, Riverside.

Professional Experience

2004-	Project Archaeologist, CRM TECH, Riverside/Colton, California.

PROJECT ARCHAEOLOGIST
John D. Goodman II, M.S.

Education

1993	M.S., Anthropology, University of California, Riverside.
1985	B.S., Anthropology, University of California, Riverside.
2005	Training Session on Senate Bill 18; sponsored by the Government Office of Planning and Research, Riverside, California.
2002	Protecting Heritage Resources under Section 106 of the National Historic Preservation Act; sponsored by the Advisory Council on Historic Preservation, Arcadia, California.
2000	Federal Historic Preservation Law for the Forest Service; sponsored by the Advisory Council on Historic Preservation, San Bernardino, California.
1994	National Environmental Policy Act workshop; Flagstaff, Arizona.

Professional Experience

2011-	Project Archaeologist/Artifact Analyst, CRM TECH, Colton, California.
2008-	Independent sub-contractor (faunal analyses and historical archaeology).
2006-2008	Project Director, Statistical Research, Inc., Redlands, California.
2003-2006	Project Manager/Principal Investigator, Stantec Consulting, Inc. (formerly The Keith Companies [TKC]), Palm Desert, California.
2000-2003	Supervisory Archaeologist, Heritage Resources Program, San Bernardino National Forest, United States Forest Service, Department of Agriculture.
1993-2000	Project Manager, Historical Archaeologist, Faunal Specialist, Human Osteologist, and Shell Specialist, SWCA Inc., Environmental Consultants, Flagstaff, Arizona.
1982-1993	Project Director, Staff Archaeologist, Physical Anthropologist, Faunal Specialist, and Lithic Specialist, Archaeological Research Unit, University of California, Riverside (part-time).

Research Interests

Subsistence practices and related technologies of both prehistoric and historical-period groups; special interest in Archaic sites of western states; ethnic/group markers; zooarchaeology/faunal analyses, lithic analyses, and historical archaeology.

Memberships

Society for American Archaeology.

APPENDIX 2

CORRESPONDENCE WITH NATIVE AMERICAN REPRESENTATIVES*

* A total of 34 local Native American representatives were contacted; a sample letter is included in this report.

SACRED LANDS FILE & NATIVE AMERICAN CONTACTS LIST REQUEST

NATIVE AMERICAN HERITAGE COMMISSION
915 Capitol Mall, RM 364
Sacramento, CA 95814
(916) 653-4082
(916) 657-5390 (fax)
nahc@pacbell.net

Project: Rancho Bonito; APN 360-350-006 Project (CRM TECH Contract No. 2998)

County: Riverside

USGS Quadrangle Name: Romoland, Calif.

Township 6 South **Range** 3 West SB **BM; Section(s)** 15

Company/Firm/Agency: CRM TECH

Contact Person: Nina Gallardo

Street Address: 1016 E. Cooley Drive, Suite A/B

City: Colton, CA **Zip:** 92324

Phone: (909) 824-6400 **Fax:** (909) 824-6405

Email: ngallardo@crmtech.us

Project Description: The primary component of the project is to develop a residential community and shopping center on 18 acres of land located on the southwest corner of Garbani Road and Huan Road in the City of Menifee, Riverside County, California.

November 12, 2015

From: Nina Gallardo <ngallardo@crmtech.us>
Sent: Thursday, November 12, 2015 9:59 AM
To: ahoover@pechanga-nsn.gov; 'Tina Thompson Mendoza'; 'rbasquez@pechanga-nsn.gov'
Subject: Cultural study & participation in the fieldwork for the Rancho Bonito Project, APN 360-350-006, City of Menifee, Riverside County (CRM TECH No. 2998)

Hello,

I'm emailing to inform you that CRM TECH will be conducting a cultural study for the Rancho Bonito Project, APN 360-350-006, City of Menifee, Riverside County (CRM TECH No. 2998). I'm contacting you to see if the tribe would like to participate in the field survey for this project. CRM TECH would appreciate any information regarding the proposed project and we will contact the tribe when we have a specific time and date for the fieldwork.

Thank you for your time and input on this project.

Nina Gallardo
(909) 824-6400 (phone)
(909) 824-6405 (fax)
CRM TECH
1016 E. Cooley Drive, Ste. A/B
Colton, CA 92324

STATE OF CALIFORNIA Edmund G. Brown, Jr., *Governor*

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710
(916) 373-5471 FAX

December 9, 2015

Nina Gallardo
CRM TECH

Sent by Email: ngallardo@crmtech.us
Number of Pages: 5

RE: Rancho Bonito; APN 360-350-006 Project (CRM TECH Contract No. 2998), City of Menifee, Riverside County

Dear Ms. Gallardo:

Attached is a consultation list of tribes with traditional lands or cultural places located within the boundaries of the above referenced project. Government Code §65352.3 requires local governments to consult with California Native American tribes identified by the Native American Heritage Commission (NAHC) for the purpose of protecting, and/or mitigating impacts to tribal cultural resources in creating or amending general plans, including specific plans. As of July 1, 2015, Public Resources Code Sections 21080.1, 21080.3.1 and 21080.3.2 require public agencies to consult with California Native American tribes identified by the NAHC for the purpose mitigating impacts to tribal cultural resources under the California Environmental Quality Act (CEQA). In accordance with Public Resources Code Section 21080.1(d):

> Within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section.

The law does not preclude agencies from initiating consultation with the tribes that are culturally and traditionally affiliated with their jurisdictions. The NAHC believes that in fact that this is the best practice to ensure that tribes are consulted commensurate with the intent of the law.

In accordance with Public Resources Code Section 21080.1(d), formal notification must include a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation. The NAHC believes that agencies should also include with their notification letters information regarding any cultural resources assessment that has been completed on the APE, such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:

   - A listing of any and all known cultural resources have already been recorded on or adjacent to the APE;
   - Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;
   - If the probability is low, moderate, or high that cultural resources are located in the APE.
   - Whether the records search indicates a low, moderate or high probability that unrecorded cultural resources are located in the potential APE; and

- If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measurers.

     All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure in accordance with Government Code Section 6254.10.

3. The results of any Sacred Lands File (SLF) check conducted through Native American Heritage Commission. A SLF search was completed with negative results.

4. Any ethnographic studies conducted for any area including all or part of the potential APE; and

5. Any geotechnical reports regarding all or part of the potential APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS is not exhaustive, and a negative response to these searches does not preclude the existence of a cultural place. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the case that they do, having the information beforehand well help to facilitate the consultation process.

If you receive notification of change of addresses and phone numbers from tribes, please notify me. With your assistance we are able to assure that our consultation list contains current information.

If you have any questions, please contact me at my email address: rw_nahc@pacbell.net.

Sincerely,

Rob Wood
Associate Environmental Planner

Native American Heritage Commission
Tribal Consultation List
Riverside County
December 9, 2015

Cabazon Band of Mission Indians
Doug Welmas, Chairperson
84-245 Indio Springs Parkway Cahuilla
Indio , CA 92203
(760) 342-2593

Los Coyotes Band of Mission Indians
Shane Chapparosa, Chairman
P.O. Box 189 Cahuilla
Warner Springs , CA 92086
Chapparosa@msn.com
(760) 782-0712

Pala Band of Mission Indians
Shasta Gaughen, PhD, THPO
PMB 50, 35008 Pala Temecula Rd. Luiseno
Pala , CA 92059 Cupeno
sgaughen@palatribe.com
(760) 891-3515

Pauma & Yuima Reservation
Temet Aguilar, Chairperson
P.O: Box 369, Ext. 303 Luiseno
Pauma Valley , CA 92061
(760) 742-1289

Pechanga Band of Mission Indians
Paul Macarro, Cultural Resources Manager
P.O. Box 1477 Luiseno
Temecula , CA 92593
pmacarro@pechanga-nsn.gov
(951) 770-8100

Ramona Band of Cahuilla Mission Indians
Joseph Hamilton, Chairman
P.O. Box 391670 Cahuilla
Anza , CA 92539
admin@ramonatribe.com
(951) 763-4105

Rincon Band of Mission Indians
Jim McPherson, Tribal Historic Pres. Officer
1 West Tribal Road Luiseno
Valley Center , CA 92082
vwhipple@rincontribe.org
(760) 297-2635

Soboba Band of Mission Indians
Rosemary Morillo, Chairperson; Attn: Carrie Garcia
P.O. Box 487 Luiseno
San Jacinto , CA 92581 Cahuilla
carrieg@soboba-nsn.gov
(951) 654-2765

Torres-Martinez Desert Cahuilla Indians
Mary Resvaloso, Chairperson
P.O. Box 1160 Cahuilla
Thermal , CA 92274
tmchair@torresmartinez.org
(760) 397-0300

Santa Rosa Band of Mission Indians
John Marcus, Chairman
P.O. Box 391820 Cahuilla
Anza , CA 92539
(951) 659-2700

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.
This list applicable only for consultation with Native American tribes under Public Resources Code Sections 21080.3.1 for the proposed Rancho Bonito; APN 360-350-006 Project (CRM TECH Contract No. 2998), City of Menifee,, Riverside County.

Native American Heritage Commission
Tribal Consultation List
Riverside County
December 9, 2015

Augustine Band of Cahuilla Mission Indians
Mary Ann Green, Chairperson
P.O. Box 846 — Cahuilla
Coachella , CA 92236
(760) 398-4722
(760) 369-7161Fax

Pauma Valley Band of Luiseño Indians
Bennae Calac
P.O. Box 369 — Luiseno
Pauma Valley , CA 92061
bennaecalac@aol.com
(760) 617-2872

Rincon Band of Mission Indians
Bo Mazzetti, Chairperson
1 West Tribal Road — Luiseno
Valley Center , CA 92082
bomazzetti@aol.com
(760) 749-1051

San Luis Rey Band of Mission Indians
Tribal Council
1889 Sunset Drive — Luiseno
Vista , CA 92081
cjmojado@slrmissionindians.org
(760) 724-8505

San Luis Rey Band of Mission Indians
Cultural Department
1889 Sunset Drive — Luiseno
Vista , CA 92081 — Cupeno
cjmojado@slrmissionindians.org
(760) 724-8505

Kupa Cultural Center (Pala Band)
Shasta Gaughen, Assistant Director
PMB 50, 35008 Pala Temecula Rd. — Luiseno
Pala , CA 92059
sgaughen@palatribe.com
(760) 891-3515

Agua Caliente Band of Cahuilla Indians
Jeff Grubbe, Chairperson
5401 Dinah Shore Drive — Cahuilla
Palm Springs , CA 92264
lavilesaguacliente.net
(760) 699-6800

Morongo Band of Mission Indians
Robert Martin, Chairperson
12700 Pumarra Rroad — Cahuilla
Banning , CA 92220 — Serrano
(951) 849-8807
(951) 755-5200
(951) 922-8146 Fax

Pechanga Band of Mission Indians
Mark Macarro, Chairperson
P.O. Box 1477 — Luiseno
Temecula , CA 92593
mgoodhart@pechanga-nsn.
(951) 770-6100

William J. Pink
48310 Pechanga Road — Luiseno
Temecula , CA 92592
wjpink@hotmail.com
(909) 936-1216
Prefers e-mail contact

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.
This list applicable only for consultation with Native American tribes under Public Resources Code Sections 21080.3.1 for the proposed Rancho Bonito; APN 360-350-006 Project (CRM TECH Contract No. 2998), City of Menifee,, Riverside County.

Native American Heritage Commission
Tribal Consultation List
Riverside County
December 9, 2015

La Jolla Band of Luiseno Indians
Thomas Rodrigues, Chairperson
22000 Highway 76 — Luiseno
Pauma Valley , CA 92061
thomas.rodrigues@lajolla-nsn.
(760) 742-3771

Agua Caliente Band of Cahuilla Indians THPO
Patricia Garcia-Plotkin Tribal Historic Perservation Officer
5401 Dinah Shore Drive — Cahuilla
Palm Springs , CA 92264
ACBCI-THPO@aguacliente.net
(760) 699-6907

Pauma & Yuima Reservation
Charles Devers, Cultural Committee
P.O. Box 369, Ext. 317 — Luiseno
Pauma Valley , CA 92061
(760) 742-1289

Cahuilla Band of Indians
Luther Salgado, Chairperson
P.O. Box 391760 — Cahuilla
Anza , CA 92539
Chairman@cahuilla.net
(760) 763-5549
(760) 763-2631Tribal EPA

Pechanga Cultural Resources Department
Anna Hoover, Cultural Analyst
P.O. Box 2183
Temecula , CA 92593 — Luiseño
ahoover@pechanga-nsn.gov
(951) 770-8104

Soboba Band of Luiseno Indians
Joseph Ontiveros, Cultural Resource Department
P.O. BOX 487 — Luiseno
San Jacinto , CA 92581 — Cahuilla
jontiveros@soboba-nsn.gov
(951) 663-5279
(951) 654-5544, ext 4137

Pala Band of Mission Indians
Robert H. Smith, Chairperson
PMB 50, 35008 Pala Temecula Rd. — Luiseno
Pala , CA 92059 — Cupeno
rsmith@palatribe.com
(760) 891-3500

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.
This list applicable only for consultation with Native American tribes under Public Resources Code Sections 21080.3.1 for the proposed Rancho Bonito; APN 360-350-006 Project (CRM TECH Contract No. 2998), City of Menifee,, Riverside County.

December 11, 2015

John Gomez, Jr., Cultural Resource Coordinator
Ramona Band of Cahuilla Mission Indians
P.O. Box 391372
Anza, CA 92539

RE: Rancho Bonito Project, APN 360-350-006
18 Acres in the City of Menifee
Riverside County, California
CRM TECH Contract #2998

Dear Mr. Gomez:

I am writing to bring to your attention an ongoing CEQA-compliance study for the project referenced above. The project area encompasses approximately 18 acres of undeveloped land located on the southwest corner of Garbani Road and Huan Road. The proposed project entails the construction of a 210-unit townhome community and two commercial buildings for a shopping center. The accompanying map, based on the USGS Romoland, Calif., 7.5' quadrangle, depicts the location of the project area in Section 15, T6S R3W, SBBM.

According to records on file at the Eastern Information Center, there are no known historical/archaeological sites within the boundaries of the project area. Outside the project boundaries but within a one-mile radius, EIC records indicate that 28 historical/archaeological sites have been previously recorded. Twenty-one of these sites were of prehistoric—i.e., Native American—origin, all of them consisting of bedrock milling features, such as grinding slicks and mortars, the most common type of prehistoric cultural features in the Menifee area. These sites were concentrated among granitic boulder outcrops located in the rolling hills and along waterways surrounding the project area. Site 33-000636 (CA-RIV-636), consisting of a single grinding slick located 0.2 mile east of the project area, was the nearest among them.

The other seven sites dated to the historic period and included foundations, single-family residences, and refuse scatters. During an intensive-level field survey conducted on December 3, 2015, with the assistance of a Native American monitor from Pechanga, no potential historical/archaeological resources were encountered within or adjacent to the project area.

In a letter dated December 9, 2015, the Native American Heritage Commission reports that the sacred lands record search identified no Native American cultural resources within the project area, but recommends that local Native American groups be contacted for further information (see attached). Therefore, as part of the cultural resources study for this project, I am writing to request your input on potential Native American cultural resources in or near the project area.

Please respond at your earliest convenience if you have any specific knowledge of sacred/religious sites or other sites of Native American traditional cultural value within or near the project area that need to be taken into consideration as part of the cultural resources investigation. Any information or concerns may be forwarded to CRM TECH by telephone, e-mail, facsimile, or standard mail.

Requests for documentation or information we cannot provide will be forwarded to our client and/or the lead agency, namely the City of Menifee. We would also like to clarify that CRM TECH, as the cultural resources consultant for the project, is not the appropriate entity to initiate government-to-government consultations or the AB 52-compliance process that should be conducted by the lead agency. Thank you for the time and effort in addressing this important matter.

Respectfully,

Nina Gallardo
Project Archaeologist/Native American Liaison
CRM TECH
Email: ngallardo@crmtech.us

Encl.: NAHC SLF response letter and project location map

RINCON BAND OF LUISEÑO INDIANS

Cultural Resources Department

1 W. Tribal Road · Valley Center, California 92082 ·
(760) 297-2635 Fax:(760) 749-2639

December 14, 2015

Nina Gallardo
CRM Tech
1016 E. Cooley Drive, Suite A/B
Colton, CA 2324

Re: Rancho Bonito Project NO. 2998

Dear Ms. Gallardo:

This letter is written on behalf of Rincon Band of Luiseño Indians. We have received your notification regarding the Rancho Bonito Project No. 2998 and we thank you for the continued consultation notification. The location you have identified is within the Territory of the Luiseño people.

Embedded in the Luiseño Territory are Rincon's history, culture and identity. The project is within the Territory of the Luiseño people but, is not within Rincon's Historic Boundaries. We do not have any additional information regarding this project but, we defer to the Pechanga Band of Luiseño Indians or Soboba Band of Luiseño Indians who are closer to your project area.

Thank you for the opportunity to protect and preserve our cultural assets.

Sincerely,

Vincent Whipple
Manager
Rincon Cultural Resources Department

DEC 23 2015

From: THPO Consulting <ACBCI-THPO@aguacaliente.net>
Sent: Tuesday, December 15, 2015 2:13 PM
To: 'Nina Gallardo'
Subject: RE: NA Scoping Letter for the Rancho Bonito Project, APN 360-350-006, City of Menifee, Riverside County (CRM TECH # 2998)

Greetings,

A records check of the ACBCI cultural registry revealed that this project is not located within the Tribe's Traditional Use Area (TUA). Therefore, we defer to the other tribes in the area. This letter shall conclude our consultation efforts.

Thank you,

Katie Croft
Archaeologist
Agua Caliente Band of Cahuilla Indians
5401 Dinah Shore Drive
Palm Springs, CA 92264
760-699-6829 Office
760-413-6253 Cell
760-699-6924 Fax
kcroft@aguacaliente.net

From: Cultural <Cultural@pauma-nsn.gov>
Sent: Monday, December 21, 2015 11:12 AM
To: Nina Gallardo
Cc: Dixon, Patti; Jeremy Zagarella
Subject: RE: NA Scoping Letter for the Rancho Bonito Project, APN 360-350-006, City of Menifee, Riverside County (CRM TECH # 2998)

Ms. Gallardo,

Thank you for the notice. Please provide us a copy of the Cultural Report when it is completed.

Mr. Chris Devers
Vice Chairman
Pauma Band of Luiseno Indians

MORONGO CULTURAL
HERITAGE PROGRAM
12700 PUMARRA RD BANNING, CA 92220
OFFICE 951-755-5025 FAX 951-572-6004

Date: December 24, 2015

Re: Rancho Bonito Project; APN 360-350-006
18 Acres in the City of Menifee
Riverside County, California
CRM TECH Contract #2998

Dear,
Nina Gallardo
CRM Tech

Thank you for contacting the Morongo Band of Mission Indians regarding the above referenced project(s). The tribe greatly appreciates the opportunity to comment on the project. After reviewing our records and consulting with our tribal elders and cultural experts, we would like to respectfully offer the following comments and/or recommendations:

___ The project is outside of the Tribe's current reservation boundaries and is not within an area considered to be a traditional use area or one in which the Tribe has cultural ties (i.e. Cahuilla or Serrano Territory). We recommend contacting the appropriate tribes who have cultural affiliation to the project area. We have no further comments at this time.

___ The project is outside of the Tribe's current reservation boundaries but within in an area considered to be a traditional use area or one in which the Tribe has cultural ties (i.e. Cahuilla or Serrano Territory). At this time, we are not aware of any cultural resources on the property; however, that is not to say there is nothing present. At this time, we ask that you impose specific conditions regarding all cultural and/or archaeological resources and buried cultural materials on any development plans or entitlement applications (see Standard Development Conditions attachment).

_X_ The project is outside of the Tribe's current reservation boundaries but within in an area considered to be a traditional use area or one in which the Tribe has cultural ties (i.e. Cahuilla or Serrano Territory). At this time we ask that you impose specific conditions regarding all cultural and/or archaeological resources and buried cultural materials on any development plans or entitlement applications (see Standard Development Conditions attachment). Furthermore, we would like to formally request the following:

_X_ A thorough records search be conducted by contacting one of the CHRIS (California Historical Resources Information System) Archaeological Information Centers and have a copy of the search results be provided to the tribe.

_X_ A comprehensive archaeological survey be conducted of the proposed project property and any APE's (Areas of Potential Effect) within the property. We would also like to request that a tribal monitor be present during the initial pedestrian survey and that a copy of the results be provided to the tribe as soon as it can be made available.

___ Morongo would like to request that our tribal monitors be present during any test pit or trenching activities and any subsequent ground disturbing activities during the construction phase of the project.

___ The project is located with the current boundaries of the Morongo Band of Mission Indians Reservation. Please contact the Morongo Band of Mission Indians planning department for further details.

Once again, the Morongo Band of Mission Indians appreciates the opportunity to comment on this project. Please be aware that receipt of this letter does not constitute "meaningful" tribal consultation nor does it conclude the consultation process. This letter is merely intended to initiate consultation between the tribe and lead agency, which may be followed up with additional emails, phone calls or face-to-face consultation if deemed necessary. If you should have any further questions with regard to this matter, please do not hesitate to contact me at your convenience.

Very truly yours,

Raymond Huaute
Cultural Resource Specialist
Morongo Band of Mission Indians
Email: rhuaute@morongo-nsn.gov
Phone: (951) 755-5025

MORONGO BAND OF MISSION INDIANS

A SOVEREIGN NATION

Standard Development Conditions

The Morongo Band of Mission Indians asks that you impose specific conditions regarding cultural and/or archaeological resources and buried cultural materials on any development plans or entitlement applications as follows:

1. If human remains are encountered during grading and other construction excavation, work in the immediate vicinity shall cease and the County Coroner shall be contacted pursuant to State Health and Safety Code §7050.5.

2. In the event that Native American cultural resources are discovered during project development/construction, all work in the immediate vicinity of the find shall cease and a qualified archaeologist meeting Secretary of Interior standards shall be hired to assess the find. Work on the overall project may continue during this assessment period.

    a. If significant Native American cultural resources are discovered, for which a Treatment Plan must be prepared, the developer or his archaeologist shall contact the Morongo Band of Mission Indians.

    b. If requested by the Tribe[1], the developer or the project archaeologist shall, in good faith, consult on the discovery and its disposition (e.g. avoidance, preservation, return of artifacts to tribe, etc.).

[1] The Morongo Band of Mission Indians realizes that there may be additional tribes claiming cultural affiliation to the area; however, Morongo can only speak for itself. The Tribe has no objection if the archaeologist wishes to consult with other tribes and if the city wishes to revise the condition to recognize other tribes.

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

N/A

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: PACIFIC COAST LAND CONSULTANTS | Date: 1/3/2018

Designed by: Ben Dela Cruz | Case No:

Company Project Number/Name: 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID: DMA A

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percent

D_{85}= 0.60 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
ROOFS	*289699*	*Roofs*	*1*	*0.89*	*258411.5*			
ROADS	*162000*	*Concrete or Asphalt*	*1*	*0.892*	*144504*			
LNDSPNG	*321046*	*Ornamental Landscaping*	*0.1*	*0.11046*	*35462.1*			
C WLK +OTHERS	*104989*	*Concrete or Asphalt*	*1*	*0.892*	*93650.2*			
	877734	***Total***			532027.8	0.60	*26601.4*	*64,469*

Notes:

Extended Detention Basin Design Procedure	BMP Subarea No. BMP-1	Legend:	Required Entries Calculated Cells

Company Name: Pacific Coast LandConsultants — Date: 1/3/2018

Designed by: Ben Dela Cruz — County/City Case No.:

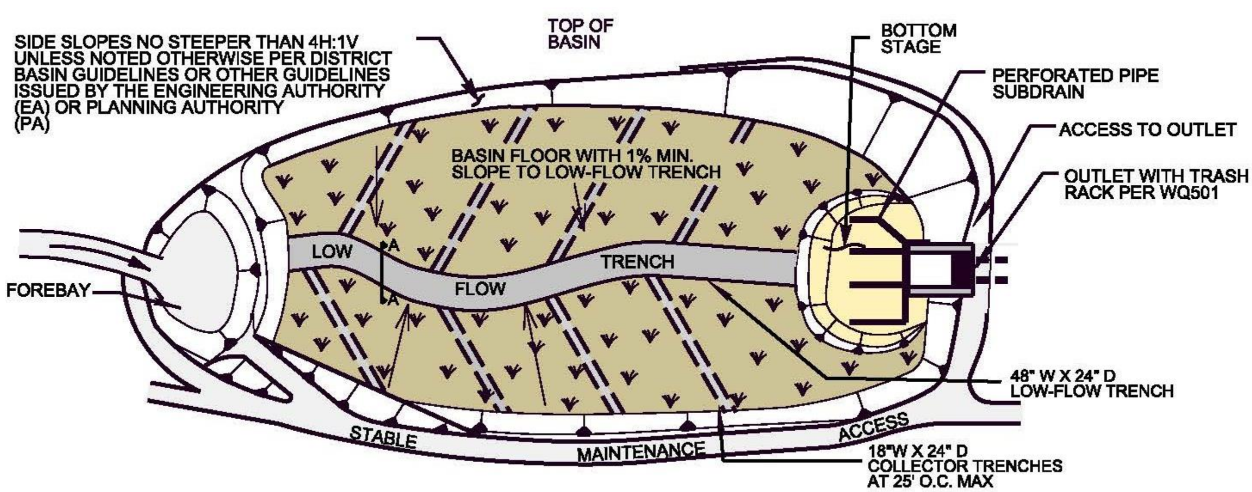
Design Volume

Tributary Area (BMP Subarea)	A_T =	20.15	acres
Enter $V_{BMP,}$ determined from Section 2.1 of this Handbook	V_{BMP}=	26,602	ft^3

Basin Footprint

Overall Geometry

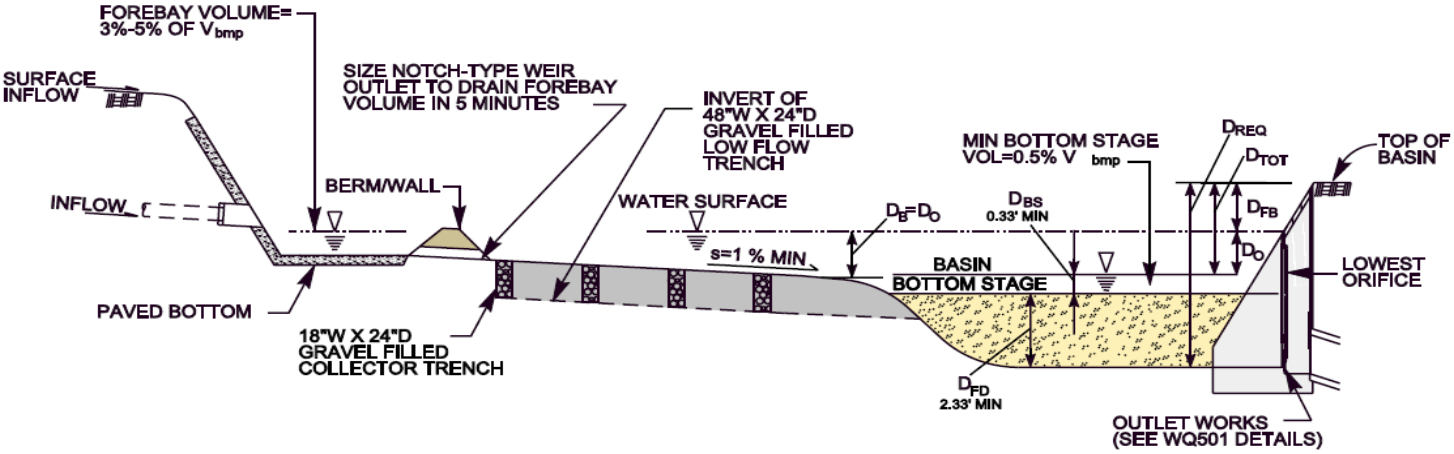
Length at Basin Bottom Surface	Length =	155	ft
Width at Basin Bottom Surface	Width =	61	ft
Meets 1.5 : 1 requirement?		✓	
Side Slopes per "Basin Guidelines", Sect. 1.2	z =	4	:1
Proposed Basin Depth (with no freeboard)	D_B =	5.00	ft
Depth of freeboard (if used)	D_{FB} =	1.00	ft
Minimum Required Allowance for Total Depth (including proposed basin depth, freeboard, minimum depth of bottom stage (D_{BS}=0.33') and minimum filter depth (D_{FD}=2.33'))	D_{REQ} =	8.7	ft
Depth from design water surface elevation to lowest orifice	D_O =	5.0	ft



Basin Design

Basin Design

Proposed Total Basin Depth (proposed depth plus freeboard)	D_{TOT} =	6.00	ft
Basin Invert Longitudinal Slope	Slope =	1.00	%
Basin Invert Transverse Slope (1% min)	Slope =	1	%
Basin Volume	V_{Basin} =	64469	ft^3



Forebay Design

Forebay Volume (3 - 5% V_{BMP})	V_{FB} =	1200	ft^3
Forebay Depth (height of berm)	D_{FBY} =	1.5	ft
Minimum Forebay Surface Area	A_{FB} =	800	ft^2
Rectangular weir (notch)	W =	36.00	in

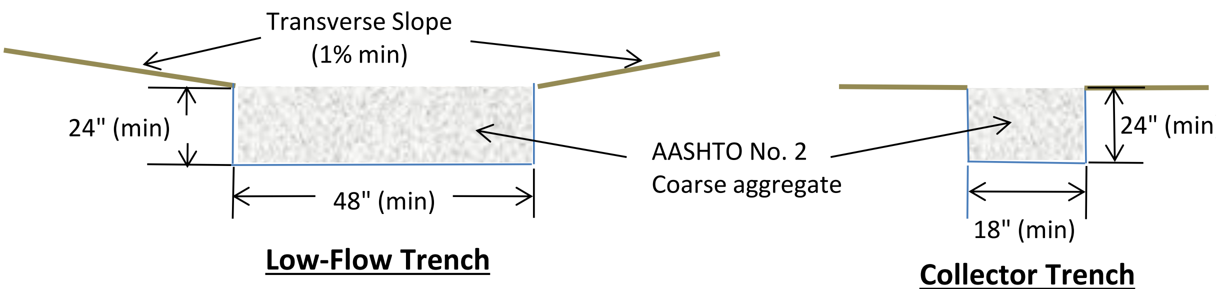
Dry Weather and Low-Flow Management

Low-Flow Trench (see graphic below)

Depth (24 inches minimum, gravel filled)	Depth =	24	inches
Width (48 inches minimum)	Width =	48	inches
Trench Invert Longitudinal Slope	Slope =	1	%

Collector Trenches (see graphic below)

Depth (24 inches minimum)	Depth =	24	inches
Width (18 inches minimum)	Width =	18	inches
Trench Invert Longitudinal Slope	Slope =	1	%
Spacing (25 feet on center maximum)	S =	25	feet



Bottom Stage (Sand Filter) Design

Depth of the Bottom Stage (4" minimum ponding)	D_{BS} =	4	in
Surface Area of Bottom Stage	A_{BS} =	9060	ft^2
Dry Weather Ponded Volume (above sand layer)	V_{BS} =	3020	ft^3

Is V_{BS} no less than 0.5% V_{BMP}? OK

Depth of ASTM-C33 sand (18 inch minimum)

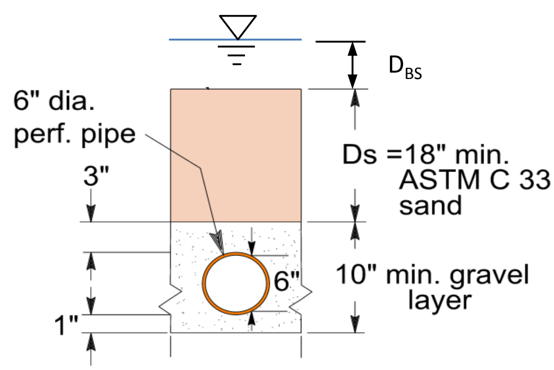
Ds = 18 inches

Diameter of Subdrains

ϕ = 6 in

Subdrain Spacing

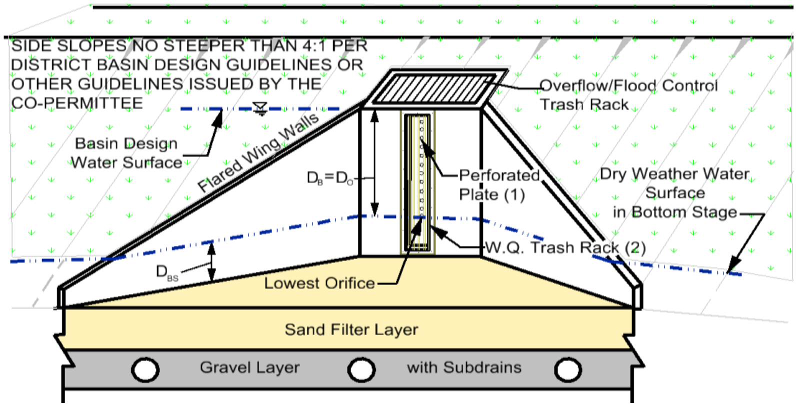
s = 10 ft. on center



Basin Outlet Design

Outlet Design

Assume an orifice area. Based on the information provided above, the spreadsheet provides discharge vs. stage data. Enter the volume vs. stage data for each interval. This information is used to route the volume through the basin. The size of the orifice is acceptable when the data shows that less than 50% of V_{BMP} has drained in 24 hours, and that 100% drawdown occurs within 72 hours.



Flow Rate, Q (cfs)

$$Q=CA[2g(H-H_o)]^{0.5}$$

Discharge Coefficient,

Default, C = 0.66

Other, C =

Orifice Area (ft^2)

Orifice Diameter, d; number of orifices per row, n; and number of orifice rows, N (from the bottom up).

d = 4 inches

n = 1 per row

N = 1 rows

Aeff = 0.087 ft^2 per row

or

Aeff = 12.560 in^2 per row

From outflow hydrograph, the time where 50% of V_{BMP} has drained from the basin (24 hour minimum):

Time (50%) = 52.77 hrs

OK

From outflow hydrograph, the time where 100% V_{BMP} has drained from the basin(within 72 hours):

Time (100 %) = 63.71 hrs

OK

Headwater Elev. / Stage (ft)	Discharge (cfs)	Volume (acre-ft)	Δt (hrs.)
0	0.0000	0.0000	
0.33	0.2666	0.070	6.35
0.67	0.3773	0.139	2.59
1.00	0.4620	0.208	1.99
1.33	0.5334		
1.67	0.5965		
2.00	0.6533	0.457	8.85
2.33	0.7056		
2.67	0.7544		
3.00	0.8002	0.751	11.69
3.33	*0.8434*		
3.67	0.8846		
4.00	0.9239	1.091	14.60
4.33	*0.9616*		
4.67	0.9980		
5.00	1.0330	1.480	17.63
5.33			
5.67			
6.00			
6.33			
6.67			
7.00			
7.33			
7.67			
8.00			
8.33			
8.67			
9.00			
9.33			
9.67			
10.00			
		∑ =	63.71

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name PACIFIC COAST LAND CONSULTANTS — Date 1/3/2018
Designed by Ben Dela Cruz — Case No
Company Project Number/Name 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID DMA B

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall — I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*ROOFS*	*35314*	*Roofs*	*1*	*0.89*	*31500.1*			
	PARKING	*65137*	*Concrete or Asphalt*	*1*	*0.892*	*58102.2*			
	LNDSPNG	*21208*	*Ornamental Landscaping*	*0.1*	*0.110458*	*2342.6*			
	C WLK	*3545*	*Concrete or Asphalt*	*1*	*0.892*	*3162.1*			
		125204	***Total***			**95107**	**0.20**	***0.4***	***2883***

Notes:

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-2		Calculated Cells

Company Name: Pacific Coast Land Consultants — Date: 1/3/2018

Designed by: Ben Dela Cruz — County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 1 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 1,834 ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 3.0 ft

Top Width of Bioretention Facility, excluding curb w_T = 6.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ d_E = 1.68 ft

Minimum Surface Area, A_m

$$A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$$

A_M = 1,090 ft^2

Proposed Surface Area A= 1,716 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = 4 :1

Diameter of Underdrain 6 inches

Longitudinal Slope of Site (3% maximum) 0.5 %

6" Check Dam Spacing 0 feet

Describe Vegetation:

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

Legend: Required Entries; Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: PACIFIC COAST LAND CONSULTANTS
Date: 1/3/2018
Designed by: Ben Dela Cruz
Case No:
Company Project Number/Name: 27259-Mill Creek Promenade

BMP Identification

BMP NAME / ID: DMA C

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percent

D_{85}= 0.60 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
ROOFS	*278274*	*Roofs*	*1*	*0.89*	*248220.4*			
RD/PRKNG	*253710*	*Concrete or Asphalt*	*1*	*0.892*	*226309.3*			
LNDSPNG	*143990*	*Ornamental Landscaping*	*0.1*	*0.11046*	*15904.8*			
C WLK	*47000*	*Concrete or Asphalt*	*1*	*0.892*	*41924*			
	722974	***Total***			**532358.5**	**0.60**	***26617.9***	***30,960***

Notes:

Sand Filter Basin (SFB) - Design Procedure	BMP ID: DmaC-BMP3	Legend: Required Entries / Calculated Cells

Company Name: Pacific coast Land Consultants | Date: 1/3/2018

Designed by: Ben Dela Cruz | County/City Case No.:

Design Volume

Total Tributary area	A_{TRIB} =	15.43	ac
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	26,618	ft^3

Basin Geometry

Basin side slopes (no steeper than 4:1)	z =	4	:1
Proposed basin depth (see Figure 1)	d_B =	2	ft
Depth of freeboard (if used)	d_{fb} =	1	ft
Minimum bottom surface area of basin ($As = V_{BMP}/d_B$)	A_s =	13309	ft^2
Minimum total depth required (includes freeboard, filter media and subdrains)	d_{req} =	5.17	ft
Proposed Surface Area		15,480	ft^2

Forebay

Forebay volume (minimum 0.5% V_{BMP})	Volume =	133.09	ft^3
Forebay depth (height of berm/splashwall. 1 foot min.)	Depth =	2	ft
Forebay surface area (minimum)	Area =	66.545	ft^2
Full height notch-type weir	Width (W) =	4.00	in

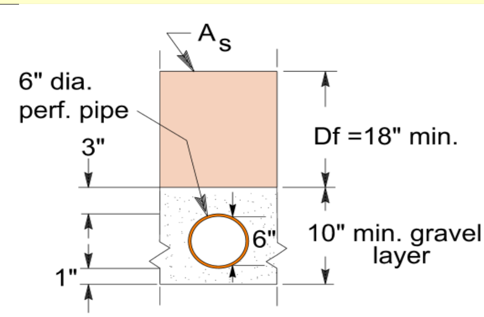
Filter Media

Description of filter media

☐ Sand (ASTM C-33)

☐ Other (Clarify in "Notes" below)

Media depth, df = ______ inches



Underdrains

Diameter of perforated underdrain			in
Spacing of underdrains (maximum 20 feet on center)	OK		ft

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries; Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	PACIFIC COAST LAND CONSULTANTS	Date	1/3/2018
Designed by	Ben Dela Cruz	Case No	
Company Project Number/Name	27259 - Mill Creek Promenade		

BMP Identification

BMP NAME / ID DMA D

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfal

I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*ROOFS*	*7744*	*Roofs*	*1*	*0.89*	*6907.6*			
	PARKING	*32808*	*Concrete or Asphalt*	*1*	*0.892*	*29264.7*			
	LNDSPNG	*11809*	*Ornamental Landscaping*	*0.1*	*0.110458*	*1304.4*			
		52361	***Total***			**37476.7**	**0.20**	***0.2***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	DmaD-BMP 4a		Calculated Cells

Company Name: Pacific Coast Land Consultants   Date: 1/3/2018

Designed by: Ben Dela Cruz   County/City Case No.:

Design Volume

Enter the area tributary to this feature A_T= 1.2 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 1,874 ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 2.0 ft

Top Width of Bioretention Facility, excluding curb w_T = 19.0 ft

Total Effective Depth, d_E

$$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$$

d_E = 1.46 ft

Minimum Surface Area, A_m

$$A_M (ft^2) = \frac{V_{BMP} (ft^3)}{d_E (ft)}$$

A_M = 1,281 ft^2

Proposed Surface Area   A= 2,470 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility   z = 4 :1

Diameter of Underdrain   6 inches

Longitudinal Slope of Site (3% maximum)   0.5 %

6" Check Dam Spacing   0 feet

Describe Vegetation:

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name PACIFIC COAST LAND CONSULTANTS — Date 1/3/2018
Designed by Ben Dela Cruz — Case No
Company Project Number/Name 27259-Mill Creek Promenade

BMP Identification

BMP NAME / ID DMA E

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall — I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*ROOFS*	*28075*	*Roofs*	*1*	*0.89*	*25042.9*			
	PARKING	*84618*	*Concrete or Asphalt*	*1*	*0.892*	*75479.3*			
	LNDSPNG	*34112*	*Ornamental Landscaping*	*0.1*	*0.110458*	*3767.9*			
	C-WALK	*7909*	*Concrete or Asphalt*	*1*	*0.892*	*7054.8*			
		154714	***Total***			**111344.9**	**0.20**	***0.5***	

Proposed Volume must be greater than the Design Capture Volume

Notes:

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	DmaE-BMP 4		Calculated Cells

Company Name: Pacific Coast Land Consultants — Date: 1/3/2018

Designed by: Ben Dela Cruz — County/City Case No.:

Design Volume

Enter the area tributary to this feature	A_T=	5.1	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	8,231	ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.1	ft
Top Width of Bioretention Facility, excluding curb	w_T =	15.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.48	ft
Minimum Surface Area, A_m $A_M (ft^2) = \frac{V_{BMP} (ft^3)}{d_E (ft)}$	A_M =	5,549	ft^2
Proposed Surface Area	A=	5,640	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.74	%
6" Check Dam Spacing		0	feet

Describe Vegetation:

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: PACIFIC COAST LAND CONSULTANTS
Date: 1/3/2018
Designed by: Ben Dela Cruz
Case No:
Company Project Number/Name: 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID: DMA F

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percent

D_{85}= 0.60 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
ROOFS	*43559*	*Roofs*	*1*	*0.89*	*38854.6*			
PARKING	*160482*	*Concrete or Asphalt*	*1*	*0.892*	*143149.9*			
LNDSPNG	*44905*	*Ornamental Landscaping*	*0.1*	*0.110458*	*4960.1*			
C-WALK	*9800*	*Concrete or Asphalt*	*1*	*0.892*	*8741.6*			
	258746	***Total***			**195706.2**	**0.60**	***9785.3***	***14,850***

Notes:

Sand Filter Basin (SFB) - Design Procedure	BMP ID	Legend:	Required Entries
	DmaF-BMP5		Calculated Cells

Company Name:	Pacific Coast Land consultants	Date:	1/3/2018
Designed by:	Ben Dela Cruz	County/City Case No.:	

Design Volume

Total Tributary area	A_{TRIB} =	5.94	ac
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	9,786	ft^3

Basin Geometry

Basin side slopes (no steeper than 4:1)	z =	4	:1
Proposed basin depth (see Figure 1)	d_B =	1.5	ft
Depth of freeboard (if used)	d_{fb} =	0.5	ft
Minimum bottom surface area of basin ($As = V_{BMP}/d_B$)	A_s =	6524	ft^2
Minimum total depth required (includes freeboard, filter media and subdrains)	d_{req} =	4.17	ft
Proposed Surface Area		9,900	ft^2

Forebay

Forebay volume (minimum 0.5% V_{BMP})	Volume =	48.93	ft^3
Forebay depth (height of berm/splashwall. 1 foot min.)	Depth =	1	ft
Forebay surface area (minimum)	Area =	48.93	ft^2
Full height notch-type weir	Width (W) =	4.00	in

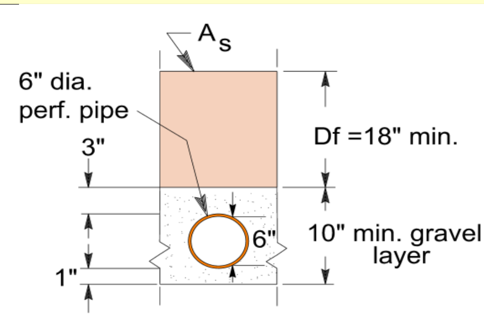
Filter Media

Description of filter media

[ ] Sand (ASTM C-33)

[ ] Other (Clarify in "Notes" below)

Media depth, df = 18 inches



Underdrains

Diameter of perforated underdrain		12	in
Spacing of underdrains (maximum 20 feet on center)	OK	2	ft

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name PACIFIC COAST LAND CONSULTANTS — Date 1/3/2018

Designed by Ben Dela Cruz — Case No

Company Project Number/Name 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID DMA G

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfal — I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*TRAIL*	*11838*	*Roofs*	*0.4*	*0.28*	*3311.2*			
	ROADS	*34653*	*Concrete or Asphalt*	*1*	*0.892*	*30910.5*			
	DRVWAY	*6638*	*Conc/ Asphlt*	*1*	*0.892*	*5921.1*			
	LNDSPNG	*10208*	*Ornamnt Lndspng*	*0.1*	*0.11046*	*1127.6*			
		63337	***Total***			**41270.4**	**0.20**	***0.2***	

#N/A

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: PACIFIC COAST LAND CONSULTANTS
Date: 1/3/2018
Designed by: Ben Dela Cruz
Case No:
Company Project Number/Name: 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID: DMA H

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfal

I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*TRAIL*	*7654*	*Decompsd Granite*	*0.4*	*0.28*	*2140.9*			
	ROADS	*40601*	*Concrete or Asphalt*	*1*	*0.892*	*36216.1*			
	DRIVEWAY	*4601*	*Concrete or Asphalt*	*1*	*0.892*	*4104.1*			
	SWLK-C	*6227*	*Concrete or Asphalt*	*1*	*0.892*	*5554.5*			
	LNDSPNG	*19426*	*Ornmnt Lndspng*	*0.1*	*0.110458*	*2145.8*			
		78509	***Total***			**50161.4**	**0.20**	***0.2***	

#N/A

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name PACIFIC COAST LAND CONSULTANTS Date 1/3/2018
Designed by Ben Dela Cruz Case No
Company Project Number/Name 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID DMA J

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfal I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*TRAIL*	*5746*	*Decompsd Granite*	*0.4*	*0.28*	*1607.2*			
	ROADS	*23051*	*Concrete or Asphalt*	*1*	*0.892*	*20561.5*			
	DRIVEWAY	*15226*	*Concrete or Asphalt*	*1*	*0.892*	*13581.6*			
	SWLK-C	*5416*	*Concrete or Asphalt*	*1*	*0.892*	*4831.1*			
	LNDSPNG	*5801*	*Ornmnt Lndspng*	*0.1*	*0.110458*	*640.8*			
		55240	***Total***			**41222.2**	**0.20**	***0.2***	

#N/A

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: PACIFIC COAST LAND CONSULTANTS — Date: 1/3/2018

Designed by: Ben Dela Cruz — Case No:

Company Project Number/Name: 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID: DMA K

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall — I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*TRAIL*	*9865*	*Decompsd Granite*	*0.4*	*0.28*	*2759.4*			
	ROADS	*26914*	*Concrete or Asphalt*	*1*	*0.892*	*24007.3*			
	DRIVEWAY	*10606*	*Concrete or Asphalt*	*1*	*0.892*	*9460.6*			
	SWLK-C	*6566*	*Concrete or Asphalt*	*1*	*0.892*	*5856.9*			
	LNDSPNG	*4534*	*Ornmnt Lndspng*	*0.1*	*0.110458*	*500.8*			
		58485	***Total***			**42585**	**0.20**	***0.2***	

#N/A

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name PACIFIC COAST LAND CONSULTANTS   Date 1/3/2018
Designed by Ben Dela Cruz   Case No
Company Project Number/Name 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID DMA L

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall   I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*TRAIL*	*3788*	*Decompsd Granite*	*0.4*	*0.28*	*1059.5*			
	ROADS	*20951*	*Concrete or Asphalt*	*1*	*0.892*	*18688.3*			
	DRIVEWAY	*890*	*Concrete or Asphalt*	*1*	*0.892*	*793.9*			
	SWLK-C	*4010*	*Concrete or Asphalt*	*1*	*0.892*	*3576.9*			
	LNDSPNG	*6561*	*Ornmnt Lndspng*	*0.1*	*0.110458*	*724.7*			
		36200	***Total***			**24843.3**	**0.20**	**0.1**	

#N/A

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: PACIFIC COAST LAND CONSULTANTS — Date: 1/3/2018

Designed by: Ben Dela Cruz — Case No:

Company Project Number/Name: 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID: DMA M

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfal

I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Rainfall Intensity (in/hr)	Design Flow Rate (cfs)	Proposed Flow Rate (cfs)
TRAIL	2368	Decompsd Granite	0.4	0.28	662.4			
ROADS	8984	Concrete or Asphalt	1	0.892	8013.7			
SWLK-C	2368	Concrete or Asphalt	1	0.892	2112.3			
LNDSPNG	1245	Ornmnt Lndspng	0.1	0.110458	137.5			
	14965	Total			10925.9	0.20	0.1	

#N/A

Proposed Volume must be greater than the Design Capture Volume

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name PACIFIC COAST LAND CONSULTANTS — Date 1/3/2018

Designed by Ben Dela Cruz — Case No

Company Project Number/Name 27259 - Mill Creek Promenade

BMP Identification

BMP NAME / ID DMA N

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfal

I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*TRAIL*	*1150*	*Decompsd Granite*	*0.4*	*0.28*	*321.7*			
	ROADS	*7297*	*Concrete or Asphalt*	*1*	*0.892*	*6508.9*			
	DRVWAY	*890*	*Concrete or Asphalt*	*1*	*0.892*	*793.9*			
	SWLK-C	*846*	*Concrete or Asphalt*	*1*	*0.892*	*754.6*			
	LNDSPNG	*939*	*Ornmnt Lndspng*	*0.1*	*0.110458*	*103.7*			
		11122	***Total***			**8482.8**	**0.20**	***0***	

#N/A

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

For Appendix 7 – Hydromodification, we are presenting here a portion of the Preliminary Drainage Study.

The following will only focus on the Unit Hydrograph Method for the 2yr 24hr storm. The resulting pre developed or existing condition storm flow runoff will be compared to post development storm flow runoff.

The following is the summary of the pre developed or existing condition:

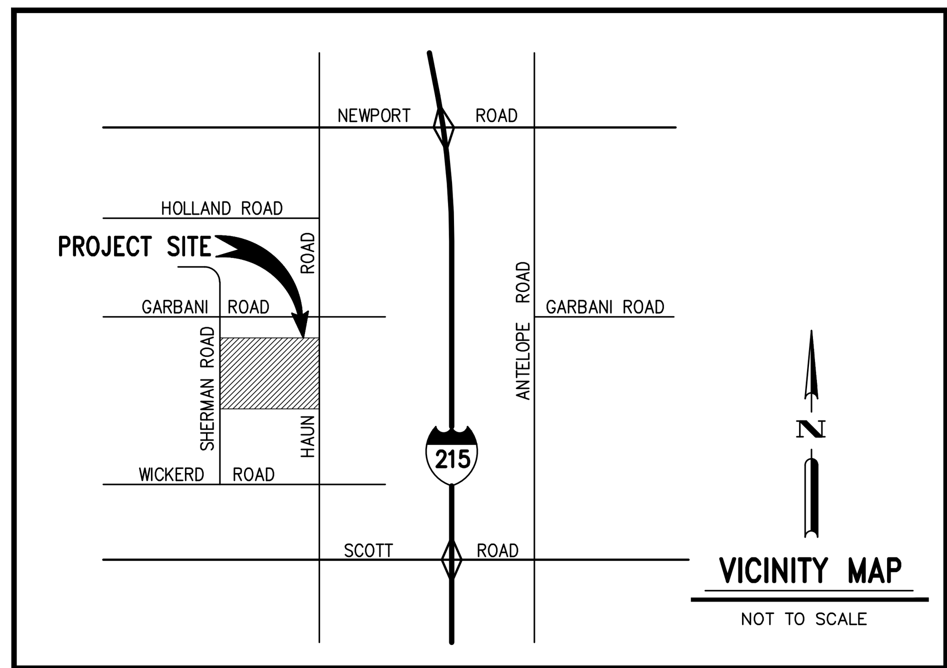
Mark	Acreage (acres)	Q (flow) 2yr 24hr – cfs
Area ABCDE	30.44	3.307
Area FGHJ	24.40	2.674
Total	54.84	5.981

The following is the summary of the post or ultimate developed condition:

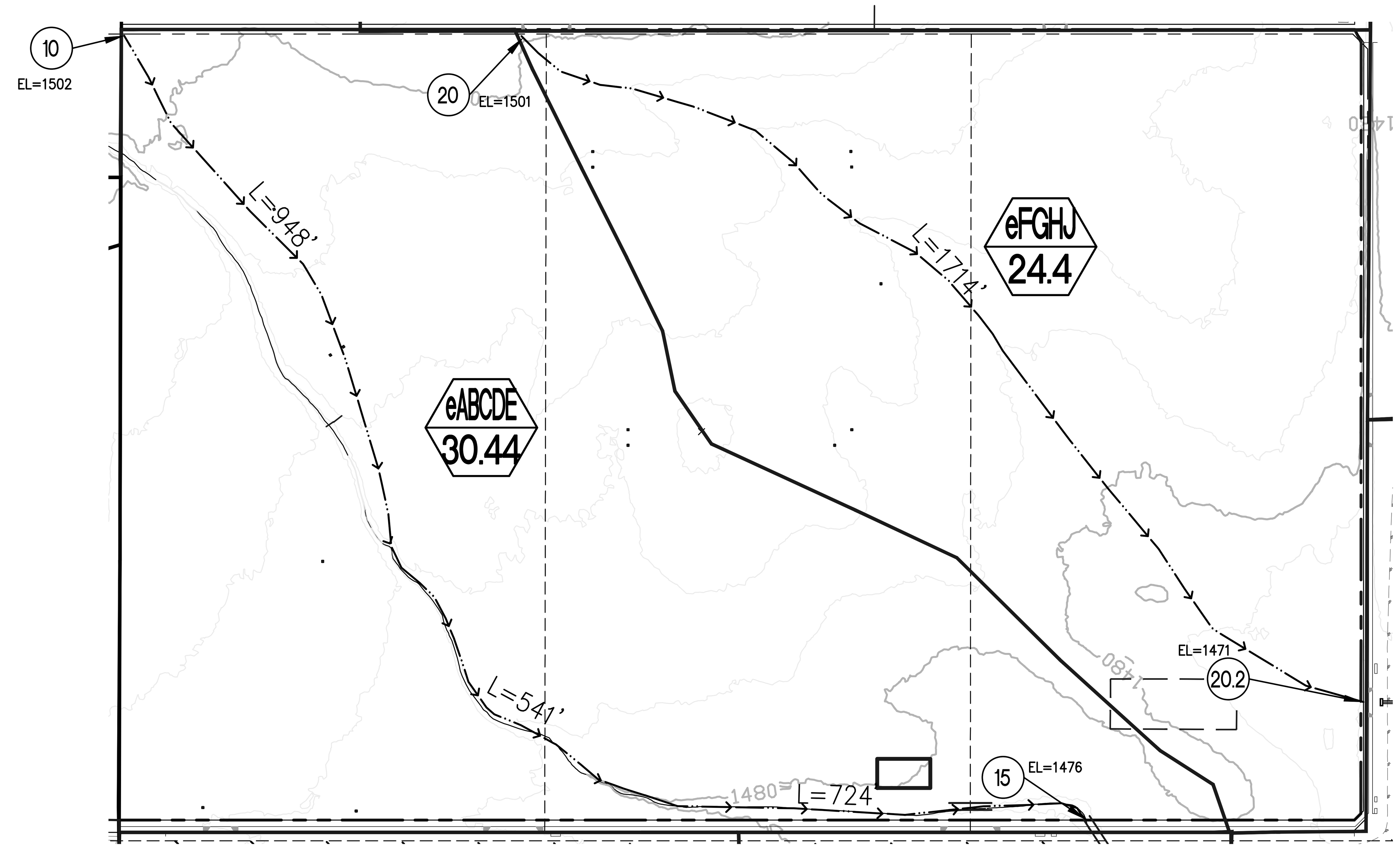
Mark	Acreage (acres)	Q (flow) 2yr 24hr – cfs
Area A	20.15	0.393
Area B	1.00	0.064
Area C	16.60	1.861
Area D	1.20	0.064
Area E	5.10	0.393
Area F	5.94	0.393
Total	49.99	3.17

Per the results we can note that the post or ultimate condition total flow Q = 3.17 cfs is less than the pre or existing condition total flow Q = 5.981 cfs, thus this qualifies under Section F: Hydromodification, F-2 HCOC Mitigation – c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Attached is the Unit Hydrograph Method Calculations for the pre development or existing, and post or ultimate development conditions.



EXISTING DRAINAGE MAP



DRAINAGE LEGEND

SYMBOL	DEFINITION
(solid line)	PROJECT BOUNDARY
(dashed line)	EXISTING RIGHT OF WAY
(heavy line)	EXISTING DRAINAGE BOUNDARY
(arrow line)	DIRECTION OF EXISTING FLOW
Q100 = 10.2cfs	100 YEAR FLOW FOR AREA
Q10 = 6.2cfs	10 YEAR FLOW FOR AREA
L=762'	LENGTH OF TRAVEL
(3) EL=1431	NODE WITH ELEVATION
eA 0.78	AREA NAME (ON-SITE EXISTING) AREA ACRES
oA 0.78	AREA NAME (OFF-SIITE EXISTING) AREA ACRES

100 YR

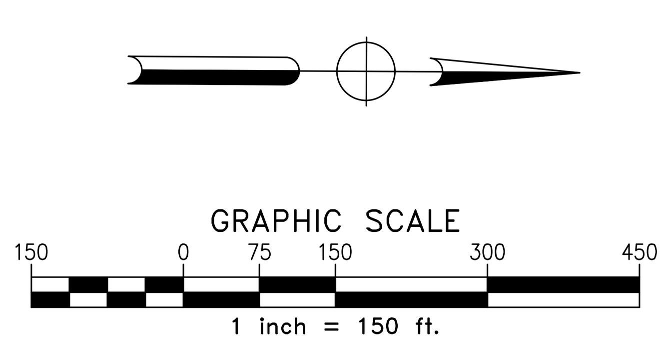
AREA DESIGNATION	AREA AC.	NODE	1HR (CFS)	3HR (CFS)	6HR (CFS)	24HR (CFS)
eABCDE	30.44	20.2	81.50	44.90	42.40	15.20
eFGHJ	24.40	15	73.30	37.40	34.00	12.20
TOTAL	54.84		154.80	82.30	76.40	27.40

10 YR

AREA DESIGNATION	AREA AC.	NODE	1HR (CFS)	3HR (CFS)	6HR (CFS)	24HR (CFS)
eABCDE	30.44	20.2	52.10	28.60	27.60	8.20
eFGHJ	24.40	15	47.70	23.90	22.20	6.60
TOTAL	54.84		99.80	52.50	49.80	14.80

2 YR

AREA DESIGNATION	AREA AC.	NODE	24HR (CFS)
eABCDE	30.44	20.2	3.31
eFGHJ	24.40	15	2.67
TOTAL	54.84		5.98



Call before you Dig
Avoid cutting underground utility lines. It's costly.
Call 811 or 1-800-227-2600

REVISIONS					
	SHT.	DESCRIPTION	DATE	BY	APRD

PACIFIC COAST LAND CONSULTANTS, Inc.
Civil Engineering • Land Planning • Land Surveying
25096 Jefferson Avenue, Suite "D" Murrieta, Ca. 92562
Tel: (951) 698-1350 Fax: (951) 698-8657

PREPARED BY:
CHRIS D. HOPPER
RCE NO. 34821
DATE
Benjie

SEAL
REGISTERED PROFESSIONAL ENGINEER
CHRIS D. HOPPER
No. 34821
Exp. 9/30/17
CIVIL
STATE OF CALIFORNIA

SCALE: 1" =150'
DESIGN: BAM/REK
DRAWN: BENJIE/RGS
CHECKED: HJK/BAM
APPROVED: HJK/TPV
DATE: MARCH, 2016

CITY OF MENIFEE
ENGINEERING DEPARTMENT
JONATHAN G. SMITH
DIRECTOR OF PUBLIC WORKS/
CITY ENGINEER
RCE 61253
EXP. 6/30/16
DATE
RECOMMENDED BY:
DATE

CITY OF MENIFEE

EXISTING DRAINAGE MAP
MILLCREEK PROMENADE
UNIT HYDROGRAPH METHOD 2YR, 10YR & 100YR

SHEET NO. 1 OF 1
PROJECT NO:

```
      U n i t   H y d r o g r a p h   A n a l y s i s

      Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0
            Study date  01/07/18 File: 27259UHeABCDE242.out

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------------------------------------------------------------------------

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978


Program License Serial Number 4066

---------------------------------------------------------------------
 English (in-lb) Input Units Used
 English Rainfall Data (Inches) Input Values Used

 English Units used in output format

---------------------------------------------------------------------
Area ABCDE - Mill Creek Promenade
2yr 24hr Storm by Pacific Coast Land Consultants, Inc.

--------------------------------------------------------------------
Drainage Area =      30.44(Ac.)  =      0.048 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =      30.44(Ac.)  =      0.048
Sq. Mi.
Length along longest watercourse =    2213.00(Ft.)
Length along longest watercourse measured to centroid =    1224.00(Ft.)
Length along longest watercourse =      0.419 Mi.
Length along longest watercourse measured to centroid =      0.232 Mi.
Difference in elevation =      26.00(Ft.)
Slope along watercourse =     62.0334 Ft./Mi.
Average Manning's 'N' = 0.025
Lag time =    0.113 Hr.
Lag time =     6.78 Min.
25% of lag time =     1.69 Min.
40% of lag time =     2.71 Min.
Unit time =     5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
       30.44         1.90               57.84

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
       30.44         4.75              144.59

STORM EVENT (YEAR) =    2.00
Area Averaged 2-Year Rainfall =    1.900(In)
Area Averaged 100-Year Rainfall =    4.750(In)

Point rain (area averaged) =    1.900(In)
Areal adjustment factor =   99.99 %
```

Adjusted average point rain = 1.900(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
30.440	72.00	0.000

Total Area Entered = 30.44(Ac.)

RI AMC2	RI AMC-3	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
72.0	86.2	0.173	0.000	0.173	1.000	0.173
					Sum (F) =	0.173

Area averaged mean soil loss (F) (In/Hr) = 0.173
Minimum soil loss rate ((In/Hr)) = 0.087
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

U n i t H y d r o g r a p h
FOOTHILL S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	73.794	7.825	2.401
2	0.167	147.587	44.102	13.530
3	0.250	221.381	27.227	8.353
4	0.333	295.174	10.461	3.209
5	0.417	368.968	5.606	1.720
6	0.500	442.761	2.642	0.811
7	0.583	516.555	0.925	0.284
8	0.667	590.348	0.554	0.170
9	0.750	664.142	0.461	0.141
10	0.833	737.935	0.196	0.060
			Sum = 100.000	Sum= 30.678

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.015	0.307	0.014	0.00
2	0.17	0.07	0.015	0.306	0.014	0.00
3	0.25	0.07	0.015	0.305	0.014	0.00
4	0.33	0.10	0.023	0.304	0.021	0.00
5	0.42	0.10	0.023	0.303	0.021	0.00
6	0.50	0.10	0.023	0.301	0.021	0.00
7	0.58	0.10	0.023	0.300	0.021	0.00
8	0.67	0.10	0.023	0.299	0.021	0.00
9	0.75	0.10	0.023	0.298	0.021	0.00
10	0.83	0.13	0.030	0.297	0.027	0.00
11	0.92	0.13	0.030	0.295	0.027	0.00
12	1.00	0.13	0.030	0.294	0.027	0.00
13	1.08	0.10	0.023	0.293	0.021	0.00
14	1.17	0.10	0.023	0.292	0.021	0.00
15	1.25	0.10	0.023	0.291	0.021	0.00
16	1.33	0.10	0.023	0.290	0.021	0.00
17	1.42	0.10	0.023	0.289	0.021	0.00
18	1.50	0.10	0.023	0.287	0.021	0.00
19	1.58	0.10	0.023	0.286	0.021	0.00
20	1.67	0.10	0.023	0.285	0.021	0.00
21	1.75	0.10	0.023	0.284	0.021	0.00

22	1.83	0.13	0.030	0.283	0.027	0.00
23	1.92	0.13	0.030	0.282	0.027	0.00
24	2.00	0.13	0.030	0.281	0.027	0.00
25	2.08	0.13	0.030	0.279	0.027	0.00
26	2.17	0.13	0.030	0.278	0.027	0.00
27	2.25	0.13	0.030	0.277	0.027	0.00
28	2.33	0.13	0.030	0.276	0.027	0.00
29	2.42	0.13	0.030	0.275	0.027	0.00
30	2.50	0.13	0.030	0.274	0.027	0.00
31	2.58	0.17	0.038	0.273	0.034	0.00
32	2.67	0.17	0.038	0.271	0.034	0.00
33	2.75	0.17	0.038	0.270	0.034	0.00
34	2.83	0.17	0.038	0.269	0.034	0.00
35	2.92	0.17	0.038	0.268	0.034	0.00
36	3.00	0.17	0.038	0.267	0.034	0.00
37	3.08	0.17	0.038	0.266	0.034	0.00
38	3.17	0.17	0.038	0.265	0.034	0.00
39	3.25	0.17	0.038	0.264	0.034	0.00
40	3.33	0.17	0.038	0.263	0.034	0.00
41	3.42	0.17	0.038	0.262	0.034	0.00
42	3.50	0.17	0.038	0.260	0.034	0.00
43	3.58	0.17	0.038	0.259	0.034	0.00
44	3.67	0.17	0.038	0.258	0.034	0.00
45	3.75	0.17	0.038	0.257	0.034	0.00
46	3.83	0.20	0.046	0.256	0.041	0.00
47	3.92	0.20	0.046	0.255	0.041	0.00
48	4.00	0.20	0.046	0.254	0.041	0.00
49	4.08	0.20	0.046	0.253	0.041	0.00
50	4.17	0.20	0.046	0.252	0.041	0.00
51	4.25	0.20	0.046	0.251	0.041	0.00
52	4.33	0.23	0.053	0.250	0.048	0.01
53	4.42	0.23	0.053	0.249	0.048	0.01
54	4.50	0.23	0.053	0.248	0.048	0.01
55	4.58	0.23	0.053	0.246	0.048	0.01
56	4.67	0.23	0.053	0.245	0.048	0.01
57	4.75	0.23	0.053	0.244	0.048	0.01
58	4.83	0.27	0.061	0.243	0.055	0.01
59	4.92	0.27	0.061	0.242	0.055	0.01
60	5.00	0.27	0.061	0.241	0.055	0.01
61	5.08	0.20	0.046	0.240	0.041	0.00
62	5.17	0.20	0.046	0.239	0.041	0.00
63	5.25	0.20	0.046	0.238	0.041	0.00
64	5.33	0.23	0.053	0.237	0.048	0.01
65	5.42	0.23	0.053	0.236	0.048	0.01
66	5.50	0.23	0.053	0.235	0.048	0.01
67	5.58	0.27	0.061	0.234	0.055	0.01
68	5.67	0.27	0.061	0.233	0.055	0.01
69	5.75	0.27	0.061	0.232	0.055	0.01
70	5.83	0.27	0.061	0.231	0.055	0.01
71	5.92	0.27	0.061	0.230	0.055	0.01
72	6.00	0.27	0.061	0.229	0.055	0.01
73	6.08	0.30	0.068	0.228	0.062	0.01
74	6.17	0.30	0.068	0.227	0.062	0.01
75	6.25	0.30	0.068	0.226	0.062	0.01
76	6.33	0.30	0.068	0.225	0.062	0.01
77	6.42	0.30	0.068	0.224	0.062	0.01
78	6.50	0.30	0.068	0.223	0.062	0.01
79	6.58	0.33	0.076	0.222	0.068	0.01
80	6.67	0.33	0.076	0.221	0.068	0.01
81	6.75	0.33	0.076	0.220	0.068	0.01
82	6.83	0.33	0.076	0.219	0.068	0.01
83	6.92	0.33	0.076	0.218	0.068	0.01
84	7.00	0.33	0.076	0.217	0.068	0.01

85	7.08	0.33	0.076	0.216	0.068	0.01
86	7.17	0.33	0.076	0.215	0.068	0.01
87	7.25	0.33	0.076	0.214	0.068	0.01
88	7.33	0.37	0.084	0.213	0.075	0.01
89	7.42	0.37	0.084	0.212	0.075	0.01
90	7.50	0.37	0.084	0.211	0.075	0.01
91	7.58	0.40	0.091	0.210	0.082	0.01
92	7.67	0.40	0.091	0.209	0.082	0.01
93	7.75	0.40	0.091	0.208	0.082	0.01
94	7.83	0.43	0.099	0.207	0.089	0.01
95	7.92	0.43	0.099	0.206	0.089	0.01
96	8.00	0.43	0.099	0.205	0.089	0.01
97	8.08	0.50	0.114	0.204	0.103	0.01
98	8.17	0.50	0.114	0.203	0.103	0.01
99	8.25	0.50	0.114	0.202	0.103	0.01
100	8.33	0.50	0.114	0.201	0.103	0.01
101	8.42	0.50	0.114	0.200	0.103	0.01
102	8.50	0.50	0.114	0.199	0.103	0.01
103	8.58	0.53	0.122	0.199	0.109	0.01
104	8.67	0.53	0.122	0.198	0.109	0.01
105	8.75	0.53	0.122	0.197	0.109	0.01
106	8.83	0.57	0.129	0.196	0.116	0.01
107	8.92	0.57	0.129	0.195	0.116	0.01
108	9.00	0.57	0.129	0.194	0.116	0.01
109	9.08	0.63	0.144	0.193	0.130	0.01
110	9.17	0.63	0.144	0.192	0.130	0.01
111	9.25	0.63	0.144	0.191	0.130	0.01
112	9.33	0.67	0.152	0.190	0.137	0.02
113	9.42	0.67	0.152	0.189	0.137	0.02
114	9.50	0.67	0.152	0.188	0.137	0.02
115	9.58	0.70	0.160	0.187	0.144	0.02
116	9.67	0.70	0.160	0.187	0.144	0.02
117	9.75	0.70	0.160	0.186	0.144	0.02
118	9.83	0.73	0.167	0.185	0.150	0.02
119	9.92	0.73	0.167	0.184	0.150	0.02
120	10.00	0.73	0.167	0.183	0.150	0.02
121	10.08	0.50	0.114	0.182	0.103	0.01
122	10.17	0.50	0.114	0.181	0.103	0.01
123	10.25	0.50	0.114	0.180	0.103	0.01
124	10.33	0.50	0.114	0.180	0.103	0.01
125	10.42	0.50	0.114	0.179	0.103	0.01
126	10.50	0.50	0.114	0.178	0.103	0.01
127	10.58	0.67	0.152	0.177	0.137	0.02
128	10.67	0.67	0.152	0.176	0.137	0.02
129	10.75	0.67	0.152	0.175	0.137	0.02
130	10.83	0.67	0.152	0.174	0.137	0.02
131	10.92	0.67	0.152	0.173	0.137	0.02
132	11.00	0.67	0.152	0.173	0.137	0.02
133	11.08	0.63	0.144	0.172	0.130	0.01
134	11.17	0.63	0.144	0.171	0.130	0.01
135	11.25	0.63	0.144	0.170	0.130	0.01
136	11.33	0.63	0.144	0.169	0.130	0.01
137	11.42	0.63	0.144	0.168	0.130	0.01
138	11.50	0.63	0.144	0.168	0.130	0.01
139	11.58	0.57	0.129	0.167	0.116	0.01
140	11.67	0.57	0.129	0.166	0.116	0.01
141	11.75	0.57	0.129	0.165	0.116	0.01
142	11.83	0.60	0.137	0.164	0.123	0.01
143	11.92	0.60	0.137	0.163	0.123	0.01
144	12.00	0.60	0.137	0.163	0.123	0.01
145	12.08	0.83	0.190	0.162	---	0.03
146	12.17	0.83	0.190	0.161	---	0.03
147	12.25	0.83	0.190	0.160	---	0.03

148	12.33	0.87	0.198	0.159	---	0.04
149	12.42	0.87	0.198	0.159	---	0.04
150	12.50	0.87	0.198	0.158	---	0.04
151	12.58	0.93	0.213	0.157	---	0.06
152	12.67	0.93	0.213	0.156	---	0.06
153	12.75	0.93	0.213	0.155	---	0.06
154	12.83	0.97	0.220	0.155	---	0.07
155	12.92	0.97	0.220	0.154	---	0.07
156	13.00	0.97	0.220	0.153	---	0.07
157	13.08	1.13	0.258	0.152	---	0.11
158	13.17	1.13	0.258	0.152	---	0.11
159	13.25	1.13	0.258	0.151	---	0.11
160	13.33	1.13	0.258	0.150	---	0.11
161	13.42	1.13	0.258	0.149	---	0.11
162	13.50	1.13	0.258	0.148	---	0.11
163	13.58	0.77	0.175	0.148	---	0.03
164	13.67	0.77	0.175	0.147	---	0.03
165	13.75	0.77	0.175	0.146	---	0.03
166	13.83	0.77	0.175	0.145	---	0.03
167	13.92	0.77	0.175	0.145	---	0.03
168	14.00	0.77	0.175	0.144	---	0.03
169	14.08	0.90	0.205	0.143	---	0.06
170	14.17	0.90	0.205	0.143	---	0.06
171	14.25	0.90	0.205	0.142	---	0.06
172	14.33	0.87	0.198	0.141	---	0.06
173	14.42	0.87	0.198	0.140	---	0.06
174	14.50	0.87	0.198	0.140	---	0.06
175	14.58	0.87	0.198	0.139	---	0.06
176	14.67	0.87	0.198	0.138	---	0.06
177	14.75	0.87	0.198	0.137	---	0.06
178	14.83	0.83	0.190	0.137	---	0.05
179	14.92	0.83	0.190	0.136	---	0.05
180	15.00	0.83	0.190	0.135	---	0.05
181	15.08	0.80	0.182	0.135	---	0.05
182	15.17	0.80	0.182	0.134	---	0.05
183	15.25	0.80	0.182	0.133	---	0.05
184	15.33	0.77	0.175	0.133	---	0.04
185	15.42	0.77	0.175	0.132	---	0.04
186	15.50	0.77	0.175	0.131	---	0.04
187	15.58	0.63	0.144	0.131	---	0.01
188	15.67	0.63	0.144	0.130	---	0.01
189	15.75	0.63	0.144	0.129	---	0.02
190	15.83	0.63	0.144	0.129	---	0.02
191	15.92	0.63	0.144	0.128	---	0.02
192	16.00	0.63	0.144	0.127	---	0.02
193	16.08	0.13	0.030	0.127	0.027	0.00
194	16.17	0.13	0.030	0.126	0.027	0.00
195	16.25	0.13	0.030	0.125	0.027	0.00
196	16.33	0.13	0.030	0.125	0.027	0.00
197	16.42	0.13	0.030	0.124	0.027	0.00
198	16.50	0.13	0.030	0.123	0.027	0.00
199	16.58	0.10	0.023	0.123	0.021	0.00
200	16.67	0.10	0.023	0.122	0.021	0.00
201	16.75	0.10	0.023	0.122	0.021	0.00
202	16.83	0.10	0.023	0.121	0.021	0.00
203	16.92	0.10	0.023	0.120	0.021	0.00
204	17.00	0.10	0.023	0.120	0.021	0.00
205	17.08	0.17	0.038	0.119	0.034	0.00
206	17.17	0.17	0.038	0.119	0.034	0.00
207	17.25	0.17	0.038	0.118	0.034	0.00
208	17.33	0.17	0.038	0.117	0.034	0.00
209	17.42	0.17	0.038	0.117	0.034	0.00
210	17.50	0.17	0.038	0.116	0.034	0.00

211	17.58	0.17	0.038	0.116	0.034	0.00
212	17.67	0.17	0.038	0.115	0.034	0.00
213	17.75	0.17	0.038	0.114	0.034	0.00
214	17.83	0.13	0.030	0.114	0.027	0.00
215	17.92	0.13	0.030	0.113	0.027	0.00
216	18.00	0.13	0.030	0.113	0.027	0.00
217	18.08	0.13	0.030	0.112	0.027	0.00
218	18.17	0.13	0.030	0.112	0.027	0.00
219	18.25	0.13	0.030	0.111	0.027	0.00
220	18.33	0.13	0.030	0.111	0.027	0.00
221	18.42	0.13	0.030	0.110	0.027	0.00
222	18.50	0.13	0.030	0.109	0.027	0.00
223	18.58	0.10	0.023	0.109	0.021	0.00
224	18.67	0.10	0.023	0.108	0.021	0.00
225	18.75	0.10	0.023	0.108	0.021	0.00
226	18.83	0.07	0.015	0.107	0.014	0.00
227	18.92	0.07	0.015	0.107	0.014	0.00
228	19.00	0.07	0.015	0.106	0.014	0.00
229	19.08	0.10	0.023	0.106	0.021	0.00
230	19.17	0.10	0.023	0.105	0.021	0.00
231	19.25	0.10	0.023	0.105	0.021	0.00
232	19.33	0.13	0.030	0.104	0.027	0.00
233	19.42	0.13	0.030	0.104	0.027	0.00
234	19.50	0.13	0.030	0.103	0.027	0.00
235	19.58	0.10	0.023	0.103	0.021	0.00
236	19.67	0.10	0.023	0.102	0.021	0.00
237	19.75	0.10	0.023	0.102	0.021	0.00
238	19.83	0.07	0.015	0.102	0.014	0.00
239	19.92	0.07	0.015	0.101	0.014	0.00
240	20.00	0.07	0.015	0.101	0.014	0.00
241	20.08	0.10	0.023	0.100	0.021	0.00
242	20.17	0.10	0.023	0.100	0.021	0.00
243	20.25	0.10	0.023	0.099	0.021	0.00
244	20.33	0.10	0.023	0.099	0.021	0.00
245	20.42	0.10	0.023	0.098	0.021	0.00
246	20.50	0.10	0.023	0.098	0.021	0.00
247	20.58	0.10	0.023	0.098	0.021	0.00
248	20.67	0.10	0.023	0.097	0.021	0.00
249	20.75	0.10	0.023	0.097	0.021	0.00
250	20.83	0.07	0.015	0.096	0.014	0.00
251	20.92	0.07	0.015	0.096	0.014	0.00
252	21.00	0.07	0.015	0.096	0.014	0.00
253	21.08	0.10	0.023	0.095	0.021	0.00
254	21.17	0.10	0.023	0.095	0.021	0.00
255	21.25	0.10	0.023	0.095	0.021	0.00
256	21.33	0.07	0.015	0.094	0.014	0.00
257	21.42	0.07	0.015	0.094	0.014	0.00
258	21.50	0.07	0.015	0.093	0.014	0.00
259	21.58	0.10	0.023	0.093	0.021	0.00
260	21.67	0.10	0.023	0.093	0.021	0.00
261	21.75	0.10	0.023	0.092	0.021	0.00
262	21.83	0.07	0.015	0.092	0.014	0.00
263	21.92	0.07	0.015	0.092	0.014	0.00
264	22.00	0.07	0.015	0.092	0.014	0.00
265	22.08	0.10	0.023	0.091	0.021	0.00
266	22.17	0.10	0.023	0.091	0.021	0.00
267	22.25	0.10	0.023	0.091	0.021	0.00
268	22.33	0.07	0.015	0.090	0.014	0.00
269	22.42	0.07	0.015	0.090	0.014	0.00
270	22.50	0.07	0.015	0.090	0.014	0.00
271	22.58	0.07	0.015	0.090	0.014	0.00
272	22.67	0.07	0.015	0.089	0.014	0.00
273	22.75	0.07	0.015	0.089	0.014	0.00

```
274  22.83     0.07      0.015         0.089     0.014         0.00
275  22.92     0.07      0.015         0.089     0.014         0.00
276  23.00     0.07      0.015         0.088     0.014         0.00
277  23.08     0.07      0.015         0.088     0.014         0.00
278  23.17     0.07      0.015         0.088     0.014         0.00
279  23.25     0.07      0.015         0.088     0.014         0.00
280  23.33     0.07      0.015         0.088     0.014         0.00
281  23.42     0.07      0.015         0.087     0.014         0.00
282  23.50     0.07      0.015         0.087     0.014         0.00
283  23.58     0.07      0.015         0.087     0.014         0.00
284  23.67     0.07      0.015         0.087     0.014         0.00
285  23.75     0.07      0.015         0.087     0.014         0.00
286  23.83     0.07      0.015         0.087     0.014         0.00
287  23.92     0.07      0.015         0.087     0.014         0.00
288  24.00     0.07      0.015         0.087     0.014         0.00
    Sum =     100.0                                  Sum =     3.8
      Flood volume = Effective rainfall      0.32(In)
       times area      30.4(Ac.)/[(In)/(Ft.)] =       0.8(Ac.Ft)
      Total soil loss =      1.58(In)
      Total soil loss =     4.015(Ac.Ft)
      Total rainfall =      1.90(In)
      Flood volume =       35034.0 Cubic Feet
      Total soil loss =      174898.2 Cubic Feet
      --------------------------------------------------------------------
       Peak flow rate of this hydrograph =      3.307(CFS)
      --------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R   S T O R M
                     R u n o f f     H y d r o g r a p h
      --------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
 Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
 ----------------------------------------------------------------------
   0+ 5       0.0000      0.00  Q         |         |         |         |
   0+10       0.0002      0.02  Q         |         |         |         |
   0+15       0.0004      0.04  Q         |         |         |         |
   0+20       0.0007      0.04  Q         |         |         |         |
   0+25       0.0011      0.06  Q         |         |         |         |
   0+30       0.0016      0.06  Q         |         |         |         |
   0+35       0.0020      0.07  Q         |         |         |         |
   0+40       0.0025      0.07  Q         |         |         |         |
   0+45       0.0030      0.07  Q         |         |         |         |
   0+50       0.0035      0.07  Q         |         |         |         |
   0+55       0.0040      0.08  Q         |         |         |         |
   1+ 0       0.0047      0.09  Q         |         |         |         |
   1+ 5       0.0053      0.09  Q         |         |         |         |
   1+10       0.0058      0.08  Q         |         |         |         |
   1+15       0.0063      0.07  Q         |         |         |         |
   1+20       0.0068      0.07  Q         |         |         |         |
   1+25       0.0073      0.07  Q         |         |         |         |
   1+30       0.0078      0.07  Q         |         |         |         |
   1+35       0.0083      0.07  Q         |         |         |         |
   1+40       0.0088      0.07  Q         |         |         |         |
   1+45       0.0093      0.07  Q         |         |         |         |
   1+50       0.0097      0.07  Q         |         |         |         |
   1+55       0.0103      0.08  Q         |         |         |         |
   2+ 0       0.0109      0.09  Q         |         |         |         |
   2+ 5       0.0115      0.09  Q         |         |         |         |
   2+10       0.0122      0.09  Q         |         |         |         |
   2+15       0.0128      0.09  Q         |         |         |         |
   2+20       0.0135      0.09  Q         |         |         |         |
```

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 2+25      0.0141      0.09  Q          |          |          |          |
 2+30      0.0147      0.09  Q          |          |          |          |
 2+35      0.0154      0.10  Q          |          |          |          |
 2+40      0.0161      0.11  Q          |          |          |          |
 2+45      0.0169      0.11  Q          |          |          |          |
 2+50      0.0177      0.11  Q          |          |          |          |
 2+55      0.0185      0.12  Q          |          |          |          |
 3+ 0      0.0193      0.12  Q          |          |          |          |
 3+ 5      0.0201      0.12  Q          |          |          |          |
 3+10      0.0209      0.12  QV         |          |          |          |
 3+15      0.0217      0.12  QV         |          |          |          |
 3+20      0.0225      0.12  QV         |          |          |          |
 3+25      0.0233      0.12  QV         |          |          |          |
 3+30      0.0241      0.12  QV         |          |          |          |
 3+35      0.0249      0.12  QV         |          |          |          |
 3+40      0.0257      0.12  QV         |          |          |          |
 3+45      0.0265      0.12  QV         |          |          |          |
 3+50      0.0273      0.12  QV         |          |          |          |
 3+55      0.0282      0.13  QV         |          |          |          |
 4+ 0      0.0291      0.14  QV         |          |          |          |
 4+ 5      0.0301      0.14  QV         |          |          |          |
 4+10      0.0310      0.14  QV         |          |          |          |
 4+15      0.0320      0.14  QV         |          |          |          |
 4+20      0.0330      0.14  QV         |          |          |          |
 4+25      0.0340      0.15  QV         |          |          |          |
 4+30      0.0351      0.16  QV         |          |          |          |
 4+35      0.0362      0.16  QV         |          |          |          |
 4+40      0.0373      0.16  QV         |          |          |          |
 4+45      0.0385      0.16  QV         |          |          |          |
 4+50      0.0396      0.16  QV         |          |          |          |
 4+55      0.0408      0.18  Q V        |          |          |          |
 5+ 0      0.0421      0.18  Q V        |          |          |          |
 5+ 5      0.0433      0.18  Q V        |          |          |          |
 5+10      0.0444      0.16  Q V        |          |          |          |
 5+15      0.0454      0.15  Q V        |          |          |          |
 5+20      0.0464      0.15  Q V        |          |          |          |
 5+25      0.0475      0.15  Q V        |          |          |          |
 5+30      0.0486      0.16  Q V        |          |          |          |
 5+35      0.0497      0.16  Q V        |          |          |          |
 5+40      0.0509      0.17  Q V        |          |          |          |
 5+45      0.0522      0.18  Q V        |          |          |          |
 5+50      0.0534      0.18  Q V        |          |          |          |
 5+55      0.0547      0.19  Q V        |          |          |          |
 6+ 0      0.0560      0.19  Q V        |          |          |          |
 6+ 5      0.0573      0.19  Q V        |          |          |          |
 6+10      0.0587      0.20  Q V        |          |          |          |
 6+15      0.0601      0.21  Q V        |          |          |          |
 6+20      0.0615      0.21  Q  V       |          |          |          |
 6+25      0.0629      0.21  Q  V       |          |          |          |
 6+30      0.0644      0.21  Q  V       |          |          |          |
 6+35      0.0658      0.21  Q  V       |          |          |          |
 6+40      0.0674      0.22  Q  V       |          |          |          |
 6+45      0.0689      0.23  Q  V       |          |          |          |
 6+50      0.0705      0.23  Q  V       |          |          |          |
 6+55      0.0721      0.23  Q  V       |          |          |          |
 7+ 0      0.0737      0.23  Q  V       |          |          |          |
 7+ 5      0.0753      0.23  Q  V       |          |          |          |
 7+10      0.0769      0.23  Q  V       |          |          |          |
 7+15      0.0785      0.23  Q  V       |          |          |          |
 7+20      0.0802      0.24  Q  V       |          |          |          |
 7+25      0.0819      0.25  Q   V      |          |          |          |
 7+30      0.0836      0.25  |Q   V     |          |          |          |
 7+35      0.0854      0.26  |Q   V     |          |          |          |
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  7+40       0.0872      0.27  |Q  V     |         |         |         |
  7+45       0.0891      0.27  |Q  V     |         |         |         |
  7+50       0.0910      0.28  |Q  V     |         |         |         |
  7+55       0.0930      0.29  |Q  V     |         |         |         |
  8+ 0       0.0951      0.30  |Q  V     |         |         |         |
  8+ 5       0.0972      0.30  |Q  V     |         |         |         |
  8+10       0.0994      0.33  |Q  V     |         |         |         |
  8+15       0.1017      0.34  |Q   V    |         |         |         |
  8+20       0.1041      0.34  |Q   V    |         |         |         |
  8+25       0.1065      0.35  |Q   V    |         |         |         |
  8+30       0.1089      0.35  |Q   V    |         |         |         |
  8+35       0.1113      0.35  |Q   V    |         |         |         |
  8+40       0.1138      0.36  |Q   V    |         |         |         |
  8+45       0.1164      0.37  |Q   V    |         |         |         |
  8+50       0.1189      0.37  |Q   V    |         |         |         |
  8+55       0.1216      0.38  |Q    V   |         |         |         |
  9+ 0       0.1243      0.39  |Q    V   |         |         |         |
  9+ 5       0.1270      0.40  |Q    V   |         |         |         |
  9+10       0.1299      0.42  |Q    V   |         |         |         |
  9+15       0.1329      0.43  |Q    V   |         |         |         |
  9+20       0.1359      0.44  |Q    V   |         |         |         |
  9+25       0.1390      0.45  |Q    V   |         |         |         |
  9+30       0.1422      0.46  |Q     V  |         |         |         |
  9+35       0.1454      0.47  |Q     V  |         |         |         |
  9+40       0.1487      0.48  |Q     V  |         |         |         |
  9+45       0.1520      0.48  |Q     V  |         |         |         |
  9+50       0.1554      0.49  |Q     V  |         |         |         |
  9+55       0.1588      0.50  | Q    V  |         |         |         |
 10+ 0       0.1623      0.51  | Q     V |         |         |         |
 10+ 5       0.1658      0.50  |Q      V |         |         |         |
 10+10       0.1687      0.43  |Q      V |         |         |         |
 10+15       0.1713      0.38  |Q      V |         |         |         |
 10+20       0.1739      0.37  |Q      V |         |         |         |
 10+25       0.1763      0.36  |Q      V |         |         |         |
 10+30       0.1788      0.35  |Q      V |         |         |         |
 10+35       0.1813      0.36  |Q       V|         |         |         |
 10+40       0.1841      0.41  |Q       V|         |         |         |
 10+45       0.1871      0.44  |Q       V|         |         |         |
 10+50       0.1903      0.45  |Q       V|         |         |         |
 10+55       0.1934      0.46  |Q       V|         |         |         |
 11+ 0       0.1966      0.46  |Q       V|         |         |         |
 11+ 5       0.1998      0.46  |Q       V|         |         |         |
 11+10       0.2029      0.45  |Q        V         |         |         |
 11+15       0.2060      0.45  |Q        V         |         |         |
 11+20       0.2091      0.45  |Q        V         |         |         |
 11+25       0.2122      0.44  |Q        V         |         |         |
 11+30       0.2152      0.44  |Q        V         |         |         |
 11+35       0.2182      0.44  |Q        V         |         |         |
 11+40       0.2211      0.42  |Q        V         |         |         |
 11+45       0.2239      0.41  |Q        |V        |         |         |
 11+50       0.2267      0.40  |Q        |V        |         |         |
 11+55       0.2295      0.41  |Q        |V        |         |         |
 12+ 0       0.2324      0.42  |Q        |V        |         |         |
 12+ 5       0.2355      0.45  |Q        |V        |         |         |
 12+10       0.2400      0.65  | Q       |V        |         |         |
 12+15       0.2454      0.79  |  Q      | V       |         |         |
 12+20       0.2514      0.87  |  Q      | V       |         |         |
 12+25       0.2585      1.02  |   Q     | V       |         |         |
 12+30       0.2662      1.12  |   Q     |  V      |         |         |
 12+35       0.2745      1.21  |   Q     |  V      |         |         |
 12+40       0.2845      1.46  |    Q    |   V     |         |         |
 12+45       0.2957      1.61  |     Q   |   V     |         |         |
 12+50       0.3074      1.71  |     Q   |    V    |         |         |
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12+55       0.3203      1.86  |      Q  |    V    |         |         |
13+ 0       0.3338      1.96  |      Q  |     V   |         |         |
13+ 5       0.3483      2.11  |       Q |      V  |         |         |
13+10       0.3667      2.66  |         Q       V |         |         |
13+15       0.3874      3.01  |         | Q      V|         |         |
13+20       0.4092      3.16  |         | Q       V         |         |
13+25       0.4316      3.25  |         |  Q      |V        |         |
13+30       0.4543      3.31  |         |  Q      | V       |         |
13+35       0.4760      3.14  |         | Q       |  V      |         |
13+40       0.4900      2.04  |       Q |         |   V     |         |
13+45       0.4994      1.37  |    Q    |         |   V     |         |
13+50       0.5072      1.13  |   Q     |         |    V    |         |
13+55       0.5141      1.00  |   Q     |         |    V    |         |
14+ 0       0.5207      0.96  |  Q      |         |    V    |         |
14+ 5       0.5278      1.03  |   Q     |         |     V   |         |
14+10       0.5378      1.45  |    Q    |         |     V   |         |
14+15       0.5496      1.72  |     Q   |         |      V  |         |
14+20       0.5621      1.81  |      Q  |         |      V  |         |
14+25       0.5744      1.78  |      Q  |         |       V |         |
14+30       0.5866      1.77  |      Q  |         |        V|         |
14+35       0.5988      1.77  |      Q  |         |        V|         |
14+40       0.6111      1.79  |      Q  |         |         V         |
14+45       0.6236      1.81  |      Q  |         |         |V        |
14+50       0.6361      1.81  |      Q  |         |         |V        |
14+55       0.6480      1.73  |     Q   |         |         | V       |
15+ 0       0.6596      1.69  |     Q   |         |         | V       |
15+ 5       0.6711      1.67  |     Q   |         |         |  V      |
15+10       0.6819      1.57  |     Q   |         |         |  V      |
15+15       0.6924      1.52  |     Q   |         |         |   V     |
15+20       0.7027      1.50  |    Q    |         |         |   V     |
15+25       0.7124      1.40  |    Q    |         |         |    V    |
15+30       0.7217      1.35  |    Q    |         |         |    V    |
15+35       0.7304      1.27  |    Q    |         |         |     V   |
15+40       0.7364      0.87  |  Q      |         |         |     V   |
15+45       0.7407      0.63  | Q       |         |         |     V   |
15+50       0.7445      0.55  | Q       |         |         |      V  |
15+55       0.7481      0.51  | Q       |         |         |      V  |
16+ 0       0.7516      0.51  | Q       |         |         |      V  |
16+ 5       0.7549      0.48  |Q        |         |         |      V  |
16+10       0.7570      0.30  |Q        |         |         |      V  |
16+15       0.7582      0.18  Q         |         |         |      V  |
16+20       0.7592      0.14  Q         |         |         |      V  |
16+25       0.7599      0.11  Q         |         |         |      V  |
16+30       0.7606      0.10  Q         |         |         |      V  |
16+35       0.7613      0.10  Q         |         |         |      V  |
16+40       0.7619      0.08  Q         |         |         |      V  |
16+45       0.7624      0.08  Q         |         |         |      V  |
16+50       0.7629      0.07  Q         |         |         |      V  |
16+55       0.7634      0.07  Q         |         |         |      V  |
17+ 0       0.7639      0.07  Q         |         |         |      V  |
17+ 5       0.7644      0.07  Q         |         |         |       V |
17+10       0.7650      0.09  Q         |         |         |       V |
17+15       0.7658      0.11  Q         |         |         |       V |
17+20       0.7665      0.11  Q         |         |         |       V |
17+25       0.7673      0.11  Q         |         |         |       V |
17+30       0.7681      0.12  Q         |         |         |       V |
17+35       0.7689      0.12  Q         |         |         |       V |
17+40       0.7697      0.12  Q         |         |         |       V |
17+45       0.7705      0.12  Q         |         |         |       V |
17+50       0.7713      0.11  Q         |         |         |       V |
17+55       0.7720      0.10  Q         |         |         |       V |
18+ 0       0.7727      0.10  Q         |         |         |       V |
18+ 5       0.7734      0.10  Q         |         |         |       V |
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18+10	0.7740	0.09	Q	|	|	|	V |
18+15	0.7747	0.09	Q	|	|	|	V |
18+20	0.7753	0.09	Q	|	|	|	V |
18+25	0.7760	0.09	Q	|	|	|	V |
18+30	0.7766	0.09	Q	|	|	|	V |
18+35	0.7772	0.09	Q	|	|	|	V |
18+40	0.7778	0.08	Q	|	|	|	V |
18+45	0.7783	0.07	Q	|	|	|	V |
18+50	0.7788	0.07	Q	|	|	|	V |
18+55	0.7792	0.06	Q	|	|	|	V |
19+ 0	0.7796	0.05	Q	|	|	|	V |
19+ 5	0.7799	0.05	Q	|	|	|	V |
19+10	0.7803	0.06	Q	|	|	|	V |
19+15	0.7808	0.07	Q	|	|	|	V |
19+20	0.7813	0.07	Q	|	|	|	V |
19+25	0.7818	0.08	Q	|	|	|	V |
19+30	0.7824	0.09	Q	|	|	|	V |
19+35	0.7830	0.09	Q	|	|	|	V |
19+40	0.7836	0.08	Q	|	|	|	V |
19+45	0.7841	0.07	Q	|	|	|	V |
19+50	0.7846	0.07	Q	|	|	|	V|
19+55	0.7850	0.06	Q	|	|	|	V|
20+ 0	0.7853	0.05	Q	|	|	|	V|
20+ 5	0.7857	0.05	Q	|	|	|	V|
20+10	0.7861	0.06	Q	|	|	|	V|
20+15	0.7866	0.07	Q	|	|	|	V|
20+20	0.7870	0.07	Q	|	|	|	V|
20+25	0.7875	0.07	Q	|	|	|	V|
20+30	0.7880	0.07	Q	|	|	|	V|
20+35	0.7885	0.07	Q	|	|	|	V|
20+40	0.7889	0.07	Q	|	|	|	V|
20+45	0.7894	0.07	Q	|	|	|	V|
20+50	0.7899	0.07	Q	|	|	|	V|
20+55	0.7903	0.06	Q	|	|	|	V|
21+ 0	0.7906	0.05	Q	|	|	|	V|
21+ 5	0.7910	0.05	Q	|	|	|	V|
21+10	0.7914	0.06	Q	|	|	|	V|
21+15	0.7919	0.07	Q	|	|	|	V|
21+20	0.7923	0.07	Q	|	|	|	V|
21+25	0.7927	0.06	Q	|	|	|	V|
21+30	0.7931	0.05	Q	|	|	|	V|
21+35	0.7934	0.05	Q	|	|	|	V|
21+40	0.7938	0.06	Q	|	|	|	V|
21+45	0.7943	0.07	Q	|	|	|	V|
21+50	0.7947	0.07	Q	|	|	|	V|
21+55	0.7951	0.06	Q	|	|	|	V|
22+ 0	0.7955	0.05	Q	|	|	|	V|
22+ 5	0.7958	0.05	Q	|	|	|	V|
22+10	0.7962	0.06	Q	|	|	|	V|
22+15	0.7967	0.07	Q	|	|	|	V|
22+20	0.7971	0.07	Q	|	|	|	V|
22+25	0.7975	0.06	Q	|	|	|	V|
22+30	0.7979	0.05	Q	|	|	|	V|
22+35	0.7982	0.05	Q	|	|	|	V|
22+40	0.7985	0.05	Q	|	|	|	V|
22+45	0.7989	0.05	Q	|	|	|	V|
22+50	0.7992	0.05	Q	|	|	|	V|
22+55	0.7995	0.05	Q	|	|	|	V|
23+ 0	0.7998	0.05	Q	|	|	|	V|
23+ 5	0.8002	0.05	Q	|	|	|	V|
23+10	0.8005	0.05	Q	|	|	|	V|
23+15	0.8008	0.05	Q	|	|	|	V|
23+20	0.8011	0.05	Q	|	|	|	V|

23+25	0.8014	0.05	Q	|	|	|	V|
23+30	0.8018	0.05	Q	|	|	|	V|
23+35	0.8021	0.05	Q	|	|	|	V|
23+40	0.8024	0.05	Q	|	|	|	V|
23+45	0.8027	0.05	Q	|	|	|	V|
23+50	0.8030	0.05	Q	|	|	|	V|
23+55	0.8034	0.05	Q	|	|	|	V|
24+ 0	0.8037	0.05	Q	|	|	|	V|
24+ 5	0.8040	0.04	Q	|	|	|	V|
24+10	0.8041	0.02	Q	|	|	|	V|
24+15	0.8042	0.01	Q	|	|	|	V|
24+20	0.8042	0.00	Q	|	|	|	V|
24+25	0.8043	0.00	Q	|	|	|	V|
24+30	0.8043	0.00	Q	|	|	|	V|
24+35	0.8043	0.00	Q	|	|	|	V|
24+40	0.8043	0.00	Q	|	|	|	V|
24+45	0.8043	0.00	Q	|	|	|	V|

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 01/07/18 File: 27259UHeFGHJ242.out

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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 4066

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area FGHJ – Mill Creek Promenade
2yr 24hr Storm by Pacific Coast Land Consultants, Inc.

Drainage Area = 24.40(Ac.) = 0.038 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 24.40(Ac.) = 0.038 Sq. Mi.
Length along longest watercourse = 1714.00(Ft.)
Length along longest watercourse measured to centroid = 857.00(Ft.)
Length along longest watercourse = 0.325 Mi.
Length along longest watercourse measured to centroid = 0.162 Mi.
Difference in elevation = 30.00(Ft.)
Slope along watercourse = 92.4154 Ft./Mi.
Average Manning's 'N' = 0.025
Lag time = 0.083 Hr.
Lag time = 4.98 Min.
25% of lag time = 1.24 Min.
40% of lag time = 1.99 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
24.40	1.90	46.36

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
24.40	4.75	115.90

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 1.900(In)
Area Averaged 100-Year Rainfall = 4.750(In)

Point rain (area averaged) = 1.900(In)
Areal adjustment factor = 100.00 %

Adjusted average point rain = 1.900(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
24.400	72.00	0.000

Total Area Entered = 24.40(Ac.)

RI AMC2	RI AMC-3	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
72.0	86.2	0.173	0.000	0.173	1.000	0.173
					Sum (F) =	0.173

Area averaged mean soil loss (F) (In/Hr) = 0.173
Minimum soil loss rate ((In/Hr)) = 0.087
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

U n i t H y d r o g r a p h
FOOTHILL S-Curve

Unit Hydrograph Data

Unit time period	(hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	100.439	14.574	3.584
2	0.167	200.879	55.761	13.712
3	0.250	301.318	18.357	4.514
4	0.333	401.757	7.387	1.817
5	0.417	502.197	2.417	0.594
6	0.500	602.636	0.845	0.208
7	0.583	703.075	0.658	0.162
			Sum = 100.000	Sum= 24.591

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.015	0.307	0.014	0.00
2	0.17	0.07	0.015	0.306	0.014	0.00
3	0.25	0.07	0.015	0.305	0.014	0.00
4	0.33	0.10	0.023	0.304	0.021	0.00
5	0.42	0.10	0.023	0.303	0.021	0.00
6	0.50	0.10	0.023	0.301	0.021	0.00
7	0.58	0.10	0.023	0.300	0.021	0.00
8	0.67	0.10	0.023	0.299	0.021	0.00
9	0.75	0.10	0.023	0.298	0.021	0.00
10	0.83	0.13	0.030	0.297	0.027	0.00
11	0.92	0.13	0.030	0.295	0.027	0.00
12	1.00	0.13	0.030	0.294	0.027	0.00
13	1.08	0.10	0.023	0.293	0.021	0.00
14	1.17	0.10	0.023	0.292	0.021	0.00
15	1.25	0.10	0.023	0.291	0.021	0.00
16	1.33	0.10	0.023	0.290	0.021	0.00
17	1.42	0.10	0.023	0.289	0.021	0.00
18	1.50	0.10	0.023	0.287	0.021	0.00
19	1.58	0.10	0.023	0.286	0.021	0.00
20	1.67	0.10	0.023	0.285	0.021	0.00
21	1.75	0.10	0.023	0.284	0.021	0.00
22	1.83	0.13	0.030	0.283	0.027	0.00
23	1.92	0.13	0.030	0.282	0.027	0.00
24	2.00	0.13	0.030	0.281	0.027	0.00

25	2.08	0.13	0.030	0.279	0.027	0.00
26	2.17	0.13	0.030	0.278	0.027	0.00
27	2.25	0.13	0.030	0.277	0.027	0.00
28	2.33	0.13	0.030	0.276	0.027	0.00
29	2.42	0.13	0.030	0.275	0.027	0.00
30	2.50	0.13	0.030	0.274	0.027	0.00
31	2.58	0.17	0.038	0.273	0.034	0.00
32	2.67	0.17	0.038	0.271	0.034	0.00
33	2.75	0.17	0.038	0.270	0.034	0.00
34	2.83	0.17	0.038	0.269	0.034	0.00
35	2.92	0.17	0.038	0.268	0.034	0.00
36	3.00	0.17	0.038	0.267	0.034	0.00
37	3.08	0.17	0.038	0.266	0.034	0.00
38	3.17	0.17	0.038	0.265	0.034	0.00
39	3.25	0.17	0.038	0.264	0.034	0.00
40	3.33	0.17	0.038	0.263	0.034	0.00
41	3.42	0.17	0.038	0.262	0.034	0.00
42	3.50	0.17	0.038	0.260	0.034	0.00
43	3.58	0.17	0.038	0.259	0.034	0.00
44	3.67	0.17	0.038	0.258	0.034	0.00
45	3.75	0.17	0.038	0.257	0.034	0.00
46	3.83	0.20	0.046	0.256	0.041	0.00
47	3.92	0.20	0.046	0.255	0.041	0.00
48	4.00	0.20	0.046	0.254	0.041	0.00
49	4.08	0.20	0.046	0.253	0.041	0.00
50	4.17	0.20	0.046	0.252	0.041	0.00
51	4.25	0.20	0.046	0.251	0.041	0.00
52	4.33	0.23	0.053	0.250	0.048	0.01
53	4.42	0.23	0.053	0.249	0.048	0.01
54	4.50	0.23	0.053	0.248	0.048	0.01
55	4.58	0.23	0.053	0.246	0.048	0.01
56	4.67	0.23	0.053	0.245	0.048	0.01
57	4.75	0.23	0.053	0.244	0.048	0.01
58	4.83	0.27	0.061	0.243	0.055	0.01
59	4.92	0.27	0.061	0.242	0.055	0.01
60	5.00	0.27	0.061	0.241	0.055	0.01
61	5.08	0.20	0.046	0.240	0.041	0.00
62	5.17	0.20	0.046	0.239	0.041	0.00
63	5.25	0.20	0.046	0.238	0.041	0.00
64	5.33	0.23	0.053	0.237	0.048	0.01
65	5.42	0.23	0.053	0.236	0.048	0.01
66	5.50	0.23	0.053	0.235	0.048	0.01
67	5.58	0.27	0.061	0.234	0.055	0.01
68	5.67	0.27	0.061	0.233	0.055	0.01
69	5.75	0.27	0.061	0.232	0.055	0.01
70	5.83	0.27	0.061	0.231	0.055	0.01
71	5.92	0.27	0.061	0.230	0.055	0.01
72	6.00	0.27	0.061	0.229	0.055	0.01
73	6.08	0.30	0.068	0.228	0.062	0.01
74	6.17	0.30	0.068	0.227	0.062	0.01
75	6.25	0.30	0.068	0.226	0.062	0.01
76	6.33	0.30	0.068	0.225	0.062	0.01
77	6.42	0.30	0.068	0.224	0.062	0.01
78	6.50	0.30	0.068	0.223	0.062	0.01
79	6.58	0.33	0.076	0.222	0.068	0.01
80	6.67	0.33	0.076	0.221	0.068	0.01
81	6.75	0.33	0.076	0.220	0.068	0.01
82	6.83	0.33	0.076	0.219	0.068	0.01
83	6.92	0.33	0.076	0.218	0.068	0.01
84	7.00	0.33	0.076	0.217	0.068	0.01
85	7.08	0.33	0.076	0.216	0.068	0.01
86	7.17	0.33	0.076	0.215	0.068	0.01
87	7.25	0.33	0.076	0.214	0.068	0.01

88	7.33	0.37	0.084	0.213	0.075	0.01
89	7.42	0.37	0.084	0.212	0.075	0.01
90	7.50	0.37	0.084	0.211	0.075	0.01
91	7.58	0.40	0.091	0.210	0.082	0.01
92	7.67	0.40	0.091	0.209	0.082	0.01
93	7.75	0.40	0.091	0.208	0.082	0.01
94	7.83	0.43	0.099	0.207	0.089	0.01
95	7.92	0.43	0.099	0.206	0.089	0.01
96	8.00	0.43	0.099	0.205	0.089	0.01
97	8.08	0.50	0.114	0.204	0.103	0.01
98	8.17	0.50	0.114	0.203	0.103	0.01
99	8.25	0.50	0.114	0.202	0.103	0.01
100	8.33	0.50	0.114	0.201	0.103	0.01
101	8.42	0.50	0.114	0.200	0.103	0.01
102	8.50	0.50	0.114	0.199	0.103	0.01
103	8.58	0.53	0.122	0.199	0.109	0.01
104	8.67	0.53	0.122	0.198	0.109	0.01
105	8.75	0.53	0.122	0.197	0.109	0.01
106	8.83	0.57	0.129	0.196	0.116	0.01
107	8.92	0.57	0.129	0.195	0.116	0.01
108	9.00	0.57	0.129	0.194	0.116	0.01
109	9.08	0.63	0.144	0.193	0.130	0.01
110	9.17	0.63	0.144	0.192	0.130	0.01
111	9.25	0.63	0.144	0.191	0.130	0.01
112	9.33	0.67	0.152	0.190	0.137	0.02
113	9.42	0.67	0.152	0.189	0.137	0.02
114	9.50	0.67	0.152	0.188	0.137	0.02
115	9.58	0.70	0.160	0.187	0.144	0.02
116	9.67	0.70	0.160	0.187	0.144	0.02
117	9.75	0.70	0.160	0.186	0.144	0.02
118	9.83	0.73	0.167	0.185	0.150	0.02
119	9.92	0.73	0.167	0.184	0.150	0.02
120	10.00	0.73	0.167	0.183	0.150	0.02
121	10.08	0.50	0.114	0.182	0.103	0.01
122	10.17	0.50	0.114	0.181	0.103	0.01
123	10.25	0.50	0.114	0.180	0.103	0.01
124	10.33	0.50	0.114	0.180	0.103	0.01
125	10.42	0.50	0.114	0.179	0.103	0.01
126	10.50	0.50	0.114	0.178	0.103	0.01
127	10.58	0.67	0.152	0.177	0.137	0.02
128	10.67	0.67	0.152	0.176	0.137	0.02
129	10.75	0.67	0.152	0.175	0.137	0.02
130	10.83	0.67	0.152	0.174	0.137	0.02
131	10.92	0.67	0.152	0.173	0.137	0.02
132	11.00	0.67	0.152	0.173	0.137	0.02
133	11.08	0.63	0.144	0.172	0.130	0.01
134	11.17	0.63	0.144	0.171	0.130	0.01
135	11.25	0.63	0.144	0.170	0.130	0.01
136	11.33	0.63	0.144	0.169	0.130	0.01
137	11.42	0.63	0.144	0.168	0.130	0.01
138	11.50	0.63	0.144	0.168	0.130	0.01
139	11.58	0.57	0.129	0.167	0.116	0.01
140	11.67	0.57	0.129	0.166	0.116	0.01
141	11.75	0.57	0.129	0.165	0.116	0.01
142	11.83	0.60	0.137	0.164	0.123	0.01
143	11.92	0.60	0.137	0.163	0.123	0.01
144	12.00	0.60	0.137	0.163	0.123	0.01
145	12.08	0.83	0.190	0.162	---	0.03
146	12.17	0.83	0.190	0.161	---	0.03
147	12.25	0.83	0.190	0.160	---	0.03
148	12.33	0.87	0.198	0.159	---	0.04
149	12.42	0.87	0.198	0.159	---	0.04
150	12.50	0.87	0.198	0.158	---	0.04

151	12.58	0.93	0.213	0.157	---	0.06
152	12.67	0.93	0.213	0.156	---	0.06
153	12.75	0.93	0.213	0.155	---	0.06
154	12.83	0.97	0.220	0.155	---	0.07
155	12.92	0.97	0.220	0.154	---	0.07
156	13.00	0.97	0.220	0.153	---	0.07
157	13.08	1.13	0.258	0.152	---	0.11
158	13.17	1.13	0.258	0.152	---	0.11
159	13.25	1.13	0.258	0.151	---	0.11
160	13.33	1.13	0.258	0.150	---	0.11
161	13.42	1.13	0.258	0.149	---	0.11
162	13.50	1.13	0.258	0.148	---	0.11
163	13.58	0.77	0.175	0.148	---	0.03
164	13.67	0.77	0.175	0.147	---	0.03
165	13.75	0.77	0.175	0.146	---	0.03
166	13.83	0.77	0.175	0.145	---	0.03
167	13.92	0.77	0.175	0.145	---	0.03
168	14.00	0.77	0.175	0.144	---	0.03
169	14.08	0.90	0.205	0.143	---	0.06
170	14.17	0.90	0.205	0.143	---	0.06
171	14.25	0.90	0.205	0.142	---	0.06
172	14.33	0.87	0.198	0.141	---	0.06
173	14.42	0.87	0.198	0.140	---	0.06
174	14.50	0.87	0.198	0.140	---	0.06
175	14.58	0.87	0.198	0.139	---	0.06
176	14.67	0.87	0.198	0.138	---	0.06
177	14.75	0.87	0.198	0.137	---	0.06
178	14.83	0.83	0.190	0.137	---	0.05
179	14.92	0.83	0.190	0.136	---	0.05
180	15.00	0.83	0.190	0.135	---	0.05
181	15.08	0.80	0.182	0.135	---	0.05
182	15.17	0.80	0.182	0.134	---	0.05
183	15.25	0.80	0.182	0.133	---	0.05
184	15.33	0.77	0.175	0.133	---	0.04
185	15.42	0.77	0.175	0.132	---	0.04
186	15.50	0.77	0.175	0.131	---	0.04
187	15.58	0.63	0.144	0.131	---	0.01
188	15.67	0.63	0.144	0.130	---	0.01
189	15.75	0.63	0.144	0.129	---	0.02
190	15.83	0.63	0.144	0.129	---	0.02
191	15.92	0.63	0.144	0.128	---	0.02
192	16.00	0.63	0.144	0.127	---	0.02
193	16.08	0.13	0.030	0.127	0.027	0.00
194	16.17	0.13	0.030	0.126	0.027	0.00
195	16.25	0.13	0.030	0.125	0.027	0.00
196	16.33	0.13	0.030	0.125	0.027	0.00
197	16.42	0.13	0.030	0.124	0.027	0.00
198	16.50	0.13	0.030	0.123	0.027	0.00
199	16.58	0.10	0.023	0.123	0.021	0.00
200	16.67	0.10	0.023	0.122	0.021	0.00
201	16.75	0.10	0.023	0.122	0.021	0.00
202	16.83	0.10	0.023	0.121	0.021	0.00
203	16.92	0.10	0.023	0.120	0.021	0.00
204	17.00	0.10	0.023	0.120	0.021	0.00
205	17.08	0.17	0.038	0.119	0.034	0.00
206	17.17	0.17	0.038	0.119	0.034	0.00
207	17.25	0.17	0.038	0.118	0.034	0.00
208	17.33	0.17	0.038	0.117	0.034	0.00
209	17.42	0.17	0.038	0.117	0.034	0.00
210	17.50	0.17	0.038	0.116	0.034	0.00
211	17.58	0.17	0.038	0.116	0.034	0.00
212	17.67	0.17	0.038	0.115	0.034	0.00
213	17.75	0.17	0.038	0.114	0.034	0.00

214	17.83	0.13	0.030	0.114	0.027	0.00
215	17.92	0.13	0.030	0.113	0.027	0.00
216	18.00	0.13	0.030	0.113	0.027	0.00
217	18.08	0.13	0.030	0.112	0.027	0.00
218	18.17	0.13	0.030	0.112	0.027	0.00
219	18.25	0.13	0.030	0.111	0.027	0.00
220	18.33	0.13	0.030	0.111	0.027	0.00
221	18.42	0.13	0.030	0.110	0.027	0.00
222	18.50	0.13	0.030	0.109	0.027	0.00
223	18.58	0.10	0.023	0.109	0.021	0.00
224	18.67	0.10	0.023	0.108	0.021	0.00
225	18.75	0.10	0.023	0.108	0.021	0.00
226	18.83	0.07	0.015	0.107	0.014	0.00
227	18.92	0.07	0.015	0.107	0.014	0.00
228	19.00	0.07	0.015	0.106	0.014	0.00
229	19.08	0.10	0.023	0.106	0.021	0.00
230	19.17	0.10	0.023	0.105	0.021	0.00
231	19.25	0.10	0.023	0.105	0.021	0.00
232	19.33	0.13	0.030	0.104	0.027	0.00
233	19.42	0.13	0.030	0.104	0.027	0.00
234	19.50	0.13	0.030	0.103	0.027	0.00
235	19.58	0.10	0.023	0.103	0.021	0.00
236	19.67	0.10	0.023	0.102	0.021	0.00
237	19.75	0.10	0.023	0.102	0.021	0.00
238	19.83	0.07	0.015	0.102	0.014	0.00
239	19.92	0.07	0.015	0.101	0.014	0.00
240	20.00	0.07	0.015	0.101	0.014	0.00
241	20.08	0.10	0.023	0.100	0.021	0.00
242	20.17	0.10	0.023	0.100	0.021	0.00
243	20.25	0.10	0.023	0.099	0.021	0.00
244	20.33	0.10	0.023	0.099	0.021	0.00
245	20.42	0.10	0.023	0.098	0.021	0.00
246	20.50	0.10	0.023	0.098	0.021	0.00
247	20.58	0.10	0.023	0.098	0.021	0.00
248	20.67	0.10	0.023	0.097	0.021	0.00
249	20.75	0.10	0.023	0.097	0.021	0.00
250	20.83	0.07	0.015	0.096	0.014	0.00
251	20.92	0.07	0.015	0.096	0.014	0.00
252	21.00	0.07	0.015	0.096	0.014	0.00
253	21.08	0.10	0.023	0.095	0.021	0.00
254	21.17	0.10	0.023	0.095	0.021	0.00
255	21.25	0.10	0.023	0.095	0.021	0.00
256	21.33	0.07	0.015	0.094	0.014	0.00
257	21.42	0.07	0.015	0.094	0.014	0.00
258	21.50	0.07	0.015	0.093	0.014	0.00
259	21.58	0.10	0.023	0.093	0.021	0.00
260	21.67	0.10	0.023	0.093	0.021	0.00
261	21.75	0.10	0.023	0.092	0.021	0.00
262	21.83	0.07	0.015	0.092	0.014	0.00
263	21.92	0.07	0.015	0.092	0.014	0.00
264	22.00	0.07	0.015	0.092	0.014	0.00
265	22.08	0.10	0.023	0.091	0.021	0.00
266	22.17	0.10	0.023	0.091	0.021	0.00
267	22.25	0.10	0.023	0.091	0.021	0.00
268	22.33	0.07	0.015	0.090	0.014	0.00
269	22.42	0.07	0.015	0.090	0.014	0.00
270	22.50	0.07	0.015	0.090	0.014	0.00
271	22.58	0.07	0.015	0.090	0.014	0.00
272	22.67	0.07	0.015	0.089	0.014	0.00
273	22.75	0.07	0.015	0.089	0.014	0.00
274	22.83	0.07	0.015	0.089	0.014	0.00
275	22.92	0.07	0.015	0.089	0.014	0.00
276	23.00	0.07	0.015	0.088	0.014	0.00

277	23.08	0.07	0.015	0.088	0.014	0.00
278	23.17	0.07	0.015	0.088	0.014	0.00
279	23.25	0.07	0.015	0.088	0.014	0.00
280	23.33	0.07	0.015	0.088	0.014	0.00
281	23.42	0.07	0.015	0.087	0.014	0.00
282	23.50	0.07	0.015	0.087	0.014	0.00
283	23.58	0.07	0.015	0.087	0.014	0.00
284	23.67	0.07	0.015	0.087	0.014	0.00
285	23.75	0.07	0.015	0.087	0.014	0.00
286	23.83	0.07	0.015	0.087	0.014	0.00
287	23.92	0.07	0.015	0.087	0.014	0.00
288	24.00	0.07	0.015	0.087	0.014	0.00
Sum =		100.0			Sum =	3.8

Flood volume = Effective rainfall 0.32(In)
times area 24.4(Ac.)/[(In)/(Ft.)] = 0.6(Ac.Ft)
Total soil loss = 1.58(In)
Total soil loss = 3.218(Ac.Ft)
Total rainfall = 1.90(In)
Flood volume = 28083.3 Cubic Feet
Total soil loss = 140195.4 Cubic Feet

Peak flow rate of this hydrograph = 2.674(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.01	Q	|	|	|	|
0+10	0.0002	0.03	Q	|	|	|	|
0+15	0.0004	0.03	Q	|	|	|	|
0+20	0.0007	0.04	Q	|	|	|	|
0+25	0.0011	0.05	Q	|	|	|	|
0+30	0.0014	0.05	Q	|	|	|	|
0+35	0.0018	0.06	Q	|	|	|	|
0+40	0.0022	0.06	Q	|	|	|	|
0+45	0.0026	0.06	Q	|	|	|	|
0+50	0.0030	0.06	Q	|	|	|	|
0+55	0.0035	0.07	Q	|	|	|	|
1+ 0	0.0040	0.07	Q	|	|	|	|
1+ 5	0.0045	0.07	Q	|	|	|	|
1+10	0.0049	0.06	Q	|	|	|	|
1+15	0.0053	0.06	Q	|	|	|	|
1+20	0.0057	0.06	Q	|	|	|	|
1+25	0.0061	0.06	Q	|	|	|	|
1+30	0.0064	0.06	Q	|	|	|	|
1+35	0.0068	0.06	Q	|	|	|	|
1+40	0.0072	0.06	Q	|	|	|	|
1+45	0.0076	0.06	Q	|	|	|	|
1+50	0.0080	0.06	Q	|	|	|	|
1+55	0.0085	0.07	Q	|	|	|	|
2+ 0	0.0090	0.07	Q	|	|	|	|
2+ 5	0.0095	0.07	Q	|	|	|	|
2+10	0.0100	0.07	Q	|	|	|	|
2+15	0.0105	0.07	Q	|	|	|	|
2+20	0.0110	0.07	Q	|	|	|	|
2+25	0.0116	0.07	Q	|	|	|	|
2+30	0.0121	0.07	Q	|	|	|	|
2+35	0.0126	0.08	Q	|	|	|	|

2+40	0.0132	0.09	Q				
2+45	0.0138	0.09	Q				
2+50	0.0145	0.09	Q				
2+55	0.0151	0.09	Q				
3+ 0	0.0158	0.09	Q				
3+ 5	0.0164	0.09	QV				
3+10	0.0170	0.09	QV				
3+15	0.0177	0.09	QV				
3+20	0.0183	0.09	QV				
3+25	0.0190	0.09	QV				
3+30	0.0196	0.09	QV				
3+35	0.0203	0.09	QV				
3+40	0.0209	0.09	QV				
3+45	0.0216	0.09	QV				
3+50	0.0222	0.10	QV				
3+55	0.0230	0.11	QV				
4+ 0	0.0237	0.11	QV				
4+ 5	0.0245	0.11	QV				
4+10	0.0252	0.11	QV				
4+15	0.0260	0.11	QV				
4+20	0.0268	0.11	QV				
4+25	0.0277	0.13	QV				
4+30	0.0286	0.13	QV				
4+35	0.0295	0.13	QV				
4+40	0.0304	0.13	QV				
4+45	0.0313	0.13	QV				
4+50	0.0322	0.13	QV				
4+55	0.0332	0.14	Q V				
5+ 0	0.0342	0.15	Q V				
5+ 5	0.0352	0.14	Q V				
5+10	0.0360	0.12	Q V				
5+15	0.0368	0.12	Q V				
5+20	0.0376	0.12	Q V				
5+25	0.0385	0.13	Q V				
5+30	0.0394	0.13	Q V				
5+35	0.0403	0.13	Q V				
5+40	0.0413	0.14	Q V				
5+45	0.0423	0.15	Q V				
5+50	0.0433	0.15	Q V				
5+55	0.0443	0.15	Q V				
6+ 0	0.0454	0.15	Q V				
6+ 5	0.0464	0.15	Q V				
6+10	0.0475	0.16	Q V				
6+15	0.0487	0.17	Q V				
6+20	0.0498	0.17	Q V				
6+25	0.0510	0.17	Q V				
6+30	0.0522	0.17	Q V				
6+35	0.0533	0.17	Q V				
6+40	0.0546	0.18	Q V				
6+45	0.0559	0.18	Q V				
6+50	0.0571	0.19	Q V				
6+55	0.0584	0.19	Q V				
7+ 0	0.0597	0.19	Q V				
7+ 5	0.0610	0.19	Q V				
7+10	0.0623	0.19	Q V				
7+15	0.0636	0.19	Q V				
7+20	0.0649	0.19	Q V				
7+25	0.0663	0.20	Q V				
7+30	0.0677	0.20	Q V				
7+35	0.0691	0.21	Q V				
7+40	0.0706	0.22	Q V				
7+45	0.0721	0.22	Q V				
7+50	0.0737	0.23	Q V				

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 7+55       0.0753      0.24  Q   V     |         |         |         |
 8+ 0       0.0770      0.24  Q   V     |         |         |         |
 8+ 5       0.0787      0.25  Q   V     |         |         |         |
 8+10       0.0805      0.27  |Q  V     |         |         |         |
 8+15       0.0824      0.28  |Q   V    |         |         |         |
 8+20       0.0844      0.28  |Q   V    |         |         |         |
 8+25       0.0863      0.28  |Q   V    |         |         |         |
 8+30       0.0882      0.28  |Q   V    |         |         |         |
 8+35       0.0902      0.28  |Q   V    |         |         |         |
 8+40       0.0922      0.29  |Q   V    |         |         |         |
 8+45       0.0942      0.30  |Q   V    |         |         |         |
 8+50       0.0963      0.30  |Q   V    |         |         |         |
 8+55       0.0985      0.31  |Q    V   |         |         |         |
 9+ 0       0.1006      0.32  |Q    V   |         |         |         |
 9+ 5       0.1029      0.32  |Q    V   |         |         |         |
 9+10       0.1052      0.34  |Q    V   |         |         |         |
 9+15       0.1076      0.35  |Q    V   |         |         |         |
 9+20       0.1101      0.36  |Q    V   |         |         |         |
 9+25       0.1126      0.37  |Q    V   |         |         |         |
 9+30       0.1152      0.37  |Q     V  |         |         |         |
 9+35       0.1178      0.38  |Q     V  |         |         |         |
 9+40       0.1204      0.39  |Q     V  |         |         |         |
 9+45       0.1231      0.39  |Q     V  |         |         |         |
 9+50       0.1259      0.39  |Q     V  |         |         |         |
 9+55       0.1286      0.41  |Q     V  |         |         |         |
10+ 0       0.1315      0.41  |Q      V |         |         |         |
10+ 5       0.1342      0.39  |Q      V |         |         |         |
10+10       0.1364      0.32  |Q      V |         |         |         |
10+15       0.1384      0.30  |Q      V |         |         |         |
10+20       0.1404      0.29  |Q      V |         |         |         |
10+25       0.1423      0.28  |Q      V |         |         |         |
10+30       0.1442      0.28  |Q      V |         |         |         |
10+35       0.1463      0.29  |Q       V|         |         |         |
10+40       0.1487      0.35  |Q       V|         |         |         |
10+45       0.1512      0.36  |Q       V|         |         |         |
10+50       0.1537      0.37  |Q       V|         |         |         |
10+55       0.1563      0.37  |Q       V|         |         |         |
11+ 0       0.1588      0.37  |Q       V|         |         |         |
11+ 5       0.1614      0.37  |Q        V         |         |         |
11+10       0.1639      0.36  |Q        V         |         |         |
11+15       0.1663      0.36  |Q        V         |         |         |
11+20       0.1688      0.36  |Q        V         |         |         |
11+25       0.1712      0.36  |Q        V         |         |         |
11+30       0.1737      0.36  |Q        V         |         |         |
11+35       0.1761      0.35  |Q        V         |         |         |
11+40       0.1784      0.33  |Q        |V        |         |         |
11+45       0.1806      0.32  |Q        |V        |         |         |
11+50       0.1828      0.32  |Q        |V        |         |         |
11+55       0.1851      0.33  |Q        |V        |         |         |
12+ 0       0.1874      0.33  |Q        |V        |         |         |
12+ 5       0.1901      0.39  |Q        |V        |         |         |
12+10       0.1941      0.59  | Q       | V       |         |         |
12+15       0.1987      0.67  | Q       | V       |         |         |
12+20       0.2039      0.74  | Q       | V       |         |         |
12+25       0.2099      0.87  |  Q      |  V      |         |         |
12+30       0.2163      0.93  |  Q      |  V      |         |         |
12+35       0.2233      1.02  |   Q     |  V      |         |         |
12+40       0.2319      1.25  |    Q    |   V     |         |         |
12+45       0.2412      1.34  |    Q    |   V     |         |         |
12+50       0.2509      1.42  |    Q    |    V    |         |         |
12+55       0.2616      1.55  |     Q   |     V   |         |         |
13+ 0       0.2727      1.61  |     Q   |     V   |         |         |
13+ 5       0.2850      1.78  |      Q  |      V  |         |         |
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13+10       0.3010      2.32   |        Q|       V |         |         |
13+15       0.3183      2.52   |         Q        V|         |         |
13+20       0.3362      2.61   |         Q         V         |         |
13+25       0.3545      2.65   |         Q         |V        |         |
13+30       0.3729      2.67   |         Q         |  V      |         |
13+35       0.3894      2.40   |        Q|         |   V     |         |
13+40       0.3982      1.27   |    Q    |         |   V     |         |
13+45       0.4044      0.91   |  Q      |         |    V    |         |
13+50       0.4098      0.78   |  Q      |         |    V    |         |
13+55       0.4149      0.75   | Q       |         |    V    |         |
14+ 0       0.4201      0.75   | Q       |         |     V   |         |
14+ 5       0.4260      0.86   |  Q      |         |     V   |         |
14+10       0.4350      1.30   |    Q    |         |     V   |         |
14+15       0.4450      1.45   |    Q    |         |      V  |         |
14+20       0.4553      1.50   |    Q    |         |       V |         |
14+25       0.4651      1.43   |    Q    |         |       V |         |
14+30       0.4749      1.42   |    Q    |         |        V|         |
14+35       0.4847      1.43   |    Q    |         |         V         |
14+40       0.4946      1.44   |    Q    |         |         V         |
14+45       0.5047      1.46   |    Q    |         |         |V        |
14+50       0.5146      1.45   |    Q    |         |         |V        |
14+55       0.5240      1.36   |    Q    |         |         | V       |
15+ 0       0.5332      1.34   |    Q    |         |         |  V      |
15+ 5       0.5423      1.32   |    Q    |         |         |  V      |
15+10       0.5508      1.23   |   Q     |         |         |   V     |
15+15       0.5591      1.21   |   Q     |         |         |   V     |
15+20       0.5672      1.18   |   Q     |         |         |    V    |
15+25       0.5747      1.09   |   Q     |         |         |    V    |
15+30       0.5821      1.07   |   Q     |         |         |     V   |
15+35       0.5888      0.96   |  Q      |         |         |     V   |
15+40       0.5926      0.56   | Q       |         |         |     V   |
15+45       0.5956      0.44   |Q        |         |         |     V   |
15+50       0.5984      0.40   |Q        |         |         |      V  |
15+55       0.6011      0.39   |Q        |         |         |      V  |
16+ 0       0.6039      0.40   |Q        |         |         |      V  |
16+ 5       0.6064      0.36   |Q        |         |         |      V  |
16+10       0.6076      0.17   Q         |         |         |      V  |
16+15       0.6083      0.11   Q         |         |         |      V  |
16+20       0.6089      0.09   Q         |         |         |      V  |
16+25       0.6095      0.08   Q         |         |         |      V  |
16+30       0.6100      0.08   Q         |         |         |      V  |
16+35       0.6105      0.07   Q         |         |         |      V  |
16+40       0.6109      0.06   Q         |         |         |      V  |
16+45       0.6113      0.06   Q         |         |         |      V  |
16+50       0.6117      0.06   Q         |         |         |      V  |
16+55       0.6121      0.06   Q         |         |         |      V  |
17+ 0       0.6125      0.06   Q         |         |         |       V |
17+ 5       0.6129      0.06   Q         |         |         |       V |
17+10       0.6135      0.08   Q         |         |         |       V |
17+15       0.6141      0.09   Q         |         |         |       V |
17+20       0.6148      0.09   Q         |         |         |       V |
17+25       0.6154      0.09   Q         |         |         |       V |
17+30       0.6160      0.09   Q         |         |         |       V |
17+35       0.6167      0.09   Q         |         |         |       V |
17+40       0.6173      0.09   Q         |         |         |       V |
17+45       0.6180      0.09   Q         |         |         |       V |
17+50       0.6186      0.09   Q         |         |         |       V |
17+55       0.6191      0.08   Q         |         |         |       V |
18+ 0       0.6197      0.08   Q         |         |         |       V |
18+ 5       0.6202      0.08   Q         |         |         |       V |
18+10       0.6207      0.08   Q         |         |         |       V |
18+15       0.6212      0.07   Q         |         |         |       V |
18+20       0.6217      0.07   Q         |         |         |       V |
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18+25      0.6223      0.07  Q         |         |         |        V |
18+30      0.6228      0.07  Q         |         |         |        V |
18+35      0.6233      0.07  Q         |         |         |        V |
18+40      0.6237      0.06  Q         |         |         |        V |
18+45      0.6241      0.06  Q         |         |         |        V |
18+50      0.6245      0.05  Q         |         |         |        V |
18+55      0.6248      0.04  Q         |         |         |        V |
19+ 0      0.6250      0.04  Q         |         |         |        V |
19+ 5      0.6253      0.04  Q         |         |         |        V |
19+10      0.6257      0.05  Q         |         |         |        V |
19+15      0.6260      0.05  Q         |         |         |        V |
19+20      0.6264      0.06  Q         |         |         |        V |
19+25      0.6269      0.07  Q         |         |         |        V |
19+30      0.6274      0.07  Q         |         |         |        V |
19+35      0.6279      0.07  Q         |         |         |        V |
19+40      0.6283      0.06  Q         |         |         |        V |
19+45      0.6287      0.06  Q         |         |         |         V|
19+50      0.6291      0.05  Q         |         |         |         V|
19+55      0.6294      0.04  Q         |         |         |         V|
20+ 0      0.6297      0.04  Q         |         |         |         V|
20+ 5      0.6300      0.04  Q         |         |         |         V|
20+10      0.6303      0.05  Q         |         |         |         V|
20+15      0.6307      0.05  Q         |         |         |         V|
20+20      0.6311      0.06  Q         |         |         |         V|
20+25      0.6314      0.06  Q         |         |         |         V|
20+30      0.6318      0.06  Q         |         |         |         V|
20+35      0.6322      0.06  Q         |         |         |         V|
20+40      0.6326      0.06  Q         |         |         |         V|
20+45      0.6330      0.06  Q         |         |         |         V|
20+50      0.6334      0.05  Q         |         |         |         V|
20+55      0.6337      0.04  Q         |         |         |         V|
21+ 0      0.6339      0.04  Q         |         |         |         V|
21+ 5      0.6342      0.04  Q         |         |         |         V|
21+10      0.6346      0.05  Q         |         |         |         V|
21+15      0.6349      0.05  Q         |         |         |         V|
21+20      0.6353      0.05  Q         |         |         |         V|
21+25      0.6356      0.04  Q         |         |         |         V|
21+30      0.6359      0.04  Q         |         |         |         V|
21+35      0.6361      0.04  Q         |         |         |         V|
21+40      0.6365      0.05  Q         |         |         |         V|
21+45      0.6369      0.05  Q         |         |         |         V|
21+50      0.6372      0.05  Q         |         |         |         V|
21+55      0.6375      0.04  Q         |         |         |         V|
22+ 0      0.6378      0.04  Q         |         |         |         V|
22+ 5      0.6381      0.04  Q         |         |         |         V|
22+10      0.6384      0.05  Q         |         |         |         V|
22+15      0.6388      0.05  Q         |         |         |         V|
22+20      0.6392      0.05  Q         |         |         |         V|
22+25      0.6394      0.04  Q         |         |         |         V|
22+30      0.6397      0.04  Q         |         |         |         V|
22+35      0.6400      0.04  Q         |         |         |         V|
22+40      0.6402      0.04  Q         |         |         |         V|
22+45      0.6405      0.04  Q         |         |         |         V|
22+50      0.6408      0.04  Q         |         |         |         V|
22+55      0.6410      0.04  Q         |         |         |         V|
23+ 0      0.6413      0.04  Q         |         |         |         V|
23+ 5      0.6415      0.04  Q         |         |         |         V|
23+10      0.6418      0.04  Q         |         |         |         V|
23+15      0.6420      0.04  Q         |         |         |         V|
23+20      0.6423      0.04  Q         |         |         |         V|
23+25      0.6426      0.04  Q         |         |         |         V|
23+30      0.6428      0.04  Q         |         |         |         V|
23+35      0.6431      0.04  Q         |         |         |         V|
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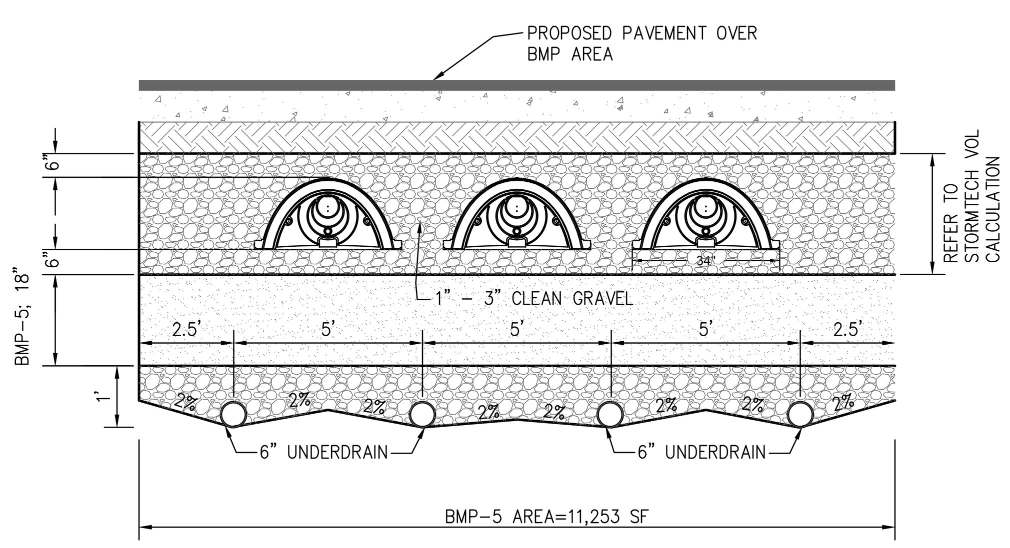
23+40	0.6433	0.04	Q	|	|	|	V|
23+45	0.6436	0.04	Q	|	|	|	V|
23+50	0.6438	0.04	Q	|	|	|	V|
23+55	0.6441	0.04	Q	|	|	|	V|
24+ 0	0.6444	0.04	Q	|	|	|	V|
24+ 5	0.6446	0.03	Q	|	|	|	V|
24+10	0.6447	0.01	Q	|	|	|	V|
24+15	0.6447	0.00	Q	|	|	|	V|
24+20	0.6447	0.00	Q	|	|	|	V|
24+25	0.6447	0.00	Q	|	|	|	V|
24+30	0.6447	0.00	Q	|	|	|	V|

PROPOSED DRAINAGE MAP - UNIT HYDROGRAPH METHOD

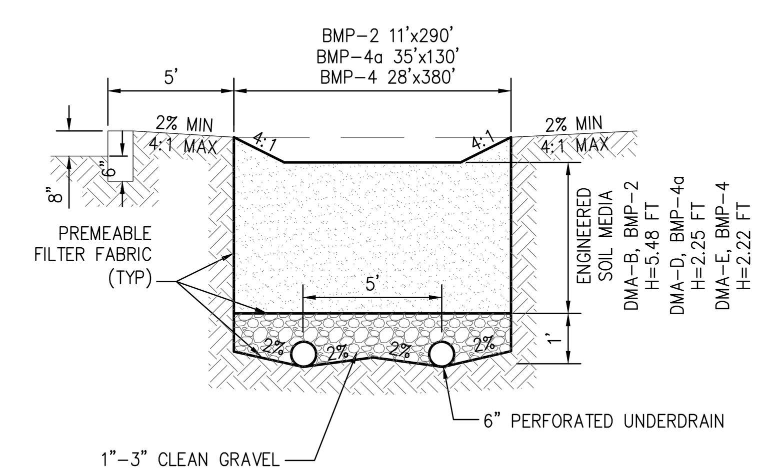
DRAINAGE LEGEND

SYMBOL	DEFINITION
(solid line)	PROJECT BOUNDARY
(dashed line)	EXISTING RIGHT OF WAY
(heavy line)	EXISTING DRAINAGE BOUNDARY
(arrow)	DIRECTION OF EXISTING FLOW
Q100 = 10.2cfs	100 YEAR FLOW FOR AREA
Q10 = 6.2cfs	10 YEAR FLOW FOR AREA
L=762'	LENGTH OF TRAVEL
(3) EL=1431	NODE WITH ELEVATION
eA 0.78	AREA NAME (ON-SITE EXISTING) AREA ACRES
oA 0.78	AREA NAME (OFF-SITE EXISTING) AREA ACRES



BMP- 3 & 5 UNDERGROUND BMP TREATMENT/RETENTION SYSTEM SECTION

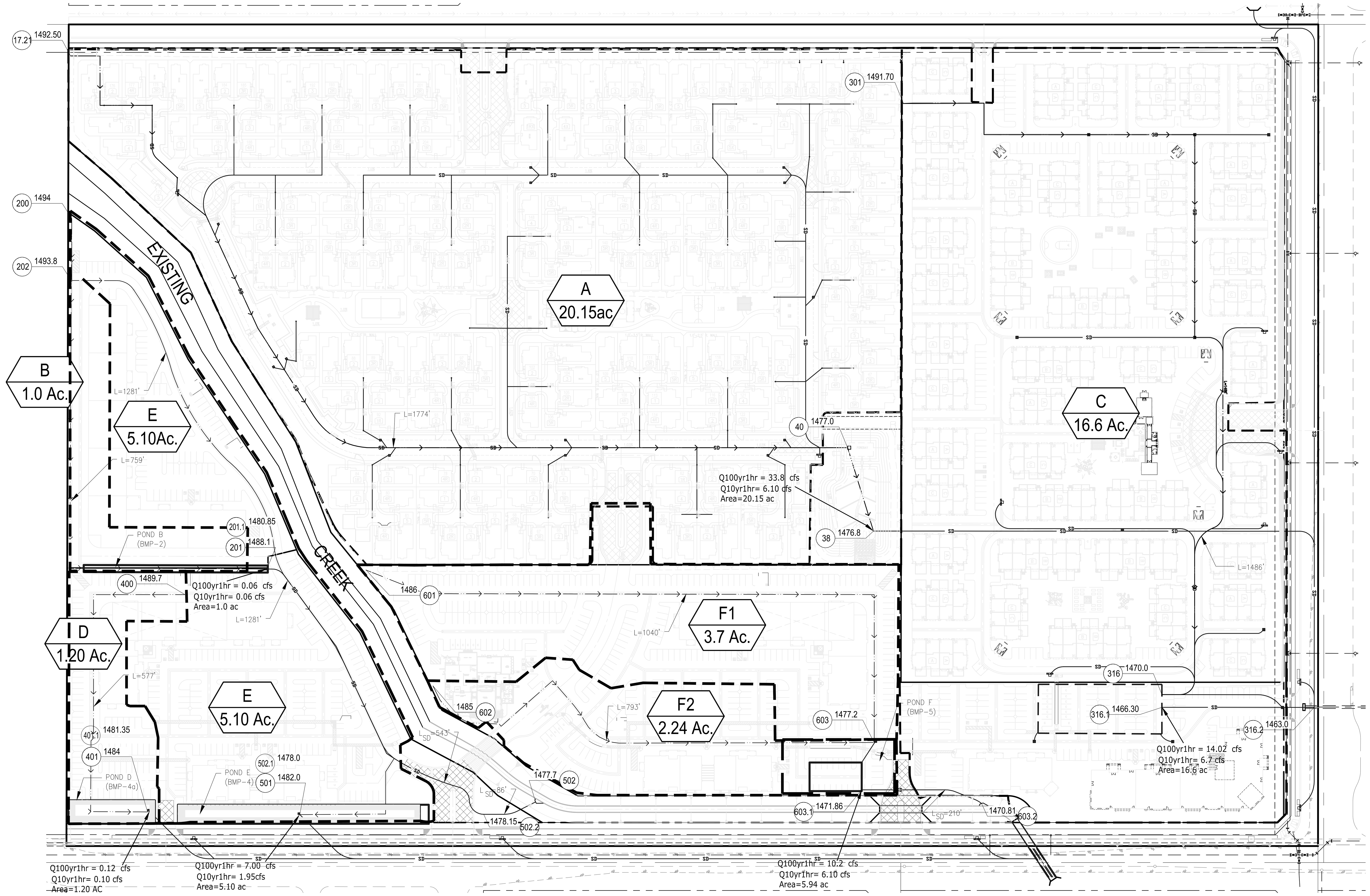
N.T.S.



BMP-2(POND B), BMP-4a(POND D) & BMP-4 (POND E)

BIORETENTION FACILITY WITH UNDERDRAIN

N.T.S.



100 YR						
AREA DESIGNATION	AREA AC.	NODE	1HR (CFS)	3HR (CFS)	6HR (CFS)	24HR (CFS)
A	20.15	38	33.8	258.9	27.50	11.60
B	1.00	201	0.06	0.06	1.50	0.60
C	16.60	316.1	14.02	16.24	18.50	6.70
D	1.20	401	0.12	0.76	1.20	0.65
E	5.10	501	7.00	6.75	6.70	3.05
F	5.94	603.1	10.2	8.13	7.90	3.52
TOTAL	49.99		65.30	60.84	63.30	26.12

10 YR						
AREA DESIGNATION	AREA AC.	NODE	1HR (CFS)	3HR (CFS)	6HR (CFS)	24HR (CFS)
A	20.15	38	6.10	16.64	18.40	6.95
B	1.00	201	0.06	0.06	0.06	0.06
C	16.60	316.1	6.70	6.70	6.70	3.85
D	1.20	401	0.10	0.10	0.50	0.32
E	5.10	501	1.95	3.97	4.53	1.91
F	5.94	603.1	5.04	5.30	5.33	2.20
TOTAL	49.99		19.95	32.77	35.52	15.29

2 YR			
AREA DESIGNATION	AREA AC.	NODE	24HR (CFS)
A	20.15	38	0.393
B	1.00	201	0.064
C	16.60	316.1	1.861
D	1.20	401.1	0.064
E	5.10	501	0.618
F	5.94	603.1	0.393
TOTAL	49.99		3.39

GRAPHIC SCALE

80 0 40 80 160 240

1 inch = 80 ft.

Call before you Dig — Avoid cutting underground utility lines. It's costly. Call 811 or 1-800-227-2600

REVISIONS				
SHT.	DESCRIPTION	DATE	BY	APPD

PACIFIC COAST LAND CONSULTANTS, Inc.
Civil Engineering • Land Planning • Land Surveying
25096 Jefferson Avenue, Suite "D" Murrieta, Ca. 92562
Tel: (951) 698-1350 Fax: (951) 698-8657

PREPARED BY: CHRIS D. HOPPER — RCE NO. 34821 — DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER — CHRIS D. HOPPER — No. 34821 — Exp. 9/30/17 — CIVIL — STATE OF CALIFORNIA

SCALE: 1" =40'
DESIGN: BAM/REK
DRAWN: BENJE
CHECKED: HJK/BAM
APPROVED: HJK/CDH
DATE: NOVEMBER, 2016

CITY OF MENIFEE
ENGINEERING DEPARTMENT

JONATHAN G. SMITH, DIRECTOR OF PUBLIC WORKS/ CITY ENGINEER — RCE 61253 — EXP. 6/30/16 — DATE

RECOMMENDED BY: — DATE

CITY OF MENIFEE

PROP. DRAINAGE MAP FOR AREA A, B, C, D, E & F
MILL CREEK PROMENADE
UNIT HYDROGRAPH METHOD-2YR,10YR & 100YR
1 HR, 3HR, 6HR & 24 HR

SHEET NO. 1 OF 1

PROJECT NO:

```
                 FLOOD HYDROGRAPH ROUTING PROGRAM
         Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                       Study date: 01/10/18

---------------------------------------------------------------------
Area A Developed Condition - Mill Creek Promenade
2yr 24hr Unit Hydrograph
By Pacific Coast Land Consultants, Inc.

--------------------------------------------------------------------


Program License Serial Number 4066

--------------------------------------------------------------------
******************** HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHA242.rte
**************************HYDROGRAPH DATA***************************
             Number of intervals =   293
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        2.466 (CFS)
             Total volume =       1.588 (Ac.Ft)
      Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
*********************************************************************



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       38.000
**** RETARDING BASIN ROUTING ****
______________________________________________________________________

Program computation of outflow v. depth




CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   1.00(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    2.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   2.00(Ft.)    Capacity =   0.39(CFS)
```

```
Total outflow at this depth =      0.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    3.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.00(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    4.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   4.00(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    5.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   5.00(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     3.00(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   0.50(Ft.)    Capacity =  39.99(CFS)

Total outflow at this depth =     40.38(CFS)

--------------------------------------------------------------------
Total number of inflow hydrograph intervals = 293
Hydrograph time unit =  5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)
--------------------------------------------------------------------
--------------------------------------------------------------------
Initial basin depth =   0.00 (Ft.)
Initial basin storage =      0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)
---------------------------------------------------------------------
--------------------------------------------------------------------
Depth vs. Storage and Depth vs. Discharge data:
 Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
     (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
---------------------------------------------------------------------
   0.000      0.000      0.000      0.000        0.000
   1.000      0.208      0.393      0.207        0.209
   2.000      0.457      0.393      0.456        0.458
   3.000      0.751      0.393      0.750        0.752
   4.000      1.091      0.393      1.090        1.092
   5.000      1.480     40.379      1.341        1.619
--------------------------------------------------------------------
             Hydrograph Detention Basin Routing
```

```
     ---------------------------------------------------------------------

     Graph values: 'I'= unit inflow; 'O'=outflow at time shown
     ---------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                    Depth
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0       0.6    1.23    1.85    2.47 (Ft.)
 0.083    0.07    0.00      0.000  O       |       |       |       |     0.00
 0.167    0.16    0.00      0.001  O I     |       |       |       |     0.00
 0.250    0.18    0.00      0.002  O I     |       |       |       |     0.01
 0.333    0.22    0.01      0.003  O I     |       |       |       |     0.02
 0.417    0.27    0.01      0.005  O  I    |       |       |       |     0.02
 0.500    0.28    0.01      0.007  O  I    |       |       |       |     0.03
 0.583    0.28    0.02      0.009  O  I    |       |       |       |     0.04
 0.667    0.29    0.02      0.011  O  I    |       |       |       |     0.05
 0.750    0.29    0.02      0.012  O  I    |       |       |       |     0.06
 0.833    0.32    0.03      0.014  O   I   |       |       |       |     0.07
 0.917    0.37    0.03      0.016  O   I   |       |       |       |     0.08
 1.000    0.38    0.04      0.019  O   I   |       |       |       |     0.09
 1.083    0.35    0.04      0.021  O   I   |       |       |       |     0.10
 1.167    0.30    0.04      0.023  O  I    |       |       |       |     0.11
 1.250    0.29    0.05      0.025  O  I    |       |       |       |     0.12
 1.333    0.29    0.05      0.026  O  I    |       |       |       |     0.13
 1.417    0.29    0.05      0.028  O  I    |       |       |       |     0.13
 1.500    0.29    0.06      0.030  O  I    |       |       |       |     0.14
 1.583    0.29    0.06      0.031  O  I    |       |       |       |     0.15
 1.667    0.29    0.06      0.033  O  I    |       |       |       |     0.16
 1.750    0.29    0.06      0.034  O  I    |       |       |       |     0.17
 1.833    0.32    0.07      0.036  O   I   |       |       |       |     0.17
 1.917    0.37    0.07      0.038  O   I   |       |       |       |     0.18
 2.000    0.38    0.08      0.040  O   I   |       |       |       |     0.19
 2.083    0.38    0.08      0.042  |O  I   |       |       |       |     0.20
 2.167    0.38    0.08      0.044  |O  I   |       |       |       |     0.21
 2.250    0.38    0.09      0.046  |O  I   |       |       |       |     0.22
 2.333    0.38    0.09      0.048  |O  I   |       |       |       |     0.23
 2.417    0.38    0.09      0.050  |O  I   |       |       |       |     0.24
 2.500    0.38    0.10      0.052  |O  I   |       |       |       |     0.25
 2.583    0.42    0.10      0.054  |O   I  |       |       |       |     0.26
 2.667    0.46    0.11      0.056  |O   I  |       |       |       |     0.27
 2.750    0.47    0.11      0.059  |O    I |       |       |       |     0.28
 2.833    0.48    0.12      0.061  |O    I |       |       |       |     0.30
 2.917    0.48    0.12      0.064  |O    I |       |       |       |     0.31
 3.000    0.48    0.13      0.066  |O    I |       |       |       |     0.32
 3.083    0.48    0.13      0.069  |O    I |       |       |       |     0.33
 3.167    0.48    0.13      0.071  |O    I |       |       |       |     0.34
 3.250    0.48    0.14      0.073  |O    I |       |       |       |     0.35
 3.333    0.48    0.14      0.076  |O    I |       |       |       |     0.36
 3.417    0.48    0.15      0.078  |O    I |       |       |       |     0.38
 3.500    0.48    0.15      0.080  |O    I |       |       |       |     0.39
 3.583    0.48    0.16      0.083  | O   I |       |       |       |     0.40
 3.667    0.48    0.16      0.085  | O   I |       |       |       |     0.41
 3.750    0.48    0.16      0.087  | O   I |       |       |       |     0.42
 3.833    0.51    0.17      0.089  | O   I |       |       |       |     0.43
 3.917    0.56    0.17      0.092  | O    I|       |       |       |     0.44
 4.000    0.57    0.18      0.094  | O    I|       |       |       |     0.45
 4.083    0.57    0.18      0.097  | O    I|       |       |       |     0.47
 4.167    0.57    0.19      0.100  | O    I|       |       |       |     0.48
 4.250    0.57    0.19      0.102  | O    I|       |       |       |     0.49
 4.333    0.61    0.20      0.105  | O    I|       |       |       |     0.51
 4.417    0.65    0.20      0.108  | O     I       |       |       |     0.52
 4.500    0.66    0.21      0.111  | O     I       |       |       |     0.53
 4.583    0.67    0.22      0.114  | O     I       |       |       |     0.55
 4.667    0.67    0.22      0.117  | O     I       |       |       |     0.56
 4.750    0.67    0.23      0.120  | O     I       |       |       |     0.58
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 4.833    0.70    0.23      0.124   |  O    |I      |       |       |     0.59
 4.917    0.75    0.24      0.127   |  O    |I      |       |       |     0.61
 5.000    0.76    0.25      0.130   |  O    |I      |       |       |     0.63
 5.083    0.70    0.25      0.134   |  O    |I      |       |       |     0.64
 5.167    0.61    0.26      0.136   |  O   I|       |       |       |     0.66
 5.250    0.59    0.26      0.139   |  O   I|       |       |       |     0.67
 5.333    0.61    0.27      0.141   |  O   I|       |       |       |     0.68
 5.417    0.65    0.27      0.144   |  O    I       |       |       |     0.69
 5.500    0.66    0.28      0.146   |  O    I       |       |       |     0.70
 5.583    0.70    0.28      0.149   |  O    |I      |       |       |     0.72
 5.667    0.75    0.29      0.152   |  O    |I      |       |       |     0.73
 5.750    0.76    0.29      0.155   |  O    |I      |       |       |     0.75
 5.833    0.76    0.30      0.158   |  O    |I      |       |       |     0.76
 5.917    0.77    0.31      0.162   |  O    |I      |       |       |     0.78
 6.000    0.77    0.31      0.165   |   O   |I      |       |       |     0.79
 6.083    0.80    0.32      0.168   |   O   | I     |       |       |     0.81
 6.167    0.84    0.32      0.171   |   O   | I     |       |       |     0.82
 6.250    0.85    0.33      0.175   |   O   |  I    |       |       |     0.84
 6.333    0.86    0.34      0.179   |   O   |  I    |       |       |     0.86
 6.417    0.86    0.34      0.182   |   O   |  I    |       |       |     0.88
 6.500    0.86    0.35      0.186   |   O   |  I    |       |       |     0.89
 6.583    0.90    0.36      0.189   |   O   |  I    |       |       |     0.91
 6.667    0.94    0.37      0.193   |   O   |   I   |       |       |     0.93
 6.750    0.95    0.37      0.197   |   O   |   I   |       |       |     0.95
 6.833    0.95    0.38      0.201   |   O   |   I   |       |       |     0.97
 6.917    0.96    0.39      0.205   |    O  |   I   |       |       |     0.99
 7.000    0.96    0.39      0.209   |    O  |   I   |       |       |     1.00
 7.083    0.96    0.39      0.213   |    O  |   I   |       |       |     1.02
 7.167    0.96    0.39      0.217   |    O  |   I   |       |       |     1.04
 7.250    0.96    0.39      0.221   |    O  |   I   |       |       |     1.05
 7.333    0.99    0.39      0.225   |    O  |   I   |       |       |     1.07
 7.417    1.04    0.39      0.229   |    O  |    I  |       |       |     1.08
 7.500    1.05    0.39      0.233   |    O  |    I  |       |       |     1.10
 7.583    1.08    0.39      0.238   |    O  |     I |       |       |     1.12
 7.667    1.13    0.39      0.243   |    O  |     I |       |       |     1.14
 7.750    1.14    0.39      0.248   |    O  |     I |       |       |     1.16
 7.833    1.18    0.39      0.253   |    O  |      I|       |       |     1.18
 7.917    1.23    0.39      0.259   |    O  |      I|       |       |     1.20
 8.000    1.24    0.39      0.265   |    O  |       I       |       |     1.23
 8.083    1.31    0.39      0.271   |    O  |       I       |       |     1.25
 8.167    1.40    0.39      0.277   |    O  |       | I     |       |     1.28
 8.250    1.42    0.39      0.284   |    O  |       | I     |       |     1.31
 8.333    1.43    0.39      0.291   |    O  |       | I     |       |     1.34
 8.417    1.43    0.39      0.299   |    O  |       | I     |       |     1.36
 8.500    1.44    0.39      0.306   |    O  |       | I     |       |     1.39
 8.583    1.47    0.39      0.313   |    O  |       |  I    |       |     1.42
 8.667    1.51    0.39      0.321   |    O  |       |  I    |       |     1.45
 8.750    1.52    0.39      0.328   |    O  |       |  I    |       |     1.48
 8.833    1.56    0.39      0.336   |    O  |       |   I   |       |     1.52
 8.917    1.61    0.39      0.345   |    O  |       |   I   |       |     1.55
 9.000    1.62    0.39      0.353   |    O  |       |    I  |       |     1.58
 9.083    1.69    0.39      0.362   |    O  |       |    I  |       |     1.62
 9.167    1.78    0.39      0.371   |    O  |       |      I|       |     1.65
 9.250    1.80    0.39      0.381   |    O  |       |      I|       |     1.69
 9.333    1.85    0.39      0.390   |    O  |       |      I|       |     1.73
 9.417    1.90    0.39      0.401   |    O  |       |       I       |     1.77
 9.500    1.91    0.39      0.411   |    O  |       |       I       |     1.82
 9.583    1.95    0.39      0.422   |    O  |       |       |I      |     1.86
 9.667    1.99    0.39      0.432   |    O  |       |       |I      |     1.90
 9.750    2.00    0.39      0.443   |    O  |       |       |I      |     1.95
 9.833    2.04    0.39      0.455   |    O  |       |       | I     |     1.99
 9.917    2.09    0.39      0.466   |    O  |       |       |  I    |     2.03
10.000    2.10    0.39      0.478   |    O  |       |       |  I    |     2.07
```

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10.083    1.87    0.39      0.489   |    O  |       |       I       |     2.11
10.167    1.56    0.39      0.498   |    O  |       |   I   |       |     2.14
10.250    1.49    0.39      0.506   |    O  |       |  I    |       |     2.17
10.333    1.46    0.39      0.513   |    O  |       | I     |       |     2.19
10.417    1.44    0.39      0.520   |    O  |       | I     |       |     2.22
10.500    1.44    0.39      0.528   |    O  |       | I     |       |     2.24
10.583    1.60    0.39      0.535   |    O  |       |   I   |       |     2.27
10.667    1.83    0.39      0.545   |    O  |       |      I|       |     2.30
10.750    1.88    0.39      0.555   |    O  |       |       I       |     2.33
10.833    1.90    0.39      0.565   |    O  |       |       I       |     2.37
10.917    1.91    0.39      0.575   |    O  |       |       I       |     2.40
11.000    1.91    0.39      0.586   |    O  |       |       I       |     2.44
11.083    1.88    0.39      0.596   |    O  |       |       I       |     2.47
11.167    1.84    0.39      0.606   |    O  |       |      I|       |     2.51
11.250    1.83    0.39      0.616   |    O  |       |      I|       |     2.54
11.333    1.82    0.39      0.626   |    O  |       |      I|       |     2.57
11.417    1.82    0.39      0.636   |    O  |       |      I|       |     2.61
11.500    1.82    0.39      0.646   |    O  |       |      I|       |     2.64
11.583    1.75    0.39      0.655   |    O  |       |     I |       |     2.67
11.667    1.66    0.39      0.664   |    O  |       |    I  |       |     2.70
11.750    1.64    0.39      0.673   |    O  |       |    I  |       |     2.73
11.833    1.67    0.39      0.682   |    O  |       |    I  |       |     2.76
11.917    1.71    0.39      0.691   |    O  |       |     I |       |     2.79
12.000    1.72    0.39      0.700   |    O  |       |     I |       |     2.83
12.083    1.41    0.39      0.708   |    O  |       | I     |       |     2.85
12.167    1.01    0.39      0.713   |    O  |    I  |       |       |     2.87
12.250    0.93    0.39      0.717   |    O  |   I   |       |       |     2.89
12.333    0.95    0.39      0.721   |    O  |   I   |       |       |     2.90
12.417    1.02    0.39      0.725   |    O  |    I  |       |       |     2.91
12.500    1.04    0.39      0.730   |    O  |    I  |       |       |     2.93
12.583    1.18    0.39      0.734   |    O  |      I|       |       |     2.94
12.667    1.34    0.39      0.740   |    O  |       |I      |       |     2.96
12.750    1.39    0.39      0.747   |    O  |       |I      |       |     2.99
12.833    1.47    0.39      0.754   |    O  |       |  I    |       |     3.01
12.917    1.56    0.39      0.762   |    O  |       |   I   |       |     3.03
13.000    1.60    0.39      0.770   |    O  |       |   I   |       |     3.06
13.083    1.89    0.39      0.779   |    O  |       |       I       |     3.08
13.167    2.27    0.39      0.791   |    O  |       |       |    I  |     3.12
13.250    2.36    0.39      0.804   |    O  |       |       |     I |     3.16
13.333    2.41    0.39      0.818   |    O  |       |       |      I|     3.20
13.417    2.45    0.39      0.832   |    O  |       |       |      I|     3.24
13.500    2.47    0.39      0.846   |    O  |       |       |       I     3.28
13.583    1.88    0.39      0.858   |    O  |       |       I       |     3.32
13.667    1.11    0.39      0.866   |    O  |     I |       |       |     3.34
13.750    0.94    0.39      0.870   |    O  |   I   |       |       |     3.35
13.833    0.88    0.39      0.874   |    O  |  I    |       |       |     3.36
13.917    0.85    0.39      0.877   |    O  |  I    |       |       |     3.37
14.000    0.85    0.39      0.880   |    O  |  I    |       |       |     3.38
14.083    1.08    0.39      0.884   |    O  |     I |       |       |     3.39
14.167    1.38    0.39      0.890   |    O  |       |I      |       |     3.41
14.250    1.46    0.39      0.897   |    O  |       | I     |       |     3.43
14.333    1.45    0.39      0.904   |    O  |       | I     |       |     3.45
14.417    1.41    0.39      0.912   |    O  |       | I     |       |     3.47
14.500    1.41    0.39      0.919   |    O  |       | I     |       |     3.49
14.583    1.41    0.39      0.926   |    O  |       | I     |       |     3.51
14.667    1.42    0.39      0.933   |    O  |       | I     |       |     3.53
14.750    1.44    0.39      0.940   |    O  |       | I     |       |     3.56
14.833    1.40    0.39      0.947   |    O  |       | I     |       |     3.58
14.917    1.34    0.39      0.954   |    O  |       |I      |       |     3.60
15.000    1.33    0.39      0.960   |    O  |       |I      |       |     3.61
15.083    1.28    0.39      0.966   |    O  |       I       |       |     3.63
15.167    1.22    0.39      0.972   |    O  |      I|       |       |     3.65
15.250    1.22    0.39      0.978   |    O  |      I|       |       |     3.67
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15.333    1.17    0.39      0.984   |    O  |      I|       |       |     3.68
15.417    1.11    0.39      0.989   |    O  |     I |       |       |     3.70
15.500    1.10    0.39      0.994   |    O  |     I |       |       |     3.71
15.583    0.89    0.39      0.998   |    O  |  I    |       |       |     3.73
15.667    0.61    0.39      1.000   |    O I|       |       |       |     3.73
15.750    0.56    0.39      1.001   |    O I|       |       |       |     3.74
15.833    0.54    0.39      1.003   |    O I|       |       |       |     3.74
15.917    0.54    0.39      1.004   |    O I|       |       |       |     3.74
16.000    0.55    0.39      1.005   |    O I|       |       |       |     3.75
16.083    0.49    0.39      1.005   |    OI |       |       |       |     3.75
16.167    0.41    0.39      1.006   |    O  |       |       |       |     3.75
16.250    0.40    0.39      1.006   |    O  |       |       |       |     3.75
16.333    0.39    0.39      1.006   |    O  |       |       |       |     3.75
16.417    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
16.500    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
16.583    0.35    0.39      1.006   |   IO  |       |       |       |     3.75
16.667    0.30    0.39      1.005   |  I O  |       |       |       |     3.75
16.750    0.29    0.39      1.005   |  I O  |       |       |       |     3.75
16.833    0.29    0.39      1.004   |  I O  |       |       |       |     3.74
16.917    0.29    0.39      1.003   |  I O  |       |       |       |     3.74
17.000    0.29    0.39      1.002   |  I O  |       |       |       |     3.74
17.083    0.35    0.39      1.002   |   IO  |       |       |       |     3.74
17.167    0.44    0.39      1.002   |    O  |       |       |       |     3.74
17.250    0.46    0.39      1.002   |    OI |       |       |       |     3.74
17.333    0.47    0.39      1.003   |    OI |       |       |       |     3.74
17.417    0.48    0.39      1.003   |    OI |       |       |       |     3.74
17.500    0.48    0.39      1.004   |    OI |       |       |       |     3.74
17.583    0.48    0.39      1.005   |    OI |       |       |       |     3.75
17.667    0.48    0.39      1.005   |    OI |       |       |       |     3.75
17.750    0.48    0.39      1.006   |    OI |       |       |       |     3.75
17.833    0.44    0.39      1.006   |    O  |       |       |       |     3.75
17.917    0.40    0.39      1.007   |    O  |       |       |       |     3.75
18.000    0.39    0.39      1.007   |    O  |       |       |       |     3.75
18.083    0.39    0.39      1.007   |    O  |       |       |       |     3.75
18.167    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
18.250    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
18.333    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
18.417    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
18.500    0.38    0.39      1.006   |   IO  |       |       |       |     3.75
18.583    0.35    0.39      1.006   |   IO  |       |       |       |     3.75
18.667    0.30    0.39      1.006   |  I O  |       |       |       |     3.75
18.750    0.29    0.39      1.005   |  I O  |       |       |       |     3.75
18.833    0.26    0.39      1.004   |  I O  |       |       |       |     3.74
18.917    0.21    0.39      1.003   | I  O  |       |       |       |     3.74
19.000    0.20    0.39      1.002   | I  O  |       |       |       |     3.74
19.083    0.23    0.39      1.000   | I  O  |       |       |       |     3.73
19.167    0.27    0.39      0.999   |  I O  |       |       |       |     3.73
19.250    0.28    0.39      0.999   |  I O  |       |       |       |     3.73
19.333    0.32    0.39      0.998   |   IO  |       |       |       |     3.73
19.417    0.36    0.39      0.998   |   IO  |       |       |       |     3.73
19.500    0.38    0.39      0.997   |   IO  |       |       |       |     3.72
19.583    0.35    0.39      0.997   |   IO  |       |       |       |     3.72
19.667    0.30    0.39      0.997   |  I O  |       |       |       |     3.72
19.750    0.29    0.39      0.996   |  I O  |       |       |       |     3.72
19.833    0.26    0.39      0.995   |  I O  |       |       |       |     3.72
19.917    0.21    0.39      0.994   | I  O  |       |       |       |     3.72
20.000    0.20    0.39      0.993   | I  O  |       |       |       |     3.71
20.083    0.23    0.39      0.992   | I  O  |       |       |       |     3.71
20.167    0.27    0.39      0.991   |  I O  |       |       |       |     3.71
20.250    0.28    0.39      0.990   |  I O  |       |       |       |     3.70
20.333    0.28    0.39      0.989   |  I O  |       |       |       |     3.70
20.417    0.29    0.39      0.988   |  I O  |       |       |       |     3.70
20.500    0.29    0.39      0.988   |  I O  |       |       |       |     3.70
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20.583    0.29    0.39      0.987  |  I O  |       |       |       |      3.69
20.667    0.29    0.39      0.986  |  I O  |       |       |       |      3.69
20.750    0.29    0.39      0.985  |  I O  |       |       |       |      3.69
20.833    0.25    0.39      0.985  |  I O  |       |       |       |      3.69
20.917    0.21    0.39      0.984  | I  O  |       |       |       |      3.68
21.000    0.20    0.39      0.982  | I  O  |       |       |       |      3.68
21.083    0.23    0.39      0.981  | I  O  |       |       |       |      3.68
21.167    0.27    0.39      0.980  |  I O  |       |       |       |      3.67
21.250    0.28    0.39      0.979  |  I O  |       |       |       |      3.67
21.333    0.25    0.39      0.978  |  I O  |       |       |       |      3.67
21.417    0.21    0.39      0.977  | I  O  |       |       |       |      3.67
21.500    0.20    0.39      0.976  | I  O  |       |       |       |      3.66
21.583    0.23    0.39      0.975  | I  O  |       |       |       |      3.66
21.667    0.27    0.39      0.974  |  I O  |       |       |       |      3.65
21.750    0.28    0.39      0.973  |  I O  |       |       |       |      3.65
21.833    0.25    0.39      0.972  |  I O  |       |       |       |      3.65
21.917    0.21    0.39      0.971  | I  O  |       |       |       |      3.65
22.000    0.20    0.39      0.970  | I  O  |       |       |       |      3.64
22.083    0.23    0.39      0.968  | I  O  |       |       |       |      3.64
22.167    0.27    0.39      0.967  |  I O  |       |       |       |      3.64
22.250    0.28    0.39      0.966  |  I O  |       |       |       |      3.63
22.333    0.25    0.39      0.966  |  I O  |       |       |       |      3.63
22.417    0.21    0.39      0.964  | I  O  |       |       |       |      3.63
22.500    0.20    0.39      0.963  | I  O  |       |       |       |      3.62
22.583    0.19    0.39      0.962  | I  O  |       |       |       |      3.62
22.667    0.19    0.39      0.960  | I  O  |       |       |       |      3.62
22.750    0.19    0.39      0.959  | I  O  |       |       |       |      3.61
22.833    0.19    0.39      0.958  | I  O  |       |       |       |      3.61
22.917    0.19    0.39      0.956  | I  O  |       |       |       |      3.60
23.000    0.19    0.39      0.955  | I  O  |       |       |       |      3.60
23.083    0.19    0.39      0.953  | I  O  |       |       |       |      3.60
23.167    0.19    0.39      0.952  | I  O  |       |       |       |      3.59
23.250    0.19    0.39      0.951  | I  O  |       |       |       |      3.59
23.333    0.19    0.39      0.949  | I  O  |       |       |       |      3.58
23.417    0.19    0.39      0.948  | I  O  |       |       |       |      3.58
23.500    0.19    0.39      0.947  | I  O  |       |       |       |      3.58
23.583    0.19    0.39      0.945  | I  O  |       |       |       |      3.57
23.667    0.19    0.39      0.944  | I  O  |       |       |       |      3.57
23.750    0.19    0.39      0.942  | I  O  |       |       |       |      3.56
23.833    0.19    0.39      0.941  | I  O  |       |       |       |      3.56
23.917    0.19    0.39      0.940  | I  O  |       |       |       |      3.55
24.000    0.19    0.39      0.938  | I  O  |       |       |       |      3.55
24.083    0.12    0.39      0.937  |I    O |       |       |       |      3.55
24.167    0.04    0.39      0.934  I     O |       |       |       |      3.54
24.250    0.01    0.39      0.932  I     O |       |       |       |      3.53
24.333    0.01    0.39      0.929  I     O |       |       |       |      3.52
24.417    0.00    0.39      0.927  I     O |       |       |       |      3.52
24.500    0.00    0.39      0.924  I     O |       |       |       |      3.51
24.583    0.00    0.39      0.921  I     O |       |       |       |      3.50
24.667    0.00    0.39      0.918  I     O |       |       |       |      3.49
24.750    0.00    0.39      0.916  I     O |       |       |       |      3.48
24.833    0.00    0.39      0.913  I     O |       |       |       |      3.48
24.917    0.00    0.39      0.910  I     O |       |       |       |      3.47
25.000    0.00    0.39      0.908  I     O |       |       |       |      3.46
25.083    0.00    0.39      0.905  I     O |       |       |       |      3.45
25.167    0.00    0.39      0.902  I     O |       |       |       |      3.44
25.250    0.00    0.39      0.900  I     O |       |       |       |      3.44
25.333    0.00    0.39      0.897  I     O |       |       |       |      3.43
25.417    0.00    0.39      0.894  I     O |       |       |       |      3.42
25.500    0.00    0.39      0.891  I     O |       |       |       |      3.41
25.583    0.00    0.39      0.889  I     O |       |       |       |      3.40
25.667    0.00    0.39      0.886  I     O |       |       |       |      3.40
25.750    0.00    0.39      0.883  I     O |       |       |       |      3.39
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25.833	0.00	0.39	0.881	I	O	|	|	|	|	3.38
25.917	0.00	0.39	0.878	I	O	|	|	|	|	3.37
26.000	0.00	0.39	0.875	I	O	|	|	|	|	3.37
26.083	0.00	0.39	0.872	I	O	|	|	|	|	3.36
26.167	0.00	0.39	0.870	I	O	|	|	|	|	3.35
26.250	0.00	0.39	0.867	I	O	|	|	|	|	3.34
26.333	0.00	0.39	0.864	I	O	|	|	|	|	3.33
26.417	0.00	0.39	0.862	I	O	|	|	|	|	3.33
26.500	0.00	0.39	0.859	I	O	|	|	|	|	3.32
26.583	0.00	0.39	0.856	I	O	|	|	|	|	3.31
26.667	0.00	0.39	0.853	I	O	|	|	|	|	3.30
26.750	0.00	0.39	0.851	I	O	|	|	|	|	3.29
26.833	0.00	0.39	0.848	I	O	|	|	|	|	3.29
26.917	0.00	0.39	0.845	I	O	|	|	|	|	3.28
27.000	0.00	0.39	0.843	I	O	|	|	|	|	3.27
27.083	0.00	0.39	0.840	I	O	|	|	|	|	3.26
27.167	0.00	0.39	0.837	I	O	|	|	|	|	3.25
27.250	0.00	0.39	0.835	I	O	|	|	|	|	3.25
27.333	0.00	0.39	0.832	I	O	|	|	|	|	3.24
27.417	0.00	0.39	0.829	I	O	|	|	|	|	3.23
27.500	0.00	0.39	0.826	I	O	|	|	|	|	3.22
27.583	0.00	0.39	0.824	I	O	|	|	|	|	3.21
27.667	0.00	0.39	0.821	I	O	|	|	|	|	3.21
27.750	0.00	0.39	0.818	I	O	|	|	|	|	3.20
27.833	0.00	0.39	0.816	I	O	|	|	|	|	3.19
27.917	0.00	0.39	0.813	I	O	|	|	|	|	3.18
28.000	0.00	0.39	0.810	I	O	|	|	|	|	3.17
28.083	0.00	0.39	0.807	I	O	|	|	|	|	3.17
28.167	0.00	0.39	0.805	I	O	|	|	|	|	3.16
28.250	0.00	0.39	0.802	I	O	|	|	|	|	3.15
28.333	0.00	0.39	0.799	I	O	|	|	|	|	3.14
28.417	0.00	0.39	0.797	I	O	|	|	|	|	3.13
28.500	0.00	0.39	0.794	I	O	|	|	|	|	3.13
28.583	0.00	0.39	0.791	I	O	|	|	|	|	3.12
28.667	0.00	0.39	0.789	I	O	|	|	|	|	3.11
28.750	0.00	0.39	0.786	I	O	|	|	|	|	3.10
28.833	0.00	0.39	0.783	I	O	|	|	|	|	3.09
28.917	0.00	0.39	0.780	I	O	|	|	|	|	3.09
29.000	0.00	0.39	0.778	I	O	|	|	|	|	3.08
29.083	0.00	0.39	0.775	I	O	|	|	|	|	3.07
29.167	0.00	0.39	0.772	I	O	|	|	|	|	3.06
29.250	0.00	0.39	0.770	I	O	|	|	|	|	3.05
29.333	0.00	0.39	0.767	I	O	|	|	|	|	3.05
29.417	0.00	0.39	0.764	I	O	|	|	|	|	3.04
29.500	0.00	0.39	0.761	I	O	|	|	|	|	3.03
29.583	0.00	0.39	0.759	I	O	|	|	|	|	3.02
29.667	0.00	0.39	0.756	I	O	|	|	|	|	3.01
29.750	0.00	0.39	0.753	I	O	|	|	|	|	3.01
29.833	0.00	0.39	0.751	I	O	|	|	|	|	3.00
29.917	0.00	0.39	0.748	I	O	|	|	|	|	2.99
30.000	0.00	0.39	0.745	I	O	|	|	|	|	2.98
30.083	0.00	0.39	0.743	I	O	|	|	|	|	2.97
30.167	0.00	0.39	0.740	I	O	|	|	|	|	2.96
30.250	0.00	0.39	0.737	I	O	|	|	|	|	2.95
30.333	0.00	0.39	0.734	I	O	|	|	|	|	2.94
30.417	0.00	0.39	0.732	I	O	|	|	|	|	2.93
30.500	0.00	0.39	0.729	I	O	|	|	|	|	2.93
30.583	0.00	0.39	0.726	I	O	|	|	|	|	2.92
30.667	0.00	0.39	0.724	I	O	|	|	|	|	2.91
30.750	0.00	0.39	0.721	I	O	|	|	|	|	2.90
30.833	0.00	0.39	0.718	I	O	|	|	|	|	2.89
30.917	0.00	0.39	0.715	I	O	|	|	|	|	2.88
31.000	0.00	0.39	0.713	I	O	|	|	|	|	2.87

31.083	0.00	0.39	0.710	I	O					2.86
31.167	0.00	0.39	0.707	I	O					2.85
31.250	0.00	0.39	0.705	I	O					2.84
31.333	0.00	0.39	0.702	I	O					2.83
31.417	0.00	0.39	0.699	I	O					2.82
31.500	0.00	0.39	0.696	I	O					2.81
31.583	0.00	0.39	0.694	I	O					2.81
31.667	0.00	0.39	0.691	I	O					2.80
31.750	0.00	0.39	0.688	I	O					2.79
31.833	0.00	0.39	0.686	I	O					2.78
31.917	0.00	0.39	0.683	I	O					2.77
32.000	0.00	0.39	0.680	I	O					2.76
32.083	0.00	0.39	0.678	I	O					2.75
32.167	0.00	0.39	0.675	I	O					2.74
32.250	0.00	0.39	0.672	I	O					2.73
32.333	0.00	0.39	0.669	I	O					2.72
32.417	0.00	0.39	0.667	I	O					2.71
32.500	0.00	0.39	0.664	I	O					2.70
32.583	0.00	0.39	0.661	I	O					2.69
32.667	0.00	0.39	0.659	I	O					2.69
32.750	0.00	0.39	0.656	I	O					2.68
32.833	0.00	0.39	0.653	I	O					2.67
32.917	0.00	0.39	0.650	I	O					2.66
33.000	0.00	0.39	0.648	I	O					2.65
33.083	0.00	0.39	0.645	I	O					2.64
33.167	0.00	0.39	0.642	I	O					2.63
33.250	0.00	0.39	0.640	I	O					2.62
33.333	0.00	0.39	0.637	I	O					2.61
33.417	0.00	0.39	0.634	I	O					2.60
33.500	0.00	0.39	0.632	I	O					2.59
33.583	0.00	0.39	0.629	I	O					2.58
33.667	0.00	0.39	0.626	I	O					2.58
33.750	0.00	0.39	0.623	I	O					2.57
33.833	0.00	0.39	0.621	I	O					2.56
33.917	0.00	0.39	0.618	I	O					2.55
34.000	0.00	0.39	0.615	I	O					2.54
34.083	0.00	0.39	0.613	I	O					2.53
34.167	0.00	0.39	0.610	I	O					2.52
34.250	0.00	0.39	0.607	I	O					2.51
34.333	0.00	0.39	0.604	I	O					2.50
34.417	0.00	0.39	0.602	I	O					2.49
34.500	0.00	0.39	0.599	I	O					2.48
34.583	0.00	0.39	0.596	I	O					2.47
34.667	0.00	0.39	0.594	I	O					2.46
34.750	0.00	0.39	0.591	I	O					2.46
34.833	0.00	0.39	0.588	I	O					2.45
34.917	0.00	0.39	0.585	I	O					2.44
35.000	0.00	0.39	0.583	I	O					2.43
35.083	0.00	0.39	0.580	I	O					2.42
35.167	0.00	0.39	0.577	I	O					2.41
35.250	0.00	0.39	0.575	I	O					2.40
35.333	0.00	0.39	0.572	I	O					2.39
35.417	0.00	0.39	0.569	I	O					2.38
35.500	0.00	0.39	0.567	I	O					2.37
35.583	0.00	0.39	0.564	I	O					2.36
35.667	0.00	0.39	0.561	I	O					2.35
35.750	0.00	0.39	0.558	I	O					2.34
35.833	0.00	0.39	0.556	I	O					2.34
35.917	0.00	0.39	0.553	I	O					2.33
36.000	0.00	0.39	0.550	I	O					2.32
36.083	0.00	0.39	0.548	I	O					2.31
36.167	0.00	0.39	0.545	I	O					2.30
36.250	0.00	0.39	0.542	I	O					2.29

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36.333    0.00    0.39     0.539  I    O  |       |       |       |     2.28
36.417    0.00    0.39     0.537  I    O  |       |       |       |     2.27
36.500    0.00    0.39     0.534  I    O  |       |       |       |     2.26
36.583    0.00    0.39     0.531  I    O  |       |       |       |     2.25
36.667    0.00    0.39     0.529  I    O  |       |       |       |     2.24
36.750    0.00    0.39     0.526  I    O  |       |       |       |     2.23
36.833    0.00    0.39     0.523  I    O  |       |       |       |     2.23
36.917    0.00    0.39     0.521  I    O  |       |       |       |     2.22
37.000    0.00    0.39     0.518  I    O  |       |       |       |     2.21
37.083    0.00    0.39     0.515  I    O  |       |       |       |     2.20
37.167    0.00    0.39     0.512  I    O  |       |       |       |     2.19
37.250    0.00    0.39     0.510  I    O  |       |       |       |     2.18
37.333    0.00    0.39     0.507  I    O  |       |       |       |     2.17
37.417    0.00    0.39     0.504  I    O  |       |       |       |     2.16
37.500    0.00    0.39     0.502  I    O  |       |       |       |     2.15
37.583    0.00    0.39     0.499  I    O  |       |       |       |     2.14
37.667    0.00    0.39     0.496  I    O  |       |       |       |     2.13
37.750    0.00    0.39     0.493  I    O  |       |       |       |     2.12
37.833    0.00    0.39     0.491  I    O  |       |       |       |     2.11
37.917    0.00    0.39     0.488  I    O  |       |       |       |     2.11
38.000    0.00    0.39     0.485  I    O  |       |       |       |     2.10
38.083    0.00    0.39     0.483  I    O  |       |       |       |     2.09
38.167    0.00    0.39     0.480  I    O  |       |       |       |     2.08
38.250    0.00    0.39     0.477  I    O  |       |       |       |     2.07
38.333    0.00    0.39     0.475  I    O  |       |       |       |     2.06
38.417    0.00    0.39     0.472  I    O  |       |       |       |     2.05
38.500    0.00    0.39     0.469  I    O  |       |       |       |     2.04
38.583    0.00    0.39     0.466  I    O  |       |       |       |     2.03
38.667    0.00    0.39     0.464  I    O  |       |       |       |     2.02
38.750    0.00    0.39     0.461  I    O  |       |       |       |     2.01
38.833    0.00    0.39     0.458  I    O  |       |       |       |     2.00
38.917    0.00    0.39     0.456  I    O  |       |       |       |     1.99
39.000    0.00    0.39     0.453  I    O  |       |       |       |     1.98
39.083    0.00    0.39     0.450  I    O  |       |       |       |     1.97
39.167    0.00    0.39     0.447  I    O  |       |       |       |     1.96
39.250    0.00    0.39     0.445  I    O  |       |       |       |     1.95
39.333    0.00    0.39     0.442  I    O  |       |       |       |     1.94
39.417    0.00    0.39     0.439  I    O  |       |       |       |     1.93
39.500    0.00    0.39     0.437  I    O  |       |       |       |     1.92
39.583    0.00    0.39     0.434  I    O  |       |       |       |     1.91
39.667    0.00    0.39     0.431  I    O  |       |       |       |     1.90
39.750    0.00    0.39     0.428  I    O  |       |       |       |     1.89
39.833    0.00    0.39     0.426  I    O  |       |       |       |     1.87
39.917    0.00    0.39     0.423  I    O  |       |       |       |     1.86
40.000    0.00    0.39     0.420  I    O  |       |       |       |     1.85
40.083    0.00    0.39     0.418  I    O  |       |       |       |     1.84
40.167    0.00    0.39     0.415  I    O  |       |       |       |     1.83
40.250    0.00    0.39     0.412  I    O  |       |       |       |     1.82
40.333    0.00    0.39     0.410  I    O  |       |       |       |     1.81
40.417    0.00    0.39     0.407  I    O  |       |       |       |     1.80
40.500    0.00    0.39     0.404  I    O  |       |       |       |     1.79
40.583    0.00    0.39     0.401  I    O  |       |       |       |     1.78
40.667    0.00    0.39     0.399  I    O  |       |       |       |     1.77
40.750    0.00    0.39     0.396  I    O  |       |       |       |     1.76
40.833    0.00    0.39     0.393  I    O  |       |       |       |     1.74
40.917    0.00    0.39     0.391  I    O  |       |       |       |     1.73
41.000    0.00    0.39     0.388  I    O  |       |       |       |     1.72
41.083    0.00    0.39     0.385  I    O  |       |       |       |     1.71
41.167    0.00    0.39     0.382  I    O  |       |       |       |     1.70
41.250    0.00    0.39     0.380  I    O  |       |       |       |     1.69
41.333    0.00    0.39     0.377  I    O  |       |       |       |     1.68
41.417    0.00    0.39     0.374  I    O  |       |       |       |     1.67
41.500    0.00    0.39     0.372  I    O  |       |       |       |     1.66
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41.583    0.00    0.39     0.369  I    O  |       |       |       |     1.65
41.667    0.00    0.39     0.366  I    O  |       |       |       |     1.64
41.750    0.00    0.39     0.364  I    O  |       |       |       |     1.62
41.833    0.00    0.39     0.361  I    O  |       |       |       |     1.61
41.917    0.00    0.39     0.358  I    O  |       |       |       |     1.60
42.000    0.00    0.39     0.355  I    O  |       |       |       |     1.59
42.083    0.00    0.39     0.353  I    O  |       |       |       |     1.58
42.167    0.00    0.39     0.350  I    O  |       |       |       |     1.57
42.250    0.00    0.39     0.347  I    O  |       |       |       |     1.56
42.333    0.00    0.39     0.345  I    O  |       |       |       |     1.55
42.417    0.00    0.39     0.342  I    O  |       |       |       |     1.54
42.500    0.00    0.39     0.339  I    O  |       |       |       |     1.53
42.583    0.00    0.39     0.336  I    O  |       |       |       |     1.52
42.667    0.00    0.39     0.334  I    O  |       |       |       |     1.50
42.750    0.00    0.39     0.331  I    O  |       |       |       |     1.49
42.833    0.00    0.39     0.328  I    O  |       |       |       |     1.48
42.917    0.00    0.39     0.326  I    O  |       |       |       |     1.47
43.000    0.00    0.39     0.323  I    O  |       |       |       |     1.46
43.083    0.00    0.39     0.320  I    O  |       |       |       |     1.45
43.167    0.00    0.39     0.317  I    O  |       |       |       |     1.44
43.250    0.00    0.39     0.315  I    O  |       |       |       |     1.43
43.333    0.00    0.39     0.312  I    O  |       |       |       |     1.42
43.417    0.00    0.39     0.309  I    O  |       |       |       |     1.41
43.500    0.00    0.39     0.307  I    O  |       |       |       |     1.40
43.583    0.00    0.39     0.304  I    O  |       |       |       |     1.39
43.667    0.00    0.39     0.301  I    O  |       |       |       |     1.37
43.750    0.00    0.39     0.299  I    O  |       |       |       |     1.36
43.833    0.00    0.39     0.296  I    O  |       |       |       |     1.35
43.917    0.00    0.39     0.293  I    O  |       |       |       |     1.34
44.000    0.00    0.39     0.290  I    O  |       |       |       |     1.33
44.083    0.00    0.39     0.288  I    O  |       |       |       |     1.32
44.167    0.00    0.39     0.285  I    O  |       |       |       |     1.31
44.250    0.00    0.39     0.282  I    O  |       |       |       |     1.30
44.333    0.00    0.39     0.280  I    O  |       |       |       |     1.29
44.417    0.00    0.39     0.277  I    O  |       |       |       |     1.28
44.500    0.00    0.39     0.274  I    O  |       |       |       |     1.27
44.583    0.00    0.39     0.271  I    O  |       |       |       |     1.25
44.667    0.00    0.39     0.269  I    O  |       |       |       |     1.24
44.750    0.00    0.39     0.266  I    O  |       |       |       |     1.23
44.833    0.00    0.39     0.263  I    O  |       |       |       |     1.22
44.917    0.00    0.39     0.261  I    O  |       |       |       |     1.21
45.000    0.00    0.39     0.258  I    O  |       |       |       |     1.20
45.083    0.00    0.39     0.255  I    O  |       |       |       |     1.19
45.167    0.00    0.39     0.253  I    O  |       |       |       |     1.18
45.250    0.00    0.39     0.250  I    O  |       |       |       |     1.17
45.333    0.00    0.39     0.247  I    O  |       |       |       |     1.16
45.417    0.00    0.39     0.244  I    O  |       |       |       |     1.15
45.500    0.00    0.39     0.242  I    O  |       |       |       |     1.14
45.583    0.00    0.39     0.239  I    O  |       |       |       |     1.12
45.667    0.00    0.39     0.236  I    O  |       |       |       |     1.11
45.750    0.00    0.39     0.234  I    O  |       |       |       |     1.10
45.833    0.00    0.39     0.231  I    O  |       |       |       |     1.09
45.917    0.00    0.39     0.228  I    O  |       |       |       |     1.08
46.000    0.00    0.39     0.225  I    O  |       |       |       |     1.07
46.083    0.00    0.39     0.223  I    O  |       |       |       |     1.06
46.167    0.00    0.39     0.220  I    O  |       |       |       |     1.05
46.250    0.00    0.39     0.217  I    O  |       |       |       |     1.04
46.333    0.00    0.39     0.215  I    O  |       |       |       |     1.03
46.417    0.00    0.39     0.212  I    O  |       |       |       |     1.02
46.500    0.00    0.39     0.209  I    O  |       |       |       |     1.00
46.583    0.00    0.39     0.207  I    O  |       |       |       |     0.99
46.667    0.00    0.39     0.204  I   O   |       |       |       |     0.98
46.750    0.00    0.38     0.201  I   O   |       |       |       |     0.97
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46.833    0.00    0.38     0.199  I   O   |        |        |        |      0.95
46.917    0.00    0.37     0.196  I   O   |        |        |        |      0.94
47.000    0.00    0.37     0.194  I   O   |        |        |        |      0.93
47.083    0.00    0.36     0.191  I   O   |        |        |        |      0.92
47.167    0.00    0.36     0.189  I   O   |        |        |        |      0.91
47.250    0.00    0.35     0.186  I   O   |        |        |        |      0.89
47.333    0.00    0.35     0.184  I   O   |        |        |        |      0.88
47.417    0.00    0.34     0.181  I   O   |        |        |        |      0.87
47.500    0.00    0.34     0.179  I   O   |        |        |        |      0.86
47.583    0.00    0.33     0.177  I   O   |        |        |        |      0.85
47.667    0.00    0.33     0.174  I   O   |        |        |        |      0.84
47.750    0.00    0.33     0.172  I   O   |        |        |        |      0.83
47.833    0.00    0.32     0.170  I   O   |        |        |        |      0.82
47.917    0.00    0.32     0.168  I   O   |        |        |        |      0.81
48.000    0.00    0.31     0.166  I   O   |        |        |        |      0.80
48.083    0.00    0.31     0.163  I   O   |        |        |        |      0.79
48.167    0.00    0.30     0.161  I  O     |        |        |        |      0.78
48.250    0.00    0.30     0.159  I  O     |        |        |        |      0.77
48.333    0.00    0.30     0.157  I  O     |        |        |        |      0.76
48.417    0.00    0.29     0.155  I  O     |        |        |        |      0.75
48.500    0.00    0.29     0.153  I  O     |        |        |        |      0.74
48.583    0.00    0.29     0.151  I  O     |        |        |        |      0.73
48.667    0.00    0.28     0.149  I  O     |        |        |        |      0.72
48.750    0.00    0.28     0.147  I  O     |        |        |        |      0.71
48.833    0.00    0.27     0.145  I  O     |        |        |        |      0.70
48.917    0.00    0.27     0.143  I  O     |        |        |        |      0.69
49.000    0.00    0.27     0.142  I  O     |        |        |        |      0.68
49.083    0.00    0.26     0.140  I  O     |        |        |        |      0.67
49.167    0.00    0.26     0.138  I  O     |        |        |        |      0.66
49.250    0.00    0.26     0.136  I  O     |        |        |        |      0.65
49.333    0.00    0.25     0.134  I  O     |        |        |        |      0.65
49.417    0.00    0.25     0.133  I  O     |        |        |        |      0.64
49.500    0.00    0.25     0.131  I  O     |        |        |        |      0.63
49.583    0.00    0.24     0.129  I  O     |        |        |        |      0.62
49.667    0.00    0.24     0.128  I  O     |        |        |        |      0.61
49.750    0.00    0.24     0.126  I  O     |        |        |        |      0.61
49.833    0.00    0.23     0.124  I  O     |        |        |        |      0.60
49.917    0.00    0.23     0.123  I  O     |        |        |        |      0.59
50.000    0.00    0.23     0.121  I O      |        |        |        |      0.58
50.083    0.00    0.23     0.120  I O      |        |        |        |      0.57
50.167    0.00    0.22     0.118  I O      |        |        |        |      0.57
50.250    0.00    0.22     0.116  I O      |        |        |        |      0.56
50.333    0.00    0.22     0.115  I O      |        |        |        |      0.55
50.417    0.00    0.21     0.113  I O      |        |        |        |      0.55
50.500    0.00    0.21     0.112  I O      |        |        |        |      0.54
50.583    0.00    0.21     0.111  I O      |        |        |        |      0.53
50.667    0.00    0.21     0.109  I O      |        |        |        |      0.52
50.750    0.00    0.20     0.108  I O      |        |        |        |      0.52
50.833    0.00    0.20     0.106  I O      |        |        |        |      0.51
50.917    0.00    0.20     0.105  I O      |        |        |        |      0.50
51.000    0.00    0.20     0.104  I O      |        |        |        |      0.50
51.083    0.00    0.19     0.102  I O      |        |        |        |      0.49
51.167    0.00    0.19     0.101  I O      |        |        |        |      0.49
51.250    0.00    0.19     0.100  I O      |        |        |        |      0.48
51.333    0.00    0.19     0.098  I O      |        |        |        |      0.47
51.417    0.00    0.18     0.097  I O      |        |        |        |      0.47
51.500    0.00    0.18     0.096  I O      |        |        |        |      0.46
51.583    0.00    0.18     0.095  I O      |        |        |        |      0.45
51.667    0.00    0.18     0.093  I O      |        |        |        |      0.45
51.750    0.00    0.17     0.092  I O      |        |        |        |      0.44
51.833    0.00    0.17     0.091  I O      |        |        |        |      0.44
51.917    0.00    0.17     0.090  I O      |        |        |        |      0.43
52.000    0.00    0.17     0.089  I O      |        |        |        |      0.43
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52.083	0.00	0.17	0.087	I O	0.42
52.167	0.00	0.16	0.086	I O	0.42
52.250	0.00	0.16	0.085	I O	0.41
52.333	0.00	0.16	0.084	I O	0.40
52.417	0.00	0.16	0.083	I O	0.40
52.500	0.00	0.15	0.082	I O	0.39
52.583	0.00	0.15	0.081	IO	0.39
52.667	0.00	0.15	0.080	IO	0.38
52.750	0.00	0.15	0.079	IO	0.38
52.833	0.00	0.15	0.078	IO	0.37
52.917	0.00	0.15	0.077	IO	0.37
53.000	0.00	0.14	0.076	IO	0.36
53.083	0.00	0.14	0.075	IO	0.36
53.167	0.00	0.14	0.074	IO	0.36
53.250	0.00	0.14	0.073	IO	0.35
53.333	0.00	0.14	0.072	IO	0.35
53.417	0.00	0.13	0.071	IO	0.34
53.500	0.00	0.13	0.070	IO	0.34
53.583	0.00	0.13	0.069	IO	0.33
53.667	0.00	0.13	0.068	IO	0.33
53.750	0.00	0.13	0.067	IO	0.32
53.833	0.00	0.13	0.067	IO	0.32
53.917	0.00	0.12	0.066	IO	0.32
54.000	0.00	0.12	0.065	IO	0.31
54.083	0.00	0.12	0.064	IO	0.31
54.167	0.00	0.12	0.063	IO	0.30
54.250	0.00	0.12	0.062	IO	0.30
54.333	0.00	0.12	0.062	IO	0.30
54.417	0.00	0.11	0.061	IO	0.29
54.500	0.00	0.11	0.060	IO	0.29
54.583	0.00	0.11	0.059	IO	0.28
54.667	0.00	0.11	0.058	IO	0.28
54.750	0.00	0.11	0.058	IO	0.28
54.833	0.00	0.11	0.057	IO	0.27
54.917	0.00	0.11	0.056	IO	0.27
55.000	0.00	0.10	0.055	IO	0.27
55.083	0.00	0.10	0.055	IO	0.26
55.167	0.00	0.10	0.054	IO	0.26
55.250	0.00	0.10	0.053	IO	0.26
55.333	0.00	0.10	0.053	IO	0.25

Remaining water in basin = 0.05 (Ac.Ft)

****************************HYDROGRAPH DATA****************************

Number of intervals = 664

Time interval = 5.0 (Min.)

Maximum/Peak flow rate = 0.393 (CFS)

Total volume = 1.536 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

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Process from Point/Station 38.100 to Point/Station 8.100

**** STREAM ROUTING SCS CONVEX METHOD ****

```
HYDROGRAPH STREAM ROUTING DATA:
Length of stream =    689.30 (Ft.)
Elevation difference =    3.45 (Ft.)
Slope of channel =  0.005005 (Vert/Horiz)
Channel type - Pipe


Pipe length  =   689.30(Ft.)   Elevation difference =   3.45(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using mean flow rate of hydrograph
Required pipe flow  =     0.353(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.353(CFS)
Normal flow depth in pipe =    4.41(In.)
Flow top width inside pipe =    5.30(In.)
Critical Depth =    0.30(Ft.)
Pipe flow velocity =      2.28(Ft/s)
Travel time through pipe =    5.03 min.


Pipe length  =   689.30(Ft.)   Elevation difference =   3.45(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using maximum flow rate of hydrograph
Required pipe flow  =     0.393(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.393(CFS)
Normal flow depth in pipe =    4.88(In.)
Flow top width inside pipe =    4.68(In.)
Critical Depth =    0.32(Ft.)
Pipe flow velocity =      2.30(Ft/s)
Travel time through pipe =    4.98 min.


********************** SCS CONVEX CHANNEL ROUTING ********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
         where c* = 1 - (1-c)^e and dt = c(length)/velocity
         c(v/v+1.7) =   0.5755   Travel time =   4.98 (min.)
       dt*(unit time interval) =   5.00(min.),  e=   1.4953
       dt(routing time-step) =   2.87 (min.),   c* =   0.7223

Output hydrograph delayed by 0  unit time increments


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

--------------------------------------------------------------------
Time(h+m) Out = O(CFS) In = I  0        0.1       0.2       0.3       0.4
-----------------------------------------------------------------------
  0+ 5       0.0001      0.00  O         |         |         |         |
  0+10       0.0008      0.00  O         |         |         |         |
  0+15       0.0022      0.00  O         |         |         |         |
  0+20       0.0043      0.01  O         |         |         |         |
  0+25       0.0068      0.01  O         |         |         |         |
  0+30       0.0099      0.01  |O        |         |         |         |
  0+35       0.0132      0.02  |O        |         |         |         |
  0+40       0.0166      0.02  |OI       |         |         |         |
  0+45       0.0201      0.02  | O       |         |         |         |
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0+50       0.0236      0.03  | O       |         |         |         |
0+55       0.0273      0.03  | OI      |         |         |         |
1+ 0       0.0314      0.04  |  O      |         |         |         |
1+ 5       0.0357      0.04  |  OI     |         |         |         |
1+10       0.0397      0.04  |   O     |         |         |         |
1+15       0.0434      0.05  |   O     |         |         |         |
1+20       0.0468      0.05  |   OI    |         |         |         |
1+25       0.0500      0.05  |    O    |         |         |         |
1+30       0.0531      0.06  |    O    |         |         |         |
1+35       0.0561      0.06  |    OI   |         |         |         |
1+40       0.0591      0.06  |     O   |         |         |         |
1+45       0.0621      0.06  |     O   |         |         |         |
1+50       0.0650      0.07  |     O   |         |         |         |
1+55       0.0682      0.07  |     OI  |         |         |         |
2+ 0       0.0718      0.08  |      O  |         |         |         |
2+ 5       0.0756      0.08  |      OI |         |         |         |
2+10       0.0795      0.08  |       O |         |         |         |
2+15       0.0834      0.09  |       O |         |         |         |
2+20       0.0872      0.09  |       OI|         |         |         |
2+25       0.0910      0.09  |        O|         |         |         |
2+30       0.0948      0.10  |        OI         |         |         |
2+35       0.0986      0.10  |         O         |         |         |
2+40       0.1026      0.11  |         O         |         |         |
2+45       0.1070      0.11  |         OI        |         |         |
2+50       0.1115      0.12  |         |O        |         |         |
2+55       0.1162      0.12  |         |OI       |         |         |
3+ 0       0.1208      0.13  |         | O       |         |         |
3+ 5       0.1254      0.13  |         | OI      |         |         |
3+10       0.1300      0.13  |         |  O      |         |         |
3+15       0.1345      0.14  |         |  OI     |         |         |
3+20       0.1390      0.14  |         |   O     |         |         |
3+25       0.1434      0.15  |         |   OI    |         |         |
3+30       0.1477      0.15  |         |    O    |         |         |
3+35       0.1520      0.16  |         |    O    |         |         |
3+40       0.1562      0.16  |         |    OI   |         |         |
3+45       0.1604      0.16  |         |     O   |         |         |
3+50       0.1646      0.17  |         |     OI  |         |         |
3+55       0.1689      0.17  |         |      O  |         |         |
4+ 0       0.1737      0.18  |         |      OI |         |         |
4+ 5       0.1786      0.18  |         |       O |         |         |
4+10       0.1836      0.19  |         |       OI|         |         |
4+15       0.1887      0.19  |         |        O|         |         |
4+20       0.1937      0.20  |         |        OI         |         |
4+25       0.1990      0.20  |         |         O         |         |
4+30       0.2045      0.21  |         |         OI        |         |
4+35       0.2103      0.22  |         |         |O        |         |
4+40       0.2162      0.22  |         |         |OI       |         |
4+45       0.2220      0.23  |         |         | OI      |         |
4+50       0.2278      0.23  |         |         |  O      |         |
4+55       0.2339      0.24  |         |         |  OI     |         |
5+ 0       0.2403      0.25  |         |         |   OI    |         |
5+ 5       0.2467      0.25  |         |         |    O    |         |
5+10       0.2526      0.26  |         |         |    OI   |         |
5+15       0.2578      0.26  |         |         |     O   |         |
5+20       0.2624      0.27  |         |         |     OI  |         |
5+25       0.2670      0.27  |         |         |      O  |         |
5+30       0.2717      0.28  |         |         |      OI |         |
5+35       0.2767      0.28  |         |         |       O |         |
5+40       0.2821      0.29  |         |         |       OI|         |
5+45       0.2878      0.29  |         |         |        O|         |
5+50       0.2937      0.30  |         |         |        OI         |
5+55       0.2997      0.31  |         |         |         OI        |
6+ 0       0.3057      0.31  |         |         |         |O        |
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 6+ 5       0.3117      0.32   |         |         |         |OI       |
 6+10       0.3179      0.32   |         |         |         | O       |
 6+15       0.3244      0.33   |         |         |         |  O      |
 6+20       0.3311      0.34   |         |         |         |  OI     |
 6+25       0.3379      0.34   |         |         |         |   OI    |
 6+30       0.3446      0.35   |         |         |         |    O    |
 6+35       0.3514      0.36   |         |         |         |    OI   |
 6+40       0.3583      0.37   |         |         |         |     OI  |
 6+45       0.3655      0.37   |         |         |         |      O  |
 6+50       0.3730      0.38   |         |         |         |      OI |
 6+55       0.3804      0.39   |         |         |         |       OI|
 7+ 0       0.3873      0.39   |         |         |         |        OI
 7+ 5       0.3915      0.39   |         |         |         |        OI
 7+10       0.3926      0.39   |         |         |         |        OI
 7+15       0.3929      0.39   |         |         |         |        OI
 7+20       0.3930      0.39   |         |         |         |        OI
 7+25       0.3931      0.39   |         |         |         |        OI
 7+30       0.3931      0.39   |         |         |         |        OI
 7+35       0.3931      0.39   |         |         |         |        OI
 7+40       0.3931      0.39   |         |         |         |        OI
 7+45       0.3931      0.39   |         |         |         |        OI
 7+50       0.3931      0.39   |         |         |         |        OI
 7+55       0.3931      0.39   |         |         |         |        OI
 8+ 0       0.3931      0.39   |         |         |         |        OI
 8+ 5       0.3931      0.39   |         |         |         |        OI
 8+10       0.3931      0.39   |         |         |         |        OI
 8+15       0.3931      0.39   |         |         |         |        OI
 8+20       0.3931      0.39   |         |         |         |        OI
 8+25       0.3931      0.39   |         |         |         |        OI
 8+30       0.3931      0.39   |         |         |         |        OI
 8+35       0.3931      0.39   |         |         |         |        OI
 8+40       0.3931      0.39   |         |         |         |        OI
 8+45       0.3931      0.39   |         |         |         |        OI
 8+50       0.3931      0.39   |         |         |         |        OI
 8+55       0.3931      0.39   |         |         |         |        OI
 9+ 0       0.3931      0.39   |         |         |         |        OI
 9+ 5       0.3931      0.39   |         |         |         |        OI
 9+10       0.3931      0.39   |         |         |         |         O
 9+15       0.3931      0.39   |         |         |         |         O
 9+20       0.3931      0.39   |         |         |         |         O
 9+25       0.3931      0.39   |         |         |         |         O
 9+30       0.3931      0.39   |         |         |         |         O
 9+35       0.3931      0.39   |         |         |         |         O
 9+40       0.3931      0.39   |         |         |         |         O
 9+45       0.3931      0.39   |         |         |         |         O
 9+50       0.3931      0.39   |         |         |         |         O
 9+55       0.3931      0.39   |         |         |         |         O
10+ 0       0.3931      0.39   |         |         |         |         O
10+ 5       0.3931      0.39   |         |         |         |         O
10+10       0.3931      0.39   |         |         |         |         O
10+15       0.3931      0.39   |         |         |         |         O
10+20       0.3931      0.39   |         |         |         |         O
10+25       0.3931      0.39   |         |         |         |         O
10+30       0.3931      0.39   |         |         |         |         O
10+35       0.3931      0.39   |         |         |         |         O
10+40       0.3931      0.39   |         |         |         |         O
10+45       0.3931      0.39   |         |         |         |         O
10+50       0.3931      0.39   |         |         |         |         O
10+55       0.3931      0.39   |         |         |         |         O
11+ 0       0.3931      0.39   |         |         |         |         O
11+ 5       0.3931      0.39   |         |         |         |         O
11+10       0.3931      0.39   |         |         |         |         O
11+15       0.3931      0.39   |         |         |         |         O
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11+20	0.3931	0.39				O
11+25	0.3931	0.39				O
11+30	0.3931	0.39				O
11+35	0.3931	0.39				O
11+40	0.3931	0.39				O
11+45	0.3931	0.39				O
11+50	0.3931	0.39				O
11+55	0.3931	0.39				O
12+ 0	0.3931	0.39				O
12+ 5	0.3931	0.39				O
12+10	0.3931	0.39				O
12+15	0.3931	0.39				O
12+20	0.3931	0.39				O
12+25	0.3931	0.39				O
12+30	0.3931	0.39				O
12+35	0.3931	0.39				O
12+40	0.3931	0.39				O
12+45	0.3931	0.39				O
12+50	0.3931	0.39				O
12+55	0.3931	0.39				O
13+ 0	0.3931	0.39				O
13+ 5	0.3931	0.39				O
13+10	0.3931	0.39				O
13+15	0.3931	0.39				O
13+20	0.3931	0.39				O
13+25	0.3931	0.39				O
13+30	0.3931	0.39				O
13+35	0.3931	0.39				O
13+40	0.3931	0.39				O
13+45	0.3931	0.39				O
13+50	0.3931	0.39				O
13+55	0.3931	0.39				O
14+ 0	0.3931	0.39				O
14+ 5	0.3931	0.39				O
14+10	0.3931	0.39				O
14+15	0.3931	0.39				O
14+20	0.3931	0.39				O
14+25	0.3931	0.39				O
14+30	0.3931	0.39				O
14+35	0.3931	0.39				O
14+40	0.3931	0.39				O
14+45	0.3931	0.39				O
14+50	0.3931	0.39				O
14+55	0.3931	0.39				O
15+ 0	0.3931	0.39				O
15+ 5	0.3931	0.39				O
15+10	0.3931	0.39				O
15+15	0.3931	0.39				O
15+20	0.3931	0.39				O
15+25	0.3931	0.39				O
15+30	0.3931	0.39				O
15+35	0.3931	0.39				O
15+40	0.3931	0.39				O
15+45	0.3931	0.39				O
15+50	0.3931	0.39				O
15+55	0.3931	0.39				O
16+ 0	0.3931	0.39				O
16+ 5	0.3931	0.39				O
16+10	0.3931	0.39				O
16+15	0.3931	0.39				O
16+20	0.3931	0.39				O
16+25	0.3931	0.39				O
16+30	0.3931	0.39				O

16+35	0.3931	0.39					O
16+40	0.3931	0.39					O
16+45	0.3931	0.39					O
16+50	0.3931	0.39					O
16+55	0.3931	0.39					O
17+ 0	0.3931	0.39					O
17+ 5	0.3931	0.39					O
17+10	0.3931	0.39					O
17+15	0.3931	0.39					O
17+20	0.3931	0.39					O
17+25	0.3931	0.39					O
17+30	0.3931	0.39					O
17+35	0.3931	0.39					O
17+40	0.3931	0.39					O
17+45	0.3931	0.39					O
17+50	0.3931	0.39					O
17+55	0.3931	0.39					O
18+ 0	0.3931	0.39					O
18+ 5	0.3931	0.39					O
18+10	0.3931	0.39					O
18+15	0.3931	0.39					O
18+20	0.3931	0.39					O
18+25	0.3931	0.39					O
18+30	0.3931	0.39					O
18+35	0.3931	0.39					O
18+40	0.3931	0.39					O
18+45	0.3931	0.39					O
18+50	0.3931	0.39					O
18+55	0.3931	0.39					O
19+ 0	0.3931	0.39					O
19+ 5	0.3931	0.39					O
19+10	0.3931	0.39					O
19+15	0.3931	0.39					O
19+20	0.3931	0.39					O
19+25	0.3931	0.39					O
19+30	0.3931	0.39					O
19+35	0.3931	0.39					O
19+40	0.3931	0.39					O
19+45	0.3931	0.39					O
19+50	0.3931	0.39					O
19+55	0.3931	0.39					O
20+ 0	0.3931	0.39					O
20+ 5	0.3931	0.39					O
20+10	0.3931	0.39					O
20+15	0.3931	0.39					O
20+20	0.3931	0.39					O
20+25	0.3931	0.39					O
20+30	0.3931	0.39					O
20+35	0.3931	0.39					O
20+40	0.3931	0.39					O
20+45	0.3931	0.39					O
20+50	0.3931	0.39					O
20+55	0.3931	0.39					O
21+ 0	0.3931	0.39					O
21+ 5	0.3931	0.39					O
21+10	0.3931	0.39					O
21+15	0.3931	0.39					O
21+20	0.3931	0.39					O
21+25	0.3931	0.39					O
21+30	0.3931	0.39					O
21+35	0.3931	0.39					O
21+40	0.3931	0.39					O
21+45	0.3931	0.39					O

21+50	0.3931	0.39					O
21+55	0.3931	0.39					O
22+ 0	0.3931	0.39					O
22+ 5	0.3931	0.39					O
22+10	0.3931	0.39					O
22+15	0.3931	0.39					O
22+20	0.3931	0.39					O
22+25	0.3931	0.39					O
22+30	0.3931	0.39					O
22+35	0.3931	0.39					O
22+40	0.3931	0.39					O
22+45	0.3931	0.39					O
22+50	0.3931	0.39					O
22+55	0.3931	0.39					O
23+ 0	0.3931	0.39					O
23+ 5	0.3931	0.39					O
23+10	0.3931	0.39					O
23+15	0.3931	0.39					O
23+20	0.3931	0.39					O
23+25	0.3931	0.39					O
23+30	0.3931	0.39					O
23+35	0.3931	0.39					O
23+40	0.3931	0.39					O
23+45	0.3931	0.39					O
23+50	0.3931	0.39					O
23+55	0.3931	0.39					O
24+ 0	0.3931	0.39					O
24+ 5	0.3931	0.39					O
24+10	0.3931	0.39					O
24+15	0.3931	0.39					O
24+20	0.3931	0.39					O
24+25	0.3931	0.39					O
24+30	0.3931	0.39					O
24+35	0.3931	0.39					O
24+40	0.3931	0.39					O
24+45	0.3931	0.39					O
24+50	0.3931	0.39					O
24+55	0.3931	0.39					O
25+ 0	0.3931	0.39					O
25+ 5	0.3931	0.39					O
25+10	0.3931	0.39					O
25+15	0.3931	0.39					O
25+20	0.3931	0.39					O
25+25	0.3931	0.39					O
25+30	0.3931	0.39					O
25+35	0.3931	0.39					O
25+40	0.3931	0.39					O
25+45	0.3931	0.39					O
25+50	0.3931	0.39					O
25+55	0.3931	0.39					O
26+ 0	0.3931	0.39					O
26+ 5	0.3931	0.39					O
26+10	0.3931	0.39					O
26+15	0.3931	0.39					O
26+20	0.3931	0.39					O
26+25	0.3931	0.39					O
26+30	0.3931	0.39					O
26+35	0.3931	0.39					O
26+40	0.3931	0.39					O
26+45	0.3931	0.39					O
26+50	0.3931	0.39					O
26+55	0.3931	0.39					O
27+ 0	0.3931	0.39					O

27+ 5	0.3931	0.39					O
27+10	0.3931	0.39					O
27+15	0.3931	0.39					O
27+20	0.3931	0.39					O
27+25	0.3931	0.39					O
27+30	0.3931	0.39					O
27+35	0.3931	0.39					O
27+40	0.3931	0.39					O
27+45	0.3931	0.39					O
27+50	0.3931	0.39					O
27+55	0.3931	0.39					O
28+ 0	0.3931	0.39					O
28+ 5	0.3931	0.39					O
28+10	0.3931	0.39					O
28+15	0.3931	0.39					O
28+20	0.3931	0.39					O
28+25	0.3931	0.39					O
28+30	0.3931	0.39					O
28+35	0.3931	0.39					O
28+40	0.3931	0.39					O
28+45	0.3931	0.39					O
28+50	0.3931	0.39					O
28+55	0.3931	0.39					O
29+ 0	0.3931	0.39					O
29+ 5	0.3931	0.39					O
29+10	0.3931	0.39					O
29+15	0.3931	0.39					O
29+20	0.3931	0.39					O
29+25	0.3931	0.39					O
29+30	0.3931	0.39					O
29+35	0.3931	0.39					O
29+40	0.3931	0.39					O
29+45	0.3931	0.39					O
29+50	0.3931	0.39					O
29+55	0.3931	0.39					O
30+ 0	0.3931	0.39					O
30+ 5	0.3931	0.39					O
30+10	0.3931	0.39					O
30+15	0.3931	0.39					O
30+20	0.3931	0.39					O
30+25	0.3931	0.39					O
30+30	0.3931	0.39					O
30+35	0.3931	0.39					O
30+40	0.3931	0.39					O
30+45	0.3931	0.39					O
30+50	0.3931	0.39					O
30+55	0.3931	0.39					O
31+ 0	0.3931	0.39					O
31+ 5	0.3931	0.39					O
31+10	0.3931	0.39					O
31+15	0.3931	0.39					O
31+20	0.3931	0.39					O
31+25	0.3931	0.39					O
31+30	0.3931	0.39					O
31+35	0.3931	0.39					O
31+40	0.3931	0.39					O
31+45	0.3931	0.39					O
31+50	0.3931	0.39					O
31+55	0.3931	0.39					O
32+ 0	0.3931	0.39					O
32+ 5	0.3931	0.39					O
32+10	0.3931	0.39					O
32+15	0.3931	0.39					O

32+20	0.3931	0.39					O
32+25	0.3931	0.39					O
32+30	0.3931	0.39					O
32+35	0.3931	0.39					O
32+40	0.3931	0.39					O
32+45	0.3931	0.39					O
32+50	0.3931	0.39					O
32+55	0.3931	0.39					O
33+ 0	0.3931	0.39					O
33+ 5	0.3931	0.39					O
33+10	0.3931	0.39					O
33+15	0.3931	0.39					O
33+20	0.3931	0.39					O
33+25	0.3931	0.39					O
33+30	0.3931	0.39					O
33+35	0.3931	0.39					O
33+40	0.3931	0.39					O
33+45	0.3931	0.39					O
33+50	0.3931	0.39					O
33+55	0.3931	0.39					O
34+ 0	0.3931	0.39					O
34+ 5	0.3931	0.39					O
34+10	0.3931	0.39					O
34+15	0.3931	0.39					O
34+20	0.3931	0.39					O
34+25	0.3931	0.39					O
34+30	0.3931	0.39					O
34+35	0.3931	0.39					O
34+40	0.3931	0.39					O
34+45	0.3931	0.39					O
34+50	0.3931	0.39					O
34+55	0.3931	0.39					O
35+ 0	0.3931	0.39					O
35+ 5	0.3931	0.39					O
35+10	0.3931	0.39					O
35+15	0.3931	0.39					O
35+20	0.3931	0.39					O
35+25	0.3931	0.39					O
35+30	0.3931	0.39					O
35+35	0.3931	0.39					O
35+40	0.3931	0.39					O
35+45	0.3931	0.39					O
35+50	0.3931	0.39					O
35+55	0.3931	0.39					O
36+ 0	0.3931	0.39					O
36+ 5	0.3931	0.39					O
36+10	0.3931	0.39					O
36+15	0.3931	0.39					O
36+20	0.3931	0.39					O
36+25	0.3931	0.39					O
36+30	0.3931	0.39					O
36+35	0.3931	0.39					O
36+40	0.3931	0.39					O
36+45	0.3931	0.39					O
36+50	0.3931	0.39					O
36+55	0.3931	0.39					O
37+ 0	0.3931	0.39					O
37+ 5	0.3931	0.39					O
37+10	0.3931	0.39					O
37+15	0.3931	0.39					O
37+20	0.3931	0.39					O
37+25	0.3931	0.39					O
37+30	0.3931	0.39					O

37+35	0.3931	0.39	|	|	|	|	O
37+40	0.3931	0.39	|	|	|	|	O
37+45	0.3931	0.39	|	|	|	|	O
37+50	0.3931	0.39	|	|	|	|	O
37+55	0.3931	0.39	|	|	|	|	O
38+ 0	0.3931	0.39	|	|	|	|	O
38+ 5	0.3931	0.39	|	|	|	|	O
38+10	0.3931	0.39	|	|	|	|	O
38+15	0.3931	0.39	|	|	|	|	O
38+20	0.3931	0.39	|	|	|	|	O
38+25	0.3931	0.39	|	|	|	|	O
38+30	0.3931	0.39	|	|	|	|	O
38+35	0.3931	0.39	|	|	|	|	O
38+40	0.3931	0.39	|	|	|	|	O
38+45	0.3931	0.39	|	|	|	|	O
38+50	0.3931	0.39	|	|	|	|	O
38+55	0.3931	0.39	|	|	|	|	O
39+ 0	0.3931	0.39	|	|	|	|	O
39+ 5	0.3931	0.39	|	|	|	|	O
39+10	0.3931	0.39	|	|	|	|	O
39+15	0.3931	0.39	|	|	|	|	O
39+20	0.3931	0.39	|	|	|	|	O
39+25	0.3931	0.39	|	|	|	|	O
39+30	0.3931	0.39	|	|	|	|	O
39+35	0.3931	0.39	|	|	|	|	O
39+40	0.3931	0.39	|	|	|	|	O
39+45	0.3931	0.39	|	|	|	|	O
39+50	0.3931	0.39	|	|	|	|	O
39+55	0.3931	0.39	|	|	|	|	O
40+ 0	0.3931	0.39	|	|	|	|	O
40+ 5	0.3931	0.39	|	|	|	|	O
40+10	0.3931	0.39	|	|	|	|	O
40+15	0.3931	0.39	|	|	|	|	O
40+20	0.3931	0.39	|	|	|	|	O
40+25	0.3931	0.39	|	|	|	|	O
40+30	0.3931	0.39	|	|	|	|	O
40+35	0.3931	0.39	|	|	|	|	O
40+40	0.3931	0.39	|	|	|	|	O
40+45	0.3931	0.39	|	|	|	|	O
40+50	0.3931	0.39	|	|	|	|	O
40+55	0.3931	0.39	|	|	|	|	O
41+ 0	0.3931	0.39	|	|	|	|	O
41+ 5	0.3931	0.39	|	|	|	|	O
41+10	0.3931	0.39	|	|	|	|	O
41+15	0.3931	0.39	|	|	|	|	O
41+20	0.3931	0.39	|	|	|	|	O
41+25	0.3931	0.39	|	|	|	|	O
41+30	0.3931	0.39	|	|	|	|	O
41+35	0.3931	0.39	|	|	|	|	O
41+40	0.3931	0.39	|	|	|	|	O
41+45	0.3931	0.39	|	|	|	|	O
41+50	0.3931	0.39	|	|	|	|	O
41+55	0.3931	0.39	|	|	|	|	O
42+ 0	0.3931	0.39	|	|	|	|	O
42+ 5	0.3931	0.39	|	|	|	|	O
42+10	0.3931	0.39	|	|	|	|	O
42+15	0.3931	0.39	|	|	|	|	O
42+20	0.3931	0.39	|	|	|	|	O
42+25	0.3931	0.39	|	|	|	|	O
42+30	0.3931	0.39	|	|	|	|	O
42+35	0.3931	0.39	|	|	|	|	O
42+40	0.3931	0.39	|	|	|	|	O
42+45	0.3931	0.39	|	|	|	|	O

```
42+50       0.3931      0.39  |         |         |         |         O
42+55       0.3931      0.39  |         |         |         |         O
43+ 0       0.3931      0.39  |         |         |         |         O
43+ 5       0.3931      0.39  |         |         |         |         O
43+10       0.3931      0.39  |         |         |         |         O
43+15       0.3931      0.39  |         |         |         |         O
43+20       0.3931      0.39  |         |         |         |         O
43+25       0.3931      0.39  |         |         |         |         O
43+30       0.3931      0.39  |         |         |         |         O
43+35       0.3931      0.39  |         |         |         |         O
43+40       0.3931      0.39  |         |         |         |         O
43+45       0.3931      0.39  |         |         |         |         O
43+50       0.3931      0.39  |         |         |         |         O
43+55       0.3931      0.39  |         |         |         |         O
44+ 0       0.3931      0.39  |         |         |         |         O
44+ 5       0.3931      0.39  |         |         |         |         O
44+10       0.3931      0.39  |         |         |         |         O
44+15       0.3931      0.39  |         |         |         |         O
44+20       0.3931      0.39  |         |         |         |         O
44+25       0.3931      0.39  |         |         |         |         O
44+30       0.3931      0.39  |         |         |         |         O
44+35       0.3931      0.39  |         |         |         |         O
44+40       0.3931      0.39  |         |         |         |         O
44+45       0.3931      0.39  |         |         |         |         O
44+50       0.3931      0.39  |         |         |         |         O
44+55       0.3931      0.39  |         |         |         |         O
45+ 0       0.3931      0.39  |         |         |         |         O
45+ 5       0.3931      0.39  |         |         |         |         O
45+10       0.3931      0.39  |         |         |         |         O
45+15       0.3931      0.39  |         |         |         |         O
45+20       0.3931      0.39  |         |         |         |         O
45+25       0.3931      0.39  |         |         |         |         O
45+30       0.3931      0.39  |         |         |         |         O
45+35       0.3931      0.39  |         |         |         |         O
45+40       0.3931      0.39  |         |         |         |         O
45+45       0.3931      0.39  |         |         |         |         O
45+50       0.3931      0.39  |         |         |         |         O
45+55       0.3931      0.39  |         |         |         |         O
46+ 0       0.3931      0.39  |         |         |         |         O
46+ 5       0.3931      0.39  |         |         |         |         O
46+10       0.3931      0.39  |         |         |         |         O
46+15       0.3931      0.39  |         |         |         |         O
46+20       0.3931      0.39  |         |         |         |         O
46+25       0.3931      0.39  |         |         |         |         O
46+30       0.3931      0.39  |         |         |         |         O
46+35       0.3922      0.39  |         |         |         |        O|
46+40       0.3892      0.39  |         |         |         |        O|
46+45       0.3848      0.38  |         |         |         |       IO|
46+50       0.3800      0.38  |         |         |         |       O |
46+55       0.3751      0.37  |         |         |         |      IO |
47+ 0       0.3703      0.37  |         |         |         |      O  |
47+ 5       0.3655      0.36  |         |         |         |     IO  |
47+10       0.3608      0.36  |         |         |         |     O   |
47+15       0.3561      0.35  |         |         |         |    IO   |
47+20       0.3515      0.35  |         |         |         |    O    |
47+25       0.3470      0.34  |         |         |         |   IO    |
47+30       0.3425      0.34  |         |         |         |   O     |
47+35       0.3380      0.33  |         |         |         |  IO     |
47+40       0.3337      0.33  |         |         |         |  O      |
47+45       0.3294      0.33  |         |         |         |  O      |
47+50       0.3251      0.32  |         |         |         | IO      |
47+55       0.3209      0.32  |         |         |         | O       |
48+ 0       0.3167      0.31  |         |         |         |IO       |
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48+ 5       0.3126      0.31  |         |         |         |O        |
48+10       0.3086      0.30  |         |         |         |O        |
48+15       0.3046      0.30  |         |         |         O         |
48+20       0.3007      0.30  |         |         |         O         |
48+25       0.2968      0.29  |         |         |        IO         |
48+30       0.2929      0.29  |         |         |        O|         |
48+35       0.2892      0.29  |         |         |        O|         |
48+40       0.2854      0.28  |         |         |       IO|         |
48+45       0.2817      0.28  |         |         |       O |         |
48+50       0.2781      0.27  |         |         |      IO |         |
48+55       0.2745      0.27  |         |         |      O  |         |
49+ 0       0.2709      0.27  |         |         |      O  |         |
49+ 5       0.2674      0.26  |         |         |     IO  |         |
49+10       0.2640      0.26  |         |         |     O   |         |
49+15       0.2606      0.26  |         |         |     O   |         |
49+20       0.2572      0.25  |         |         |    IO   |         |
49+25       0.2539      0.25  |         |         |    O    |         |
49+30       0.2506      0.25  |         |         |    O    |         |
49+35       0.2474      0.24  |         |         |   IO    |         |
49+40       0.2442      0.24  |         |         |   O     |         |
49+45       0.2410      0.24  |         |         |   O     |         |
49+50       0.2379      0.23  |         |         |  IO     |         |
49+55       0.2348      0.23  |         |         |  O      |         |
50+ 0       0.2318      0.23  |         |         |  O      |         |
50+ 5       0.2288      0.23  |         |         | IO      |         |
50+10       0.2258      0.22  |         |         | O       |         |
50+15       0.2229      0.22  |         |         | O       |         |
50+20       0.2200      0.22  |         |         | O       |         |
50+25       0.2172      0.21  |         |         |IO       |         |
50+30       0.2144      0.21  |         |         |O        |         |
50+35       0.2116      0.21  |         |         |O        |         |
50+40       0.2088      0.21  |         |         IO        |         |
50+45       0.2061      0.20  |         |         O         |         |
50+50       0.2035      0.20  |         |         O         |         |
50+55       0.2009      0.20  |         |         O         |         |
51+ 0       0.1983      0.20  |         |        IO         |         |
51+ 5       0.1957      0.19  |         |        O|         |         |
51+10       0.1932      0.19  |         |        O|         |         |
51+15       0.1907      0.19  |         |        O|         |         |
51+20       0.1882      0.19  |         |       IO|         |         |
51+25       0.1858      0.18  |         |       O |         |         |
51+30       0.1834      0.18  |         |       O |         |         |
51+35       0.1810      0.18  |         |       O |         |         |
51+40       0.1787      0.18  |         |      IO |         |         |
51+45       0.1763      0.17  |         |      O  |         |         |
51+50       0.1741      0.17  |         |      O  |         |         |
51+55       0.1718      0.17  |         |      O  |         |         |
52+ 0       0.1696      0.17  |         |      O  |         |         |
52+ 5       0.1674      0.17  |         |     IO  |         |         |
52+10       0.1652      0.16  |         |     O   |         |         |
52+15       0.1631      0.16  |         |     O   |         |         |
52+20       0.1610      0.16  |         |     O   |         |         |
52+25       0.1589      0.16  |         |    IO   |         |         |
52+30       0.1568      0.15  |         |    O    |         |         |
52+35       0.1548      0.15  |         |    O    |         |         |
52+40       0.1528      0.15  |         |    O    |         |         |
52+45       0.1508      0.15  |         |    O    |         |         |
52+50       0.1489      0.15  |         |   IO    |         |         |
52+55       0.1470      0.15  |         |   O     |         |         |
53+ 0       0.1451      0.14  |         |   O     |         |         |
53+ 5       0.1432      0.14  |         |   O     |         |         |
53+10       0.1413      0.14  |         |   O     |         |         |
53+15       0.1395      0.14  |         |   O     |         |         |
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 53+20       0.1377      0.14  |         |  IO     |         |         |
 53+25       0.1359      0.13  |         |  O      |         |         |
 53+30       0.1342      0.13  |         |  O      |         |         |
 53+35       0.1324      0.13  |         |  O      |         |         |
 53+40       0.1307      0.13  |         |  O      |         |         |
 53+45       0.1290      0.13  |         | IO      |         |         |
 53+50       0.1274      0.13  |         | O       |         |         |
 53+55       0.1257      0.12  |         | O       |         |         |
 54+ 0       0.1241      0.12  |         | O       |         |         |
 54+ 5       0.1225      0.12  |         | O       |         |         |
 54+10       0.1209      0.12  |         | O       |         |         |
 54+15       0.1193      0.12  |         |IO       |         |         |
 54+20       0.1178      0.12  |         |O        |         |         |
 54+25       0.1163      0.11  |         |O        |         |         |
 54+30       0.1148      0.11  |         |O        |         |         |
 54+35       0.1133      0.11  |         |O        |         |         |
 54+40       0.1118      0.11  |         |O        |         |         |
 54+45       0.1104      0.11  |         |O        |         |         |
 54+50       0.1089      0.11  |         IO        |         |         |
 54+55       0.1075      0.11  |         O         |         |         |
 55+ 0       0.1061      0.10  |         O         |         |         |
 55+ 5       0.1048      0.10  |         O         |         |         |
 55+10       0.1034      0.10  |         O         |         |         |
 55+15       0.1021      0.10  |         O         |         |         |
 55+20       0.1008      0.10  |         O         |         |         |
 55+25       0.0692      0.00  I      O  |         |         |         |
 55+30       0.0192      0.00  IO        |         |         |         |
 55+35       0.0053      0.00  O         |         |         |         |
 55+40       0.0015      0.00  O         |         |         |         |
 55+45       0.0000      0.00  O         |         |         |         |
-----------------------------------------------------------------------
      ****************************HYDROGRAPH DATA****************************
             Number of intervals =   669
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        0.393 (CFS)
             Total volume =       1.536 (Ac.Ft)
       Status of hydrographs being held in storage
                  Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
       Peak (CFS)      0.000     0.000     0.000     0.000     0.000
       Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      -------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station       38.100 to Point/Station       8.100
      **** STORE OR DELETE CURRENT HYDROGRAPH ****
      ______________________________________________________________________
      Current stream hydrograph saved in file 27259PONDA224.rte
      ****************************HYDROGRAPH DATA****************************
             Number of intervals =     0
             Time interval =    0.0 (Min.)
             Maximum/Peak flow rate =        0.000 (CFS)
             Total volume =       0.000 (Ac.Ft)
       Status of hydrographs being held in storage
                  Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
       Peak (CFS)      0.000     0.000     0.000     0.000     0.000
       Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      -------------------------------------------------------------------
```

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                  FLOOD HYDROGRAPH ROUTING PROGRAM
          Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                       Study date: 02/09/18

--------------------------------------------------------------------
Area B Developed Condition – Mill Creek Promenade
2yr 24hr Unit Hydrograph
By Pacific Coast Land Consultants, Inc.

--------------------------------------------------------------------


Program License Serial Number 4066

--------------------------------------------------------------------
******************** HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHB242.rte
**************************HYDROGRAPH DATA***************************
             Number of intervals =   291
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        0.226 (CFS)
             Total volume =       0.110 (Ac.Ft)
      Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
*********************************************************************



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      201.000
**** RETARDING BASIN ROUTING ****
______________________________________________________________________

Program computation of outflow v. depth




CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.16(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.16(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   1.00(Ft.)    Capacity =   0.06(CFS)

Total outflow at this depth =      0.06(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    6.48(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.16(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.16(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   6.48(Ft.)    Capacity =   0.06(CFS)
```

```
Total outflow at this depth =      0.06(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    7.48(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.16(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.16(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   7.48(Ft.)    Capacity =   0.06(CFS)


Free outlet pipe flow:  Pipe Diameter =     2.40(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   0.48(Ft.)    Capacity =  25.07(CFS)

Total outflow at this depth =     25.14(CFS)

--------------------------------------------------------------------
Total number of inflow hydrograph intervals = 291
Hydrograph time unit =  5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)
--------------------------------------------------------------------
--------------------------------------------------------------------
Initial basin depth =   0.00 (Ft.)
Initial basin storage =      0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)
---------------------------------------------------------------------
--------------------------------------------------------------------
Depth vs. Storage and Depth vs. Discharge data:
 Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
     (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
---------------------------------------------------------------------
   0.000      0.000      0.000      0.000        0.000
   1.000      0.029      0.064      0.029        0.029
   6.480      0.149      0.064      0.149        0.149
   7.480      0.198     25.138      0.111        0.285
--------------------------------------------------------------------
             Hydrograph Detention Basin Routing
---------------------------------------------------------------------

Graph values: 'I'= unit inflow; 'O'=outflow at time shown
---------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                  Depth
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0       0.1    0.11    0.17    0.23 (Ft.)
 0.083    0.01    0.00      0.000  O        |       |       |       |      0.00
 0.167    0.01    0.00      0.000  OI       |       |       |       |      0.00
 0.250    0.01    0.00      0.000  OI       |       |       |       |      0.01
 0.333    0.02    0.00      0.000  O I      |       |       |       |      0.01
 0.417    0.02    0.00      0.000  O I      |       |       |       |      0.01
 0.500    0.02    0.00      0.000  O I      |       |       |       |      0.02
 0.583    0.02    0.00      0.001  O I      |       |       |       |      0.02
 0.667    0.02    0.00      0.001  O I      |       |       |       |      0.03
 0.750    0.02    0.00      0.001  O I      |       |       |       |      0.03
 0.833    0.02    0.00      0.001  O  I     |       |       |       |      0.03
 0.917    0.02    0.00      0.001  O  I     |       |       |       |      0.04
 1.000    0.03    0.00      0.001  O  I     |       |       |       |      0.04
 1.083    0.02    0.00      0.001  O  I     |       |       |       |      0.05
 1.167    0.02    0.00      0.002  O I      |       |       |       |      0.05
 1.250    0.02    0.00      0.002  O I      |       |       |       |      0.06
 1.333    0.02    0.00      0.002  O I      |       |       |       |      0.06
 1.417    0.02    0.00      0.002  O I      |       |       |       |      0.06
 1.500    0.02    0.00      0.002  O I      |       |       |       |      0.07
```

```
1.583    0.02    0.00      0.002  O I     |       |       |       |      0.07
1.667    0.02    0.00      0.002  O I     |       |       |       |      0.07
1.750    0.02    0.00      0.002  O I     |       |       |       |      0.08
1.833    0.02    0.01      0.002  O  I    |       |       |       |      0.08
1.917    0.02    0.01      0.002  O  I    |       |       |       |      0.09
2.000    0.03    0.01      0.003  O  I    |       |       |       |      0.09
2.083    0.03    0.01      0.003  O  I    |       |       |       |      0.09
2.167    0.03    0.01      0.003  O  I    |       |       |       |      0.10
2.250    0.03    0.01      0.003  O  I    |       |       |       |      0.10
2.333    0.03    0.01      0.003  O  I    |       |       |       |      0.11
2.417    0.03    0.01      0.003  |O I    |       |       |       |      0.11
2.500    0.03    0.01      0.003  |O I    |       |       |       |      0.12
2.583    0.03    0.01      0.004  |O  I   |       |       |       |      0.12
2.667    0.03    0.01      0.004  |O  I   |       |       |       |      0.13
2.750    0.03    0.01      0.004  |O  I   |       |       |       |      0.13
2.833    0.03    0.01      0.004  |O  I   |       |       |       |      0.14
2.917    0.03    0.01      0.004  |O  I   |       |       |       |      0.14
3.000    0.03    0.01      0.004  |O  I   |       |       |       |      0.15
3.083    0.03    0.01      0.004  |O  I   |       |       |       |      0.15
3.167    0.03    0.01      0.005  |O  I   |       |       |       |      0.16
3.250    0.03    0.01      0.005  |O  I   |       |       |       |      0.16
3.333    0.03    0.01      0.005  |O  I   |       |       |       |      0.17
3.417    0.03    0.01      0.005  |O  I   |       |       |       |      0.17
3.500    0.03    0.01      0.005  |O  I   |       |       |       |      0.18
3.583    0.03    0.01      0.005  |O  I   |       |       |       |      0.18
3.667    0.03    0.01      0.005  |O  I   |       |       |       |      0.19
3.750    0.03    0.01      0.006  |O  I   |       |       |       |      0.19
3.833    0.03    0.01      0.006  |O  I   |       |       |       |      0.20
3.917    0.04    0.01      0.006  |O   I  |       |       |       |      0.20
4.000    0.04    0.01      0.006  |O   I  |       |       |       |      0.21
4.083    0.04    0.01      0.006  |O   I  |       |       |       |      0.21
4.167    0.04    0.01      0.006  |O   I  |       |       |       |      0.22
4.250    0.04    0.01      0.007  | O  I  |       |       |       |      0.22
4.333    0.04    0.01      0.007  | O  I  |       |       |       |      0.23
4.417    0.04    0.02      0.007  | O   I |       |       |       |      0.24
4.500    0.04    0.02      0.007  | O   I |       |       |       |      0.24
4.583    0.04    0.02      0.007  | O   I |       |       |       |      0.25
4.667    0.04    0.02      0.007  | O   I |       |       |       |      0.26
4.750    0.04    0.02      0.008  | O   I |       |       |       |      0.26
4.833    0.02    0.02      0.008  | OI    |       |       |       |      0.27
4.917    0.01    0.02      0.008  |IO     |       |       |       |      0.27
5.000    0.01    0.02      0.008  I O     |       |       |       |      0.26
5.083    0.02    0.02      0.008  | OI    |       |       |       |      0.26
5.167    0.03    0.02      0.008  | O I   |       |       |       |      0.27
5.250    0.04    0.02      0.008  | O  I  |       |       |       |      0.27
5.333    0.04    0.02      0.008  | O  I  |       |       |       |      0.28
5.417    0.04    0.02      0.008  | O   I |       |       |       |      0.28
5.500    0.04    0.02      0.008  | O   I |       |       |       |      0.29
5.583    0.03    0.02      0.008  | OI    |       |       |       |      0.29
5.667    0.01    0.02      0.008  |IO     |       |       |       |      0.29
5.750    0.01    0.02      0.008  |IO     |       |       |       |      0.29
5.833    0.01    0.02      0.008  |IO     |       |       |       |      0.29
5.917    0.01    0.02      0.008  |IO     |       |       |       |      0.28
6.000    0.01    0.02      0.008  |IO     |       |       |       |      0.28
6.083    0.01    0.02      0.008  |IO     |       |       |       |      0.28
6.167    0.02    0.02      0.008  | O     |       |       |       |      0.28
6.250    0.02    0.02      0.008  | O     |       |       |       |      0.28
6.333    0.02    0.02      0.008  | O     |       |       |       |      0.28
6.417    0.02    0.02      0.008  | O     |       |       |       |      0.28
6.500    0.02    0.02      0.008  | O     |       |       |       |      0.28
6.583    0.02    0.02      0.008  | OI    |       |       |       |      0.28
6.667    0.03    0.02      0.008  | OI    |       |       |       |      0.28
6.750    0.03    0.02      0.008  | OI    |       |       |       |      0.28
```

```
 6.833    0.03    0.02      0.008  | OI    |       |       |       |     0.28
 6.917    0.03    0.02      0.008  | OI    |       |       |       |     0.29
 7.000    0.03    0.02      0.008  | OI    |       |       |       |     0.29
 7.083    0.03    0.02      0.008  | OI    |       |       |       |     0.29
 7.167    0.03    0.02      0.008  | OI    |       |       |       |     0.29
 7.250    0.03    0.02      0.009  | OI    |       |       |       |     0.29
 7.333    0.03    0.02      0.009  | O I   |       |       |       |     0.30
 7.417    0.03    0.02      0.009  | O I   |       |       |       |     0.30
 7.500    0.04    0.02      0.009  | O  I  |       |       |       |     0.30
 7.583    0.04    0.02      0.009  | O  I  |       |       |       |     0.31
 7.667    0.04    0.02      0.009  | O   I |       |       |       |     0.31
 7.750    0.04    0.02      0.009  | O   I |       |       |       |     0.32
 7.833    0.05    0.02      0.009  | O   I |       |       |       |     0.32
 7.917    0.05    0.02      0.010  |  O   I|       |       |       |     0.33
 8.000    0.05    0.02      0.010  |  O   I|       |       |       |     0.34
 8.083    0.06    0.02      0.010  |  O    I       |       |       |     0.35
 8.167    0.07    0.02      0.010  |  O    |I      |       |       |     0.36
 8.250    0.07    0.02      0.011  |  O    |I      |       |       |     0.37
 8.333    0.07    0.02      0.011  |  O    |I      |       |       |     0.38
 8.417    0.07    0.02      0.011  |  O    |I      |       |       |     0.39
 8.500    0.07    0.03      0.012  |  O    |I      |       |       |     0.40
 8.583    0.07    0.03      0.012  |  O    | I     |       |       |     0.41
 8.667    0.08    0.03      0.012  |  O    | I     |       |       |     0.42
 8.750    0.08    0.03      0.013  |  O    | I     |       |       |     0.43
 8.833    0.08    0.03      0.013  |   O   |  I    |       |       |     0.44
 8.917    0.08    0.03      0.013  |   O   |  I    |       |       |     0.46
 9.000    0.09    0.03      0.014  |   O   |   I   |       |       |     0.47
 9.083    0.09    0.03      0.014  |   O   |    I  |       |       |     0.48
 9.167    0.10    0.03      0.015  |   O   |     I |       |       |     0.50
 9.250    0.10    0.03      0.015  |   O   |     I |       |       |     0.52
 9.333    0.11    0.03      0.015  |   O   |     I |       |       |     0.53
 9.417    0.11    0.04      0.016  |    O  |      I|       |       |     0.55
 9.500    0.11    0.04      0.016  |    O  |      I|       |       |     0.57
 9.583    0.11    0.04      0.017  |    O  |       I       |       |     0.59
 9.667    0.12    0.04      0.018  |    O  |       I       |       |     0.60
 9.750    0.12    0.04      0.018  |    O  |       I       |       |     0.62
 9.833    0.12    0.04      0.019  |    O  |       |I      |       |     0.64
 9.917    0.13    0.04      0.019  |     O |       |I      |       |     0.66
10.000    0.13    0.04      0.020  |     O |       |I      |       |     0.68
10.083    0.10    0.04      0.020  |     O |    I  |       |       |     0.70
10.167    0.08    0.05      0.021  |     O |  I    |       |       |     0.71
10.250    0.07    0.05      0.021  |     O | I     |       |       |     0.71
10.333    0.07    0.05      0.021  |     O | I     |       |       |     0.72
10.417    0.07    0.05      0.021  |     O | I     |       |       |     0.73
10.500    0.07    0.05      0.021  |     O | I     |       |       |     0.73
10.583    0.09    0.05      0.022  |     O |    I  |       |       |     0.74
10.667    0.11    0.05      0.022  |     O |      I|       |       |     0.76
10.750    0.11    0.05      0.022  |      O|      I|       |       |     0.77
10.833    0.11    0.05      0.023  |      O|      I|       |       |     0.78
10.917    0.11    0.05      0.023  |      O|       I       |       |     0.80
11.000    0.11    0.05      0.024  |      O|       I       |       |     0.81
11.083    0.11    0.05      0.024  |      O|      I|       |       |     0.83
11.167    0.11    0.05      0.024  |      O|      I|       |       |     0.84
11.250    0.11    0.05      0.025  |      O|      I|       |       |     0.85
11.333    0.11    0.06      0.025  |      O|      I|       |       |     0.87
11.417    0.11    0.06      0.025  |      O|      I|       |       |     0.88
11.500    0.11    0.06      0.026  |       O      I|       |       |     0.89
11.583    0.10    0.06      0.026  |       O     I |       |       |     0.90
11.667    0.09    0.06      0.026  |       O    I  |       |       |     0.91
11.750    0.09    0.06      0.027  |       O    I  |       |       |     0.92
11.833    0.10    0.06      0.027  |       O    I  |       |       |     0.93
11.917    0.10    0.06      0.027  |       O     I |       |       |     0.94
12.000    0.10    0.06      0.027  |       O     I |       |       |     0.94
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12.083    0.13    0.06      0.028  |       O       | I     |       |     0.96
12.167    0.15    0.06      0.028  |       O       |    I  |       |     0.98
12.250    0.15    0.06      0.029  |       |O      |    I  |       |     1.00
12.333    0.16    0.06      0.030  |       |O      |     I |       |     1.02
12.417    0.16    0.06      0.030  |       |O      |     I |       |     1.05
12.500    0.16    0.06      0.031  |       |O      |      I|       |     1.09
12.583    0.17    0.06      0.032  |       |O      |       I       |     1.12
12.667    0.18    0.06      0.032  |       |O      |       |I      |     1.15
12.750    0.18    0.06      0.033  |       |O      |       |I      |     1.19
12.833    0.18    0.06      0.034  |       |O      |       |I      |     1.22
12.917    0.19    0.06      0.035  |       |O      |       | I     |     1.26
13.000    0.19    0.06      0.036  |       |O      |       | I     |     1.30
13.083    0.21    0.06      0.037  |       |O      |       |    I  |     1.34
13.167    0.22    0.06      0.038  |       |O      |       |      I|     1.39
13.250    0.23    0.06      0.039  |       |O      |       |      I|     1.44
13.333    0.23    0.06      0.040  |       |O      |       |      I|     1.49
13.417    0.23    0.06      0.041  |       |O      |       |      I|     1.54
13.500    0.23    0.06      0.042  |       |O      |       |       I     1.59
13.583    0.18    0.06      0.043  |       |O      |       |I      |     1.64
13.667    0.15    0.06      0.044  |       |O      |    I  |       |     1.67
13.750    0.14    0.06      0.044  |       |O      |   I   |       |     1.69
13.833    0.14    0.06      0.045  |       |O      |   I   |       |     1.72
13.917    0.14    0.06      0.045  |       |O      |   I   |       |     1.74
14.000    0.14    0.06      0.046  |       |O      |   I   |       |     1.77
14.083    0.16    0.06      0.046  |       |O      |     I |       |     1.80
14.167    0.17    0.06      0.047  |       |O      |       I       |     1.83
14.250    0.17    0.06      0.048  |       |O      |       I       |     1.86
14.333    0.17    0.06      0.049  |       |O      |       I       |     1.90
14.417    0.17    0.06      0.049  |       |O      |      I|       |     1.93
14.500    0.17    0.06      0.050  |       |O      |      I|       |     1.96
14.583    0.17    0.06      0.051  |       |O      |      I|       |     1.99
14.667    0.17    0.06      0.051  |       |O      |      I|       |     2.03
14.750    0.17    0.06      0.052  |       |O      |      I|       |     2.06
14.833    0.16    0.06      0.053  |       |O      |      I|       |     2.09
14.917    0.16    0.06      0.054  |       |O      |     I |       |     2.12
15.000    0.16    0.06      0.054  |       |O      |     I |       |     2.15
15.083    0.16    0.06      0.055  |       |O      |     I |       |     2.18
15.167    0.15    0.06      0.055  |       |O      |    I  |       |     2.21
15.250    0.15    0.06      0.056  |       |O      |    I  |       |     2.24
15.333    0.15    0.06      0.057  |       |O      |    I  |       |     2.27
15.417    0.15    0.06      0.057  |       |O      |   I   |       |     2.29
15.500    0.15    0.06      0.058  |       |O      |   I   |       |     2.32
15.583    0.13    0.06      0.058  |       |O      | I     |       |     2.34
15.667    0.12    0.06      0.059  |       |O      I       |       |     2.36
15.750    0.12    0.06      0.059  |       |O      I       |       |     2.38
15.833    0.12    0.06      0.059  |       |O      I       |       |     2.39
15.917    0.12    0.06      0.060  |       |O      I       |       |     2.41
16.000    0.12    0.06      0.060  |       |O      I       |       |     2.43
16.083    0.06    0.06      0.060  |       IO      |       |       |     2.43
16.167    0.01    0.06      0.060  |I      |O      |       |       |     2.42
16.250    0.00    0.06      0.060  I       |O      |       |       |     2.40
16.333    0.00    0.06      0.059  I       |O      |       |       |     2.39
16.417    0.00    0.06      0.059  I       |O      |       |       |     2.37
16.500    0.00    0.06      0.058  I       |O      |       |       |     2.35
16.583    0.01    0.06      0.058  |I      |O      |       |       |     2.33
16.667    0.02    0.06      0.058  | I     |O      |       |       |     2.31
16.750    0.02    0.06      0.057  | I     |O      |       |       |     2.30
16.833    0.02    0.06      0.057  | I     |O      |       |       |     2.28
16.917    0.02    0.06      0.057  | I     |O      |       |       |     2.27
17.000    0.02    0.06      0.056  | I     |O      |       |       |     2.25
17.083    0.01    0.06      0.056  | I     |O      |       |       |     2.24
17.167    0.01    0.06      0.056  |I      |O      |       |       |     2.22
17.250    0.01    0.06      0.055  |I      |O      |       |       |     2.21
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17.333    0.01    0.06      0.055  |I       |O       |        |        |       2.19
17.417    0.01    0.06      0.055  |I       |O       |        |        |       2.17
17.500    0.01    0.06      0.054  |I       |O       |        |        |       2.16
17.583    0.01    0.06      0.054  |I       |O       |        |        |       2.14
17.667    0.01    0.06      0.054  |I       |O       |        |        |       2.12
17.750    0.01    0.06      0.053  |I       |O       |        |        |       2.11
17.833    0.01    0.06      0.053  |I       |O       |        |        |       2.09
17.917    0.01    0.06      0.052  I        |O       |        |        |       2.07
18.000    0.00    0.06      0.052  I        |O       |        |        |       2.05
18.083    0.00    0.06      0.052  I        |O       |        |        |       2.04
18.167    0.00    0.06      0.051  I        |O       |        |        |       2.02
18.250    0.01    0.06      0.051  I        |O       |        |        |       2.00
18.333    0.01    0.06      0.050  I        |O       |        |        |       1.98
18.417    0.01    0.06      0.050  I        |O       |        |        |       1.96
18.500    0.01    0.06      0.050  I        |O       |        |        |       1.94
18.583    0.01    0.06      0.049  |I       |O       |        |        |       1.92
18.667    0.02    0.06      0.049  | I      |O       |        |        |       1.91
18.750    0.02    0.06      0.049  | I      |O       |        |        |       1.89
18.833    0.02    0.06      0.048  | I      |O       |        |        |       1.88
18.917    0.01    0.06      0.048  |I       |O       |        |        |       1.86
19.000    0.01    0.06      0.048  |I       |O       |        |        |       1.85
19.083    0.02    0.06      0.047  | I      |O       |        |        |       1.83
19.167    0.02    0.06      0.047  | I      |O       |        |        |       1.82
19.250    0.02    0.06      0.047  | I      |O       |        |        |       1.80
19.333    0.01    0.06      0.046  |I       |O       |        |        |       1.79
19.417    0.01    0.06      0.046  |I       |O       |        |        |       1.77
19.500    0.01    0.06      0.045  |I       |O       |        |        |       1.75
19.583    0.01    0.06      0.045  |I       |O       |        |        |       1.74
19.667    0.02    0.06      0.045  | I      |O       |        |        |       1.72
19.750    0.02    0.06      0.044  | I      |O       |        |        |       1.71
19.833    0.02    0.06      0.044  | I      |O       |        |        |       1.69
19.917    0.01    0.06      0.044  |I       |O       |        |        |       1.68
20.000    0.01    0.06      0.043  |I       |O       |        |        |       1.66
20.083    0.01    0.06      0.043  I        |O       |        |        |       1.64
20.167    0.00    0.06      0.043  I        |O       |        |        |       1.62
20.250    0.00    0.06      0.042  I        |O       |        |        |       1.60
20.333    0.00    0.06      0.042  I        |O       |        |        |       1.58
20.417    0.00    0.06      0.041  I        |O       |        |        |       1.56
20.500    0.00    0.06      0.041  I        |O       |        |        |       1.54
20.583    0.00    0.06      0.040  I        |O       |        |        |       1.52
20.667    0.00    0.06      0.040  I        |O       |        |        |       1.50
20.750    0.00    0.06      0.040  I        |O       |        |        |       1.48
20.833    0.01    0.06      0.039  I        |O       |        |        |       1.46
20.917    0.01    0.06      0.039  |I       |O       |        |        |       1.45
21.000    0.01    0.06      0.038  |I       |O       |        |        |       1.43
21.083    0.01    0.06      0.038  I        |O       |        |        |       1.41
21.167    0.00    0.06      0.038  I        |O       |        |        |       1.39
21.250    0.00    0.06      0.037  I        |O       |        |        |       1.37
21.333    0.01    0.06      0.037  |I       |O       |        |        |       1.35
21.417    0.01    0.06      0.036  |I       |O       |        |        |       1.34
21.500    0.01    0.06      0.036  |I       |O       |        |        |       1.32
21.583    0.01    0.06      0.036  I        |O       |        |        |       1.30
21.667    0.00    0.06      0.035  I        |O       |        |        |       1.28
21.750    0.00    0.06      0.035  I        |O       |        |        |       1.27
21.833    0.01    0.06      0.034  |I       |O       |        |        |       1.25
21.917    0.01    0.06      0.034  |I       |O       |        |        |       1.23
22.000    0.01    0.06      0.034  |I       |O       |        |        |       1.21
22.083    0.01    0.06      0.033  |I       |O       |        |        |       1.20
22.167    0.00    0.06      0.033  I        |O       |        |        |       1.18
22.250    0.00    0.06      0.032  I        |O       |        |        |       1.16
22.333    0.01    0.06      0.032  |I       |O       |        |        |       1.14
22.417    0.01    0.06      0.032  |I       |O       |        |        |       1.12
22.500    0.01    0.06      0.031  |I       |O       |        |        |       1.11
```

```
22.583    0.01    0.06      0.031  |I       |O       |       |       |     1.09
22.667    0.01    0.06      0.031  |I       |O       |       |       |     1.07
22.750    0.01    0.06      0.030  |I       |O       |       |       |     1.06
22.833    0.01    0.06      0.030  |I       |O       |       |       |     1.04
22.917    0.01    0.06      0.030  |I       |O       |       |       |     1.02
23.000    0.01    0.06      0.029  |I       |O       |       |       |     1.01
23.083    0.01    0.06      0.029  |I       |O       |       |       |     0.99
23.167    0.01    0.06      0.028  |I       O        |       |       |     0.98
23.250    0.01    0.06      0.028  |I       O        |       |       |     0.97
23.333    0.01    0.06      0.028  |I       O        |       |       |     0.96
23.417    0.01    0.06      0.027  |I       O        |       |       |     0.95
23.500    0.01    0.06      0.027  |I       O        |       |       |     0.93
23.583    0.01    0.06      0.027  |I       O        |       |       |     0.92
23.667    0.01    0.06      0.026  |I       O        |       |       |     0.91
23.750    0.01    0.06      0.026  |I       O        |       |       |     0.90
23.833    0.01    0.06      0.026  |I       O        |       |       |     0.89
23.917    0.01    0.06      0.026  |I       O        |       |       |     0.88
24.000    0.01    0.06      0.025  |I      O|        |       |       |     0.87
24.083    0.01    0.06      0.025  I       O|        |       |       |     0.86
24.167    0.00    0.05      0.025  I       O|        |       |       |     0.85
24.250    0.00    0.05      0.024  I       O|        |       |       |     0.83
24.333    0.00    0.05      0.024  I       O|        |       |       |     0.82


      Remaining water in basin =    0.02 (Ac.Ft)


      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =   292
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.064 (CFS)
                   Total volume =       0.087 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      --------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      201.100 to Point/Station      602.000
      **** STREAM ROUTING SCS CONVEX METHOD ****
      ______________________________________________________________________
      HYDROGRAPH STREAM ROUTING DATA:
      Length of stream =    543.00 (Ft.)
      Elevation difference =    2.70 (Ft.)
      Slope of channel =  0.004972 (Vert/Horiz)
      Channel type - Pipe


      Pipe length  =   543.00(Ft.)   Elevation difference =   2.70(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using mean flow rate of hydrograph
      Required pipe flow  =     0.043(CFS)
      Nearest computed pipe diameter  =      3.00(In.)
      Calculated individual pipe flow  =     0.043(CFS)
      Normal flow depth in pipe =    1.86(In.)
      Flow top width inside pipe =    2.91(In.)
      Critical Depth =    0.12(Ft.)
      Pipe flow velocity =      1.38(Ft/s)
      Travel time through pipe =    6.58 min.
```

```
Pipe length  =   543.00(Ft.)   Elevation difference =   2.70(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using maximum flow rate of hydrograph
Required pipe flow  =     0.064(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.064(CFS)
Normal flow depth in pipe =    1.65(In.)
Flow top width inside pipe =    5.35(In.)
Critical Depth =    0.12(Ft.)
Pipe flow velocity =      1.49(Ft/s)
Travel time through pipe =    6.08 min.


********************** SCS CONVEX CHANNEL ROUTING ********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
         where c* = 1 - (1-c)^e and dt = c(length)/velocity
         c(v/v+1.7) =   0.4667   Travel time =   6.08 (min.)
       dt*(unit time interval) =   5.00(min.),  e=   1.5075
       dt(routing time-step) =   2.84 (min.),   c* =   0.6124

Output hydrograph delayed by 0  unit time increments


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

--------------------------------------------------------------------
Time(h+m) Out = O(CFS) In = I  0        0.0       0.0       0.0       0.1
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  O         |         |         |         |
  0+10       0.0001      0.00  O         |         |         |         |
  0+15       0.0002      0.00  O         |         |         |         |
  0+20       0.0004      0.00  O         |         |         |         |
  0+25       0.0006      0.00  O         |         |         |         |
  0+30       0.0008      0.00  O         |         |         |         |
  0+35       0.0010      0.00  O         |         |         |         |
  0+40       0.0013      0.00  OI        |         |         |         |
  0+45       0.0016      0.00  OI        |         |         |         |
  0+50       0.0018      0.00  |O        |         |         |         |
  0+55       0.0021      0.00  |O        |         |         |         |
  1+ 0       0.0024      0.00  |O        |         |         |         |
  1+ 5       0.0028      0.00  |O        |         |         |         |
  1+10       0.0031      0.00  |OI       |         |         |         |
  1+15       0.0033      0.00  | O       |         |         |         |
  1+20       0.0036      0.00  | O       |         |         |         |
  1+25       0.0038      0.00  | O       |         |         |         |
  1+30       0.0041      0.00  | O       |         |         |         |
  1+35       0.0043      0.00  | O       |         |         |         |
  1+40       0.0045      0.00  | O       |         |         |         |
  1+45       0.0047      0.00  | OI      |         |         |         |
  1+50       0.0049      0.01  |  O      |         |         |         |
  1+55       0.0052      0.01  |  O      |         |         |         |
  2+ 0       0.0054      0.01  |  O      |         |         |         |
  2+ 5       0.0057      0.01  |  O      |         |         |         |
  2+10       0.0060      0.01  |  O      |         |         |         |
  2+15       0.0063      0.01  |  OI     |         |         |         |
```

```
2+20       0.0066      0.01  |   O     |         |         |         |
2+25       0.0069      0.01  |   O     |         |         |         |
2+30       0.0071      0.01  |   O     |         |         |         |
2+35       0.0074      0.01  |   O     |         |         |         |
2+40       0.0077      0.01  |   OI    |         |         |         |
2+45       0.0080      0.01  |    O    |         |         |         |
2+50       0.0084      0.01  |    O    |         |         |         |
2+55       0.0087      0.01  |    O    |         |         |         |
3+ 0       0.0091      0.01  |    O    |         |         |         |
3+ 5       0.0094      0.01  |    OI   |         |         |         |
3+10       0.0097      0.01  |     O   |         |         |         |
3+15       0.0101      0.01  |     O   |         |         |         |
3+20       0.0104      0.01  |     O   |         |         |         |
3+25       0.0107      0.01  |     O   |         |         |         |
3+30       0.0110      0.01  |     OI  |         |         |         |
3+35       0.0113      0.01  |      O  |         |         |         |
3+40       0.0116      0.01  |      O  |         |         |         |
3+45       0.0119      0.01  |      O  |         |         |         |
3+50       0.0122      0.01  |      O  |         |         |         |
3+55       0.0126      0.01  |      OI |         |         |         |
4+ 0       0.0129      0.01  |       O |         |         |         |
4+ 5       0.0133      0.01  |       O |         |         |         |
4+10       0.0136      0.01  |       O |         |         |         |
4+15       0.0140      0.01  |       O |         |         |         |
4+20       0.0144      0.01  |       OI|         |         |         |
4+25       0.0147      0.02  |        O|         |         |         |
4+30       0.0151      0.02  |        O|         |         |         |
4+35       0.0156      0.02  |        O|         |         |         |
4+40       0.0160      0.02  |        OI         |         |         |
4+45       0.0164      0.02  |         O         |         |         |
4+50       0.0168      0.02  |         O         |         |         |
4+55       0.0170      0.02  |         O         |         |         |
5+ 0       0.0171      0.02  |         O         |         |         |
5+ 5       0.0170      0.02  |         O         |         |         |
5+10       0.0171      0.02  |         O         |         |         |
5+15       0.0172      0.02  |         O         |         |         |
5+20       0.0174      0.02  |         OI        |         |         |
5+25       0.0177      0.02  |         |O        |         |         |
5+30       0.0181      0.02  |         |O        |         |         |
5+35       0.0184      0.02  |         |O        |         |         |
5+40       0.0186      0.02  |         |O        |         |         |
5+45       0.0187      0.02  |         |O        |         |         |
5+50       0.0186      0.02  |         |O        |         |         |
5+55       0.0185      0.02  |         |O        |         |         |
6+ 0       0.0183      0.02  |         |O        |         |         |
6+ 5       0.0182      0.02  |         |O        |         |         |
6+10       0.0181      0.02  |         |O        |         |         |
6+15       0.0180      0.02  |         |O        |         |         |
6+20       0.0180      0.02  |         |O        |         |         |
6+25       0.0180      0.02  |         |O        |         |         |
6+30       0.0180      0.02  |         |O        |         |         |
6+35       0.0180      0.02  |         |O        |         |         |
6+40       0.0180      0.02  |         |O        |         |         |
6+45       0.0181      0.02  |         |O        |         |         |
6+50       0.0182      0.02  |         |O        |         |         |
6+55       0.0183      0.02  |         |O        |         |         |
7+ 0       0.0184      0.02  |         |O        |         |         |
7+ 5       0.0185      0.02  |         |O        |         |         |
7+10       0.0187      0.02  |         |O        |         |         |
7+15       0.0188      0.02  |         |O        |         |         |
7+20       0.0189      0.02  |         |O        |         |         |
7+25       0.0191      0.02  |         |OI       |         |         |
7+30       0.0193      0.02  |         |OI       |         |         |
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 7+35       0.0195      0.02  |         | O       |         |         |
 7+40       0.0198      0.02  |         | O       |         |         |
 7+45       0.0201      0.02  |         | O       |         |         |
 7+50       0.0205      0.02  |         | O       |         |         |
 7+55       0.0209      0.02  |         | OI      |         |         |
 8+ 0       0.0213      0.02  |         |  O      |         |         |
 8+ 5       0.0217      0.02  |         |  O      |         |         |
 8+10       0.0223      0.02  |         |  OI     |         |         |
 8+15       0.0229      0.02  |         |   O     |         |         |
 8+20       0.0235      0.02  |         |   OI    |         |         |
 8+25       0.0242      0.02  |         |    O    |         |         |
 8+30       0.0249      0.03  |         |    O    |         |         |
 8+35       0.0255      0.03  |         |    OI   |         |         |
 8+40       0.0262      0.03  |         |     O   |         |         |
 8+45       0.0270      0.03  |         |     OI  |         |         |
 8+50       0.0277      0.03  |         |      O  |         |         |
 8+55       0.0285      0.03  |         |      OI |         |         |
 9+ 0       0.0293      0.03  |         |       O |         |         |
 9+ 5       0.0301      0.03  |         |       OI|         |         |
 9+10       0.0311      0.03  |         |        OI         |         |
 9+15       0.0320      0.03  |         |        OI         |         |
 9+20       0.0330      0.03  |         |         OI        |         |
 9+25       0.0341      0.04  |         |         |OI       |         |
 9+30       0.0352      0.04  |         |         |OI       |         |
 9+35       0.0363      0.04  |         |         | OI      |         |
 9+40       0.0375      0.04  |         |         |  OI     |         |
 9+45       0.0386      0.04  |         |         |   O     |         |
 9+50       0.0398      0.04  |         |         |   OI    |         |
 9+55       0.0410      0.04  |         |         |    OI   |         |
10+ 0       0.0423      0.04  |         |         |     OI  |         |
10+ 5       0.0435      0.04  |         |         |      O  |         |
10+10       0.0445      0.05  |         |         |      OI |         |
10+15       0.0452      0.05  |         |         |       O |         |
10+20       0.0458      0.05  |         |         |       O |         |
10+25       0.0463      0.05  |         |         |       OI|         |
10+30       0.0467      0.05  |         |         |        O|         |
10+35       0.0472      0.05  |         |         |        O|         |
10+40       0.0478      0.05  |         |         |        OI         |
10+45       0.0485      0.05  |         |         |         O         |
10+50       0.0494      0.05  |         |         |         OI        |
10+55       0.0503      0.05  |         |         |         |O        |
11+ 0       0.0513      0.05  |         |         |         |OI       |
11+ 5       0.0522      0.05  |         |         |         | OI      |
11+10       0.0531      0.05  |         |         |         | OI      |
11+15       0.0539      0.05  |         |         |         |  OI     |
11+20       0.0547      0.06  |         |         |         |   O     |
11+25       0.0555      0.06  |         |         |         |   OI    |
11+30       0.0563      0.06  |         |         |         |    O    |
11+35       0.0571      0.06  |         |         |         |    OI   |
11+40       0.0578      0.06  |         |         |         |    OI   |
11+45       0.0584      0.06  |         |         |         |     O   |
11+50       0.0589      0.06  |         |         |         |     OI  |
11+55       0.0595      0.06  |         |         |         |     OI  |
12+ 0       0.0601      0.06  |         |         |         |      O  |
12+ 5       0.0607      0.06  |         |         |         |      OI |
12+10       0.0616      0.06  |         |         |         |       OI|
12+15       0.0627      0.06  |         |         |         |       OI|
12+20       0.0636      0.06  |         |         |         |        OI
12+25       0.0641      0.06  |         |         |         |        OI
12+30       0.0642      0.06  |         |         |         |        OI
12+35       0.0643      0.06  |         |         |         |        OI
12+40       0.0643      0.06  |         |         |         |        OI
12+45       0.0643      0.06  |         |         |         |        OI
```

12+50	0.0643	0.06					OI
12+55	0.0643	0.06					OI
13+ 0	0.0643	0.06					OI
13+ 5	0.0643	0.06					OI
13+10	0.0643	0.06					OI
13+15	0.0643	0.06					OI
13+20	0.0643	0.06					OI
13+25	0.0643	0.06					OI
13+30	0.0643	0.06					OI
13+35	0.0643	0.06					OI
13+40	0.0643	0.06					OI
13+45	0.0643	0.06					OI
13+50	0.0643	0.06					OI
13+55	0.0643	0.06					OI
14+ 0	0.0643	0.06					OI
14+ 5	0.0643	0.06					OI
14+10	0.0643	0.06					OI
14+15	0.0643	0.06					OI
14+20	0.0643	0.06					OI
14+25	0.0643	0.06					OI
14+30	0.0643	0.06					OI
14+35	0.0643	0.06					OI
14+40	0.0643	0.06					OI
14+45	0.0643	0.06					OI
14+50	0.0643	0.06					OI
14+55	0.0643	0.06					OI
15+ 0	0.0643	0.06					OI
15+ 5	0.0643	0.06					OI
15+10	0.0643	0.06					OI
15+15	0.0643	0.06					O
15+20	0.0643	0.06					O
15+25	0.0643	0.06					O
15+30	0.0643	0.06					O
15+35	0.0643	0.06					O
15+40	0.0643	0.06					O
15+45	0.0643	0.06					O
15+50	0.0643	0.06					O
15+55	0.0643	0.06					O
16+ 0	0.0643	0.06					O
16+ 5	0.0643	0.06					O
16+10	0.0643	0.06					O
16+15	0.0643	0.06					O
16+20	0.0643	0.06					O
16+25	0.0643	0.06					O
16+30	0.0643	0.06					O
16+35	0.0643	0.06					O
16+40	0.0643	0.06					O
16+45	0.0643	0.06					O
16+50	0.0643	0.06					O
16+55	0.0643	0.06					O
17+ 0	0.0643	0.06					O
17+ 5	0.0643	0.06					O
17+10	0.0643	0.06					O
17+15	0.0643	0.06					O
17+20	0.0643	0.06					O
17+25	0.0643	0.06					O
17+30	0.0643	0.06					O
17+35	0.0643	0.06					O
17+40	0.0643	0.06					O
17+45	0.0643	0.06					O
17+50	0.0643	0.06					O
17+55	0.0643	0.06					O
18+ 0	0.0643	0.06					O

```
18+ 5      0.0643     0.06  |         |         |         |        O
18+10      0.0643     0.06  |         |         |         |        O
18+15      0.0643     0.06  |         |         |         |        O
18+20      0.0643     0.06  |         |         |         |        O
18+25      0.0643     0.06  |         |         |         |        O
18+30      0.0643     0.06  |         |         |         |        O
18+35      0.0643     0.06  |         |         |         |        O
18+40      0.0643     0.06  |         |         |         |        O
18+45      0.0643     0.06  |         |         |         |        O
18+50      0.0643     0.06  |         |         |         |        O
18+55      0.0643     0.06  |         |         |         |        O
19+ 0      0.0643     0.06  |         |         |         |        O
19+ 5      0.0643     0.06  |         |         |         |        O
19+10      0.0643     0.06  |         |         |         |        O
19+15      0.0643     0.06  |         |         |         |        O
19+20      0.0643     0.06  |         |         |         |        O
19+25      0.0643     0.06  |         |         |         |        O
19+30      0.0643     0.06  |         |         |         |        O
19+35      0.0643     0.06  |         |         |         |        O
19+40      0.0643     0.06  |         |         |         |        O
19+45      0.0643     0.06  |         |         |         |        O
19+50      0.0643     0.06  |         |         |         |        O
19+55      0.0643     0.06  |         |         |         |        O
20+ 0      0.0643     0.06  |         |         |         |        O
20+ 5      0.0643     0.06  |         |         |         |        O
20+10      0.0643     0.06  |         |         |         |        O
20+15      0.0643     0.06  |         |         |         |        O
20+20      0.0643     0.06  |         |         |         |        O
20+25      0.0643     0.06  |         |         |         |        O
20+30      0.0643     0.06  |         |         |         |        O
20+35      0.0643     0.06  |         |         |         |        O
20+40      0.0643     0.06  |         |         |         |        O
20+45      0.0643     0.06  |         |         |         |        O
20+50      0.0643     0.06  |         |         |         |        O
20+55      0.0643     0.06  |         |         |         |        O
21+ 0      0.0643     0.06  |         |         |         |        O
21+ 5      0.0643     0.06  |         |         |         |        O
21+10      0.0643     0.06  |         |         |         |        O
21+15      0.0643     0.06  |         |         |         |        O
21+20      0.0643     0.06  |         |         |         |        O
21+25      0.0643     0.06  |         |         |         |        O
21+30      0.0643     0.06  |         |         |         |        O
21+35      0.0643     0.06  |         |         |         |        O
21+40      0.0643     0.06  |         |         |         |        O
21+45      0.0643     0.06  |         |         |         |        O
21+50      0.0643     0.06  |         |         |         |        O
21+55      0.0643     0.06  |         |         |         |        O
22+ 0      0.0643     0.06  |         |         |         |        O
22+ 5      0.0643     0.06  |         |         |         |        O
22+10      0.0643     0.06  |         |         |         |        O
22+15      0.0643     0.06  |         |         |         |        O
22+20      0.0643     0.06  |         |         |         |        O
22+25      0.0643     0.06  |         |         |         |        O
22+30      0.0643     0.06  |         |         |         |        O
22+35      0.0643     0.06  |         |         |         |        O
22+40      0.0643     0.06  |         |         |         |        O
22+45      0.0643     0.06  |         |         |         |        O
22+50      0.0643     0.06  |         |         |         |        O
22+55      0.0643     0.06  |         |         |         |        O
23+ 0      0.0643     0.06  |         |         |         |        O
23+ 5      0.0642     0.06  |         |         |         |       O|
23+10      0.0638     0.06  |         |         |         |       O|
23+15      0.0632     0.06  |         |         |         |      IO|
```

```
    23+20       0.0625      0.06  |         |         |         |       O |
    23+25       0.0618      0.06  |         |         |         |      IO |
    23+30       0.0610      0.06  |         |         |         |      O  |
    23+35       0.0603      0.06  |         |         |         |     IO  |
    23+40       0.0596      0.06  |         |         |         |     IO  |
    23+45       0.0589      0.06  |         |         |         |     O   |
    23+50       0.0582      0.06  |         |         |         |    IO   |
    23+55       0.0575      0.06  |         |         |         |    O    |
    24+ 0       0.0568      0.06  |         |         |         |   IO    |
    24+ 5       0.0561      0.06  |         |         |         |   O     |
    24+10       0.0554      0.05  |         |         |         |  IO     |
    24+15       0.0546      0.05  |         |         |         |  O      |
    24+20       0.0538      0.05  |         |         |         | IO      |
    24+25       0.0392      0.00  I         |         |   O     |         |
    24+30       0.0152      0.00  I        O|         |         |         |
    24+35       0.0059      0.00  I  O      |         |         |         |
    24+40       0.0023      0.00  IO        |         |         |         |
    24+45       0.0000      0.00  O         |         |         |         |
-----------------------------------------------------------------------
      ***************************HYDROGRAPH DATA***************************
             Number of intervals =   297
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        0.064 (CFS)
             Total volume =       0.087 (Ac.Ft)
       Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
       Peak (CFS)      0.000     0.000     0.000     0.000     0.000
       Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      **********************************************************************

      --------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      201.100 to Point/Station      602.000
      **** STORE OR DELETE CURRENT HYDROGRAPH ****
      ______________________________________________________________________
      Current stream hydrograph saved in file 27259BPOND224.rte
      ***************************HYDROGRAPH DATA***************************
             Number of intervals =     0
             Time interval =    0.0 (Min.)
             Maximum/Peak flow rate =        0.000 (CFS)
             Total volume =       0.000 (Ac.Ft)
       Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
       Peak (CFS)      0.000     0.000     0.000     0.000     0.000
       Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      **********************************************************************

      --------------------------------------------------------------------
```

```
                 FLOOD HYDROGRAPH ROUTING PROGRAM
          Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                      Study date: 01/31/18

--------------------------------------------------------------------
PM #13523
MILL CREEK PROMENADE
AREA C (Pond C)- Q2yr24hr(ONSITE)- Unit Hydrograph Method
-------------------------------------------------------------------


Program License Serial Number 4066

-------------------------------------------------------------------
******************** HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHC242.rte
**************************HYDROGRAPH DATA***************************
             Number of intervals =   291
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        2.068 (CFS)
             Total volume =       1.472 (Ac.Ft)
      Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
*********************************************************************



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      316.000 to Point/Station      316.000
**** RETARDING BASIN ROUTING ****
____________________________________________________________________

Program computation of outflow v. depth





CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   1.00(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    3.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.00(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)
```

```
CALCULATED OUTFLOW DATA AT DEPTH =    4.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   4.00(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.00(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   1.00(Ft.)    Capacity =   6.28(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.50(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   1.00(Ft.)    Capacity =  14.14(CFS)

Total outflow at this depth =     20.81(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    5.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   5.00(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.00(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   1.00(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   2.00(Ft.)    Capacity =   6.28(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.50(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   1.50(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   2.00(Ft.)    Capacity =  17.31(CFS)

Total outflow at this depth =     23.99(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    6.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   6.00(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.00(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   1.00(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.00(Ft.)    Capacity =   6.28(CFS)
```

```
Free outlet pipe flow:  Pipe Diameter =     1.50(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   1.50(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.00(Ft.)    Capacity =  17.31(CFS)

Total outflow at this depth =     23.99(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    6.50(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   6.50(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.00(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   1.00(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.50(Ft.)    Capacity =   6.28(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.50(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   1.50(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.50(Ft.)    Capacity =  17.31(CFS)

Total outflow at this depth =     23.99(CFS)

--------------------------------------------------------------------
Total number of inflow hydrograph intervals = 291
Hydrograph time unit =  5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)
--------------------------------------------------------------------
--------------------------------------------------------------------
Initial basin depth =   0.00 (Ft.)
Initial basin storage =      0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)
---------------------------------------------------------------------
--------------------------------------------------------------------
Depth vs. Storage and Depth vs. Discharge data:
 Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
     (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
---------------------------------------------------------------------
   0.000      0.000      0.000      0.000        0.000
   1.000      0.174      0.393      0.173        0.175
   3.000      0.435      0.393      0.434        0.436
   4.000      0.740     20.813      0.668        0.812
   5.000      1.081     23.991      0.998        1.164
   6.000      1.367     23.991      1.284        1.450
   6.500      1.475     23.991      1.392        1.558
--------------------------------------------------------------------
             Hydrograph Detention Basin Routing
---------------------------------------------------------------------

Graph values: 'I'= unit inflow; 'O'=outflow at time shown
---------------------------------------------------------------------
```
```
Time   Inflow  Outflow    Storage                                   Depth
```

```
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0       0.5    1.03    1.55    2.07 (Ft.)
 0.083    0.09    0.00      0.000  OI      |       |       |       |     0.00
 0.167    0.17    0.00      0.001  O I     |       |       |       |     0.01
 0.250    0.18    0.01      0.002  O I     |       |       |       |     0.01
 0.333    0.23    0.01      0.004  O  I    |       |       |       |     0.02
 0.417    0.27    0.01      0.005  O   I   |       |       |       |     0.03
 0.500    0.28    0.02      0.007  O   I   |       |       |       |     0.04
 0.583    0.28    0.02      0.009  O   I   |       |       |       |     0.05
 0.667    0.28    0.02      0.011  O   I   |       |       |       |     0.06
 0.750    0.28    0.03      0.013  O   I   |       |       |       |     0.07
 0.833    0.33    0.03      0.014  O    I  |       |       |       |     0.08
 0.917    0.37    0.04      0.017  O    I  |       |       |       |     0.10
 1.000    0.37    0.04      0.019  O    I  |       |       |       |     0.11
 1.083    0.33    0.05      0.021  O    I  |       |       |       |     0.12
 1.167    0.29    0.05      0.023  O   I   |       |       |       |     0.13
 1.250    0.29    0.06      0.024  O   I   |       |       |       |     0.14
 1.333    0.28    0.06      0.026  O   I   |       |       |       |     0.15
 1.417    0.28    0.06      0.028  O   I   |       |       |       |     0.16
 1.500    0.28    0.07      0.029  |O  I   |       |       |       |     0.17
 1.583    0.28    0.07      0.030  |O  I   |       |       |       |     0.18
 1.667    0.28    0.07      0.032  |O  I   |       |       |       |     0.18
 1.750    0.28    0.08      0.033  |O  I   |       |       |       |     0.19
 1.833    0.33    0.08      0.035  |O   I  |       |       |       |     0.20
 1.917    0.37    0.08      0.037  |O   I  |       |       |       |     0.21
 2.000    0.37    0.09      0.039  |O   I  |       |       |       |     0.22
 2.083    0.38    0.09      0.041  |O   I  |       |       |       |     0.23
 2.167    0.38    0.10      0.043  |O   I  |       |       |       |     0.25
 2.250    0.38    0.10      0.045  |O   I  |       |       |       |     0.26
 2.333    0.38    0.10      0.046  |O   I  |       |       |       |     0.27
 2.417    0.38    0.11      0.048  |O   I  |       |       |       |     0.28
 2.500    0.38    0.11      0.050  |O   I  |       |       |       |     0.29
 2.583    0.42    0.12      0.052  |O    I |       |       |       |     0.30
 2.667    0.46    0.12      0.054  |O     I|       |       |       |     0.31
 2.750    0.47    0.13      0.057  |O     I|       |       |       |     0.33
 2.833    0.47    0.13      0.059  | O    I|       |       |       |     0.34
 2.917    0.47    0.14      0.061  | O    I|       |       |       |     0.35
 3.000    0.47    0.14      0.064  | O    I|       |       |       |     0.37
 3.083    0.47    0.15      0.066  | O    I|       |       |       |     0.38
 3.167    0.47    0.15      0.068  | O    I|       |       |       |     0.39
 3.250    0.47    0.16      0.070  | O    I|       |       |       |     0.40
 3.333    0.47    0.16      0.072  | O    I|       |       |       |     0.42
 3.417    0.47    0.17      0.074  | O    I|       |       |       |     0.43
 3.500    0.47    0.17      0.076  | O    I|       |       |       |     0.44
 3.583    0.47    0.18      0.078  | O    I|       |       |       |     0.45
 3.667    0.47    0.18      0.080  | O    I|       |       |       |     0.46
 3.750    0.47    0.19      0.082  | O    I|       |       |       |     0.47
 3.833    0.51    0.19      0.085  | O    I|       |       |       |     0.49
 3.917    0.55    0.20      0.087  |  O    I       |       |       |     0.50
 4.000    0.56    0.20      0.089  |  O    I       |       |       |     0.51
 4.083    0.56    0.21      0.092  |  O    I       |       |       |     0.53
 4.167    0.56    0.21      0.094  |  O    I       |       |       |     0.54
 4.250    0.56    0.22      0.097  |  O    I       |       |       |     0.56
 4.333    0.61    0.22      0.099  |  O    |I      |       |       |     0.57
 4.417    0.65    0.23      0.102  |  O    | I     |       |       |     0.59
 4.500    0.66    0.24      0.105  |  O    | I     |       |       |     0.60
 4.583    0.66    0.24      0.108  |  O    | I     |       |       |     0.62
 4.667    0.66    0.25      0.111  |  O    | I     |       |       |     0.64
 4.750    0.66    0.26      0.113  |  O    | I     |       |       |     0.65
 4.833    0.70    0.26      0.116  |   O   | I     |       |       |     0.67
 4.917    0.74    0.27      0.119  |   O   |  I    |       |       |     0.69
 5.000    0.75    0.28      0.123  |   O   |  I    |       |       |     0.70
 5.083    0.66    0.28      0.126  |   O   | I     |       |       |     0.72
 5.167    0.59    0.29      0.128  |   O   |I      |       |       |     0.74
```

```
 5.250    0.57    0.29      0.130   |   O   I       |       |       |     0.75
 5.333    0.61    0.30      0.132   |   O   |I      |       |       |     0.76
 5.417    0.65    0.30      0.134   |   O   | I     |       |       |     0.77
 5.500    0.66    0.31      0.137   |   O   | I     |       |       |     0.78
 5.583    0.70    0.31      0.139   |   O   | I     |       |       |     0.80
 5.667    0.74    0.32      0.142   |   O   |  I    |       |       |     0.82
 5.750    0.75    0.33      0.145   |    O  |  I    |       |       |     0.83
 5.833    0.75    0.33      0.148   |    O  |  I    |       |       |     0.85
 5.917    0.75    0.34      0.151   |    O  |  I    |       |       |     0.87
 6.000    0.75    0.35      0.153   |    O  |  I    |       |       |     0.88
 6.083    0.80    0.35      0.156   |    O  |   I   |       |       |     0.90
 6.167    0.84    0.36      0.160   |    O  |   I   |       |       |     0.92
 6.250    0.84    0.37      0.163   |    O  |    I  |       |       |     0.94
 6.333    0.85    0.38      0.166   |    O  |    I  |       |       |     0.95
 6.417    0.85    0.38      0.169   |    O  |    I  |       |       |     0.97
 6.500    0.85    0.39      0.172   |     O |    I  |       |       |     0.99
 6.583    0.89    0.39      0.176   |     O |    I  |       |       |     1.01
 6.667    0.93    0.39      0.179   |     O |     I |       |       |     1.04
 6.750    0.94    0.39      0.183   |     O |     I |       |       |     1.07
 6.833    0.94    0.39      0.187   |     O |     I |       |       |     1.10
 6.917    0.94    0.39      0.191   |     O |     I |       |       |     1.13
 7.000    0.94    0.39      0.194   |     O |     I |       |       |     1.16
 7.083    0.94    0.39      0.198   |     O |     I |       |       |     1.18
 7.167    0.94    0.39      0.202   |     O |     I |       |       |     1.21
 7.250    0.94    0.39      0.206   |     O |     I |       |       |     1.24
 7.333    0.99    0.39      0.210   |     O |      I|       |       |     1.27
 7.417    1.02    0.39      0.214   |     O |      I|       |       |     1.31
 7.500    1.03    0.39      0.218   |     O |      I|       |       |     1.34
 7.583    1.08    0.39      0.223   |     O |       I       |       |     1.37
 7.667    1.12    0.39      0.228   |     O |       |I      |       |     1.41
 7.750    1.13    0.39      0.233   |     O |       |I      |       |     1.45
 7.833    1.17    0.39      0.238   |     O |       | I     |       |     1.49
 7.917    1.21    0.39      0.243   |     O |       | I     |       |     1.53
 8.000    1.22    0.39      0.249   |     O |       | I     |       |     1.58
 8.083    1.31    0.39      0.255   |     O |       |   I   |       |     1.62
 8.167    1.39    0.39      0.262   |     O |       |    I  |       |     1.67
 8.250    1.41    0.39      0.269   |     O |       |    I  |       |     1.72
 8.333    1.41    0.39      0.276   |     O |       |    I  |       |     1.78
 8.417    1.41    0.39      0.283   |     O |       |    I  |       |     1.83
 8.500    1.41    0.39      0.290   |     O |       |    I  |       |     1.89
 8.583    1.46    0.39      0.297   |     O |       |     I |       |     1.94
 8.667    1.50    0.39      0.304   |     O |       |      I|       |     2.00
 8.750    1.50    0.39      0.312   |     O |       |      I|       |     2.06
 8.833    1.55    0.39      0.320   |     O |       |      I|       |     2.12
 8.917    1.59    0.39      0.328   |     O |       |       I       |     2.18
 9.000    1.60    0.39      0.336   |     O |       |       I       |     2.24
 9.083    1.69    0.39      0.345   |     O |       |       | I     |     2.31
 9.167    1.77    0.39      0.354   |     O |       |       |  I    |     2.38
 9.250    1.78    0.39      0.363   |     O |       |       |  I    |     2.45
 9.333    1.83    0.39      0.373   |     O |       |       |   I   |     2.53
 9.417    1.87    0.39      0.383   |     O |       |       |   I   |     2.60
 9.500    1.88    0.39      0.393   |     O |       |       |    I  |     2.68
 9.583    1.93    0.39      0.404   |     O |       |       |    I  |     2.76
 9.667    1.97    0.39      0.414   |     O |       |       |     I |     2.84
 9.750    1.97    0.39      0.425   |     O |       |       |     I |     2.93
 9.833    2.02    0.47      0.436   |      O|       |       |      I|     3.00
 9.917    2.06    1.06      0.445   |       |       O       |      I|     3.03
10.000    2.07    1.43      0.451   |       |       |     O |       I     3.05
10.083    1.76    1.61      0.453   |       |       |       O  I    |     3.06
10.167    1.49    1.62      0.453   |       |       |     I |O      |     3.06
10.250    1.43    1.56      0.452   |       |       |     I O       |     3.06
10.333    1.41    1.51      0.452   |       |       |    I O|       |     3.05
10.417    1.41    1.47      0.451   |       |       |    IO |       |     3.05
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10.500    1.41    1.45      0.451   |       |       |    IO |       |     3.05
10.583    1.63    1.48      0.451   |       |       |     O |I      |     3.05
10.667    1.83    1.57      0.453   |       |       |       O   I   |     3.06
10.750    1.87    1.68      0.454   |       |       |       |O  I   |     3.06
10.833    1.88    1.75      0.455   |       |       |       |  O I  |     3.07
10.917    1.88    1.80      0.456   |       |       |       |  O I  |     3.07
11.000    1.88    1.83      0.456   |       |       |       |   OI  |     3.07
11.083    1.84    1.84      0.457   |       |       |       |   O   |     3.07
11.167    1.80    1.83      0.457   |       |       |       |  IO   |     3.07
11.250    1.79    1.82      0.456   |       |       |       |  IO   |     3.07
11.333    1.79    1.81      0.456   |       |       |       |  O    |     3.07
11.417    1.79    1.80      0.456   |       |       |       |  O    |     3.07
11.500    1.79    1.80      0.456   |       |       |       |  O    |     3.07
11.583    1.70    1.78      0.456   |       |       |       | IO    |     3.07
11.667    1.62    1.73      0.455   |       |       |       |IO     |     3.07
11.750    1.61    1.69      0.454   |       |       |       I O     |     3.06
11.833    1.64    1.66      0.454   |       |       |       |O      |     3.06
11.917    1.68    1.66      0.454   |       |       |       |OI     |     3.06
12.000    1.69    1.67      0.454   |       |       |       |OI     |     3.06
12.083    1.19    1.59      0.453   |       |       | I     O       |     3.06
12.167    0.75    1.35      0.449   |       |  I    |   O   |       |     3.05
12.250    0.67    1.11      0.446   |       | I     |O      |       |     3.04
12.333    0.71    0.95      0.443   |       | I   O |       |       |     3.03
12.417    0.77    0.87      0.442   |       |  I O  |       |       |     3.02
12.500    0.80    0.84      0.442   |       |   O   |       |       |     3.02
12.583    0.93    0.85      0.442   |       |    OI |       |       |     3.02
12.667    1.05    0.90      0.443   |       |    O  I       |       |     3.02
12.750    1.08    0.96      0.444   |       |     O I       |       |     3.03
12.833    1.16    1.02      0.444   |       |      O| I     |       |     3.03
12.917    1.23    1.09      0.445   |       |       O  I    |       |     3.03
13.000    1.25    1.15      0.446   |       |       |O I    |       |     3.04
13.083    1.57    1.24      0.448   |       |       |  O    I       |     3.04
13.167    1.85    1.42      0.450   |       |       |    O  |   I   |     3.05
13.250    1.91    1.59      0.453   |       |       |       O    I  |     3.06
13.333    1.94    1.72      0.455   |       |       |       | O   I |     3.06
13.417    1.95    1.80      0.456   |       |       |       |  O  I |     3.07
13.500    1.97    1.86      0.457   |       |       |       |   O I |     3.07
13.583    1.32    1.78      0.456   |       |       |   I   |  O    |     3.07
13.667    0.75    1.50      0.452   |       |  I    |      O|       |     3.05
13.750    0.65    1.20      0.447   |       | I     | O     |       |     3.04
13.833    0.61    0.99      0.444   |       |I     O|       |       |     3.03
13.917    0.63    0.85      0.442   |       |I   O  |       |       |     3.02
14.000    0.64    0.77      0.441   |       |I O    |       |       |     3.02
14.083    0.89    0.77      0.441   |       |  O I  |       |       |     3.02
14.167    1.11    0.85      0.442   |       |    O  |I      |       |     3.02
14.250    1.16    0.96      0.443   |       |     O | I     |       |     3.03
14.333    1.13    1.03      0.445   |       |      O|I      |       |     3.03
14.417    1.09    1.06      0.445   |       |       O       |       |     3.03
14.500    1.09    1.07      0.445   |       |       O       |       |     3.03
14.583    1.10    1.08      0.445   |       |       OI      |       |     3.03
14.667    1.11    1.09      0.445   |       |       OI      |       |     3.03
14.750    1.12    1.10      0.446   |       |       |O      |       |     3.03
14.833    1.07    1.10      0.446   |       |       IO      |       |     3.03
14.917    1.03    1.08      0.445   |       |      IO       |       |     3.03
15.000    1.03    1.06      0.445   |       |      IO       |       |     3.03
15.083    0.98    1.04      0.445   |       |      IO       |       |     3.03
15.167    0.94    1.01      0.444   |       |     IO|       |       |     3.03
15.250    0.94    0.98      0.444   |       |     IO|       |       |     3.03
15.333    0.89    0.96      0.443   |       |    IO |       |       |     3.03
15.417    0.84    0.92      0.443   |       |    IO |       |       |     3.03
15.500    0.84    0.89      0.442   |       |    O  |       |       |     3.02
15.583    0.61    0.83      0.442   |       |I  O   |       |       |     3.02
15.667    0.41    0.71      0.440   |     I |  O    |       |       |     3.02
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15.750    0.38    0.59      0.438   |    I  |O      |       |       |     3.01
15.833    0.37    0.51      0.437   |    I O|       |       |       |     3.01
15.917    0.38    0.46      0.436   |    I O|       |       |       |     3.00
16.000    0.39    0.43      0.436   |     O |       |       |       |     3.00
16.083    0.39    0.42      0.435   |     O |       |       |       |     3.00
16.167    0.38    0.41      0.435   |    IO |       |       |       |     3.00
16.250    0.38    0.40      0.435   |    IO |       |       |       |     3.00
16.333    0.38    0.39      0.435   |    IO |       |       |       |     3.00
16.417    0.38    0.39      0.435   |    IO |       |       |       |     3.00
16.500    0.38    0.39      0.435   |    IO |       |       |       |     3.00
16.583    0.33    0.39      0.434   |    IO |       |       |       |     3.00
16.667    0.29    0.39      0.434   |   I O |       |       |       |     2.99
16.750    0.29    0.39      0.433   |   I O |       |       |       |     2.99
16.833    0.28    0.39      0.432   |   I O |       |       |       |     2.98
16.917    0.28    0.39      0.432   |   I O |       |       |       |     2.97
17.000    0.28    0.39      0.431   |   I O |       |       |       |     2.97
17.083    0.37    0.39      0.430   |    IO |       |       |       |     2.96
17.167    0.45    0.39      0.431   |     O |       |       |       |     2.97
17.250    0.46    0.39      0.431   |     OI|       |       |       |     2.97
17.333    0.47    0.39      0.431   |     OI|       |       |       |     2.97
17.417    0.47    0.39      0.432   |     OI|       |       |       |     2.98
17.500    0.47    0.39      0.433   |     OI|       |       |       |     2.98
17.583    0.47    0.39      0.433   |     OI|       |       |       |     2.99
17.667    0.47    0.39      0.434   |     OI|       |       |       |     2.99
17.750    0.47    0.39      0.434   |     OI|       |       |       |     2.99
17.833    0.43    0.39      0.435   |     O |       |       |       |     3.00
17.917    0.39    0.39      0.435   |    IO |       |       |       |     3.00
18.000    0.38    0.39      0.435   |    IO |       |       |       |     3.00
18.083    0.38    0.39      0.434   |    IO |       |       |       |     3.00
18.167    0.38    0.39      0.434   |    IO |       |       |       |     3.00
18.250    0.38    0.39      0.434   |    IO |       |       |       |     2.99
18.333    0.38    0.39      0.434   |    IO |       |       |       |     2.99
18.417    0.38    0.39      0.434   |    IO |       |       |       |     2.99
18.500    0.38    0.39      0.434   |    IO |       |       |       |     2.99
18.583    0.33    0.39      0.434   |    IO |       |       |       |     2.99
18.667    0.29    0.39      0.433   |   I O |       |       |       |     2.99
18.750    0.29    0.39      0.432   |   I O |       |       |       |     2.98
18.833    0.24    0.39      0.431   |  I  O |       |       |       |     2.97
18.917    0.20    0.39      0.430   |  I  O |       |       |       |     2.96
19.000    0.19    0.39      0.429   | I   O |       |       |       |     2.95
19.083    0.23    0.39      0.428   |  I  O |       |       |       |     2.94
19.167    0.27    0.39      0.427   |   I O |       |       |       |     2.94
19.250    0.28    0.39      0.426   |   I O |       |       |       |     2.93
19.333    0.33    0.39      0.425   |    IO |       |       |       |     2.93
19.417    0.37    0.39      0.425   |    IO |       |       |       |     2.92
19.500    0.37    0.39      0.425   |    IO |       |       |       |     2.92
19.583    0.33    0.39      0.424   |    IO |       |       |       |     2.92
19.667    0.29    0.39      0.424   |   I O |       |       |       |     2.92
19.750    0.29    0.39      0.423   |   I O |       |       |       |     2.91
19.833    0.24    0.39      0.422   |  I  O |       |       |       |     2.90
19.917    0.20    0.39      0.421   |  I  O |       |       |       |     2.89
20.000    0.19    0.39      0.420   | I   O |       |       |       |     2.88
20.083    0.23    0.39      0.419   |  I  O |       |       |       |     2.87
20.167    0.27    0.39      0.418   |   I O |       |       |       |     2.87
20.250    0.28    0.39      0.417   |   I O |       |       |       |     2.86
20.333    0.28    0.39      0.416   |   I O |       |       |       |     2.85
20.417    0.28    0.39      0.415   |   I O |       |       |       |     2.85
20.500    0.28    0.39      0.414   |   I O |       |       |       |     2.84
20.583    0.28    0.39      0.414   |   I O |       |       |       |     2.84
20.667    0.28    0.39      0.413   |   I O |       |       |       |     2.83
20.750    0.28    0.39      0.412   |   I O |       |       |       |     2.82
20.833    0.24    0.39      0.411   |  I  O |       |       |       |     2.82
20.917    0.20    0.39      0.410   |  I  O |       |       |       |     2.81
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21.000    0.19    0.39      0.409  | I   O |       |       |       |     2.80
21.083    0.23    0.39      0.407  |  I  O |       |       |       |     2.79
21.167    0.27    0.39      0.406  |   I O |       |       |       |     2.78
21.250    0.28    0.39      0.406  |   I O |       |       |       |     2.77
21.333    0.24    0.39      0.405  |  I  O |       |       |       |     2.77
21.417    0.20    0.39      0.404  |  I  O |       |       |       |     2.76
21.500    0.19    0.39      0.402  | I   O |       |       |       |     2.75
21.583    0.23    0.39      0.401  |  I  O |       |       |       |     2.74
21.667    0.27    0.39      0.400  |   I O |       |       |       |     2.73
21.750    0.28    0.39      0.399  |   I O |       |       |       |     2.72
21.833    0.24    0.39      0.398  |  I  O |       |       |       |     2.72
21.917    0.20    0.39      0.397  |  I  O |       |       |       |     2.71
22.000    0.19    0.39      0.396  | I   O |       |       |       |     2.70
22.083    0.23    0.39      0.394  |  I  O |       |       |       |     2.69
22.167    0.27    0.39      0.393  |   I O |       |       |       |     2.68
22.250    0.28    0.39      0.393  |   I O |       |       |       |     2.68
22.333    0.24    0.39      0.392  |  I  O |       |       |       |     2.67
22.417    0.20    0.39      0.390  |  I  O |       |       |       |     2.66
22.500    0.19    0.39      0.389  | I   O |       |       |       |     2.65
22.583    0.19    0.39      0.388  | I   O |       |       |       |     2.64
22.667    0.19    0.39      0.386  | I   O |       |       |       |     2.63
22.750    0.19    0.39      0.385  | I   O |       |       |       |     2.62
22.833    0.19    0.39      0.383  | I   O |       |       |       |     2.61
22.917    0.19    0.39      0.382  | I   O |       |       |       |     2.59
23.000    0.19    0.39      0.381  | I   O |       |       |       |     2.58
23.083    0.19    0.39      0.379  | I   O |       |       |       |     2.57
23.167    0.19    0.39      0.378  | I   O |       |       |       |     2.56
23.250    0.19    0.39      0.376  | I   O |       |       |       |     2.55
23.333    0.19    0.39      0.375  | I   O |       |       |       |     2.54
23.417    0.19    0.39      0.374  | I   O |       |       |       |     2.53
23.500    0.19    0.39      0.372  | I   O |       |       |       |     2.52
23.583    0.19    0.39      0.371  | I   O |       |       |       |     2.51
23.667    0.19    0.39      0.369  | I   O |       |       |       |     2.50
23.750    0.19    0.39      0.368  | I   O |       |       |       |     2.49
23.833    0.19    0.39      0.367  | I   O |       |       |       |     2.48
23.917    0.19    0.39      0.365  | I   O |       |       |       |     2.46
24.000    0.19    0.39      0.364  | I   O |       |       |       |     2.45
24.083    0.10    0.39      0.362  |I    O |       |       |       |     2.44
24.167    0.02    0.39      0.360  I     O |       |       |       |     2.42
24.250    0.01    0.39      0.357  I     O |       |       |       |     2.40
24.333    0.00    0.39      0.354  I     O |       |       |       |     2.38
24.417    0.00    0.39      0.352  I     O |       |       |       |     2.36
24.500    0.00    0.39      0.349  I     O |       |       |       |     2.34
24.583    0.00    0.39      0.346  I     O |       |       |       |     2.32
24.667    0.00    0.39      0.344  I     O |       |       |       |     2.30
24.750    0.00    0.39      0.341  I     O |       |       |       |     2.28
24.833    0.00    0.39      0.338  I     O |       |       |       |     2.26
24.917    0.00    0.39      0.335  I     O |       |       |       |     2.24
25.000    0.00    0.39      0.333  I     O |       |       |       |     2.22
25.083    0.00    0.39      0.330  I     O |       |       |       |     2.20
25.167    0.00    0.39      0.327  I     O |       |       |       |     2.18
25.250    0.00    0.39      0.325  I     O |       |       |       |     2.15
25.333    0.00    0.39      0.322  I     O |       |       |       |     2.13
25.417    0.00    0.39      0.319  I     O |       |       |       |     2.11
25.500    0.00    0.39      0.317  I     O |       |       |       |     2.09
25.583    0.00    0.39      0.314  I     O |       |       |       |     2.07
25.667    0.00    0.39      0.311  I     O |       |       |       |     2.05
25.750    0.00    0.39      0.308  I     O |       |       |       |     2.03
25.833    0.00    0.39      0.306  I     O |       |       |       |     2.01
25.917    0.00    0.39      0.303  I     O |       |       |       |     1.99
26.000    0.00    0.39      0.300  I     O |       |       |       |     1.97
26.083    0.00    0.39      0.298  I     O |       |       |       |     1.95
26.167    0.00    0.39      0.295  I     O |       |       |       |     1.93
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26.250	0.00	0.39	0.292	I O | | | |	1.91
26.333	0.00	0.39	0.289	I O | | | |	1.88
26.417	0.00	0.39	0.287	I O | | | |	1.86
26.500	0.00	0.39	0.284	I O | | | |	1.84
26.583	0.00	0.39	0.281	I O | | | |	1.82
26.667	0.00	0.39	0.279	I O | | | |	1.80
26.750	0.00	0.39	0.276	I O | | | |	1.78
26.833	0.00	0.39	0.273	I O | | | |	1.76
26.917	0.00	0.39	0.271	I O | | | |	1.74
27.000	0.00	0.39	0.268	I O | | | |	1.72
27.083	0.00	0.39	0.265	I O | | | |	1.70
27.167	0.00	0.39	0.262	I O | | | |	1.68
27.250	0.00	0.39	0.260	I O | | | |	1.66
27.333	0.00	0.39	0.257	I O | | | |	1.64
27.417	0.00	0.39	0.254	I O | | | |	1.62
27.500	0.00	0.39	0.252	I O | | | |	1.59
27.583	0.00	0.39	0.249	I O | | | |	1.57
27.667	0.00	0.39	0.246	I O | | | |	1.55
27.750	0.00	0.39	0.243	I O | | | |	1.53
27.833	0.00	0.39	0.241	I O | | | |	1.51
27.917	0.00	0.39	0.238	I O | | | |	1.49
28.000	0.00	0.39	0.235	I O | | | |	1.47
28.083	0.00	0.39	0.233	I O | | | |	1.45
28.167	0.00	0.39	0.230	I O | | | |	1.43
28.250	0.00	0.39	0.227	I O | | | |	1.41
28.333	0.00	0.39	0.224	I O | | | |	1.39
28.417	0.00	0.39	0.222	I O | | | |	1.37
28.500	0.00	0.39	0.219	I O | | | |	1.35
28.583	0.00	0.39	0.216	I O | | | |	1.32
28.667	0.00	0.39	0.214	I O | | | |	1.30
28.750	0.00	0.39	0.211	I O | | | |	1.28
28.833	0.00	0.39	0.208	I O | | | |	1.26
28.917	0.00	0.39	0.206	I O | | | |	1.24
29.000	0.00	0.39	0.203	I O | | | |	1.22
29.083	0.00	0.39	0.200	I O | | | |	1.20
29.167	0.00	0.39	0.197	I O | | | |	1.18
29.250	0.00	0.39	0.195	I O | | | |	1.16
29.333	0.00	0.39	0.192	I O | | | |	1.14
29.417	0.00	0.39	0.189	I O | | | |	1.12
29.500	0.00	0.39	0.187	I O | | | |	1.10
29.583	0.00	0.39	0.184	I O | | | |	1.08
29.667	0.00	0.39	0.181	I O | | | |	1.05
29.750	0.00	0.39	0.178	I O | | | |	1.03
29.833	0.00	0.39	0.176	I O | | | |	1.01
29.917	0.00	0.39	0.173	I O | | | |	0.99
30.000	0.00	0.38	0.170	I O | | | |	0.98
30.083	0.00	0.38	0.168	I O | | | |	0.96
30.167	0.00	0.37	0.165	I O | | | |	0.95
30.250	0.00	0.37	0.163	I O | | | |	0.93
30.333	0.00	0.36	0.160	I O | | | |	0.92
30.417	0.00	0.36	0.158	I O | | | |	0.91
30.500	0.00	0.35	0.155	I O | | | |	0.89
30.583	0.00	0.35	0.153	I O | | | |	0.88
30.667	0.00	0.34	0.150	I O | | | |	0.86
30.750	0.00	0.33	0.148	I O | | | |	0.85
30.833	0.00	0.33	0.146	I O | | | |	0.84
30.917	0.00	0.32	0.144	I O | | | |	0.83
31.000	0.00	0.32	0.141	I O | | | |	0.81
31.083	0.00	0.31	0.139	I O | | | |	0.80
31.167	0.00	0.31	0.137	I O | | | |	0.79
31.250	0.00	0.30	0.135	I O | | | |	0.78
31.333	0.00	0.30	0.133	I O | | | |	0.76
31.417	0.00	0.30	0.131	I O | | | |	0.75

31.500	0.00	0.29	0.129	I O					0.74
31.583	0.00	0.29	0.127	I O					0.73
31.667	0.00	0.28	0.125	I O					0.72
31.750	0.00	0.28	0.123	I O					0.71
31.833	0.00	0.27	0.121	I O					0.70
31.917	0.00	0.27	0.119	I O					0.68
32.000	0.00	0.26	0.117	I O					0.67
32.083	0.00	0.26	0.115	I O					0.66
32.167	0.00	0.26	0.114	I O					0.65
32.250	0.00	0.25	0.112	I O					0.64
32.333	0.00	0.25	0.110	I O					0.63
32.417	0.00	0.25	0.109	I O					0.62
32.500	0.00	0.24	0.107	I O					0.61
32.583	0.00	0.24	0.105	I O					0.60
32.667	0.00	0.23	0.104	I O					0.60
32.750	0.00	0.23	0.102	I O					0.59
32.833	0.00	0.23	0.100	I O					0.58
32.917	0.00	0.22	0.099	I O					0.57
33.000	0.00	0.22	0.097	I O					0.56
33.083	0.00	0.22	0.096	I O					0.55
33.167	0.00	0.21	0.094	I O					0.54
33.250	0.00	0.21	0.093	I O					0.53
33.333	0.00	0.21	0.091	I O					0.53
33.417	0.00	0.20	0.090	I O					0.52
33.500	0.00	0.20	0.089	I O					0.51
33.583	0.00	0.20	0.087	I O					0.50
33.667	0.00	0.19	0.086	I O					0.49
33.750	0.00	0.19	0.085	I O					0.49
33.833	0.00	0.19	0.083	I O					0.48
33.917	0.00	0.19	0.082	I O					0.47
34.000	0.00	0.18	0.081	I O					0.46
34.083	0.00	0.18	0.079	I O					0.46
34.167	0.00	0.18	0.078	I O					0.45
34.250	0.00	0.17	0.077	I O					0.44
34.333	0.00	0.17	0.076	I O					0.44
34.417	0.00	0.17	0.075	I O					0.43
34.500	0.00	0.17	0.074	I O					0.42
34.583	0.00	0.16	0.072	I O					0.42
34.667	0.00	0.16	0.071	I O					0.41
34.750	0.00	0.16	0.070	I O					0.40
34.833	0.00	0.16	0.069	I O					0.40
34.917	0.00	0.15	0.068	I O					0.39
35.000	0.00	0.15	0.067	I O					0.39
35.083	0.00	0.15	0.066	I O					0.38
35.167	0.00	0.15	0.065	I O					0.37
35.250	0.00	0.14	0.064	I O					0.37
35.333	0.00	0.14	0.063	I O					0.36
35.417	0.00	0.14	0.062	I O					0.36
35.500	0.00	0.14	0.061	I O					0.35
35.583	0.00	0.14	0.060	I O					0.35
35.667	0.00	0.13	0.059	I O					0.34
35.750	0.00	0.13	0.058	I O					0.33
35.833	0.00	0.13	0.057	I O					0.33
35.917	0.00	0.13	0.056	IO					0.32
36.000	0.00	0.13	0.056	IO					0.32
36.083	0.00	0.12	0.055	IO					0.31
36.167	0.00	0.12	0.054	IO					0.31
36.250	0.00	0.12	0.053	IO					0.30
36.333	0.00	0.12	0.052	IO					0.30
36.417	0.00	0.12	0.051	IO					0.30
36.500	0.00	0.11	0.051	IO					0.29
36.583	0.00	0.11	0.050	IO					0.29
36.667	0.00	0.11	0.049	IO					0.28

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36.750    0.00    0.11      0.048  IO      |       |       |       |     0.28
36.833    0.00    0.11      0.048  IO      |       |       |       |     0.27
36.917    0.00    0.11      0.047  IO      |       |       |       |     0.27
37.000    0.00    0.10      0.046  IO      |       |       |       |     0.27
37.083    0.00    0.10      0.045  IO      |       |       |       |     0.26
37.167    0.00    0.10      0.045  IO      |       |       |       |     0.26
37.250    0.00    0.10      0.044  IO      |       |       |       |     0.25


      Remaining water in basin =    0.04 (Ac.Ft)


      ***************************HYDROGRAPH DATA****************************
                   Number of intervals =   447
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        1.861 (CFS)
                   Total volume =       1.429 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      **********************************************************************

      ---------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      316.100 to Point/Station      316.200
      **** STREAM ROUTING SCS CONVEX METHOD ****
      ______________________________________________________________________
      HYDROGRAPH STREAM ROUTING DATA:
      Length of stream =    239.75 (Ft.)
      Elevation difference =    3.30 (Ft.)
      Slope of channel =  0.013764 (Vert/Horiz)
      Channel type - Pipe


      Pipe length  =   239.75(Ft.)   Elevation difference =   3.30(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using mean flow rate of hydrograph
      Required pipe flow  =     0.631(CFS)
      Nearest computed pipe diameter  =      6.00(In.)
      Calculated individual pipe flow  =     0.631(CFS)
      Normal flow depth in pipe =    4.71(In.)
      Flow top width inside pipe =    4.93(In.)
      Critical Depth =    0.40(Ft.)
      Pipe flow velocity =      3.82(Ft/s)
      Travel time through pipe =    1.05 min.


      Pipe length  =   239.75(Ft.)   Elevation difference =   3.30(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using maximum flow rate of hydrograph
      Required pipe flow  =     1.861(CFS)
      Nearest computed pipe diameter  =      9.00(In.)
      Calculated individual pipe flow  =     1.861(CFS)
      Normal flow depth in pipe =    7.07(In.)
      Flow top width inside pipe =    7.39(In.)
      Critical Depth =    0.62(Ft.)
      Pipe flow velocity =      5.00(Ft/s)
      Travel time through pipe =    0.80 min.
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********************** SCS CONVEX CHANNEL ROUTING ********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
         where c* = 1 - (1-c)^e and dt = c(length)/velocity
         c(v/v+1.7) =   0.7464   Travel time =   0.80 (min.)
       dt*(unit time interval) =   5.00(min.),  e=   5.9247
       dt(routing time-step) =   0.60 (min.),   c* =   0.9997

Output hydrograph delayed by 0  unit time increments


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

--------------------------------------------------------------------
Time(h+m) Out = O(CFS) In = I  0        0.5       0.9       1.4       1.9
-----------------------------------------------------------------------
  0+ 5       0.0006      0.00  O         |         |         |         |
  0+10       0.0024      0.00  O         |         |         |         |
  0+15       0.0050      0.01  O         |         |         |         |
  0+20       0.0080      0.01  O         |         |         |         |
  0+25       0.0117      0.01  O         |         |         |         |
  0+30       0.0158      0.02  O         |         |         |         |
  0+35       0.0198      0.02  O         |         |         |         |
  0+40       0.0239      0.02  O         |         |         |         |
  0+45       0.0279      0.03  O         |         |         |         |
  0+50       0.0321      0.03  O         |         |         |         |
  0+55       0.0369      0.04  O         |         |         |         |
  1+ 0       0.0420      0.04  O         |         |         |         |
  1+ 5       0.0468      0.05  |O        |         |         |         |
  1+10       0.0510      0.05  |O        |         |         |         |
  1+15       0.0547      0.06  |O        |         |         |         |
  1+20       0.0583      0.06  |O        |         |         |         |
  1+25       0.0617      0.06  |O        |         |         |         |
  1+30       0.0651      0.07  |O        |         |         |         |
  1+35       0.0685      0.07  |O        |         |         |         |
  1+40       0.0718      0.07  |O        |         |         |         |
  1+45       0.0750      0.08  |O        |         |         |         |
  1+50       0.0785      0.08  |O        |         |         |         |
  1+55       0.0826      0.08  |O        |         |         |         |
  2+ 0       0.0870      0.09  |O        |         |         |         |
  2+ 5       0.0914      0.09  |O        |         |         |         |
  2+10       0.0958      0.10  | O       |         |         |         |
  2+15       0.1001      0.10  | O       |         |         |         |
  2+20       0.1044      0.10  | O       |         |         |         |
  2+25       0.1086      0.11  | O       |         |         |         |
  2+30       0.1127      0.11  | O       |         |         |         |
  2+35       0.1171      0.12  | O       |         |         |         |
  2+40       0.1220      0.12  | O       |         |         |         |
  2+45       0.1273      0.13  | O       |         |         |         |
  2+50       0.1325      0.13  | O       |         |         |         |
  2+55       0.1378      0.14  | O       |         |         |         |
  3+ 0       0.1429      0.14  |  O      |         |         |         |
  3+ 5       0.1480      0.15  |  O      |         |         |         |
  3+10       0.1529      0.15  |  O      |         |         |         |
  3+15       0.1578      0.16  |  O      |         |         |         |
  3+20       0.1627      0.16  |  O      |         |         |         |
  3+25       0.1674      0.17  |  O      |         |         |         |
  3+30       0.1721      0.17  |  O      |         |         |         |
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3+35       0.1767      0.18   |  O      |         |         |         |
3+40       0.1813      0.18   |  O      |         |         |         |
3+45       0.1857      0.19   |  OI     |         |         |         |
3+50       0.1904      0.19   |   O     |         |         |         |
3+55       0.1957      0.20   |   O     |         |         |         |
4+ 0       0.2012      0.20   |   O     |         |         |         |
4+ 5       0.2068      0.21   |   O     |         |         |         |
4+10       0.2123      0.21   |   O     |         |         |         |
4+15       0.2177      0.22   |   O     |         |         |         |
4+20       0.2234      0.22   |   O     |         |         |         |
4+25       0.2296      0.23   |   O     |         |         |         |
4+30       0.2361      0.24   |    O    |         |         |         |
4+35       0.2426      0.24   |    O    |         |         |         |
4+40       0.2490      0.25   |    O    |         |         |         |
4+45       0.2553      0.26   |    O    |         |         |         |
4+50       0.2618      0.26   |    O    |         |         |         |
4+55       0.2689      0.27   |    O    |         |         |         |
5+ 0       0.2762      0.28   |    O    |         |         |         |
5+ 5       0.2829      0.28   |     O   |         |         |         |
5+10       0.2884      0.29   |     O   |         |         |         |
5+15       0.2929      0.29   |     O   |         |         |         |
5+20       0.2975      0.30   |     O   |         |         |         |
5+25       0.3025      0.30   |     O   |         |         |         |
5+30       0.3079      0.31   |     O   |         |         |         |
5+35       0.3136      0.31   |     O   |         |         |         |
5+40       0.3198      0.32   |     O   |         |         |         |
5+45       0.3264      0.33   |      O  |         |         |         |
5+50       0.3329      0.33   |      O  |         |         |         |
5+55       0.3394      0.34   |      O  |         |         |         |
6+ 0       0.3458      0.35   |      O  |         |         |         |
6+ 5       0.3524      0.35   |      O  |         |         |         |
6+10       0.3595      0.36   |      O  |         |         |         |
6+15       0.3668      0.37   |      O  |         |         |         |
6+20       0.3742      0.38   |       O |         |         |         |
6+25       0.3815      0.38   |       O |         |         |         |
6+30       0.3887      0.39   |       O |         |         |         |
6+35       0.3926      0.39   |       O |         |         |         |
6+40       0.3931      0.39   |       O |         |         |         |
6+45       0.3931      0.39   |       O |         |         |         |
6+50       0.3931      0.39   |       O |         |         |         |
6+55       0.3931      0.39   |       O |         |         |         |
7+ 0       0.3931      0.39   |       O |         |         |         |
7+ 5       0.3931      0.39   |       O |         |         |         |
7+10       0.3931      0.39   |       O |         |         |         |
7+15       0.3931      0.39   |       O |         |         |         |
7+20       0.3931      0.39   |       O |         |         |         |
7+25       0.3931      0.39   |       O |         |         |         |
7+30       0.3931      0.39   |       O |         |         |         |
7+35       0.3931      0.39   |       O |         |         |         |
7+40       0.3931      0.39   |       O |         |         |         |
7+45       0.3931      0.39   |       O |         |         |         |
7+50       0.3931      0.39   |       O |         |         |         |
7+55       0.3931      0.39   |       O |         |         |         |
8+ 0       0.3931      0.39   |       O |         |         |         |
8+ 5       0.3931      0.39   |       O |         |         |         |
8+10       0.3931      0.39   |       O |         |         |         |
8+15       0.3931      0.39   |       O |         |         |         |
8+20       0.3931      0.39   |       O |         |         |         |
8+25       0.3931      0.39   |       O |         |         |         |
8+30       0.3931      0.39   |       O |         |         |         |
8+35       0.3931      0.39   |       O |         |         |         |
8+40       0.3931      0.39   |       O |         |         |         |
8+45       0.3931      0.39   |       O |         |         |         |
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 8+50       0.3931      0.39   |       O |         |         |         |
 8+55       0.3931      0.39   |       O |         |         |         |
 9+ 0       0.3931      0.39   |       O |         |         |         |
 9+ 5       0.3931      0.39   |       O |         |         |         |
 9+10       0.3931      0.39   |       O |         |         |         |
 9+15       0.3931      0.39   |       O |         |         |         |
 9+20       0.3931      0.39   |       O |         |         |         |
 9+25       0.3931      0.39   |       O |         |         |         |
 9+30       0.3931      0.39   |       O |         |         |         |
 9+35       0.3931      0.39   |       O |         |         |         |
 9+40       0.3931      0.39   |       O |         |         |         |
 9+45       0.3931      0.39   |       O |         |         |         |
 9+50       0.4589      0.47   |        OI         |         |         |
 9+55       0.9868      1.06   |         |         |OI       |         |
10+ 0       1.3894      1.43   |         |         |        OI         |
10+ 5       1.5931      1.61   |         |         |         |   O     |
10+10       1.6178      1.62   |         |         |         |   O     |
10+15       1.5660      1.56   |         |         |         |  O      |
10+20       1.5140      1.51   |         |         |         | O       |
10+25       1.4763      1.47   |         |         |         |O        |
10+30       1.4522      1.45   |         |         |         |O        |
10+35       1.4735      1.48   |         |         |         |O        |
10+40       1.5606      1.57   |         |         |         |  O      |
10+45       1.6632      1.68   |         |         |         |    OI   |
10+50       1.7414      1.75   |         |         |         |      O  |
10+55       1.7940      1.80   |         |         |         |       O |
11+ 0       1.8272      1.83   |         |         |         |        O|
11+ 5       1.8407      1.84   |         |         |         |        O|
11+10       1.8344      1.83   |         |         |         |        O|
11+15       1.8208      1.82   |         |         |         |        O|
11+20       1.8095      1.81   |         |         |         |       O |
11+25       1.8017      1.80   |         |         |         |       O |
11+30       1.7968      1.80   |         |         |         |       O |
11+35       1.7792      1.78   |         |         |         |       O |
11+40       1.7386      1.73   |         |         |         |      O  |
11+45       1.6940      1.69   |         |         |         |     O   |
11+50       1.6678      1.66   |         |         |         |    O    |
11+55       1.6646      1.66   |         |         |         |    O    |
12+ 0       1.6722      1.67   |         |         |         |    O    |
12+ 5       1.5966      1.59   |         |         |         |   O     |
12+10       1.3821      1.35   |         |         |        O|         |
12+15       1.1410      1.11   |         |         |  IO     |         |
12+20       0.9723      0.95   |         |         O         |         |
12+25       0.8830      0.87   |         |        O |         |         |
12+30       0.8440      0.84   |         |        O |         |         |
12+35       0.8479      0.85   |         |        O |         |         |
12+40       0.8959      0.90   |         |         O|         |         |
12+45       0.9567      0.96   |         |         O         |         |
12+50       1.0168      1.02   |         |         |OI       |         |
12+55       1.0811      1.09   |         |         |  O      |         |
13+ 0       1.1390      1.15   |         |         |   O     |         |
13+ 5       1.2328      1.24   |         |         |     O   |         |
13+10       1.3968      1.42   |         |         |         O         |
13+15       1.5691      1.59   |         |         |         |  OI     |
13+20       1.7003      1.72   |         |         |         |     O   |
13+25       1.7920      1.80   |         |         |         |       O |
13+30       1.8542      1.86   |         |         |         |        OI
13+35       1.7897      1.78   |         |         |         |       O |
13+40       1.5343      1.50   |         |         |         | O       |
13+45       1.2360      1.20   |         |         |    IO   |         |
13+50       1.0123      0.99   |         |         |O        |         |
13+55       0.8658      0.85   |         |        O |         |         |
14+ 0       0.7775      0.77   |         |      O  |         |         |
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14+ 5       0.7660      0.77  |         |     O   |         |         |
14+10       0.8430      0.85  |         |       O |         |         |
14+15       0.9476      0.96  |         |         O         |         |
14+20       1.0226      1.03  |         |         |OI       |         |
14+25       1.0579      1.06  |         |         | O       |         |
14+30       1.0716      1.07  |         |         |  O      |         |
14+35       1.0806      1.08  |         |         |  O      |         |
14+40       1.0896      1.09  |         |         |  O      |         |
14+45       1.0993      1.10  |         |         |  O      |         |
14+50       1.0997      1.10  |         |         |  O      |         |
14+55       1.0842      1.08  |         |         |  O      |         |
15+ 0       1.0657      1.06  |         |         | O       |         |
15+ 5       1.0447      1.04  |         |         | O       |         |
15+10       1.0147      1.01  |         |         |O        |         |
15+15       0.9869      0.98  |         |         |O        |         |
15+20       0.9601      0.96  |         |         O         |         |
15+25       0.9264      0.92  |         |        O|         |         |
15+30       0.8962      0.89  |         |        O|         |         |
15+35       0.8383      0.83  |         |      IO |         |         |
15+40       0.7253      0.71  |         |    O    |         |         |
15+45       0.6065      0.59  |         | IO      |         |         |
15+50       0.5210      0.51  |         IO        |         |         |
15+55       0.4675      0.46  |        IO         |         |         |
16+ 0       0.4376      0.43  |        O|         |         |         |
16+ 5       0.4200      0.42  |       IO|         |         |         |
16+10       0.4067      0.41  |       O |         |         |         |
16+15       0.3962      0.40  |       O |         |         |         |
16+20       0.3933      0.39  |       O |         |         |         |
16+25       0.3931      0.39  |       O |         |         |         |
16+30       0.3931      0.39  |       O |         |         |         |
16+35       0.3931      0.39  |       O |         |         |         |
16+40       0.3931      0.39  |       O |         |         |         |
16+45       0.3931      0.39  |       O |         |         |         |
16+50       0.3931      0.39  |       O |         |         |         |
16+55       0.3931      0.39  |       O |         |         |         |
17+ 0       0.3931      0.39  |       O |         |         |         |
17+ 5       0.3931      0.39  |       O |         |         |         |
17+10       0.3931      0.39  |       O |         |         |         |
17+15       0.3931      0.39  |       O |         |         |         |
17+20       0.3931      0.39  |       O |         |         |         |
17+25       0.3931      0.39  |       O |         |         |         |
17+30       0.3931      0.39  |       O |         |         |         |
17+35       0.3931      0.39  |       O |         |         |         |
17+40       0.3931      0.39  |       O |         |         |         |
17+45       0.3931      0.39  |       O |         |         |         |
17+50       0.3931      0.39  |       O |         |         |         |
17+55       0.3931      0.39  |       O |         |         |         |
18+ 0       0.3931      0.39  |       O |         |         |         |
18+ 5       0.3931      0.39  |       O |         |         |         |
18+10       0.3931      0.39  |       O |         |         |         |
18+15       0.3931      0.39  |       O |         |         |         |
18+20       0.3931      0.39  |       O |         |         |         |
18+25       0.3931      0.39  |       O |         |         |         |
18+30       0.3931      0.39  |       O |         |         |         |
18+35       0.3931      0.39  |       O |         |         |         |
18+40       0.3931      0.39  |       O |         |         |         |
18+45       0.3931      0.39  |       O |         |         |         |
18+50       0.3931      0.39  |       O |         |         |         |
18+55       0.3931      0.39  |       O |         |         |         |
19+ 0       0.3931      0.39  |       O |         |         |         |
19+ 5       0.3931      0.39  |       O |         |         |         |
19+10       0.3931      0.39  |       O |         |         |         |
19+15       0.3931      0.39  |       O |         |         |         |
```

19+20	0.3931	0.39	O				
19+25	0.3931	0.39	O				
19+30	0.3931	0.39	O				
19+35	0.3931	0.39	O				
19+40	0.3931	0.39	O				
19+45	0.3931	0.39	O				
19+50	0.3931	0.39	O				
19+55	0.3931	0.39	O				
20+ 0	0.3931	0.39	O				
20+ 5	0.3931	0.39	O				
20+10	0.3931	0.39	O				
20+15	0.3931	0.39	O				
20+20	0.3931	0.39	O				
20+25	0.3931	0.39	O				
20+30	0.3931	0.39	O				
20+35	0.3931	0.39	O				
20+40	0.3931	0.39	O				
20+45	0.3931	0.39	O				
20+50	0.3931	0.39	O				
20+55	0.3931	0.39	O				
21+ 0	0.3931	0.39	O				
21+ 5	0.3931	0.39	O				
21+10	0.3931	0.39	O				
21+15	0.3931	0.39	O				
21+20	0.3931	0.39	O				
21+25	0.3931	0.39	O				
21+30	0.3931	0.39	O				
21+35	0.3931	0.39	O				
21+40	0.3931	0.39	O				
21+45	0.3931	0.39	O				
21+50	0.3931	0.39	O				
21+55	0.3931	0.39	O				
22+ 0	0.3931	0.39	O				
22+ 5	0.3931	0.39	O				
22+10	0.3931	0.39	O				
22+15	0.3931	0.39	O				
22+20	0.3931	0.39	O				
22+25	0.3931	0.39	O				
22+30	0.3931	0.39	O				
22+35	0.3931	0.39	O				
22+40	0.3931	0.39	O				
22+45	0.3931	0.39	O				
22+50	0.3931	0.39	O				
22+55	0.3931	0.39	O				
23+ 0	0.3931	0.39	O				
23+ 5	0.3931	0.39	O				
23+10	0.3931	0.39	O				
23+15	0.3931	0.39	O				
23+20	0.3931	0.39	O				
23+25	0.3931	0.39	O				
23+30	0.3931	0.39	O				
23+35	0.3931	0.39	O				
23+40	0.3931	0.39	O				
23+45	0.3931	0.39	O				
23+50	0.3931	0.39	O				
23+55	0.3931	0.39	O				
24+ 0	0.3931	0.39	O				
24+ 5	0.3931	0.39	O				
24+10	0.3931	0.39	O				
24+15	0.3931	0.39	O				
24+20	0.3931	0.39	O				
24+25	0.3931	0.39	O				
24+30	0.3931	0.39	O				

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24+35       0.3931      0.39  |       O  |         |         |         |
24+40       0.3931      0.39  |       O  |         |         |         |
24+45       0.3931      0.39  |       O  |         |         |         |
24+50       0.3931      0.39  |       O  |         |         |         |
24+55       0.3931      0.39  |       O  |         |         |         |
25+ 0       0.3931      0.39  |       O  |         |         |         |
25+ 5       0.3931      0.39  |       O  |         |         |         |
25+10       0.3931      0.39  |       O  |         |         |         |
25+15       0.3931      0.39  |       O  |         |         |         |
25+20       0.3931      0.39  |       O  |         |         |         |
25+25       0.3931      0.39  |       O  |         |         |         |
25+30       0.3931      0.39  |       O  |         |         |         |
25+35       0.3931      0.39  |       O  |         |         |         |
25+40       0.3931      0.39  |       O  |         |         |         |
25+45       0.3931      0.39  |       O  |         |         |         |
25+50       0.3931      0.39  |       O  |         |         |         |
25+55       0.3931      0.39  |       O  |         |         |         |
26+ 0       0.3931      0.39  |       O  |         |         |         |
26+ 5       0.3931      0.39  |       O  |         |         |         |
26+10       0.3931      0.39  |       O  |         |         |         |
26+15       0.3931      0.39  |       O  |         |         |         |
26+20       0.3931      0.39  |       O  |         |         |         |
26+25       0.3931      0.39  |       O  |         |         |         |
26+30       0.3931      0.39  |       O  |         |         |         |
26+35       0.3931      0.39  |       O  |         |         |         |
26+40       0.3931      0.39  |       O  |         |         |         |
26+45       0.3931      0.39  |       O  |         |         |         |
26+50       0.3931      0.39  |       O  |         |         |         |
26+55       0.3931      0.39  |       O  |         |         |         |
27+ 0       0.3931      0.39  |       O  |         |         |         |
27+ 5       0.3931      0.39  |       O  |         |         |         |
27+10       0.3931      0.39  |       O  |         |         |         |
27+15       0.3931      0.39  |       O  |         |         |         |
27+20       0.3931      0.39  |       O  |         |         |         |
27+25       0.3931      0.39  |       O  |         |         |         |
27+30       0.3931      0.39  |       O  |         |         |         |
27+35       0.3931      0.39  |       O  |         |         |         |
27+40       0.3931      0.39  |       O  |         |         |         |
27+45       0.3931      0.39  |       O  |         |         |         |
27+50       0.3931      0.39  |       O  |         |         |         |
27+55       0.3931      0.39  |       O  |         |         |         |
28+ 0       0.3931      0.39  |       O  |         |         |         |
28+ 5       0.3931      0.39  |       O  |         |         |         |
28+10       0.3931      0.39  |       O  |         |         |         |
28+15       0.3931      0.39  |       O  |         |         |         |
28+20       0.3931      0.39  |       O  |         |         |         |
28+25       0.3931      0.39  |       O  |         |         |         |
28+30       0.3931      0.39  |       O  |         |         |         |
28+35       0.3931      0.39  |       O  |         |         |         |
28+40       0.3931      0.39  |       O  |         |         |         |
28+45       0.3931      0.39  |       O  |         |         |         |
28+50       0.3931      0.39  |       O  |         |         |         |
28+55       0.3931      0.39  |       O  |         |         |         |
29+ 0       0.3931      0.39  |       O  |         |         |         |
29+ 5       0.3931      0.39  |       O  |         |         |         |
29+10       0.3931      0.39  |       O  |         |         |         |
29+15       0.3931      0.39  |       O  |         |         |         |
29+20       0.3931      0.39  |       O  |         |         |         |
29+25       0.3931      0.39  |       O  |         |         |         |
29+30       0.3931      0.39  |       O  |         |         |         |
29+35       0.3931      0.39  |       O  |         |         |         |
29+40       0.3931      0.39  |       O  |         |         |         |
29+45       0.3931      0.39  |       O  |         |         |         |
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29+50       0.3931      0.39  |       O |         |         |         |
29+55       0.3912      0.39  |       O |         |         |         |
30+ 0       0.3856      0.38  |       O |         |         |         |
30+ 5       0.3797      0.38  |       O |         |         |         |
30+10       0.3738      0.37  |       O |         |         |         |
30+15       0.3680      0.37  |      O  |         |         |         |
30+20       0.3624      0.36  |      O  |         |         |         |
30+25       0.3568      0.36  |      O  |         |         |         |
30+30       0.3513      0.35  |      O  |         |         |         |
30+35       0.3458      0.35  |      O  |         |         |         |
30+40       0.3405      0.34  |      O  |         |         |         |
30+45       0.3352      0.33  |      O  |         |         |         |
30+50       0.3301      0.33  |      O  |         |         |         |
30+55       0.3250      0.32  |     O   |         |         |         |
31+ 0       0.3200      0.32  |     O   |         |         |         |
31+ 5       0.3150      0.31  |     O   |         |         |         |
31+10       0.3101      0.31  |     O   |         |         |         |
31+15       0.3054      0.30  |     O   |         |         |         |
31+20       0.3006      0.30  |     O   |         |         |         |
31+25       0.2960      0.30  |     O   |         |         |         |
31+30       0.2914      0.29  |     O   |         |         |         |
31+35       0.2869      0.29  |     O   |         |         |         |
31+40       0.2825      0.28  |     O   |         |         |         |
31+45       0.2781      0.28  |    O    |         |         |         |
31+50       0.2739      0.27  |    O    |         |         |         |
31+55       0.2696      0.27  |    O    |         |         |         |
32+ 0       0.2655      0.26  |    O    |         |         |         |
32+ 5       0.2614      0.26  |    O    |         |         |         |
32+10       0.2573      0.26  |    O    |         |         |         |
32+15       0.2534      0.25  |    O    |         |         |         |
32+20       0.2494      0.25  |    O    |         |         |         |
32+25       0.2456      0.25  |    O    |         |         |         |
32+30       0.2418      0.24  |    O    |         |         |         |
32+35       0.2381      0.24  |    O    |         |         |         |
32+40       0.2344      0.23  |    O    |         |         |         |
32+45       0.2308      0.23  |   O     |         |         |         |
32+50       0.2272      0.23  |   O     |         |         |         |
32+55       0.2237      0.22  |   O     |         |         |         |
33+ 0       0.2203      0.22  |   O     |         |         |         |
33+ 5       0.2169      0.22  |   O     |         |         |         |
33+10       0.2135      0.21  |   O     |         |         |         |
33+15       0.2102      0.21  |   O     |         |         |         |
33+20       0.2070      0.21  |   O     |         |         |         |
33+25       0.2038      0.20  |   O     |         |         |         |
33+30       0.2006      0.20  |   O     |         |         |         |
33+35       0.1975      0.20  |   O     |         |         |         |
33+40       0.1945      0.19  |   O     |         |         |         |
33+45       0.1915      0.19  |   O     |         |         |         |
33+50       0.1885      0.19  |   O     |         |         |         |
33+55       0.1856      0.19  |  O      |         |         |         |
34+ 0       0.1827      0.18  |  O      |         |         |         |
34+ 5       0.1799      0.18  |  O      |         |         |         |
34+10       0.1771      0.18  |  O      |         |         |         |
34+15       0.1744      0.17  |  O      |         |         |         |
34+20       0.1717      0.17  |  O      |         |         |         |
34+25       0.1691      0.17  |  O      |         |         |         |
34+30       0.1665      0.17  |  O      |         |         |         |
34+35       0.1639      0.16  |  O      |         |         |         |
34+40       0.1614      0.16  |  O      |         |         |         |
34+45       0.1589      0.16  |  O      |         |         |         |
34+50       0.1564      0.16  |  O      |         |         |         |
34+55       0.1540      0.15  |  O      |         |         |         |
35+ 0       0.1516      0.15  |  O      |         |         |         |
```

```
  35+ 5       0.1493      0.15  |  O      |         |         |         |
  35+10       0.1470      0.15  |  O      |         |         |         |
  35+15       0.1447      0.14  |  O      |         |         |         |
  35+20       0.1425      0.14  |  O      |         |         |         |
  35+25       0.1403      0.14  |  O      |         |         |         |
  35+30       0.1381      0.14  | O       |         |         |         |
  35+35       0.1360      0.14  | O       |         |         |         |
  35+40       0.1339      0.13  | O       |         |         |         |
  35+45       0.1318      0.13  | O       |         |         |         |
  35+50       0.1298      0.13  | O       |         |         |         |
  35+55       0.1278      0.13  | O       |         |         |         |
  36+ 0       0.1258      0.13  | O       |         |         |         |
  36+ 5       0.1239      0.12  | O       |         |         |         |
  36+10       0.1219      0.12  | O       |         |         |         |
  36+15       0.1201      0.12  | O       |         |         |         |
  36+20       0.1182      0.12  | O       |         |         |         |
  36+25       0.1164      0.12  | O       |         |         |         |
  36+30       0.1146      0.11  | O       |         |         |         |
  36+35       0.1128      0.11  | O       |         |         |         |
  36+40       0.1111      0.11  | O       |         |         |         |
  36+45       0.1094      0.11  | O       |         |         |         |
  36+50       0.1077      0.11  | O       |         |         |         |
  36+55       0.1060      0.11  | O       |         |         |         |
  37+ 0       0.1044      0.10  | O       |         |         |         |
  37+ 5       0.1028      0.10  | O       |         |         |         |
  37+10       0.1012      0.10  | O       |         |         |         |
  37+15       0.0996      0.10  | O       |         |         |         |
  37+20       0.0119      0.00  O         |         |         |         |
  37+25       0.0000      0.00  O         |         |         |         |
-----------------------------------------------------------------------
      ***************************HYDROGRAPH DATA****************************
             Number of intervals =   449
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =       1.854 (CFS)
             Total volume =       1.429 (Ac.Ft)
         Status of hydrographs being held in storage
                  Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
         Peak (CFS)      0.000     0.000     0.000     0.000     0.000
         Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      **********************************************************************

      -------------------------------------------------------------------


      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      316.100 to Point/Station      316.200
      **** STORE OR DELETE CURRENT HYDROGRAPH ****
      _____________________________________________________________________
      Current stream hydrograph saved in file 27259PONDC224.rte
      ***************************HYDROGRAPH DATA****************************
             Number of intervals =     0
             Time interval =    0.0 (Min.)
             Maximum/Peak flow rate =       0.000 (CFS)
             Total volume =       0.000 (Ac.Ft)
         Status of hydrographs being held in storage
                  Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
         Peak (CFS)      0.000     0.000     0.000     0.000     0.000
         Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      **********************************************************************

      -------------------------------------------------------------------
```

```
                   FLOOD HYDROGRAPH ROUTING PROGRAM
          Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                         Study date: 01/11/18

---------------------------------------------------------------------
Area D Developed Condition – Mill Creek Promenade
2yr 24hr Unit Hydrograph
By Pacific Coast Land Consultants, Inc.

--------------------------------------------------------------------


Program License Serial Number 4066

--------------------------------------------------------------------
******************** HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHD242.rte
**************************HYDROGRAPH DATA***************************
             Number of intervals =   290
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        0.186 (CFS)
             Total volume =       0.105 (Ac.Ft)
      Status of hydrographs being held in storage
                Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
*********************************************************************



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      401.000
**** RETARDING BASIN ROUTING ****
______________________________________________________________________

Program computation of outflow v. depth




CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.16(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.16(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   0.50(Ft.)    Capacity =   0.06(CFS)

Total outflow at this depth =      0.06(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    3.25(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.16(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.16(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   2.75(Ft.)    Capacity =   0.06(CFS)
```

Total outflow at this depth =   0.06(CFS)

CALCULATED OUTFLOW DATA AT DEPTH =   4.40(Ft.))

Free outlet pipe flow: Pipe Diameter =   0.16(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.16(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.90(Ft.)   Capacity =   0.06(CFS)

Free outlet pipe flow: Pipe Diameter =   1.00(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   0.15(Ft.)   Capacity =   2.43(CFS)

Total outflow at this depth =   2.50(CFS)

Total number of inflow hydrograph intervals = 290
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)

Initial basin depth =   0.00 (Ft.)
Initial basin storage =   0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
1.000	0.042	0.064	0.042	0.042
3.250	0.113	0.064	0.113	0.113
4.400	0.222	2.498	0.213	0.231

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

```
 Time   Inflow  Outflow    Storage                                         Depth
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0       0.0     0.09    0.14    0.19 (Ft.)
 0.083    0.01    0.00      0.000  OI       |       |       |       |      0.00
 0.167    0.01    0.00      0.000  O I      |       |       |       |      0.00
 0.250    0.02    0.00      0.000  O I      |       |       |       |      0.01
 0.333    0.02    0.00      0.000  O  I     |       |       |       |      0.01
 0.417    0.02    0.00      0.000  O  I     |       |       |       |      0.01
 0.500    0.02    0.00      0.001  O  I     |       |       |       |      0.01
 0.583    0.02    0.00      0.001  O  I     |       |       |       |      0.02
 0.667    0.02    0.00      0.001  O  I     |       |       |       |      0.02
 0.750    0.02    0.00      0.001  O  I     |       |       |       |      0.03
 0.833    0.03    0.00      0.001  O   I    |       |       |       |      0.03
 0.917    0.03    0.00      0.001  O    I   |       |       |       |      0.03
 1.000    0.03    0.00      0.002  O    I   |       |       |       |      0.04
 1.083    0.03    0.00      0.002  O   I    |       |       |       |      0.04
 1.167    0.02    0.00      0.002  O  I     |       |       |       |      0.05
 1.250    0.02    0.00      0.002  O  I     |       |       |       |      0.05
 1.333    0.02    0.00      0.002  O  I     |       |       |       |      0.05
 1.417    0.02    0.00      0.002  O  I     |       |       |       |      0.06
 1.500    0.02    0.00      0.002  O  I     |       |       |       |      0.06
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1.583    0.02    0.00      0.003   O  I    |       |       |       |     0.06
1.667    0.02    0.00      0.003   O  I    |       |       |       |     0.06
1.750    0.02    0.00      0.003   O  I    |       |       |       |     0.07
1.833    0.03    0.00      0.003   O   I   |       |       |       |     0.07
1.917    0.03    0.00      0.003   O    I  |       |       |       |     0.07
2.000    0.03    0.01      0.003   O    I  |       |       |       |     0.08
2.083    0.03    0.01      0.003   O    I  |       |       |       |     0.08
2.167    0.03    0.01      0.004   O    I  |       |       |       |     0.09
2.250    0.03    0.01      0.004   |O   I  |       |       |       |     0.09
2.333    0.03    0.01      0.004   |O   I  |       |       |       |     0.09
2.417    0.03    0.01      0.004   |O   I  |       |       |       |     0.10
2.500    0.03    0.01      0.004   |O   I  |       |       |       |     0.10
2.583    0.03    0.01      0.004   |O   I  |       |       |       |     0.11
2.667    0.04    0.01      0.005   |O    I |       |       |       |     0.11
2.750    0.04    0.01      0.005   |O    I |       |       |       |     0.12
2.833    0.04    0.01      0.005   |O    I |       |       |       |     0.12
2.917    0.04    0.01      0.005   |O    I |       |       |       |     0.13
3.000    0.04    0.01      0.006   |O    I |       |       |       |     0.13
3.083    0.04    0.01      0.006   |O    I |       |       |       |     0.14
3.167    0.04    0.01      0.006   |O    I |       |       |       |     0.14
3.250    0.04    0.01      0.006   |O    I |       |       |       |     0.15
3.333    0.04    0.01      0.006   |O    I |       |       |       |     0.15
3.417    0.04    0.01      0.006   |O    I |       |       |       |     0.15
3.500    0.04    0.01      0.007   |O    I |       |       |       |     0.16
3.583    0.04    0.01      0.007   |O    I |       |       |       |     0.16
3.667    0.04    0.01      0.007   |O    I |       |       |       |     0.17
3.750    0.04    0.01      0.007   |O    I |       |       |       |     0.17
3.833    0.04    0.01      0.007   |O     I|       |       |       |     0.18
3.917    0.04    0.01      0.008   | O    I|       |       |       |     0.18
4.000    0.05    0.01      0.008   | O    I|       |       |       |     0.19
4.083    0.05    0.01      0.008   | O    I|       |       |       |     0.19
4.167    0.05    0.01      0.008   | O    I|       |       |       |     0.20
4.250    0.05    0.01      0.009   | O    I|       |       |       |     0.20
4.333    0.05    0.01      0.009   | O     I       |       |       |     0.21
4.417    0.05    0.01      0.009   | O     |I      |       |       |     0.22
4.500    0.05    0.01      0.009   | O     |I      |       |       |     0.22
4.583    0.05    0.01      0.010   | O     |I      |       |       |     0.23
4.667    0.05    0.02      0.010   | O     |I      |       |       |     0.23
4.750    0.05    0.02      0.010   | O     |I      |       |       |     0.24
4.833    0.06    0.02      0.010   | O     |I      |       |       |     0.25
4.917    0.06    0.02      0.011   | O     | I     |       |       |     0.25
5.000    0.06    0.02      0.011   | O     | I     |       |       |     0.26
5.083    0.05    0.02      0.011   | O     I       |       |       |     0.27
5.167    0.05    0.02      0.011   |  O   I|       |       |       |     0.27
5.250    0.05    0.02      0.012   |  O   I|       |       |       |     0.28
5.333    0.05    0.02      0.012   |  O    I       |       |       |     0.28
5.417    0.05    0.02      0.012   |  O    |I      |       |       |     0.29
5.500    0.05    0.02      0.012   |  O    |I      |       |       |     0.29
5.583    0.06    0.02      0.013   |  O    |I      |       |       |     0.30
5.667    0.06    0.02      0.013   |  O    | I     |       |       |     0.31
5.750    0.06    0.02      0.013   |  O    | I     |       |       |     0.31
5.833    0.06    0.02      0.013   |  O    | I     |       |       |     0.32
5.917    0.06    0.02      0.014   |  O    | I     |       |       |     0.33
6.000    0.06    0.02      0.014   |  O    | I     |       |       |     0.33
6.083    0.06    0.02      0.014   |  O    |  I    |       |       |     0.34
6.167    0.07    0.02      0.015   |  O    |  I    |       |       |     0.35
6.250    0.07    0.02      0.015   |  O    |  I    |       |       |     0.35
6.333    0.07    0.02      0.015   |  O    |  I    |       |       |     0.36
6.417    0.07    0.02      0.015   |   O   |  I    |       |       |     0.37
6.500    0.07    0.02      0.016   |   O   |  I    |       |       |     0.37
6.583    0.07    0.02      0.016   |   O   |   I   |       |       |     0.38
6.667    0.08    0.03      0.016   |   O   |   I   |       |       |     0.39
6.750    0.08    0.03      0.017   |   O   |   I   |       |       |     0.40
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 6.833    0.08    0.03      0.017  |   O   |   I   |       |       |     0.41
 6.917    0.08    0.03      0.017  |   O   |   I   |       |       |     0.41
 7.000    0.08    0.03      0.018  |   O   |   I   |       |       |     0.42
 7.083    0.08    0.03      0.018  |   O   |   I   |       |       |     0.43
 7.167    0.08    0.03      0.018  |   O   |   I   |       |       |     0.44
 7.250    0.08    0.03      0.019  |   O   |   I   |       |       |     0.45
 7.333    0.08    0.03      0.019  |    O  |    I  |       |       |     0.45
 7.417    0.08    0.03      0.019  |    O  |     I |       |       |     0.46
 7.500    0.08    0.03      0.020  |    O  |     I |       |       |     0.47
 7.583    0.09    0.03      0.020  |    O  |      I|       |       |     0.48
 7.667    0.09    0.03      0.021  |    O  |      I|       |       |     0.49
 7.750    0.09    0.03      0.021  |    O  |      I|       |       |     0.50
 7.833    0.10    0.03      0.021  |    O  |       I       |       |     0.51
 7.917    0.10    0.03      0.022  |    O  |       I       |       |     0.52
 8.000    0.10    0.03      0.022  |    O  |       I       |       |     0.53
 8.083    0.11    0.03      0.023  |    O  |       | I     |       |     0.54
 8.167    0.11    0.04      0.023  |     O |       |  I    |       |     0.55
 8.250    0.11    0.04      0.024  |     O |       |  I    |       |     0.57
 8.333    0.11    0.04      0.024  |     O |       |  I    |       |     0.58
 8.417    0.11    0.04      0.025  |     O |       |  I    |       |     0.59
 8.500    0.11    0.04      0.025  |     O |       |  I    |       |     0.60
 8.583    0.12    0.04      0.026  |     O |       |   I   |       |     0.62
 8.667    0.12    0.04      0.026  |     O |       |   I   |       |     0.63
 8.750    0.12    0.04      0.027  |      O|       |   I   |       |     0.64
 8.833    0.13    0.04      0.028  |      O|       |    I  |       |     0.65
 8.917    0.13    0.04      0.028  |      O|       |    I  |       |     0.67
 9.000    0.13    0.04      0.029  |      O|       |     I |       |     0.68
 9.083    0.06    0.04      0.029  |      O|I      |       |       |     0.69
 9.167    0.02    0.04      0.029  | I    O|       |       |       |     0.69
 9.250    0.01    0.04      0.029  | I    O|       |       |       |     0.68
 9.333    0.02    0.04      0.029  |  I   O|       |       |       |     0.68
 9.417    0.02    0.04      0.028  |  I   O|       |       |       |     0.68
 9.500    0.02    0.04      0.028  |   I  O|       |       |       |     0.67
 9.583    0.03    0.04      0.028  |    I O|       |       |       |     0.67
 9.667    0.03    0.04      0.028  |    I O|       |       |       |     0.67
 9.750    0.03    0.04      0.028  |     IO|       |       |       |     0.67
 9.833    0.04    0.04      0.028  |      O|       |       |       |     0.67
 9.917    0.05    0.04      0.028  |      O|       |       |       |     0.67
10.000    0.05    0.04      0.028  |      O|       |       |       |     0.67
10.083    0.09    0.04      0.028  |      O|      I|       |       |     0.67
10.167    0.11    0.04      0.029  |      O|       | I     |       |     0.68
10.250    0.11    0.04      0.029  |      O|       |  I    |       |     0.69
10.333    0.11    0.05      0.029  |      O|       |  I    |       |     0.70
10.417    0.11    0.05      0.030  |      O|       |  I    |       |     0.71
10.500    0.11    0.05      0.030  |      O|       |  I    |       |     0.72
10.583    0.06    0.05      0.031  |       O  I    |       |       |     0.73
10.667    0.04    0.05      0.031  |     I O       |       |       |     0.73
10.750    0.03    0.05      0.031  |    I  O       |       |       |     0.73
10.833    0.04    0.05      0.031  |     I O       |       |       |     0.73
10.917    0.04    0.05      0.030  |     I O       |       |       |     0.73
11.000    0.04    0.05      0.030  |     I O       |       |       |     0.72
11.083    0.03    0.05      0.030  |    I O|       |       |       |     0.72
11.167    0.03    0.05      0.030  |    I O|       |       |       |     0.72
11.250    0.03    0.05      0.030  |    I O|       |       |       |     0.72
11.333    0.03    0.05      0.030  |    I O|       |       |       |     0.71
11.417    0.03    0.05      0.030  |    I O|       |       |       |     0.71
11.500    0.03    0.05      0.030  |    I O|       |       |       |     0.71
11.583    0.02    0.05      0.030  |  I   O|       |       |       |     0.71
11.667    0.02    0.05      0.029  | I    O|       |       |       |     0.70
11.750    0.02    0.04      0.029  | I    O|       |       |       |     0.70
11.833    0.02    0.04      0.029  |  I   O|       |       |       |     0.69
11.917    0.03    0.04      0.029  |   I  O|       |       |       |     0.69
12.000    0.03    0.04      0.029  |   I  O|       |       |       |     0.69
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12.083    0.07    0.04      0.029  |      O|  I    |       |       |     0.69
12.167    0.09    0.04      0.029  |      O|      I|       |       |     0.69
12.250    0.09    0.05      0.029  |      O|       I       |       |     0.70
12.333    0.10    0.05      0.030  |      O|       |I      |       |     0.71
12.417    0.10    0.05      0.030  |      O|       |I      |       |     0.72
12.500    0.10    0.05      0.031  |       O       |I      |       |     0.73
12.583    0.12    0.05      0.031  |       O       |   I   |       |     0.74
12.667    0.12    0.05      0.031  |       O       |    I  |       |     0.75
12.750    0.13    0.05      0.032  |       O       |    I  |       |     0.76
12.833    0.13    0.05      0.033  |       O       |     I |       |     0.78
12.917    0.14    0.05      0.033  |       O       |      I|       |     0.79
13.000    0.14    0.05      0.034  |       O       |      I|       |     0.80
13.083    0.17    0.05      0.034  |       |O      |       |   I   |     0.82
13.167    0.18    0.05      0.035  |       |O      |       |      I|     0.84
13.250    0.18    0.06      0.036  |       |O      |       |      I|     0.86
13.333    0.18    0.06      0.037  |       |O      |       |      I|     0.88
13.417    0.19    0.06      0.038  |       |O      |       |      I|     0.90
13.500    0.19    0.06      0.039  |       | O     |       |      I|     0.92
13.583    0.12    0.06      0.039  |       | O     |    I  |       |     0.94
13.667    0.09    0.06      0.040  |       | O    I|       |       |     0.95
13.750    0.09    0.06      0.040  |       | O   I |       |       |     0.95
13.833    0.09    0.06      0.040  |       | O    I|       |       |     0.95
13.917    0.09    0.06      0.040  |       | O    I|       |       |     0.96
14.000    0.09    0.06      0.040  |       | O    I|       |       |     0.96
14.083    0.11    0.06      0.041  |       | O     |  I    |       |     0.97
14.167    0.13    0.06      0.041  |       | O     |    I  |       |     0.98
14.250    0.13    0.06      0.042  |       | O     |    I  |       |     0.99
14.333    0.12    0.06      0.042  |       |  O    |    I  |       |     1.00
14.417    0.12    0.06      0.042  |       |  O    |   I   |       |     1.01
14.500    0.12    0.06      0.043  |       |  O    |   I   |       |     1.02
14.583    0.12    0.06      0.043  |       |  O    |   I   |       |     1.04
14.667    0.12    0.06      0.044  |       |  O    |   I   |       |     1.05
14.750    0.12    0.06      0.044  |       |  O    |   I   |       |     1.06
14.833    0.12    0.06      0.044  |       |  O    |   I   |       |     1.07
14.917    0.11    0.06      0.045  |       |  O    |  I    |       |     1.08
15.000    0.11    0.06      0.045  |       |  O    |  I    |       |     1.10
15.083    0.11    0.06      0.045  |       |  O    | I     |       |     1.11
15.167    0.11    0.06      0.046  |       |  O    | I     |       |     1.12
15.250    0.11    0.06      0.046  |       |  O    | I     |       |     1.12
15.333    0.10    0.06      0.046  |       |  O    |I      |       |     1.13
15.417    0.10    0.06      0.046  |       |  O    |I      |       |     1.14
15.500    0.10    0.06      0.047  |       |  O    |I      |       |     1.15
15.583    0.08    0.06      0.047  |       |  O I  |       |       |     1.15
15.667    0.07    0.06      0.047  |       |  O    |       |       |     1.16
15.750    0.06    0.06      0.047  |       |  O    |       |       |     1.16
15.833    0.07    0.06      0.047  |       |  O    |       |       |     1.16
15.917    0.07    0.06      0.047  |       |  O    |       |       |     1.16
16.000    0.07    0.06      0.047  |       |  O    |       |       |     1.16
16.083    0.04    0.06      0.047  |      I|  O    |       |       |     1.15
16.167    0.03    0.06      0.047  |    I  |  O    |       |       |     1.15
16.250    0.03    0.06      0.046  |    I  |  O    |       |       |     1.14
16.333    0.03    0.06      0.046  |    I  |  O    |       |       |     1.13
16.417    0.03    0.06      0.046  |    I  |  O    |       |       |     1.13
16.500    0.03    0.06      0.046  |    I  |  O    |       |       |     1.12
16.583    0.03    0.06      0.046  |   I   |  O    |       |       |     1.11
16.667    0.02    0.06      0.045  |  I    |  O    |       |       |     1.10
16.750    0.02    0.06      0.045  |  I    |  O    |       |       |     1.09
16.833    0.02    0.06      0.045  |  I    |  O    |       |       |     1.08
16.917    0.02    0.06      0.044  |  I    |  O    |       |       |     1.08
17.000    0.02    0.06      0.044  |  I    |  O    |       |       |     1.07
17.083    0.03    0.06      0.044  |    I  |  O    |       |       |     1.06
17.167    0.04    0.06      0.044  |     I |  O    |       |       |     1.05
17.250    0.04    0.06      0.043  |     I |  O    |       |       |     1.05
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17.333    0.04    0.06      0.043  |     I |  O    |       |       |     1.04
17.417    0.04    0.06      0.043  |     I |  O    |       |       |     1.03
17.500    0.04    0.06      0.043  |     I |  O    |       |       |     1.03
17.583    0.04    0.06      0.043  |     I |  O    |       |       |     1.02
17.667    0.04    0.06      0.043  |     I |  O    |       |       |     1.02
17.750    0.04    0.06      0.042  |     I |  O    |       |       |     1.01
17.833    0.03    0.06      0.042  |    I  |  O    |       |       |     1.00
17.917    0.03    0.06      0.042  |    I  |  O    |       |       |     1.00
18.000    0.03    0.06      0.042  |    I  | O     |       |       |     0.99
18.083    0.03    0.06      0.041  |    I  | O     |       |       |     0.99
18.167    0.03    0.06      0.041  |    I  | O     |       |       |     0.98
18.250    0.03    0.06      0.041  |    I  | O     |       |       |     0.98
18.333    0.03    0.06      0.041  |    I  | O     |       |       |     0.97
18.417    0.03    0.06      0.041  |    I  | O     |       |       |     0.97
18.500    0.03    0.06      0.040  |    I  | O     |       |       |     0.96
18.583    0.03    0.06      0.040  |   I   | O     |       |       |     0.95
18.667    0.02    0.06      0.040  |  I    | O     |       |       |     0.95
18.750    0.02    0.06      0.040  |  I    | O     |       |       |     0.94
18.833    0.02    0.06      0.039  |  I    | O     |       |       |     0.94
18.917    0.02    0.06      0.039  | I     | O     |       |       |     0.93
19.000    0.02    0.06      0.039  | I     | O     |       |       |     0.92
19.083    0.02    0.06      0.038  |  I    | O     |       |       |     0.91
19.167    0.02    0.06      0.038  |  I    | O     |       |       |     0.91
19.250    0.02    0.06      0.038  |  I    |O      |       |       |     0.90
19.333    0.03    0.06      0.038  |   I   |O      |       |       |     0.90
19.417    0.03    0.06      0.037  |    I  |O      |       |       |     0.89
19.500    0.03    0.06      0.037  |    I  |O      |       |       |     0.89
19.583    0.03    0.06      0.037  |   I   |O      |       |       |     0.88
19.667    0.02    0.06      0.037  |  I    |O      |       |       |     0.88
19.750    0.02    0.06      0.037  |  I    |O      |       |       |     0.87
19.833    0.02    0.06      0.036  |  I    |O      |       |       |     0.87
19.917    0.02    0.06      0.036  | I     |O      |       |       |     0.86
20.000    0.02    0.05      0.036  | I     |O      |       |       |     0.85
20.083    0.02    0.05      0.036  |  I    |O      |       |       |     0.85
20.167    0.02    0.05      0.035  |  I    |O      |       |       |     0.84
20.250    0.02    0.05      0.035  |  I    |O      |       |       |     0.84
20.333    0.02    0.05      0.035  |  I    |O      |       |       |     0.83
20.417    0.02    0.05      0.035  |  I    |O      |       |       |     0.83
20.500    0.02    0.05      0.035  |  I    |O      |       |       |     0.82
20.583    0.02    0.05      0.034  |  I    |O      |       |       |     0.82
20.667    0.02    0.05      0.034  |  I    O       |       |       |     0.81
20.750    0.02    0.05      0.034  |  I    O       |       |       |     0.81
20.833    0.02    0.05      0.034  |  I    O       |       |       |     0.80
20.917    0.02    0.05      0.033  | I     O       |       |       |     0.80
21.000    0.02    0.05      0.033  | I     O       |       |       |     0.79
21.083    0.02    0.05      0.033  |  I    O       |       |       |     0.79
21.167    0.02    0.05      0.033  |  I    O       |       |       |     0.78
21.250    0.02    0.05      0.033  |  I    O       |       |       |     0.78
21.333    0.02    0.05      0.032  |  I    O       |       |       |     0.77
21.417    0.02    0.05      0.032  | I     O       |       |       |     0.77
21.500    0.02    0.05      0.032  | I     O       |       |       |     0.76
21.583    0.02    0.05      0.032  |  I    O       |       |       |     0.75
21.667    0.02    0.05      0.032  |  I    O       |       |       |     0.75
21.750    0.02    0.05      0.031  |  I    O       |       |       |     0.75
21.833    0.02    0.05      0.031  |  I    O       |       |       |     0.74
21.917    0.02    0.05      0.031  | I     O       |       |       |     0.74
22.000    0.02    0.05      0.031  | I     O       |       |       |     0.73
22.083    0.02    0.05      0.031  |  I    O       |       |       |     0.73
22.167    0.02    0.05      0.030  |  I   O|       |       |       |     0.72
22.250    0.02    0.05      0.030  |  I   O|       |       |       |     0.72
22.333    0.02    0.05      0.030  |  I   O|       |       |       |     0.71
22.417    0.02    0.05      0.030  | I    O|       |       |       |     0.71
22.500    0.02    0.05      0.030  | I    O|       |       |       |     0.70
```

```
22.583    0.02    0.05      0.029  | I    O|       |       |       |     0.70
22.667    0.02    0.04      0.029  | I    O|       |       |       |     0.69
22.750    0.02    0.04      0.029  | I    O|       |       |       |     0.69
22.833    0.02    0.04      0.029  | I    O|       |       |       |     0.68
22.917    0.02    0.04      0.029  | I    O|       |       |       |     0.68
23.000    0.02    0.04      0.028  | I    O|       |       |       |     0.68
23.083    0.02    0.04      0.028  | I    O|       |       |       |     0.67
23.167    0.02    0.04      0.028  | I    O|       |       |       |     0.67
23.250    0.02    0.04      0.028  | I    O|       |       |       |     0.66
23.333    0.02    0.04      0.028  | I    O|       |       |       |     0.66
23.417    0.02    0.04      0.027  | I    O|       |       |       |     0.65
23.500    0.02    0.04      0.027  | I    O|       |       |       |     0.65
23.583    0.02    0.04      0.027  | I    O|       |       |       |     0.64
23.667    0.02    0.04      0.027  | I    O|       |       |       |     0.64
23.750    0.02    0.04      0.027  | I    O|       |       |       |     0.64
23.833    0.02    0.04      0.027  | I   O |       |       |       |     0.63
23.917    0.02    0.04      0.026  | I   O |       |       |       |     0.63
24.000    0.02    0.04      0.026  | I   O |       |       |       |     0.62
24.083    0.01    0.04      0.026  |I    O |       |       |       |     0.62
24.167    0.00    0.04      0.026  I     O |       |       |       |     0.61
24.250    0.00    0.04      0.025  I     O |       |       |       |     0.61


      Remaining water in basin =    0.03 (Ac.Ft)


      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =   291
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.064 (CFS)
                   Total volume =       0.080 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      --------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      401.100 to Point/Station      602.000
      **** STREAM ROUTING SCS CONVEX METHOD ****
      ______________________________________________________________________
      HYDROGRAPH STREAM ROUTING DATA:
      Length of stream =    526.70 (Ft.)
      Elevation difference =    2.65 (Ft.)
      Slope of channel =  0.005031 (Vert/Horiz)
      Channel type - Pipe


      Pipe length  =   526.70(Ft.)   Elevation difference =   2.65(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using mean flow rate of hydrograph
      Required pipe flow  =     0.040(CFS)
      Nearest computed pipe diameter  =      3.00(In.)
      Calculated individual pipe flow  =     0.040(CFS)
      Normal flow depth in pipe =    1.76(In.)
      Flow top width inside pipe =    2.95(In.)
      Critical Depth =    0.12(Ft.)
      Pipe flow velocity =      1.36(Ft/s)
      Travel time through pipe =    6.46 min.
```

```
Pipe length  =   526.70(Ft.)   Elevation difference =   2.65(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using maximum flow rate of hydrograph
Required pipe flow  =     0.064(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.064(CFS)
Normal flow depth in pipe =    1.62(In.)
Flow top width inside pipe =    5.33(In.)
Critical Depth =    0.12(Ft.)
Pipe flow velocity =      1.48(Ft/s)
Travel time through pipe =    5.91 min.


********************** SCS CONVEX CHANNEL ROUTING ********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
         where c* = 1 - (1-c)^e and dt = c(length)/velocity
         c(v/v+1.7) =   0.4662   Travel time =   5.91 (min.)
       dt*(unit time interval) =   5.00(min.),  e=   1.5426
       dt(routing time-step) =   2.76 (min.),   c* =   0.6203

Output hydrograph delayed by 0  unit time increments


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

--------------------------------------------------------------------
Time(h+m) Out = O(CFS) In = I  0        0.0       0.0       0.0       0.1
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  O         |         |         |         |
  0+10       0.0001      0.00  O         |         |         |         |
  0+15       0.0002      0.00  O         |         |         |         |
  0+20       0.0003      0.00  O         |         |         |         |
  0+25       0.0005      0.00  O         |         |         |         |
  0+30       0.0007      0.00  O         |         |         |         |
  0+35       0.0009      0.00  O         |         |         |         |
  0+40       0.0011      0.00  O         |         |         |         |
  0+45       0.0014      0.00  OI        |         |         |         |
  0+50       0.0016      0.00  OI        |         |         |         |
  0+55       0.0018      0.00  |O        |         |         |         |
  1+ 0       0.0021      0.00  |O        |         |         |         |
  1+ 5       0.0024      0.00  |O        |         |         |         |
  1+10       0.0026      0.00  |O        |         |         |         |
  1+15       0.0029      0.00  |O        |         |         |         |
  1+20       0.0031      0.00  |OI       |         |         |         |
  1+25       0.0033      0.00  | O       |         |         |         |
  1+30       0.0035      0.00  | O       |         |         |         |
  1+35       0.0037      0.00  | O       |         |         |         |
  1+40       0.0039      0.00  | O       |         |         |         |
  1+45       0.0041      0.00  | O       |         |         |         |
  1+50       0.0043      0.00  | O       |         |         |         |
  1+55       0.0045      0.00  | O       |         |         |         |
  2+ 0       0.0048      0.01  | OI      |         |         |         |
  2+ 5       0.0050      0.01  |  O      |         |         |         |
  2+10       0.0053      0.01  |  O      |         |         |         |
  2+15       0.0055      0.01  |  O      |         |         |         |
  2+20       0.0058      0.01  |  O      |         |         |         |
```

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2+25       0.0061      0.01  |  O      |         |         |         |
2+30       0.0063      0.01  |  OI     |         |         |         |
2+35       0.0066      0.01  |   O     |         |         |         |
2+40       0.0068      0.01  |   O     |         |         |         |
2+45       0.0071      0.01  |   O     |         |         |         |
2+50       0.0075      0.01  |   O     |         |         |         |
2+55       0.0078      0.01  |   OI    |         |         |         |
3+ 0       0.0081      0.01  |    O    |         |         |         |
3+ 5       0.0084      0.01  |    O    |         |         |         |
3+10       0.0087      0.01  |    O    |         |         |         |
3+15       0.0090      0.01  |    O    |         |         |         |
3+20       0.0093      0.01  |    OI   |         |         |         |
3+25       0.0096      0.01  |    OI   |         |         |         |
3+30       0.0099      0.01  |     O   |         |         |         |
3+35       0.0102      0.01  |     O   |         |         |         |
3+40       0.0105      0.01  |     O   |         |         |         |
3+45       0.0108      0.01  |     O   |         |         |         |
3+50       0.0111      0.01  |     OI  |         |         |         |
3+55       0.0114      0.01  |      O  |         |         |         |
4+ 0       0.0117      0.01  |      O  |         |         |         |
4+ 5       0.0120      0.01  |      O  |         |         |         |
4+10       0.0124      0.01  |      O  |         |         |         |
4+15       0.0127      0.01  |      OI |         |         |         |
4+20       0.0131      0.01  |       O |         |         |         |
4+25       0.0134      0.01  |       O |         |         |         |
4+30       0.0138      0.01  |       O |         |         |         |
4+35       0.0142      0.01  |       OI|         |         |         |
4+40       0.0146      0.02  |        O|         |         |         |
4+45       0.0150      0.02  |        O|         |         |         |
4+50       0.0154      0.02  |        O|         |         |         |
4+55       0.0158      0.02  |        OI         |         |         |
5+ 0       0.0163      0.02  |         O         |         |         |
5+ 5       0.0167      0.02  |         O         |         |         |
5+10       0.0171      0.02  |         O         |         |         |
5+15       0.0175      0.02  |         OI        |         |         |
5+20       0.0178      0.02  |         |O        |         |         |
5+25       0.0181      0.02  |         |O        |         |         |
5+30       0.0184      0.02  |         |O        |         |         |
5+35       0.0188      0.02  |         |O        |         |         |
5+40       0.0192      0.02  |         |OI       |         |         |
5+45       0.0196      0.02  |         | O       |         |         |
5+50       0.0200      0.02  |         | O       |         |         |
5+55       0.0204      0.02  |         | OI      |         |         |
6+ 0       0.0208      0.02  |         | OI      |         |         |
6+ 5       0.0213      0.02  |         |  O      |         |         |
6+10       0.0217      0.02  |         |  O      |         |         |
6+15       0.0222      0.02  |         |  OI     |         |         |
6+20       0.0226      0.02  |         |   O     |         |         |
6+25       0.0231      0.02  |         |   O     |         |         |
6+30       0.0236      0.02  |         |   O     |         |         |
6+35       0.0240      0.02  |         |   OI    |         |         |
6+40       0.0245      0.03  |         |    O    |         |         |
6+45       0.0250      0.03  |         |    O    |         |         |
6+50       0.0256      0.03  |         |    OI   |         |         |
6+55       0.0261      0.03  |         |     O   |         |         |
7+ 0       0.0266      0.03  |         |     O   |         |         |
7+ 5       0.0271      0.03  |         |     OI  |         |         |
7+10       0.0276      0.03  |         |      O  |         |         |
7+15       0.0281      0.03  |         |      O  |         |         |
7+20       0.0286      0.03  |         |      OI |         |         |
7+25       0.0291      0.03  |         |       O |         |         |
7+30       0.0297      0.03  |         |       O |         |         |
7+35       0.0302      0.03  |         |       OI|         |         |
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 7+40       0.0308      0.03  |         |        O|         |         |
 7+45       0.0314      0.03  |         |        O|         |         |
 7+50       0.0320      0.03  |         |        OI         |         |
 7+55       0.0327      0.03  |         |         O         |         |
 8+ 0       0.0333      0.03  |         |         OI        |         |
 8+ 5       0.0340      0.03  |         |         |O        |         |
 8+10       0.0347      0.04  |         |         |OI       |         |
 8+15       0.0355      0.04  |         |         | O       |         |
 8+20       0.0363      0.04  |         |         | OI      |         |
 8+25       0.0371      0.04  |         |         |  O      |         |
 8+30       0.0379      0.04  |         |         |  OI     |         |
 8+35       0.0387      0.04  |         |         |   O     |         |
 8+40       0.0395      0.04  |         |         |   OI    |         |
 8+45       0.0403      0.04  |         |         |    O    |         |
 8+50       0.0412      0.04  |         |         |    OI   |         |
 8+55       0.0420      0.04  |         |         |     O   |         |
 9+ 0       0.0429      0.04  |         |         |     OI  |         |
 9+ 5       0.0437      0.04  |         |         |      O  |         |
 9+10       0.0441      0.04  |         |         |      O  |         |
 9+15       0.0442      0.04  |         |         |      O  |         |
 9+20       0.0440      0.04  |         |         |      O  |         |
 9+25       0.0438      0.04  |         |         |      O  |         |
 9+30       0.0435      0.04  |         |         |     IO  |         |
 9+35       0.0433      0.04  |         |         |     O   |         |
 9+40       0.0431      0.04  |         |         |     O   |         |
 9+45       0.0430      0.04  |         |         |     O   |         |
 9+50       0.0429      0.04  |         |         |     O   |         |
 9+55       0.0429      0.04  |         |         |     O   |         |
10+ 0       0.0429      0.04  |         |         |     O   |         |
10+ 5       0.0429      0.04  |         |         |     O   |         |
10+10       0.0432      0.04  |         |         |     OI  |         |
10+15       0.0437      0.04  |         |         |      O  |         |
10+20       0.0443      0.05  |         |         |      OI |         |
10+25       0.0450      0.05  |         |         |      OI |         |
10+30       0.0457      0.05  |         |         |       O |         |
10+35       0.0464      0.05  |         |         |       OI|         |
10+40       0.0468      0.05  |         |         |        O|         |
10+45       0.0469      0.05  |         |         |        O|         |
10+50       0.0469      0.05  |         |         |        O|         |
10+55       0.0468      0.05  |         |         |        O|         |
11+ 0       0.0467      0.05  |         |         |       IO|         |
11+ 5       0.0466      0.05  |         |         |       O |         |
11+10       0.0465      0.05  |         |         |       O |         |
11+15       0.0463      0.05  |         |         |       O |         |
11+20       0.0461      0.05  |         |         |       O |         |
11+25       0.0460      0.05  |         |         |       O |         |
11+30       0.0458      0.05  |         |         |       O |         |
11+35       0.0457      0.05  |         |         |       O |         |
11+40       0.0454      0.05  |         |         |       O |         |
11+45       0.0452      0.04  |         |         |      IO |         |
11+50       0.0449      0.04  |         |         |      O  |         |
11+55       0.0446      0.04  |         |         |      O  |         |
12+ 0       0.0444      0.04  |         |         |      O  |         |
12+ 5       0.0443      0.04  |         |         |      O  |         |
12+10       0.0443      0.04  |         |         |      O  |         |
12+15       0.0446      0.05  |         |         |      OI |         |
12+20       0.0451      0.05  |         |         |       O |         |
12+25       0.0456      0.05  |         |         |       O |         |
12+30       0.0461      0.05  |         |         |       OI|         |
12+35       0.0467      0.05  |         |         |        O|         |
12+40       0.0474      0.05  |         |         |        O|         |
12+45       0.0481      0.05  |         |         |        OI         |
12+50       0.0489      0.05  |         |         |         OI        |
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12+55       0.0498      0.05  |         |         |         OI        |
13+ 0       0.0506      0.05  |         |         |         |OI       |
13+ 5       0.0515      0.05  |         |         |         | O       |
13+10       0.0526      0.05  |         |         |         | OI      |
13+15       0.0538      0.06  |         |         |         |  OI     |
13+20       0.0551      0.06  |         |         |         |   OI    |
13+25       0.0565      0.06  |         |         |         |    OI   |
13+30       0.0578      0.06  |         |         |         |    OI   |
13+35       0.0590      0.06  |         |         |         |     OI  |
13+40       0.0600      0.06  |         |         |         |      O  |
13+45       0.0606      0.06  |         |         |         |      OI |
13+50       0.0610      0.06  |         |         |         |      OI |
13+55       0.0614      0.06  |         |         |         |       O |
14+ 0       0.0617      0.06  |         |         |         |       O |
14+ 5       0.0620      0.06  |         |         |         |       O |
14+10       0.0624      0.06  |         |         |         |       OI|
14+15       0.0629      0.06  |         |         |         |        O|
14+20       0.0636      0.06  |         |         |         |        O|
14+25       0.0640      0.06  |         |         |         |        OI
14+30       0.0642      0.06  |         |         |         |        OI
14+35       0.0643      0.06  |         |         |         |        OI
14+40       0.0643      0.06  |         |         |         |        OI
14+45       0.0643      0.06  |         |         |         |        OI
14+50       0.0643      0.06  |         |         |         |        OI
14+55       0.0643      0.06  |         |         |         |        OI
15+ 0       0.0643      0.06  |         |         |         |        OI
15+ 5       0.0643      0.06  |         |         |         |        OI
15+10       0.0643      0.06  |         |         |         |        OI
15+15       0.0643      0.06  |         |         |         |        OI
15+20       0.0643      0.06  |         |         |         |        OI
15+25       0.0643      0.06  |         |         |         |        OI
15+30       0.0643      0.06  |         |         |         |        OI
15+35       0.0643      0.06  |         |         |         |        OI
15+40       0.0643      0.06  |         |         |         |        OI
15+45       0.0643      0.06  |         |         |         |        OI
15+50       0.0643      0.06  |         |         |         |        OI
15+55       0.0643      0.06  |         |         |         |        OI
16+ 0       0.0643      0.06  |         |         |         |        OI
16+ 5       0.0643      0.06  |         |         |         |        OI
16+10       0.0643      0.06  |         |         |         |        OI
16+15       0.0643      0.06  |         |         |         |        OI
16+20       0.0643      0.06  |         |         |         |        OI
16+25       0.0643      0.06  |         |         |         |        OI
16+30       0.0643      0.06  |         |         |         |        OI
16+35       0.0643      0.06  |         |         |         |        OI
16+40       0.0643      0.06  |         |         |         |        OI
16+45       0.0643      0.06  |         |         |         |        OI
16+50       0.0643      0.06  |         |         |         |        OI
16+55       0.0643      0.06  |         |         |         |        OI
17+ 0       0.0643      0.06  |         |         |         |        OI
17+ 5       0.0643      0.06  |         |         |         |        OI
17+10       0.0643      0.06  |         |         |         |        OI
17+15       0.0643      0.06  |         |         |         |        OI
17+20       0.0643      0.06  |         |         |         |        OI
17+25       0.0643      0.06  |         |         |         |        OI
17+30       0.0643      0.06  |         |         |         |        OI
17+35       0.0643      0.06  |         |         |         |        OI
17+40       0.0643      0.06  |         |         |         |        OI
17+45       0.0643      0.06  |         |         |         |        OI
17+50       0.0643      0.06  |         |         |         |        OI
17+55       0.0643      0.06  |         |         |         |        O|
18+ 0       0.0642      0.06  |         |         |         |        O|
18+ 5       0.0639      0.06  |         |         |         |        O|
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18+10       0.0635      0.06  |         |         |         |        O|
18+15       0.0632      0.06  |         |         |         |        O|
18+20       0.0629      0.06  |         |         |         |       IO|
18+25       0.0625      0.06  |         |         |         |       O |
18+30       0.0622      0.06  |         |         |         |       O |
18+35       0.0618      0.06  |         |         |         |       O |
18+40       0.0615      0.06  |         |         |         |      IO |
18+45       0.0611      0.06  |         |         |         |      O  |
18+50       0.0607      0.06  |         |         |         |      O  |
18+55       0.0603      0.06  |         |         |         |      O  |
19+ 0       0.0598      0.06  |         |         |         |     IO  |
19+ 5       0.0594      0.06  |         |         |         |     O   |
19+10       0.0589      0.06  |         |         |         |     O   |
19+15       0.0585      0.06  |         |         |         |     O   |
19+20       0.0582      0.06  |         |         |         |    IO   |
19+25       0.0578      0.06  |         |         |         |    O    |
19+30       0.0575      0.06  |         |         |         |    O    |
19+35       0.0572      0.06  |         |         |         |    O    |
19+40       0.0569      0.06  |         |         |         |    O    |
19+45       0.0565      0.06  |         |         |         |   IO    |
19+50       0.0562      0.06  |         |         |         |   O     |
19+55       0.0558      0.06  |         |         |         |   O     |
20+ 0       0.0554      0.05  |         |         |         |   O     |
20+ 5       0.0550      0.05  |         |         |         |  IO     |
20+10       0.0546      0.05  |         |         |         |  O      |
20+15       0.0543      0.05  |         |         |         |  O      |
20+20       0.0539      0.05  |         |         |         |  O      |
20+25       0.0536      0.05  |         |         |         |  O      |
20+30       0.0533      0.05  |         |         |         | IO      |
20+35       0.0529      0.05  |         |         |         | O       |
20+40       0.0526      0.05  |         |         |         | O       |
20+45       0.0523      0.05  |         |         |         | O       |
20+50       0.0520      0.05  |         |         |         | O       |
20+55       0.0516      0.05  |         |         |         |IO       |
21+ 0       0.0513      0.05  |         |         |         |O        |
21+ 5       0.0509      0.05  |         |         |         |O        |
21+10       0.0506      0.05  |         |         |         |O        |
21+15       0.0503      0.05  |         |         |         |O        |
21+20       0.0500      0.05  |         |         |         IO        |
21+25       0.0496      0.05  |         |         |         O         |
21+30       0.0493      0.05  |         |         |         O         |
21+35       0.0490      0.05  |         |         |         O         |
21+40       0.0486      0.05  |         |         |         O         |
21+45       0.0483      0.05  |         |         |        IO         |
21+50       0.0480      0.05  |         |         |        O|         |
21+55       0.0478      0.05  |         |         |        O|         |
22+ 0       0.0474      0.05  |         |         |        O|         |
22+ 5       0.0471      0.05  |         |         |        O|         |
22+10       0.0468      0.05  |         |         |       IO|         |
22+15       0.0465      0.05  |         |         |       O |         |
22+20       0.0463      0.05  |         |         |       O |         |
22+25       0.0460      0.05  |         |         |       O |         |
22+30       0.0457      0.05  |         |         |       O |         |
22+35       0.0454      0.05  |         |         |      IO |         |
22+40       0.0451      0.04  |         |         |      IO |         |
22+45       0.0447      0.04  |         |         |      O  |         |
22+50       0.0444      0.04  |         |         |      O  |         |
22+55       0.0441      0.04  |         |         |      O  |         |
23+ 0       0.0438      0.04  |         |         |      O  |         |
23+ 5       0.0435      0.04  |         |         |     IO  |         |
23+10       0.0432      0.04  |         |         |     O   |         |
23+15       0.0429      0.04  |         |         |     O   |         |
23+20       0.0426      0.04  |         |         |     O   |         |
```

```
    23+25       0.0423      0.04  |         |         |     O   |         |
    23+30       0.0421      0.04  |         |         |    IO   |         |
    23+35       0.0418      0.04  |         |         |    O    |         |
    23+40       0.0415      0.04  |         |         |    O    |         |
    23+45       0.0412      0.04  |         |         |    O    |         |
    23+50       0.0409      0.04  |         |         |    O    |         |
    23+55       0.0407      0.04  |         |         |    O    |         |
    24+ 0       0.0404      0.04  |         |         |   IO    |         |
    24+ 5       0.0401      0.04  |         |         |   O     |         |
    24+10       0.0398      0.04  |         |         |   O     |         |
    24+15       0.0394      0.04  |         |         |   O     |         |
    24+20       0.0283      0.00  I         |       O |         |         |
    24+25       0.0107      0.00  I     O   |         |         |         |
    24+30       0.0041      0.00  I O       |         |         |         |
    24+35       0.0015      0.00  O         |         |         |         |
    24+40       0.0000      0.00  O         |         |         |         |
----------------------------------------------------------------------
      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =   296
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.064 (CFS)
                   Total volume =       0.080 (Ac.Ft)
            Status of hydrographs being held in storage
                       Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      -------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      201.100 to Point/Station      602.000
      **** STORE OR DELETE CURRENT HYDROGRAPH ****
      ______________________________________________________________________
      Current stream hydrograph saved in file 27259DPOND224.rte
      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =     0
                   Time interval =    0.0 (Min.)
                   Maximum/Peak flow rate =        0.000 (CFS)
                   Total volume =       0.000 (Ac.Ft)
            Status of hydrographs being held in storage
                       Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      -------------------------------------------------------------------
```

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                  FLOOD HYDROGRAPH ROUTING PROGRAM
         Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                     Study date: 02/21/18

---------------------------------------------------------------------
Area E Developed Condition - Mill Creek Promenade
2yr 24hr Unit Hydrograph
By Pacific Coast Land Consultants, Inc.

--------------------------------------------------------------------

Program License Serial Number 4066

--------------------------------------------------------------------
******************** HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHE242.rte
***************************HYDROGRAPH DATA***************************
             Number of intervals =   292
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        0.827 (CFS)
             Total volume =       0.456 (Ac.Ft)
      Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
*********************************************************************



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      501.000
**** RETARDING BASIN ROUTING ****
______________________________________________________________________

Program computation of outflow v. depth




CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   1.00(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    3.22(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.22(Ft.)    Capacity =   0.39(CFS)

Total outflow at this depth =      0.39(CFS)
```

CALCULATED OUTFLOW DATA AT DEPTH =   5.22(Ft.))

Free outlet pipe flow: Pipe Diameter =   0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   5.22(Ft.)   Capacity =   0.39(CFS)

Free outlet pipe flow: Pipe Diameter =   2.20(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   0.52(Ft.)   Capacity = 21.93(CFS)

Total outflow at this depth =   22.32(CFS)

Total number of inflow hydrograph intervals = 292
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)

Initial basin depth =   0.00 (Ft.)
Initial basin storage =   0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
1.000	0.098	0.393	0.097	0.099
3.220	0.261	0.393	0.260	0.262
5.220	0.652	22.322	0.575	0.729

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

```
--------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                    Depth
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0        0.2    0.41    0.62    0.83 (Ft.)
 0.083    0.03    0.00      0.000  OI       |       |       |       |     0.00
 0.167    0.06    0.00      0.000  O I      |       |       |       |     0.00
 0.250    0.06    0.00      0.001  O I      |       |       |       |     0.01
 0.333    0.08    0.00      0.001  O I      |       |       |       |     0.01
 0.417    0.09    0.01      0.002  O  I     |       |       |       |     0.02
 0.500    0.09    0.01      0.002  O  I     |       |       |       |     0.02
 0.583    0.10    0.01      0.003  O  I     |       |       |       |     0.03
 0.667    0.10    0.01      0.003  O  I     |       |       |       |     0.04
 0.750    0.10    0.02      0.004  O  I     |       |       |       |     0.04
 0.833    0.11    0.02      0.005  O   I    |       |       |       |     0.05
 0.917    0.12    0.02      0.005  O   I    |       |       |       |     0.05
 1.000    0.13    0.02      0.006  O   I    |       |       |       |     0.06
 1.083    0.11    0.03      0.007  |O  I    |       |       |       |     0.07
 1.167    0.10    0.03      0.007  |O I     |       |       |       |     0.07
 1.250    0.10    0.03      0.008  |O I     |       |       |       |     0.08
 1.333    0.10    0.03      0.008  |O I     |       |       |       |     0.08
 1.417    0.10    0.03      0.009  |O I     |       |       |       |     0.09
 1.500    0.10    0.04      0.009  |O I     |       |       |       |     0.09
 1.583    0.10    0.04      0.009  |O I     |       |       |       |     0.10
```

```
1.667    0.10     0.04       0.010  |O I    |       |       |       |      0.10
1.750    0.10     0.04       0.010  |O I    |       |       |       |      0.10
1.833    0.11     0.04       0.011  |O  I   |       |       |       |      0.11
1.917    0.12     0.04       0.011  |O  I   |       |       |       |      0.11
2.000    0.13     0.05       0.012  |O  I   |       |       |       |      0.12
2.083    0.13     0.05       0.012  |O  I   |       |       |       |      0.12
2.167    0.13     0.05       0.013  |O  I   |       |       |       |      0.13
2.250    0.13     0.05       0.013  | O I   |       |       |       |      0.14
2.333    0.13     0.06       0.014  | O I   |       |       |       |      0.14
2.417    0.13     0.06       0.014  | O I   |       |       |       |      0.15
2.500    0.13     0.06       0.015  | O I   |       |       |       |      0.15
2.583    0.14     0.06       0.015  | O  I  |       |       |       |      0.16
2.667    0.16     0.06       0.016  | O   I |       |       |       |      0.16
2.750    0.16     0.07       0.016  | O   I |       |       |       |      0.17
2.833    0.16     0.07       0.017  | O   I |       |       |       |      0.17
2.917    0.16     0.07       0.018  | O   I |       |       |       |      0.18
3.000    0.16     0.07       0.018  | O   I |       |       |       |      0.19
3.083    0.16     0.08       0.019  | O   I |       |       |       |      0.19
3.167    0.16     0.08       0.020  |  O  I |       |       |       |      0.20
3.250    0.16     0.08       0.020  |  O  I |       |       |       |      0.20
3.333    0.16     0.08       0.021  |  O  I |       |       |       |      0.21
3.417    0.16     0.08       0.021  |  O  I |       |       |       |      0.22
3.500    0.16     0.09       0.022  |  O  I |       |       |       |      0.22
3.583    0.16     0.09       0.022  |  O  I |       |       |       |      0.23
3.667    0.16     0.09       0.023  |  O  I |       |       |       |      0.23
3.750    0.16     0.09       0.023  |  O  I |       |       |       |      0.24
3.833    0.17     0.09       0.024  |  O  I |       |       |       |      0.24
3.917    0.19     0.10       0.024  |  O   I|       |       |       |      0.25
4.000    0.19     0.10       0.025  |  O   I|       |       |       |      0.25
4.083    0.19     0.10       0.025  |  O   I|       |       |       |      0.26
4.167    0.19     0.10       0.026  |   O  I|       |       |       |      0.27
4.250    0.19     0.11       0.027  |   O  I|       |       |       |      0.27
4.333    0.21     0.11       0.027  |   O  I|       |       |       |      0.28
4.417    0.22     0.11       0.028  |   O   I       |       |       |      0.29
4.500    0.22     0.12       0.029  |   O   I       |       |       |      0.29
4.583    0.22     0.12       0.029  |   O   I       |       |       |      0.30
4.667    0.22     0.12       0.030  |   O   I       |       |       |      0.31
4.750    0.22     0.12       0.031  |   O   I       |       |       |      0.32
4.833    0.24     0.13       0.032  |   O   |I      |       |       |      0.32
4.917    0.25     0.13       0.032  |    O  |I      |       |       |      0.33
5.000    0.25     0.13       0.033  |    O  |I      |       |       |      0.34
5.083    0.23     0.14       0.034  |    O  I       |       |       |      0.35
5.167    0.20     0.14       0.035  |    O I|       |       |       |      0.35
5.250    0.20     0.14       0.035  |    O I|       |       |       |      0.36
5.333    0.21     0.14       0.035  |    O I|       |       |       |      0.36
5.417    0.22     0.14       0.036  |    O  I       |       |       |      0.37
5.500    0.22     0.15       0.036  |    O  I       |       |       |      0.37
5.583    0.24     0.15       0.037  |    O  |I      |       |       |      0.38
5.667    0.25     0.15       0.038  |    O  |I      |       |       |      0.38
5.750    0.25     0.15       0.038  |    O  |I      |       |       |      0.39
5.833    0.26     0.16       0.039  |     O |I      |       |       |      0.40
5.917    0.26     0.16       0.040  |     O |I      |       |       |      0.40
6.000    0.26     0.16       0.040  |     O |I      |       |       |      0.41
6.083    0.27     0.16       0.041  |     O | I     |       |       |      0.42
6.167    0.28     0.17       0.042  |     O | I     |       |       |      0.43
6.250    0.29     0.17       0.043  |     O |  I    |       |       |      0.43
6.333    0.29     0.17       0.043  |     O |  I    |       |       |      0.44
6.417    0.29     0.18       0.044  |     O |  I    |       |       |      0.45
6.500    0.29     0.18       0.045  |     O |  I    |       |       |      0.46
6.583    0.30     0.18       0.046  |      O|  I    |       |       |      0.47
6.667    0.32     0.19       0.047  |      O|   I   |       |       |      0.47
6.750    0.32     0.19       0.047  |      O|   I   |       |       |      0.48
6.833    0.32     0.19       0.048  |      O|   I   |       |       |      0.49
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 6.917    0.32    0.20      0.049   |      O|   I   |       |       |     0.50
 7.000    0.32    0.20      0.050   |      O|   I   |       |       |     0.51
 7.083    0.32    0.20      0.051   |      O|   I   |       |       |     0.52
 7.167    0.32    0.21      0.052   |       O   I   |       |       |     0.53
 7.250    0.32    0.21      0.052   |       O   I   |       |       |     0.53
 7.333    0.33    0.21      0.053   |       O   I   |       |       |     0.54
 7.417    0.35    0.22      0.054   |       O    I  |       |       |     0.55
 7.500    0.35    0.22      0.055   |       O    I  |       |       |     0.56
 7.583    0.37    0.22      0.056   |       O     I |       |       |     0.57
 7.667    0.38    0.23      0.057   |       O     I |       |       |     0.58
 7.750    0.38    0.23      0.058   |       O     I |       |       |     0.59
 7.833    0.40    0.24      0.059   |       |O     I|       |       |     0.60
 7.917    0.41    0.24      0.060   |       |O     I|       |       |     0.61
 8.000    0.42    0.25      0.061   |       |O      I       |       |     0.63
 8.083    0.44    0.25      0.063   |       |O      |I      |       |     0.64
 8.167    0.47    0.26      0.064   |       |O      | I     |       |     0.65
 8.250    0.48    0.26      0.065   |       | O     | I     |       |     0.67
 8.333    0.48    0.27      0.067   |       | O     | I     |       |     0.68
 8.417    0.48    0.27      0.068   |       | O     | I     |       |     0.70
 8.500    0.48    0.28      0.070   |       | O     | I     |       |     0.71
 8.583    0.49    0.29      0.071   |       |  O    |  I    |       |     0.73
 8.667    0.51    0.29      0.073   |       |  O    |  I    |       |     0.74
 8.750    0.51    0.30      0.074   |       |  O    |  I    |       |     0.76
 8.833    0.30    0.30      0.075   |       |  O    |       |       |     0.76
 8.917    0.08    0.30      0.074   | I     |  O    |       |       |     0.76
 9.000    0.03    0.29      0.072   |I      |  O    |       |       |     0.74
 9.083    0.05    0.28      0.071   |I      | O     |       |       |     0.72
 9.167    0.08    0.28      0.069   |  I    | O     |       |       |     0.71
 9.250    0.09    0.27      0.068   |  I    | O     |       |       |     0.69
 9.333    0.12    0.27      0.067   |   I   | O     |       |       |     0.68
 9.417    0.14    0.26      0.066   |    I  | O     |       |       |     0.67
 9.500    0.14    0.26      0.065   |    I  | O     |       |       |     0.66
 9.583    0.16    0.26      0.064   |     I |O      |       |       |     0.66
 9.667    0.18    0.26      0.064   |      I|O      |       |       |     0.65
 9.750    0.19    0.25      0.063   |      I|O      |       |       |     0.65
 9.833    0.21    0.25      0.063   |       IO      |       |       |     0.64
 9.917    0.23    0.25      0.063   |       |O      |       |       |     0.64
10.000    0.24    0.25      0.063   |       |O      |       |       |     0.64
10.083    0.34    0.25      0.063   |       |O   I  |       |       |     0.64
10.167    0.45    0.26      0.064   |       |O      |I      |       |     0.65
10.250    0.47    0.26      0.065   |       | O     | I     |       |     0.67
10.333    0.48    0.27      0.067   |       | O     | I     |       |     0.68
10.417    0.48    0.27      0.068   |       | O     | I     |       |     0.69
10.500    0.48    0.28      0.070   |       | O     | I     |       |     0.71
10.583    0.36    0.28      0.070   |       | O   I |       |       |     0.72
10.667    0.23    0.28      0.071   |       I O     |       |       |     0.72
10.750    0.20    0.28      0.070   |      I| O     |       |       |     0.71
10.833    0.20    0.28      0.070   |      I| O     |       |       |     0.71
10.917    0.20    0.28      0.069   |      I| O     |       |       |     0.70
11.000    0.20    0.27      0.068   |      I| O     |       |       |     0.70
11.083    0.18    0.27      0.068   |      I| O     |       |       |     0.69
11.167    0.17    0.27      0.067   |     I | O     |       |       |     0.69
11.250    0.17    0.27      0.067   |     I | O     |       |       |     0.68
11.333    0.17    0.26      0.066   |     I | O     |       |       |     0.67
11.417    0.17    0.26      0.065   |     I | O     |       |       |     0.67
11.500    0.18    0.26      0.065   |     I | O     |       |       |     0.66
11.583    0.15    0.26      0.064   |    I  |O      |       |       |     0.65
11.667    0.11    0.25      0.063   |   I   |O      |       |       |     0.64
11.750    0.11    0.25      0.062   |   I   |O      |       |       |     0.63
11.833    0.13    0.25      0.061   |   I   |O      |       |       |     0.63
11.917    0.15    0.24      0.061   |    I  |O      |       |       |     0.62
12.000    0.15    0.24      0.060   |    I  |O      |       |       |     0.61
12.083    0.27    0.24      0.060   |       |OI     |       |       |     0.61
```

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12.167    0.39    0.24      0.060  |       |O     I|       |       |     0.62
12.250    0.42    0.25      0.061  |       |O      I       |       |     0.63
12.333    0.45    0.25      0.063  |       |O      |I      |       |     0.64
12.417    0.47    0.26      0.064  |       |O      | I     |       |     0.66
12.500    0.48    0.26      0.066  |       | O     | I     |       |     0.67
12.583    0.52    0.27      0.067  |       | O     |   I   |       |     0.69
12.667    0.56    0.28      0.069  |       | O     |    I  |       |     0.71
12.750    0.57    0.28      0.071  |       |  O    |    I  |       |     0.72
12.833    0.59    0.29      0.073  |       |  O    |     I |       |     0.74
12.917    0.61    0.30      0.075  |       |  O    |      I|       |     0.77
13.000    0.61    0.31      0.077  |       |  O    |      I|       |     0.79
13.083    0.70    0.32      0.080  |       |   O   |       |  I    |     0.81
13.167    0.79    0.33      0.082  |       |   O   |       |     I |     0.84
13.250    0.81    0.34      0.086  |       |    O  |       |      I|     0.87
13.333    0.82    0.36      0.089  |       |    O  |       |      I|     0.91
13.417    0.82    0.37      0.092  |       |     O |       |      I|     0.94
13.500    0.83    0.38      0.095  |       |     O |       |       I     0.97
13.583    0.65    0.39      0.097  |       |      O|       |I      |     0.99
13.667    0.46    0.39      0.099  |       |      O|I      |       |     1.01
13.750    0.43    0.39      0.099  |       |      OI       |       |     1.01
13.833    0.41    0.39      0.099  |       |      O|       |       |     1.02
13.917    0.41    0.39      0.099  |       |      O|       |       |     1.02
14.000    0.41    0.39      0.099  |       |      O|       |       |     1.02
14.083    0.48    0.39      0.100  |       |      O| I     |       |     1.02
14.167    0.55    0.39      0.101  |       |      O|    I  |       |     1.04
14.250    0.57    0.39      0.102  |       |      O|    I  |       |     1.05
14.333    0.56    0.39      0.103  |       |      O|    I  |       |     1.07
14.417    0.55    0.39      0.104  |       |      O|    I  |       |     1.08
14.500    0.55    0.39      0.105  |       |      O|    I  |       |     1.10
14.583    0.55    0.39      0.106  |       |      O|    I  |       |     1.11
14.667    0.55    0.39      0.107  |       |      O|    I  |       |     1.13
14.750    0.55    0.39      0.108  |       |      O|    I  |       |     1.14
14.833    0.54    0.39      0.109  |       |      O|   I   |       |     1.15
14.917    0.52    0.39      0.110  |       |      O|   I   |       |     1.17
15.000    0.52    0.39      0.111  |       |      O|   I   |       |     1.18
15.083    0.51    0.39      0.112  |       |      O|  I    |       |     1.19
15.167    0.49    0.39      0.113  |       |      O| I     |       |     1.20
15.250    0.49    0.39      0.113  |       |      O| I     |       |     1.21
15.333    0.47    0.39      0.114  |       |      O| I     |       |     1.22
15.417    0.46    0.39      0.114  |       |      O|I      |       |     1.22
15.500    0.46    0.39      0.115  |       |      O|I      |       |     1.23
15.583    0.39    0.39      0.115  |       |      O|       |       |     1.23
15.667    0.32    0.39      0.115  |       |   I  O|       |       |     1.23
15.750    0.31    0.39      0.114  |       |   I  O|       |       |     1.22
15.833    0.31    0.39      0.114  |       |  I   O|       |       |     1.22
15.917    0.31    0.39      0.113  |       |  I   O|       |       |     1.21
16.000    0.31    0.39      0.113  |       |   I  O|       |       |     1.20
16.083    0.23    0.39      0.112  |       |I     O|       |       |     1.19
16.167    0.15    0.39      0.110  |    I  |      O|       |       |     1.17
16.250    0.14    0.39      0.109  |    I  |      O|       |       |     1.15
16.333    0.13    0.39      0.107  |    I  |      O|       |       |     1.12
16.417    0.13    0.39      0.105  |   I   |      O|       |       |     1.10
16.500    0.13    0.39      0.103  |   I   |      O|       |       |     1.07
16.583    0.11    0.39      0.101  |   I   |      O|       |       |     1.05
16.667    0.10    0.39      0.100  |  I    |      O|       |       |     1.02
16.750    0.10    0.39      0.098  |  I    |      O|       |       |     1.00
16.833    0.10    0.38      0.096  |  I    |     O |       |       |     0.97
16.917    0.10    0.38      0.094  |  I    |     O |       |       |     0.95
17.000    0.10    0.37      0.092  |  I    |     O |       |       |     0.94
17.083    0.12    0.36      0.090  |   I   |    O  |       |       |     0.92
17.167    0.15    0.35      0.088  |    I  |    O  |       |       |     0.90
17.250    0.16    0.35      0.087  |     I |    O  |       |       |     0.89
17.333    0.16    0.34      0.086  |     I |    O  |       |       |     0.87
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17.417    0.16    0.34      0.084  |     I |    O  |       |       |    0.86
17.500    0.16    0.33      0.083  |     I |   O   |       |       |    0.85
17.583    0.16    0.33      0.082  |     I |   O   |       |       |    0.84
17.667    0.16    0.32      0.081  |     I |   O   |       |       |    0.83
17.750    0.16    0.32      0.080  |     I |   O   |       |       |    0.81
17.833    0.15    0.32      0.079  |    I  |   O   |       |       |    0.80
17.917    0.13    0.31      0.078  |    I  |   O   |       |       |    0.79
18.000    0.13    0.31      0.076  |    I  |  O    |       |       |    0.78
18.083    0.13    0.30      0.075  |   I   |  O    |       |       |    0.77
18.167    0.13    0.30      0.074  |   I   |  O    |       |       |    0.75
18.250    0.13    0.29      0.073  |   I   |  O    |       |       |    0.74
18.333    0.13    0.29      0.072  |   I   |  O    |       |       |    0.73
18.417    0.13    0.28      0.071  |   I   | O     |       |       |    0.72
18.500    0.13    0.28      0.070  |   I   | O     |       |       |    0.71
18.583    0.11    0.27      0.068  |   I   | O     |       |       |    0.70
18.667    0.10    0.27      0.067  |  I    | O     |       |       |    0.69
18.750    0.10    0.27      0.066  |  I    | O     |       |       |    0.68
18.833    0.08    0.26      0.065  |  I    | O     |       |       |    0.66
18.917    0.07    0.26      0.064  | I     |O      |       |       |    0.65
19.000    0.07    0.25      0.062  | I     |O      |       |       |    0.64
19.083    0.08    0.25      0.061  |  I    |O      |       |       |    0.62
19.167    0.09    0.24      0.060  |  I    |O      |       |       |    0.61
19.250    0.09    0.24      0.059  |  I    |O      |       |       |    0.60
19.333    0.11    0.23      0.058  |   I   |O      |       |       |    0.59
19.417    0.12    0.23      0.057  |   I   O       |       |       |    0.59
19.500    0.13    0.23      0.057  |   I   O       |       |       |    0.58
19.583    0.11    0.22      0.056  |   I   O       |       |       |    0.57
19.667    0.10    0.22      0.055  |  I    O       |       |       |    0.56
19.750    0.10    0.22      0.054  |  I    O       |       |       |    0.55
19.833    0.08    0.21      0.053  |  I    O       |       |       |    0.55
19.917    0.07    0.21      0.053  | I     O       |       |       |    0.54
20.000    0.07    0.21      0.052  | I     O       |       |       |    0.53
20.083    0.08    0.20      0.051  |  I   O|       |       |       |    0.52
20.167    0.09    0.20      0.050  |  I   O|       |       |       |    0.51
20.250    0.09    0.20      0.049  |  I   O|       |       |       |    0.50
20.333    0.10    0.19      0.048  |  I   O|       |       |       |    0.49
20.417    0.10    0.19      0.048  |  I   O|       |       |       |    0.49
20.500    0.10    0.19      0.047  |  I   O|       |       |       |    0.48
20.583    0.10    0.19      0.046  |  I   O|       |       |       |    0.47
20.667    0.10    0.18      0.046  |  I   O|       |       |       |    0.47
20.750    0.10    0.18      0.045  |  I   O|       |       |       |    0.46
20.833    0.08    0.18      0.045  |  I  O |       |       |       |    0.46
20.917    0.07    0.18      0.044  | I   O |       |       |       |    0.45
21.000    0.07    0.17      0.043  | I   O |       |       |       |    0.44
21.083    0.08    0.17      0.043  |  I  O |       |       |       |    0.43
21.167    0.09    0.17      0.042  |  I  O |       |       |       |    0.43
21.250    0.09    0.17      0.041  |  I  O |       |       |       |    0.42
21.333    0.08    0.16      0.041  |  I  O |       |       |       |    0.42
21.417    0.07    0.16      0.040  | I   O |       |       |       |    0.41
21.500    0.07    0.16      0.040  | I   O |       |       |       |    0.40
21.583    0.08    0.16      0.039  |  I  O |       |       |       |    0.40
21.667    0.09    0.15      0.039  |  I O  |       |       |       |    0.39
21.750    0.09    0.15      0.038  |  I O  |       |       |       |    0.39
21.833    0.08    0.15      0.038  |  I O  |       |       |       |    0.38
21.917    0.07    0.15      0.037  | I  O  |       |       |       |    0.38
22.000    0.07    0.15      0.037  | I  O  |       |       |       |    0.37
22.083    0.08    0.14      0.036  |  I O  |       |       |       |    0.37
22.167    0.09    0.14      0.036  |  I O  |       |       |       |    0.36
22.250    0.09    0.14      0.035  |  I O  |       |       |       |    0.36
22.333    0.08    0.14      0.035  |  I O  |       |       |       |    0.36
22.417    0.07    0.14      0.035  | I  O  |       |       |       |    0.35
22.500    0.07    0.14      0.034  | I  O  |       |       |       |    0.35
22.583    0.06    0.13      0.034  | I  O  |       |       |       |    0.34
```

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22.667    0.06    0.13      0.033  | I  O  |       |       |       |     0.34
22.750    0.06    0.13      0.033  | I  O  |       |       |       |     0.33
22.833    0.06    0.13      0.032  | I O   |       |       |       |     0.33
22.917    0.06    0.13      0.032  | I O   |       |       |       |     0.32
23.000    0.06    0.13      0.031  | I O   |       |       |       |     0.32
23.083    0.06    0.12      0.031  | I O   |       |       |       |     0.32
23.167    0.06    0.12      0.031  | I O   |       |       |       |     0.31
23.250    0.06    0.12      0.030  | I O   |       |       |       |     0.31
23.333    0.06    0.12      0.030  | I O   |       |       |       |     0.30
23.417    0.06    0.12      0.029  | I O   |       |       |       |     0.30
23.500    0.06    0.12      0.029  | I O   |       |       |       |     0.30
23.583    0.06    0.11      0.029  | I O   |       |       |       |     0.29
23.667    0.06    0.11      0.028  | I O   |       |       |       |     0.29
23.750    0.06    0.11      0.028  | I O   |       |       |       |     0.29
23.833    0.06    0.11      0.028  | I O   |       |       |       |     0.28
23.917    0.06    0.11      0.027  | I O   |       |       |       |     0.28
24.000    0.06    0.11      0.027  | I O   |       |       |       |     0.28
24.083    0.04    0.11      0.027  |I   O  |       |       |       |     0.27
24.167    0.01    0.10      0.026  I    O  |       |       |       |     0.27
24.250    0.00    0.10      0.025  I  O    |       |       |       |     0.26
24.333    0.00    0.10      0.025  I  O    |       |       |       |     0.25
24.417    0.00    0.10      0.024  I  O    |       |       |       |     0.25


      Remaining water in basin =    0.02 (Ac.Ft)


      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =   293
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.393 (CFS)
                   Total volume =       0.432 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      --------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      502.100 to Point/Station      10.000
      **** STREAM ROUTING SCS CONVEX METHOD ****
      ______________________________________________________________________
      HYDROGRAPH STREAM ROUTING DATA:
      Length of stream =   1281.00 (Ft.)
      Elevation difference =    9.20 (Ft.)
      Slope of channel =  0.007182 (Vert/Horiz)
      Channel type - Pipe


      Pipe length  =  1281.00(Ft.)   Elevation difference =   9.20(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using mean flow rate of hydrograph
      Required pipe flow  =     0.229(CFS)
      Nearest computed pipe diameter  =      6.00(In.)
      Calculated individual pipe flow  =     0.229(CFS)
      Normal flow depth in pipe =    2.93(In.)
      Flow top width inside pipe =    6.00(In.)
      Critical Depth =    0.24(Ft.)
      Pipe flow velocity =      2.40(Ft/s)
      Travel time through pipe =    8.90 min.
```

```
Pipe length  =  1281.00(Ft.)   Elevation difference =   9.20(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using maximum flow rate of hydrograph
Required pipe flow  =     0.393(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.393(CFS)
Normal flow depth in pipe =    4.16(In.)
Flow top width inside pipe =    5.53(In.)
Critical Depth =    0.32(Ft.)
Pipe flow velocity =      2.71(Ft/s)
Travel time through pipe =    7.89 min.


********************** SCS CONVEX CHANNEL ROUTING ********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
         where c* = 1 - (1-c)^e and dt = c(length)/velocity
         c(v/v+1.7) =   0.6142   Travel time =   7.89 (min.)
       dt*(unit time interval) =   5.00(min.),  e=   1.0213
       dt(routing time-step) =   4.85 (min.),   c* =   0.6219

Output hydrograph delayed by 0  unit time increments


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
               R u n o f f     H y d r o g r a p h
---------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

---------------------------------------------------------------------
Time(h+m) Out = O(CFS) In = I  0        0.1       0.2       0.3       0.4
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  O         |         |         |         |
  0+10       0.0003      0.00  O         |         |         |         |
  0+15       0.0010      0.00  O         |         |         |         |
  0+20       0.0023      0.00  O         |         |         |         |
  0+25       0.0039      0.01  O         |         |         |         |
  0+30       0.0059      0.01  O         |         |         |         |
  0+35       0.0081      0.01  OI        |         |         |         |
  0+40       0.0104      0.01  |O        |         |         |         |
  0+45       0.0126      0.02  |O        |         |         |         |
  0+50       0.0149      0.02  |O        |         |         |         |
  0+55       0.0172      0.02  |OI       |         |         |         |
  1+ 0       0.0198      0.02  | O       |         |         |         |
  1+ 5       0.0225      0.03  | O       |         |         |         |
  1+10       0.0252      0.03  | O       |         |         |         |
  1+15       0.0275      0.03  | OI      |         |         |         |
  1+20       0.0296      0.03  |  O      |         |         |         |
  1+25       0.0315      0.03  |  O      |         |         |         |
  1+30       0.0333      0.04  |  O      |         |         |         |
  1+35       0.0350      0.04  |  O      |         |         |         |
  1+40       0.0367      0.04  |  O      |         |         |         |
  1+45       0.0383      0.04  |  OI     |         |         |         |
  1+50       0.0399      0.04  |   O     |         |         |         |
  1+55       0.0416      0.04  |   O     |         |         |         |
  2+ 0       0.0435      0.05  |   O     |         |         |         |
  2+ 5       0.0455      0.05  |   O     |         |         |         |
  2+10       0.0477      0.05  |   OI    |         |         |         |
  2+15       0.0498      0.05  |    O    |         |         |         |
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2+20       0.0520      0.06   |    O    |         |         |         |
2+25       0.0540      0.06   |    O    |         |         |         |
2+30       0.0560      0.06   |    OI   |         |         |         |
2+35       0.0580      0.06   |    OI   |         |         |         |
2+40       0.0601      0.06   |     O   |         |         |         |
2+45       0.0623      0.07   |     O   |         |         |         |
2+50       0.0647      0.07   |     O   |         |         |         |
2+55       0.0672      0.07   |     OI  |         |         |         |
3+ 0       0.0697      0.07   |      O  |         |         |         |
3+ 5       0.0722      0.08   |      O  |         |         |         |
3+10       0.0746      0.08   |      O  |         |         |         |
3+15       0.0769      0.08   |      OI |         |         |         |
3+20       0.0792      0.08   |       O |         |         |         |
3+25       0.0814      0.08   |       O |         |         |         |
3+30       0.0835      0.09   |       O |         |         |         |
3+35       0.0856      0.09   |       OI|         |         |         |
3+40       0.0877      0.09   |       OI|         |         |         |
3+45       0.0896      0.09   |        O|         |         |         |
3+50       0.0916      0.09   |        O|         |         |         |
3+55       0.0936      0.10   |        O|         |         |         |
4+ 0       0.0958      0.10   |        OI         |         |         |
4+ 5       0.0982      0.10   |        OI         |         |         |
4+10       0.1006      0.10   |         O         |         |         |
4+15       0.1031      0.11   |         O         |         |         |
4+20       0.1055      0.11   |         OI        |         |         |
4+25       0.1080      0.11   |         OI        |         |         |
4+30       0.1107      0.12   |         |O        |         |         |
4+35       0.1136      0.12   |         |OI       |         |         |
4+40       0.1165      0.12   |         |OI       |         |         |
4+45       0.1194      0.12   |         | O       |         |         |
4+50       0.1222      0.13   |         | O       |         |         |
4+55       0.1251      0.13   |         | OI      |         |         |
5+ 0       0.1282      0.13   |         |  O      |         |         |
5+ 5       0.1315      0.14   |         |  O      |         |         |
5+10       0.1345      0.14   |         |  OI     |         |         |
5+15       0.1370      0.14   |         |  OI     |         |         |
5+20       0.1390      0.14   |         |   O     |         |         |
5+25       0.1407      0.14   |         |   O     |         |         |
5+30       0.1426      0.15   |         |   O     |         |         |
5+35       0.1447      0.15   |         |   OI    |         |         |
5+40       0.1469      0.15   |         |   OI    |         |         |
5+45       0.1493      0.15   |         |    O    |         |         |
5+50       0.1520      0.16   |         |    O    |         |         |
5+55       0.1547      0.16   |         |    OI   |         |         |
6+ 0       0.1575      0.16   |         |     O   |         |         |
6+ 5       0.1601      0.16   |         |     O   |         |         |
6+10       0.1629      0.17   |         |     OI  |         |         |
6+15       0.1658      0.17   |         |     OI  |         |         |
6+20       0.1689      0.17   |         |      O  |         |         |
6+25       0.1721      0.18   |         |      OI |         |         |
6+30       0.1752      0.18   |         |      OI |         |         |
6+35       0.1783      0.18   |         |       O |         |         |
6+40       0.1814      0.19   |         |       O |         |         |
6+45       0.1847      0.19   |         |       OI|         |         |
6+50       0.1882      0.19   |         |        O|         |         |
6+55       0.1917      0.20   |         |        OI         |         |
7+ 0       0.1952      0.20   |         |        OI         |         |
7+ 5       0.1986      0.20   |         |         O         |         |
7+10       0.2019      0.21   |         |         OI        |         |
7+15       0.2051      0.21   |         |         OI        |         |
7+20       0.2083      0.21   |         |         |O        |         |
7+25       0.2114      0.22   |         |         |OI       |         |
7+30       0.2148      0.22   |         |         |OI       |         |
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 7+35       0.2183      0.22  |         |         | O       |         |
 7+40       0.2220      0.23  |         |         | OI      |         |
 7+45       0.2259      0.23  |         |         | OI      |         |
 7+50       0.2300      0.24  |         |         |  OI     |         |
 7+55       0.2342      0.24  |         |         |  OI     |         |
 8+ 0       0.2387      0.25  |         |         |   OI    |         |
 8+ 5       0.2433      0.25  |         |         |   OI    |         |
 8+10       0.2482      0.26  |         |         |    OI   |         |
 8+15       0.2535      0.26  |         |         |    OI   |         |
 8+20       0.2592      0.27  |         |         |     OI  |         |
 8+25       0.2650      0.27  |         |         |     OI  |         |
 8+30       0.2708      0.28  |         |         |      OI |         |
 8+35       0.2765      0.29  |         |         |       OI|         |
 8+40       0.2822      0.29  |         |         |       OI|         |
 8+45       0.2880      0.30  |         |         |        OI         |
 8+50       0.2938      0.30  |         |         |        OI         |
 8+55       0.2977      0.30  |         |         |         O         |
 9+ 0       0.2972      0.29  |         |         |        IO         |
 9+ 5       0.2929      0.28  |         |         |       IO|         |
 9+10       0.2871      0.28  |         |         |       IO|         |
 9+15       0.2813      0.27  |         |         |      IO |         |
 9+20       0.2758      0.27  |         |         |      IO |         |
 9+25       0.2709      0.26  |         |         |     IO  |         |
 9+30       0.2667      0.26  |         |         |     IO  |         |
 9+35       0.2630      0.26  |         |         |     O   |         |
 9+40       0.2598      0.26  |         |         |     O   |         |
 9+45       0.2571      0.25  |         |         |    IO   |         |
 9+50       0.2550      0.25  |         |         |    O    |         |
 9+55       0.2533      0.25  |         |         |    O    |         |
10+ 0       0.2522      0.25  |         |         |    O    |         |
10+ 5       0.2515      0.25  |         |         |    O    |         |
10+10       0.2520      0.26  |         |         |    OI   |         |
10+15       0.2546      0.26  |         |         |    OI   |         |
10+20       0.2591      0.27  |         |         |     OI  |         |
10+25       0.2643      0.27  |         |         |     OI  |         |
10+30       0.2699      0.28  |         |         |      OI |         |
10+35       0.2755      0.28  |         |         |       O |         |
10+40       0.2799      0.28  |         |         |       O |         |
10+45       0.2817      0.28  |         |         |       O |         |
10+50       0.2812      0.28  |         |         |       O |         |
10+55       0.2797      0.28  |         |         |       O |         |
11+ 0       0.2777      0.27  |         |         |      IO |         |
11+ 5       0.2756      0.27  |         |         |      IO |         |
11+10       0.2734      0.27  |         |         |      O  |         |
11+15       0.2709      0.27  |         |         |      O  |         |
11+20       0.2683      0.26  |         |         |     IO  |         |
11+25       0.2657      0.26  |         |         |     IO  |         |
11+30       0.2631      0.26  |         |         |     O   |         |
11+35       0.2607      0.26  |         |         |     O   |         |
11+40       0.2581      0.25  |         |         |    IO   |         |
11+45       0.2549      0.25  |         |         |    O    |         |
11+50       0.2514      0.25  |         |         |    O    |         |
11+55       0.2478      0.24  |         |         |   IO    |         |
12+ 0       0.2446      0.24  |         |         |   O     |         |
12+ 5       0.2418      0.24  |         |         |   O     |         |
12+10       0.2404      0.24  |         |         |   O     |         |
12+15       0.2415      0.25  |         |         |   OI    |         |
12+20       0.2447      0.25  |         |         |   OI    |         |
12+25       0.2492      0.26  |         |         |    OI   |         |
12+30       0.2544      0.26  |         |         |    OI   |         |
12+35       0.2602      0.27  |         |         |     OI  |         |
12+40       0.2664      0.28  |         |         |      OI |         |
12+45       0.2732      0.28  |         |         |      OI |         |
```

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12+50       0.2806      0.29   |         |         |       OI|         |
12+55       0.2884      0.30   |         |         |        OI         |
13+ 0       0.2964      0.31   |         |         |         OI        |
13+ 5       0.3048      0.32   |         |         |         |OI       |
13+10       0.3139      0.33   |         |         |         |O I      |
13+15       0.3245      0.34   |         |         |         |  OI     |
13+20       0.3365      0.36   |         |         |         |   O I   |
13+25       0.3490      0.37   |         |         |         |    O I  |
13+30       0.3616      0.38   |         |         |         |     O I |
13+35       0.3741      0.39   |         |         |         |       OI|
13+40       0.3847      0.39   |         |         |         |        OI
13+45       0.3899      0.39   |         |         |         |        OI
13+50       0.3919      0.39   |         |         |         |        OI
13+55       0.3926      0.39   |         |         |         |        OI
14+ 0       0.3929      0.39   |         |         |         |        OI
14+ 5       0.3930      0.39   |         |         |         |        OI
14+10       0.3930      0.39   |         |         |         |        OI
14+15       0.3931      0.39   |         |         |         |        OI
14+20       0.3931      0.39   |         |         |         |        OI
14+25       0.3931      0.39   |         |         |         |        OI
14+30       0.3931      0.39   |         |         |         |        OI
14+35       0.3931      0.39   |         |         |         |        OI
14+40       0.3931      0.39   |         |         |         |        OI
14+45       0.3931      0.39   |         |         |         |        OI
14+50       0.3931      0.39   |         |         |         |        OI
14+55       0.3931      0.39   |         |         |         |        OI
15+ 0       0.3931      0.39   |         |         |         |        OI
15+ 5       0.3931      0.39   |         |         |         |        OI
15+10       0.3931      0.39   |         |         |         |        OI
15+15       0.3931      0.39   |         |         |         |        OI
15+20       0.3931      0.39   |         |         |         |        OI
15+25       0.3931      0.39   |         |         |         |        OI
15+30       0.3931      0.39   |         |         |         |        OI
15+35       0.3931      0.39   |         |         |         |        OI
15+40       0.3931      0.39   |         |         |         |        OI
15+45       0.3931      0.39   |         |         |         |        OI
15+50       0.3931      0.39   |         |         |         |        OI
15+55       0.3931      0.39   |         |         |         |        OI
16+ 0       0.3931      0.39   |         |         |         |        OI
16+ 5       0.3931      0.39   |         |         |         |        OI
16+10       0.3931      0.39   |         |         |         |        OI
16+15       0.3931      0.39   |         |         |         |        OI
16+20       0.3931      0.39   |         |         |         |        OI
16+25       0.3931      0.39   |         |         |         |        OI
16+30       0.3931      0.39   |         |         |         |         O
16+35       0.3931      0.39   |         |         |         |         O
16+40       0.3931      0.39   |         |         |         |         O
16+45       0.3930      0.39   |         |         |         |        O|
16+50       0.3917      0.38   |         |         |         |       IO|
16+55       0.3862      0.38   |         |         |         |       IO|
17+ 0       0.3793      0.37   |         |         |         |      IO |
17+ 5       0.3719      0.36   |         |         |         |     IO  |
17+10       0.3648      0.35   |         |         |         |     IO  |
17+15       0.3583      0.35   |         |         |         |    IO   |
17+20       0.3525      0.34   |         |         |         |   IO    |
17+25       0.3471      0.34   |         |         |         |   IO    |
17+30       0.3419      0.33   |         |         |         |  IO     |
17+35       0.3369      0.33   |         |         |         |  IO     |
17+40       0.3321      0.32   |         |         |         |  O      |
17+45       0.3274      0.32   |         |         |         | IO      |
17+50       0.3228      0.32   |         |         |         | O       |
17+55       0.3183      0.31   |         |         |         |IO       |
18+ 0       0.3136      0.31   |         |         |         |O        |
```

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18+ 5       0.3087      0.30  |         |         |         IO        |
18+10       0.3039      0.30  |         |         |         O         |
18+15       0.2992      0.29  |         |         |        IO         |
18+20       0.2945      0.29  |         |         |        O|         |
18+25       0.2900      0.28  |         |         |       IO|         |
18+30       0.2856      0.28  |         |         |       IO|         |
18+35       0.2813      0.27  |         |         |      IO |         |
18+40       0.2770      0.27  |         |         |      IO |         |
18+45       0.2726      0.27  |         |         |      O  |         |
18+50       0.2680      0.26  |         |         |     IO  |         |
18+55       0.2633      0.26  |         |         |     O   |         |
19+ 0       0.2584      0.25  |         |         |    IO   |         |
19+ 5       0.2533      0.25  |         |         |   IO    |         |
19+10       0.2484      0.24  |         |         |   IO    |         |
19+15       0.2438      0.24  |         |         |   O     |         |
19+20       0.2396      0.23  |         |         |  IO     |         |
19+25       0.2357      0.23  |         |         |  O      |         |
19+30       0.2323      0.23  |         |         |  O      |         |
19+35       0.2292      0.22  |         |         | IO      |         |
19+40       0.2262      0.22  |         |         | IO      |         |
19+45       0.2231      0.22  |         |         | O       |         |
19+50       0.2198      0.21  |         |         |IO       |         |
19+55       0.2164      0.21  |         |         |IO       |         |
20+ 0       0.2128      0.21  |         |         |O        |         |
20+ 5       0.2090      0.20  |         |         IO        |         |
20+10       0.2053      0.20  |         |         O         |         |
20+15       0.2019      0.20  |         |         O         |         |
20+20       0.1988      0.19  |         |        IO         |         |
20+25       0.1959      0.19  |         |        O|         |         |
20+30       0.1931      0.19  |         |        O|         |         |
20+35       0.1905      0.19  |         |       IO|         |         |
20+40       0.1879      0.18  |         |       IO|         |         |
20+45       0.1854      0.18  |         |       O |         |         |
20+50       0.1830      0.18  |         |       O |         |         |
20+55       0.1805      0.18  |         |      IO |         |         |
21+ 0       0.1778      0.17  |         |      IO |         |         |
21+ 5       0.1749      0.17  |         |      O  |         |         |
21+10       0.1721      0.17  |         |      O  |         |         |
21+15       0.1696      0.17  |         |     IO  |         |         |
21+20       0.1674      0.16  |         |     IO  |         |         |
21+25       0.1652      0.16  |         |     O   |         |         |
21+30       0.1629      0.16  |         |     O   |         |         |
21+35       0.1604      0.16  |         |    IO   |         |         |
21+40       0.1580      0.15  |         |    IO   |         |         |
21+45       0.1559      0.15  |         |    O    |         |         |
21+50       0.1541      0.15  |         |    O    |         |         |
21+55       0.1523      0.15  |         |    O    |         |         |
22+ 0       0.1503      0.15  |         |   IO    |         |         |
22+ 5       0.1482      0.14  |         |   IO    |         |         |
22+10       0.1461      0.14  |         |   O     |         |         |
22+15       0.1443      0.14  |         |   O     |         |         |
22+20       0.1428      0.14  |         |   O     |         |         |
22+25       0.1413      0.14  |         |   O     |         |         |
22+30       0.1396      0.14  |         |  IO     |         |         |
22+35       0.1378      0.13  |         |  IO     |         |         |
22+40       0.1359      0.13  |         |  O      |         |         |
22+45       0.1339      0.13  |         |  O      |         |         |
22+50       0.1321      0.13  |         |  O      |         |         |
22+55       0.1302      0.13  |         | IO      |         |         |
23+ 0       0.1284      0.13  |         | IO      |         |         |
23+ 5       0.1267      0.12  |         | O       |         |         |
23+10       0.1250      0.12  |         | O       |         |         |
23+15       0.1233      0.12  |         | O       |         |         |
```

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  23+20       0.1217      0.12  |         | O        |         |         |
  23+25       0.1201      0.12  |         |IO        |         |         |
  23+30       0.1186      0.12  |         |IO        |         |         |
  23+35       0.1171      0.11  |         |O         |         |         |
  23+40       0.1157      0.11  |         |O         |         |         |
  23+45       0.1143      0.11  |         |O         |         |         |
  23+50       0.1129      0.11  |         |O         |         |         |
  23+55       0.1116      0.11  |         |O         |         |         |
  24+ 0       0.1103      0.11  |         |O         |         |         |
  24+ 5       0.1090      0.11  |         IO         |         |         |
  24+10       0.1075      0.10  |         O          |         |         |
  24+15       0.1055      0.10  |         O          |         |         |
  24+20       0.1031      0.10  |         O          |         |         |
  24+25       0.1005      0.10  |        IO          |         |         |
  24+30       0.0961      0.00  I        O|          |         |         |
  24+35       0.0363      0.00  I  O      |          |         |         |
  24+40       0.0137      0.00  IO        |          |         |         |
  24+45       0.0052      0.00  O         |          |         |         |
  24+50       0.0020      0.00  O         |          |         |         |
  24+55       0.0000      0.00  O         |          |         |         |
-----------------------------------------------------------------------
      **************************HYDROGRAPH DATA***************************
                   Number of intervals =   299
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.393 (CFS)
                   Total volume =       0.432 (Ac.Ft)
            Status of hydrographs being held in storage
                       Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      *******************************************************************

      -----------------------------------------------------------------


      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      502.000 to Point/Station      602.000
      **** STORE OR DELETE CURRENT HYDROGRAPH ****
      ___________________________________________________________________
      Current stream hydrograph saved in file 27259EPOND224.rte
      **************************HYDROGRAPH DATA***************************
                   Number of intervals =     0
                   Time interval =    0.0 (Min.)
                   Maximum/Peak flow rate =        0.000 (CFS)
                   Total volume =       0.000 (Ac.Ft)
            Status of hydrographs being held in storage
                       Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      *******************************************************************

      -----------------------------------------------------------------
```

```
                 FLOOD HYDROGRAPH ROUTING PROGRAM
          Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                       Study date: 01/11/18

--------------------------------------------------------------------
Area F Developed Condition - Mill Creek Promenade
2yr 24hr Unit Hydrograph
By Pacific Coast Land Consultants, Inc.
--------------------------------------------------------------------
Program License Serial Number 4066
--------------------------------------------------------------------
********************* HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHF1242.rte
*************************HYDROGRAPH DATA**************************
             Number of intervals =   291
             Time interval =    5.0 (Min.)
             Maximum/Peak flow rate =        0.556 (CFS)
             Total volume =       0.314 (Ac.Ft)
      Status of hydrographs being held in storage
                Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
**********************************************************************
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      602.000 to Point/Station      603.000
**** ADD/COMBINE/RECOVER HYDROGRAPHS ****
______________________________________________________________________
********************* HYDROGRAPH INFORMATION *********************

             From study/file name: 27259UHF2242.rte
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                 P R I N T  O F  S T O R M
              R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

--------------------------------------------------------------------
Time(h+m) Add q(CFS)  Tot. Q   0         0.2       0.4       0.7       0.9
---------------------------------------------------------------------
  0+ 5       0.0157      0.04  qQ        |         |         |         |
  0+10       0.0263      0.07  |q Q      |         |         |         |
  0+15       0.0282      0.07  |q Q      |         |         |         |
  0+20       0.0360      0.09  |q  Q     |         |         |         |
  0+25       0.0413      0.11  |q  Q     |         |         |         |
  0+30       0.0422      0.11  |q  Q     |         |         |         |
  0+35       0.0422      0.11  |q   Q    |         |         |         |
  0+40       0.0422      0.11  |q   Q    |         |         |         |
  0+45       0.0422      0.11  |q   Q    |         |         |         |
  0+50       0.0501      0.13  | q  Q    |         |         |         |
  0+55       0.0554      0.15  | q   Q   |         |         |         |
  1+ 0       0.0563      0.15  | q   Q   |         |         |         |
  1+ 5       0.0485      0.13  | q  Q    |         |         |         |
  1+10       0.0432      0.12  |q   Q    |         |         |         |
  1+15       0.0422      0.11  |q   Q    |         |         |         |
  1+20       0.0422      0.11  |q   Q    |         |         |         |
  1+25       0.0422      0.11  |q   Q    |         |         |         |
  1+30       0.0422      0.11  |q   Q    |         |         |         |
  1+35       0.0422      0.11  |q   Q    |         |         |         |
  1+40       0.0422      0.11  |q   Q    |         |         |         |
  1+45       0.0422      0.11  |q   Q    |         |         |         |
```

```
1+50       0.0501      0.13   | q  Q    |         |         |         |
1+55       0.0554      0.15   | q   Q   |         |         |         |
2+ 0       0.0563      0.15   | q   Q   |         |         |         |
2+ 5       0.0563      0.15   | q   Q   |         |         |         |
2+10       0.0563      0.15   | q   Q   |         |         |         |
2+15       0.0563      0.15   | q   Q   |         |         |         |
2+20       0.0563      0.15   | q   Q   |         |         |         |
2+25       0.0563      0.15   | q   Q   |         |         |         |
2+30       0.0563      0.15   | q   Q   |         |         |         |
2+35       0.0641      0.17   | q    Q  |         |         |         |
2+40       0.0694      0.18   |  q    Q |         |         |         |
2+45       0.0704      0.19   |  q    Q |         |         |         |
2+50       0.0704      0.19   |  q    Q |         |         |         |
2+55       0.0704      0.19   |  q    Q |         |         |         |
3+ 0       0.0704      0.19   |  q    Q |         |         |         |
3+ 5       0.0704      0.19   |  q    Q |         |         |         |
3+10       0.0704      0.19   |  q    Q |         |         |         |
3+15       0.0704      0.19   |  q    Q |         |         |         |
3+20       0.0704      0.19   |  q    Q |         |         |         |
3+25       0.0704      0.19   |  q    Q |         |         |         |
3+30       0.0704      0.19   |  q    Q |         |         |         |
3+35       0.0704      0.19   |  q    Q |         |         |         |
3+40       0.0704      0.19   |  q    Q |         |         |         |
3+45       0.0704      0.19   |  q    Q |         |         |         |
3+50       0.0782      0.20   |  q     Q|         |         |         |
3+55       0.0835      0.22   |  q     Q|         |         |         |
4+ 0       0.0845      0.22   |  q     Q|         |         |         |
4+ 5       0.0845      0.22   |  q      Q         |         |         |
4+10       0.0845      0.22   |  q      Q         |         |         |
4+15       0.0845      0.22   |  q      Q         |         |         |
4+20       0.0923      0.24   |   q     Q         |         |         |
4+25       0.0976      0.26   |   q     |Q        |         |         |
4+30       0.0985      0.26   |   q     |Q        |         |         |
4+35       0.0985      0.26   |   q     |Q        |         |         |
4+40       0.0985      0.26   |   q     |Q        |         |         |
4+45       0.0985      0.26   |   q     |Q        |         |         |
4+50       0.1064      0.28   |   q     | Q       |         |         |
4+55       0.1117      0.29   |    q    |  Q      |         |         |
5+ 0       0.1126      0.30   |    q    |  Q      |         |         |
5+ 5       0.0970      0.26   |   q     |Q        |         |         |
5+10       0.0863      0.23   |  q      Q         |         |         |
5+15       0.0845      0.23   |  q      Q         |         |         |
5+20       0.0923      0.24   |   q     Q         |         |         |
5+25       0.0976      0.26   |   q     |Q        |         |         |
5+30       0.0985      0.26   |   q     |Q        |         |         |
5+35       0.1064      0.28   |   q     | Q       |         |         |
5+40       0.1117      0.29   |    q    |  Q      |         |         |
5+45       0.1126      0.30   |    q    |  Q      |         |         |
5+50       0.1126      0.30   |    q    |  Q      |         |         |
5+55       0.1126      0.30   |    q    |  Q      |         |         |
6+ 0       0.1126      0.30   |    q    |  Q      |         |         |
6+ 5       0.1204      0.32   |    q    |   Q     |         |         |
6+10       0.1257      0.33   |    q    |   Q     |         |         |
6+15       0.1267      0.34   |    q    |    Q    |         |         |
6+20       0.1267      0.34   |    q    |    Q    |         |         |
6+25       0.1267      0.34   |    q    |    Q    |         |         |
6+30       0.1267      0.34   |    q    |    Q    |         |         |
6+35       0.1345      0.35   |     q   |    Q    |         |         |
6+40       0.1398      0.37   |     q   |     Q   |         |         |
6+45       0.1408      0.37   |     q   |     Q   |         |         |
6+50       0.1408      0.37   |     q   |     Q   |         |         |
6+55       0.1408      0.37   |     q   |     Q   |         |         |
7+ 0       0.1408      0.37   |     q   |     Q   |         |         |
```

```
 7+ 5       0.1408      0.37   |     q   |     Q   |         |         |
 7+10       0.1408      0.37   |     q   |     Q   |         |         |
 7+15       0.1408      0.37   |     q   |     Q   |         |         |
 7+20       0.1486      0.39   |     q   |      Q  |         |         |
 7+25       0.1539      0.41   |     q   |       Q |         |         |
 7+30       0.1548      0.41   |     q   |       Q |         |         |
 7+35       0.1627      0.43   |      q  |        Q|         |         |
 7+40       0.1680      0.44   |      q  |        Q|         |         |
 7+45       0.1689      0.45   |      q  |         Q         |         |
 7+50       0.1767      0.47   |      q  |         Q         |         |
 7+55       0.1820      0.48   |       q |         |Q        |         |
 8+ 0       0.1830      0.48   |       q |         |Q        |         |
 8+ 5       0.1986      0.52   |       q |         |  Q      |         |
 8+10       0.2093      0.55   |        q|         |   Q     |         |
 8+15       0.2111      0.56   |        q|         |    Q    |         |
 8+20       0.2111      0.56   |        q|         |    Q    |         |
 8+25       0.2111      0.56   |        q|         |    Q    |         |
 8+30       0.2111      0.56   |        q|         |    Q    |         |
 8+35       0.2190      0.58   |        q|         |    Q    |         |
 8+40       0.2243      0.59   |         q         |     Q   |         |
 8+45       0.2252      0.60   |         q         |     Q   |         |
 8+50       0.2330      0.62   |         q         |      Q  |         |
 8+55       0.2383      0.63   |         q         |       Q |         |
 9+ 0       0.2393      0.63   |         q         |       Q |         |
 9+ 5       0.1096      0.33   |   q     |   Q     |         |         |
 9+10       0.0225      0.08   |q Q      |         |         |         |
 9+15       0.0083      0.04   qQ        |         |         |         |
 9+20       0.0194      0.05   q Q       |         |         |         |
 9+25       0.0274      0.07   |q Q      |         |         |         |
 9+30       0.0300      0.08   |q Q      |         |         |         |
 9+35       0.0411      0.11   |q  Q     |         |         |         |
 9+40       0.0490      0.13   | q  Q    |         |         |         |
 9+45       0.0517      0.14   | q   Q   |         |         |         |
 9+50       0.0627      0.16   | q    Q  |         |         |         |
 9+55       0.0706      0.19   |  q    Q |         |         |         |
10+ 0       0.0733      0.19   |  q    Q |         |         |         |
10+ 5       0.1502      0.37   |     q   |     Q   |         |         |
10+10       0.2020      0.52   |        q|         |  Q      |         |
10+15       0.2111      0.55   |        q|         |   Q     |         |
10+20       0.2111      0.56   |        q|         |    Q    |         |
10+25       0.2111      0.56   |        q|         |    Q    |         |
10+30       0.2111      0.56   |        q|         |    Q    |         |
10+35       0.1214      0.35   |    q    |    Q    |         |         |
10+40       0.0614      0.18   | q    Q  |         |         |         |
10+45       0.0520      0.15   | q   Q   |         |         |         |
10+50       0.0534      0.14   | q   Q   |         |         |         |
10+55       0.0548      0.14   | q   Q   |         |         |         |
11+ 0       0.0563      0.15   | q   Q   |         |         |         |
11+ 5       0.0481      0.13   | q  Q    |         |         |         |
11+10       0.0431      0.12   |q   Q    |         |         |         |
11+15       0.0433      0.12   |q   Q    |         |         |         |
11+20       0.0447      0.12   | q  Q    |         |         |         |
11+25       0.0461      0.12   | q  Q    |         |         |         |
11+30       0.0475      0.13   | q  Q    |         |         |         |
11+35       0.0298      0.08   |q Q      |         |         |         |
11+40       0.0182      0.05   q Q       |         |         |         |
11+45       0.0173      0.05   q Q       |         |         |         |
11+50       0.0282      0.07   |q Q      |         |         |         |
11+55       0.0360      0.09   |q  Q     |         |         |         |
12+ 0       0.0385      0.10   |q  Q     |         |         |         |
12+ 5       0.1067      0.26   |   q     |Q        |         |         |
12+10       0.1534      0.39   |     q   |      Q  |         |         |
12+15       0.1627      0.42   |      q  |       Q |         |         |
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12+20       0.1736      0.46  |      q  |         Q         |         |
12+25       0.1814      0.48  |       q |         |Q        |         |
12+30       0.1839      0.49  |       q |         |Q        |         |
12+35       0.2043      0.54  |        q|         |  Q      |         |
12+40       0.2186      0.58  |        q|         |    Q    |         |
12+45       0.2222      0.59  |        q|         |     Q   |         |
12+50       0.2330      0.61  |         q         |      Q  |         |
12+55       0.2408      0.64  |         q         |       Q |         |
13+ 0       0.2432      0.64  |         q         |       Q |         |
13+ 5       0.2923      0.76  |         |  q      |         |   Q     |
13+10       0.3259      0.86  |         |   q     |         |       Q |
13+15       0.3329      0.88  |         |   q     |         |        Q|
13+20       0.3342      0.89  |         |   q     |         |        Q|
13+25       0.3355      0.89  |         |    q    |         |        Q|
13+30       0.3367      0.89  |         |    q    |         |         Q
13+35       0.2330      0.65  |         q         |        Q|         |
13+40       0.1630      0.45  |      q  |         Q         |         |
13+45       0.1516      0.41  |     q   |       Q |         |         |
13+50       0.1529      0.41  |     q   |       Q |         |         |
13+55       0.1541      0.41  |     q   |       Q |         |         |
14+ 0       0.1553      0.41  |     q   |       Q |         |         |
14+ 5       0.1948      0.50  |       q |         | Q       |         |
14+10       0.2219      0.58  |        q|         |     Q   |         |
14+15       0.2277      0.60  |         q         |     Q   |         |
14+20       0.2193      0.58  |        q|         |     Q   |         |
14+25       0.2141      0.57  |        q|         |    Q    |         |
14+30       0.2141      0.57  |        q|         |    Q    |         |
14+35       0.2153      0.57  |        q|         |    Q    |         |
14+40       0.2165      0.57  |        q|         |    Q    |         |
14+45       0.2177      0.58  |        q|         |    Q    |         |
14+50       0.2093      0.56  |        q|         |   Q     |         |
14+55       0.2040      0.54  |        q|         |   Q     |         |
15+ 0       0.2040      0.54  |        q|         |   Q     |         |
15+ 5       0.1956      0.52  |       q |         |  Q      |         |
15+10       0.1903      0.51  |       q |         | Q       |         |
15+15       0.1903      0.51  |       q |         | Q       |         |
15+20       0.1819      0.48  |       q |         |Q        |         |
15+25       0.1765      0.47  |      q  |         |Q        |         |
15+30       0.1765      0.47  |      q  |         |Q        |         |
15+35       0.1394      0.38  |     q   |      Q  |         |         |
15+40       0.1147      0.31  |    q    |  Q      |         |         |
15+45       0.1112      0.30  |   q     |  Q      |         |         |
15+50       0.1123      0.30  |    q    |  Q      |         |         |
15+55       0.1134      0.30  |    q    |  Q      |         |         |
16+ 0       0.1144      0.30  |    q    |  Q      |         |         |
16+ 5       0.0823      0.23  |  q      Q         |         |         |
16+10       0.0602      0.17  | q    Q  |         |         |         |
16+15       0.0563      0.15  | q   Q   |         |         |         |
16+20       0.0563      0.15  | q   Q   |         |         |         |
16+25       0.0563      0.15  | q   Q   |         |         |         |
16+30       0.0563      0.15  | q   Q   |         |         |         |
16+35       0.0485      0.13  | q  Q    |         |         |         |
16+40       0.0432      0.12  |q   Q    |         |         |         |
16+45       0.0422      0.11  |q   Q    |         |         |         |
16+50       0.0422      0.11  |q   Q    |         |         |         |
16+55       0.0422      0.11  |q   Q    |         |         |         |
17+ 0       0.0422      0.11  |q   Q    |         |         |         |
17+ 5       0.0579      0.15  | q   Q   |         |         |         |
17+10       0.0685      0.18  |  q    Q |         |         |         |
17+15       0.0704      0.18  |  q    Q |         |         |         |
17+20       0.0704      0.19  |  q    Q |         |         |         |
17+25       0.0704      0.19  |  q    Q |         |         |         |
17+30       0.0704      0.19  |  q    Q |         |         |         |
```

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17+35       0.0704      0.19  |  q    Q |         |         |         |
17+40       0.0704      0.19  |  q    Q |         |         |         |
17+45       0.0704      0.19  |  q    Q |         |         |         |
17+50       0.0626      0.17  | q    Q  |         |         |         |
17+55       0.0572      0.15  | q   Q   |         |         |         |
18+ 0       0.0563      0.15  | q   Q   |         |         |         |
18+ 5       0.0563      0.15  | q   Q   |         |         |         |
18+10       0.0563      0.15  | q   Q   |         |         |         |
18+15       0.0563      0.15  | q   Q   |         |         |         |
18+20       0.0563      0.15  | q   Q   |         |         |         |
18+25       0.0563      0.15  | q   Q   |         |         |         |
18+30       0.0563      0.15  | q   Q   |         |         |         |
18+35       0.0485      0.13  | q  Q    |         |         |         |
18+40       0.0432      0.12  |q   Q    |         |         |         |
18+45       0.0422      0.11  |q   Q    |         |         |         |
18+50       0.0344      0.09  |q  Q     |         |         |         |
18+55       0.0291      0.08  |q Q      |         |         |         |
19+ 0       0.0282      0.08  |q Q      |         |         |         |
19+ 5       0.0360      0.09  |q  Q     |         |         |         |
19+10       0.0413      0.11  |q  Q     |         |         |         |
19+15       0.0422      0.11  |q  Q     |         |         |         |
19+20       0.0501      0.13  | q  Q    |         |         |         |
19+25       0.0554      0.15  | q   Q   |         |         |         |
19+30       0.0563      0.15  | q   Q   |         |         |         |
19+35       0.0485      0.13  | q  Q    |         |         |         |
19+40       0.0432      0.12  |q   Q    |         |         |         |
19+45       0.0422      0.11  |q   Q    |         |         |         |
19+50       0.0344      0.09  |q  Q     |         |         |         |
19+55       0.0291      0.08  |q Q      |         |         |         |
20+ 0       0.0282      0.08  |q Q      |         |         |         |
20+ 5       0.0360      0.09  |q  Q     |         |         |         |
20+10       0.0413      0.11  |q  Q     |         |         |         |
20+15       0.0422      0.11  |q  Q     |         |         |         |
20+20       0.0422      0.11  |q   Q    |         |         |         |
20+25       0.0422      0.11  |q   Q    |         |         |         |
20+30       0.0422      0.11  |q   Q    |         |         |         |
20+35       0.0422      0.11  |q   Q    |         |         |         |
20+40       0.0422      0.11  |q   Q    |         |         |         |
20+45       0.0422      0.11  |q   Q    |         |         |         |
20+50       0.0344      0.09  |q  Q     |         |         |         |
20+55       0.0291      0.08  |q Q      |         |         |         |
21+ 0       0.0282      0.08  |q Q      |         |         |         |
21+ 5       0.0360      0.09  |q  Q     |         |         |         |
21+10       0.0413      0.11  |q  Q     |         |         |         |
21+15       0.0422      0.11  |q  Q     |         |         |         |
21+20       0.0344      0.09  |q  Q     |         |         |         |
21+25       0.0291      0.08  |q Q      |         |         |         |
21+30       0.0282      0.08  |q Q      |         |         |         |
21+35       0.0360      0.09  |q  Q     |         |         |         |
21+40       0.0413      0.11  |q  Q     |         |         |         |
21+45       0.0422      0.11  |q  Q     |         |         |         |
21+50       0.0344      0.09  |q  Q     |         |         |         |
21+55       0.0291      0.08  |q Q      |         |         |         |
22+ 0       0.0282      0.08  |q Q      |         |         |         |
22+ 5       0.0360      0.09  |q  Q     |         |         |         |
22+10       0.0413      0.11  |q  Q     |         |         |         |
22+15       0.0422      0.11  |q  Q     |         |         |         |
22+20       0.0344      0.09  |q  Q     |         |         |         |
22+25       0.0291      0.08  |q Q      |         |         |         |
22+30       0.0282      0.08  |q Q      |         |         |         |
22+35       0.0282      0.07  |q Q      |         |         |         |
22+40       0.0282      0.07  |q Q      |         |         |         |
22+45       0.0282      0.07  |q Q      |         |         |         |
```

```
  22+50       0.0282      0.07  |q Q       |         |         |         |
  22+55       0.0282      0.07  |q Q       |         |         |         |
  23+ 0       0.0282      0.07  |q Q       |         |         |         |
  23+ 5       0.0282      0.07  |q Q       |         |         |         |
  23+10       0.0282      0.07  |q Q       |         |         |         |
  23+15       0.0282      0.07  |q Q       |         |         |         |
  23+20       0.0282      0.07  |q Q       |         |         |         |
  23+25       0.0282      0.07  |q Q       |         |         |         |
  23+30       0.0282      0.07  |q Q       |         |         |         |
  23+35       0.0282      0.07  |q Q       |         |         |         |
  23+40       0.0282      0.07  |q Q       |         |         |         |
  23+45       0.0282      0.07  |q Q       |         |         |         |
  23+50       0.0282      0.07  |q Q       |         |         |         |
  23+55       0.0282      0.07  |q Q       |         |         |         |
  24+ 0       0.0282      0.07  |q Q       |         |         |         |
  24+ 5       0.0125      0.04  qQ         |         |         |         |
  24+10       0.0019      0.01  Q          |         |         |         |
  24+15       0.0000      0.00  Q          |         |         |         |
-----------------------------------------------------------------------
      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =   291
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.892 (CFS)
                   Total volume =       0.504 (Ac.Ft)
            Status of hydrographs being held in storage
                         Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************
      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      603.000 to Point/Station      603.000
      **** RETARDING BASIN ROUTING ****
      ______________________________________________________________________

      Program computation of outflow v. depth

      CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))

      Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
      Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
      Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
      flow capacity is being calculated using depth = diameter
      Depth above pipe =   1.00(Ft.)    Capacity =   0.39(CFS)

      Total outflow at this depth =      0.39(CFS)


      CALCULATED OUTFLOW DATA AT DEPTH =    2.50(Ft.))

      Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
      Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
      Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
      flow capacity is being calculated using depth = diameter
      Depth above pipe =   2.50(Ft.)    Capacity =   0.39(CFS)

      Total outflow at this depth =      0.39(CFS)


      CALCULATED OUTFLOW DATA AT DEPTH =    3.50(Ft.))

      Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
      Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
      Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
```

```
flow capacity is being calculated using depth = diameter
Depth above pipe =   3.50(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.50(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   0.50(Ft.)    Capacity =  10.00(CFS)

Total outflow at this depth =     10.39(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    4.50(Ft.))

Free outlet pipe flow:  Pipe Diameter =     0.33(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Note: Depth of   0.33(Ft.) is greater than diameter of pipe,
flow capacity is being calculated using depth = diameter
Depth above pipe =   4.50(Ft.)    Capacity =   0.39(CFS)


Free outlet pipe flow:  Pipe Diameter =     1.50(Ft.)
Capacity = 8 * Pipe area * depth ^ 0.5(Using feet as units)
Depth above pipe =   1.50(Ft.)    Capacity =  17.31(CFS)

Total outflow at this depth =     17.71(CFS)

--------------------------------------------------------------------
Total number of inflow hydrograph intervals = 291
Hydrograph time unit =  5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)
--------------------------------------------------------------------
--------------------------------------------------------------------
Initial basin depth =   0.00 (Ft.)
Initial basin storage =      0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)
---------------------------------------------------------------------
--------------------------------------------------------------------
Depth vs. Storage and Depth vs. Discharge data:
 Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
     (Ft.)    (Ac.Ft)     (CFS)     (Ac.Ft)    (Ac.Ft)
---------------------------------------------------------------------
   0.000      0.000      0.000      0.000        0.000
   1.000      0.096      0.393      0.095        0.097
   2.500      0.200      0.393      0.199        0.201
   3.500      0.310     10.390      0.274        0.346
   4.500      0.420     17.707      0.359        0.481
--------------------------------------------------------------------
             Hydrograph Detention Basin Routing
---------------------------------------------------------------------

Graph values: 'I'= unit inflow; 'O'=outflow at time shown
---------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                Depth
(Hours)  (CFS)   (CFS)      (Ac.Ft) .0       0.2    0.45    0.67    0.89 (Ft.)
 0.083    0.04    0.00       0.000  OI       |       |       |       |     0.00
 0.167    0.07    0.00       0.000  O I      |       |       |       |     0.00
 0.250    0.07    0.00       0.001  O I      |       |       |       |     0.01
 0.333    0.09    0.01       0.001  O  I     |       |       |       |     0.02
 0.417    0.11    0.01       0.002  O  I     |       |       |       |     0.02
 0.500    0.11    0.01       0.003  O  I     |       |       |       |     0.03
 0.583    0.11    0.01       0.003  O   I    |       |       |       |     0.04
 0.667    0.11    0.02       0.004  O   I    |       |       |       |     0.04
 0.750    0.11    0.02       0.005  O   I    |       |       |       |     0.05
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0.833    0.13    0.02      0.005  O   I   |       |       |       |     0.06
0.917    0.15    0.03      0.006  O    I  |       |       |       |     0.07
1.000    0.15    0.03      0.007  |O   I  |       |       |       |     0.07
1.083    0.13    0.03      0.008  |O  I   |       |       |       |     0.08
1.167    0.12    0.03      0.008  |O  I   |       |       |       |     0.09
1.250    0.11    0.04      0.009  |O  I   |       |       |       |     0.09
1.333    0.11    0.04      0.010  |O  I   |       |       |       |     0.10
1.417    0.11    0.04      0.010  |O  I   |       |       |       |     0.10
1.500    0.11    0.04      0.010  |O  I   |       |       |       |     0.11
1.583    0.11    0.04      0.011  |O  I   |       |       |       |     0.11
1.667    0.11    0.05      0.011  |O  I   |       |       |       |     0.12
1.750    0.11    0.05      0.012  |O  I   |       |       |       |     0.12
1.833    0.13    0.05      0.012  |O  I   |       |       |       |     0.13
1.917    0.15    0.05      0.013  |O   I  |       |       |       |     0.13
2.000    0.15    0.06      0.014  |O   I  |       |       |       |     0.14
2.083    0.15    0.06      0.014  | O  I  |       |       |       |     0.15
2.167    0.15    0.06      0.015  | O  I  |       |       |       |     0.15
2.250    0.15    0.06      0.015  | O  I  |       |       |       |     0.16
2.333    0.15    0.07      0.016  | O  I  |       |       |       |     0.17
2.417    0.15    0.07      0.017  | O  I  |       |       |       |     0.17
2.500    0.15    0.07      0.017  | O  I  |       |       |       |     0.18
2.583    0.17    0.07      0.018  | O   I |       |       |       |     0.18
2.667    0.18    0.08      0.018  | O   I |       |       |       |     0.19
2.750    0.19    0.08      0.019  | O   I |       |       |       |     0.20
2.833    0.19    0.08      0.020  | O   I |       |       |       |     0.21
2.917    0.19    0.08      0.021  |  O  I |       |       |       |     0.21
3.000    0.19    0.09      0.021  |  O  I |       |       |       |     0.22
3.083    0.19    0.09      0.022  |  O  I |       |       |       |     0.23
3.167    0.19    0.09      0.023  |  O  I |       |       |       |     0.24
3.250    0.19    0.10      0.023  |  O  I |       |       |       |     0.24
3.333    0.19    0.10      0.024  |  O  I |       |       |       |     0.25
3.417    0.19    0.10      0.025  |  O  I |       |       |       |     0.26
3.500    0.19    0.10      0.025  |  O  I |       |       |       |     0.26
3.583    0.19    0.11      0.026  |  O  I |       |       |       |     0.27
3.667    0.19    0.11      0.026  |  O  I |       |       |       |     0.27
3.750    0.19    0.11      0.027  |  O  I |       |       |       |     0.28
3.833    0.20    0.11      0.027  |   O  I|       |       |       |     0.28
3.917    0.22    0.11      0.028  |   O  I|       |       |       |     0.29
4.000    0.22    0.12      0.029  |   O  I|       |       |       |     0.30
4.083    0.22    0.12      0.029  |   O   I       |       |       |     0.31
4.167    0.22    0.12      0.030  |   O   I       |       |       |     0.31
4.250    0.22    0.13      0.031  |   O   I       |       |       |     0.32
4.333    0.24    0.13      0.032  |   O   I       |       |       |     0.33
4.417    0.26    0.13      0.032  |   O   |I      |       |       |     0.34
4.500    0.26    0.14      0.033  |   O   |I      |       |       |     0.35
4.583    0.26    0.14      0.034  |    O  |I      |       |       |     0.36
4.667    0.26    0.14      0.035  |    O  |I      |       |       |     0.36
4.750    0.26    0.15      0.036  |    O  |I      |       |       |     0.37
4.833    0.28    0.15      0.037  |    O  | I     |       |       |     0.38
4.917    0.29    0.15      0.038  |    O  | I     |       |       |     0.39
5.000    0.30    0.16      0.038  |    O  | I     |       |       |     0.40
5.083    0.26    0.16      0.039  |    O  |I      |       |       |     0.41
5.167    0.23    0.16      0.040  |    O  I       |       |       |     0.42
5.250    0.23    0.17      0.040  |    O  I       |       |       |     0.42
5.333    0.24    0.17      0.041  |    O  I       |       |       |     0.42
5.417    0.26    0.17      0.041  |     O |I      |       |       |     0.43
5.500    0.26    0.17      0.042  |     O |I      |       |       |     0.44
5.583    0.28    0.17      0.043  |     O | I     |       |       |     0.44
5.667    0.29    0.18      0.043  |     O | I     |       |       |     0.45
5.750    0.30    0.18      0.044  |     O | I     |       |       |     0.46
5.833    0.30    0.18      0.045  |     O | I     |       |       |     0.47
5.917    0.30    0.19      0.046  |     O | I     |       |       |     0.48
6.000    0.30    0.19      0.047  |     O | I     |       |       |     0.48
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  6.083     0.32     0.19      0.047   |     O |  I    |       |       |     0.49
  6.167     0.33     0.20      0.048   |      O|  I    |       |       |     0.50
  6.250     0.34     0.20      0.049   |      O|   I   |       |       |     0.51
  6.333     0.34     0.20      0.050   |      O|   I   |       |       |     0.52
  6.417     0.34     0.21      0.051   |      O|   I   |       |       |     0.53
  6.500     0.34     0.21      0.052   |      O|   I   |       |       |     0.54
  6.583     0.35     0.22      0.053   |      O|   I   |       |       |     0.55
  6.667     0.37     0.22      0.054   |      O|    I  |       |       |     0.56
  6.750     0.37     0.22      0.055   |       O    I  |       |       |     0.57
  6.833     0.37     0.23      0.056   |       O    I  |       |       |     0.58
  6.917     0.37     0.23      0.057   |       O    I  |       |       |     0.59
  7.000     0.37     0.24      0.058   |       O    I  |       |       |     0.60
  7.083     0.37     0.24      0.059   |       O    I  |       |       |     0.61
  7.167     0.37     0.24      0.060   |       O    I  |       |       |     0.62
  7.250     0.37     0.25      0.060   |       O    I  |       |       |     0.63
  7.333     0.39     0.25      0.061   |       |O    I |       |       |     0.64
  7.417     0.41     0.26      0.062   |       |O    I |       |       |     0.65
  7.500     0.41     0.26      0.063   |       |O    I |       |       |     0.66
  7.583     0.43     0.26      0.064   |       |O     I|       |       |     0.67
  7.667     0.44     0.27      0.066   |       |O     I|       |       |     0.68
  7.750     0.45     0.27      0.067   |       |O      I       |       |     0.70
  7.833     0.47     0.28      0.068   |       |O      I       |       |     0.71
  7.917     0.48     0.28      0.069   |       | O     |I      |       |     0.72
  8.000     0.48     0.29      0.071   |       | O     |I      |       |     0.74
  8.083     0.52     0.30      0.072   |       | O     | I     |       |     0.75
  8.167     0.55     0.30      0.074   |       | O     |  I    |       |     0.77
  8.250     0.56     0.31      0.076   |       |  O    |   I   |       |     0.79
  8.333     0.56     0.32      0.077   |       |  O    |   I   |       |     0.80
  8.417     0.56     0.32      0.079   |       |  O    |   I   |       |     0.82
  8.500     0.56     0.33      0.081   |       |  O    |   I   |       |     0.84
  8.583     0.58     0.34      0.082   |       |   O   |   I   |       |     0.86
  8.667     0.59     0.34      0.084   |       |   O   |    I  |       |     0.87
  8.750     0.60     0.35      0.086   |       |   O   |    I  |       |     0.89
  8.833     0.62     0.36      0.087   |       |   O   |     I |       |     0.91
  8.917     0.63     0.36      0.089   |       |    O  |     I |       |     0.93
  9.000     0.63     0.37      0.091   |       |    O  |     I |       |     0.95
  9.083     0.33     0.38      0.092   |       |  I O  |       |       |     0.95
  9.167     0.08     0.37      0.090   | I     |    O  |       |       |     0.94
  9.250     0.04     0.36      0.088   |I      |   O   |       |       |     0.92
  9.333     0.05     0.35      0.086   |I      |   O   |       |       |     0.90
  9.417     0.07     0.34      0.084   | I     |   O   |       |       |     0.88
  9.500     0.08     0.34      0.082   | I     |   O   |       |       |     0.86
  9.583     0.11     0.33      0.081   |  I    |  O    |       |       |     0.84
  9.667     0.13     0.32      0.079   |   I   |  O    |       |       |     0.83
  9.750     0.14     0.32      0.078   |   I   |  O    |       |       |     0.81
  9.833     0.16     0.31      0.077   |    I  |  O    |       |       |     0.80
  9.917     0.19     0.31      0.076   |     I |  O    |       |       |     0.79
 10.000     0.19     0.31      0.075   |     I |  O    |       |       |     0.78
 10.083     0.37     0.31      0.075   |       | O  I  |       |       |     0.78
 10.167     0.52     0.31      0.076   |       |  O    | I     |       |     0.79
 10.250     0.55     0.32      0.077   |       |  O    |  I    |       |     0.81
 10.333     0.56     0.32      0.079   |       |  O    |   I   |       |     0.82
 10.417     0.56     0.33      0.081   |       |  O    |   I   |       |     0.84
 10.500     0.56     0.34      0.082   |       |   O   |   I   |       |     0.86
 10.583     0.35     0.34      0.083   |       |   O   |       |       |     0.86
 10.667     0.18     0.34      0.082   |     I |   O   |       |       |     0.86
 10.750     0.15     0.33      0.081   |    I  |  O    |       |       |     0.85
 10.833     0.14     0.33      0.080   |    I  |  O    |       |       |     0.83
 10.917     0.14     0.32      0.079   |    I  |  O    |       |       |     0.82
 11.000     0.15     0.32      0.078   |    I  |  O    |       |       |     0.81
 11.083     0.13     0.31      0.076   |   I   |  O    |       |       |     0.79
 11.167     0.12     0.31      0.075   |   I   |  O    |       |       |     0.78
 11.250     0.12     0.30      0.074   |   I   | O     |       |       |     0.77
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11.333    0.12    0.30      0.072  |   I   | O     |       |       |     0.75
11.417    0.12    0.29      0.071  |   I   | O     |       |       |     0.74
11.500    0.13    0.29      0.070  |   I   | O     |       |       |     0.73
11.583    0.08    0.28      0.069  |  I    | O     |       |       |     0.72
11.667    0.05    0.28      0.067  |I      |O      |       |       |     0.70
11.750    0.05    0.27      0.066  |I      |O      |       |       |     0.69
11.833    0.07    0.26      0.064  | I     |O      |       |       |     0.67
11.917    0.09    0.26      0.063  |  I    |O      |       |       |     0.66
12.000    0.10    0.25      0.062  |  I    |O      |       |       |     0.65
12.083    0.26    0.25      0.062  |       |O      |       |       |     0.64
12.167    0.39    0.25      0.062  |       |O    I |       |       |     0.65
12.250    0.42    0.26      0.063  |       |O     I|       |       |     0.66
12.333    0.46    0.26      0.064  |       |O      I       |       |     0.67
12.417    0.48    0.27      0.066  |       |O      |I      |       |     0.69
12.500    0.49    0.28      0.067  |       |O      |I      |       |     0.70
12.583    0.54    0.28      0.069  |       | O     |  I    |       |     0.72
12.667    0.58    0.29      0.071  |       | O     |   I   |       |     0.74
12.750    0.59    0.30      0.073  |       | O     |    I  |       |     0.76
12.833    0.61    0.31      0.075  |       | O     |     I |       |     0.78
12.917    0.64    0.31      0.077  |       |  O    |     I |       |     0.80
13.000    0.64    0.32      0.079  |       |  O    |      I|       |     0.82
13.083    0.76    0.33      0.082  |       |  O    |       |  I    |     0.85
13.167    0.86    0.35      0.085  |       |   O   |       |     I |     0.88
13.250    0.88    0.36      0.088  |       |   O   |       |      I|     0.92
13.333    0.89    0.38      0.092  |       |    O  |       |      I|     0.96
13.417    0.89    0.39      0.095  |       |     O |       |      I|     0.99
13.500    0.89    0.39      0.099  |       |     O |       |       I     1.04
13.583    0.65    0.39      0.101  |       |     O |      I|       |     1.08
13.667    0.45    0.39      0.103  |       |     O I       |       |     1.09
13.750    0.41    0.39      0.103  |       |     O |       |       |     1.10
13.833    0.41    0.39      0.103  |       |     O |       |       |     1.10
13.917    0.41    0.39      0.103  |       |     O |       |       |     1.10
14.000    0.41    0.39      0.103  |       |     O |       |       |     1.10
14.083    0.50    0.39      0.104  |       |     O | I     |       |     1.11
14.167    0.58    0.39      0.105  |       |     O |   I   |       |     1.12
14.250    0.60    0.39      0.106  |       |     O |    I  |       |     1.14
14.333    0.58    0.39      0.107  |       |     O |   I   |       |     1.16
14.417    0.57    0.39      0.109  |       |     O |   I   |       |     1.18
14.500    0.57    0.39      0.110  |       |     O |   I   |       |     1.20
14.583    0.57    0.39      0.111  |       |     O |   I   |       |     1.22
14.667    0.57    0.39      0.112  |       |     O |   I   |       |     1.23
14.750    0.58    0.39      0.114  |       |     O |   I   |       |     1.25
14.833    0.56    0.39      0.115  |       |     O |  I    |       |     1.27
14.917    0.54    0.39      0.116  |       |     O |  I    |       |     1.29
15.000    0.54    0.39      0.117  |       |     O |  I    |       |     1.30
15.083    0.52    0.39      0.118  |       |     O | I     |       |     1.31
15.167    0.51    0.39      0.119  |       |     O | I     |       |     1.33
15.250    0.51    0.39      0.119  |       |     O | I     |       |     1.34
15.333    0.48    0.39      0.120  |       |     O |I      |       |     1.35
15.417    0.47    0.39      0.121  |       |     O I       |       |     1.36
15.500    0.47    0.39      0.121  |       |     O I       |       |     1.36
15.583    0.38    0.39      0.121  |       |    IO |       |       |     1.37
15.667    0.31    0.39      0.121  |       |  I  O |       |       |     1.36
15.750    0.30    0.39      0.120  |       | I   O |       |       |     1.35
15.833    0.30    0.39      0.120  |       | I   O |       |       |     1.34
15.917    0.30    0.39      0.119  |       | I   O |       |       |     1.33
16.000    0.30    0.39      0.119  |       | I   O |       |       |     1.33
16.083    0.23    0.39      0.118  |       I     O |       |       |     1.31
16.167    0.17    0.39      0.116  |    I  |     O |       |       |     1.29
16.250    0.15    0.39      0.115  |    I  |     O |       |       |     1.27
16.333    0.15    0.39      0.113  |    I  |     O |       |       |     1.25
16.417    0.15    0.39      0.111  |    I  |     O |       |       |     1.22
16.500    0.15    0.39      0.110  |    I  |     O |       |       |     1.20
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16.583    0.13    0.39      0.108  |   I   |     O |       |       |     1.17
16.667    0.12    0.39      0.106  |   I   |     O |       |       |     1.15
16.750    0.11    0.39      0.104  |   I   |     O |       |       |     1.12
16.833    0.11    0.39      0.102  |   I   |     O |       |       |     1.09
16.917    0.11    0.39      0.100  |   I   |     O |       |       |     1.06
17.000    0.11    0.39      0.098  |   I   |     O |       |       |     1.03
17.083    0.15    0.39      0.097  |    I  |     O |       |       |     1.01
17.167    0.18    0.39      0.095  |     I |    O  |       |       |     0.99
17.250    0.18    0.38      0.094  |     I |    O  |       |       |     0.97
17.333    0.19    0.38      0.092  |     I |    O  |       |       |     0.96
17.417    0.19    0.37      0.091  |     I |    O  |       |       |     0.95
17.500    0.19    0.37      0.090  |     I |    O  |       |       |     0.93
17.583    0.19    0.36      0.088  |     I |   O   |       |       |     0.92
17.667    0.19    0.36      0.087  |     I |   O   |       |       |     0.91
17.750    0.19    0.35      0.086  |     I |   O   |       |       |     0.90
17.833    0.17    0.35      0.085  |     I |   O   |       |       |     0.88
17.917    0.15    0.34      0.084  |    I  |   O   |       |       |     0.87
18.000    0.15    0.34      0.082  |    I  |   O   |       |       |     0.86
18.083    0.15    0.33      0.081  |    I  |  O    |       |       |     0.84
18.167    0.15    0.33      0.080  |    I  |  O    |       |       |     0.83
18.250    0.15    0.32      0.079  |    I  |  O    |       |       |     0.82
18.333    0.15    0.32      0.077  |    I  |  O    |       |       |     0.81
18.417    0.15    0.31      0.076  |    I  |  O    |       |       |     0.79
18.500    0.15    0.31      0.075  |    I  |  O    |       |       |     0.78
18.583    0.13    0.30      0.074  |   I   | O     |       |       |     0.77
18.667    0.12    0.30      0.073  |   I   | O     |       |       |     0.76
18.750    0.11    0.29      0.072  |   I   | O     |       |       |     0.75
18.833    0.09    0.29      0.070  |  I    | O     |       |       |     0.73
18.917    0.08    0.28      0.069  | I     | O     |       |       |     0.72
19.000    0.08    0.28      0.068  | I     |O      |       |       |     0.70
19.083    0.09    0.27      0.066  |  I    |O      |       |       |     0.69
19.167    0.11    0.27      0.065  |  I    |O      |       |       |     0.68
19.250    0.11    0.26      0.064  |  I    |O      |       |       |     0.67
19.333    0.13    0.26      0.063  |   I   |O      |       |       |     0.66
19.417    0.15    0.25      0.062  |    I  |O      |       |       |     0.65
19.500    0.15    0.25      0.062  |    I  |O      |       |       |     0.64
19.583    0.13    0.25      0.061  |   I   O       |       |       |     0.63
19.667    0.12    0.25      0.060  |   I   O       |       |       |     0.62
19.750    0.11    0.24      0.059  |   I   O       |       |       |     0.61
19.833    0.09    0.24      0.058  |  I    O       |       |       |     0.60
19.917    0.08    0.23      0.057  | I     O       |       |       |     0.59
20.000    0.08    0.23      0.056  | I     O       |       |       |     0.58
20.083    0.09    0.23      0.055  |  I    O       |       |       |     0.57
20.167    0.11    0.22      0.054  |  I   O|       |       |       |     0.56
20.250    0.11    0.22      0.053  |  I   O|       |       |       |     0.56
20.333    0.11    0.22      0.053  |   I  O|       |       |       |     0.55
20.417    0.11    0.21      0.052  |   I  O|       |       |       |     0.54
20.500    0.11    0.21      0.051  |   I  O|       |       |       |     0.53
20.583    0.11    0.21      0.051  |   I  O|       |       |       |     0.53
20.667    0.11    0.20      0.050  |   I  O|       |       |       |     0.52
20.750    0.11    0.20      0.049  |   I  O|       |       |       |     0.51
20.833    0.09    0.20      0.049  |  I   O|       |       |       |     0.51
20.917    0.08    0.20      0.048  | I    O|       |       |       |     0.50
21.000    0.08    0.19      0.047  | I   O |       |       |       |     0.49
21.083    0.09    0.19      0.046  |  I  O |       |       |       |     0.48
21.167    0.11    0.19      0.046  |  I  O |       |       |       |     0.48
21.250    0.11    0.19      0.045  |  I  O |       |       |       |     0.47
21.333    0.09    0.18      0.045  |  I  O |       |       |       |     0.47
21.417    0.08    0.18      0.044  | I   O |       |       |       |     0.46
21.500    0.08    0.18      0.043  | I   O |       |       |       |     0.45
21.583    0.09    0.17      0.043  |  I  O |       |       |       |     0.44
21.667    0.11    0.17      0.042  |  I  O |       |       |       |     0.44
21.750    0.11    0.17      0.042  |  I  O |       |       |       |     0.43
```

```
21.833    0.09    0.17      0.041  |  I  O |       |       |       |     0.43
21.917    0.08    0.17      0.041  | I  O  |       |       |       |     0.42
22.000    0.08    0.16      0.040  | I  O  |       |       |       |     0.42
22.083    0.09    0.16      0.040  |  I O  |       |       |       |     0.41
22.167    0.11    0.16      0.039  |  I O  |       |       |       |     0.41
22.250    0.11    0.16      0.039  |  I O  |       |       |       |     0.40
22.333    0.09    0.16      0.038  |  I O  |       |       |       |     0.40
22.417    0.08    0.16      0.038  | I  O  |       |       |       |     0.39
22.500    0.08    0.15      0.037  | I  O  |       |       |       |     0.39
22.583    0.07    0.15      0.037  | I  O  |       |       |       |     0.38
22.667    0.07    0.15      0.036  | I  O  |       |       |       |     0.38
22.750    0.07    0.15      0.036  | I  O  |       |       |       |     0.37
22.833    0.07    0.14      0.035  | I  O  |       |       |       |     0.37
22.917    0.07    0.14      0.035  | I  O  |       |       |       |     0.36
23.000    0.07    0.14      0.034  | I  O  |       |       |       |     0.36
23.083    0.07    0.14      0.034  | I O   |       |       |       |     0.35
23.167    0.07    0.14      0.034  | I O   |       |       |       |     0.35
23.250    0.07    0.14      0.033  | I O   |       |       |       |     0.34
23.333    0.07    0.13      0.033  | I O   |       |       |       |     0.34
23.417    0.07    0.13      0.032  | I O   |       |       |       |     0.34
23.500    0.07    0.13      0.032  | I O   |       |       |       |     0.33
23.583    0.07    0.13      0.032  | I O   |       |       |       |     0.33
23.667    0.07    0.13      0.031  | I O   |       |       |       |     0.32
23.750    0.07    0.13      0.031  | I O   |       |       |       |     0.32
23.833    0.07    0.12      0.030  | I O   |       |       |       |     0.32
23.917    0.07    0.12      0.030  | I O   |       |       |       |     0.31
24.000    0.07    0.12      0.030  | I O   |       |       |       |     0.31
24.083    0.04    0.12      0.029  |I  O   |       |       |       |     0.31
24.167    0.01    0.12      0.029  I   O   |       |       |       |     0.30
24.250    0.00    0.11      0.028  I   O   |       |       |       |     0.29
24.333    0.00    0.11      0.027  I  O    |       |       |       |     0.28
24.417    0.00    0.11      0.026  I  O    |       |       |       |     0.27
24.500    0.00    0.10      0.026  I  O    |       |       |       |     0.27
24.583    0.00    0.10      0.025  I  O    |       |       |       |     0.26
24.667    0.00    0.10      0.024  I  O    |       |       |       |     0.25

      Remaining water in basin =    0.02 (Ac.Ft)

      ****************************HYDROGRAPH DATA****************************
                   Number of intervals =   296
                   Time interval =    5.0 (Min.)
                   Maximum/Peak flow rate =        0.393 (CFS)
                   Total volume =       0.480 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
      ***********************************************************************

      ---------------------------------------------------------------------


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station      603.100 to Point/Station      603.200
      **** STREAM ROUTING SCS CONVEX METHOD ****
      ______________________________________________________________________
      HYDROGRAPH STREAM ROUTING DATA:
      Length of stream =    210.00 (Ft.)
      Elevation difference =    1.05 (Ft.)
      Slope of channel =  0.005000 (Vert/Horiz)
      Channel type - Pipe
```

```
Pipe length  =   210.00(Ft.)   Elevation difference =   1.05(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using mean flow rate of hydrograph
Required pipe flow  =     0.252(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.252(CFS)
Normal flow depth in pipe =    3.47(In.)
Flow top width inside pipe =    5.93(In.)
Critical Depth =    0.25(Ft.)
Pipe flow velocity =      2.14(Ft/s)
Travel time through pipe =    1.64 min.


Pipe length  =   210.00(Ft.)   Elevation difference =   1.05(Ft.)
Manning's N = 0.013   No. of pipes = 1
Pipe evaluation using maximum flow rate of hydrograph
Required pipe flow  =     0.393(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.393(CFS)
Normal flow depth in pipe =    4.88(In.)
Flow top width inside pipe =    4.68(In.)
Critical Depth =    0.32(Ft.)
Pipe flow velocity =      2.30(Ft/s)
Travel time through pipe =    1.52 min.


*********************** SCS CONVEX CHANNEL ROUTING ********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
         where c* = 1 - (1-c)^e and dt = c(length)/velocity
         c(v/v+1.7) =   0.5754   Travel time =   1.52 (min.)
       dt*(unit time interval) =   5.00(min.),  e=   4.1463
       dt(routing time-step) =   0.87 (min.),   c* =   0.9713

Output hydrograph delayed by 0  unit time increments


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals (CFS)

--------------------------------------------------------------------
Time(h+m) Out = O(CFS) In = I  0        0.1       0.2       0.3       0.4
-----------------------------------------------------------------------
  0+ 5       0.0004      0.00  O         |         |         |         |
  0+10       0.0016      0.00  O         |         |         |         |
  0+15       0.0034      0.00  O         |         |         |         |
  0+20       0.0056      0.01  O         |         |         |         |
  0+25       0.0081      0.01  O         |         |         |         |
  0+30       0.0109      0.01  |O        |         |         |         |
  0+35       0.0137      0.01  |O        |         |         |         |
  0+40       0.0164      0.02  |O        |         |         |         |
  0+45       0.0191      0.02  |O        |         |         |         |
  0+50       0.0218      0.02  | O       |         |         |         |
  0+55       0.0250      0.03  | O       |         |         |         |
  1+ 0       0.0283      0.03  | O       |         |         |         |
  1+ 5       0.0315      0.03  |  O      |         |         |         |
  1+10       0.0341      0.03  |  O      |         |         |         |
```

```
1+15       0.0364      0.04   |  O      |         |         |         |
1+20       0.0385      0.04   |  O      |         |         |         |
1+25       0.0406      0.04   |   O     |         |         |         |
1+30       0.0425      0.04   |   O     |         |         |         |
1+35       0.0445      0.04   |   O     |         |         |         |
1+40       0.0464      0.05   |   O     |         |         |         |
1+45       0.0482      0.05   |   O     |         |         |         |
1+50       0.0502      0.05   |    O    |         |         |         |
1+55       0.0525      0.05   |    O    |         |         |         |
2+ 0       0.0551      0.06   |    O    |         |         |         |
2+ 5       0.0577      0.06   |    O    |         |         |         |
2+10       0.0602      0.06   |     O   |         |         |         |
2+15       0.0627      0.06   |     O   |         |         |         |
2+20       0.0651      0.07   |     O   |         |         |         |
2+25       0.0674      0.07   |     O   |         |         |         |
2+30       0.0697      0.07   |      O  |         |         |         |
2+35       0.0721      0.07   |      O  |         |         |         |
2+40       0.0749      0.08   |      O  |         |         |         |
2+45       0.0779      0.08   |      O  |         |         |         |
2+50       0.0809      0.08   |       O |         |         |         |
2+55       0.0838      0.08   |       O |         |         |         |
3+ 0       0.0867      0.09   |       O |         |         |         |
3+ 5       0.0895      0.09   |        O|         |         |         |
3+10       0.0922      0.09   |        O|         |         |         |
3+15       0.0948      0.10   |        O|         |         |         |
3+20       0.0973      0.10   |        O|         |         |         |
3+25       0.0998      0.10   |         O         |         |         |
3+30       0.1022      0.10   |         O         |         |         |
3+35       0.1046      0.11   |         O         |         |         |
3+40       0.1069      0.11   |         O         |         |         |
3+45       0.1091      0.11   |         |O        |         |         |
3+50       0.1114      0.11   |         |O        |         |         |
3+55       0.1142      0.11   |         |O        |         |         |
4+ 0       0.1171      0.12   |         |O        |         |         |
4+ 5       0.1200      0.12   |         | O       |         |         |
4+10       0.1229      0.12   |         | O       |         |         |
4+15       0.1257      0.13   |         | O       |         |         |
4+20       0.1287      0.13   |         |  O      |         |         |
4+25       0.1320      0.13   |         |  O      |         |         |
4+30       0.1354      0.14   |         |  O      |         |         |
4+35       0.1389      0.14   |         |   O     |         |         |
4+40       0.1423      0.14   |         |   O     |         |         |
4+45       0.1456      0.15   |         |   O     |         |         |
4+50       0.1490      0.15   |         |    O    |         |         |
4+55       0.1528      0.15   |         |    O    |         |         |
5+ 0       0.1567      0.16   |         |    OI   |         |         |
5+ 5       0.1602      0.16   |         |     O   |         |         |
5+10       0.1628      0.16   |         |     O   |         |         |
5+15       0.1648      0.17   |         |     O   |         |         |
5+20       0.1667      0.17   |         |     O   |         |         |
5+25       0.1689      0.17   |         |      O  |         |         |
5+30       0.1713      0.17   |         |      O  |         |         |
5+35       0.1740      0.17   |         |      O  |         |         |
5+40       0.1771      0.18   |         |       O |         |         |
5+45       0.1803      0.18   |         |       O |         |         |
5+50       0.1836      0.18   |         |       O |         |         |
5+55       0.1868      0.19   |         |        O|         |         |
6+ 0       0.1899      0.19   |         |        O|         |         |
6+ 5       0.1931      0.19   |         |        O|         |         |
6+10       0.1967      0.20   |         |         O         |         |
6+15       0.2004      0.20   |         |         O         |         |
6+20       0.2042      0.20   |         |         O         |         |
6+25       0.2078      0.21   |         |         |O        |         |
```

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 6+30       0.2114      0.21  |         |         |O        |         |
 6+35       0.2151      0.22  |         |         |O        |         |
 6+40       0.2191      0.22  |         |         | O       |         |
 6+45       0.2232      0.22  |         |         | O       |         |
 6+50       0.2274      0.23  |         |         |  O      |         |
 6+55       0.2314      0.23  |         |         |  O      |         |
 7+ 0       0.2354      0.24  |         |         |  OI     |         |
 7+ 5       0.2392      0.24  |         |         |   O     |         |
 7+10       0.2429      0.24  |         |         |   O     |         |
 7+15       0.2466      0.25  |         |         |    O    |         |
 7+20       0.2503      0.25  |         |         |    O    |         |
 7+25       0.2543      0.26  |         |         |    O    |         |
 7+30       0.2586      0.26  |         |         |     O   |         |
 7+35       0.2630      0.26  |         |         |     O   |         |
 7+40       0.2677      0.27  |         |         |      O  |         |
 7+45       0.2726      0.27  |         |         |      O  |         |
 7+50       0.2776      0.28  |         |         |       O |         |
 7+55       0.2830      0.28  |         |         |       O |         |
 8+ 0       0.2885      0.29  |         |         |        O|         |
 8+ 5       0.2943      0.30  |         |         |        OI         |
 8+10       0.3009      0.30  |         |         |         O         |
 8+15       0.3079      0.31  |         |         |         |O        |
 8+20       0.3148      0.32  |         |         |         | O       |
 8+25       0.3216      0.32  |         |         |         | O       |
 8+30       0.3283      0.33  |         |         |         |  O      |
 8+35       0.3349      0.34  |         |         |         |   O     |
 8+40       0.3418      0.34  |         |         |         |   O     |
 8+45       0.3488      0.35  |         |         |         |    O    |
 8+50       0.3559      0.36  |         |         |         |     O   |
 8+55       0.3632      0.36  |         |         |         |     OI  |
 9+ 0       0.3706      0.37  |         |         |         |      O  |
 9+ 5       0.3746      0.38  |         |         |         |       O |
 9+10       0.3714      0.37  |         |         |         |      O  |
 9+15       0.3636      0.36  |         |         |         |     IO  |
 9+20       0.3548      0.35  |         |         |         |    IO   |
 9+25       0.3465      0.34  |         |         |         |    O    |
 9+30       0.3388      0.34  |         |         |         |   O     |
 9+35       0.3319      0.33  |         |         |         |  O      |
 9+40       0.3257      0.32  |         |         |         |  O      |
 9+45       0.3202      0.32  |         |         |         | O       |
 9+50       0.3154      0.31  |         |         |         |IO       |
 9+55       0.3113      0.31  |         |         |         |O        |
10+ 0       0.3078      0.31  |         |         |         |O        |
10+ 5       0.3066      0.31  |         |         |         |O        |
10+10       0.3096      0.31  |         |         |         |O        |
10+15       0.3154      0.32  |         |         |         | O       |
10+20       0.3220      0.32  |         |         |         | O       |
10+25       0.3286      0.33  |         |         |         |  O      |
10+30       0.3350      0.34  |         |         |         |   O     |
10+35       0.3389      0.34  |         |         |         |   O     |
10+40       0.3379      0.34  |         |         |         |   O     |
10+45       0.3336      0.33  |         |         |         |  O      |
10+50       0.3285      0.33  |         |         |         |  O      |
10+55       0.3234      0.32  |         |         |         | O       |
11+ 0       0.3184      0.32  |         |         |         | O       |
11+ 5       0.3135      0.31  |         |         |         |O        |
11+10       0.3083      0.31  |         |         |         |O        |
11+15       0.3030      0.30  |         |         |         O         |
11+20       0.2978      0.30  |         |         |         O         |
11+25       0.2928      0.29  |         |         |        O|         |
11+30       0.2881      0.29  |         |         |        O|         |
11+35       0.2831      0.28  |         |         |       O |         |
11+40       0.2773      0.28  |         |         |       O |         |
```

```
11+45       0.2711      0.27  |         |         |      O  |         |
11+50       0.2652      0.26  |         |         |     O   |         |
11+55       0.2599      0.26  |         |         |     O   |         |
12+ 0       0.2553      0.25  |         |         |    O    |         |
12+ 5       0.2528      0.25  |         |         |    O    |         |
12+10       0.2541      0.25  |         |         |    O    |         |
12+15       0.2579      0.26  |         |         |     O   |         |
12+20       0.2628      0.26  |         |         |     O   |         |
12+25       0.2683      0.27  |         |         |      O  |         |
12+30       0.2742      0.28  |         |         |      OI |         |
12+35       0.2806      0.28  |         |         |       O |         |
12+40       0.2880      0.29  |         |         |        O|         |
12+45       0.2960      0.30  |         |         |         O         |
12+50       0.3044      0.31  |         |         |         OI        |
12+55       0.3132      0.31  |         |         |         |OI       |
13+ 0       0.3222      0.32  |         |         |         | O       |
13+ 5       0.3324      0.33  |         |         |         |  OI     |
13+10       0.3450      0.35  |         |         |         |    O    |
13+15       0.3591      0.36  |         |         |         |     O   |
13+20       0.3736      0.38  |         |         |         |       O |
13+25       0.3878      0.39  |         |         |         |        O|
13+30       0.3925      0.39  |         |         |         |        OI
13+35       0.3930      0.39  |         |         |         |        OI
13+40       0.3931      0.39  |         |         |         |        OI
13+45       0.3931      0.39  |         |         |         |        OI
13+50       0.3931      0.39  |         |         |         |        OI
13+55       0.3931      0.39  |         |         |         |        OI
14+ 0       0.3931      0.39  |         |         |         |        OI
14+ 5       0.3931      0.39  |         |         |         |        OI
14+10       0.3931      0.39  |         |         |         |        OI
14+15       0.3931      0.39  |         |         |         |         O
14+20       0.3931      0.39  |         |         |         |         O
14+25       0.3931      0.39  |         |         |         |         O
14+30       0.3931      0.39  |         |         |         |         O
14+35       0.3931      0.39  |         |         |         |         O
14+40       0.3931      0.39  |         |         |         |         O
14+45       0.3931      0.39  |         |         |         |         O
14+50       0.3931      0.39  |         |         |         |         O
14+55       0.3931      0.39  |         |         |         |         O
15+ 0       0.3931      0.39  |         |         |         |         O
15+ 5       0.3931      0.39  |         |         |         |         O
15+10       0.3931      0.39  |         |         |         |         O
15+15       0.3931      0.39  |         |         |         |         O
15+20       0.3931      0.39  |         |         |         |         O
15+25       0.3931      0.39  |         |         |         |         O
15+30       0.3931      0.39  |         |         |         |         O
15+35       0.3931      0.39  |         |         |         |         O
15+40       0.3931      0.39  |         |         |         |         O
15+45       0.3931      0.39  |         |         |         |         O
15+50       0.3931      0.39  |         |         |         |         O
15+55       0.3931      0.39  |         |         |         |         O
16+ 0       0.3931      0.39  |         |         |         |         O
16+ 5       0.3931      0.39  |         |         |         |         O
16+10       0.3931      0.39  |         |         |         |         O
16+15       0.3931      0.39  |         |         |         |         O
16+20       0.3931      0.39  |         |         |         |         O
16+25       0.3931      0.39  |         |         |         |         O
16+30       0.3931      0.39  |         |         |         |         O
16+35       0.3931      0.39  |         |         |         |         O
16+40       0.3931      0.39  |         |         |         |         O
16+45       0.3931      0.39  |         |         |         |         O
16+50       0.3931      0.39  |         |         |         |         O
16+55       0.3931      0.39  |         |         |         |         O
```

```
17+ 0       0.3931      0.39  |         |         |         |         O
17+ 5       0.3931      0.39  |         |         |         |         O
17+10       0.3897      0.39  |         |         |         |        O|
17+15       0.3843      0.38  |         |         |         |       IO|
17+20       0.3788      0.38  |         |         |         |       O |
17+25       0.3734      0.37  |         |         |         |      O  |
17+30       0.3682      0.37  |         |         |         |      O  |
17+35       0.3632      0.36  |         |         |         |     O   |
17+40       0.3583      0.36  |         |         |         |     O   |
17+45       0.3535      0.35  |         |         |         |    O    |
17+50       0.3486      0.35  |         |         |         |    O    |
17+55       0.3435      0.34  |         |         |         |   O     |
18+ 0       0.3382      0.34  |         |         |         |   O     |
18+ 5       0.3330      0.33  |         |         |         |  O      |
18+10       0.3279      0.33  |         |         |         |  O      |
18+15       0.3229      0.32  |         |         |         | O       |
18+20       0.3181      0.32  |         |         |         | O       |
18+25       0.3134      0.31  |         |         |         |O        |
18+30       0.3088      0.31  |         |         |         |O        |
18+35       0.3042      0.30  |         |         |         O         |
18+40       0.2993      0.30  |         |         |         O         |
18+45       0.2942      0.29  |         |         |        O|         |
18+50       0.2889      0.29  |         |         |        O|         |
18+55       0.2834      0.28  |         |         |       O |         |
19+ 0       0.2777      0.28  |         |         |       O |         |
19+ 5       0.2723      0.27  |         |         |      O  |         |
19+10       0.2674      0.27  |         |         |      O  |         |
19+15       0.2630      0.26  |         |         |     O   |         |
19+20       0.2590      0.26  |         |         |     O   |         |
19+25       0.2555      0.25  |         |         |    IO   |         |
19+30       0.2524      0.25  |         |         |    O    |         |
19+35       0.2493      0.25  |         |         |    O    |         |
19+40       0.2459      0.25  |         |         |   IO    |         |
19+45       0.2423      0.24  |         |         |   O     |         |
19+50       0.2385      0.24  |         |         |   O     |         |
19+55       0.2344      0.23  |         |         |  O      |         |
20+ 0       0.2301      0.23  |         |         |  O      |         |
20+ 5       0.2260      0.23  |         |         | O       |         |
20+10       0.2224      0.22  |         |         | O       |         |
20+15       0.2192      0.22  |         |         | O       |         |
20+20       0.2162      0.22  |         |         |O        |         |
20+25       0.2133      0.21  |         |         |O        |         |
20+30       0.2105      0.21  |         |         |O        |         |
20+35       0.2077      0.21  |         |         |O        |         |
20+40       0.2051      0.20  |         |         O         |         |
20+45       0.2025      0.20  |         |         O         |         |
20+50       0.1998      0.20  |         |         O         |         |
20+55       0.1967      0.20  |         |        IO         |         |
21+ 0       0.1934      0.19  |         |        O|         |         |
21+ 5       0.1903      0.19  |         |        O|         |         |
21+10       0.1878      0.19  |         |        O|         |         |
21+15       0.1855      0.19  |         |       O |         |         |
21+20       0.1833      0.18  |         |       O |         |         |
21+25       0.1806      0.18  |         |       O |         |         |
21+30       0.1778      0.18  |         |       O |         |         |
21+35       0.1752      0.17  |         |      O  |         |         |
21+40       0.1730      0.17  |         |      O  |         |         |
21+45       0.1712      0.17  |         |      O  |         |         |
21+50       0.1693      0.17  |         |      O  |         |         |
21+55       0.1671      0.17  |         |     IO  |         |         |
22+ 0       0.1646      0.16  |         |     O   |         |         |
22+ 5       0.1624      0.16  |         |     O   |         |         |
22+10       0.1606      0.16  |         |     O   |         |         |
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   22+15       0.1591      0.16  |         |     O   |         |         |
   22+20       0.1576      0.16  |         |     O   |         |         |
   22+25       0.1557      0.16  |         |    O    |         |         |
   22+30       0.1535      0.15  |         |    O    |         |         |
   22+35       0.1514      0.15  |         |    O    |         |         |
   22+40       0.1492      0.15  |         |    O    |         |         |
   22+45       0.1471      0.15  |         |   O     |         |         |
   22+50       0.1451      0.14  |         |   O     |         |         |
   22+55       0.1432      0.14  |         |   O     |         |         |
   23+ 0       0.1413      0.14  |         |   O     |         |         |
   23+ 5       0.1394      0.14  |         |   O     |         |         |
   23+10       0.1376      0.14  |         |  IO     |         |         |
   23+15       0.1359      0.14  |         |  O      |         |         |
   23+20       0.1342      0.13  |         |  O      |         |         |
   23+25       0.1325      0.13  |         |  O      |         |         |
   23+30       0.1309      0.13  |         |  O      |         |         |
   23+35       0.1293      0.13  |         |  O      |         |         |
   23+40       0.1278      0.13  |         | IO      |         |         |
   23+45       0.1263      0.13  |         | O       |         |         |
   23+50       0.1249      0.12  |         | O       |         |         |
   23+55       0.1235      0.12  |         | O       |         |         |
   24+ 0       0.1221      0.12  |         | O       |         |         |
   24+ 5       0.1204      0.12  |         | O       |         |         |
   24+10       0.1179      0.12  |         |O        |         |         |
   24+15       0.1149      0.11  |         |O        |         |         |
   24+20       0.1117      0.11  |         |O        |         |         |
   24+25       0.1086      0.11  |         IO        |         |         |
   24+30       0.1056      0.10  |         O         |         |         |
   24+35       0.1027      0.10  |         O         |         |         |
   24+40       0.0998      0.10  |         O         |         |         |
   24+45       0.0197      0.00  I O       |         |         |         |
   24+50       0.0000      0.00  O         |         |         |         |
-----------------------------------------------------------------------
       ****************************HYDROGRAPH DATA****************************
                    Number of intervals =   298
                    Time interval =    5.0 (Min.)
                    Maximum/Peak flow rate =        0.393 (CFS)
                    Total volume =       0.480 (Ac.Ft)
              Status of hydrographs being held in storage
                         Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
              Peak (CFS)      0.000     0.000     0.000     0.000     0.000
              Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
       ***********************************************************************

       --------------------------------------------------------------------


       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
       Process from Point/Station      603.200 to Point/Station      603.200
       **** STORE OR DELETE CURRENT HYDROGRAPH ****
       ______________________________________________________________________
       Current stream hydrograph saved in file 27259FPOND224.rte
       ****************************HYDROGRAPH DATA****************************
                    Number of intervals =     0
                    Time interval =    0.0 (Min.)
                    Maximum/Peak flow rate =        0.000 (CFS)
                    Total volume =       0.000 (Ac.Ft)
              Status of hydrographs being held in storage
                         Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
              Peak (CFS)      0.000     0.000     0.000     0.000     0.000
              Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
       ***********************************************************************
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Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☒ A. On-site storm drain inlets	☒ Locations of inlets.	☒ Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	☒ Maintain and periodically repaint or replace inlet markings. ☒ Provide stormwater pollution prevention information to new site owners, lessees, or operators. ☒ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ☒ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
☐ B. Interior floor drains and elevator shaft sump pumps		☐ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ C. Interior parking garages		☐ State that parking garage floor drains will be plumbed to the sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ **D1.** Need for future indoor & structural pest control		☐ Note building design features that discourage entry of pests.	☐ Provide Integrated Pest Management information to owners, lessees, and operators.
☒ **D2.** Landscape/ Outdoor Pesticide Use	☐ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ☐ Show self-retaining landscape areas, if any. ☐ Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)	☐State that final landscape plans will accomplish all of the following. ☐ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☒ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☐ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☒ Consider using pest-resistant plants, especially adjacent to hardscape. ☐ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☒ Maintain landscaping using minimum or no pesticides. ☒ See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater/Downloads/LandscapeGardenBrochure.pdf ☐ Provide IPM information to new owners, lessees and operators.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☒ E. Pools, spas, ponds, decorative fountains, and other water features.	☒ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☒ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
☐ F. Food service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ Provide this brochure to new site owners, lessees, and operators.
☒ G. Refuse areas	☒ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☒ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☒ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☒ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	State how the following will be implemented: ☒ Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ H. Industrial processes.	☐ Show process area.	☐ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	☐ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ I. Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	☐ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ☐ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ☐ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for: • Hazardous Waste Generation • Hazardous Materials Release Response and Inventory • California Accidental Release (CalARP) • Aboveground Storage Tank • Uniform Fire Code Article 80 Section 103(b) & (c) 1991 • Underground Storage Tank www.cchealth.org/groups/hazmat /	☐ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ J. Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shutoff to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☐ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ☐Car dealerships and similar may rinse cars with water only.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ K. Vehicle/Equipment Repair and Maintenance	☐ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ☐ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ☐ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ☐ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ☐ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ☐ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ L. Fuel Dispensing Areas	☐ Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☐ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		☐ The property owner shall dry sweep the fueling area routinely. ☐ See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

[6] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ M. Loading Docks	☐ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ☐ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ☐ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☐ Move loaded and unloaded items indoors as soon as possible. ☐ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☒ N. Fire Sprinkler Test Water		☒ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☒ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
☒ O. Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☒ Rooftop equipment ☒ Drainage sumps ☒ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☒ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☒ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☒ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. ☒ Include controls for other sources as specified by local reviewer.	

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☒ P. Plazas, sidewalks, and parking lots.			☒ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

WHEN RECORDED MAIL TO:

City Clerk
City of Corona
City Hall, 29714 Haun Road
Menifee, CA 92586

Planning Case: xx

For Recorder's Office Use Only

COVENANT AND AGREEMENT
ESTABLISHING NOTIFICATION PROCESS AND RESPONSIBILITY FOR
WATER QUALITY MANAGEMENT PLAN IMPLEMENTATION AND MAINTENANCE

THIS COVENANT AND AGREEMENT FOR WATER QUALITY MANAGEMENT PLAN IMPLEMENTATION AND MAINTENANCE is made and entered into this ______ day of ___________________, 20__, by __________, ("Declarant"), with reference to the following facts:

A. Declarant is the fee owner of the real property (the "Property") situated in the City of Menifee, County of Riverside, State of California, and legally described in Exhibit "A", which is attached hereto and incorporated within by reference.

B. Declarant has applied to the City of Menifee ("City") for Mill Creek Promenade – Haun Road; (planning case #)__________.

C. As a condition of approval and prior to the map recordation and/or issuance of any permits, the City is requiring Declarant to execute and record an agreement stating that the future property owners shall be informed of the requirements to implement and maintain the Best Management Practices ("BMPs") as described in the approved project specific Water Quality Management Plan.

D. Declarant intends by this document to comply with the conditions imposed by the City and to impose upon the Property mutually beneficial restrictions, conditions, covenants and agreements for the benefit of Property.

NOW, THEREFORE, for the purposes of complying with the conditions imposed by the City of Menifee for the approval of Planning Case _______, Declarant hereby declares that the Property is and hereafter shall be held, conveyed, transferred, mortgaged, encumbered, leased, rented, used, occupied, sold and improved subject to the following declarations, limitations, covenants, conditions, restrictions and easements, all of which are imposed as equitable servitudes pursuant to a general plan for the development of the Property for the purpose of enhancing and protecting the value and attractiveness of the Property, and each Parcel thereof, in accordance with the plan for the improvement of the Property, and to comply with certain conditions imposed by the City for the approval of (planning case no.)_______, and shall be binding and inure to the benefit of each successor and assignee in interest of each such party. Any conveyance, transfer, sale, assignment, lease or sublease made by Declarant of a Parcel of the Property shall be and hereby is deemed to incorporate by reference all the provisions of the Covenant and Agreement including, but not limited to, all the covenants, conditions, restrictions, limitations, grants of easement, rights, rights-of-way, and equitable servitude contained herein.

1. This Covenant and Agreement hereby establishes a notification process for future individual property owners to ensure they are subject to and adhere to the Water Quality Management Plan implementation measures and that it shall be the responsibility of the Declarant, its heirs, successors and assigns to implement and maintain all Best Management Practices (BMPs) in good working order.

2. Declarant shall use its best efforts to diligently implement and maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Declarant, its heirs, successors and assigns, in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, Declarant, its heirs, successors and assigns shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

3. In the event Declarant, or its heirs, successors or assigns, fails to undertake the maintenance contemplated by this Covenant and Agreement within twenty-one (21) days of being given written notice by the City, or fails to complete any maintenance contemplated by this Covenant and Agreement with reasonable diligence, the City is hereby authorized to cause any maintenance necessary to be completed and charge the entire cost and expense to the Declarant or Declarant's successors or assigns, including administrative costs, reasonable attorneys fees and interest thereon at the maximum rate authorized by the Civil Code from the date of the notice of expense until paid in full. As an additional remedy, the Public Works Director may withdraw any previous urban runoff-related approval with respect to the Property on which BMPs have been installed and/or implemented until such time as Declarant, its heirs, successors or assigns, repays to City its reasonable costs incurred in accordance with this paragraph.

4. Any person who now or hereafter owns or acquires any right, title or interest in or to any parcel of the Property shall be deemed to have consented and agreed to every covenant, condition, restriction and easement contained herein.

5. In addition, each of the provisions hereof shall operate as covenants running with the land for the benefit of the Property and each Parcel thereof and shall inure to the benefit of all owners of the Parcels thereof, their successors and assigns in interest, and shall apply to and bind each successive owner of each Parcel, their successors and assigns in interest.

6. The terms of this Covenant and Agreement may be enforced by the City, its successors or assigns, and by any owner, lessee or tenant of the Parcels of the Property. Should the City or any owner, lessee or tenant bring an action to enforce any of the terms of this Covenant and Agreement, the prevailing party shall be entitled to costs of suit including reasonable attorneys' fees.

7. Subject to the prior written approval of the City by its Public Works Director, any provision contained herein may be terminated, modified or amended as to all of the Property or any portion thereof. No such termination, modification or amendment shall be effective until there shall have been executed, acknowledged and recorded in the Office of the Recorder of Riverside County, California, an appropriate instrument evidencing the same including the consent thereto by the City.

IN WITNESS WHEREOF, Declarant has caused this Covenant and Agreement to be executed as of the day and year first written above.

____
Name:
Title:

____
Name:
Title:

APPROVED AS TO FORM:	APPROVED AS TO CONTENT
______________________________	______________________________
Name:	Name:
Deputy City Attorney	Public Works Department:

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of ____________________________________)

On ______________________________, before me, ________________________________, a

notary public, personally appeared _______________________________________ , who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_________________________________ **(SEAL)**
Signature

ACKNOWLEDGMENT

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California
County of ____________________________________)

On ______________________________, before me, ________________________________, a

notary public, personally appeared _______________________________________ , who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_________________________________ **(SEAL)**
Signature

Inspection and Maintenance Checklist for Mill Creek Promenade

Date of Inspection: ______________________ Time: ______________________ AM/PM (circle)

Inspected By: ______________________ ______________________

(print name) (print name)

Responsible Party: ______________________ ______________________

______________________ ______________________

Funding Party:

The designated Site Inspector shall use the following guidelines, Section I of the WQMP and cut sheets in Appendix 9 for maintainance, inspection, and repair of BMPs identified in the WQMP. Include any comments in the box to the right including repairs made or needed. If repairs are needed, provide a follow-up date.

Best Management Practices (BMPs)	Inspection Frequency (all controls)	Recommendation(s)	Observations/Comments
NON-STRUCTURAL BMPs			
Educate Operators, Tenants, Occupants, or Employees	- Anually in September (before rainy season)	- Familiarize with WQMP and basic requirements	
Activity Restrictions	- Anually in September (before rainy season)	- Familiarize with WQMP and basic requirements - only use chemicals as directed by manufacturer	
Irrigation System and Landscape Maintenance	- Monthly	- Stabilize any exposed slopes with vegetations - Sweep and properly dispose of any fertilizer(s)	
Street Sweeping (Parking Lot)	-Weekley and as needed	- Sweep around drain inlets, driveways, and any points of discharge off-site; apply absorbent over any mechanical spills	
Drainge Facility Inspection and Maintenance	- Prior to an anticipated rain event - Following a rain event -Bi-weekly during dry months	- Adjust sprinklers to eliminate overspray and prevent discharge to paved areas - Clean trash and Debris at On-Site Catch Basins and Vegetated Swales	

Best Management Practices (BMPs)	Inspection Frequency (all controls)	Recommendation(s)	Observations/Comments
STRUCTURAL BMPs			
MS4 Stenciling and Signage	- Anually in September (before rainy season)	- re-stencile if display is unclear	
Landscape and Irrigation System Design	- Monthly	- Install automatic shutoff valves to avoid excess watering during storm season - Familiarize with landscape plan	
Protect Slopes and Channels	- Anually in September (before rainy season)	- Plant vegetation in eroded areas - Remove trash and debris	
Best Management Practices (BMPs)	Inspection Frequecny (all controls)	Recommendation(s)	Observations/Comments
TREATMENT CONTROL BMPs			
Bioretention Facility	- Semi-anually (before and after rain season)	- Ensure water infiltrates into the subsurface and vegetation is managed to prevent creating mosquito and other vector habitants - Remove accumulated trash and Debris in the Infiltration Trenches - Trim vegetation at the beginning and end of wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons - if erosion is occuring within the trench, revegetate immediately and stablize with an erosion control mulch or mat until vegetation cover is established. - See the Bioretention information sheet (TC-32) found in Appendix 10 of the WQMP for additional Maintenance measures	

TREATMENT CONTROL BMPs			
Sand Filter Facility - Storm Chambers by Storm Tech	- See attached Maintenance Procedure by Storm Tech	-See attached Maintenance Procedure by Storm Tech	

StormTech®
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™

THE ISOLATOR® ROW

INTRODUCTION
An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW
The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

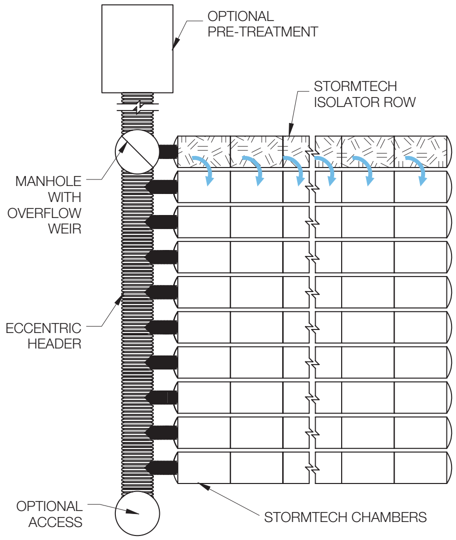
The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

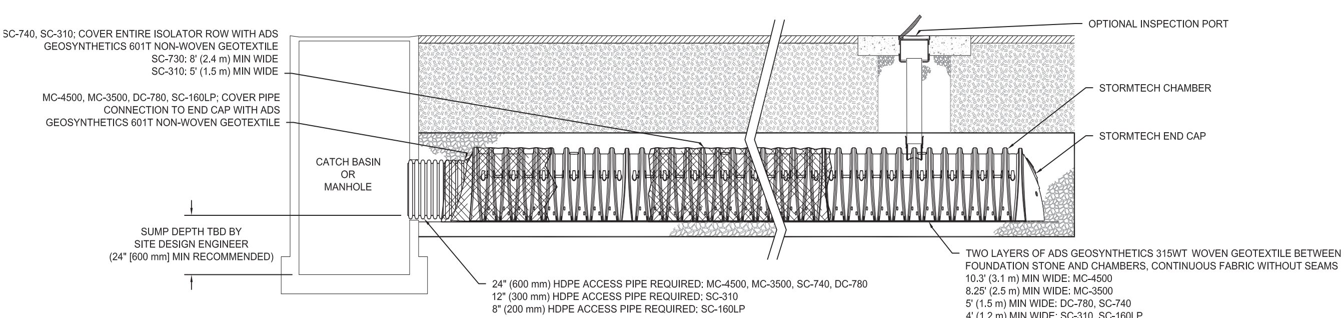
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



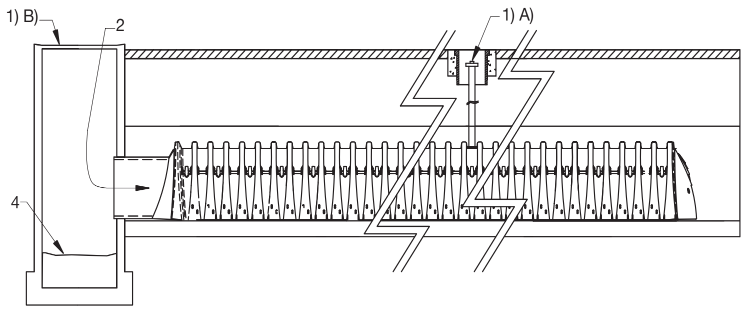
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
A) Inspection ports (if present)
  i. Remove lid from floor box frame
  ii. Remove cap from inspection riser
  iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
B) All Isolator Rows
  i. Remove cover from manhole at upstream end of Isolator Row
  ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings: Fixed point to chamber bottom (1)	Stadia Rod Readings: Fixed point to top of sediment (2)	Sediment Depth (1)–(2)	Observations/Actions	Inspector
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

StormTech® Detention • Retention • Water Quality
A division of ADS

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Maintenance Guidelines

Schedule	Inspection and Maintenance Activity
During every scheduled maintenance check (per below), and *as needed* at other times	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strongly avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used: o Care should be taken to avoid contact with the low-flow or other trenches, and the media filter in the bottom stage. o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rainy season. • No ponded water should be present for more than 72 hours to avoid nuisance or vector problems. No algae formation should be visible. Correct problems as needed.
Annually. If possible, schedule these inspections before the beginning of the rain season to allow for any repairs to occur before rains occur.	• Remove debris and litter from the entire basin • Inspect hydraulic and structural facilities. Examine the outlet for clogging, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Inspect sand media at the filter drain to verify it is allowing acceptable infiltration. **Scarify top <u>3 inches</u> by raking the filter drain's sand surface annually.** • Check the media filter underdrains (via the cleanout) for damage or clogging. Repair as needed. • Remove accumulated sediment and debris from the forebay, and ensure that the notch weir is clear and will allow proper drainage. • Check gravel filled low flow and collector trenches for sediment buildup and repair as needed.
Every 5 years or sooner (depending on whether observed drain times to empty the basin are less than 72 hours).	• Remove the top 3 inches of sand from the filter drain and backfill with 3 inches of new sand to return the sand layer to its original depth. When scarification or removal of the top 3 inches of sand is no longer effective, remove and replace sand filter layer.
Whenever substantial sediment accumulation has occurred.	• Remove accumulated sediment from the bottom of the basin. Removal should extend to original basin depth.

Operation and Maintenance Plan
StormTree Tree Filter System
Mill Creek Promenade, Menifee, CA

The following Operation and Maintenance (O&M) Plan was prepared by StormTree to assist the designated owner/operator in providing for the successful long-term operation of the tree filter systems for the above referenced project. It is understood that the O&M Plan will become effective immediately following construction and system installation. Maintenance will be performed as described and required by the owner/operator, assignee, or other third party entity.

Post Installation:

Following the installation of the tree filter (system), including backfilling the area surrounding the system to final grade, the system is considered to be "active" since water, sand, sediment, trash, etc. could potentially enter the system. Should the site not be secured, in that construction activities including grading, paving, or final landscaping have not been completed, the system could be impacted by quantities of construction debris entering the system. This impact could compromise the system's ability to function properly causing a reduction in infiltration efficiency and overall performance. It is **highly recommended** that the throat opening and surface grating be covered with wood sheeting, non-woven filter fabric or other materials to restrict the movement of water (and debris) from entering the system until the site is fully secured.

Watering:

The engineered media of a tree filter system is very porous and designed to provide high water conductivity (infiltration) but also sufficient organic material to maintain essential water holding capacity to allow for successful plant growth. Due to the inherent high infiltration capacity of the media, particular attention is required to the installation of plant material and irrigation needs.

The ideal season to install plant material (e.g., trees, shrubs) is Fall (September 1 thru November 1); Spring (April 1 thru June 1) is also a preferred season to install plant material. The acclimation of plant material is most successful during these two seasonal periods. Following plant installation, and at least one month thereafter, it is recommended that twice weekly (deep) watering take place, particularly during periods of drought or minimal rain events.

If possible, avoid installing plant material during the heat of summer, between approximately June 1 and August 31, due to the potential for placing tremendous stress on plant material following transplanting. Daily watering over a period of several weeks may be required to prevent mortality and allow for the establishment of a healthy root system.

General Maintenance:

Maintenance should optimally be performed on a yearly basis. If large quantities of accumulated trash are anticipated (or occurs) additional inspection and maintenance may be necessary.

1. Inspect tree for broken and/or dead branches and prune as necessary.

2. Remove any debris or trash from the concrete surface and/or surface grating.

3. Inspect the fiberglass grate opening surrounding the tree trunk to determine if the exterior trunk is in contact with, or in close proximity to the grate. If so, with the use of a narrow blade hand saw, powered jigsaw, or other cutting device, increase the opening by removing portions of the grating material as necessary. Make "closed cell" cuts to avoid leaving any jagged edges which may come in contact with the base or trunk of the plant material. Grate enlargement may not be required at all over the life cycle of the system.

4. Remove surface grating surrounding the tree and media bed to expose the internal surface and media filtration area; remove any visible debris and trash. Should any accumulated sands or sediment be observed on the media surface (including mulch layer), remove to assure a loose and unobstructed media layer.

5. Inspect the overflow/bypass port, piping and atrium grate, remove any debris or obstruction surrounding these components to facilitate unobstructed flow of water into the inlet port.

6. Inspect irrigation tubing and orifice opening to ensure that all components are in working order. Inspect for any kinking or clogging that may restrict operational functionality and adjust or replace as necessary.

7. Replace surface grating ensuring stable positioning.

8. Complete any required maintenance logs or paperwork.

9. Properly dispose of sands, sediment, debris, and trash.

   Although not a proprietary product, the engineered media is a specially blended mixture of several components formulated to maintain a specific infiltration capacity. The mixture materials are readily available from a sand & gravel facility and landscape nursery. Please consult StormTree directly regarding potential media addition/replacement.

   StormTree also provides contracted maintenance and inspection services.

For additional information please contact StormTree (www.storm-tree.com) 401-626-8999.

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

3.6 Extended Detention Basin

Type of BMP	LID - Biotreatment
Treatment Mechanisms	Sedimentation, Infiltration, Biofiltration, Evapotranspiration, and Evaporation
Minimum Tributary Drainage Area	5 acres
Other Names	Enhanced Water Quality Basin

Overview

The Extended Detention Basin (EDB) is designed to detain the design volume of stormwater, V_{BMP}, and maximize opportunities for volume losses through infiltration, evaporation, evapotranspiration and surface wetting. Additional pollutant removal is provided through sedimentation, in which pollutants can attach to sediment accumulated in the basin through the process of settling. Stormwater enters the EDB through a *forebay* where any trash, debris, and sediment accumulate for easy removal. Flows from the forebay enter the basin which is vegetated with native grasses that enhance infiltration and evapotranspiration, and which is interspersed with gravel-filled trenches that help further enhance infiltration. Water that does not get infiltrated or evapotranspired is conveyed to the *bottom stage* of the basin. At the bottom stage of the basin, low or incidental dry weather flows will be treated through a sand filter and collected in a subdrain structure. Any additional flows will be detained in the basin for an extended period by incorporating an outlet structure that is more restrictive than a traditional detention basin outlet. The restrictive outlet structure extends the drawdown time of the basin which further allows particles and associated pollutants to settle out before exiting the basin, while maximizing opportunities for additional incidental volume losses.

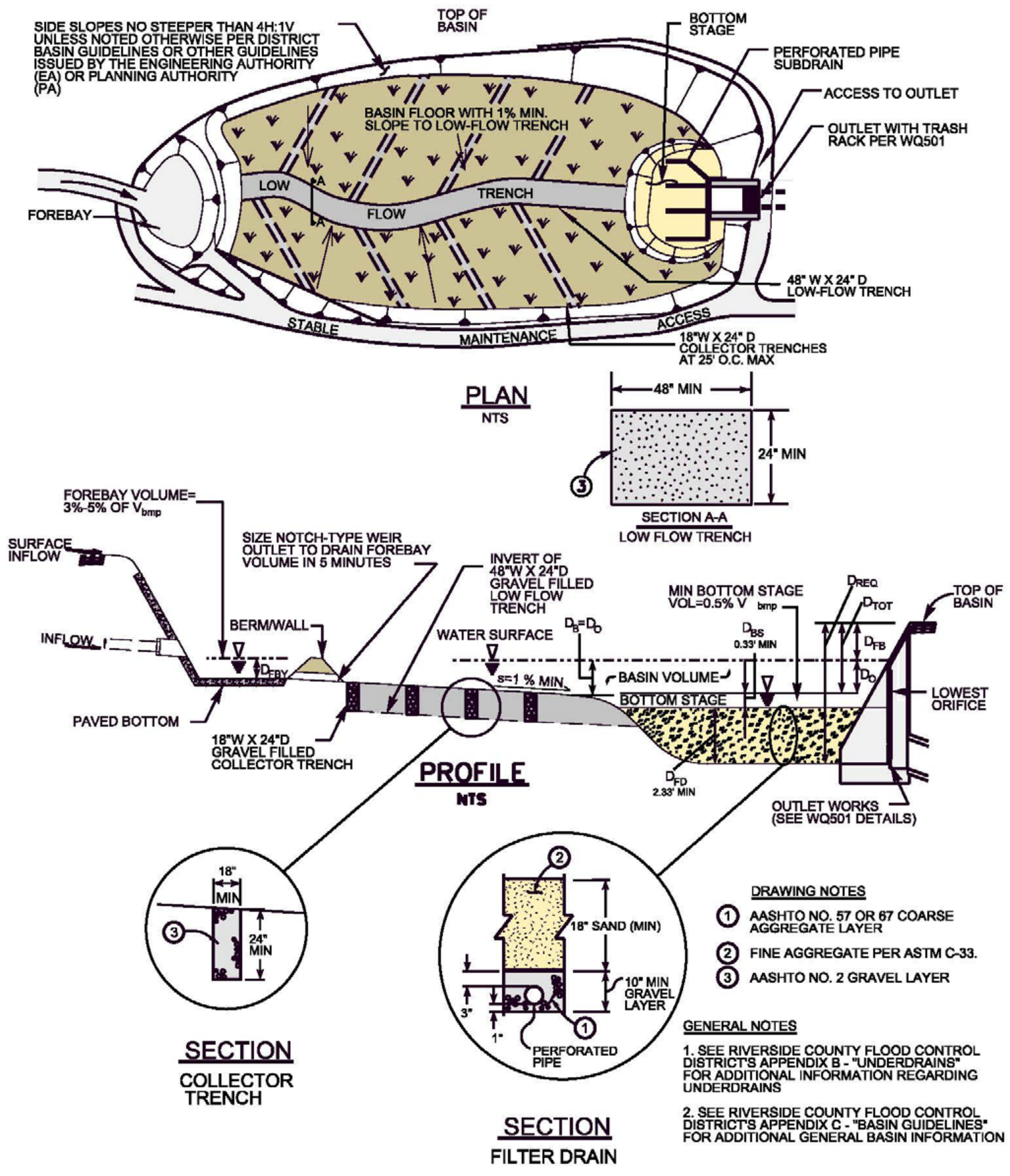


Figure 1 – Extended Detention Basin

Siting Considerations

Soils: EDBs can be used with almost all soils and geology. However, pollutant removal effectiveness is greatly improved when the underlying soil permits at least some infiltration.

Tributary Area: EDBs should only be used where the tributary drainage area is at least 5 acres, since meeting the draw-down requirements (discussed below) for smaller areas would result in very small outlet orifice diameters which would be prone to clogging.

Proximity to Receiving Waters: All site runoff must be treated to the MEP with appropriate BMPs *before* being discharged into Receiving Waters; as such the EDB cannot be constructed in-line within Receiving Waters.

Setbacks: Due to the infiltration characteristics incorporated into the EDB design, the lowest pervious point (beneath the filter drain) of the extended detention facility should be a minimum of 10' above the seasonal high groundwater table. All other setbacks shall be in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA).

Basin Guidelines: See Section 1 of the "Basin Guidelines" (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.) that may be required by the Engineering Authority (EA).

Landscaping Requirements

Basin vegetation provides erosion protection, enhances evapotranspiration and infiltration, and improves pollutant removal. The upper stage basin surface, berms and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through the use of pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the EA.

Maintenance Guidelines

Schedule	Inspection and Maintenance Activity
During every scheduled maintenance check (per below), and *as needed* at other times	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strongly avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used: o Care should be taken to avoid contact with the low-flow or other trenches, and the media filter in the bottom stage. o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rainy season. • No ponded water should be present for more than 72 hours to avoid nuisance or vector problems. No algae formation should be visible. Correct problems as needed.
Annually. If possible, schedule these inspections before the beginning of the rain season to allow for any repairs to occur before rains occur.	• Remove debris and litter from the entire basin • Inspect hydraulic and structural facilities. Examine the outlet for clogging, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Inspect sand media at the filter drain to verify it is allowing acceptable infiltration. **Scarify top <u>3 inches</u> by raking the filter drain's sand surface annually.** • Check the media filter underdrains (via the cleanout) for damage or clogging. Repair as needed. • Remove accumulated sediment and debris from the forebay, and ensure that the notch weir is clear and will allow proper drainage. • Check gravel filled low flow and collector trenches for sediment buildup and repair as needed.
Every 5 years or sooner (depending on whether observed drain times to empty the basin are less than 72 hours).	• Remove the top 3 inches of sand from the filter drain and backfill with 3 inches of new sand to return the sand layer to its original depth. When scarification or removal of the top 3 inches of sand is no longer effective, remove and replace sand filter layer.
Whenever substantial sediment accumulation has occurred.	• Remove accumulated sediment from the bottom of the basin. Removal should extend to original basin depth.

Design Summary

Design Parameter	Extended Detention Basin
Drawdown time (total)	72 hours [2,3]
Minimum drawdown time for 50% V_{BMP}	24 hours [2]
Minimum tributary area	5 acres [2]
Outlet erosion control	Energy dissipaters to reduce velocities[1]
Forebay volume	3 to 5 % of V_{BMP} [3]
Basin Invert Longitudinal Slope (min.)	1%
Basin Invert Transverse (cross) Slope (min)	1%
Low-flow trench width (min.)	48 inches
Low-flow trench depth (min.)	24 inches
Slope of low-flow trench along bottom excavated Surface (max.)	1%
Slope of gravel collector trenches along bottom excavated surface (max.)	1 %
Length to width ratio (min.)	1.5:1
Basin depth (min.)	1 foot [3]
Bottom stage volume	0.5 % of V_{BMP} [3]
Bottom stage depth (min)	0.33 feet [3]
Filter drain depth (min)	2.33 feet [3]

1. **Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures**
2. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**
3. **Denver, Colorado's UDFCD Drainage Criteria Manual, Volume 3**

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the "Basin Guidelines" (Appendix C). In addition, information herein may be superseded by other guidelines issued by the Engineering Authority.

Design Procedure

These steps correspond to and provide a description of the information required in the EDB Design Worksheet.

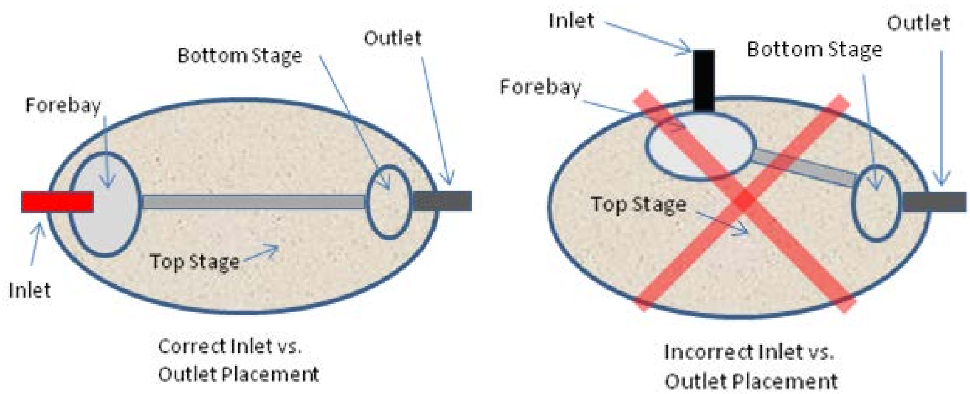
1. Find the Design Volume, V_{BMP}.

a) Enter the tributary area, A_T to the BMP. The minimum tributary area is 5 acres.

b) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.

2. Basin Footprint

a) Enter the length and width of the EDB. The length shall be measured between the inlet to the basin and the outlet structure; and the width shall be measured at the widest point of the basin invert. The length to width ratio should be 1.5:1 or longer to prevent short-circuiting and increase the overall effectiveness of the BMP.



b) Enter the internal basin side slopes. See the "Basin Guidelines" (Appendix C) for side slope requirements. If variable internal side-slopes are used, enter the steepest slope that will be used.

c) Using Figure 1 as a guide, enter the proposed basin depth, D_B, and the freeboard depth, D_{FB}. Based on the information provided, the spreadsheet will calculate the minimum total depth required, D_{REQ}, for this BMP. D_{REQ} is the depth from the bottom of the underdrain layer in the bottom stage (see step 5c), to the top of the freeboard. This calculated minimum required depth can be used to determine if enough elevation difference is available within the design topography to allow for use of this BMP.

d) Additionally, the basin depth D_B is equal to $D_{O,}$ which is the depth from the design pond water surface elevation to the lowest orifice in the outlet structure. D_O is confirmed by the spreadsheet and is used in the Basin Outlet Design described in step 6 below. It should be noted that this lowest orifice is a critical elevation in the design of this BMP. The Volume of the Basin V_{Basin} described in step 3d) is the volume of water above this lowest orifice. This lowest-orifice also represents the dry weather ponded water surface discussed in step 5c below. Below this elevation there must be a minimum of a 4-inch drop down to the surface of the Sand Filter in the bottom stage.

3. Basin Design

a) The Total Basin Depth, D_{TOT}, is calculated automatically, and is the sum of the basin depth D_B plus the freeboard depth D_{FB}.

b) Enter the longitudinal slope of the basin invert. This slope must be at least 1% and is measured along the low flow trench between the forebay and the bottom stage. Note that the surface of the sand layer in the bottom stage must be level (see Figure 1).

c) Enter the transverse slope of the basin invert. This transverse (cross sectional) slope must be at least 1% sloped toward the low flow trench.

d) Enter the Volume of the Basin, V_{Basin}. This volume must be the actual volume of water held within the basin as substantiated by modeling or appropriate volumetric calculations, and must be equal to or greater than V_{BMP}. This volume must be held above the lowest orifice in the Basin Outlet Design described in step 6 below.

4. Forebay Design

All flows must enter the basin through the forebay. The forebay provides a location for the settlement and collection of larger particles, and any other trash or debris. A relatively smooth and level concrete bottom surface should be provided to facilitate mechanical removal of any accumulated sediment, trash and debris.

Figure 2: Forebay filled with storm water

a) Enter the Forebay Volume VFB. This volume must be from 3 to 5 percent of V_{BMP}.

b) A rock or concrete berm must be constructed to detain water before it drains into the basin. The top of the berm shall be set no higher than the invert of the inlet conveyance. Enter the Forebay Depth, D_{FBY}.

c) The spreadsheet will calculate the minimum surface area of the forebay, A_{FB}, based on the provided Forebay Volume and Depth. Ensure that the plans provide for a forbay area at least this large.

d) Although the forebay will be well submerged in the design event, a full height rectangular notch-type weir shall be constructed through the berm to prevent permanent ponding in the forebay, and allow water to slowly and fully drain to the main body of the basin. This notch should be offset from the inflow streamline to prevent low-flows from short circuiting. Enter the width, W, of this rectangular notch weir. The width shall not be less than 1.5 inches to prevent clogging. Additionally, immediately outside the notch construct a minimum 1-foot by 1-foot gravel pad to prevent vegetative growth within the basin invert from blocking the notch.

5. Dry Weather and Low-Flow Management

The basin shall have both a low-flow gravel trench and a network of gravel collector trenches across the invert of the basin, as well as a bottom stage sand filter to treat low flows and dry weather flows (see Figure 1).

a) Low Flow Trench: The low-flow gravel trench conveys flow from the forebay to the bottom stage, while allowing for maximum incidental infiltration and volume loss. The trench shall be a minimum of 48 inches wide by 24 inches deep. This trench shall be unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished surface of the basin invert, and shall not use underdrains. The bottom excavated surface of the low-flow trench shall be 1 percent or flatter to promote infiltration.

Figure 3: Gravel filled low-flow trench

b) Collector Trenches: Gravel collector trenches beneath the top stage shall be arranged as illustrated in Figure 1 of Appendix C with minimal slope (1% maximum) along their bottom excavated surface to promote infiltration, and must extend from the low-flow trench to the toe of the basin side slopes. They shall be a minimum of 18-inches wide by 24-inches deep, unlined and backfilled with AASHTO No. 2 gravel (or similar) to the finished basin invert surface. The gravel collector trenches shall not use underdrains and shall be constructed with a maximum spacing of 25 feet, center to center. See Figure 1 of Appendix C.

c) Bottom Stage: A depressed sand filter drain area, referred to as the bottom stage, must be constructed adjacent to the outlet structure to treat any dry weather flows. To ensure that dry weather flows are treated through the sand filter and not discharged through the orifice plate, the top surface of the sand filter must be depressed at least 4 inches below the lowest orifice in the outlet structure. This depressed area will create a micro pool of water that is then filtered down through the sand filter and out through underdrains. Based on the minimum dimensions described below, the minimum depth of excavation below the lowest orifice in the outlet structure is 2.33 feet.

   i. Enter the Depth of the bottom stage, D_{BS}. As mentioned above, this depth must be at least 4 inches, and extend down below the lowest orifice in the outlet structure.

   ii. Enter the area of the bottom stage, A_{BS}.

iii. Based on the D_{BS} and A_{BS} entered, the spreadsheet will calculate V_{BS}. This volume is the volume of ponded water that will be held below the lowest orifice in the outlet structure, and above the surface of the sand filter. This volume must be at least 0.5% of V_{BMP}.

iv. Enter the thickness of the ASTM C-33 sand layer that will be provided, D_S. A minimum thickness of 18 inches is required.

v. Below the sand layer, a minimum 10-inch thick layer of gravel shall be installed with underdrains to drain the water that has been treated through the sand filter. The underdrains shall connect into the outlet structure. See Appendix B for standard underdrain construction. Enter the diameter of the underdrain pipe (minimum 6" dia.), and the spacing of the underdrains. The maximum spacing of the underdrains is 20 feet on center, however where the area of the bottom stage is particularly small (less than 500 square feet), the underdrain pipes shall be placed at no more than a 10-foot separation on center.

6. Basin Outlet Design

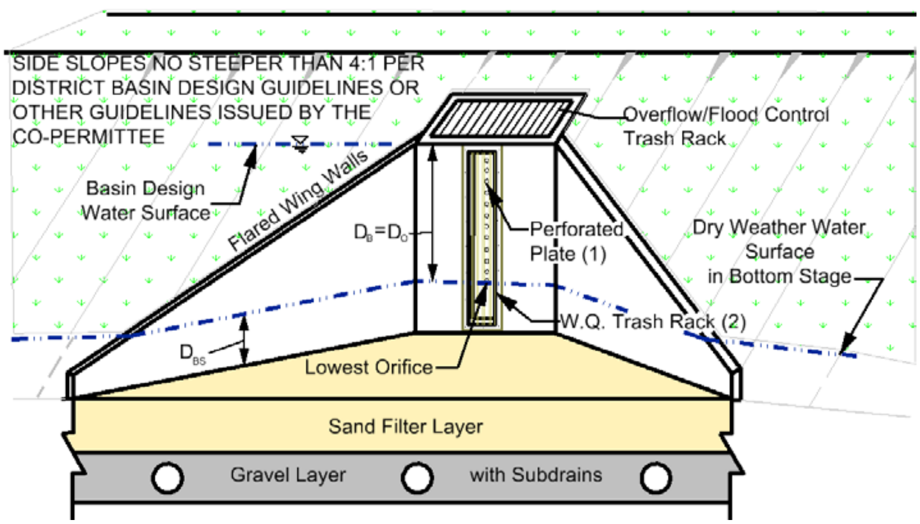


Figure 4: Basin Outlet Structure with Bottom Stage Shown

Outlet structures for publicly maintained basins shall conform to District Standard Drawings WQ501 unless approved in advance by the local Engineering Authority (EA). This standardization is to provide for efficient maintenance. The basin outlet should be sized to release the design volume, VBMP, within a 72-hour period but 50 percent of VBMP within 24 hours. This is an iterative design process where an appropriate control orifice can be selected using the following steps:

a. Develop a Stage vs. Discharge Curve for the Outlet Structure

Estimate the orifice size and outlet plate configuration (number per row, etc.). Based on D_O provided in the Basin Footprint section, the spreadsheet will automatically generate the stage vs. discharge relationship for this outlet:

$$Q = C*A*[2*g*(H-H_o)]^{0.5}$$

Where:

Q = discharge (ft^3/s)

C = orifice coefficient

A = area of the orifice (ft)

g = gravitational constant (32.2 ft2/s)

H = water surface elevation (ft)

H_o = orifice elevation (ft)

The lowest orifice shall be located with its centerline at the top of the bottom stage; at least 4 inches above the surface of the sand filter drain. To help avoid clogging, the minimum orifice diameter is limited to 3/8 inch. Since the 1/4 inch thickness of the orifice plate will be less than the orifice diameter, a value for C of 0.66 may be used. If another value for C is used, justification may be required.

b. Develop a Discharge/Volume vs. Stage Table for the Basin

Based on the shape and size of the basin, develop a relationship between the stage and the volume of water in the basin. Since the orifice spacing is 4 inches on center for the standard orifice plate, the stage intervals must also be 4 inches. Enter the basin volume at each interval starting at the centerline of the lowest orifice.

c. Route the Design Volume through the Basin

The spreadsheet assumes that the Design Volume, $V_{BMP,}$ enters the basin instantaneously and as such, no inflow/outflow hydrograph is necessary. The drawdown time for each stage becomes:

$$\Delta t = V_i/Q$$

Where:

Δt = drawdown time for each stage

V_i = the volume at each stage

Q = the flow rate corresponding to the headwater elevation at each stage.

The spreadsheet automatically determines the drawdown time from the sum of the Δt values for each stage. If the orifice size and plate configuration estimate meets the hydraulic retention time requirements (50% of the volume empties in not less than 24 hours, 100% of the volume empties in no more than 72 hours), the outlet is correctly sized. If these requirements are not met, select a new orifice size or configuration and repeat the process starting at Step 6a.

7. Outlet Protection

To prevent the orifices from clogging, trash racks are required where perforated vertical outlet control plates are used. This allows for easier access to outlet orifices for inspection and cleaning. Trash racks shall be sized to prevent clogging of the primary water quality outlet without restricting the hydraulic capacity of the outlet control orifices. The orifice plate shall be protected with a trash rack conforming to Standard Drawing WQ501 (at end of this section) with at least six square feet of open surface area or 25 times the total orifice area, whichever is greater. The rack shall be adequately secured to prevent it from being removed or opened when maintenance is not occurring.

Overflow Structure Similar to Standard Drawing Number WQ 501
(Photo courtesy of Colorado Association of Stormwater Floodplain Managers)

Trash rack with screen

8. Overflow Outlet

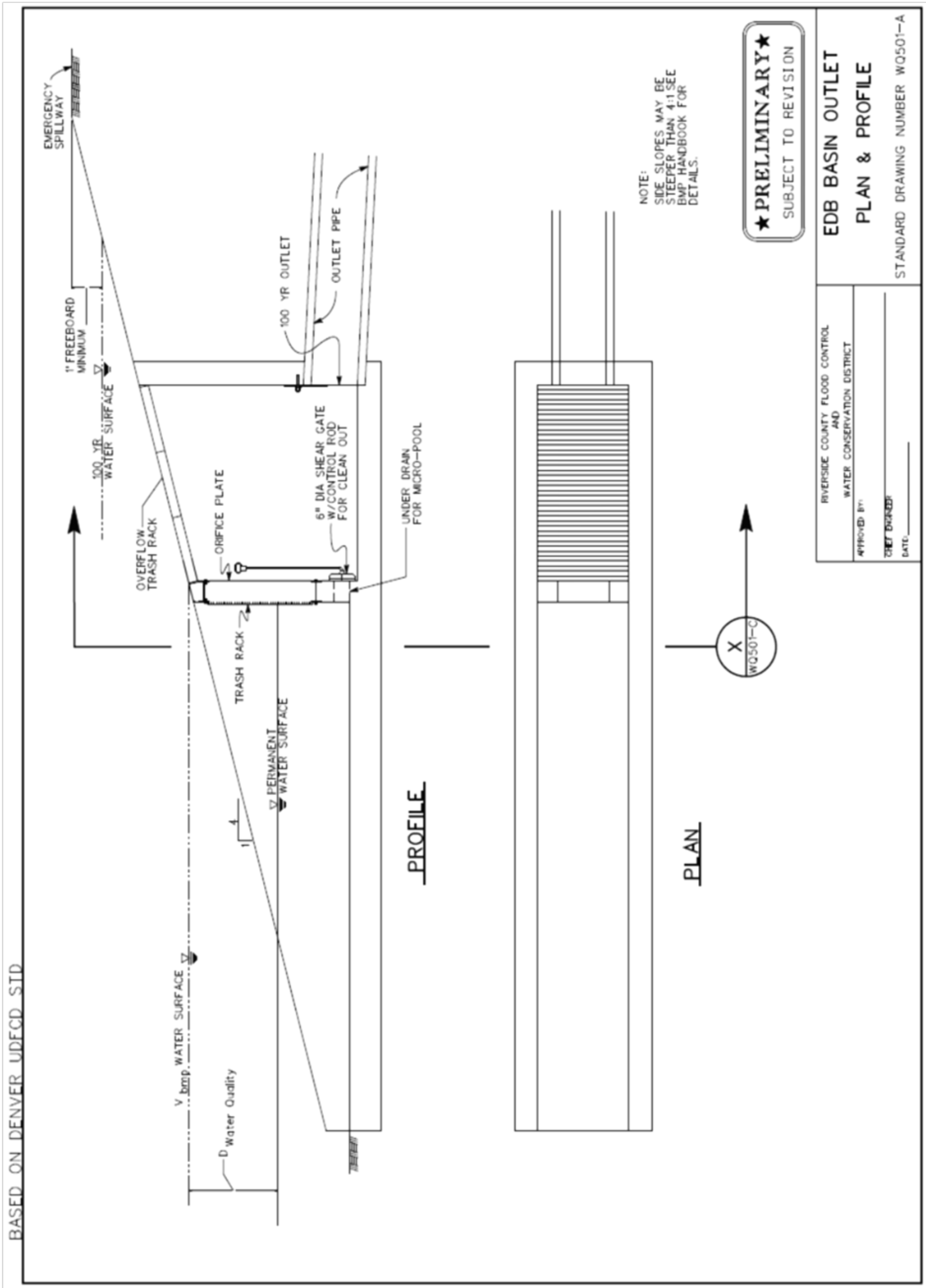
Overflow outlets for publicly maintained basins shall conform to Standard Drawing WQ501 (at end of this section) unless approved in advance by the Engineering Authority (EA).

9. Embankment

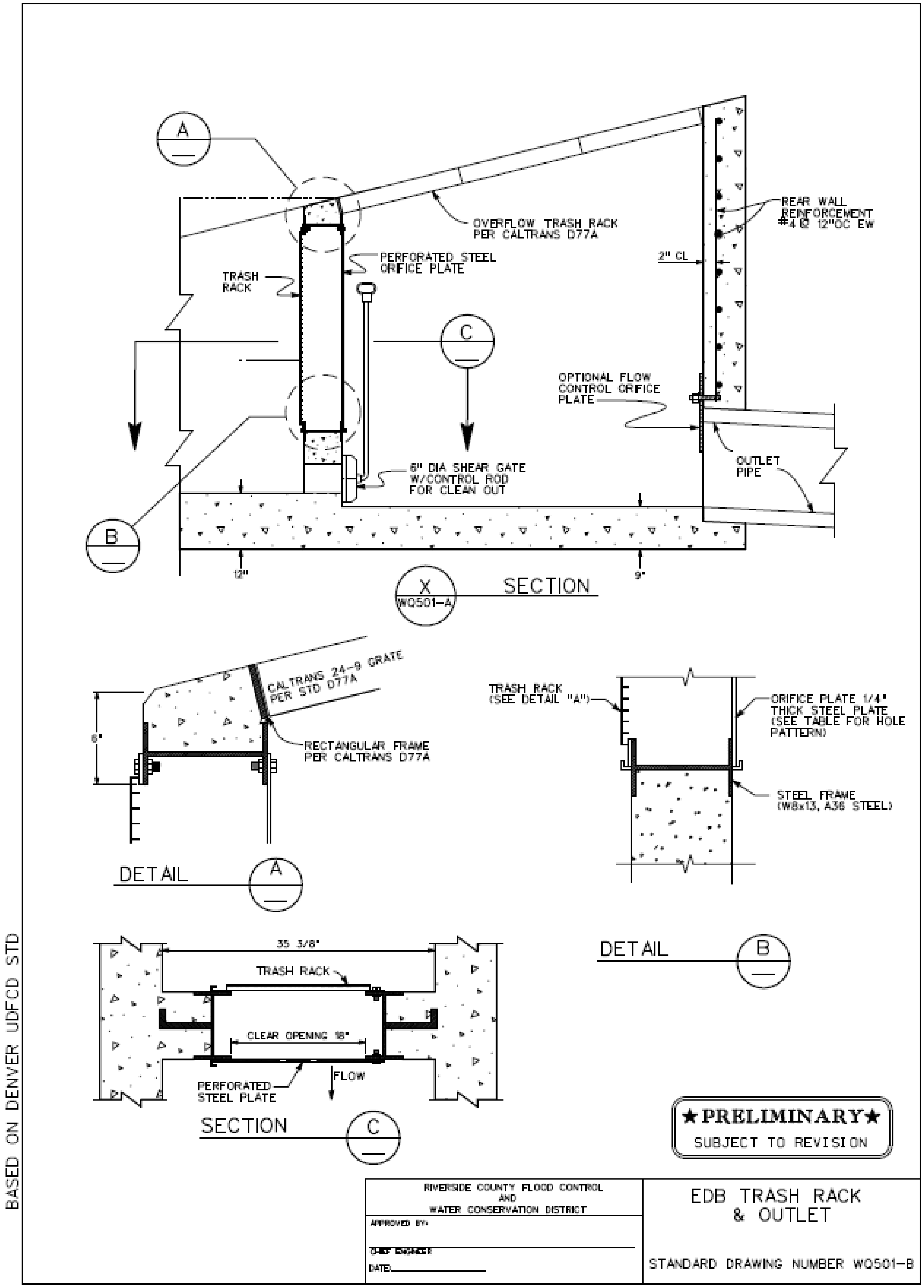
Embankments shall be designed in accordance with applicable standards of Riverside County Flood Control District's "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA). Where applicable, embankment designs must additionally conform to the requirements of the State of California Division of Safety of Dams.

10. Spillway and Overflow Structures

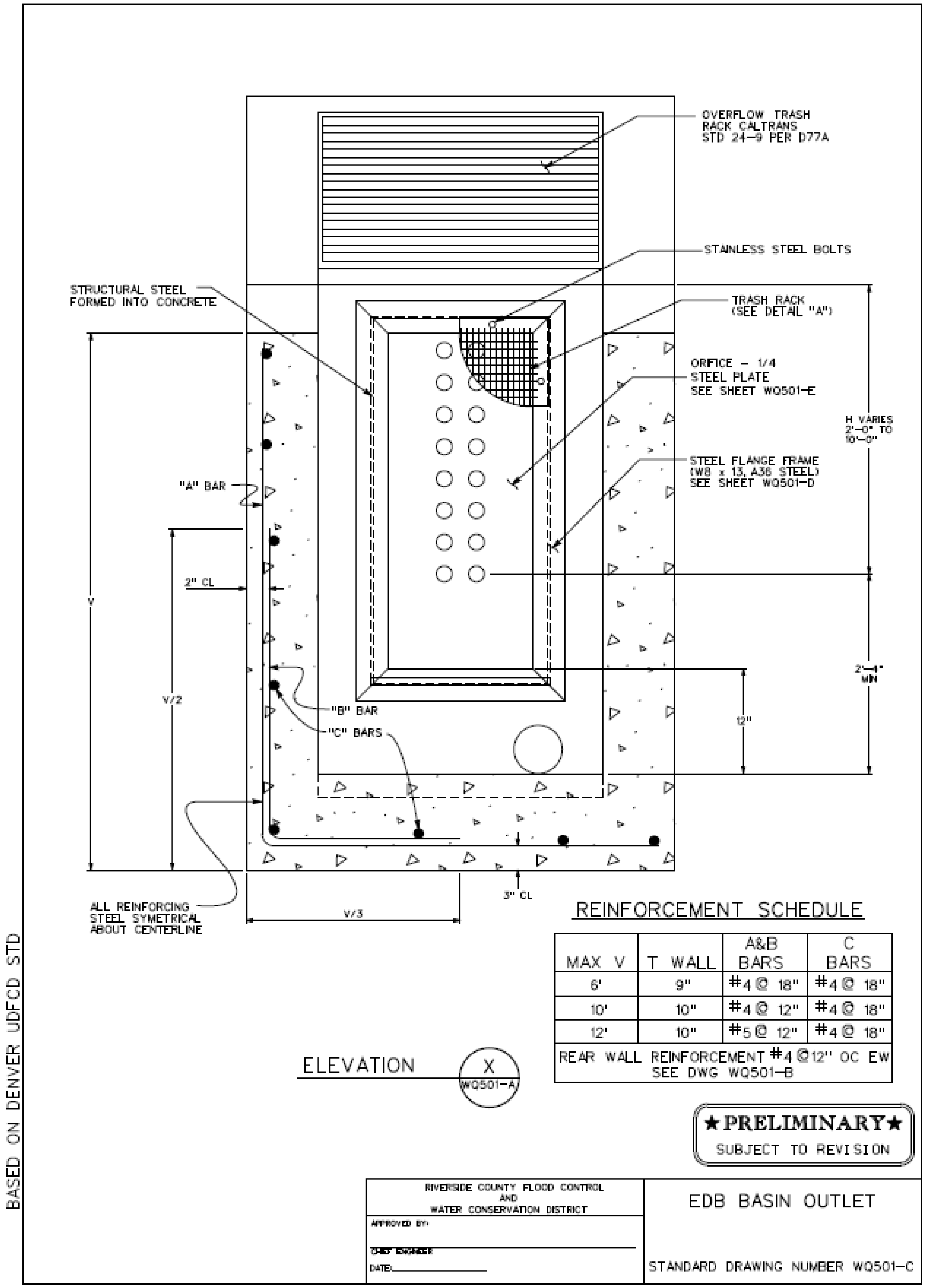
Spillway and overflow structures should be designed in accordance with applicable standards of the "Basin Guidelines" (Appendix C) or other guidelines issued by the Engineering Authority (EA).



EMERGENCY SPILLWAY
1' FREEBOARD MINIMUM
100 YR WATER SURFACE
100 YR OUTLET
OUTLET PIPE
OVERFLOW TRASH RACK
ORIFICE PLATE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
UNDER DRAIN FOR MICRO-POOL
TRASH RACK
PERMANENT WATER SURFACE
V bmp WATER SURFACE
D Water Quality
PROFILE
PLAN
NOTE: SIDE SLOPES MAY BE STEEPER THAN 4:1 SEE BMP HANDBOOK FOR DETAILS.
★PRELIMINARY★
SUBJECT TO REVISION
EDB BASIN OUTLET
PLAN & PROFILE
STANDARD DRAWING NUMBER WQ501-A
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
X
WQ501-C
BASED ON DENVER UDFCD STD

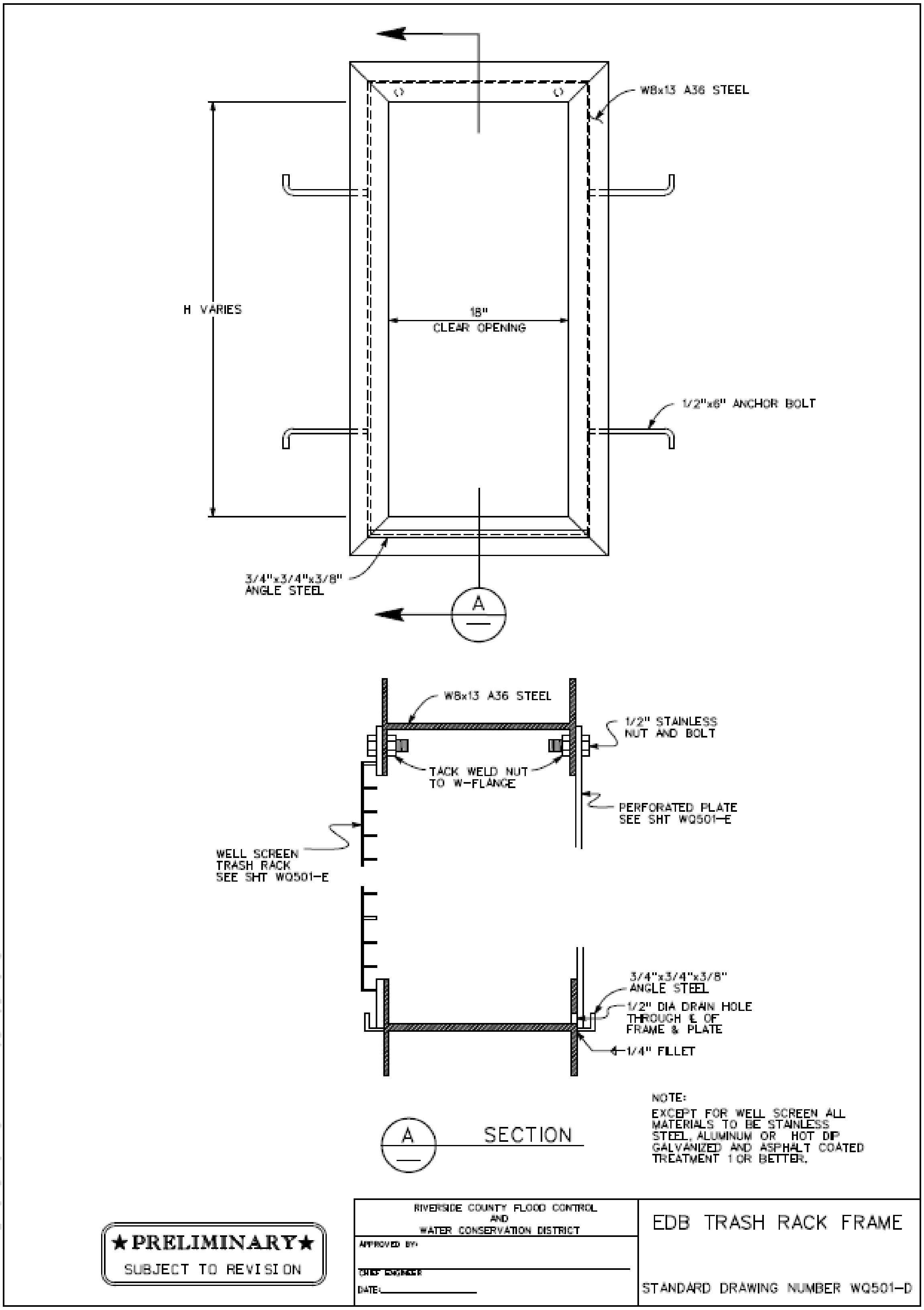


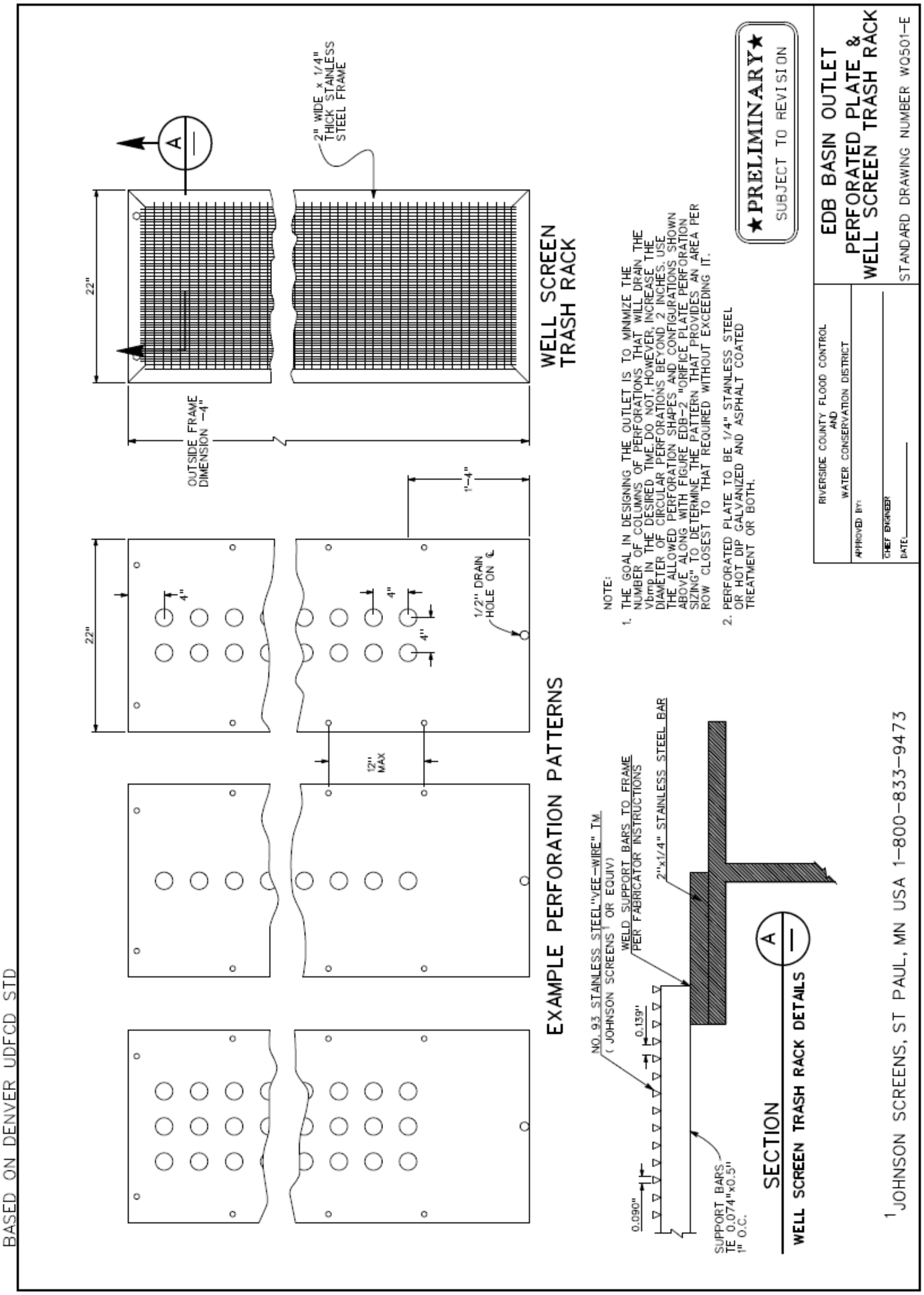
OVERFLOW TRASH RACK PER CALTRANS D77A
REAR WALL REINFORCEMENT #4 @ 12"OC EW
2" CL
PERFORATED STEEL ORIFICE PLATE
TRASH RACK
OPTIONAL FLOW CONTROL ORIFICE PLATE
OUTLET PIPE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
12"
9"
SECTION X WQ501-A
CALTRANS 24-9 GRATE PER STD D77A
RECTANGULAR FRAME PER CALTRANS D77A
6"
DETAIL A
TRASH RACK (SEE DETAIL "A")
ORIFICE PLATE 1/4" THICK STEEL PLATE (SEE TABLE FOR HOLE PATTERN)
STEEL FRAME (W8x13, A36 STEEL)
DETAIL B
35 3/8"
TRASH RACK
CLEAR OPENING 18"
PERFORATED STEEL PLATE
FLOW
SECTION C
★PRELIMINARY★
SUBJECT TO REVISION
BASED ON DENVER UDFCD STD
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE
EDB TRASH RACK & OUTLET
STANDARD DRAWING NUMBER WQ501-B



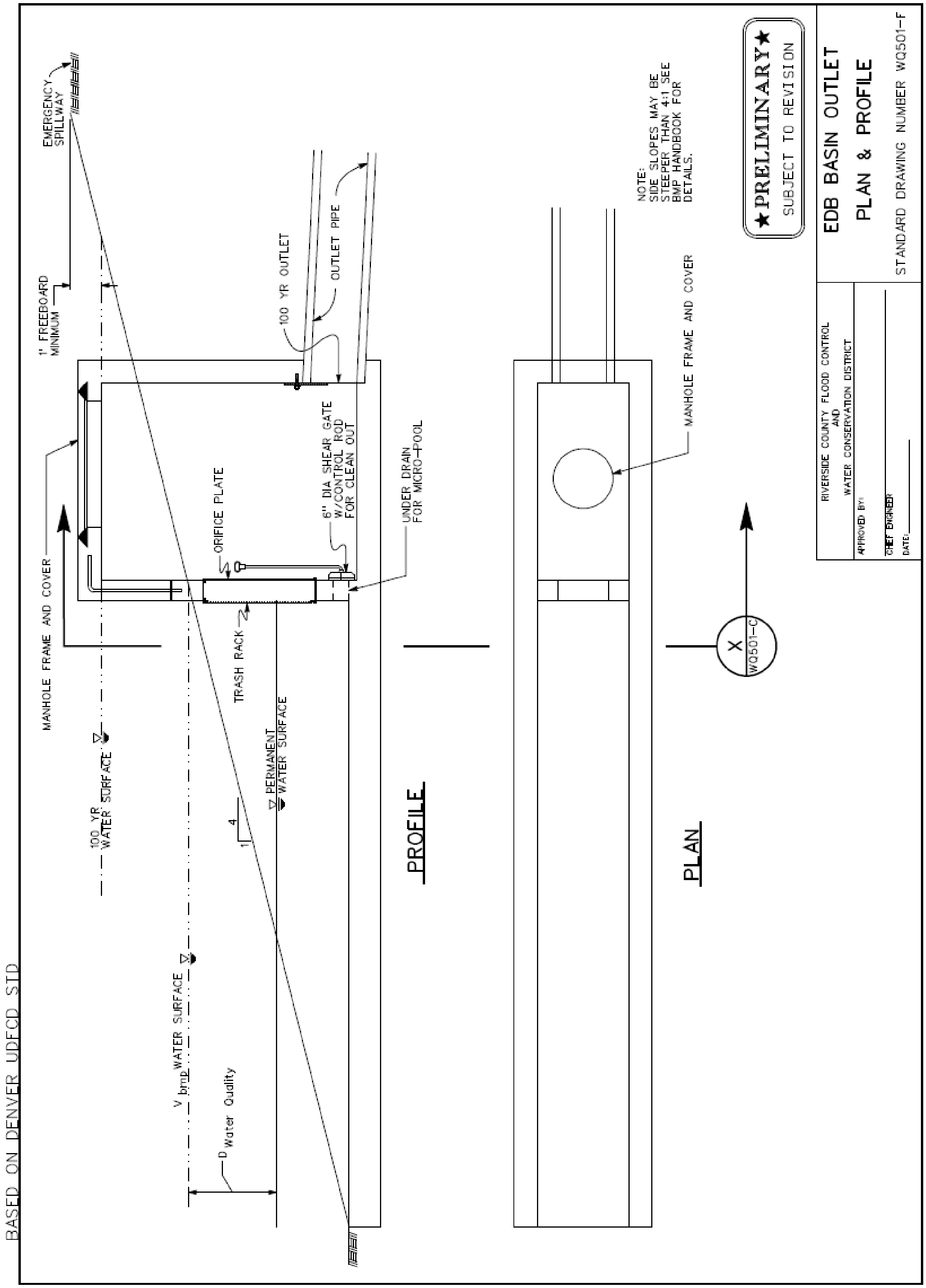
REINFORCEMENT SCHEDULE

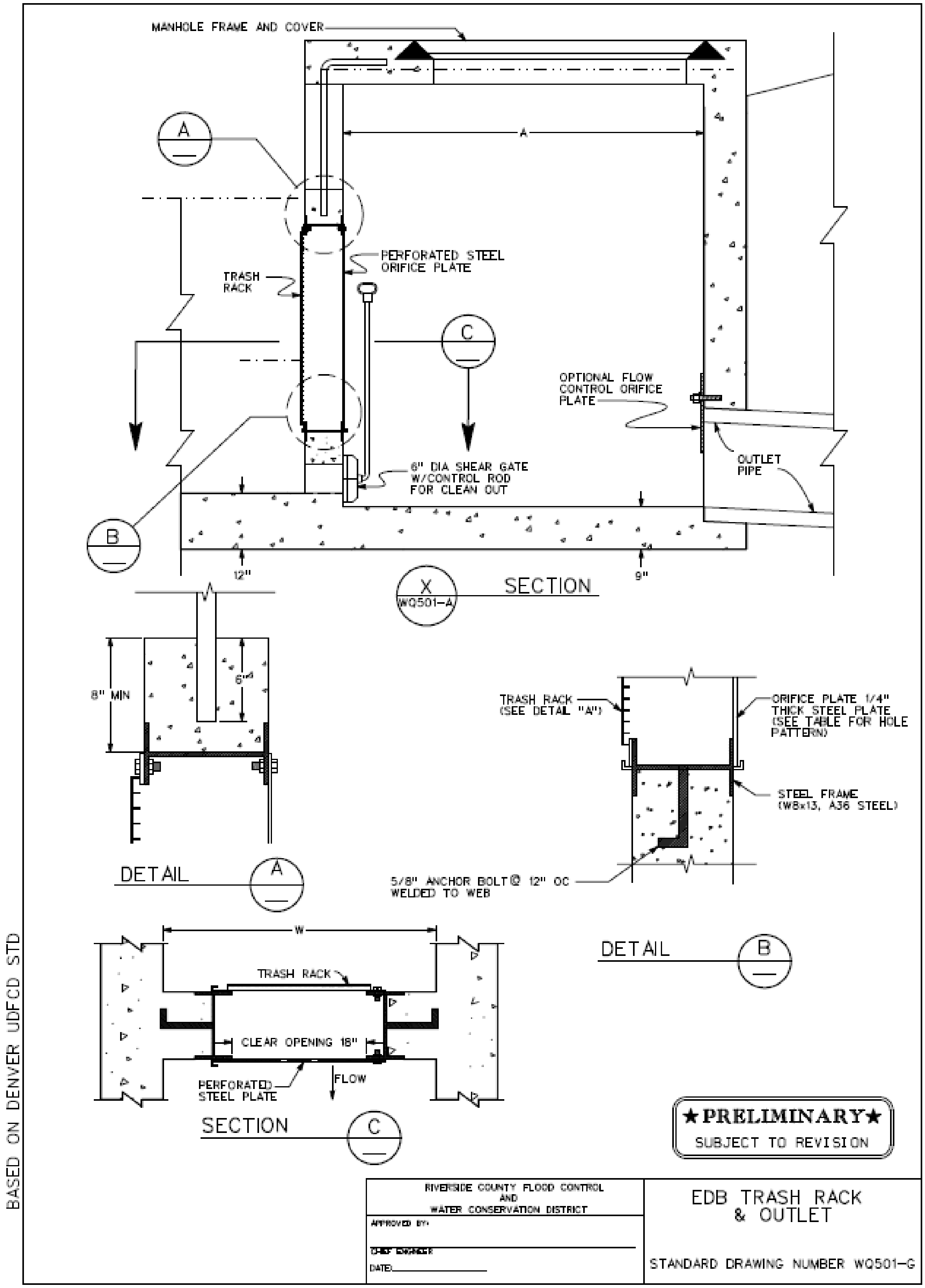
MAX V	T WALL	A&B BARS	C BARS
6'	9"	#4 @ 18"	#4 @ 18"
10'	10"	#4 @ 12"	#4 @ 18"
12'	10"	#5 @ 12"	#4 @ 18"
REAR WALL REINFORCEMENT #4 @ 12" OC EW SEE DWG WQ501-B			

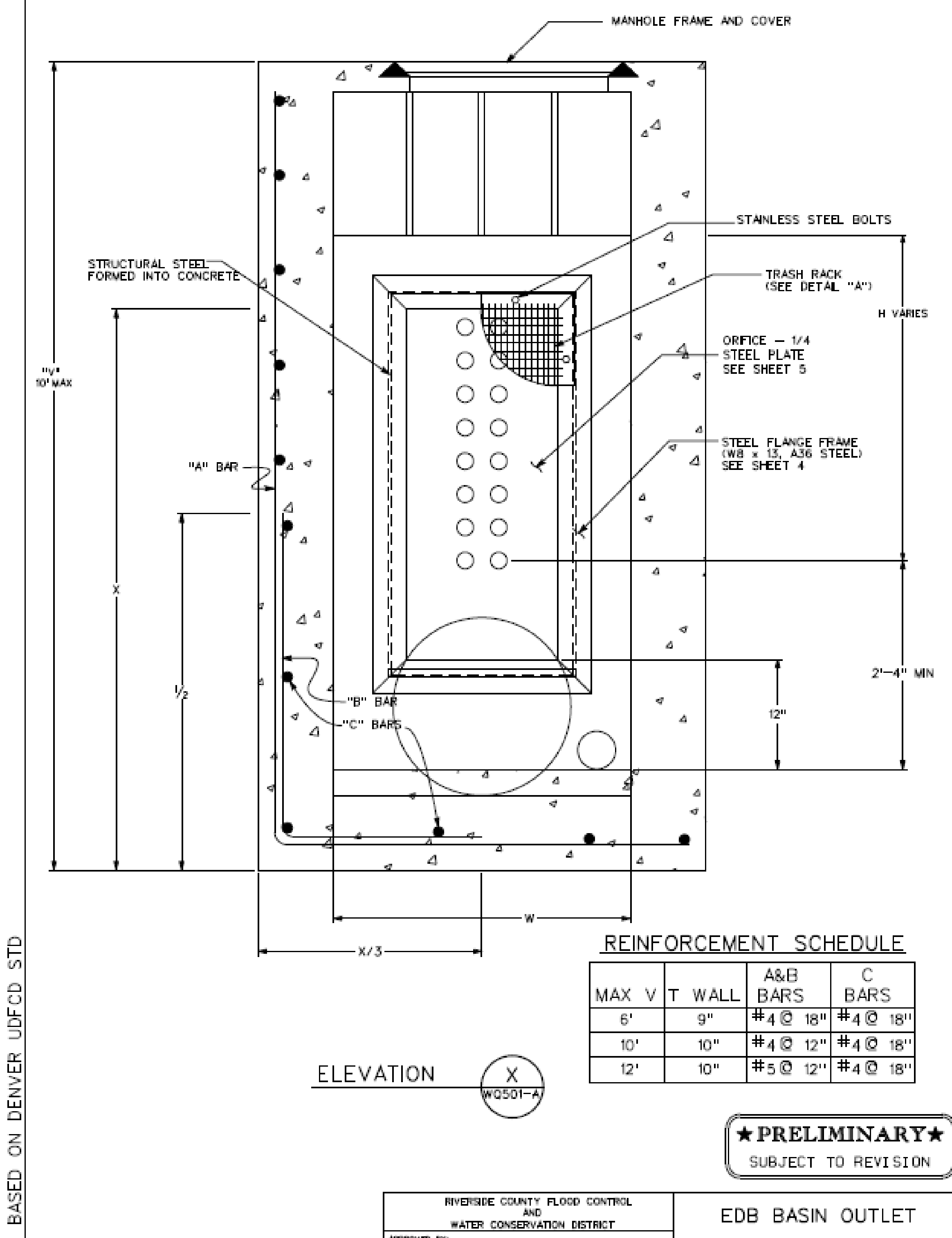

W8x13 A36 STEEL
H VARIES
18"
CLEAR OPENING
1/2"x6" ANCHOR BOLT
3/4"x3/4"x3/8"
ANGLE STEEL
A
W8x13 A36 STEEL
1/2" STAINLESS
NUT AND BOLT
TACK WELD NUT
TO W-FLANGE
PERFORATED PLATE
SEE SHT WQ501-E
WELL SCREEN
TRASH RACK
SEE SHT WQ501-E
3/4"x3/4"x3/8"
ANGLE STEEL
1/2" DIA DRAIN HOLE
THROUGH ℄ OF
FRAME & PLATE
1/4" FILLET
A SECTION
NOTE:
EXCEPT FOR WELL SCREEN ALL MATERIALS TO BE STAINLESS STEEL, ALUMINUM OR HOT DIP GALVANIZED AND ASPHALT COATED TREATMENT 1 OR BETTER.
BASED ON DENVER UDFCD STD
★PRELIMINARY★
SUBJECT TO REVISION
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB TRASH RACK FRAME
STANDARD DRAWING NUMBER WQ501-D



BASED ON DENVER UDFCD STD
22"
OUTSIDE FRAME DIMENSION -4"
2" WIDE x 1/4" THICK STAINLESS STEEL FRAME
WELL SCREEN TRASH RACK
1'-4"
4"
1/2" DRAIN HOLE ON ℄
12" MAX
EXAMPLE PERFORATION PATTERNS
NOTE:
1. THE GOAL IN DESIGNING THE OUTLET IS TO MINIMIZE THE NUMBER OF COLUMNS OF PERFORATIONS THAT WILL DRAIN THE Vbmp IN THE DESIRED TIME. DO NOT, HOWEVER, INCREASE THE DIAMETER OF CIRCULAR PERFORATIONS BEYOND 2 INCHES. USE THE ALLOWED PERFORATION SHAPES AND CONFIGURATIONS SHOWN ABOVE ALONG WITH FIGURE EDB-2 "ORIFICE PLATE PERFORATION SIZING" TO DETERMINE THE PATTERN THAT PROVIDES AN AREA PER ROW CLOSEST TO THAT REQUIRED WITHOUT EXCEEDING IT.
2. PERFORATED PLATE TO BE 1/4" STAINLESS STEEL OR HOT DIP GALVANIZED AND ASPHALT COATED TREATMENT OR BOTH.
★PRELIMINARY★
SUBJECT TO REVISION
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB BASIN OUTLET PERFORATED PLATE & WELL SCREEN TRASH RACK
STANDARD DRAWING NUMBER WQ501-E
NO. 93 STAINLESS STEEL "VEE-WIRE" TM (JOHNSON SCREENS[1] OR EQUIV)
WELD SUPPORT BARS TO FRAME PER FABRICATOR INSTRUCTIONS
2"x1/4" STAINLESS STEEL BAR
0.139"
0.090"
SUPPORT BARS TE 0.074"x0.5" 1" O.C.
SECTION A
WELL SCREEN TRASH RACK DETAILS
[1]JOHNSON SCREENS, ST PAUL, MN USA 1-800-833-9473


EMERGENCY SPILLWAY
1' FREEBOARD MINIMUM
100 YR OUTLET
OUTLET PIPE
NOTE: SIDE SLOPES MAY BE STEEPER THAN 4:1 SEE BMP HANDBOOK FOR DETAILS.
★PRELIMINARY★
SUBJECT TO REVISION
EDB BASIN OUTLET
PLAN & PROFILE
STANDARD DRAWING NUMBER WQ501-F
MANHOLE FRAME AND COVER
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
UNDER DRAIN FOR MICRO-POOL
ORIFICE PLATE
TRASH RACK
X
WQ501-C
100 YR WATER SURFACE
PERMANENT WATER SURFACE
4
1
PROFILE
PLAN
V bmp WATER SURFACE
D Water Quality
BASED ON DENVER UDFCD STD


MANHOLE FRAME AND COVER
A
A
PERFORATED STEEL ORIFICE PLATE
TRASH RACK
C
OPTIONAL FLOW CONTROL ORIFICE PLATE
OUTLET PIPE
6" DIA SHEAR GATE W/CONTROL ROD FOR CLEAN OUT
B
12"
9"
X
WQ501-A
SECTION
8" MIN
6"
DETAIL A
TRASH RACK (SEE DETAIL "A")
ORIFICE PLATE 1/4" THICK STEEL PLATE (SEE TABLE FOR HOLE PATTERN)
STEEL FRAME (W8x13, A36 STEEL)
5/8" ANCHOR BOLT @ 12" OC WELDED TO WEB
DETAIL B
W
TRASH RACK
CLEAR OPENING 18"
PERFORATED STEEL PLATE
FLOW
SECTION C
★PRELIMINARY★
SUBJECT TO REVISION
BASED ON DENVER UDFCD STD
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE:
EDB TRASH RACK & OUTLET
STANDARD DRAWING NUMBER WQ501-G



REINFORCEMENT SCHEDULE

MAX V	T WALL	A&B BARS	C BARS
6'	9"	#4 @ 18"	#4 @ 18"
10'	10"	#4 @ 12"	#4 @ 18"
12'	10"	#5 @ 12"	#4 @ 18"

★PRELIMINARY★
SUBJECT TO REVISION

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT	EDB BASIN OUTLET
APPROVED BY: CHIEF ENGINEER DATE:	STANDARD DRAWING NUMBER WQ501-H

Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).

- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

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be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft^2 of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

Pollutant	Removal Rate
Total Phosphorus	70-83%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-80%
Total Suspended Solids	90%
Organics	90%
Bacteria	90%

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at $111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of $24,000 (PGDER, 1993). And a new residential development spent a total of approximately $100,000 using bioretention cells on each lot instead of nearly $400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

References and Sources of Additional Information

Coffman, L.S., R. Goo and R. Frederick, 1999: Low impact development: an innovative alternative approach to stormwater management. Proceedings of the 26th Annual Water Resources Planning and Management Conference ASCE, June 6-9, Tempe, Arizona.

Davis, A.P., Shokouhian, M., Sharma, H. and Minami, C., "Laboratory Study of Biological Retention (Bioretention) for Urban Stormwater Management," *Water Environ. Res.*, 73(1), 5-14 (2001).

Davis, A.P., Shokouhian, M., Sharma, H., Minami, C., and Winogradoff, D. "Water Quality Improvement through Bioretention: Lead, Copper, and Zinc," *Water Environ. Res.*, accepted for publication, August 2002.

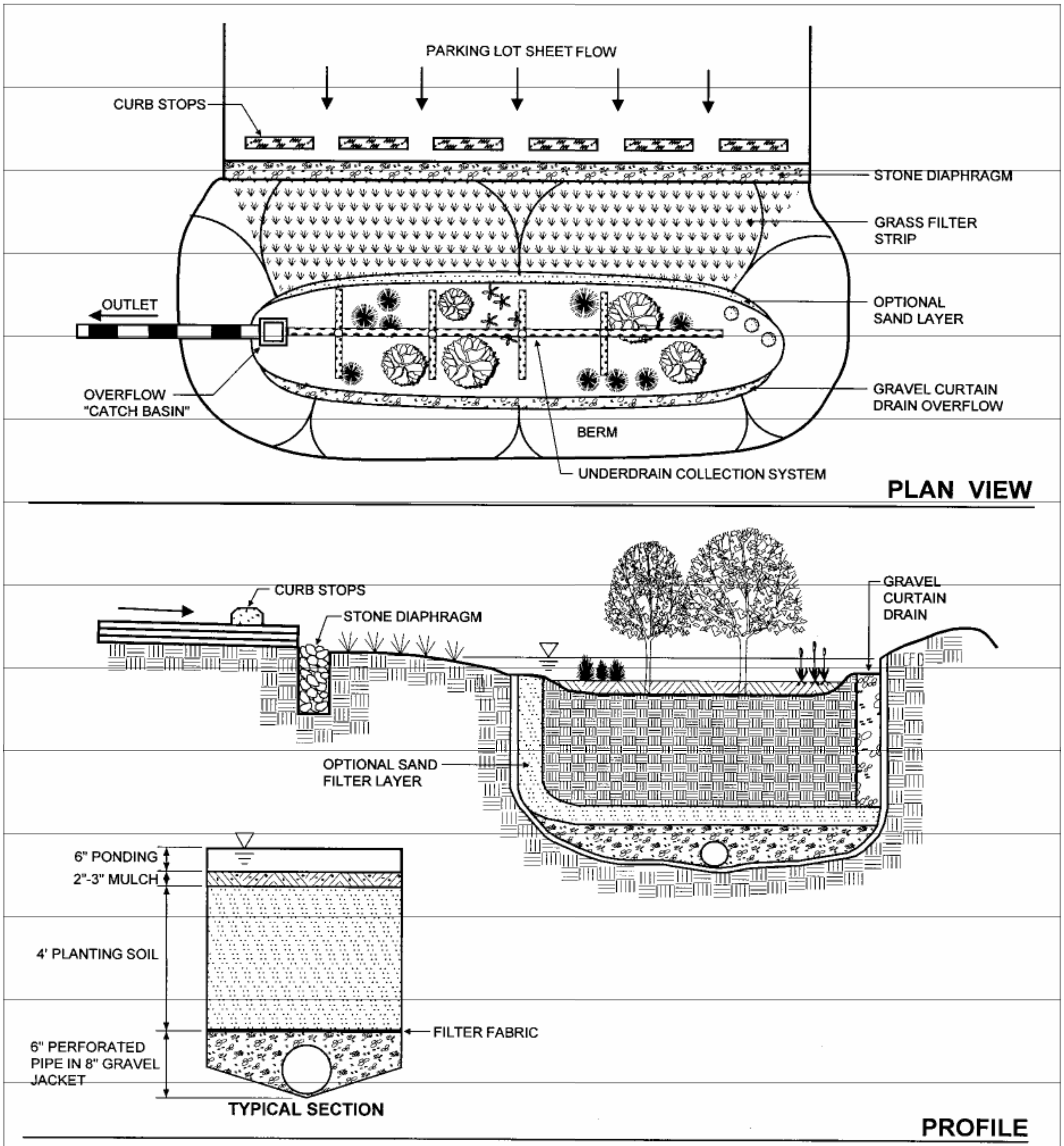
Kim, H., Seagren, E.A., and Davis, A.P., "Engineered Bioretention for Removal of Nitrate from Stormwater Runoff," *WEFTEC 2000 Conference Proceedings on CDROM Research Symposium, Nitrogen Removal*, Session 19, Anaheim CA, October 2000.

Hsieh, C.-h. and Davis, A.P. "Engineering Bioretention for Treatment of Urban Stormwater Runoff," *Watersheds 2002, Proceedings on CDROM Research Symposium*, Session 15, Ft. Lauderdale, FL, Feb. 2002.

Prince George's County Department of Environmental Resources (PGDER), 1993. Design Manual for Use of *Bioretention in Stormwater Management*. Division of Environmental Management, Watershed Protection Branch. Landover, MD.

U.S. EPA Office of Water, 1999. Stormwater Technology Fact Sheet: Bioretention. EPA 832-F-99-012.

Weinstein, N. Davis, A.P. and Veeramachaneni, R. "Low Impact Development (LID) Stormwater Management Approach for the Control of Diffuse Pollution from Urban Roadways," *5th International Conference Diffuse/Nonpoint Pollution and Watershed Management Proceedings*, C.S. Melching and Emre Alp, Eds. 2001 International Water Association



Schematic of a Bioretention Facility (MDE, 2000)

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

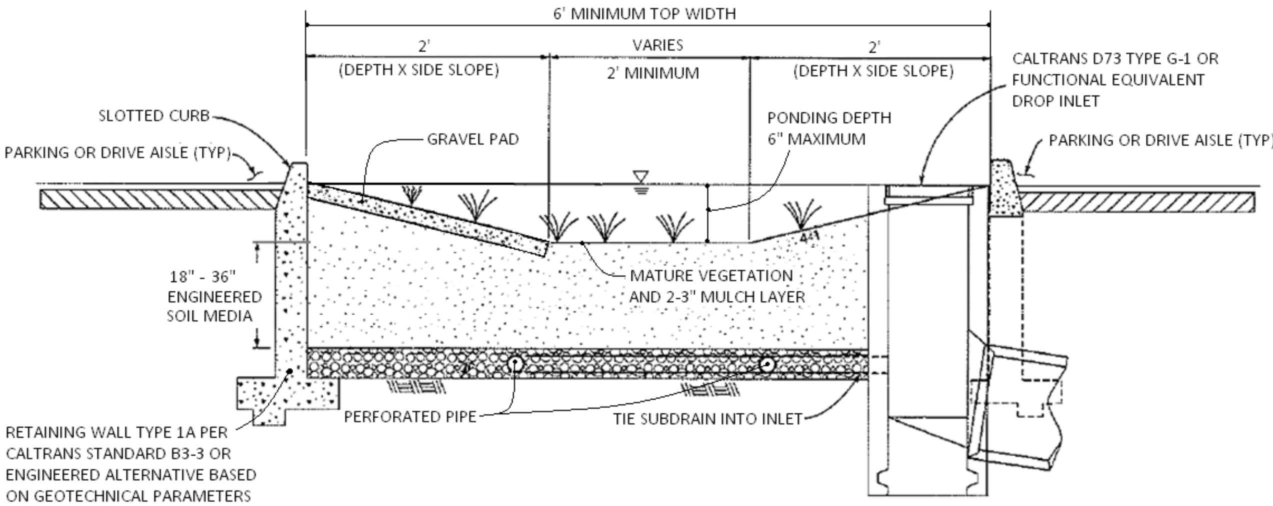
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

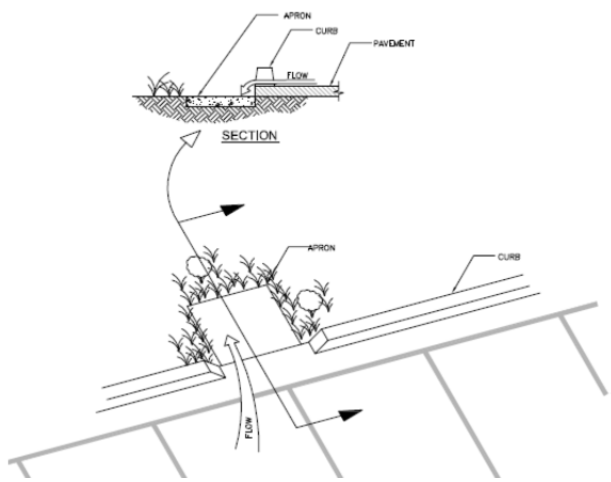


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6" Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

Side Slope Requirements

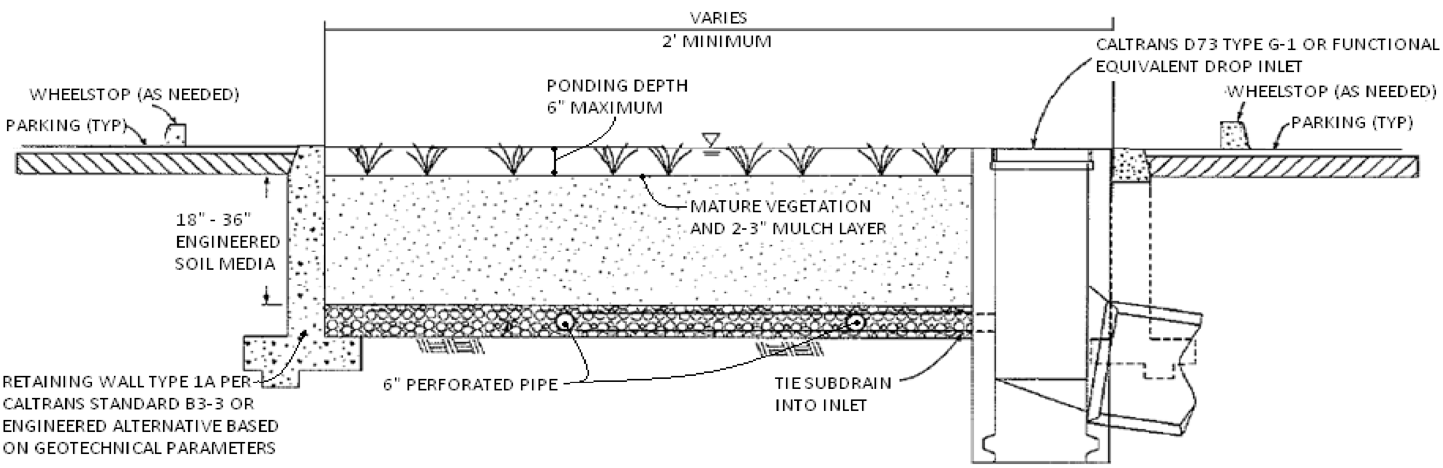
Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,

but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box

Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes
An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

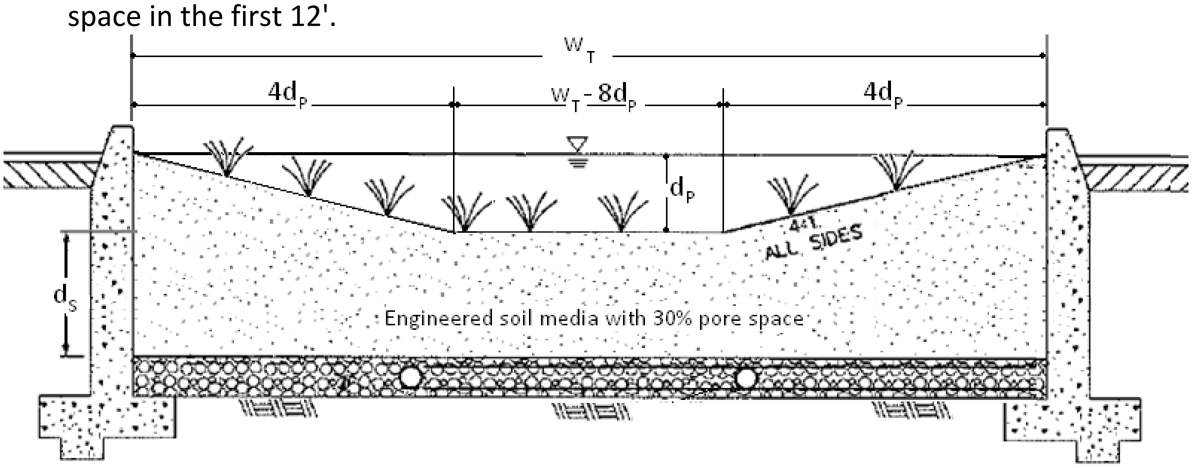
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



   a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[\left(w_T(\text{ft}) \times d_S(\text{ft})\right) + 4\left(d_P(\text{ft})\right)^2\right] + 0.4 \times 1(\text{ft}) + d_P(\text{ft})\left[4d_P(\text{ft}) + \left(w_T(\text{ft}) - 8d_P(\text{ft})\right)\right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5’ is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_S(\text{ft}) + 0.4 \text{ x } 1(\text{ft})) - \left(\frac{0.7\ (\text{ft}^2)}{w_T(\text{ft})}\right) + 0.5(\text{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(ft) = d_P(ft) + [(0.3) \times d_S(ft) + (0.4) \times 1(ft)]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(ft) = 0.5\ (ft) + [(0.3) \times d_S(ft) + (0.4) \times 1(ft)]$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$A_M(ft^2) = \frac{V_{BMP}(ft^3)}{d_E\ (ft)}$$

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

References Used to Develop this Fact Sheet

Anderson, Dale V. "Landscaped Filter Basin Soil Requirements." Riverside, May 2010.

California Department of Transportation. CalTrans Standard Plans. 15 September 2005. May 2010 <http://www.dot.ca.gov/hq/esc/oe/project_plans/HTM/stdplns-met-new99.htm>.

Camp Dresser and McKee Inc.; Larry Walker Associates. California Stormwater Best Management Practice Handbook for New Development and Redevelopment. California Stormwater Quality Association (CASQA), 2004.

Contra Costa Clean Water Program. Stormwater Quality Requirements for Development Applications. 3rd Edition. Contra Costa, 2006.

County of Los Angeles Public Works. Stormwater Best Management Practice Design and Maintenance Manual. Los Angeles, 2009.

Kim, Hunho, Eric A. Seagren and Allen P. Davis. "Engineered Bioretention for Removal of Nitrate from Stormwater Runoff." Water Environment Research 75.4 (2003): 355-366.

LA Team Effort. LA Team Effort: FREE Planter Boxes for Businesses. 2 November 2009. May 2010 <http://lateameffort.blogspot.com/2009/11/free-planter-boxes-for-businesses-est.html>.

Montgomery County Maryland Department of Permitting Services Water Resources Section. Biofiltration (BF). Montgomery County, 2005.

Program, Ventura Countywide Stormwater Quality Management. Technical Guidance Manual for Stormwater Quality Control Measures. Ventura, 2002.

United States Environmental Protection Agency. Storm Water Technology Fact Sheet Bioretention. Washington D.C, 1999.

Urban Drainage and Flood Control District. Urban Storm Drainage Criteria Manual Volume 3 - Best Management Practices. Vol. 3. Denver, 2008. 3 vols.

Urbonas, Ben R. Stormwater Sand Filter Sizing and Design: A Unit Operations Approach. Denver: Urban Drainage and Flood Control District, 2002.

3.7 Sand Filter Basin

Type of BMP	Treatment
Treatment Mechanisms	Filtration, Biofiltration
Maximum Tributary Area	25 acres
Other Names	Sand Filter, Media Filter, Pocket Filter

Description

The Sand Filter Basin (SFB) is a basin where the entire invert is constructed as a stormwater filter, using a sand bed above an underdrain system. Stormwater enters the SFB at its forebay where trash and sediment accumulate or through overland sheet flow. Overland sheet flow into the Sand Filter Basin is biofiltered through the vegetated side slopes or other pre-treatment. Flows pass into the sand filter surcharge zone and are gradually filtered through the underlying sand bed. The underdrain gradually dewaters the sand bed and discharges the filtered runoff to a nearby channel, swale, or storm drain.

The primary advantage of the SFB is its effectiveness in removing pollutants where infiltration into the underlying soil is not practical, and where site conditions preclude the use of a Bioretention Facility . The primary disadvantage is a potential for clogging if silts and clays are allowed to flow into the SFB. In addition, this BMP's performance relies heavily on its being regularly and properly maintained.

While this BMP is not currently considered an LID BMP, when designed in accordance with this manual, a Sand Filter Basin is considered to be a highly effective Treatment Control BMP.

Siting Considerations

SFBs should be avoided where onsite configurations include a base flow and/or where this BMP would be put into operation while construction, grading or major landscaping activities are taking place in the tributary catchment. **This BMP has a flat surface area**, so it may be challenging to incorporate into steeply sloping terrain. SFBs should be set away from areas that could discharge fine sediments into the basin such as at the bottom of a slope. **See Section 1 of Riverside County Flood Control and Water Conservation District's "Basin Guidelines" (Appendix C) for additional requirements** (i.e., fencing, maintenance access, etc.) or other guidelines issued by the Engineering Authority (EA)[1].

[1] The Engineering Authority (EA) may choose to alter these guidelines and may have different/additional requirements. These entities, along with the District, will be referred to as the EA.

Setbacks

The bottom of the sand filter should remain above the seasonal high groundwater level. Always consult your geotechnical engineer for additional site specific recommendations.

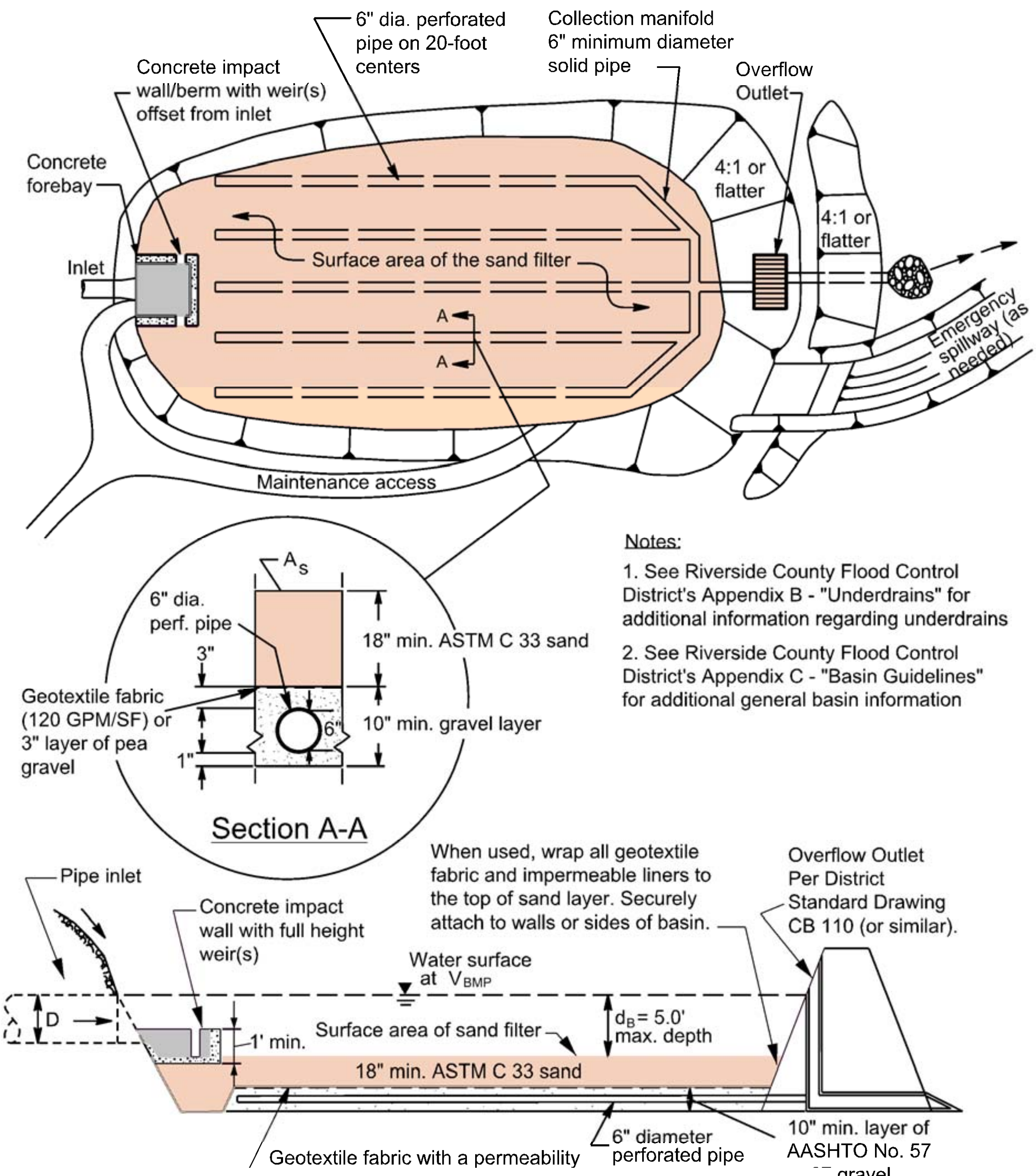


Figure 1 – Plan and Profile Views of SFB Basin

Forebay

A concrete forebay shall be provided to reduce sediment clogging and to reduce erosion. The forebay shall have a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall. Full height notch-type weir(s), offset from the line of flow from the basin inlet to prevent short circuiting shall be used to outlet the forebay. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 1).

Underdrains

Underdrain piping shall consist of a manifold (collector) pipe with perforated lateral branching. The lateral branching conveys the filtered water to the manifold where it is discharged into the outlet structure. See Appendix B for additional information.

Overflow Structure

An overflow must be provided to drain volume in excess of V_{BMP} or to help drain the system if clogging were to occur. Overflows shall flow to an acceptable discharge point such as a downstream conveyance system. Overflows must be placed above the water quality capture volume and near the outlet of the system. The overflow structure shall be similar to the District's Standard Drawing CB 110.

Recommended Maintenance

Table 1 - Recommended Inspection and Maintenance Activities for SFBs

Schedule	Inspection and Maintenance Activity
Semi-monthly including just before the annual storm season and following rainfall events.	• Routine maintenance and inspection. • Remove debris and litter from the entire basin to minimize filter clogging and to improve aesthetics. • Check for obvious problems especially filter clogging and signs of long term ponding. Repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. There should be no long-term ponding water. • Check for erosion and sediment laden areas in the basin. Repair as needed. Clean forebay if needed. • Revegetate side slopes where needed.
Annually. If possible, schedule these inspections within 72 hours after a significant rainfall.	• Inspection of hydraulic and structural facilities. Examine the overflow outlet for clogging, the embankment and spillway integrity, and damage to any structural element. • Check side slopes and embankments for erosion, slumping and overgrowth. • Inspect the sand media at the filter drain to verify it is allowing acceptable infiltration. **Scarify the top 3 inches by raking the filter drain's sand surface annually.** • Check the filter drain underdrains for damage or clogging. Repair as needed. • Repair basin inlets, outlets, forebays, and energy dissipaters whenever damage is discovered. • No water should be present 72 hours after an event. No long term standing water should be present at all. No algae formation should be visible. Correct problem as needed.
Every 5 years or sooner depending on the observed drain times (no more than 72 hours to empty the basin).	• Remove the top 3 inches of sand from the filter drain and backfill with 3 inches of new sand to return the sand layer to its original depth. When scarification or removal of the top 3 inches of sand is no longer effective, remove and replace sand filter layer.

Table 2 - Design and Sizing Criteria for SFBs

Design Parameter	Extended Detention Basin
Maximum tributary area	25 acres [2]
Basin design volume	100% of V_{BMP}
Maximum basin depth	5 feet
Forebay volume	0.5 % of V_{BMP}
Longitudinal Slope	0%
Transverse Slope (min.)	0%
Outlet erosion control	Energy dissipaters to reduce velocities[1]

1. **Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures**
2. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the District's "Basin Guidelines" (Appendix C). In addition, information herein may be superseded by other guidelines issued by the EA.

Design Procedure

1. Enter the Tributary Area, A_{TRIB}
2. Enter the Design Capture Volume, V_{BMP}, determined from Section 2.1 of this Handbook
3. SFB Geometry

   Determine the minimum sand filter area required. The filtration bed surface shall be flat with the maximum depth for the reservoir design volume no greater than 5 feet*. The reservoir design volume does not include the volume of the sand filter. No credit is given for voids in the sand layer toward the reservoir volume since the sand is part of the water quality filter and not a reservoir layer. The design storage volume shall equal 100 percent of V_{BMP}. The minimum sand filter area (As) of the basin's bottom shall be determined using the equation:

   $$A_S = (V_{BMP}/ d_B)$$

   Where:

   V_{BMP} = Design Volume, ft^3
   d_B = proposed basin depth (5 feet maximum), ft

   Once the basin side slopes, proposed basin depth and depth of freeboard are entered, the spreadsheet will calculate the minimum total depth required to use this BMP. This is the depth from the top of the basin (including freeboard) down to the bottom of the underdrain gravel layer. This depth can be used to determine if enough vertical separation is available between the BMP and its outlet destination.

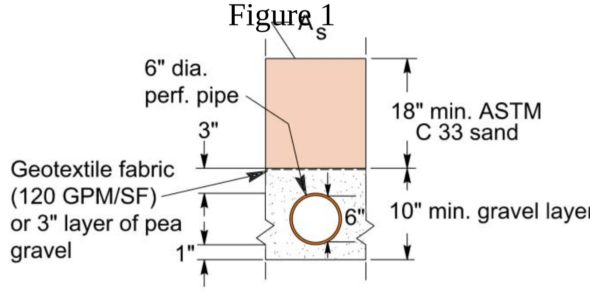
*Note: The 5 foot maximum depth equates to a minimum filter media infiltration rate of 0.83 inches per hour with a 72 hour drawdown time. Studies have shown that while initially most filter media will infiltrate at a much higher rate, it is not uncommon for that rate to decrease significantly over a very short period of time. (Urbonas, 1996)

4. Enter the proposed surface area of the basin.

5. Forebay

   Provide a concrete forebay. Its volume shall be at least 0.5% V_{BMP} with a minimum 1 foot high concrete splashwall. Full-height notch-type weir(s) shall be used to outlet the forebay. The weir(s) must be offset from the line of flow from the basin inlet. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 1). Notches shall not be less than 1.5 inches in width.

Figure 1



6. Filter Media

   Provide, as a minimum, an 18-inch layer of filter media (ASTM C-33 sand). Other filter media may be considered with sufficient supporting documentation. Where a medium level of removal efficiency is desired for nutrients, the depth of the sand layer must be increased to 36 inches.

5. Underdrains

   Underdrains shall be provided per the guidelines outlined in Appendix B.

Sand Filter Basin (SFB) - Design Procedure

BMP ID	Legend: Required Entries / Calculated Cells

Company Name: ______ Date: ______

Designed by: ______ County/City Case No.: ______

Design Volume

Total Tributary area A_{TRIB} = ______ ac

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= ______ ft^3

Basin Geometry

Basin side slopes (no steeper than 4:1) z = ______ :1

Proposed basin depth (see Figure 1) d_B = ______ ft

Depth of freeboard (if used) d_{fb} = ______ ft

Minimum bottom surface area of basin ($As = V_{BMP}/d_B$) A_s = ______ ft^2

Minimum total depth required (includes freeboard, filter media and subdrains) d_{req} = ______ ft

Proposed Surface Area ______ ft^2

Forebay

Forebay volume (minimum 0.5% V_{BMP}) Volume = ______ ft^3

Forebay depth (height of berm/splashwall. 1 foot min.) Depth = ______ ft

Forebay surface area (minimum) Area = ______ ft^2

Full height notch-type weir Width (W) = ______ in

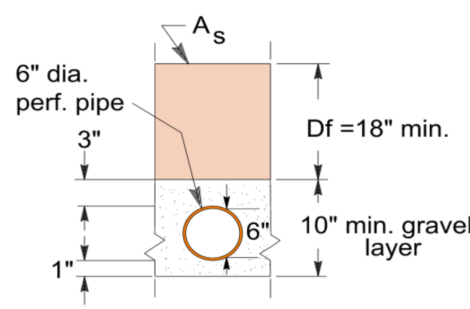
Filter Media

Description of filter media

______ Sand (ASTM C-33)

______ Other (Clarify in "Notes" below)

Media depth, df = ______ inches



Underdrains

Diameter of perforated underdrain ______ in

Spacing of underdrains (maximum 20 feet on center) OK ______ ft

Notes: ______

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post “No Littering” signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.

- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.

- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.

- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.

- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:

  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.

  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.

  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.

  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.

  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).

  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.

  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.

- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a know in location

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.

- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.

- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Waste Handling & Disposal SC-34

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Pollution Prevention

- Accomplish reduction in the amount of waste generated using the following source controls:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

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Suggested Protocols

General

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

Run-on/Runoff Prevention

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropyleneor hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Inspection

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.

- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training
- Train staff in pollution prevention measures and proper disposal methods.
- Train employees and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

Other Considerations (Limitations and Regulations)
Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Requirements

Costs
Capital and O&M costs for these programs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance
- None except for maintaining equipment for material tracking program.

Supplemental Information

Further Detail of the BMP
Land Treatment System
Minimize runoff of polluted stormwater from land application by:

- Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, and there is a closed drainage system

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water
- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site
- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)
- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins
- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples
The port of Long Beach has a state-of-the-art database for identifying potential pollutant sources, documenting facility management practices, and tracking pollutants.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety. Harvard University. 2002.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/