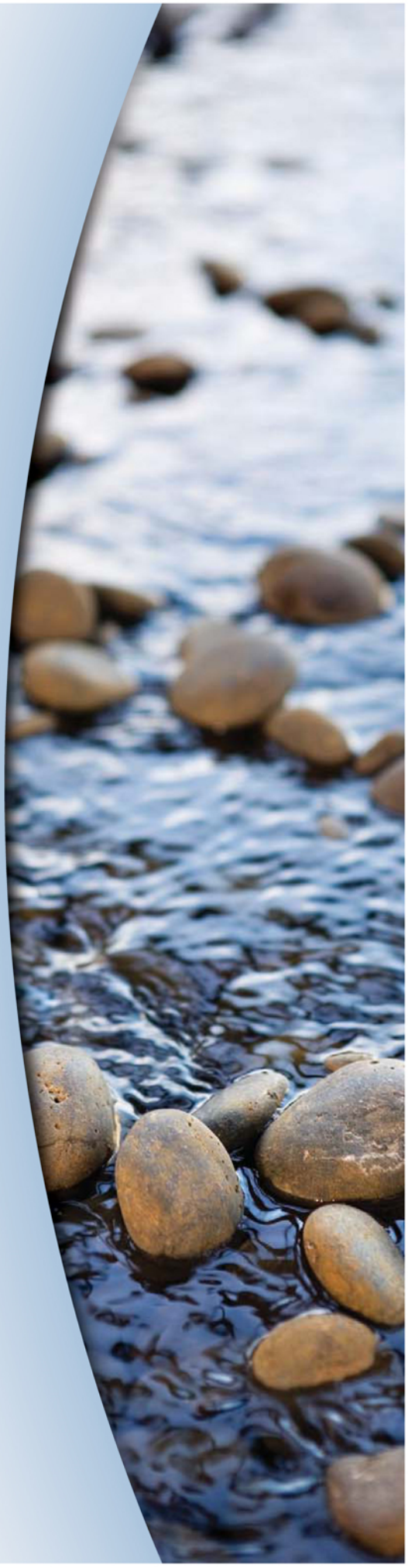

CONCEPTUAL WATER QUALITY MANAGEMENT PLAN
(CWQMP)

CIELO VISTA

PLANNING APPLICATION NO. PA100004

Yorba Linda, California
County of Orange

Prepared for

North County BRS Project LLC
3 Corporate Plaza, Suite 102
Newport Beach, CA 92660
(949) 644-3514

Prepared by

Fuscoe Engineering, Inc.
16795 Von Karman, Suite 100
Irvine, California 92606
949.474.1960
www.fuscoe.com

Project Manager:
Puneet Comar, P.E.

Date Prepared: September 21, 2012
Date Revised: October 8, 2015
Job Number: 1296-001

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CONCEPTUAL
WATER QUALITY MANAGEMENT PLAN (WQMP)

CIELO VISTA PROJECT

Yorba Linda, CA, County of Orange

TENTATIVE TRACT 17341
APN: 351-031-05 AND 351-031-17

Planning Application No. PA100004

Prepared for:

NORTH COUNTY BRS PROJECT, LLC
3 Corporate Plaza, Suite 102
Newport Beach, CA 92660
(949) 644-3514

Prepared by:

FUSCOE ENGINEERING, INC.
16795 Von Karman, Suite 100
Irvine, CA 92618
949.474.1960
Puneet Comar, P.E., Q.S.D.

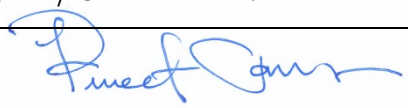
Date Prepared: September 21, 2012
Date Revised: October 8, 2015

PROJECT OWNER'S CERTIFICATION			
Permit/Application No.:	PA10-004	**Grading Permit No.:**	TBD
Tract/Parcel Map and Lot(s)No.:	TTM 17341	**Building Permit No.:**	TBD
Address of Project Site and APN:	Yorba Linda, CA 351-031-05 and 351-031-17		

This Water Quality Management Plan (WQMP) has been prepared for NORTH COUNTY BRS PROJECT, LLC by FUSCOE ENGINEERING, INC. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

OWNERS: Virginia Richards Revocable Intervivos Trust & The Travis Ranch Trusts			
Contact Name:	Larry Netherton		
Title:	Regional Manager		
Company:	North County BRS Project, LLC		
Address:	3 Corporate Plaza, Suite 102 Newport Beach, CA 92660		
Email:	lnetherton@sagecommunity.com		
Telephone #:	(949) 644-3514, ext. 24		
I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein.			
Owner Signature:		**Date:**	10-1-15

PREPARER (ENGINEER): Puneet Comar			
Title:	Senior Project Manager	**PE Registration #:**	C73065
Company:	Fuscoe Engineering, Inc.		
Address:	16795 Von Karman Suite 100, Irvine, CA 92606		
Email:	pcomar@fuscoe.com		
Telephone #:	949.474.1960		
I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board.			
Preparer Signature:		**Date:**	10-1-15
Place Stamp Here:			

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APPENDICES

EXHIBITS & BMP DETAILS (INCLUDED IN SECTION VI)

SECTION I DISCRETIONARY PERMITS AND WATER QUALITY CONDITIONS

PROJECT INFORMATION			
Permit/Application No.:	PA10-0004	Grading or Building Permit No.:	TBD
Address of Project Site (or Tract Map and Lot Number if no address) and APN:	TRACT 17341, Yorba Linda, CA APN: 351-031-05 & 351-031-17		
WATER QUALITY CONDITIONS OF APPROVAL OR ISSUANCE			
Discretionary Permit(s):	TTM 17341		
Water Quality Conditions of Approval or Issuance applied to this project: (Please list verbatim.)	Pending – to be provided in Final WQMP		
CONCEPTUAL WQMP			
Was a Conceptual Water Quality Management Plan previously approved for this project?	No. This report is the initial WQMP for the site.		
WATERSHED-BASED PLAN CONDITIONS			
Applicable conditions from watershed - based plans including WIHMPs and TMDLs:	There are no TMDLs within the drainage watershed of the subject property.		

SECTION II PROJECT DESCRIPTION

II.1 PROJECT DESCRIPTION

The proposed Tract No. 17341 project site encompasses approximately 83.96 acres located in unincorporated Orange County. The project site is bounded by Dorinda Road and Aspen Way to the west; and Via Del Agua and Stonehaven Drive to the south. A Vicinity Map is included in Section VI.

Under existing conditions, the project site is vacant, with the exception of several operational and abandoned oil wells and various dirt access roads and trails that traverse the site. The project site has been subject to a mineral lease for oil production as part of the Esperanza Oil Field. Oil production facilities within the project site include five operational wells, one abandoned well, one idle well and tank batteries, unimproved oil field service roads, and unimproved drill pad sites scattered throughout the site. Contamination at the site of the oilfield production is minor and consistent with other such sites in a typical oilfield setting. A Southern California Gas Company easement of approximately 100 feet in width crosses the northwesterly edge of the project site. Also, a Metropolitan Water District (MWD) easement is located at the southern boundary within the project site. Adjacent land uses include residential properties to the west and south of the site.

The table below summarizes the proposed project.

DESCRIPTION OF PROPOSED PROJECT	
Development Category (Model WQMP, Table 7.11-2; or 7.11-3):	1. New development projects that create 10,000 square feet or more of impervious surface. This category includes commercial, industrial, residential housing subdivisions, mixed-use, and public projects on private or public property that falls under the planning and building authority or the Permittees. 4. Hillside development greater than 5,000 square feet. Hillside development is defined as any development which is located in an area with known erosive soil conditions or where the natural slope is twenty-five percent or greater.
Project Area (ft^2):	3,657,297.6 ft^2 (83.96 acres)
# of Dwelling Units:	112 Single-Family Residential Lots
SIC Code:	N/A – Residential Site

DESCRIPTION OF PROPOSED PROJECT				
Narrative Project Description:	The Project proposes to develop a maximum of 112 single-family dwellings and associated infrastructure within two Planning Areas. Planning Area 1, located in the southerly portion of the site, would include 95 residences within 41.3 gross acres with access provided from Via Del Agua along the south of the site. Planning Area 2, located in the northwesterly part of the site, would include 17 residences within 6.4 gross acres with access provided from Aspen Way to the west.			
Project Area:	Pervious Area	Pervious Area Percentage	Impervious Area	Impervious Area Percentage
Pre-Project Conditions:	83.96 ac	100%	0 ac	0%
Post-Project Conditions:	55.47 ac	66%	28.49 ac	34%

DESCRIPTION OF PROPOSED PROJECT	
Drainage Patterns/ Connections:	Under existing conditions, natural runoff from the undeveloped site area flows in a westerly direction towards three receiving storm drain systems located at Stonehaven Drive to the south, Dorinda Road to the southwest and San Antonio Road to the west of the project site. These are the three points of outlet within the project site. The proposed Planning Area 1 and Planning Area 2 sites are designed as stand-alone development areas. Each site has a different access point, independent utility connection points and downstream drainage connection points. Under proposed conditions, the Project will generally maintain existing natural drainage patterns, drainage facilities will be designed so discharging flows to the downstream facilities will be equal or less then conditions that exist prior to development or the hydraulic capacity of the existing system. Similar to existing conditions, drainage from the southern portion of the site (Planning Area 1) will join the existing 8-foot x 7-foot box culvert within Stonehaven Drive, which under existing conditions is functioning adequately during a 100-year storm event. Existing offsite runoff from the east will be intercepted by a proposed headwall at the end of the proposed "B" Street. Flows will be conveyed via storm drain, ultimately joining into said existing 8-foot x 7-foot box culvert. A portion of Planning Area 1 drains offsite toward the westerly property line and then in a southerly direction offsite toward an existing City of Yorba Linda maintained 36-inch storm drain line at Dorinda Road. Drainage from the northern portion of the site (Planning Area 2) will be directed towards the site's western boundary at a confluence of existing drainages just south of Aspen Way. Existing offsite flows from the north are intercepted by a headwall located north of Aspen Way and passed through the site. Existing offsite flows from the northeast will be intercepted by a proposed headwall located at the northern end of proposed "F" Street. These flows will be conveyed via storm drain through the site in a southerly direction, draining to a natural existing flow path south of Planning Area 2 and ultimately off-site.

PROJECT FEATURES	
Building Summary:	The range of proposed residential lot sizes on the TTM is from approximately 0.17 acres to approximately 0.77 acres. Home sizes have not yet been established but are expected to range from 2,200 SF to 3,200 SF, with an average footprint of 1,800 SF. A maximum of 112-single family detached residential units are proposed.

PROJECT FEATURES	
Amenities:	There are no amenities such as open space parks, tot lots, sports facilities, or recreation centers currently proposed for the project site.
Landscaped Areas:	The project site will include landscaping in the form of planters and gardens around the proposed residences, along the proposed private drive, and along the slopes/open space areas on-site. It is estimated that approximately 66% of the 83.96-acre site will consist of landscaping.
Parking Facilities:	On-site street parking will be provided in Planning Area 1 along Streets "B", "C", "D" and "E". On-site street parking will be provided in Planning Area 2 along Street "F".
Other Project Features:	The site is not anticipated to have any trash enclosures, below-grade loading docks, outdoor storage areas, community car wash racks, equipment wash areas, or commercial kitchens or other food preparation areas associated with food service establishments. Trash will be managed privately within each of the residential lots via individual receptacles.
Outdoor Activities:	Outdoor areas throughout the site will be used for recreational purposes. All other outdoor areas will be used for walkways, common areas and landscaping. No outdoor storage areas are proposed.
Materials Stored:	Materials used and stored on site will include those associated with residential land uses, such as normal cleaning supplies and maintenance materials. Materials will be stored totally within the buildings, and no outdoor storage areas are proposed.
Wastes Generated:	Wastes anticipated to be generated include those associated with residential land uses, including trash & debris, and landscape maintenance wastes. Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets.

II.2 POTENTIAL STORM WATER POLLUTANTS

The table below, derived from Table 2 of the Countywide Model WQMP Technical Guidance Document (May 2011), summarizes the categories of land use or project features of concern and the general pollutant categories associated with them.

ANTICIPATED & POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE								
Priority Project Categories and/or Project Features	General Pollutant Categories							
	Suspended Solid/ Sediments	Nutrients	Heavy Metals	Pathogens (Bacteria/ Virus)	Pesticides	Oil & Grease	Toxic Organic Compounds	Trash & Debris
Detached Residential Development	E	E	N	E	E	E	N	E
Attached Residential Development	E	E	N	E	E	E(2)	N	E
Hillside Development >5,000 ft²	E	E	N	E	E	E	N	E
Streets, Highways, & Freeways	E	E(1)	E	E(4)	E(1)	E	E	E

Notes:
E = expected to be of concern N = not expected to be of concern
(1) Expected pollutant if landscaping exists on-site, otherwise not expected.
(2) Expected pollutant if the project includes uncovered parking areas, otherwise not expected.
(3) Expected pollutant if land use involves food or animal waste products, otherwise not expected.
(4) Bacterial indicators are routinely detected in pavement runoff.
(5) Expected if outdoor storage or metal roofs, otherwise not expected.
Source: County of Orange. (2011, May 19). Technical Guidance Document for the Preparation of Conceptual/ Preliminary and/or Project Water Quality Management Plans (WQMPs). Table 2.1.

Priority Project Categories and/or Features: Detached Residential Development

POLLUTANTS OF CONCERN		
Pollutant	E = Expected to be of concern N =Not Expected to be of concern	Additional Information and Comments
Suspended Solid/ Sediment	E	
Nutrients	E	
Heavy Metals	N	
Pathogens (Bacteria/Virus)	E	Santa Ana River Reach 2 is 2012 303(d) listed for indicator bacteria impairment.
Pesticides	E	
Oil & Grease	E	
Toxic Organic Compounds	N	

POLLUTANTS OF CONCERN		
Pollutant	**E = Expected to be of concern N =Not Expected to be of concern**	**Additional Information and Comments**
Trash & Debris	E	

Due to Santa Ana River Reach 2 being 303(d) listed for indicator bacteria, the project's primary pollutant of concern is pathogens. Selected LID BMPs must consider and demonstrate pollutant removal effectiveness for bacteria.

II.3 HYDROLOGIC CONDITIONS OF CONCERN

The purpose of this section is to identify any hydrologic conditions of concern (HCOC) with respect to downstream flooding, erosion potential of natural channels downstream, impacts of increased flows on natural habitat, etc. As specified in Section 2.3.3 of the 2011 Model WQMP, projects must identify and mitigate any HCOCs. A HCOC is a combination of upland hydrologic conditions and stream biological and physical conditions that presents a condition of concern for physical and/or biological degradation of streams.

In the North Orange County permit area, HCOCs are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts and either of the following conditions exists:

- Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent

or

- Time of concentration (Tc) of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent.

If these conditions do not exist or streams are not potentially susceptible to hydromodification impacts, an HCOC does not exist and hydromodification does not need to be considered further. In the North Orange County permit area, downstream channels are considered not susceptible to hydromodification, and therefore do not have the potential for a HCOC, if all downstream conveyance channels that will receive runoff from the project are engineered, hardened, and regularly maintained to ensure design flow capacity, and no sensitive habitat areas will be affected.

Is the proposed project potentially susceptible to hydromodification impacts?

☒ **Yes** ☐ **No (show map)**

Based on the 2011 Technical Guidance Document (TGD), much of **Planning Area 1** (South Site) is located in an areas identified as "potential areas of erosion, habitat, & physical structure

susceptibility." Therefore the entire Planning Area 1 portion of the site will be considered potentially susceptible to hydromodification within the Santa Ana River Watershed (Figure XVI-3c, see Appendix A). In order to quantify the HCOC potential, the 2-year, 24-hour storm was evaluated for the existing and proposed conditions for the project.

The following Table II.3-1 and Table II.3-2 compare and identify the differences between the unmitigated Pre-development versus Proposed conditions for Planning Area 1. Table II.3-1 shows impact within the limits of development for portions that are tributary to the existing offsite 8'x7' RCB. Table II.3-2 shows the impact with the limits of development for portions that are draining offsite towards the existing 36" RCP.

Table II.3-1

PLANNING AREA 1 (8x7 RCB) - UNMITIGATED 2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Acreage**	**Tc (Lag Time)**	**Peak Runoff**	**Volume**
Pre-development	21.6 ac	5.9 min	26.93 cfs	0.80 ac-ft
Proposed	31.8 ac	2.9 min	42.14 cfs	2.56 ac-ft
Difference	**10.2 ac**	**–3.0 min**	**+15.21 cfs**	**+1.76 ac-ft**
% Change	**47%**	**-51%**	**+56%**	**+219%**

Table II.3-2

PLANNING AREA 1 (36" RCP) - UNMITIGATED 2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Acreage**	**Tc (Lag Time)**	**Peak Runoff**	**Volume**
Pre-development	12.5 ac	2.9 min	15.50 cfs	0.48 ac-ft
Proposed	2.3 ac	2.6 min	2.76 cfs	0.09 ac-ft
Difference	**-10.2 ac**	**–0.3 min**	**-12.74 cfs**	**-0.39 ac-ft**
% Change	**-82%**	**–10%**	**-82%**	**-81%**

The results indicate that for portions tributary to the 8'x7' RCB the 2-year time of concentration (Tc) decreases by 51%, the peak runoff increases by 56% and the volume increases by 219% as compared to the existing conditions. Due to the existing soil constraints (see Section III.2), infiltration of the increase in volume is not feasible, and reuse demands are not sufficient to draw down the volume within 48 hours. The 2011 Model WQMP (Section 7.II-2.4.2.2) and the 4th Term MS4 Permit, identifies the following criteria:

> "Where the Project WQMP documents that excess runoff volume from the two-year runoff event cannot feasibly be retained and where in-stream controls cannot be used to otherwise mitigate HCOCs, the project shall implement on-site or regional hydromodification controls to:
>
> - Retain the excess volume from the two-year runoff event to the MEP

- Implement on-site or regional hydromodification controls such that the post-development runoff two-year peak flow rate is no greater than 110 percent of the predevelopment runoff two-year peak flow rate."

The proposed project's will meet the above "110 percent" threshold by utilizing a split-flow structure proposed along storm drain Line "B" in "B" Street adjacent to Lot 8 that will bifurcate 12.74 cfs from the storm drain system and convey this flow rate southwesterly toward the offsite 36" RCP line. This mitigated condition will ensure that peak runoff conditions for 2-year 24-hour storm events at both points of discharge is no greater than 110 percent of predevelopment conditions, as summarized in the below tables 11.3-3 and 11.3-4.

Table II.3-3

PLANNING AREA 1 (8x7 RCB) - MITIGATED 2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Acreage**	**Tc (Lag Time)**	**Peak Runoff**	**Volume**
Pre-development	21.6 ac	5.9 min	26.93 cfs	0.80 ac-ft
Proposed	31.8 ac	2.9 min	29.40 cfs	2.56 ac-ft
Difference	**10.2 ac**	**–3.0 min**	**+2.47 cfs** (1)	**Mitigated** (2)
% Change	**47%**	**-51%**	**+9%**	**N/A**

Notes:

1. 12.74 cfs will be bifurcated from storm drain Line "B" in "B" Street adjacent to Lot 8 as labelled on Planning Area 1 BMP Plan (Figure 1-1) and conveyed toward the offsite 36" RCP to mitigate the required HCOC.
2. Retention for the project is not feasible, volume detention will be provided in retention water quality features

Table II.3-4

PLANNING AREA 1 (36" RCP) - MITIGATED 2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Acreage**	**Tc (Lag Time)**	**Peak Runoff**	**Volume**
Pre-development	12.5 ac	2.9 min	15.50 cfs	0.48 ac-ft
Proposed	2.3 ac	2.6 min	15.50 cfs	0.09 ac-ft
Difference	**-10.2 ac**	**–0.3 min**	**0.0 cfs** (1)	**Mitigated** (2)
% Change	**-82%**	**–10%**	**0%**	**N/A**

Notes:

1. 12.74 cfs will be bifurcated from storm drain Line "B" as described in Table II.3-3.
2. Retention for the project is not feasible, volume detention will be provided in retention water quality features

The above tables indicate that flows tributary to the 8'x7' RCB will be reduced by the proposed split-flow structure thus allowing for only a 9% increase in a 2-year 24-hour storm condition, which meets the County's requirements.

Based on the 2011 Technical Guidance Document (TGD), Planning Area 2 (North Site) of the project site is located in an areas identified as "potential areas of erosion, habitat, & physical structure

susceptibility" and therefore is susceptible to hydromodification within the Santa Ana River Watershed (Figure XVI-3c, see Appendix A).

Table II.3-5

PLANNING AREA 2 – UNMITIGATED 2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Acreage**	**Tc**	**Peak Runoff**	**Volume**
Pre-development	8.1	18.3 min	6.0 cfs	0.24 ac-ft
Proposed	8.1	10.9 min	9.4 cfs	0.66 ac-ft
Difference	**0**	**-7.4 min**	**3.4 cfs**	**0.42 ac-ft**
% Change		**40.4%**	**57.0%**	**174.0%**

The results indicate the 2-year time of concentration (Tc) decreases by 40.4% and the volume increases by 174.0% as compared to the existing conditions. Therefore, Planning Area 2 will need to retain the 2-year volume difference to effectively mitigate hydrologic conditions of concern.

An infiltration basin has been proposed within Lot E in order to accommodate the hydromodification requirements described above (see BMP INF-1 in Section VI of this report). Routing the 2-year 24 hour storm event through this system will reduce peak flow volumetric flow to comply with the hydromodification requirements and allowable discharge provisions. A summary table is provided below and hydrology calculations are provided in Appendix A.1 and A.2.

Table II.3-6

PLANNING AREA 2 - MITIGATED 2-YEAR, 24-HOUR STORM SUMMARY				
Condition	**Acreage**	**Tc**	**Peak Runoff**	**Volume**
Existing	8.1 ac	18.3 min	6.0 cfs	0.24 ac-ft
Proposed Mitigated	8.1 ac	10.9 min	6.0 cfs	0.66 ac-ft
Difference	**0**	**–7.4 min**	**0.0 cfs** [1]	**Mitigated** [1]
% Change		**40.4%**	**0%**	**N/A**

Notes:

3. A volume of 18,300 ft^3 provided by an infiltration basin within Lot E will mitigate the required HCOC. Basin routing calculations provided in the Preliminary WQMP as applicable.

The above table summarized the hydraulic calculations that have been performed to mitigate the proposed condition to meet the 4th Term MS4 Permit's and 2011 Model WQMP's Hydromodification requirements. The above table indicates that the proposed infiltration basin within Lot E will reduce the peak flow runoff of a 2-year 24 hour storm event as well as infiltrate the 0.42 acre-ft (18,300 ft^3) of runoff when compared to the peak flow runoff of the existing condition. Moreover, the hydromod mitigation volume is greater than the DCV of 9,109 ft^3 for Planning Area 2 (see Section IV). Therefore, implementing the proposed infiltration basin within Lot E will, in turn, satisfy LID performance capture volume requirements for Planning Area 2.

II.4 POST DEVELOPMENT DRAINAGE CHARACTERISTICS

Under proposed conditions for the North Site (Planning Area 2), new on-site area drains and terrace drains will be constructed to intercept offsite adjacent hillside runoff and convey the flows to a proposed storm drain in "F" Street. On-site runoff will be directed toward "F" Street and intercepted by proposed catch basins in "F" Street. The proposed "F" Street storm drain will divert the necessary amount of flows into a detention basin for water quality purposes. Existing offsite flows from the north is intercepted by a headwall located north of Aspen Way. Existing offsite flows from the northeast will be intercepted by a proposed headwall located at the northern end of proposed "F" Street. These flows will be conveyed via storm drain through the site in a southerly direction, draining to a natural existing flow path south of Planning Area 2 and ultimately off-site.

Under proposed conditions for the South Site (Planning Area 1), new on-site area drains and terrace drains will be constructed to intercept offsite adjacent hillside runoff that is directed on-site. On-site runoff will be directed toward proposed catch basins throughout the site. The proposed storm drain system generally flows in a southerly direction connecting offsite to the existing 8'x7' RCB in Via Del Agua/Stonehaven Drive. Offsite Existing offsite flows from the east Wire Springs Canyon (a.k.a. Blue Mud Canyon) will be intercepted by a debris basin and inlet that connects to a proposed bypass storm drain system that will direct the flows within the proposed streets toward the existing 8'x7' RCB in Via Del Agua/Stonehaven Drive. The westerly graded/landscaped slopes combines with the offsite tributary runoff and is directed south along the tract boundary toward the existing 36" storm drain system in Dorinda Road.

II.5 PROPERTY OWNERSHIP/MANAGEMENT

PROPERTY OWNERSHIP/MANAGEMENT	
Public Streets:	County of Orange
Private Streets:	North County BRS Project, LLC
Landscaped Areas:	North County BRS Project, LLC
Open Space:	North County BRS Project, LLC
Easements:	County of Orange, Southern California Edison, Metropolitan Water District
Parks:	N/A
Buildings:	North County BRS Project, LLC
Structural BMPs:	North County BRS Project, LLC

A Home Owners Association (HOA) will be formed upon project completion. The HOA will be responsible for inspecting and maintaining all BMPs prescribed for Cielo Vista. Until a HOA is formally established, North County BRS Project, LLC shall assume all BMP maintenance and inspection responsibilities for the proposed project. Inspection and maintenance responsibilities are outlined in Section V of this report.

SECTION III SITE DESCRIPTION

III.1 PHYSICAL SETTING

Planning Area/ Community Name:	Tract 17341
Address:	Via Del Agua at Stonehaven
Project Area Description:	Located north of Via Del Agua at Stonehaven Drive and east of Aspen Way in unincorporated Orange County (adjacent to Yorba Lida).
Land Use:	Suburban Residential – 1B
Zoning:	A1(0) – General Agricultural with Oil Production Overlay
Acreage:	83.96 Acres
Predominant Soil Type:	Soil Types C & D
Impervious Conditions:	Existing Impervious: 0% (100% Pervious) Proposed Impervious: 34% (66% Pervious)

III.2 SITE CHARACTERISTICS

Precipitation Zone:	0.90
Topography:	The existing site consists of rolling terrain that directs runoff in valley and creeks that slope southwesterly at slopes varying from 2% to areas as steep as 1.5:1. The project site is characterized by steep sloping hillsides vegetated by scrub and chaparral. Elevations range from approximately 560 feet above mean sea level (MSL) in the southern portions of the project site, to approximately 885 feet above MSL at the highest point in the northern portions of the project site. A westerly draining canyon of approximately 100 to 200 feet in depth bisects the project site. Side slopes within this canyon vary from 1.5:1 to 2:1 with locally steeper and flatter elements.

Drainage Patterns/ Connections:	The North Site runoff consists of three parts. The first part, offsite runoff from the Northwest Subarea "D" (Creek "D", which also includes tributary runoff from residential Tract 9813 [(1)]) will be conveyed through a storm drain between Lot 96 and Lot 97, then underneath the extended Aspen Way, before it outlets just upstream of Confluence BCD. The second part, runoff from the East Subarea "C" (Creek "C") is intercepted via debris basin/inlets along the toe of the landscaped slope adjacent to lots 101 through 112. The runoff is then directed southerly via a combination storm drain and above ground channel that outlets upstream of Confluence BCD. The third part consists of the North Site improvements that directs all runoff to the single retention basin. The fully mitigated runoff leaving the retention Basin outlets upstream of Confluence BCD. No improvements are proposed within Subarea "B" (Creek "B"). As a result, all drainage generated in Subarea "B" continues to Confluence BCD and is not affected by the proposed improvements. The South Site runoff consists of two parts: The first part, the westerly landscaped slope combines with offsite area and is directed southerly along the tract boundary. All runoff will settle in the proposed rip rap pad prior to leaving the tract boundary, ultimately draining toward the existing offsite 36" RCP at Dorinda Road. The second part, offsite runoff from the east Wire Springs Canyon a.k.a. Blue Mud Canyon, Area "A" (Creek "A") will be intercepted by a debris basin and inlet, and piped via a new 84" Bypass storm drain onsite RCP (exact size to be determined during final engineering) within the proposed streets and connects to the existing 8'x7' RCB storm drain at Via Del Agua/Stonehaven. All runoff generated within the South Site improvements (not including the westerly slope) is collected in onsite inlets and storm drains and is directed toward bioretention basins with the exception of the project entrance road, accounting for 0.5 acres, which is treated by two Modular Wetland Systems prior to discharging into the 84"RCP Bypass Storm drain.

Notes:

1. Previous drainage studies in support of the Project EIR include Tract 9813 within Creek 'D' tributaries and analyses.

Proposed Drainage Patterns/ Connections:	Under proposed conditions for the North Site (Planning Area 2), new on-site area drains and terrace drains will be constructed to intercept offsite adjacent hillside runoff and convey the flows to a proposed storm drain in "F" Street. On-site runoff will be directed toward "F" Street and intercepted by proposed catch basins in "F" Street. The proposed "F" Street storm drain will divert the necessary amount of flows into a detention basin for water quality purposes. Existing offsite flows from the north is intercepted by a headwall located north of Aspen Way. Existing offsite flows from the northeast will be intercepted by a proposed headwall located at the northern end of proposed "F" Street. These flows will be conveyed via storm drain through the site in a southerly direction, draining to a natural existing flow path south of Planning Area 2 and ultimately off-site. Under proposed conditions for the South Site (Planning Area 1), new on-site area drains and terrace drains will be constructed to intercept offsite adjacent hillside runoff that is directed on-site. On-site runoff will be directed toward proposed catch basins throughout the site. The proposed storm drain system generally flows in a southerly direction connecting offsite to the existing 8'x7' RCB in Via Del Agua/Stonehaven Drive. Offsite Existing offsite flows from the east Wire Springs Canyon (a.k.a. Blue Mud Canyon) will be intercepted by a debris basin and inlet that connects to a proposed bypass storm drain system that will direct the flows within the proposed streets toward the existing 8'x7' RCB in Via Del Agua/Stonehaven Drive. The westerly graded/landscaped slopes combines with the offsite tributary runoff and is directed south along the tract boundary toward the existing 36" storm drain system in Dorinda Road. Storm flows from the south easterly natural slope behind lots 87-92 will be intercepted prior to entering into the residential pads and conveyed towards the entrance of the project joining directly to the proposed storm drain system.
Soil Type, Geology, and Infiltration Properties:	Preliminary geotechnical studies performed for the project site indicate that a branch of the Whittier Fault Zone traverses the site in a generally northwesterly to southeasterly direction. The geotechnical studies also indicate a potential ancient landslide exists along the primarily northwest facing slope located within the northerly portion of the site. Per figure XVI-2b, the majority of the site is Soil Type D, with pockets of alluvial soil. Infiltration testing will not be performed at this EIR phase of this project's development. Site-specific infiltration rates will be evaluated at a later phase, such as final design. Infiltration feasibility will be documented in the project's future preliminary or final WQMP.

Hydrogeologic (Groundwater) Conditions:	To be determined during the geotechnical investigation.
Geotechnical Conditions (relevant to infiltration):	Per the soils investigation by LGC Geotechnical, stormwater infiltration is only recommended at the water quality basin in Planning Area 2 (the North site). LGC Geotechnical advises against infiltration in Planning Area 1 (the South site) due to existing soils conditions. Therefore, the geotechnical engineer's assessment shall serve as the determination for infiltration feasibility for this EIR phase. Percolation rate testing will not occur at this time.
Off-Site Drainage:	Under existing conditions, runoff from undeveloped properties to the west of the site drains onto the property.
Utility and Infrastructure Information:	There are several easements on the project site for utilities (Southern California Edison, Yorba Linda Water District and Metropolitan Water District) for ingress/egress and other public utility maintenance purposes. Refer to the WQMP Exhibit in Section VI for the location of the easement on the project site.

III.3 WATERSHED DESCRIPTION

Receiving Waters:	Santa Ana River – Reach 2
303(d) Listed Impairments:	Unknown Toxicity and Indicator Bacteria (2010 303d list)
Applicable TMDLs:	No downstream TMDL's for the project.
Pollutants of Concern for the Project:	Suspended Soils/Sediment, Nutrients, Heavy Metals, Pathogens (Bacteria/Virus), Pesticides, Oil & Grease, Toxic Organic Compounds, Trash & Debris
Hydrologic Conditions of Concern (HCOCs):	The project site is located in an areas identified as "potential areas of erosion, habitat, & physical structure susceptibility and therefore is susceptible to hydromodification.
Environmentally Sensitive and Special Biological Significant Areas:	There are no Environmentally Sensitive Areas (ESAs) or Areas of Special Biological Significance (ASBS) within the project site or within the project's vicinity.

SECTION IV BEST MANAGEMENT PRACTICES (BMPs)

IV.1 PROJECT PERFORMANCE CRITERIA

Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis?

☐ Yes ☒ No

PROJECT PERFORMANCE CRITERIA	
Hydromodification Control Performance Criteria: (Model WQMP Section 7.II-2.4.2.2)	If a hydrologic condition of concern (HCOC) exists, priority projects shall implement onsite or regional hydromodification controls such that: ▪ Post-development runoff volume for the two-year frequency storm does not exceed that of the predevelopment condition by more than five percent, and ▪ Time of concentration of post-development runoff for the two-year storm event is not less than that for the predevelopment condition by more than five percent. Where the Project WQMP documents that excess runoff volume from the two-year runoff event cannot feasibly be retained and where in-stream controls cannot be used to otherwise mitigate HCOCs, the project shall implement on-site or regional hydromodification controls to: ▪ Retain the excess volume from the two-year runoff event to the MEP, and ▪ Implement on-site or regional hydromodification controls such that the post-development runoff two-year peak flow rate is no greater than 110 percent of the predevelopment runoff two-year peak flow rate.
LID Performance Criteria: (Model WQMP Section 7.II-2.4.3)	Infiltrate, harvest and use, evapotranspire, or biotreat/biofilter, the 85th percentile, 24-hour storm event (Design Capture Volume). LID BMPs must be designed to retain, on-site, (infiltrate, harvest and use, or evapotranspire) storm water runoff up to 80 percent average annual capture efficiency.
Treatment Control BMP Performance Criteria: (Model WQMP Section 7.II-3.2.2)	If it is not feasible to meet LID performance criteria through retention and/or biotreatment provided on-site or at a sub-regional/regional scale, then treatment control BMPs shall be provided on-site or offsite prior to discharge to waters of the US. Sizing of treatment control BMP(s) shall be based on either the unmet volume after claiming applicable water quality credits, if appropriate.

PROJECT PERFORMANCE CRITERIA	
LID Design Storm Capture Volume:	DCV = C × d × A × 43560 sf/ac × 1/12 in/ft Where: DCV = design storm capture volume, cu-ft C = runoff coefficient = (0.75 × imp + 0.15) Imp = impervious fraction of drainage area (ranges from 0 to 1) d = storm depth (inches) A = tributary area (acres) to water quality BMP <u>Planning Area 1 (On-Site):</u> Imp = 39.4% d = 0.9 inches A = 29.78 acres *DCV* = *(0.75 x .394 +0.15) x* 0.9 *inches x* 29.78 *ac x 43560 sf/ac x 1/12 in/ft* = **43,364 ft³** <u>Planning Area 2 (B2):</u> Imp = 40.0% d = 0.9 inches A = 6.20 acres *DCV* = *(0.75 x .40 +0.15) x* 0.9 *inches x* 6.20 *ac x 43560 sf/ac x 1/12 in/ft* = **9,109 ft³** (mitigated by Lot E hydromodification BMP) *Refer to Section IV.2.2 for specific Drainage Manage Area (DMA) breakdown and Appendix A for detailed calculations (Worksheet B).*

IV.2 SITE DESIGN AND DRAINAGE PLAN

The following section describes the site design BMPs used in this project and the methods used to incorporate them. Careful consideration of site design is a critical first step in storm water pollution prevention from new developments and redevelopments.

IV.2.1 Site Design BMPs

Minimize Impervious Area

Though the project will increase impervious surfaces as compared to the existing conditions, landscaping will be provided throughout the site surrounding the future residences and along the re-

graded slopes. In addition, runoff from the proposed impervious surfaces will drain to landscaped bioretention features and systems.

Maximize Natural Infiltration Capacity

Based on existing soils characteristics, infiltration is not recommended in Planning Area 1.

The proposed retention basin in Lot E in Planning Area 2 is designed to allow for infiltration.

Preserve Existing Drainage Patterns and Time of Concentration

Runoff from the site will continue to flow similar to existing conditions.

Disconnect Impervious Areas

Landscaping will be provided throughout the site, including on the re-graded slopes, surrounding the proposed residences and adjacent to sidewalks/walkways.

Protect Existing Vegetation and Sensitive Areas, and Revegetate Disturbed Areas

There are no existing vegetated or sensitive areas to preserve on the project site. All disturbed areas will either be paved or landscaped.

Xeriscape Landscaping

Native and/or tolerant landscaping will be incorporated into the site design consistent with County guidelines.

IV.2.2 Drainage Management Areas

In accordance with the MS4 permit and the 2011 Model WQMP, the project site has been divided into Drainage Management Areas (DMAs) to be utilized for defining drainage areas and sizing LID and other treatment control BMPs. DMAs have been delineated based on the proposed site grading patterns, drainage patterns, storm drain and catch basin locations.

The design capture volumes (DCV) and treatment flow rates (Q_{Design}) for each DMA are summarized in the table below. These have been derived utilizing the "Simple Method" in accordance with the TGD Section III.1.1. Actual BMP sizing requirements, including 80 percent capture design volumes, flow rates, depths, and other design details for the specific BMPs proposed are provided in Sections IV.3.1 and IV.3.4 below. Locations of DMAs and associated LID and treatment BMPs are identified on the exhibits in Section VI. Additional calculations and TGD Worksheets are provided in Appendix A.

DRAINAGE MANAGEMENT AREAS (DMAs) – PA 1							
DMA/ Drainage Area ID[1]	Tributary Drainage Area (ft^2)	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth[2] (in)	Estimated Tc (min)	Rainfall Intensity[3] (in/hr)	Simple Method DCV[4] (ft^3)
A1 Residential	407,247.47	9.35	40%	0.9	5	0.26	13,745

DRAINAGE MANAGEMENT AREAS (DMAs) – PA 1							
DMA/ Drainage Area ID[1]	Tributary Drainage Area (ft^2)	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth[2] (in)	Estimated Tc (min)	Rainfall Intensity[3] (in/hr)	Simple Method DCV[4] (ft^3)
A2 Offsite Slope	98,563	2.26	5%	0.9	5	0.26	1,386
A3 Residential	202,883	4.66	40%	0.9	5	0.26	6,847
A4 Residential	258,715	5.94	31%	0.9	5	0.26	7,422
A5 Residential	262,996	6.04	46%	0.9	5	0.26	9,764
A6 Offsite Slope	14,329	0.33	5%	0.9	5	0.26	202
A7 Residential	70,140	1.61	40%	0.9	5	0.26	2,367
A8 Residential	95,390	2.19	40%	0.9	5	0.26	3,219
A9 Dwy Entrance	20,125	0.46	90%	0.9	5	0.26	1,245
A10 Offsite Slope	54,534	1.25	5%	0.9	5	0.26	767
Total On-Site	1,297,372	29.78	39.4%	0.9	5	0.26	43,364
Overall Site	1,484,931	34.09	36.2%	0.9	5	0.26	46,968

Notes:
1. Refer to exhibits in Section VI for locations of each DMA.
2. Per Figure XVI-1 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
3. Per Figure III.4 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
4. Per Section III.1.1 of the Technical Guidance Document.
5. Per Section III.3.3 and Worksheet D of the Technical Guidance Document.

DMAs A2, A6 and A10 are slope areas that are considered off-site and do not drain onto the proposed project site. These slopes will be planted with native landscaping and will only be irrigated for vegetation establishment. Once the slopes stabilized and established, they are considered returned to their natural condition similar to the surrounding natural terrain. These areas are not considered land development areas that require water quality treatment. As illustrated in the table above, DMAs A2, A6, A10 comprise approximately 2,355 ft^3 or 5% of the DCV for the overall site.

DRAINAGE MANAGEMENT AREAS (DMAs) – PA 2							
DMA/ Drainage Area ID[1]	Tributary Drainage Area (ft^2)	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth[2] (in)	Estimated Tc (min)	Rainfall Intensity[3] (in/hr)	Simple Method DCV[4] (ft^3)
B1 Offsite Slope	24,285	0.56	5%	0.9	5	0.26	342

DRAINAGE MANAGEMENT AREAS (DMAs) – PA 2							
DMA/ Drainage Area ID[1]	Tributary Drainage Area (ft^2)	Tributary Drainage Area (ac)	% Imp.	Design Storm Depth[2] (in)	Estimated Tc (min)	Rainfall Intensity[3] (in/hr)	Simple Method DCV[4] (ft^3)
B2 Residential	269,898	6.20	40%	0.9	5	0.26	9,109
B3 Offsite Slope	9,181	0.21	5%	0.9	5	0.26	129
B4 Offsite Slope	32,149	0.74	5%	0.9	5	0.26	452
B5 Offsite Slope	24,683	0.57	5%	0.9	5	0.26	347
Total @ P.L. for PA - 2	360,197	8.27	31.23%	0.9	5	0.26	10,379

Notes:
1. Refer to exhibits in Section VI for locations of each DMA.
2. Per Figure XVI-1 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
3. Per Figure III.4 of the Technical Guidance Document, dated December 20, 2013. See also Appendix A.
4. Per Section III.1.1 of the Technical Guidance Document.
5. Per Section III.3.3 and Worksheet D of the Technical Guidance Document.

Similar to Planning Area 1, DMAs B1, B3, B4 and B5, these off-site areas are comprised of natural slopes once native vegetation is re-established. The slopes do not drain onto the residential site of Planning Area 2 and, therefore, do not require water quality treatment. As a result, Planning Area 2 DCV is only comprised of DMA B2. And as mentioned in Section II.3, the resultant 9,109.06 ft^3 of runoff will be infiltrated as part of the 18,300 ft^3 of hydromodification mitigation volume required for Planning Area 2. No additional LID BMPs are necessary for the treatment of DCV for Planning Area 2.

IV.3 LID BMP SELECTION AND PROJECT CONFORMANCE ANALYSIS

Low Impact Development (LID) BMPs are required in addition to site design measures and source controls to reduce pollutants in storm water discharges. LID BMPs are engineered facilities that are designed to retain or biotreat runoff on the project site. The 4th Term MS4 Storm Water Permit (Order R8-2009-0030) requires the evaluation and use of LID features using the following hierarchy of treatment: infiltration, evapotranspiration, harvest/reuse, and biotreatment. The following sections summarize the LID BMPs proposed for the project in accordance with the permit hierarchy and performance criteria outlined in Section IV.1.

IV.3.1 Hydrologic Source Controls (HSCs)

Hydrologic source controls (HSCs) can be considered to be a hybrid between site design practices and LID BMPs. HSCs are distinguished from site design BMPs in that they do not reduce the tributary area or reduce the imperviousness of a drainage area; rather they reduce the runoff volume that would result from a drainage area with a given imperviousness compared to what would result if HSCs were not used.

HYDROLOGIC SOURCE CONTROLS		
ID	Name	Included?
HSC-1	Localized on-lot infiltration	☐
HSC-2	Impervious area dispersion (e.g. roof top disconnection)	☐
HSC-3	Street trees (canopy interception)	☐
HSC-4	Residential rain barrels (not actively managed)	☐
HSC-5	Green roofs/Brown roofs	☐
HSC-6	Blue roofs	☐
HSC-7	Impervious area reduction (e.g. permeable pavers, site design)	☐

Due to the projects conceptual design, HSCs have not been incorporated into this Conceptual WQMP. HSCs are final design level BMP features and will be considered at a later phase in the project's development. It is not feasible at this time to consider or quantify HSCs.

IV.3.2 Infiltration BMPs

Infiltration BMPs are LID BMPs that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. Examples of infiltration BMPs include infiltration trenches, bioretention without underdrains, drywells, permeable pavement, and underground infiltration galleries.

INFILTRATION		
ID	Name	Included?
INF-3 INF-4	Bioretention Without Underdrains	☐
	Rain Gardens	☐
	Porous Landscaping	☐
	Infiltration Planters	☐
	Retention Swales	☐
INF-2	Infiltration Trenches	☐
INF-1	Infiltration Basins	☒
INF-5	Drywells	☐
INF-7	Subsurface Infiltration Galleries	☐

INFILTRATION		
ID	**Name**	**Included?**
--	French Drains	☐
INF-6	Permeable Asphalt	☐
	Permeable Concrete	☐
	Permeable Concrete Pavers	☐
	Other:	☐

Infiltration Basins in Planning Area 1 are not feasible. The project soils engineer does not recommend stormwater runoff to percolate, saturate or load the underlying soils due to hillside terrain, liquefaction potential and landslide proximity.

Planning Area 2 will utilize infiltration basins (LID BMP INF-1) in order to capture, store and infiltrate storm water runoff. Basin design and sizing criteria are discussed in Section IV.3.5, since the hydromodification mitigation retention volume of 18,300 ft^3 is greater than the Planning Area 2 DCV of 9,109 ft^3. Since the infiltration basin will be utilized to address both LID and hydomodification control performance criteria, the hydromodification mitigation volume is the controlling design criteria because it is the larger volume.

IV.3.3 Evapotranspiration & Rainwater Harvesting BMPs

Evapotranspiration BMPs are a class of retention BMPs that discharges stored volume predominately to ET, though some infiltration may occur. ET includes both evaporation and transpiration, and ET BMPs may incorporate one or more of these processes. BMPs must be designed to achieve the maximum feasible ET, where required to demonstrate that the maximum amount of water has been retained on-site. Since ET is not the sole process in these BMPs, specific design and sizing criteria have not been developed for ET-based BMPs.

EVAPOTRANSPIRATION		
ID	**Name**	**Included?**
--	HSCs, *see Section IV.3.1*	☐
--	Surface-based infiltration BMPs	☒
--	Biotreatment BMPs, see *Section VI.3.4*	☒
	Other:	☐

Both Infiltration and Bioretention BMPs are proposed which utilize evapotranspiration as physical process for runoff volume reduction. Bioretention BMPs are described further in Section IV.3.4.

Harvest and use (aka. Rainwater Harvesting) BMPs are LID BMPs that capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. Harvest and use BMPs include both above-ground and below-ground cisterns. Examples of uses for harvested water include irrigation, toilet and urinal flushing, vehicle washing, evaporative cooling, industrial processes and other non-potable uses.

HARVEST & REUSE / RAINWATER HARVESTING		
ID	**Name**	**Included?**
HU-1	Above-ground cisterns and basins	☐
HU-2	Underground detention	☐
--	Other:	☐

Harvest and reuse is typically evaluated for outdoor irrigation demand and indoor toilet flushing demand. On a conceptual level, single-family detached housing with limited common area landscaping does not lend itself to a centralized harvest and reuse system. All the storm water must be collected at the downstream end of the project site and then pumped back up to each individual house through separate irrigation systems and separate storage systems. Based on the proposed site plan and the proposed grades, such a system is not practicable for single-family detached housing. Such systems are more practicable when there are common areas landscape facilities within a small footprint (i.e. commercial/retail or high density apartments). However, the incorporation of individual rain barrels for each house to collect rainfall and use via passive gravity flow following a rain event should be evaluated. The following evaluation is intended for this type of harvest and re-use system.

In order to quantify harvested water demand for the common areas of the project, the Modified Estimated Applied Water Use (EAWU) method was used, consistent with Appendix X of the Model WQMP's Technical Guidance Document (TGD), dated December 20, 2013.

The Modified EAWU method is modified from the OC Irrigation Code (County Ordinance No. 09-010) to account for the wet season demand and storm events (assuming that no irrigation would be applied for approximately 30% of the days in the wet season).

The equation used to calculate the Modified EAWU is:

$$Modified\ EAWU = \frac{(ETo_{wet} \times K_L \times LA \times 0.015)}{IE}$$

Where:

$Modified\ EAWU$ = estimated daily average water use during wet season
ETo_{wet} = average reference ET from November through April (inches per month) per Table X.2 of the TGD
K_L = landscape coefficient (Table X.4 of the TGD)
LA = landscape area irrigated with harvested water (square feet)
IE = irrigation efficiency (assumed at 90%)

Note: In the equation, the coefficient (0.015) accounts for unit conversions and shut down of irrigation during and for three days following a significant precipitation event.

For a system to be considered "feasible", the system must be designed with a storage volume equal to the DCV from the tributary area and achieve more than 40% capture. The system must also be able to drawdown in 30 days to meet the 40% capture value. In addition, Table X.6 of the Technical Guidance Document sets forth the demand thresholds for minimum partial capture.

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE	
Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

Only Planning Area 1 is considered since Planning Area 2 will be treated by an infiltration basin. The following table summarizes the estimated applied water use for the common area landscaping of the project. Landscape type will be conservation, low water use type plants. Furthermore, the off-site slopes that are to remain natural, native landscaping were not accounted for since these slopes will not be irrigated once vegetation has been established. As a result, only DMAs A1, A3, and A4, totaling 27.76 acres are considered in this feasibility assessment for irrigation demand.

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING									
Landscape Type	Total Area (ac)	% Impervious	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{Wet} [1] (in/mo)	K_L [2]	Modified EAWU (gpd)	Modified EAWU per impervious acre (gpd/ac)	Minimum Capture Threshold [3] (gpd/ac)
Conservation	27.76	47%	13.05	14.71	2.93	0.35	10,954	840	730
Design Capture Volume (gal)					Drawdown (days)				31.1

ESTIMATED APPLIED WATER USE (EAWU) FOR COMMON AREA LANDSCAPING									
Landscape Type	Total Area (ac)	% Impervious	Impervious Tributary (ac)	Irrigated LS Area (ac)	ETo_{Wet} [1] (in/mo)	K_L [2]	Modified EAWU (gpd)	Modified EAWU per impervious acre (gpd/ac)	Minimum Capture Threshold [3] (gpd/ac)

Notes:
1 Per Table X.2 for Santa Ana Region (similar climate type), Model WQMP Technical Guidance Document, dated December 20, 2013.
2 Per Table X.4 of the Model WQMP Technical Guidance Document, dated December 20, 2013.
3 Per Table X.6 of Model WQMP Technical Guidance Document, dated December 20, 2013.

Based on irrigation demand, the project does not meet minimum partial capture threshold. Though it achieves greater than 40% capture, the system would not be able to drawdown the DCV within 30 days to be feasible.

The proposed project also assessed feasibility for indoor toilet flushing demand but results showed that meeting minimum partial capture threshold was not feasible. Similar to landscaping irrigation demand, these systems are more practicable when there are a high number and density of fixtures within a small footprint (i.e. commercial/retail or high density apartments). The minimum TUTIA for partial capture, according to Table X.7 of the TGD is 110 toilet users/impervious acre for residential use. Based on 112 detached residential units with an average household of 4 persons, Planning Area 1 will have roughly 448 toilet users over 13.05 acres of impervious area. This results in 34.3 toilet users/impervious acre. Planning Area 1 does not meet the partial capture threshold for toilet flushing demand and is, therefore, insufficient for harvest and re-use to be feasible at this EIR phase. See Appendix A for detailed calculations and TGD Worksheets.

IV.3.4 Biotreatment BMPs

Biotreatment BMPs are a broad class of LID BMPs that reduce storm water volume to the maximum extent practicable, treat storm water using a suite of treatment mechanisms characteristic of biologically active systems, and discharge water to the downstream storm drain system or directly to receiving waters. Treatment mechanisms include media filtration (though biologically-active media), vegetative filtration (straining, sedimentation, interception, and stabilization of particles resulting from shallow flow through vegetation), general sorption processes (i.e., absorption, adsorption, ion-exchange, precipitation, surface complexation), biologically-mediated transformations, and other processes to address both suspended and dissolved constituents. Examples of biotreatment BMPs include bioretention with underdrains, vegetated swales, constructed wetlands, and proprietary biotreatment systems.

BIOTREATMENT		
ID	Name	Included?
BIO-1	Bioretention with underdrains	☒
	Storm Water planter boxes with underdrains	☐

BIOTREATMENT		
ID	**Name**	**Included?**
	Rain gardens with underdrains	☐
BIO-5	Constructed wetlands	☐
BIO-2	Vegetated swales	☐
BIO-3	Vegetated filter strips	☐
BIO-7	Proprietary vegetated biotreatment systems	☒
BIO-4	Wet extended detention basin	☐
BIO-6	Dry extended detention basins	☐
--	Other:	☐

Bioretention with Underdrains Biotreatment BMP

Due to the infeasibility of harvest and reuse, Planning Area 1 will incorporate biotreatment LID BMP for on-site water quality treatment. In particular, bioretention with underdrains (BIO-1) are proposed. According to Table 4.2 of the TGD, bioretention has a medium treatment performance rating for treating bacteria, which is the project's primary pollutant of concern. The locations of the bioretention facilities are identified in the WQMP exhibit in Section VI.

Bioretention with underdrains are plant-based biotreatment systems that typically consist of a ponding area, mulch layer, planting soils and plants. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants. Underdrains collect the treated water and return it back into the storm drain system.

Biotreatment BMP Sizing & Design

In accordance with the Model WQMP and TGD, the bioretention/biotreatment BMPs will be sized to treat runoff from the Design Capture Storm (85th percentile, 24-hour). Locations and tributary drainage areas (DMAs) are shown on the exhibits included in Section VI. BMP details and typical cross sections are also included in Section VI. Detailed calculations and associated TGD Worksheets are included in Appendix A. Operation and maintenance details are included in Section V and Appendix B (O&M Plan).

The bioretention with underdrains will each have a ponding depth of 1.5 feet to capture the DCV. They will have an additional 2 feet of media layer where the runoff will filter through. The treated runoff will then flow into an underdrain system and discharged into the storm drain system. High flows will bypass the bioretention treatment into the proposed storm drain, since low flows are bifurcated to the bioretention BMPs. The Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs was used for bioretention sizing. A total surface area of 12,287 ft^2 of bioretention with underdrain is required to treat the DCV for Planning Area 1.

However, due to impending adoption of the (currently) draft 5th Term MS4 Permit for North Orange County, Draft Order No. R8-2015-0001, biotreatment control BMPs must be sized and designed to treat 1.5 times the design capture volume not retained. In this case, Planning Area 1 bioretention facilities will need a total surface area of 18,430 ft^2. The table below summarizes the BMP footprint requirement for Planning Area 1.

BIORETENTION WITH UNDERDRAIN (BIO-1) DESIGN SUMMARY
80% CAPTURE EFFICIENCY METHOD

DMA[1]	Total Drainage Area (acres)	% Imp.	DCV (ft^3)	80% Adjusted Storm Depth[3] (in)	80% Capture DCV x1.5[4,5] (ft^3)	BMP Surface Area for 1.5 times DCV[5] (ft^2)	BMP Surface Area Provided (ft^2)
A2	N/A Offsite Slope	5%	--	--	--	--	--
A3	4.66	40%	6,847	0.43	4,366	2,910	3,085 (BASIN C)
A4	5.94	31%	7,422	0.43	4,731	3,154	5,120 (BASIN A)
A5	6.04	46%	9,764	0.43	6,225	4,150	5,100 (BASIN B)
A6	N/A Offsite Slope	5%	--	--	--	--	--
A1	9.35	40%	13,745	0.43	8,762	5,841	8,400 (BASIN D)
A7	1.61	40%	2,367	0.43	1,509	1,006	
A8	2.19	40%	3,219	0.43	2,053	1,368	
A10	N/A Offsite Slope	5%	--	--	--	--	--
TOTAL	29.78	39%	43,364	0.43	65,047	18,430	

Notes:
1. Refer to WQMP Exhibit in Section VI for locations of BMPs.
2. Refer to Section IV.2.2 for individual DMA tributary areas.
3. Per Figure III.2 of the TGD.
4. Per Worksheet E, "Determining Capture Efficiency of Volume Based, Constant Drawdown BMP based on Design Volume. Copies are included in Appendix A.
5. Draft 5th Term MS4 Permit requirement (Draft Order No. R8-2015-0001, Section XII.G.7.)

Four bioretention BMPs are proposed for Planning Area 1, designated Basins A, B, C, and D. Together, they comprise approximately 21,705 ft^2 of BMP surface area. Basin A bioretention with

underdrain will be situated between Lots 65 and 66, and will treat DMA A4. Its footprint will be 5,120 ft^2 in size, which is larger than the required 3,154 ft^2. Basin B bioretention will be 5,100 ft^2 in size and is located between Lots 78 and 79, biofiltering runoff from DMA A5. Basin C bioretention will be within Lot 7, totaling 3,085 ft^2, and it will be treating DMA A3 of the project site. Basin D, located at Lot 95, will have a tributary drainage of DMAs A1, A7, and A8, totaling 13.15 acres. Its 8,400 ft^2 footprint will exceed the 8,215 ft^2 needed to treat its DMAs.

See WQMP Exhibit in Section VI for further details regarding bioretention BMP locations and tributary drainages.

Modular Wetland Biotreatment BMP

Since the main drive access for Planning Area 1 (off of Stonehaven Drive) lies downstream from the proposed bioretention facilities, the project will implement a series of proprietary biotreatment systems for water quality treatment to treat all pollutants of concern within the site access to a medium to high level of effectiveness.

The systems will include the Modular Wetlands Systems developed by Bio Clean Environmental Services, Inc. There are several advantages of the Modular Wetland System over traditional bioretention planters including the following reasons:

- Modular Wetlands are the only proprietary biotreatment device approved through the Washington State University TAPE (Technology Assessment Protocol – Ecology) program for basic storm water treatment and enhanced treatment including sediment, nutrients and heavy metals (all proposed pollutants of concern for the Upper and Lower Newport Bay watersheds). TAPE approval is based on a series of independent field studies using strict sampling criteria to validate vendor's claims. TAPE approval is considered one of the most stringent and most reliable in the Country.

- Modular Wetlands have a pre-treatment chamber that is specifically designed to capture fine sediments and particulates through a series of BioMediaGREEN sponges which prohibit the fines and particulates from entering the bioretention chamber and accelerating potential clogging of the bioretention soil. The City of Huntington Beach has installed a Modular Wetland for a residential neighborhood and has monitored the maintenance and functionality of the system for several years. Contact: Mark Birchfield, City of Huntington Beach (714-375-5041; MBirchfield@surfcity-hb.org)

- Modular Wetland systems are specifically designed for higher flow through treatment rates which reduce the potential for nutrient and copper leaching under more stagnant conditions (a common occurrence with planters that are left unmaintained).

Modular Wetlands by Modular Wetlands Systems, Inc. are proprietary biotreatment systems that utilize multi-stage treatment processes including screening media filtration, settling, and biofiltration. The pre-treatment chamber contains the first three stages of treatment, and includes a catch basin inlet filter to capture trash, debris, gross solids and sediments, a settling chamber for separating out larger solids, and a media filter cartridge for capturing fine TSS, metals, nutrients, and bacteria. Runoff then flows through the wetland chamber where treatment is achieved through a variety of physical,

chemical, and biological processes. As storm water passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded and sequestered by the soil and plants, functioning similar to bioretention systems. The discharge chamber at the end of the unit collects treated flows and discharges back into the storm drain system.

These systems were selected based on their ability to treat the project's pollutants of concerns to a medium or high effectiveness, in accordance with the Model WQMP and TGD requirements. The table below summarizes the overall treatment effectiveness for a Bioretention System and Modular Wetlands, derived from Table 4.2 of the Technical Guidance Document and testing data provided by the manufacturer. Additional details for the Modular Wetland units included in Section VI of this WQMP.

POLLUTANTS OF CONCERN AND PERFORMANCE RATINGS		
Pollutant of Concern (1)	**Treatment Effectiveness**	
	Bioretention System (2)	**Modular Wetlands Proprietary Bioretention Units** (3)
Oil & Grease	High	High
Trash & Debris	High	High
Sediment	High	High
Nutrients	Medium	Medium-High
Pesticides	N/A	N/A
Primary Pollutant of Concern (303d listed impairments & TMDLs)		
Pathogens/Bacteria	Medium	Medium-High

Notes:
1 See Section II.2 of the PWQMP, revised September 27, 2012.
2 Per Table 4.2 of the Model WQMP's companion Technical Guidance Document dated December 20, 2013.
3 Based on Washington State University Technology Assessment Protocol – Ecology (TAPE) third-party independent field tests for a high-flow biotreatment system with raised under drain (Modular Wetland System-Linear). Refer to manufacturer documentation (attached) for specific removal efficiencies and source references.
4 Field and Lab Testing demonstrates 75-83% removal rates of Chemical Oxygen Demand (COD), a measure of the amount of organic pollutants commonly found in surface water. COD removals of this range would fall within the Medium-High effectiveness category.

Modular Wetland Biotreatment BMP Sizing & Design

In accordance with the Model WQMP and TGD, the Modular Wetland Biotreatment BMPs will be sized to treat runoff from the Design Capture Storm (85th percentile, 24-hour). Since Modular Wetlands are sized based on flow rate, they were sized utilizing the methodology for flow based BMPs (TGD Section III.1.2 and Worksheet D). Locations and tributary drainage areas are shown on the WQMP Exhibit included in Section VI. BMP details are also included in Section VI. Detailed calculations and associated TGD Worksheets are included in Appendix A. Operation and maintenance details are included in Section V and Appendix D (O&M Plan).

MODULAR WETLAND DESIGN SUMMARY						
DMA / BMP ID[1][2]	BMP Name	BMP GPS Coordinate	Total Drainage Area (ac)	Q_{Design}[3] (cfs)	Sizes / Models[4]	Combined Treatment Capacity [5] (cfs)
A9	MWS #1	33.892928, -117.758544	0.5	0.099	MWS-L-4-8-C	0.116

Notes:
(1) See also Section IV.2.2.
(2) Refer to WQMP Exhibit in Section VI for locations of each drainage area and BMP.
(3) Detailed calculations and worksheets are included in Appendix A.
(4) Unit details and specifications are included in Section VI.
(5) Treatment capacities of each unit are based on wetland media design loading rate (controlled by downstream orifice) and perimeter surface area of wetland media provided. Individual unit sizing calculations provided by the manufacturer are included on each cut sheet/detail included in Section VI.

IV.3.5 Hydromodification Control BMPs

As described in Section II.3, hydromodification control BMPs will be needed in both Planning Area 1 and Planning Area 2. In Planning Area 1, a split-flow structure will be installed along storm drain Line "B" in "B" Street adjacent to Lot 8 that will bifurcate 12.74 cfs southwesterly toward the offsite 36" RCP line. This mitigated condition will ensure that peak runoff conditions for 2-year 24-hour storm events at both points of discharge is no greater than 110 percent of predevelopment conditions.

In order to mitigate hydrologic conditions of concern for Planning Area 2, an infiltration basin (BMP INF-1) with a capacity of 18,300 ft^3 will be implemented on Lot E. This capacity is more than sufficient to accommodate the DCV for Planning Area 2, which is 9,109 ft^3. As such, the proposed infiltration basin will address both LID and hydromodification performance criteria. Percolation testing will not be performed at the EIR phase of development. Infiltration rates will be measured at or prior to final design phase development of the project. Infiltration basin sizing details are provided below.

HYDROMODIFICATION CONTROLS	
BMP Name	BMP Description
PA1 – N/A	Split-Flow Structure to Bifurcate 12.74 cfs
PA2 – Infiltration Basin (INF-1)	Basin Depth = 6 ft Side Slope = 2:1 Footprint = 3,050 ft^2 Retention Capacity = 18,300 ft^3

See Section VI for further details regarding the proposed Infiltration Basin on Lot E.

IV.3.6 Regional/Sub-Regional LID BMPs

Not applicable. LID BMPs (infiltration and biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.3.7 Treatment Control BMPs

Not applicable. LID BMPs (infiltration and biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.3.8 Non-Structural Source Control BMPs

The table below indicates all BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
N1	Education for Property Owners, Tenants and Occupants	☒	☐	
N2	Activity Restrictions	☒	☐	
N3	Common Area Landscape Management	☒	☐	
N4	BMP Maintenance	☒	☐	
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous materials anticipated.
N6	Local Water Quality Permit Compliance	☐	☒	The County of Orange does not issue water quality permits.
N7	Spill Contingency Plan	☐	☒	No activities that generate hazardous spills proposed.
N8	Underground Storage Tank Compliance	☐	☒	No USTs proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials anticipated.
N10	Uniform Fire Code Implementation	☐	☒	No hazardous materials anticipated.
N11	Common Area Litter Control	☒	☐	
N12	Employee Training	☒	☐	

NON-STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
N13	Housekeeping of Loading Docks	☐	☒	No loading docks proposed.
N14	Common Area Catch Basin Inspection	☒	☐	
N15	Street Sweeping Private Streets and Parking Lots	☒	☐	
N16	Retail Gasoline Outlets	☐	☒	No RGOs proposed.

N1, Education for Property Owners, Tenants and Occupants

Educational materials will be provided to tenants, including brochures and restrictions to reduce pollutants from reaching the storm drain system. Examples include tips for pet care, household tips, and proper household hazardous waste disposal. Tenants will be provided with these materials by the property management prior to occupancy, and periodically thereafter. Refer to Section VII for a list of materials available and attached to this WQMP. Additional materials are available through the County of Orange Stormwater Program website (http://ocwatersheds.com/PublicEd/) and the California Stormwater Quality Association's (CASQA) BMP Handbooks (http://www.cabmphandbooks.com/).

N2, Activity Restrictions

The HOA shall develop ongoing activity restrictions that include those that have the potential to create adverse impacts on water quality. Activities include, but are not limited to: handling and disposal of contaminants, fertilizer and pesticide application restrictions, litter control and pick-up, and vehicle or equipment repair and maintenance in non-designated areas, as well as any other activities that may potentially contribute to water pollution.

N3, Common Area Landscape Management

Management programs will be designed and implemented by the HOA to maintain all the common areas within the project site. These programs will cover how to reduce the potential pollutant sources of fertilizer and pesticide uses, utilization of water-efficient landscaping practices and proper disposal of landscape wastes by the owner/developer and/or contractors.

N4, BMP Maintenance

The HOA will be responsible for the implementation and maintenance of each applicable non-structural BMP, as well as scheduling inspections and maintenance of all applicable structural BMP facilities through its staff, landscape contractor, and/or any other necessary maintenance contractors. Details on BMP maintenance are provided in Section V of this WQMP, and the O&M Plan is included in Appendix D.

N11, Common Area Litter Control

The HOA will be responsible for performing trash pickup and sweeping of littered common areas on a weekly basis or whenever necessary. Responsibilities will also include noting improper disposal materials by the public and reporting such violations for investigation.

N12, Employee Training

All employees of the HOA and any contractors will require training to ensure that employees are aware of maintenance activities that may result in pollutants reaching the storm drain. Training will include, but not be limited to, spill cleanup procedures, proper waste disposal, housekeeping practices, etc.

N14, Common Area Catch Basin Inspection

All on-site catch basin inlets and drainage facilities shall be inspected and maintained by the HOA at least once a year, prior to the rainy season, no later than October 1st of each year.

N15, Street Sweeping Private Streets and Parking Lots

The HOA shall be responsible for sweeping all on-site streets within the project on a minimum quarterly basis.

IV.3.9 Structural Source Control BMPs

The table below indicates all BMPs to be incorporated in the project. For those designated as not applicable (N/A), a brief explanation why is provided.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S1 SD-13	Provide storm drain system stenciling and signage	☒	☐	
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	☐	☒	None proposed.
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	☐	☒	None proposed.
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	☒	☐	
S5	Protect slopes and channels and provide energy dissipation	☒	☐	
S6 SD-31	Properly Design: Dock areas	☐	☒	None proposed.
S7 SD-31	Properly Design: Maintenance bays	☐	☒	None proposed.

STRUCTURAL SOURCE CONTROL BMPs				
ID	Name	Included?	Not Applicable?	If Not Applicable, Provide Brief Reason
S8 SD-33	Properly Design: Vehicle wash areas	☐	☒	None proposed.
S9 SD-36	Properly Design: Outdoor processing areas	☐	☒	None proposed.
S10	Properly Design: Equipment wash areas	☐	☒	None proposed.
S11 SD-30	Properly Design: Fueling areas	☐	☒	None proposed.
S12 SD-10	Properly Design: Hillside landscaping	☒	☐	
S13	Properly Design: Wash water control for food preparation areas	☐	☒	None proposed.
S14	Properly Design: Community car wash racks	☐	☒	None proposed.

S1/SD-13, Provide storm drain system stenciling and signage

The phrase "NO DUMPING! DRAINS TO OCEAN", or an equally effective phrase approved by the City, will be stenciled on all major storm drain inlets within the project site to alert the public to the destination of pollutants discharged into storm water. Stencils shall be in place prior to release of certificate of occupancy. Stencils shall be inspected for legibility on an annual basis and re-stenciled as necessary.

S4/SD-12, Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control

The HOA will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. The HOA will be responsible for implementing all efficient irrigation systems for common area landscaping including, but not limited to, provisions for water sensors and programmable irrigation cycles. This includes smart timers, rain sensors, and moisture shut-off valves. The irrigation systems shall be in conformance with water efficiency guidelines. Systems shall be tested twice per year, and water used during testing/flushing shall not be discharged to the storm drain system.

S5, Protect slopes and channels and provide energy dissipation

The site drainage design shall include appropriate BMPs to decrease the potential for erosion of slopes and/or channels. The design shall be consistent with Federal, State, and local standards (e.g., RWQCB, ACOE, CDFG). Where feasible, the following principles shall be considered: 1) convey runoff safely from the tops of slopes, 2) avoid disturbing steep or unstable slopes, as well as natural channels, 3) implement a permanent stabilization BMP on disturbed slopes and channels as quickly as

possible, such as native vegetation, and 4) install energy dissipaters at the outlets of new storm drains, culverts, or channels.

S12/SD-10, Properly Design: Hillside landscaping

All slopes shall be vegetated and stabilized to prevent erosion, in accordance with "Efficient Irrigation and Landscape Design" source control BMP to prevent erosion.

IV.4 ALTERNATIVE COMPLIANCE PLAN

IV.4.1 Water Quality Credits

Local jurisdictions may develop a water quality credit program that applies to certain types of development projects after they first evaluate the feasibility of meeting LID requirements on-site. If it is not feasible to meet the requirements for on-site LID, project proponents for specific project types can apply credits that would reduce project obligations for selecting and sizing other treatment BMPs or participating in other alternative programs.

WATER QUALITY CREDITS	
Credit	**Applicable?**
Redevelopment projects that reduce the overall impervious footprint of the project site.	☐
Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface water quality if not redeveloped.	☐
Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance)	☐
Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).	☐
Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned	☐
Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).	☐

WATER QUALITY CREDITS	
Credit	**Applicable?**
Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.	☐
Developments in a city center area.	☐
Developments in historic districts or historic preservation areas.	☐
Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.	☐
In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.	☐

Not applicable. Water quality credits will not be applied for the project. LID BMPs will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

IV.4.2 Alternative Compliance Plan Information

Not applicable. LID BMPs (infiltration and biotreatment) will be utilized for water quality treatment on-site in accordance with the MS4 Permit hierarchy identified at the beginning of this Section.

SECTION V INSPECTION/MAINTENANCE RESPONSIBILITY FOR BMPs

It has been determined that North County BRS Project, LLC shall assume all BMP inspection and maintenance responsibilities for the Cielo Vista project.

Contact Name:	Larry Netherton
Title:	Regional Manager
Company:	North County BRS Project, LLC
Address:	3 Corporate Plaza, Suite 102 Newport Beach, CA 92660
Phone:	(949) 644-3514, ext. 24
Fax:	(949) 644-3977
Email:	lnetherton@sagecommunity.com

Should the maintenance responsibility be transferred at any time during the operational life of Cielo Vista Project, such as when an HOA or POA is formed for a project, a formal notice of transfer shall be submitted to the County of Orange at the time responsibility of the property subject to this WQMP is transferred. The transfer of responsibility shall be incorporated into this WQMP as an amendment.

The HOA shall verify BMP implementation and ongoing maintenance through inspection, self-certification, survey, or other equally effective measure. The certification shall verify that, at a minimum, the inspection and maintenance of all structural BMPs including inspection and performance of any required maintenance in the late summer / early fall, prior to the start of the rainy season. A form that may be used to record implementation, maintenance, and inspection of BMPs is included in Appendix D.

The County of Orange may conduct verifications to assure that implementation and appropriate maintenance of structural and non-structural BMPs prescribed within this WQMP is taking place at the project site. The HOA shall retain operations, inspections and maintenance records of these BMPs and they will be made available to the City or County upon request. All records must be maintained for at least five (5) years after the recorded inspection date for the lifetime of the project.

Long-term funding for BMP maintenance shall be funded through fees paid into the HOA. North County BRS Project, LLC, which will set up the HOA shall oversee that adequate funding for BMP maintenance is included within the HOA fee structure including annual maintenance fees and long-term maintenance reserve funds.

The Operations and Maintenance (O&M) Plan can be found in Appendix D.

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
INFILTRATION BMPs				
INF-1	Infiltration Basin	Inspect BMPs semi-annually or after major storm events to check for maintenance needs and function. Routine maintenance shall be performed in conjunction with routine maintenance activities to ensure consistently high performance and extend facility life. Routine maintenance activities include: ▪ Check for debris/sediment accumulation, rake surface, and remove sediment (if any), and evaluate potential sources of sediment and vegetative or other debris. ▪ Determine if it is necessary to remove the top layer of native soil to restore infiltrative capacity. ▪ Remove and dispose of trash and debris, as needed, but at least prior to the start of the wet season. ▪ Eliminate standing water to prevent vector breeding. ▪ Maintain vegetation as needed to sustain the aesthetic appearance of the site. ▪ Re-establish vegetation, which may require replanting and/or reseeding, following sediment removal activities. ▪ Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.	2x per year	HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
BIOTREATMENT BMPs				
BIO-1	Bioretention with Underdrain (4)	Inspect BMPs semi-annually or after major storm events to check for maintenance needs and function. Routine maintenance shall be performed in conjunction with routine maintenance activities to ensure consistently high performance and extend facility life. Routine maintenance activities include: ▪ Maintain vegetation and media to perpetuate a robust vegetative and microbial community (thin/trim vegetation, replace spent media and mulch). ▪ Periodically remove dead vegetative biomass to prevent export of nutrients or clogging of the system. ▪ Remove accumulated sediment before it significantly interferes with system function. ▪ Conduct maintenance to prevent surface clogging (surface scarring, raking, mulch replacement, etc.). ▪ Maintain splash blocks/energy dissipation and scour-protection as required based on facility inspection. ▪ Routinely remove accumulated sediment at the inlet and outlet and trash and debris from the area. ▪ Repair torn or broken liners as necessary.	2x per year	HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
BIO-7	Proprietary Biotreatment: Modular Wetlands	The Modular Wetland units shall be maintained in accordance with manufacturer's specifications. The system shall be inspected at a minimum of once every six months, prior to the start of the rainy season (October 1) each year, and after major storm events. Typical maintenance includes removing trash & debris from the catch basin screening filter (by hand), removal of sediment and solids in the settlement chamber (vacuum truck), replacement of the BioMediaGREEN™ filter cartridge, and replacement of the BioMediaGREEN™ drain down filter (if equipped). In addition, plants within the wetland chamber will require trimming as needed in conjunction with routine landscape maintenance activities. No fertilizer shall be used in this chamber. Wetland chamber should be inspected during rain events to verify flow through the system. If little to no flow is observed from the lower valve or orifice plate, the wetland media may require replacement. If prior treatment stages are properly maintained, the life of the wetland media can be up to 20 years.	2x per year	BIO-7
NON-STRUCTURAL SOURCE CONTROL BMPs				
N1	Education for Property Owners, Tenants and Occupants	Educational materials will be provided to tenants annually. Materials to be distributed are found in Appendix C of this WQMP. Tenants will be provided these materials by Property Management prior to occupancy and annually thereafter.	Annually	HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N2	Activity Restrictions	The Owner will prescribe activity restrictions to protect surface water quality, through lease terms or equally effective measure, for the property. Restrictions include but are not limited to prohibiting vehicle maintenance or vehicle washing.	Ongoing	HOA
N3	Common Area Landscape Management	Maintenance shall be consistent with County requirements. Fertilizer and/or pesticide usage shall be consistent with County Management Guidelines for Use of Fertilizers (OC DAMP § 5.5). Maintenance includes mowing, weeding, and debris removal on a weekly basis. Trimming, replanting, and replacement of mulch shall be performed on an as-needed basis to prevent exposure of erodible surfaces. Trimmings, clippings, and other landscape wastes shall be properly disposed of in accordance with local regulations. Materials temporarily stockpiled during maintenance activities shall be placed away from water courses and drain inlets.	Monthly	HOA
N4	BMP Maintenance	Maintenance of structural BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP (Appendix B). Records of inspections and BMP maintenance shall be kept by the Owner and shall be available for review upon request.	Ongoing	HOA
N5	Title 22 CCR Compliance (How development will comply)		--	--
N6	Local Industrial Permit Compliance	Not Applicable	--	--
N7	Spill Contingency Plan	Not Applicable	--	--

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
N8	Underground Storage Tank Compliance	Not Applicable	--	--
N9	Hazardous Materials Disclosure Compliance	Not Applicable	--	--
N10	Uniform Fire Code Implementation	Not Applicable	--	--
N11	Common Area Litter Control	Litter patrol, violations investigations, reporting and other litter control activities shall be performed on a weekly basis and in conjunction with routine maintenance activities.	Weekly	HOA
N12	Employee Training	The Owner shall educate all new employees/managers on storm water pollution prevention, particularly good housekeeping practices, prior to the start of the rainy season (October 1). Refresher courses shall be conducted on an as needed basis. Materials that may be utilized on BMP maintenance are included in Appendix B.	Annually	HOA
N13	Housekeeping of Loading Docks	Not Applicable	--	--
N14	Common Area Catch Basin Inspection	On-site catch basin inlets shall be inspected and, if necessary, cleaned prior to the storm season by October 1st each year.	Annually	HOA
N15	Street Sweeping Private Streets and Parking Lots	All private streets, drive aisles and exposed parking areas within the project shall be swept at a minimum frequency quarterly as well as once per year prior to the storm season, no later than October 1 each year.	Quarterly	HOA
N16	Retail Gasoline Outlets	Not Applicable	--	--

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
STRUCTURAL SOURCE CONTROL BMPs				
S1 SD-13	Provide storm drain system stenciling and signage	On-site storm drain stencils shall be inspected for legibility, at minimum, once prior to the storm season, no later than October 1st each year. Those determined to be illegible will be re-stenciled as soon as possible.	Annually	HOA
S2 SD-34	Design and construct outdoor material storage areas to reduce pollution introduction	Not Applicable	--	--
S3 SD-32	Design and construct trash and waste storage areas to reduce pollution introduction	Not Applicable	--	--
S4 SD-12	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	In conjunction with routine maintenance, verify that landscape design continues to function properly by adjusting systems to eliminate overspray to hardscape areas and to verify that irrigation timing and cycle lengths are adjusted in accordance to water demands, given the time of year, weather, and day or nighttime temperatures. System testing shall occur twice per year. Water from testing/flushing shall be collected and properly disposed to the sewer system and shall not discharge to the storm drain system.	2x per year	HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
S5	Protect slopes and channels and provide energy dissipation	To be performed in conjunction with maintenance activities. Maintain vegetative cover and/or mulch to eliminate exposed soils. Any eroded surfaces to be repaired immediately. Inspections to be performed twice each year (spring and fall) and after major storm events to check for signs of erosion, gullies, and sloughing.	Monthly	HOA
S6 SD-31	Properly Design: Dock areas	Not Applicable	--	--
S7 SD-31	Properly Design: Maintenance bays	Not Applicable	--	--
S8 SD-33	Properly Design: Vehicle wash areas	Not Applicable	--	--
S9 SD-36	Properly Design: Outdoor processing areas	Not Applicable	--	--
S10	Properly Design: Equipment wash areas	Not Applicable	--	--
S11 SD-30	Properly Design: Fueling areas	Not Applicable	--	--
S12 SD-10	Properly Design: Hillside landscaping	To be performed in conjunction with maintenance activities. Maintain vegetative cover and/or mulch to eliminate exposed soils. Any eroded surfaces to be repaired immediately. Inspections to be performed twice each year (spring and fall) and after major storm events to check for signs of erosion, gullies, and sloughing.	Monthly	HOA

BMP INSPECTION & MAINTENANCE RESPONSIBILITY MATRIX				
	BMP	Inspection/Maintenance Activities	Minimum Frequency	Responsible Party
S13	Properly Design: Wash water control for food preparation areas	Not Applicable	--	--
S14	Properly Design: Community car wash racks	Not Applicable	--	--

Any waste generated from maintenance activities will be disposed of properly. Wash water and other waste from maintenance activities is not to be discharged or disposed of into the storm drain system. Clippings from landscape maintenance (i.e. prunings) will be collected and disposed of properly off-site, and will not be washed into the streets, local area drains/conveyances, or catch basin inlets.

SECTION VI SITE PLAN AND DRAINAGE PLAN

The exhibits provided in this section are to illustrate the post construction BMPs prescribed within this WQMP. Drainage flow information of the proposed project, such as general surface flow lines, concrete or other surface drainage conveyances, and storm drain facilities are also depicted. All structural source control and treatment control BMPs are shown as well.

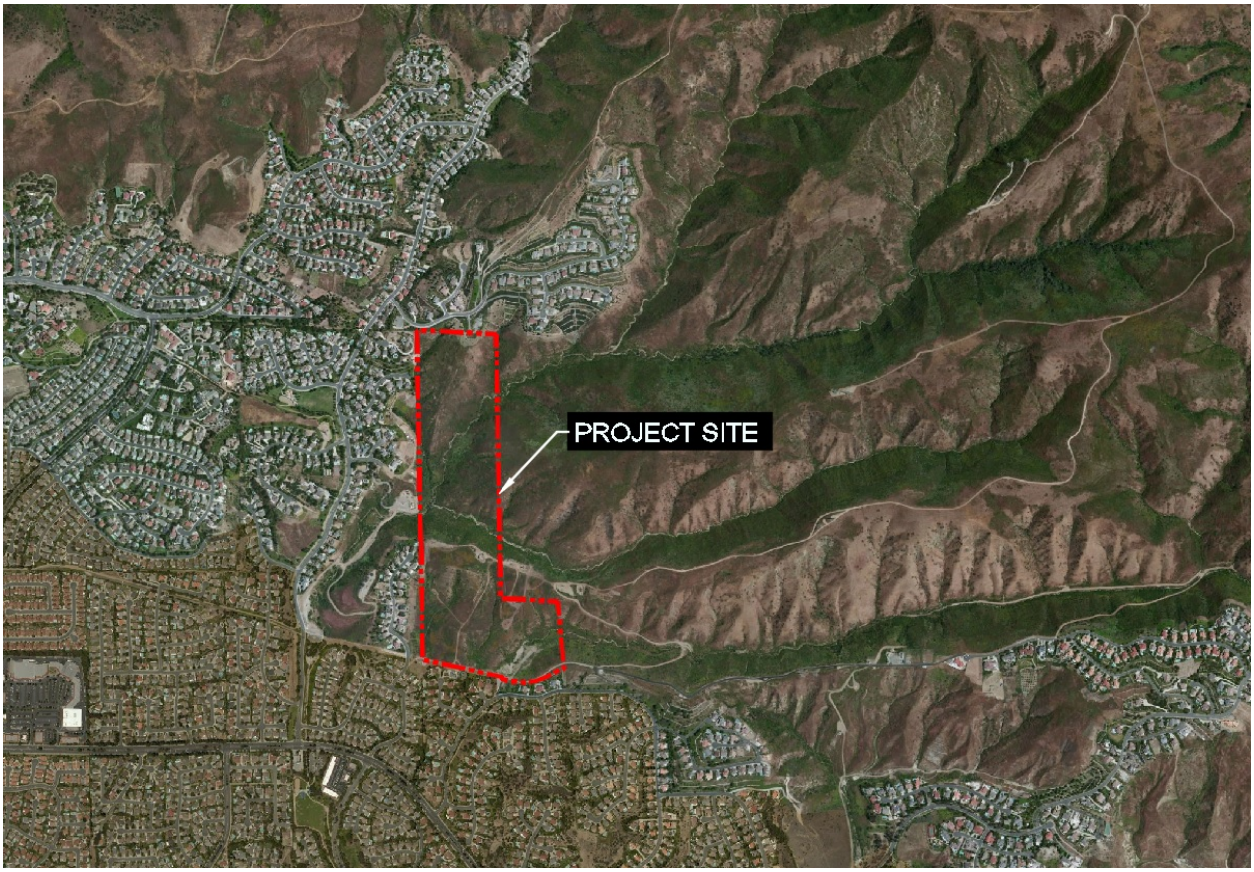
EXHIBITS

- Vicinity Map
- Planning Area 1 (South Site) BMP Plan (Figure 1-1)
- Planning Area 2 (North Site) BMP Plan (Figure 1-2)
- Existing Hydromodification Exhibit – Planning Area 1
- Proposed Hydromodification Exhibit – Planning Area 1
- Existing Hydromodification Exhibit – Planning Area 2
- Proposed Hydromodification Exhibit – Planning Area 2

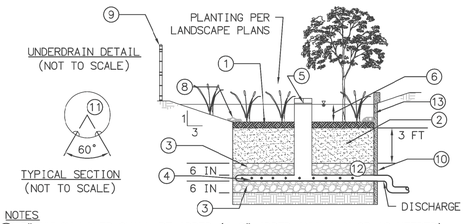
BMP DETAILS & FACT SHEETS

- Infiltration Basin Fact Sheet (INF-1)
- Bioretention with Underdrain Fact Sheet (BIO-1)
- Proprietary Biotreatment (BIO-7)
- Modular Wetland Systems

VICINITY MAP



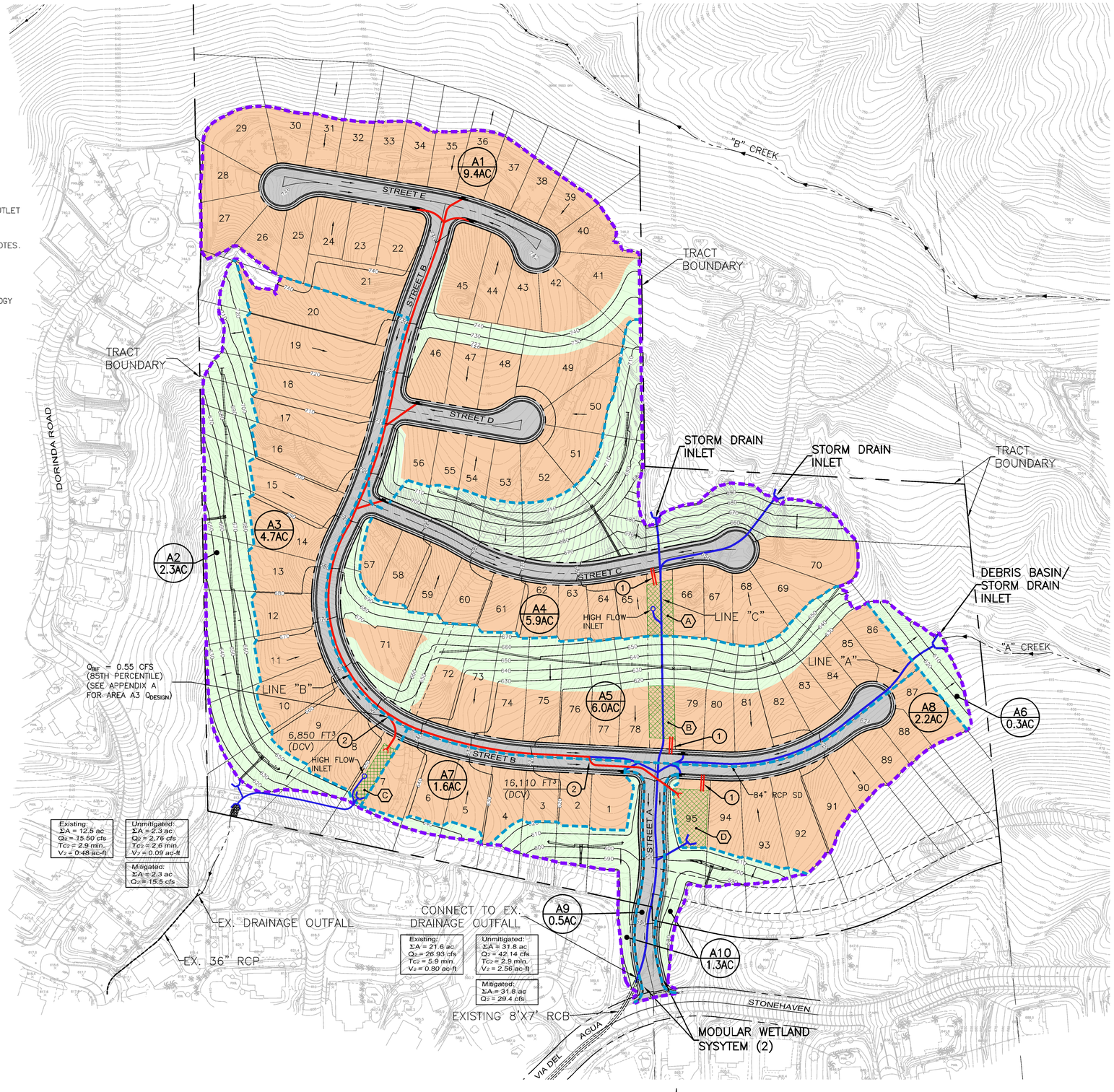
[Planning Area 1 (South Site) BMP Plan (Figure 1-1)]



NOTES

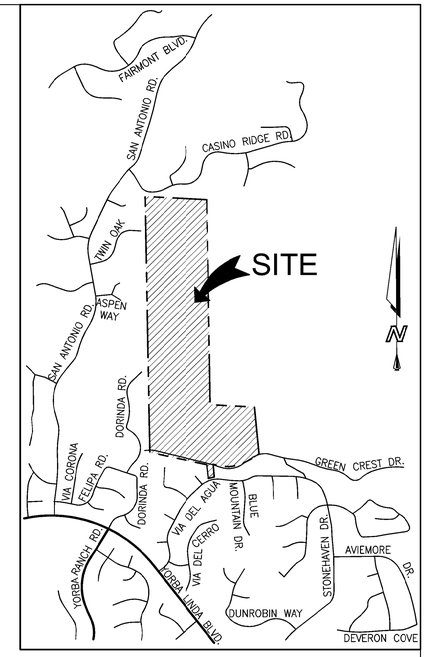
1. 3" MULCH LAYER SHALL BE ADDED (1-2" ADDED ANNUALLY OR AS NEEDED).
2. 2'-3' ENGINEERED SOIL DEPTH (3' DEPTH IS PREFERRED). SEE MEDIA STORAGE NOTES.
3. UNDERDRAIN SHALL BE SURROUNDED BY 6" OF WASHED AGGREGATE.
4. 6" PVC WITH A 0.5% MINIMUM SLOPE. SEE ALSO NOTE 11 AND 12.
5. OVERFLOW RISER SHALL BE SIZED TO CONVEY LARGE STORM EVENTS PER OC HYDROLOGY MANUAL.
6. PONDING DEPTH SHOULD NOT EXCEED 18".
7. 12" WIDE MINIMUM CURB OPENING.
8. ENERGY DISSIPATOR SHALL BE SIZED BY ENGINEER.

BIORETENTION WITH UNDERDRAIN SECTION



BMP SUMMARY TABLE (SOUTH SIDE)

SUBAREA	AREA (ACRES)	DCV (FT³)	BMP PROPOSED
A1	9.4	13,740	BIORETENTION–BASIN D
A2	2.3		N/A–OFFSITE SLOPE
A3	4.7	6,850	BIORETENTION–BASIN C
A4	5.9	7,420	BIORETENTION–BASIN A
A5	6.0	9,760	BIORETENTION–BASIN B
A6	0.3		N/A–OFFSITE SLOPE
A7	1.6	2,370	BIORETENTION–BASIN D
A8	2.2	3,220	BIORETENTION–BASIN D
A9	0.5	1,870	MODULAR WETLANDS
A10	1.3		N/A–OFFISTE SLOPE



LOCATION MAP
N.T.S.

LEGEND

- STREETS
- INDIVIDUAL LOT LANDSCAPE/HARDSCAPE
- H.O.A. MAINTAINED LANDSCAPING
- BIORETENTION WITH UNDERDRAIN
- OVERALL DRAINAGE BOUNDARY
- SUB AREA DRAINAGE AREA PER BMP CALCULATIONS
- DRAINAGE FLOWLINE
- DIRECTION OF FLOW
- PROPOSED CATCH BASIN
- UNTREATED STORMWATER
- TREATED / CLEAN STORMWATER
- (A) BIORETENTION BASIN I.D.
- A1 / 9.4AC SUB AREAS WITH ACREAGE

NOTES

1. Untreated runoff directed via parkway culvert to basin for bioretention. (Areas A4, A5, A8)
2. Bifurcate untreated runoff for bioretention. Equivalent DCV diversion flow indicated on plan. (Areas A1, A3, A7)

FIGURE 1-1

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www.fuscoe.com

100' 0' 50' 100'
SCALE: 1" = 100'

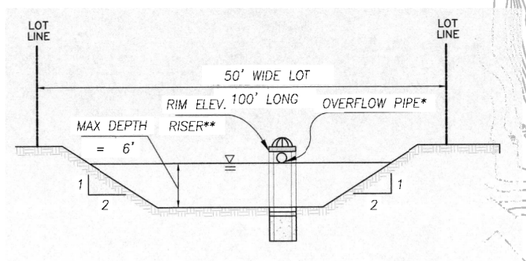
PLANNING APPLICATION NO. PA100004
GRADING PERMIT NO. GAXXXXXX
WATER QUALITY NO. WQXXXXX
APN 351-031-05 AND 351-031-17

OWNER:
NORTH COUNTY BRS PROJECT, LLC
3 CORPORATE PLAZA, SUITE 102
NEWPORT BEACH, CA 92660
(949) 644-3514

PLANNING AREA 1 BMP PLAN
TRACT 17341 COUNTY OF ORANGE

Exhibit Date: 9/30/2015

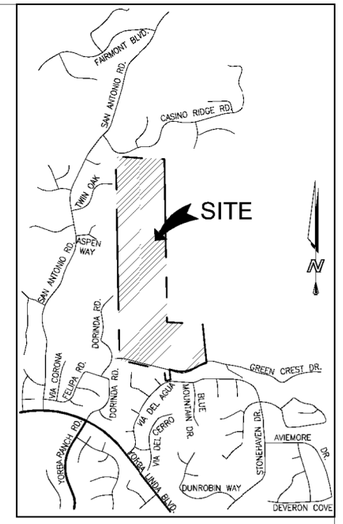
[Planning Area 2 (North Site) BMP Plan (Figure 1-2)]



SECTION A-A RETENTION BASIN

* THE OVER-FLOW PIPE/RISER WILL CONNECT TO PERIMETER STORM SYSTEM AND WILL BE DESIGNED AND SIZED SUCH THAT IT IS ONLY ACTIVATED IN THE EVENT THE PERMEABLE BOTTOM OF THE RETENTION BASIN IS UNABLE TO ADEQUATELY DRAWDOWN WITHIN 48-HOURS.

* THE LOW-FLOW PIPE WILL CONNECT TO THE PERIMETER STORM SYSTEM AND WILL BE DESIGNED AND SIZED SUCH THAT.



LOCATION MAP
N.T.S.

LEGEND

- STREETS
- INDIVIDUAL LOT LANDSCAPE/HARDSCAPE
- H.O.A. MAINTAINED LANDSCAPING
- INFILTRATION BASIN
- OVERALL DRAINAGE BOUNDARY
- SUB AREA DRAINAGE AREA PER BMP CALCULATIONS
- DIRECTION OF FLOW
- DRAINAGE FLOWLINE
- PROPOSED CATCH BASIN
- UNTREATED STORMWATER
- TREATED / CLEAN STORMWATER
- A1 / 9.4AC — SUB AREAS WITH ACREAGE

N

SCALE: 1"=120'

BMP SUMMARY TABLE (NORTH SITE)

SUBAREA	AREA (ACRES)	DCV (FT³)	BMP PROPOSED
B1	0.6	340	LANDSCAPED/GRADED SLOPE
B2	6.2	9,110	INFILTRATION BASIN
B3	0.2	130	OFFSITE SLOPE
B4	0.7	450	OFFSITE SLOPE
B5	0.6	350	OFFSITE SLOPE

FIGURE 1-2

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PLANNING APPLICATION NO. PA100004

GRADING PERMIT NO. GAXXXXXX

WATER QUALITY NO. WQXXXXX

APN 351-031-05 AND 351-031-17

OWNER:

NORTH COUNTY BRS PROJECT, LLC
3 CORPORATE PLAZA, SUITE 102
NEWPORT BEACH, CA 92660
(949) 644-3514

PLANNING AREA 2 BMP PLAN

TRACT 17341 COUNTY OF ORANGE

Exhibit Date: 2/20/2015

[Existing Hydromodification Exhibit – Planning Area 1]

'F' CREEK

EX. DRAINAGE CHANNEL

OPEN SPACE

LIMITS OF GRADING (TYP)

'B' CREEK

767.2 FG

'E' STREET

803.7 FG

LIMITS OF GRADING (TYP)

TRACT 10519

DORINDA ROAD

TRACT BOUNDARY

1
12.5AC

'D' STREET

TRACT BOUNDARY

EX. 50' WIDE EASEMENT FOR ACCESS PURPOSES AS STATED IN THE OIL & GAS LEASE PER BOOK 6520 PAGE 381 & BOOK 7625 PAGE 235 OF OFFICIAL RECORDS (TO BE VACATED)

2
21.6AC

'C' STREET

LIMITS OF GRADING (TYP)

Lot F

'A' CREEK

TRACT BOUNDARY

611.5 FG
POINT OF DISCHARGE

'B' STREET

EX. 50' AQUADUCT ESMT. (TO REMAIN)

'A' STREET

LIMITS OF GRADING (TYP)

$\Sigma A = 12.5$ ac
$Q_2 = 15.50$ cfs
$Tc_2 = 2.9$ min.
$V_2 = 0.48$ ac-ft

TRACT BOUNDARY

LIMITS OF GRADING (TYP)

TRACT 10455

TRACT 12850

EXISTING 36" RCP

EX. R/W DEDICATED AS LOT "A" OF TRACT 10455

EX. R/W DEDICTED AS LOT 'A' OF TRACT 13800

TRACT 13800

$\Sigma A = 21.6$ ac
$Q_2 = 26.93$ cfs
$Tc_2 = 5.9$ min.
$V_2 = 0.80$ ac-ft

562.1 INV
8'X7' RCB
POINT OF DISCHARGE

EXISTING
8' X 7' RCB

STONEHAVEN

VIA DEL AGUA

LEGEND

- TRACT BOUNDARY
- LIMITS OF GRADING
- STREET CENTER LINE
- LOT LINE
- DRAINAGE FLOWLINE
- 650 EXISTING CONTOUR
- A1 / 0.3AC SUBAREAS WITH ACREAGE
- 110 / 263 NODE / ELEVATION

N

80' 0' 40' 80'

SCALE: 1" = 80'

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PUNEET COMAR RCE# DATE

PLANNING AREA 1
EXISTING CONDITION HYDROMODIFICATION EXHIBIT
TRACT 17341
COUNTY OF ORANGE, CALIFORNIA

DRAWN:	CK
DESIGN:	CK
CHECKED:	PC
SCALE:	1"=80'
JOB NO.:	1296-001
DATE:	9/28/15
SHEET	1 OF 2

7/27/2015 | TRACT 17341, COUNTY OF ORANGE, CALIFORNIA DRAINAGE-TREATMENT | PLAN SET: A

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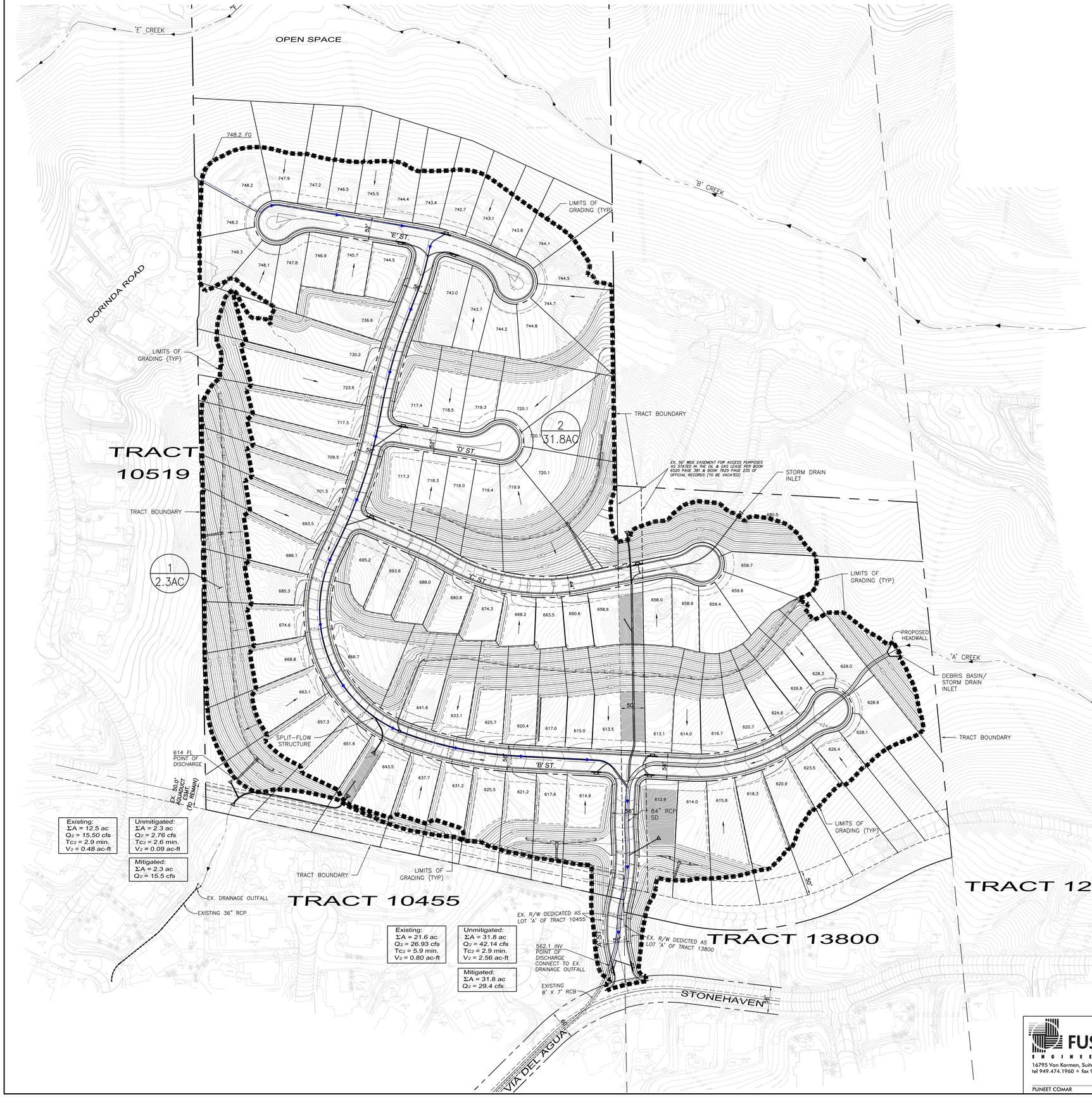
[Proposed Hydromodification Exhibit – Planning Area 1]



LEGEND

- TRACT BOUNDARY
- LIMITS OF GRADING
- STREET CENTER LINE
- LOT LINE
- EXISTING DRAINAGE FLOWLINE
- PROPOSED DRAINAGE FLOWLINE
- PROPOSED CONTOUR (650)
- EXISTING CONTOUR (650)
- LOT NO. (77) / PAD ELEV. (651.3)
- P.B. DRAINAGE AREA
- BIORETENTION WITH UNDERDRAIN
- V-DITCH
- SUBAREAS WITH ACREAGE (A1 / 0.3AC)
- NODE (110) / ELEVATION (263)
- CATCH BASIN
- STORM DRAIN / SD JUNCTION STRUCTURE

PLAN SET: A

7/27/2015

TRACT 17341, COUNTY OF ORANGE, CALIFORNIA
DRAINAGE-TREATMENT

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PUNEET COMAR RCE# DATE

PLANNING AREA 1
PROPOSED CONDITION HYDROMODIFICATION EXHIBIT
TRACT 17341
COUNTY OF ORANGE, CALIFORNIA

DRAWN:	CK
DESIGN:	CK
CHECKED:	PC
SCALE:	1"=80'
JOB NO.:	1296-001
DATE:	9/28/15
SHEET	2 OF 2

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[Existing Hydromodification Exhibit – Planning Area 2]

TRACT NO. 15501
M.M. 848/1-6

TRACT NO. 9813

TRACT BOUNDARY

OPEN SPACE

EX. 100' WIDE EASEMENT TO SOUTHERN CALIFORNIA GAS CO. PER BOOK 5197 PAGE 247 OF OFFICIAL RECORDS (TO REMAIN).

EX. DRAINAGE CHANNEL

LIMITS OF GRADING

"C" CREEK

"D" CREEK

101 — 1 / 1.04AC — 101 / 648.7

102 — 102 / 640

103

104

105

106

107

108

109

110

111

112

100 — 2 / 7.23AC

99

98

97

96

52'

'F' STREET

Lot E

TRACT BOUNDARY

EX. CURB

EX. RIGHT-OF-WAY PER TRACT 9813

ASPEN WAY

LIMITS OF GRADING

103 / 612.5 POD

ΣA = 8.12 ac
Q_2 = 5.97 cfs
Tc_2 = 18.34 min.
V_2 = 0.24 ac-ft

'B' CREEK

'E' CREEK

'F' CREEK

EX. DRAINAGE CHANNEL

OPEN SPACE

LEGEND

- TRACT BOUNDARY
- LIMITS OF GRADING
- STREET CENTER LINE
- LOT LINE
- DRAINAGE FLOWLINE
- 650 — EXISTING CONTOUR
- A1 / 0.3AC — SUBAREAS WITH ACREAGE
- 110 / 263 — NODE / ELEVATION

N

80' 0' 40' 80'

SCALE: 1" = 80'

PLAN SET: A

7/27/2015

TRACT 17341, COUNTY OF ORANGE, CALIFORNIA
DRAINAGE TREATMENT

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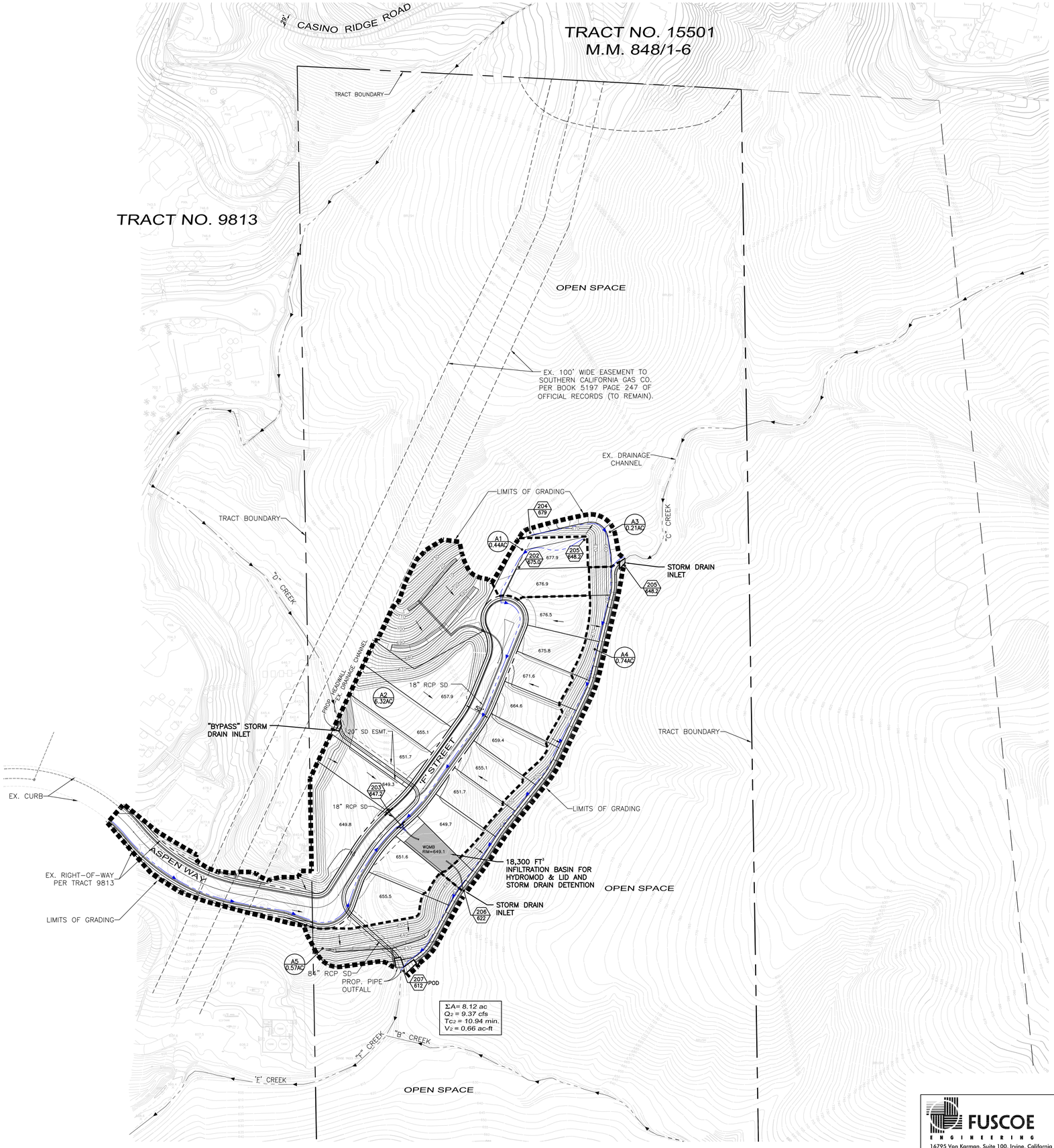
PUNEET COMAR RCE# DATE

PLANNING AREA 2
EXISTING CONDITION HYDROMODIFICATION EXHIBIT

TRACT 17341
COUNTY OF ORANGE, CALIFORNIA

DRAWN:	CK
DESIGN:	CK
CHECKED:	PC
SCALE:	1"=80'
JOB NO.:	1296-001
DATE:	9/28/15
SHEET	1 OF 2

[Proposed Hydromodification Exhibit – Planning Area 2]



LEGEND

- TRACT BOUNDARY
- LIMITS OF GRADING
- STREET CENTER LINE
- LOT LINE
- EXISTING DRAINAGE FLOWLINE
- PROPOSED DRAINAGE FLOWLINE
- PROPOSED CONTOUR (650)
- EXISTING CONTOUR (650)
- LOT NO. / PAD ELEV. (77 / 651.3)
- P.B. DRAINAGE AREA
- V-DITCH
- SUBAREAS WITH ACREAGE (A1 0.3AC)
- NODE (110) / ELEVATION (263)
- CATCH BASIN
- STORM DRAIN SD JUNCTION STRUCTURE

N

80' 0' 40' 80'

SCALE: 1" = 80'

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PUNEET COMAR RCE# DATE

PLANNING AREA 2
PROPOSED CONDITION HYDROMODIFICATION EXHIBIT
TRACT 17341
COUNTY OF ORANGE, CALIFORNIA

DRAWN:	CK
DESIGN:	CK
CHECKED:	PC
SCALE:	1"=80'
JOB NO.:	1296-001
DATE:	9/28/15
SHEET	2 OF 2

PLAN SET: A
7/27/2015
TRACT 17341, COUNTY OF ORANGE, CALIFORNIA
DRAINAGE TREATMENT

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Infiltration Basin (INF-1) Fact Sheet

XIV.3. Infiltration BMP Fact Sheets (INF)

INF-1: Infiltration Basin Fact Sheet

An infiltration basin consists of an earthen basin constructed in naturally pervious soils (Type A or B soils) with a flat bottom. An energy dissipating inlet must be provided, along with an emergency spillway to control excess flows. An optional relief underdrain may be provided to drain the basin if standing water conditions occur. A forebay settling basin or separate treatment control measure must be provided as pretreatment. An infiltration basin retains the stormwater quality design volume in the basin and allows the retained runoff to percolate into the underlying soils in 72 hours or less. The bottom of an infiltration basin is typically vegetated with dryland grasses or irrigated turf grass; however other types of vegetation are permissible if they can survive periodic inundation and long inter-event dry periods.

Feasibility Screening Considerations

- Infiltration bains shall pass infeasibility screening criteria to be considered for use
- Infiltration basins pose a potential risk of groundwater contamination if underlying soils have very high permeability and low pollutant assimilation capacity; pretreatment should always be provided.
- Evaporation tends to be minor, therefore increases in infiltration compared to natural conditions may result.
- The potential for groundwater mounding should be evaluated if depth to seasonally high groundwater (unmounded) is less than 15 feet.

Also known as:

- *Recharge basins*
- *Infiltration pond*

Infiltration Basin

Source: Pennsylvania Stormwater BMP Manual

Opportunity Criteria

- Soils are adequate for infiltration or can be amended to provide an adequate infiltration rate.
- Typically need 2-5 percent of drainage area available for infiltration.
- Space available for pretreatment (biotreatment or treatment control BMP as described below).
- Potential for groundwater contamination can be mitigated through isolation of pollutant sources, pretreatment of inflow, and/or demonstration of adequate treatment capacity of underlying soils.
- Infiltration is into native soil, or
- The depth of engineered fill is ≤ 5 feet from the bottom of the facility to native material and infiltration into fill is approved by a geotechnical professional.
- Tributary area land uses include mixed-use and commercial, sngle-family and multi-family, roads and parking lots, and parks and open spaces. Basins can be integrated into parks and open spaces. High pollutant land uses should not be tributary to infiltration BMPs.

OC-Specific Design Criteria and Considerations

☐ Placement of BMPs shall observe geotechnical recommendations with respect to geological hazards (e.g. landslides, liquefaction zones, erosion, etc.) and set-backs (e.g., foundations,

utilities, roadways, etc.)

- ☐ For facilities with tributary area less than 5 acres, minimum separation to mounded seasonally high groundwater of 5 feet shall be observed.
- ☐ For facilities with tributary area greater than 5 acres, minimum separation to mounded seasonally high groundwater of 10 feet shall be observed.
- ☐ Minimum pretreatment (settling forebay or separate BMP) should be provided upstream of the infiltration basin, and water bypassing pretreatment should not be directed to the infiltration basin.
- ☐ If a settling forebay is used, forebay should have a volume equal to 25% of facility volume and have a minimum length to width ratio of 2:1
- ☐ Infiltration basins should not be used for drainage areas with high sediment production potential unless preceded by full treatment control with a BMP effective for sediment removal.
- ☐ Side-slopes should be no steeper than 3H:1V.
- ☐ Design infiltration rate should be determined consistent with guidance contained in **Appendix VII**.
- ☐ Energy dissipators should be provided at inlet and outlet to prevent erosion.
- ☐ An overflow device must be provided if basin is on-line.
- ☐ A minimum freeboard of one foot should be provided above the overflow device (for an on-line basin) or the outlet (for an off-line basin).
- ☐ Infiltration basin bottom must be as flat as possible.
- ☐ Basin length to width ratio should be a minimum of 2:1 L:W.

Simple Sizing Method for Infiltration Basins

If the Simple DCV Sizing Method is used to size an infiltration basin, the user calculates the DCV and designs the BMP geometry required to draw down the DCV in 48 hours. The sizing steps are as follows:

Step 1: Determine Infiltration Basin DCV

Calculate the DCV using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1**.

Step 2: Determine the 48-hour Depth

The depth of water that can be drawn down in 48 hours can be calculated using the following equation:

$d_{48} = K_{DESIGN} \times 4$

Where:

d_{48} = basin 48-hour drawdown depth, ft

K_{DESIGN} = basin design infiltration rate, in/hr (See **Appendix VII**)

This is the maximum depth of the basin below the overflow device to achieve drawdown in 48 hours.

Step 3: Calculate the Required Infiltrating Area

The required infiltrating area (i.e. basin area at mid ponding depth) can be calculated using the following equation:

$A = DCV / (d_P)$

Where:

A = required basin infiltrating area, sq-ft (assumed to be the basin area at mid-ponding depth)

DCV = design capture volume, cu-ft (see Step 1)

d_P = ponding depth, ft (should be equal to or less than d_{48})

Capture Efficiency Method for Infiltration Basins

If BMP geometry has already been defined and deviates from the 48 hour drawdown time, the designer can use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix III.3.2**) to determine the fraction of the DCV that must be provided to manage 80 percent of average annual runoff volume. This method accounts for drawdown time different than 48 hours.

Step 1: Determine the drawdown time associated with the selected basin geometry

$DD = (d_P / K_{DESIGN}) \times 12$

Where:

DD = time to completely drain infiltration basin ponding depth, hours

d_P = ponding depth below overflow device, ft

K_{DESIGN} = basin design infiltration rate, in/hr (See **Appendix VII**)

Step 2: Determine the Required Adjusted DCV for this Drawdown Time

Use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (**Appendix III.3.2**) to calculate the fraction of the DCV the basin must hold to achieve 80 percent capture of average annual stormwater runoff volume based on the basin drawdown time calculated above.

Step 3: Determine the Basin Infiltrating Area Needed

The required infiltrating area (i.e. basin bottom) can be calculated using the following equation:

$A = DCV/ ((d_P)$

Where:

A = required basin infiltrating area, sq-ft (assumed to be the basin area at mid-ponding depth)

DCV = design capture volume, adjusted for drawdown time, cu-ft (see Step 1)

d_P = ponding depth, ft

If the area required is greater than the selected basin area, adjust surface area or adjust ponding depth and recalculate required area until the required area is achieved.

Configuration for Use in a Treatment Train

- Infiltration basins may be preceeded in a treatment train by HSCs in the drainage area, which would reduce the required design volume of the basins.
- Infiltration basins must be preceeded by some form of pretreatment, which may be biotreatment or a treatment control BMP; if an approved biotreatment BMP is used as pretreatment, the overflow from the infiltration basin may be considered “biotreated” for the purposes of meeting the LID requirements.
- The overflow or bypass from an infiltration basin can be routed to a downstream biotreatment BMP and/or a treatment control BMP if additional control is required to achieve LID or treatment control requirements.

Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment:
  http://www.cabmphandbooks.com/Documents/Development/TC-11.pdf
- SMC LID Manual (pp 139):
  http://www.lowimpactdevelopment.org/guest75/pub/All_Projects/SoCal_LID_Manual/SoCalLID_Manual_FINAL_040910.pdf
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 6:
  http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- City of Portland Stormwater Management Manual (Basin, page 2-57)
  http://www.portlandonline.com/bes/index.cfm?c=47954&a=202883
- San Diego County LID Handbook Appendix 4 (Factsheet 2):
  http://www.sdcounty.ca.gov/dplu/docs/LID-Appendices.pdf

Bioretention with Underdrain (BIO-1) Fact Sheet

XIV.5. Biotreatment BMP Fact Sheets (BIO)

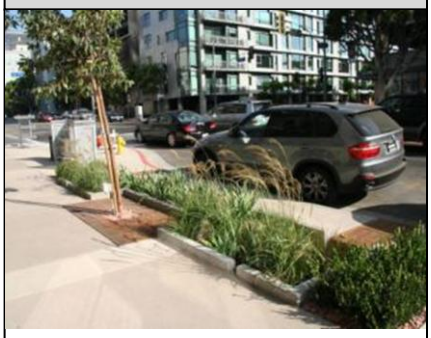
Conceptual criteria for biotreatment BMP selection, design, and maintenance are contained in **Appendix XII**. These criteria are generally applicable to the design of biotreatment BMPs in Orange County and BMP-specific guidance is provided in the following fact sheets. [24]

*Note: Biotreatment BMPs shall be designed to provide the maximum feasible infiltration and ET based on criteria contained in **Appendix XI.2**.*

BIO-1: Bioretention with Underdrains

Also known as:

- *Rain gardens with underdrains*
- *Vegetated media filter*
- *Downspout planter boxes*



Bioretention
Source: Geosyntec Consultants

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, planting soils, and plants. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, biodegraded, and sequestered by the soil and plants. Bioretention with an underdrain are utilized for areas with low permeability native soils or steep slopes where the underdrain system that routes the treated runoff to the storm drain system rather than depending entirely on infiltration. **Bioretention must be designed without an underdrain** in areas of high soil permeability.

Feasibility Screening Considerations

- If there are no hazards associated with infiltration (such as groundwater concerns, contaminant plumes or geotechnical concerns), **bioinfiltration facilities**, which achieve partial infiltration, should be used to maximize infiltration.

[24] Not all BMPs presented in this section are considered "biofiltration BMPs" under the South Orange County Permit Area. Biofiltration BMPs are vegetated treat-and-release BMPs that filter stormwater through amended soil media that is biologically active, support plant growth, and also promote infiltration and/or evapotranspiration. For projects in South Orange County, the total volume of storage in surface ponding and pores spaces is required to be at least 75% of the remaining DCV that the biofiltration BMP is designed to address. This prevents significant down-sizing of BMPs which otherwise may be possible via routing calculations. Biotreatment BMPs that do not meet this definition are not considered to be LID BMPs, but may be used as treatment control or pre-treatment BMPs. See Section III.7 and Worksheet SOC-1 for guidance.

- Bioretention with underdrain facilities should be lined if contaminant plumes or geotechnical concerns exist. If high groundwater is the reason for infiltration infeasibility, bioretention facilities with underdrains do not need to be lined.

Opportunity Criteria

- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Bioretention may also be applied in parking lot islands, cul-de-sacs, traffic circles, road shoulders, road medians, and next to buildings in planter boxes.
- Drainage area is ≤ 5 acres.
- Area is available for infiltration.
- Site must have adequate relief between land surface and the stormwater conveyance system to permit vertical percolation through the soil media and collection and conveyance in underdrain to stormwater conveyance system.

OC-Specific Design Criteria and Considerations

☐ Ponding depth should not exceed 18 inches; fencing may be required if ponding depth is greater than 6 inches to mitigate drowning.

☐ The minimum soil depth is 2 feet (3 feet is preferred).

☐ The maximum drawdown time of the bioretention ponding area is 48 hours. The maximum drawdown time of the planting media and gravel drainage layer is 96 hours, if applicable.

☐ Infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent water proofing, may be placed along the vertical walls to reduce lateral flows. This liner should have a minimum thickness of 30 mils.

☐ If infiltration in bioretention location is hazardous due to groundwater or geotechnical concerns, a geomembrane liner must be installed at the base of the bioretention facility. This liner should have a minimum thickness of 30 mils.

☐ The planting media placed in the cell shall be designed per the recommendations contained in MISC-1: Planting/Storage Media

☐ Plant materials should be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 48 hours; native place species and/or hardy cultivars that are not invasive and do not require chemical inputs should be used to the maximum extent feasible

☐ The bioretention area should be covered with 2-4 inches (average 3 inches) or mulch at the start and an additional placement of 1-2 inches of mulch should be added annually.

☐ Underdrain should be sized with a 6 inch minimum diameter and have a 0.5% minimum slope. Underdrain should be slotted polyvinyl chloride (PVC) pipe; underdrain pipe should be more than 5 feet from tree locations (if space allows).

☐ A gravel blanket or bedding is required for the underdrain pipe(s). At least 0.5 feet of washed aggregate must be placed below, to the top, and to the sides of the underdrain pipe(s).

☐ An overflow device is required at the top of the bioretention area ponding depth.

☐ Dispersed flow or energy dissipation (i.e. splash rocks) for piped inlets should be provided at basin inlet to prevent erosion.

☐ Ponding area side slopes shall be no steeper than 3:1 (H:V) unless designed as a planter box BMP with appropriate consideration for trip and fall hazards.

Simple Sizing Method for Bioretention with Underdrain

If the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** is used to size a bioretention with underdrain facility, the user selects the basin depth and then determines the appropriate surface area to capture the DCV. The sizing steps are as follows:

Step 1: Determine DCV

Calculate the DCV using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1**.

Step 2: Verify that the Ponding Depth will Draw Down within 48 Hours

The ponding area drawdown time can be calculated using the following equation:

$DD_P = (d_P / K_{MEDIA}) \times 12$ in/ft

Where:

DD_P = time to drain ponded water, hours

d_P = depth of ponding above bioretention area, ft (not to exceed 1.5 ft)

K_{MEDIA} = media design infiltration rate, in/hr (equivalent to the media hydraulic conductivity with a factor of safety of 2; K_{MEDIA} of 2.5 in/hr should be used unless other information is available)

If the drawdown time exceeds 48 hours, adjust ponding depth and/or media infiltration rate until 48 hour drawdown time is achieved.

Step 3: Determine the Depth of Water Filtered During Design Capture Storm

The depth of water filtered during the design capture storm can be estimated as the amount routed through the media during the storm, or the ponding depth, whichever is smaller.

$d_{FILTERED}$ = Minimum [$((K_{MEDIA} \times T_{ROUTING})/12)$, d_P]

Where:

$d_{FILTERED}$ = depth of water that may be considered to be filtered during the design storm event, ft

K_{MEDIA} = media design infiltration rate, in/hr (equivalent to the media hydraulic conductivity with a factor of safety of 2; K_{MEDIA} of 2.5 in/hr should be used unless other information is available)

$T_{ROUTING}$ = storm duration that may be assumed for routing calculations; this should be assumed to be no greater than 3 hours. If the designer desires to account for further routing effects, the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix III.3.2**) should be used.

d_P = depth of ponding above bioretention area, ft (not to exceed 1.5 ft)

Step 4: Determine the Facility Surface Area

$A = DCV / (d_P + d_{FILTERED})$

Where:

A = required area of bioretention facility, sq-ft

DCV = design capture volume, cu-ft

$d_{FILTERED}$ = depth of water that may be considered to be filtered during the design storm event, ft

d_P = depth of ponding above bioretention area, ft (not to exceed 1.5 ft)

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. See Section III.7 and Worksheet SOC-1.

Capture Efficiency Method for Bioretention with Underdrains

If the bioretention geometry has already been defined and the user wishes to account more explicitly for routing, the user can determine the required footprint area using the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix III.3.2**) to determine the fraction of the DCV that must be provided to manage 80 percent of average annual runoff volume. This method accounts for drawdown time different than 48 hours.

Step 1: Determine the drawdown time associated with the selected basin geometry

$DD = (d_p / K_{DESIGN}) \times 12$ in/ft

Where:

DD = time to completely drain infiltration basin ponding depth, hours

d_P = bioretention ponding depth, ft (should be less than or equal to 1.5 ft)

K_{DESIGN} = design media infiltration rate, in/hr (assume 2.5 inches per hour unless otherwise proposed)

If drawdown is less than 3 hours, the drawdown time should be rounded to 3 hours or the Capture Efficiency Method for Flow-based BMPs (See **Appendix III.3.3**) shall be used.

Step 2: Determine the Required Adjusted DCV for this Drawdown Time

Use the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs (See **Appendix III.3.2**) to calculate the fraction of the DCV the basin must hold to achieve 80 percent capture of average annual stormwater runoff volume based on the basin drawdown time calculated above.

Step 3: Determine the Basin Infiltrating Area Needed

The required infiltrating area (i.e. the surface area of the top of the media layer) can be calculated using the following equation:

$A = \text{Design Volume} / d_p$

Where:

A = required infiltrating area, sq-ft (measured at the media surface)

Design Volume = fraction of DCV, adjusted for drawdown, cu-ft (see Step 2)

d_p = ponding depth of water stored in bioretention area, ft (from Step 1)

This does not include the side slopes, access roads, etc. which would increase bioretention footprint. If the area required is greater than the selected basin area, adjust surface area or adjust ponding depth and recalculate required area until the required area is achieved.

In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. See Section III.7 and Worksheet SOC-1.

Configuration for Use in a Treatment Train

- Bioretention areas may be preceeded in a treatment train by HSCs in the drainage area, which would reduce the required design volume of the bioretention cell. For example, bioretention could be used to manage overflow from a cistern.
- Bioretention areas can be used to provide pretreatment for underground infiltration systems.

Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment: **http://www.cabmphandbooks.com/Documents/Development/TC-32.pdf**

- SMC LID Manual (pp 68):
  http://www.lowimpactdevelopment.org/guest75/pub/All_Projects/SoCal_LID_Manual/SoCalLID_Manual_FINAL_040910.pdf
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 5:
  http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- San Diego County LID Handbook Appendix 4 (Factsheet 7):
  http://www.sdcounty.ca.gov/dplu/docs/LID-Appendices.pdf

  Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4:
  http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850
- County of Los Angeles Low Impact Development Standards Manual, Chapter 5:
  http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf

Proprietary Biotreatment (BIO-7) Fact Sheet

BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

Also known as:

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
Source: http://www.americastusa.com /index.php/filterra/

Feasibility Screening Considerations

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

OC-Specific Design Criteria and Considerations

☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

☐ Consult proprietors for specific criteria concerning the design and performance.

☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.

☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

Computing Sizing Criteria for Proprietary Biotreatment Device

- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

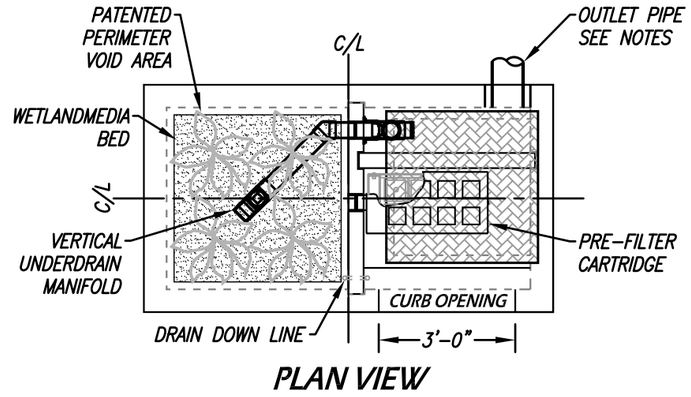
In South Orange County, the provided ponding plus pore volume must be checked to demonstrate that it is greater than 0.75 of the remaining DCV that this BMP is designed to address. Many propretary biotreatment BMPs will not be able to meet the definition of "biofiltration" that applies in South Orange County. See Section III.7 and Worksheet SOC-1.

Additional References for Design Guidance

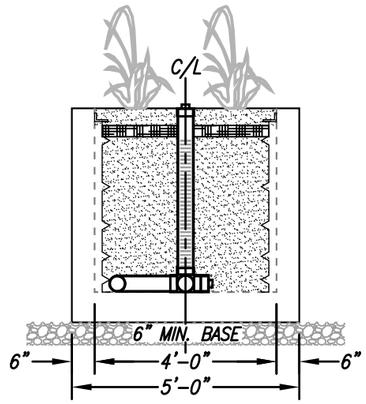
- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

Modular Wetland Systems

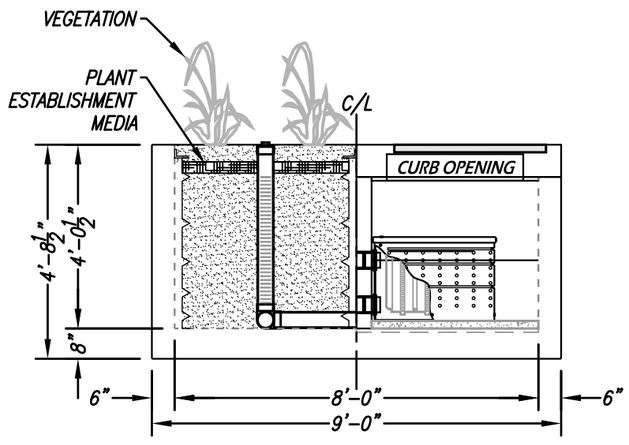
SITE SPECIFIC DATA			
PROJECT NAME		Cielo Vista Project	
PROJECT LOCATION		Yorba Linda, CA-County of Orange	
STRUCTURE ID		BMP ID A9	
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
1,245 (combined)		0.116 cfs (combined)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PARKWAY	OPEN PLANTER	PARKWAY
FRAME & COVER	36" X 36"	N/A	N/A
WETLANDMEDIA VOLUME (CY)			2.03
WETLANDMEDIA DELIVERY METHOD			TBD
ORIFICE SIZE (DIA. INCHES)			ø1.53"
MAXIMUM PICK WEIGHT (LBS)			15000
NOTES: Conceptual Report - SD inverts and rim elevations are TBD.			



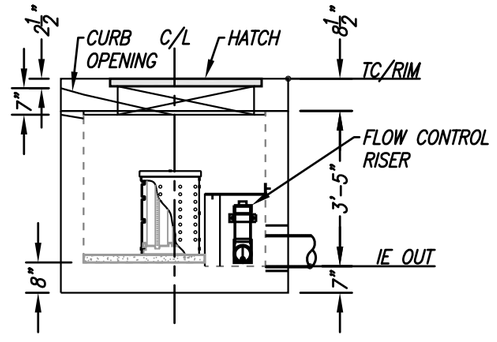
PLAN VIEW



LEFT END VIEW
BIOFILTRATION



ELEVATION VIEW



RIGHT END VIEW
PRETREATMENT/DISCHARGE

INSTALLATION NOTES

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

GENERAL NOTES

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

TREATMENT FLOW (CFS)	0.115
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	TBD
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

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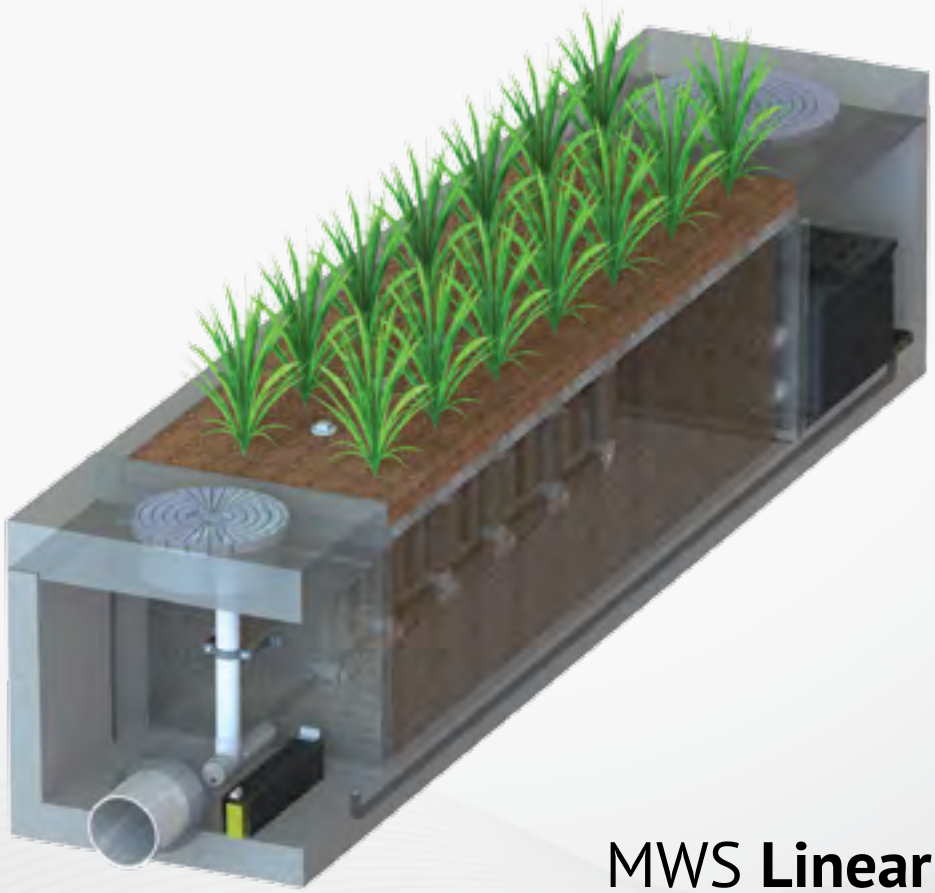
MWS-L-4-8-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

MODULAR WETLANDS™

*Advanced **Stormwater** Biofiltration*



MWS **Linear**

Contents

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS Linear

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and prefilter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.

Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

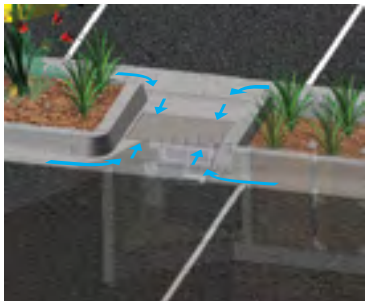
- Agriculture
- Reuse
- Low Impact Development
- Waste Water

Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.

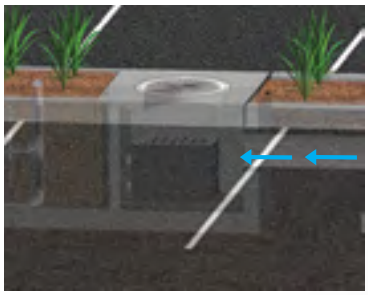
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

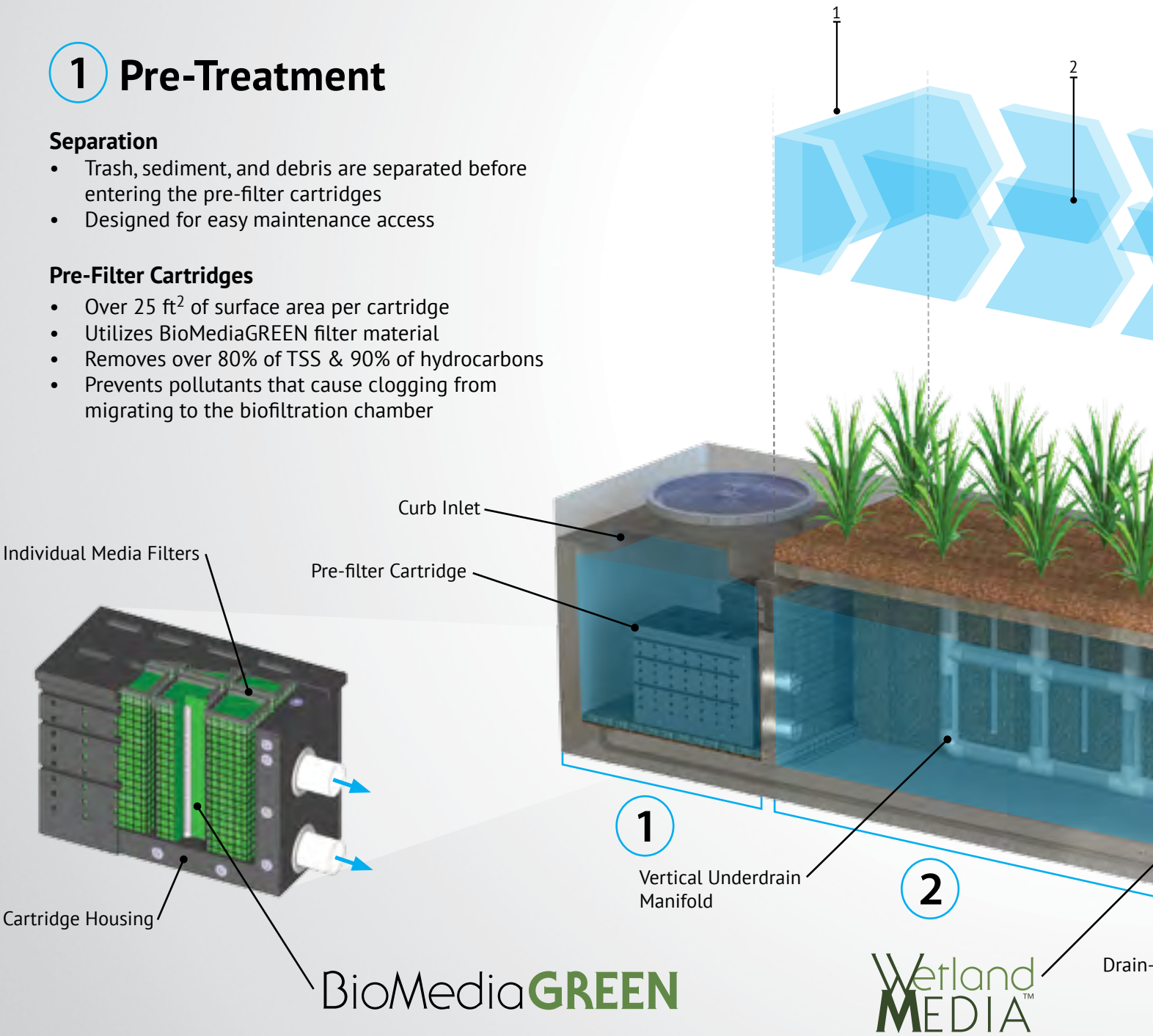
1 Pre-Treatment

Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber



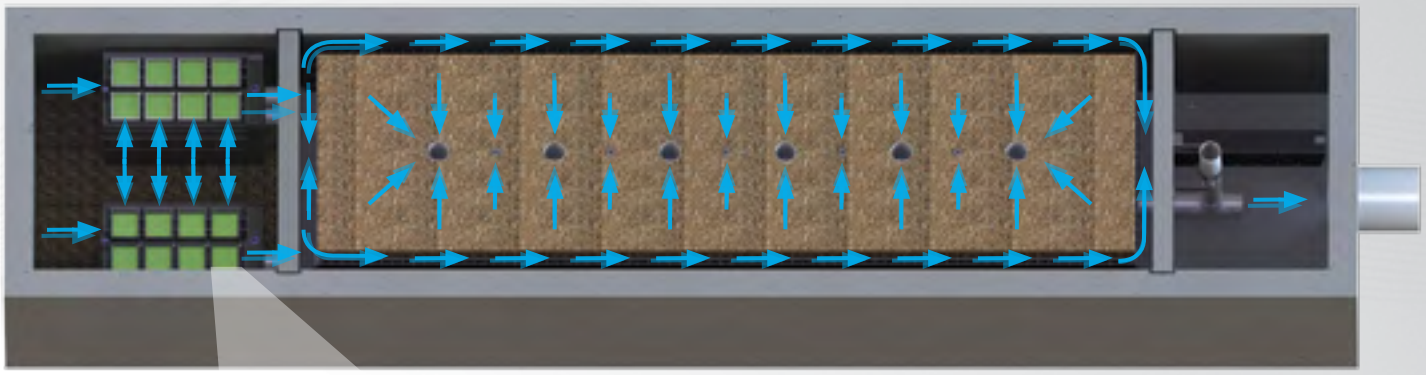


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

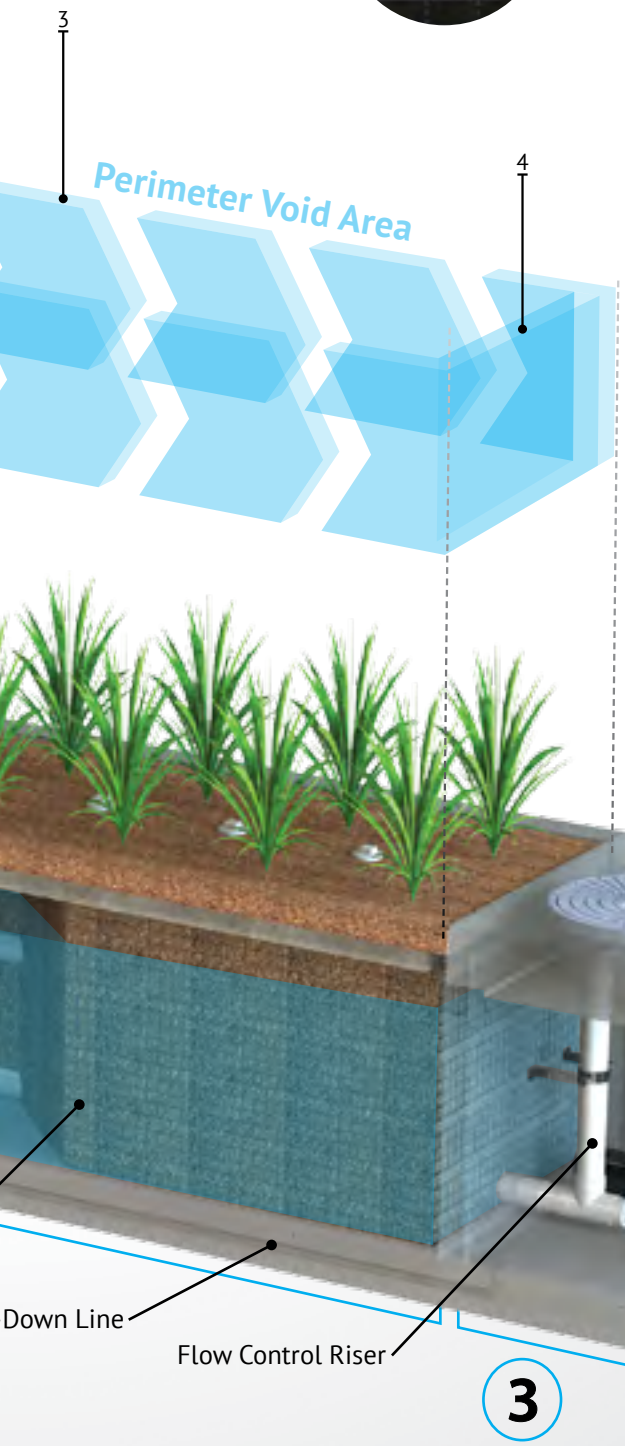


Fig. 1

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

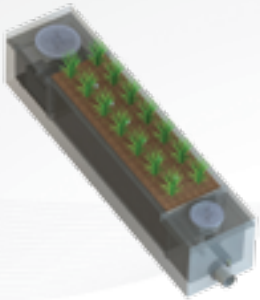
Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.



End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

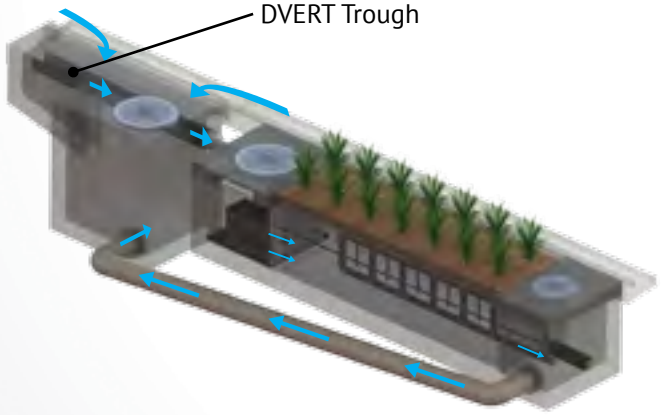
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

Washington State TAPE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.

Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit www.ModularWetlands.com/Plants for more information and various plant lists.

SECTION VII EDUCATIONAL MATERIALS

The educational materials included in this WQMP are provided to inform people involved in future uses, activities, or ownership of the site about the potential pitfalls associated with careless storm water management. "The Ocean Begins at Your Front Door" provides users with information about storm water that is/will be generated on site, what happens when water enters a storm drain, and its ultimate fate, discharging into the ocean. Also included are activities guidelines to educate anyone who is or will be associated with activities that have a potential to impact storm water runoff quality, and provide a menu of BMPs to effectively reduce the generation of storm water runoff pollutants from a variety of activities. The educational materials that may be used for the proposed project will be included in Appendix C of the preliminary and/or final WQMP to be developed in the future, and are listed below.

EDUCATION MATERIALS			
Residential Materials (http://www.ocwatersheds.com)	**Check If Attached**	**Business Materials (http://www.ocwatersheds.com)**	**Check If Attached**
The Ocean Begins at Your Front Door	☒	Tips for the Automotive Industry	☐
Tips for Car Wash Fund-raisers	☐	Tips for Using Concrete and Mortar	☐
Tips for the Home Mechanic	☐	Tips for the Food Service Industry	☐
Homeowners Guide for Sustainable Water Use	☒	Proper Maintenance Practices for Your Business	☐
Household Tips	☒	**Other Materials (http://www.ocwatersheds.com) (http://www.cabmphandbooks.com)**	**Check If Attached**
Proper Disposal of Household Hazardous Waste	☒		
Recycle at Your Local Used Oil Collection Center (North County)	☒	DF-1 Drainage System Operation & Maintenance	☒
Recycle at Your Local Used Oil Collection Center (Central County)	☐	R-1 Automobile Repair & Maintenance	☐
Recycle at Your Local Used Oil Collection Center (South County)	☐	R-2 Automobile Washing	☐
Tips for Maintaining Septic Tank Systems	☐	R-3 Automobile Parking	☒
Responsible Pest Control	☒	R-4 Home & Garden Care Activities	☒
Sewer Spill	☒	R-5 Disposal of Pet Waste	☐
Tips for the Home Improvement Projects	☒	R-6 Disposal of Green Waste	☒
Tips for Horse Care	☐	R-7 Household Hazardous Waste	☒
Tips for Landscaping and Gardening	☒	R-8 Water Conservation	☒
Tips for Pet Care	☐	SD-10 Site Design & Landscape Planning	☒
Tips for Pool Maintenance	☒	SD-11 Roof Runoff Controls	☒
Tips for Residential Pool, Landscape and Hardscape Drains	☒	SD-12 Efficient Irrigation	☒
Tips for Projects Using Paint	☒	SD-13 Storm Drain Signage	☒
Tips for Protecting Your Watershed	☒	SD-31 Maintenance Bays & Docs	☐
Other: Children's Brochure	☐	SD-32 Trash Storage Areas	☐

APPENDICES

APPENDIX A

SUPPORTING CALCULATIONS

Worksheet J: Summary of Harvested Water Demand and Feasibility

1	What demands for harvested water exist in the tributary area (check all that apply):			
2	Toilet and urinal flushing		X	
3	Landscape irrigation		X	
4	Other:_____			
5	What is the design capture storm depth? (Figure III.1)	d	0.9	inches
6	What is the project size?	A	27.76	ac
7	What is the acreage of impervious area?	IA	13.05	ac
For projects with multiple types of demand (toilet flushing, irrigation demand, and/or other demand)				
8	What is the minimum use required for partial capture? (Table X.6)			gpd
9	What is the project estimated wet season total daily use (Section X.2)?			gpd
10	Is partial capture potentially feasible? (Line 9 > Line 8?)			
For projects with only toilet flushing demand				
11	What is the minimum TUTIA for partial capture? (Table X.7)		110	
12	What is the project estimated TUTIA?		34.3	
13	Is partial capture potentially feasible? (Line 12 > Line 11?)		No	
For projects with only irrigation demand				
14	What is the minimum irrigation area required based on conservation landscape design? (Table X.8)		1.01	ac
15	What is the proposed project irrigated area? (multiply conservation landscaping by 1; multiply active turf by 2)		1.12	ac
16	Is partial capture potentially feasible? (Line 15 > Line 14?)		No*	

Provide supporting assumptions and citations for controlling demand calculation:
See Irrigation Demand Calculations Worksheet attached for EAWU method and Drawdown times.

Lines Items
(12) 112 residences x 4 per household / 13.05 ac impervious = 34.3 toilet users/impervious acre
(15) 14.71 ac irrigated area / 13.05 ac impervious area = 1.12
(16) *Achieves 40% capture but takes 31.1 days to drawdown DCV. Therefore it is **not feasible**. See attached Worksheet.

Harvest & Reuse Irrigation Demand Calculations - Planning Area 1

Project: CIELO VISTA
6-Aug-15

Storm Water Design Caputre Volume (SQDV)

Drainage Area / Land Use Type	Impervious Area (ac)	Irrigated Area (ac)	% impervious	Runoff Coefficient	Design Storm Depth (in)	Drainage Area (acres)	DCV (ft^3)	DCV (gal)
Planning Area 1	13.05	14.71	47%	0.5025	0.9	27.760	**45,572.7**	**340,884**

	Eto
Irvine	3.00
Laguna Beach	2.75
Santa Ana	2.93

Modified

$$EAWU = \frac{(Eto \times KL \times LA \times 0.015)}{IE}$$

$$EIATA = \frac{LA \times KL}{(IE \times \text{Tributary Imp. Area})}$$

Low Water Use Landscaping

Drainage Area / Land Use Type	Total Area (ac)	Total Area (sf)	% Impervious	Impervious (sf)	Pervious / LA (sf)	Eto	KL	Modified EAWU	EAWU/ Impervious Acre	Minimum EAWU/ Impervious Acre (Table X.6)	Feasible?	EIATA	Minimum EIATA (Table X.8)	Drawdown (days)	Drawdown (hours)
Planning Area 1	27.760	1,209,226	47%	568,336	640,890	2.93	0.35	10,953.87	839.56	730	Yes	0.44	1.01	31.1	747

TABLE X.6: HARVESTED WATER DEMAND THRESHOLDS FOR MINIMUM PARTIAL CAPTURE

Design Capture Storm Depth, inches	Wet Season Demand Required for Minimum Partial Capture, gpd per impervious acre
0.60	490
0.65	530
0.70	570
0.75	610
0.80	650
0.85	690
0.90	730
0.95	770
1.00	810

TABLE X.8: MINIMUM IRRIGATED AREA FOR POTENTIAL PARTIAL CAPTURE FEASIBILITY

General Landscape Type	Conservation Design: KL = 0.35			Active Turf Areas: KL = 0.7		
Closest ET Station	Irvine	Santa Ana	Laguna	Irvine	Santa Ana	Laguna
Design Capture Storm Depth, inches	Minimum Required Irrigated Area per Tributary Impervious Acre for Potential Partial Capture, ac/ac					
0.60	0.66	0.68	0.72	0.33	0.34	0.36
0.65	0.72	0.73	0.78	0.36	0.37	0.39
0.70	0.77	0.79	0.84	0.39	0.39	0.42
0.75	0.83	0.84	0.9	0.41	0.42	0.45
0.80	0.88	0.9	0.96	0.44	0.45	0.48
0.85	0.93	0.95	1.02	0.47	0.48	0.51
0.90	0.99	1.01	1.08	0.49	0.51	0.54
0.95	1.04	1.07	1.14	0.52	0.53	0.57
1.00	1.1	1.12	1.2	0.55	0.56	0.6

Source: Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs). March 22, 2011. Appendix X.

Worksheet C: Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs

Project: CIELO VISTA PLANNING AREA 1

Date: August 6, 2015

			DMA A1	DMA A3	DMA A4	DMA A5	DMA A7	DMA A8	
Step 1: Determine the design capture storm depth used for calculating volume									
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	1.35	1.35	1.35	1.35	1.35	1.35	inches
2	Enter calculated drawdown time of the proposed BMP based on equation provided in applicable BMP Fact Sheet, *T* (hours)	T=	7.20	7.20	7.20	7.20	7.20	7.20	hours
3	Using Figure III.2, determine the "fraction of design capture storm depth" at which the BMP drawdown time (T) line achieves 80% capture efficiency, X_1	X_1=	0.43	0.43	0.43	0.43	0.43	0.43	
4	Enter the effect depth of provided HSCs upstream, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	0	0	0	0	0	inches
5	Enter capture efficiency corresponding to d_{HSC}, Y_2 *(Worksheet A)*	Y_2=	0%	0%	0%	0%	0%	0%	%
6	Using Figure III.2, determine the fraction of "design capture storm depth" at which the drawdown time (T) achieves the equivalent of the upstream capture efficiency (Y_2), X_2	X_2=	0	0	0	0	0	0	
7	Calculate the fraction of design volume that must be provided by BMP, *fraction* = $X_1 - X_2$	fraction=	0.43	0.43	0.43	0.43	0.43	0.43	
8	Calculate the resultant design capture storm depth (inches), $d_{fraction}$ = *fraction* × *d*	$d_{fraction}$=	0.5738	0.5738	0.5738	0.5738	0.5738	0.5738	inches
Step 2: Calculate the DCV									
1	Enter Project area tributary to BMP(s), *A* (acres)	A=	9.349	4.658	5.939	6.038	1.610	2.190	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	40.0%	40.0%	31.0%	46.0%	40.0%	40.0%	%
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.450	0.450	0.383	0.495	0.450	0.450	
4	Calculate runoff volume, V_{design} = *(C x* $d_{rfraction}$ *x A x 43560 x (1/12))*	V_{design}=	8,762.1	4,365.6	4,731.2	6,224.8	1,508.9	2,052.5	cu-ft
Supporting Calculations									
Describe System:									
Bioretention BMP Sizing accounts for 1.5 times DCV not retained by converting design storm depth from 0.9" to 1.35"									
	Bioretention with Underdrains (BIO-1)								
	Ponding Depth (d_p) =		*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	*1.5*	ft
	Media Filtration Rate (K_{design}) =		*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	in/hr
	Surface Area Needed (Amin) =		*5841.4*	*2910.4*	*3154.2*	*4149.9*	*1006.0*	*1368.3*	ft^2
	Surface Area Provided (A) =		*8400*	*3085*	*5120*	*5100*	*8400*	*8400*	ft^2
	Total Volume Bio-Treated (V) =		*12600*	*4627.5*	*7680*	*7650*	*12600*	*12600*	ft^3
			Basin D	*Basin C*	*Basin A*	*Basin B*	*Basin D*	*Basin D*	
Provide drawdown time calculations per applicable BMP Fact Sheet:									
	Per Fact Sheet BIO-1, Drawdown (T) = (dp / Kdesign) x 12								
	Drawdown (T) =		*7.20*	*7.20*	*7.20*	*7.20*	*7.20*	*7.20*	hours

Storm Water Quality Design Calculations

CIELO VISTA PLANNING AREA 1

6-Aug-15

Drainage Area Name / DMA	BMP	Total Drainage Area (ft^2)	Total Drainage Area (acres)	Total Pervious Area (ft^2)	Calculated % impervious	Assumed % impervious	Runoff Coefficient	Design Storm Depth (in)	Average or Estimated Tc (min)	Rainfall Intensity (in/hr)	Simple Method DCV (ft^3)	Q_{Design} (cfs)
Planning Area 1		1484931.40	34.089		100%	34%	0.406	1.35	5	0.26	**67,769.3**	**3.596**
DMA A1	**Basin D (BIO-1)**	407247.47	9.349		100%	40%	0.450	1.35	5	0.26	**20,616.6**	**1.094**
DMA A2	Off-site Slope	98562.74	2.263		100%	5%	0.188	1.35	5	0.26	**2,079.3**	**0.110**
DMA A3	**Basin C (BIO-1)**	202882.56	4.658		100%	40%	0.450	1.35	5	0.26	**10,271.9**	**0.545**
DMA A4	**Basin A (BIO-1)**	258714.97	5.939		100%	31%	0.383	1.35	5	0.26	**11,132.3**	**0.591**
DMA A5	**Basin B (BIO-1)**	262996.36	6.038		100%	46%	0.495	1.35	5	0.26	**14,646.7**	**0.777**
DMA A6	Off-site Slope	14328.90	0.329		100%	5%	0.188	1.35	5	0.26	**302.3**	**0.016**
DMA A7	**Basin D (BIO-1)**	70140.18	1.610		100%	40%	0.450	1.35	5	0.26	**3,550.4**	**0.188**
DMA A8	**Basin D (BIO-1)**	95,390.3	2.190		100%	40%	0.450	1.35	5	0.26	**4,829.4**	**0.256**
DMA A9	**Modular Wetland**	20,125.1	0.462		100%	90%	0.825	1.35	5	0.26	**1,867.8**	**0.099**
DMA A10	Off-site Slope	54,533.7	1.252		100%	5%	0.188	1.35	5	0.26	**1,150.4**	**0.061**

80% Capture Efficiency Method (Worksheet C)

CIELO VISTA PLANNING AREA 1
6-Aug-15

Drainage Area Name / DMA	BMP	Total Drainage Area (ft^2)	Total Drainage Area (acres)	Total Pervious Area (ft^2)	Calculated % impervious	Assumed % impervious	Runoff Coefficient	Original Design Storm Depth (in)	BMP Ponding Depth (ft)	Effective Depth (equals ponding depth for biotreatment)	Infiltration or Filtration Rate (in/hr)	Calculated Drawdown (hours)	Fraction of Design Capture Storm Depth (Fig. III.2)	New Design Storm Depth (in)	Adjusted DCV (ft^3)	BMP Surface Area Needed (ft^2)	BMP Surface Area Provided (ft^2)	Total Volume Bio-Treated (ft^3)
Planning Area 1	0	1,484,931.4	34.089	0.0	100.0%	34%	0.4057	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	28,801.9	19,201.3		0.0
DMA A1	**Basin D (BIO-1)**	407,247.5	9.349	0.0	100.0%	40%	0.4500	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**8,762.1**	**5,841.4**	**8,400.0**	**12,600.0**
DMA A2	Off-site Slope	98,562.7	2.263	0.0	100.0%	5%	0.1875	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**883.7**	**589.1**		0.0
DMA A3	**Basin C (BIO-1)**	202,882.6	4.658	0.0	100.0%	40%	0.4500	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**4,365.6**	**2,910.4**	**3,085.0**	**4,627.5**
DMA A4	**Basin A (BIO-1)**	258,715.0	5.939	0.0	100.0%	31%	0.3825	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**4,731.2**	**3,154.2**	**5,120.0**	**7,680.0**
DMA A5	**Basin B (BIO-1)**	262,996.4	6.038	0.0	100.0%	46%	0.4950	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**6,224.8**	**4,149.9**	**5,100.0**	**7,650.0**
DMA A6	Off-site Slope	14,328.9	0.329	0.0	100.0%	5%	0.1875	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**128.5**	**85.7**		0.0
DMA A7	**Basin D (BIO-1)**	70,140.2	1.610	0.0	100.0%	40%	0.4500	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**1,508.9**	**1,006.0**	**8,400.0**	**12,600.0**
DMA A8	**Basin D (BIO-1)**	95,390.3	2.190	0.0	100.0%	40%	0.4500	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**2,052.5**	**1,368.3**	**8,400.0**	**12,600.0**
DMA A9	**Modular Wetland**	20,125.1	0.462	0.0	100.0%	90%	0.8250	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**793.8**	**529.2**		0.0
DMA A10	Off-site Slope	54,533.7	1.252	0.0	100.0%	5%	0.1875	1.35	1.5	1.5	2.5	7.2	0.43	0.5738	**488.9**	**325.9**		0.0

Worksheet B: Simple Design Capture Volume Sizing Method

Project: CIELO VIST PLANNING AREA 2

Date: August 6, 2015

			DMA B2	
Step 1: Determine the design capture storm depth used for calculating volume				
1	Enter design capture storm depth from Figure III.1, *d* (inches)	d=	0.90	inches
2	Enter the effect of provided HSCs, d_{HSC} (inches) (Worksheet A)	d_{HSC}=	0	inches
3	Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2)	$d_{remainder}$=	0.90	inches
Step 2: Calculate the DCV				
1	Enter Project area tributary to BMP (s), *A* (acres)	A=	6.1960	acres
2	Enter Project Imperviousness, *imp* (unitless)	imp=	40.0%	%
3	Calculate runoff coefficient, *C= (0.75 x imp) + 0.15*	C=	0.4500	
4	Calculate runoff volume, $V_{design} = (C \times d_{remainder} \times A \times 43560 \times (1/12))$	V_{design}=	9,109.0	cu-ft
Step 3: Design BMPs to ensure full retention of the DCV				
Step 3a: Determine design infiltration rate				
1	Enter measured infiltration rate, $K_{measured}$ (in/hr) (Appendix VII)	$K_{measured}$=	*3.00**	in/hr
2	Enter combined safety factor from Worksheet H, S_{final} (unitless)	S_{final}=	*2.00*	
3	Calculate design infiltration rate, $K_{design} = K_{measured} / S_{final}$	K_{design}=	*1.50*	in/hr
Step 3b: Determine minimum BMP footprint				
4	Enter drawdown time, *T* (max 48 hours)	T=	*48.00*	hours
5	Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$	D_{max}=	*6.00*	feet
6	Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$	A_{min}=	*1518.17*	sq-ft

** Infiltration tests to be conducted at final design.*

Storm Water Quality Design Calculations

CIELO VISTA PLANNING AREA 2

6-Aug-15

Drainage Area Name / DMA	BMP	Total Drainage Area (ft^2)	Total Drainage Area (acres)	Total Pervious Area (ft^2)	Calculated % impervious	Assumed % impervious	Runoff Coefficient	Design Storm Depth (in)	Average or Estimated Tc (min)	Rainfall Intensity (in/hr)	Simple Method DCV (ft^3)	Q_{Design} (cfs)
Planning Area 2		360,196.8	8.269		100.0%	31%	0.384	0.9	5	0.26	10,379.8	0.826
DMA B1	Offsite Slope	24,285.16	0.558		100.0%	5%	0.188	0.9	5	0.26	**341.8**	**0.027**
DMA B2	**Basin (INF-1)**	269,898.10	6.196		100.0%	40%	0.450	0.9	5	0.26	**9,109.0**	**0.725**
DMA B3	Offsite Slope	9,181.47	0.211		100.0%	5%	0.188	0.9	5	0.26	**129.3**	**0.010**
DMA B4	Offsite Slope	32,149.02	0.738		100.0%	5%	0.188	0.9	5	0.26	**452.1**	**0.036**
DMA B5	Offsite Slope	24,683.05	0.567		100.0%	5%	0.188	0.9	5	0.26	**347.3**	**0.028**

Figure III.2. Capture Efficiency Nomograph for Constant Drawdown Systems in Orange County

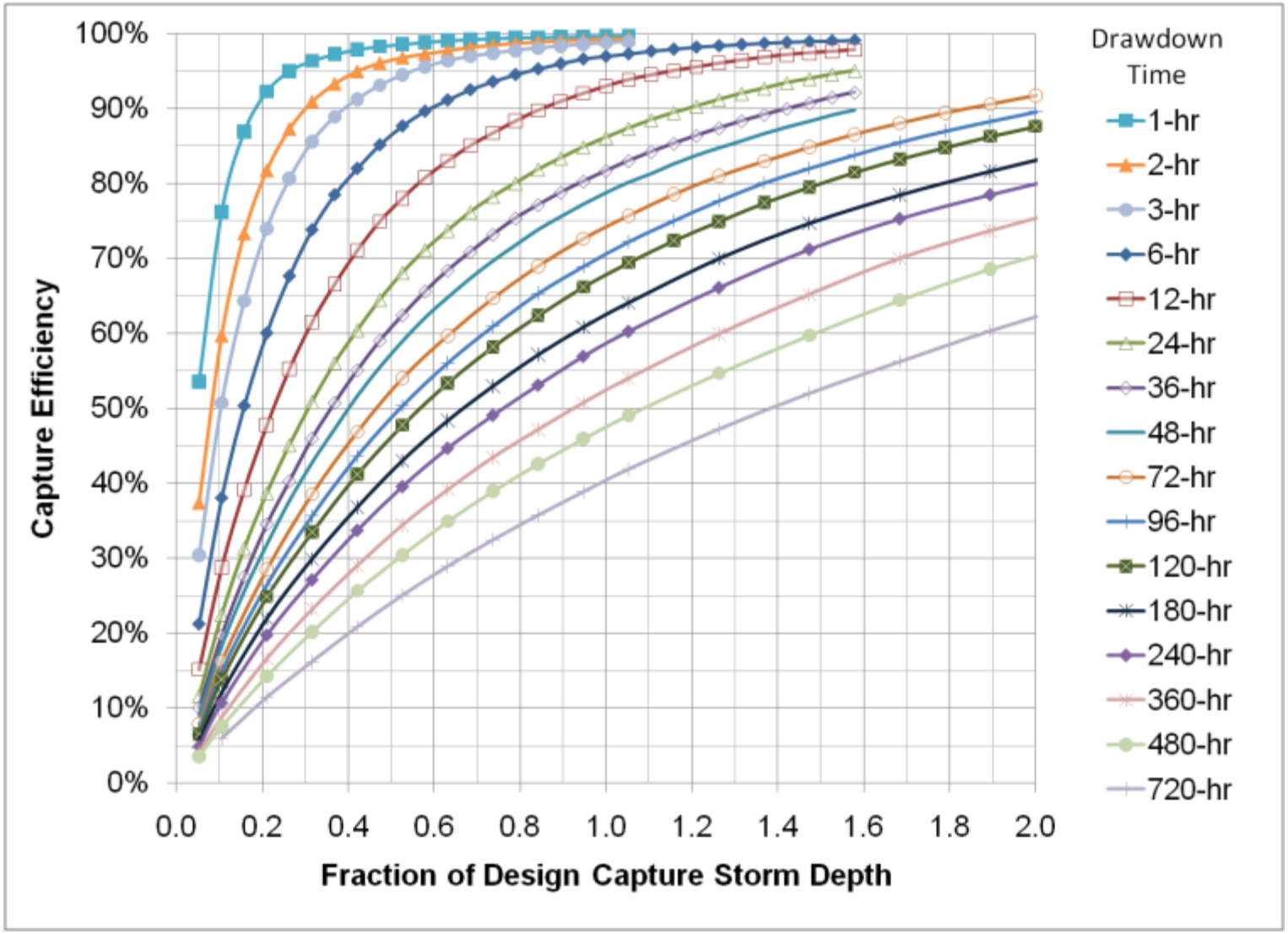
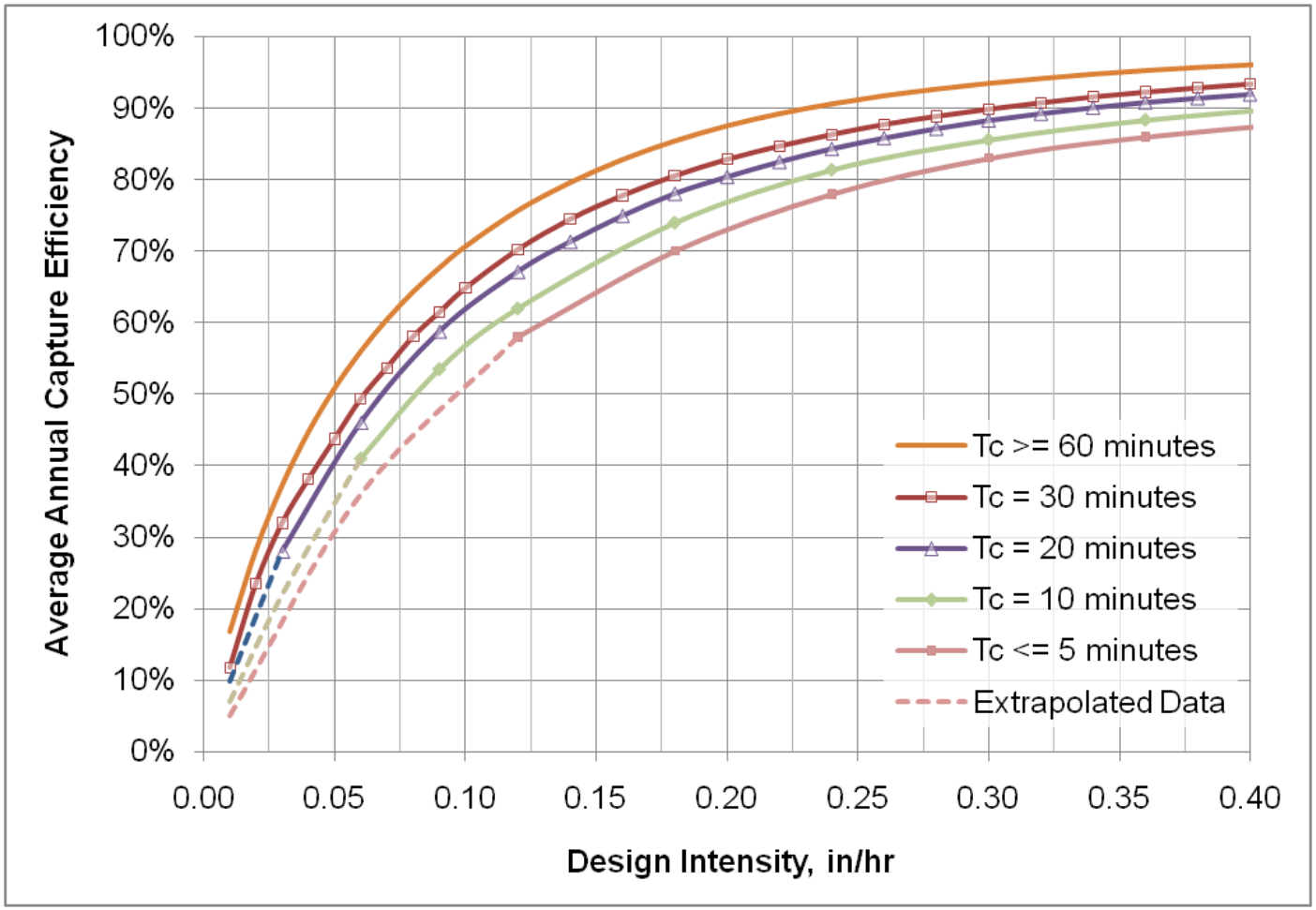


Figure III.4. Capture Efficiency Nomograph for Off-line Flow-based Systems in Orange County



SUBJECT TO FURTHER REVISION

Project Site

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
ORANGE COUNTY

0.9
0.9
0.95
0.7
0.75
0.7
0.65
0.75
0.8
0.85
0.9
0.95
1.05
1
0.9
0.85
0.8
0.75

LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

Rainfall Zones

Design Capture Storm Depth (inches)

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO., CA

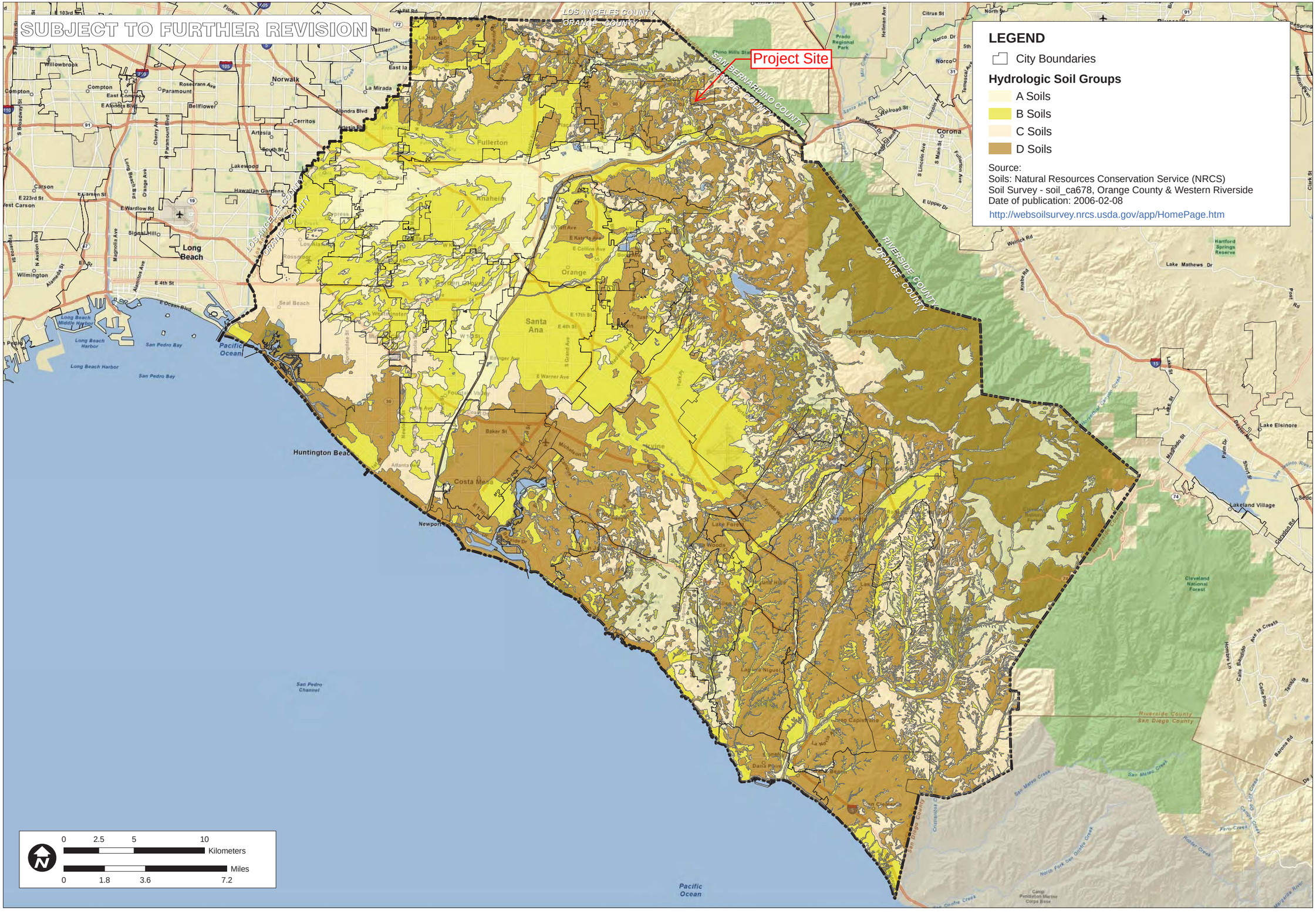
SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE Advanced Water Engineering

FIGURE XVI-1

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

SUBJECT TO FURTHER REVISION



LEGEND

City Boundaries

Hydrologic Soil Groups

- A Soils
- B Soils
- C Soils
- D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

TITLE
NRCS HYDROLOGIC SOILS GROUPS

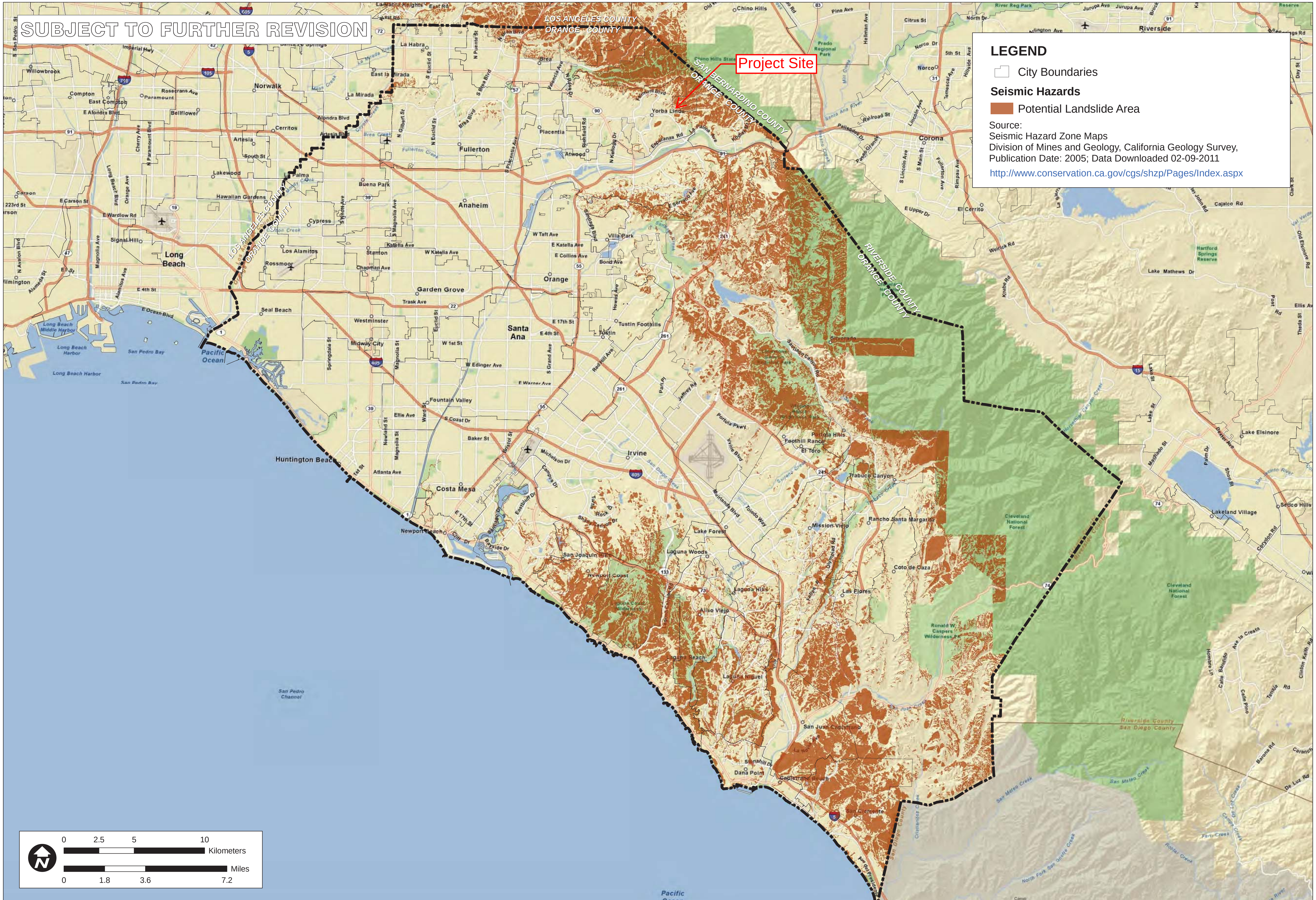
JOB
ORANGE COUNTY INFILTRATION STUDY
CA
ORANGE CO.

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2a

P: \ 9526E \ 6-GIS \ Mxds \ Reports \ InfiltrationFeasability_20110215 \ 9526E_FigureXVI-2a_HydroSoils_20110215.mxd



TITLE

HYDROLOGIC SOIL GROUP
TYPE D NRCS SOIL SURVEY

JOB

ORANGE COUNTY
INFILTRATION STUDY

ORANGE CO. CA

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE

XVI-2c

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SUBJECT TO FURTHER REVISION

LEGEND

- Depth To First Groundwater Contours
- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

Project Site

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY

0 2 4 8 Kilometers
0 1.25 2.5 5 Miles

TITLE
NORTH ORANGE COUNTY
MAPPED DEPTH TO FIRST
GROUNDWATER

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

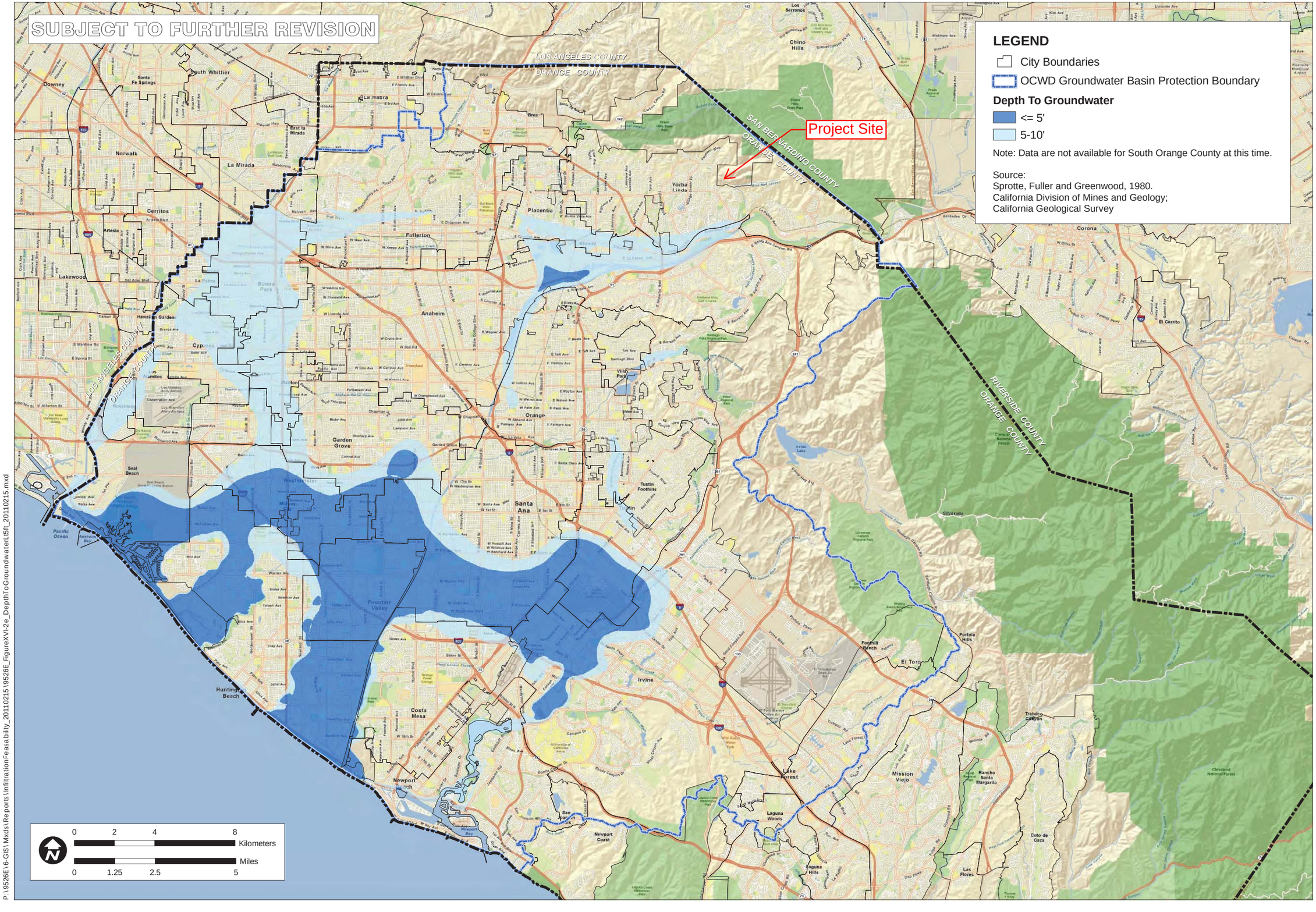
SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2d

P:\9526E\16-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2d_DepthToGroundwaterOverview_20110215.mxd

SUBJECT TO FURTHER REVISION



LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Depth To Groundwater

- <= 5'
- 5-10'

Note: Data are not available for South Orange County at this time.

Source:
Sprotte, Fuller and Greenwood, 1980.
California Division of Mines and Geology;
California Geological Survey

TITLE
NORTH ORANGE COUNTY
MAPPED SHALLOW GROUNDWATER

ORANGE COUNTY
INFILTRATION STUDY

JOB
ORANGE CO.

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

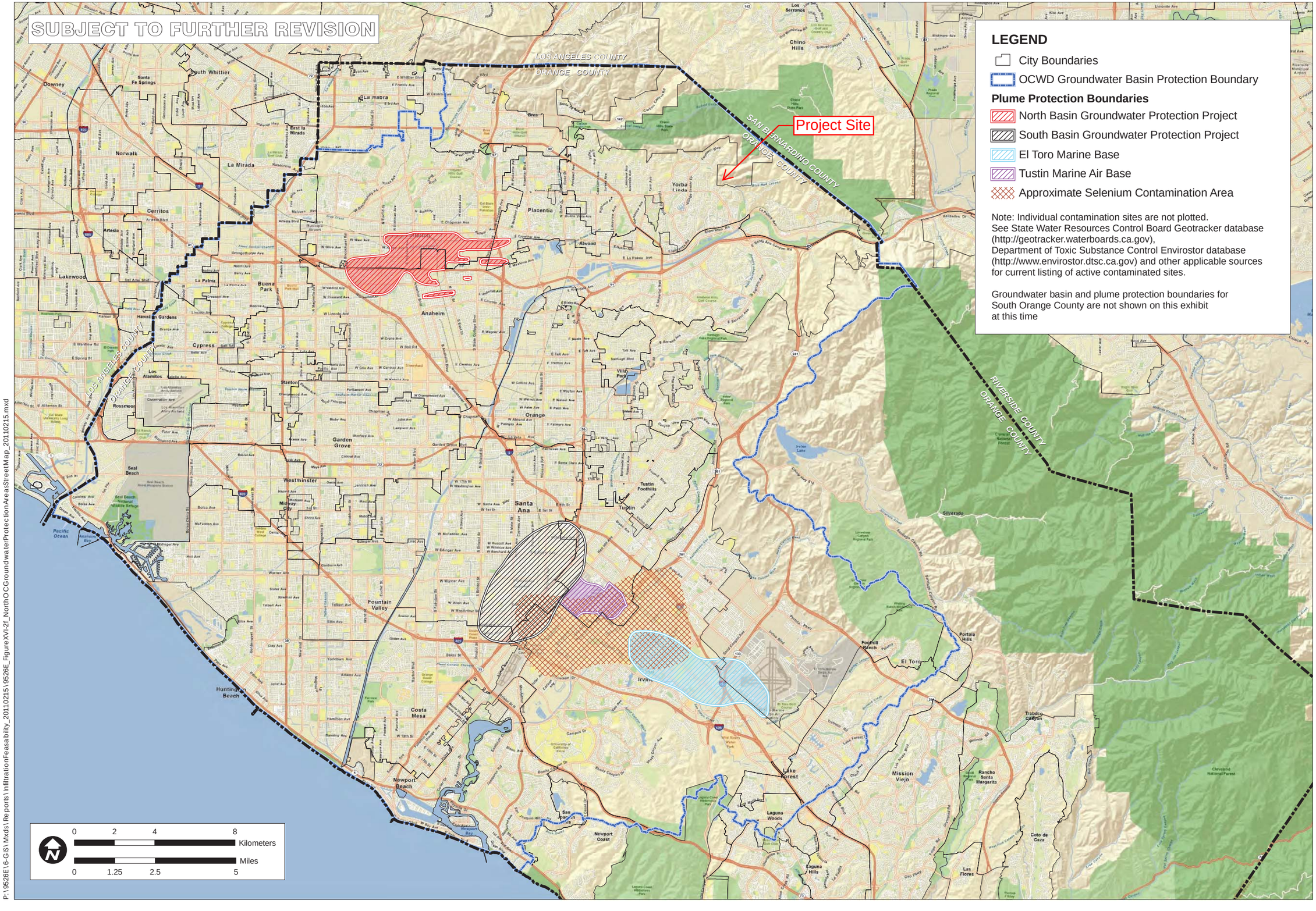
CA

PACE
Advanced Water Engineering

FIGURE
XVI-2e

P:\9526E\16-GIS\Mxds\Reports\Infiltration\Feasability_20110215\9526E_FigureXVI-2e_DepthToGroundwaterLt5ft_20110215.mxd

SUBJECT TO FURTHER REVISION



LEGEND

- City Boundaries
- OCWD Groundwater Basin Protection Boundary

Plume Protection Boundaries

- North Basin Groundwater Protection Project
- South Basin Groundwater Protection Project
- El Toro Marine Base
- Tustin Marine Air Base
- Approximate Selenium Contamination Area

Note: Individual contamination sites are not plotted.
See State Water Resources Control Board Geotracker database (http://geotracker.waterboards.ca.gov),
Department of Toxic Substance Control Envirostor database (http://www.envirostor.dtsc.ca.gov) and other applicable sources for current listing of active contaminated sites.

Groundwater basin and plume protection boundaries for South Orange County are not shown on this exhibit at this time

0 2 4 8 Kilometers

0 1.25 2.5 5 Miles

TITLE

NORTH ORANGE COUNTY GROUNDWATER PROTECTION AREAS

ORANGE COUNTY INFILTRATION STUDY

CA

JOB

ORANGE CO.

SCALE	1" = 1.25 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

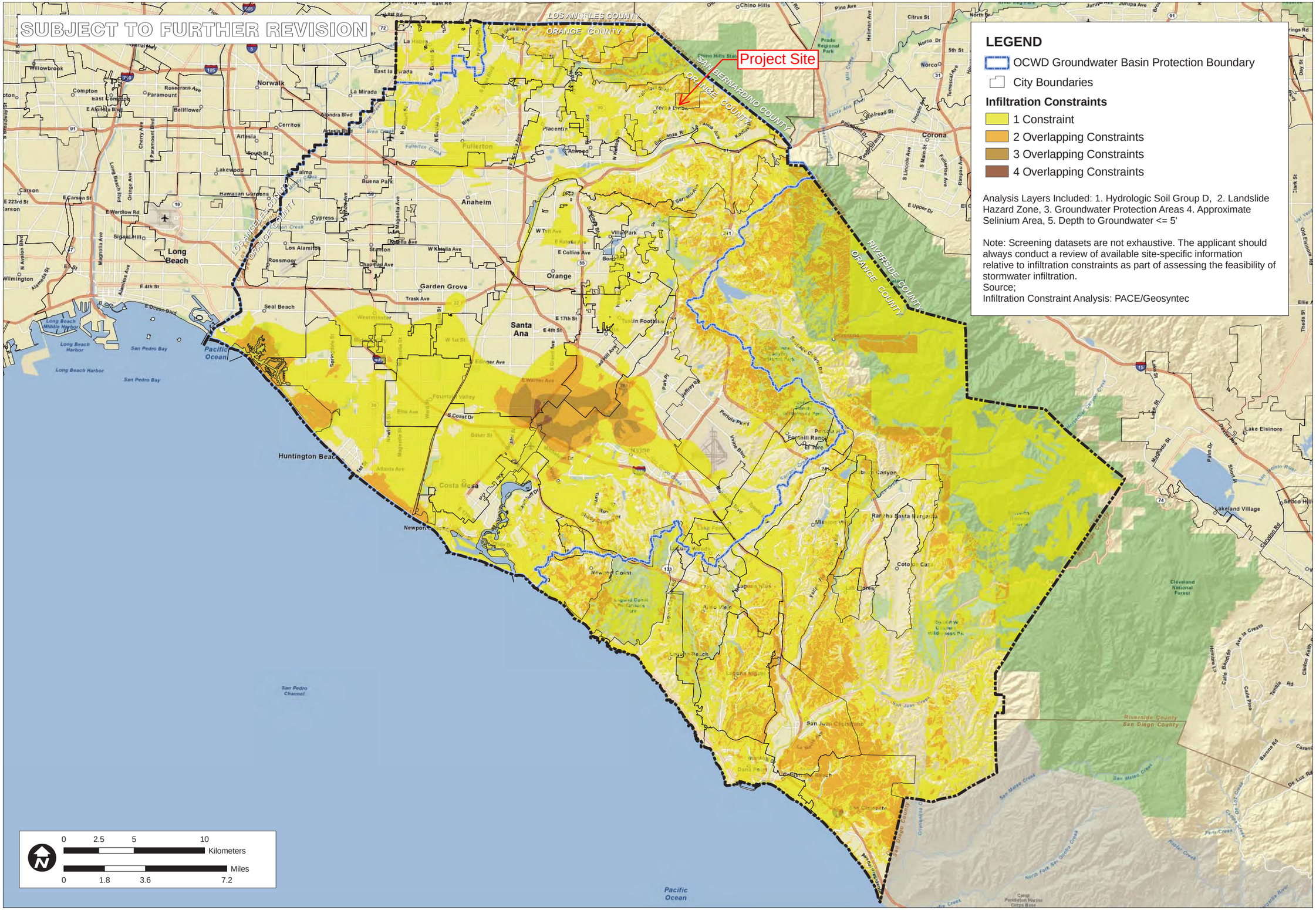
PACE
Advanced Water Engineering

FIGURE

XVI-2f

P:\9526E\16-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2f_NorthOCGroundwaterProtectionAreasStreetMap_20110215.mxd

SUBJECT TO FURTHER REVISION



LEGEND

- OCWD Groundwater Basin Protection Boundary
- City Boundaries

Infiltration Constraints

- 1 Constraint
- 2 Overlapping Constraints
- 3 Overlapping Constraints
- 4 Overlapping Constraints

Analysis Layers Included: 1. Hydrologic Soil Group D, 2. Landslide Hazard Zone, 3. Groundwater Protection Areas 4. Approximate Selinium Area, 5. Depth to Groundwater <= 5'

Note: Screening datasets are not exhaustive. The applicant should always conduct a review of available site-specific information relative to infiltration constraints as part of assessing the feasibility of stormwater infiltration.
Source;
Infiltration Constraint Analysis: PACE/Geosyntec

TITLE
INFILTRATION ANALYSIS
OVERLAPPING CONSTRAINT
LOCATIONS

JOB
ORANGE COUNTY
INFILTRATION STUDY
CA
ORANGE CO.

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	04/22/10
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2g

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2g_InfiltrationFinal_20110215.mxd

Susceptibility

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

Channel Type

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

Tidel Influence

- <= Mean High Water Line (4.28')

Water Body

- Basin
- Dam
- Lake
- Reservoir

Forest Areas

- Cleveland National Forest

Other Lands

- Airport/Military

San Bernardino County

Project Site

San Gabriel-Coyote Creek Watershed

CARBON CANYON

YORBA LINDA RESERVOIR

MILLER RETARDING BASIN

KRAEMER BASIN

ANAHEIM LAKE

WARNER BASIN

OLIVE HILLS

WALNUT CANYON RESERVOIR

FLETCHER RETARDING BASIN

VILLA PARK DAM

PETERS CANYON RESERVOIR

IRVINE LAKE

Riverside County

Santa Ana River Watershed

Anaheim Bay-Huntington Harbor Watershed

Seal Beach Naval Weapons Station

Naval Air Station

SOUTHPARK PUMP STATION

BARTLETT RETARDING BASIN

Huntington Beach

Costa Mesa

Newport Bay Watershed

John Wayne Airport

South Orange County

PRELIMINARY MAP - SUBJECT TO FURTHER REVISION

0 6,000 12,000 24,000 Feet

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-3c_SantaAnaRiverSusceptibility_20100430.mxd

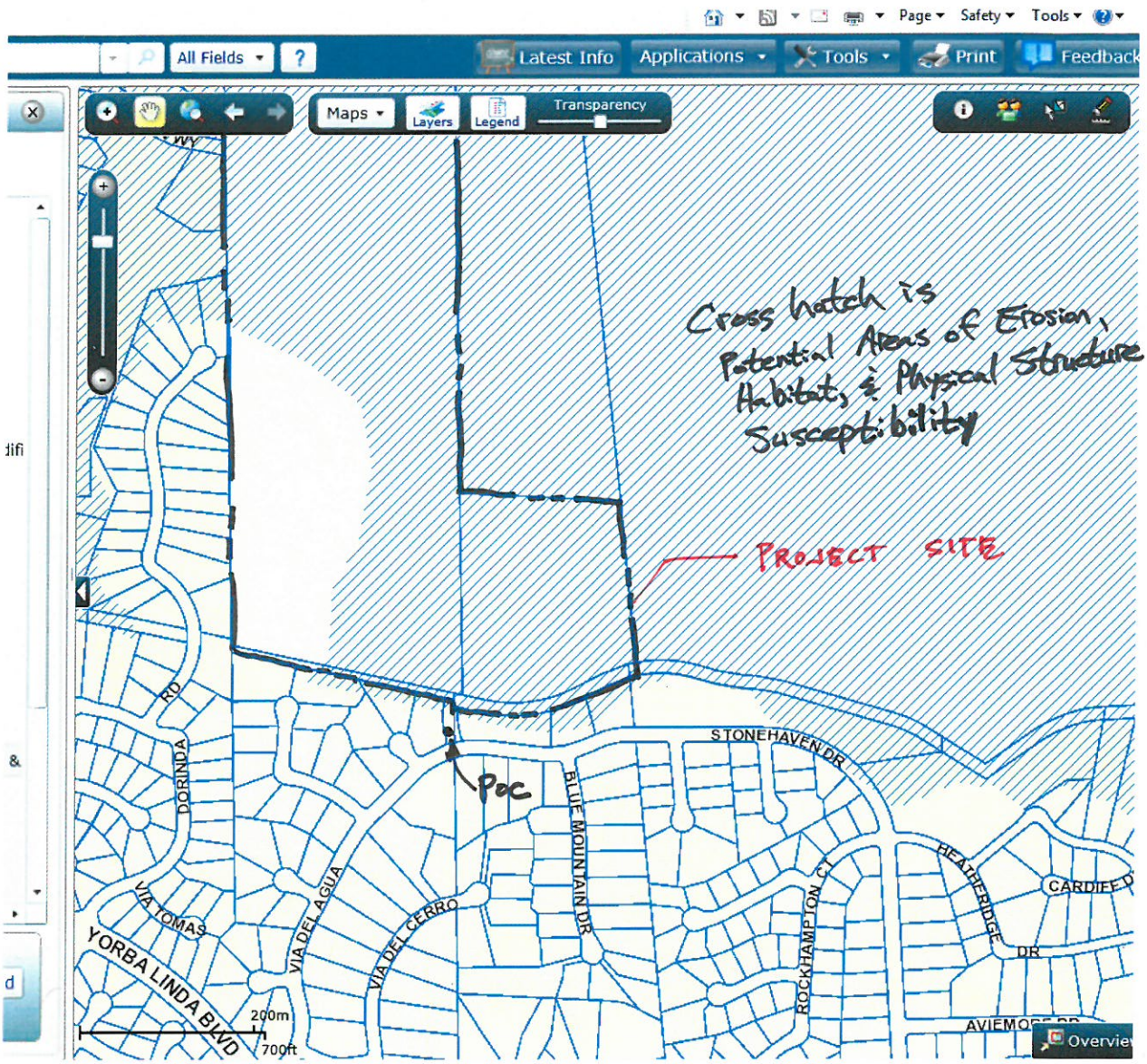
TITLE: SUSCEPTIBILITY ANALYIS SANTA ANA RIVER

JOB: ORANGE CO. WATERSHED MASTER PLANNING ORANGE COUNTY CA

SCALE	DESIGNED	DRAWING	CHECKED	DATE	JOB NO.
1" = 6000'	TH	TH	BMP	04/30/10	9526-E

PACE Advanced Water Engineering

FIGURE XVI-3c



From OC Land Records website

Attachment 2A

APPENDIX A.1

EXISTING CONDITION HYDROLOGY CALCULATIONS FOR HYDROMODIFICATION (2-YEAR, 24-HOUR STORM)

Planning Area 1 (South Site)

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

Study date 09/29/15 File Name EXPA1HYME.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6103

PLANNING AREA 1 - 8'x7' RCB
EXISTING CONDITIONS - HYDROMOD CALCULATIONS
2-YEAR 24-HOUR STORM
BY FUSCOE ENGINEERING

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	3.9	0.18	B	0.300	1.000	0.300
79.0	0.6	0.03	C	0.250	1.000	0.250
84.0	17.1	0.79	D	0.200	1.000	0.200

Area-averaged adjusted loss rate Fm (In/Hr) = 0.219

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
3.90	0.181	69.0	49.8	10.08	0.000
0.60	0.028	79.0	61.8	6.18	0.046
17.10	0.792	84.0	68.6	4.58	0.110

Area-averaged catchment yield fraction, Y = 0.088
Area-averaged low loss fraction, Yb = 0.912

++
Watercourse length = 2345.27(Ft.)
Length from concentration point to centroid = 1363.63(Ft.)
Elevation difference along watercourse = 205.10(Ft.)
Mannings friction factor along watercourse = 0.030
Watershed area = 21.60(Ac.)
Catchment Lag time = 0.099 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 84.5410
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.219(In/Hr)
Average low loss rate fraction (Yb) = 0.912 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.190(In)
Computed peak 30-minute rainfall = 0.400(In)
Specified peak 1-hour rainfall = 0.530(In)
Computed peak 3-hour rainfall = 0.890(In)
Specified peak 6-hour rainfall = 1.220(In)
Specified peak 24-hour rainfall = 2.050(In)

Rainfall depth area reduction factors:

Using a total area of 21.60(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.190(In)
30-minute factor = 0.999 Adjusted rainfall = 0.400(In)
1-hour factor = 0.999 Adjusted rainfall = 0.529(In)
3-hour factor = 1.000 Adjusted rainfall = 0.890(In)
6-hour factor = 1.000 Adjusted rainfall = 1.220(In)
24-hour factor = 1.000 Adjusted rainfall = 2.050(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 261.23 (CFS))	
1	9.978	26.064
2	60.958	133.173
3	83.680	59.355
4	92.874	24.018
5	97.200	11.302
6	98.640	3.760
7	99.318	1.771
8	99.826	1.329
9	100.000	0.453

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.1898	0.1898
2	0.2532	0.0633
3	0.2996	0.0464
4	0.3376	0.0380
5	0.3704	0.0328
6	0.3996	0.0292
7	0.4254	0.0258
8	0.4491	0.0237
9	0.4711	0.0220
10	0.4917	0.0206
11	0.5111	0.0194
12	0.5295	0.0184
13	0.5499	0.0204
14	0.5695	0.0196
15	0.5884	0.0189
16	0.6066	0.0182
17	0.6242	0.0176
18	0.6413	0.0171
19	0.6579	0.0166
20	0.6740	0.0161
21	0.6898	0.0157
22	0.7051	0.0153
23	0.7201	0.0150
24	0.7347	0.0146
25	0.7490	0.0143
26	0.7630	0.0140
27	0.7768	0.0137
28	0.7902	0.0135
29	0.8034	0.0132
30	0.8164	0.0130
31	0.8292	0.0128
32	0.8417	0.0125
33	0.8540	0.0123
34	0.8662	0.0121
35	0.8781	0.0119
36	0.8899	0.0118
37	0.9011	0.0112
38	0.9121	0.0110
39	0.9229	0.0108
40	0.9336	0.0107
41	0.9441	0.0106
42	0.9546	0.0104
43	0.9648	0.0103
44	0.9750	0.0101
45	0.9850	0.0100
46	0.9949	0.0099
47	1.0047	0.0098

48	1.0144	0.0097
49	1.0239	0.0096
50	1.0334	0.0095
51	1.0427	0.0094
52	1.0520	0.0093
53	1.0612	0.0092
54	1.0702	0.0091
55	1.0792	0.0090
56	1.0881	0.0089
57	1.0969	0.0088
58	1.1056	0.0087
59	1.1142	0.0086
60	1.1228	0.0086
61	1.1313	0.0085
62	1.1397	0.0084
63	1.1480	0.0083
64	1.1562	0.0083
65	1.1644	0.0082
66	1.1726	0.0081
67	1.1806	0.0081
68	1.1886	0.0080
69	1.1965	0.0079
70	1.2044	0.0079
71	1.2122	0.0078
72	1.2199	0.0077
73	1.2262	0.0063
74	1.2325	0.0063
75	1.2387	0.0062
76	1.2449	0.0062
77	1.2510	0.0061
78	1.2570	0.0061
79	1.2630	0.0060
80	1.2690	0.0060
81	1.2749	0.0059
82	1.2808	0.0059
83	1.2866	0.0058
84	1.2924	0.0058
85	1.2981	0.0057
86	1.3038	0.0057
87	1.3095	0.0057
88	1.3151	0.0056
89	1.3207	0.0056
90	1.3262	0.0055
91	1.3317	0.0055
92	1.3372	0.0055
93	1.3426	0.0054
94	1.3480	0.0054
95	1.3533	0.0054
96	1.3587	0.0053
97	1.3639	0.0053
98	1.3692	0.0052
99	1.3744	0.0052
100	1.3796	0.0052
101	1.3847	0.0051
102	1.3898	0.0051
103	1.3949	0.0051
104	1.4000	0.0051
105	1.4050	0.0050
106	1.4100	0.0050
107	1.4150	0.0050
108	1.4199	0.0049
109	1.4248	0.0049
110	1.4297	0.0049
111	1.4345	0.0049
112	1.4394	0.0048
113	1.4442	0.0048
114	1.4489	0.0048
115	1.4537	0.0047
116	1.4584	0.0047
117	1.4631	0.0047
118	1.4678	0.0047
119	1.4724	0.0046
120	1.4770	0.0046
121	1.4816	0.0046
122	1.4862	0.0046
123	1.4908	0.0045

124	1.4953	0.0045
125	1.4998	0.0045
126	1.5043	0.0045
127	1.5087	0.0045
128	1.5132	0.0044
129	1.5176	0.0044
130	1.5220	0.0044
131	1.5263	0.0044
132	1.5307	0.0044
133	1.5350	0.0043
134	1.5393	0.0043
135	1.5436	0.0043
136	1.5479	0.0043
137	1.5521	0.0043
138	1.5564	0.0042
139	1.5606	0.0042
140	1.5648	0.0042
141	1.5690	0.0042
142	1.5731	0.0042
143	1.5773	0.0041
144	1.5814	0.0041
145	1.5855	0.0041
146	1.5896	0.0041
147	1.5936	0.0041
148	1.5977	0.0041
149	1.6017	0.0040
150	1.6057	0.0040
151	1.6097	0.0040
152	1.6137	0.0040
153	1.6177	0.0040
154	1.6216	0.0040
155	1.6256	0.0039
156	1.6295	0.0039
157	1.6334	0.0039
158	1.6373	0.0039
159	1.6412	0.0039
160	1.6450	0.0039
161	1.6488	0.0038
162	1.6527	0.0038
163	1.6565	0.0038
164	1.6603	0.0038
165	1.6641	0.0038
166	1.6678	0.0038
167	1.6716	0.0038
168	1.6753	0.0037
169	1.6791	0.0037
170	1.6828	0.0037
171	1.6865	0.0037
172	1.6902	0.0037
173	1.6938	0.0037
174	1.6975	0.0037
175	1.7011	0.0036
176	1.7048	0.0036
177	1.7084	0.0036
178	1.7120	0.0036
179	1.7156	0.0036
180	1.7192	0.0036
181	1.7227	0.0036
182	1.7263	0.0036
183	1.7298	0.0035
184	1.7334	0.0035
185	1.7369	0.0035
186	1.7404	0.0035
187	1.7439	0.0035
188	1.7474	0.0035
189	1.7509	0.0035
190	1.7543	0.0035
191	1.7578	0.0035
192	1.7612	0.0034
193	1.7646	0.0034
194	1.7681	0.0034
195	1.7715	0.0034
196	1.7749	0.0034
197	1.7783	0.0034
198	1.7816	0.0034
199	1.7850	0.0034

200	1.7883	0.0034
201	1.7917	0.0033
202	1.7950	0.0033
203	1.7983	0.0033
204	1.8017	0.0033
205	1.8050	0.0033
206	1.8082	0.0033
207	1.8115	0.0033
208	1.8148	0.0033
209	1.8181	0.0033
210	1.8213	0.0033
211	1.8246	0.0032
212	1.8278	0.0032
213	1.8310	0.0032
214	1.8342	0.0032
215	1.8374	0.0032
216	1.8406	0.0032
217	1.8438	0.0032
218	1.8470	0.0032
219	1.8502	0.0032
220	1.8533	0.0032
221	1.8565	0.0031
222	1.8596	0.0031
223	1.8627	0.0031
224	1.8659	0.0031
225	1.8690	0.0031
226	1.8721	0.0031
227	1.8752	0.0031
228	1.8783	0.0031
229	1.8813	0.0031
230	1.8844	0.0031
231	1.8875	0.0031
232	1.8905	0.0031
233	1.8936	0.0030
234	1.8966	0.0030
235	1.8996	0.0030
236	1.9027	0.0030
237	1.9057	0.0030
238	1.9087	0.0030
239	1.9117	0.0030
240	1.9147	0.0030
241	1.9177	0.0030
242	1.9206	0.0030
243	1.9236	0.0030
244	1.9266	0.0030
245	1.9295	0.0030
246	1.9325	0.0029
247	1.9354	0.0029
248	1.9383	0.0029
249	1.9413	0.0029
250	1.9442	0.0029
251	1.9471	0.0029
252	1.9500	0.0029
253	1.9529	0.0029
254	1.9558	0.0029
255	1.9586	0.0029
256	1.9615	0.0029
257	1.9644	0.0029
258	1.9672	0.0029
259	1.9701	0.0029
260	1.9729	0.0028
261	1.9758	0.0028
262	1.9786	0.0028
263	1.9814	0.0028
264	1.9842	0.0028
265	1.9871	0.0028
266	1.9899	0.0028
267	1.9927	0.0028
268	1.9954	0.0028
269	1.9982	0.0028
270	2.0010	0.0028
271	2.0038	0.0028
272	2.0065	0.0028
273	2.0093	0.0028
274	2.0121	0.0028
275	2.0148	0.0027

276	2.0175	0.0027
277	2.0203	0.0027
278	2.0230	0.0027
279	2.0257	0.0027
280	2.0284	0.0027
281	2.0311	0.0027
282	2.0338	0.0027
283	2.0365	0.0027
284	2.0392	0.0027
285	2.0419	0.0027
286	2.0446	0.0027
287	2.0473	0.0027
288	2.0499	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0027	0.0024	0.0002
2	0.0027	0.0024	0.0002
3	0.0027	0.0024	0.0002
4	0.0027	0.0025	0.0002
5	0.0027	0.0025	0.0002
6	0.0027	0.0025	0.0002
7	0.0027	0.0025	0.0002
8	0.0027	0.0025	0.0002
9	0.0027	0.0025	0.0002
10	0.0027	0.0025	0.0002
11	0.0028	0.0025	0.0002
12	0.0028	0.0025	0.0002
13	0.0028	0.0025	0.0002
14	0.0028	0.0025	0.0002
15	0.0028	0.0026	0.0002
16	0.0028	0.0026	0.0002
17	0.0028	0.0026	0.0002
18	0.0028	0.0026	0.0002
19	0.0028	0.0026	0.0003
20	0.0028	0.0026	0.0003
21	0.0029	0.0026	0.0003
22	0.0029	0.0026	0.0003
23	0.0029	0.0026	0.0003
24	0.0029	0.0026	0.0003
25	0.0029	0.0026	0.0003
26	0.0029	0.0027	0.0003
27	0.0029	0.0027	0.0003
28	0.0029	0.0027	0.0003
29	0.0029	0.0027	0.0003
30	0.0030	0.0027	0.0003
31	0.0030	0.0027	0.0003
32	0.0030	0.0027	0.0003
33	0.0030	0.0027	0.0003
34	0.0030	0.0027	0.0003
35	0.0030	0.0027	0.0003
36	0.0030	0.0028	0.0003
37	0.0030	0.0028	0.0003
38	0.0030	0.0028	0.0003
39	0.0031	0.0028	0.0003
40	0.0031	0.0028	0.0003
41	0.0031	0.0028	0.0003
42	0.0031	0.0028	0.0003
43	0.0031	0.0028	0.0003
44	0.0031	0.0028	0.0003
45	0.0031	0.0029	0.0003
46	0.0031	0.0029	0.0003
47	0.0032	0.0029	0.0003
48	0.0032	0.0029	0.0003
49	0.0032	0.0029	0.0003
50	0.0032	0.0029	0.0003
51	0.0032	0.0029	0.0003
52	0.0032	0.0029	0.0003
53	0.0033	0.0030	0.0003
54	0.0033	0.0030	0.0003
55	0.0033	0.0030	0.0003
56	0.0033	0.0030	0.0003
57	0.0033	0.0030	0.0003
58	0.0033	0.0030	0.0003

59	0.0033	0.0030	0.0003
60	0.0034	0.0031	0.0003
61	0.0034	0.0031	0.0003
62	0.0034	0.0031	0.0003
63	0.0034	0.0031	0.0003
64	0.0034	0.0031	0.0003
65	0.0034	0.0031	0.0003
66	0.0035	0.0031	0.0003
67	0.0035	0.0032	0.0003
68	0.0035	0.0032	0.0003
69	0.0035	0.0032	0.0003
70	0.0035	0.0032	0.0003
71	0.0035	0.0032	0.0003
72	0.0036	0.0032	0.0003
73	0.0036	0.0033	0.0003
74	0.0036	0.0033	0.0003
75	0.0036	0.0033	0.0003
76	0.0036	0.0033	0.0003
77	0.0037	0.0033	0.0003
78	0.0037	0.0033	0.0003
79	0.0037	0.0034	0.0003
80	0.0037	0.0034	0.0003
81	0.0037	0.0034	0.0003
82	0.0038	0.0034	0.0003
83	0.0038	0.0034	0.0003
84	0.0038	0.0035	0.0003
85	0.0038	0.0035	0.0003
86	0.0038	0.0035	0.0003
87	0.0039	0.0035	0.0003
88	0.0039	0.0035	0.0003
89	0.0039	0.0036	0.0003
90	0.0039	0.0036	0.0003
91	0.0040	0.0036	0.0004
92	0.0040	0.0036	0.0004
93	0.0040	0.0037	0.0004
94	0.0040	0.0037	0.0004
95	0.0041	0.0037	0.0004
96	0.0041	0.0037	0.0004
97	0.0041	0.0038	0.0004
98	0.0041	0.0038	0.0004
99	0.0042	0.0038	0.0004
100	0.0042	0.0038	0.0004
101	0.0042	0.0039	0.0004
102	0.0043	0.0039	0.0004
103	0.0043	0.0039	0.0004
104	0.0043	0.0039	0.0004
105	0.0044	0.0040	0.0004
106	0.0044	0.0040	0.0004
107	0.0044	0.0040	0.0004
108	0.0044	0.0040	0.0004
109	0.0045	0.0041	0.0004
110	0.0045	0.0041	0.0004
111	0.0045	0.0041	0.0004
112	0.0046	0.0042	0.0004
113	0.0046	0.0042	0.0004
114	0.0046	0.0042	0.0004
115	0.0047	0.0043	0.0004
116	0.0047	0.0043	0.0004
117	0.0048	0.0044	0.0004
118	0.0048	0.0044	0.0004
119	0.0049	0.0044	0.0004
120	0.0049	0.0044	0.0004
121	0.0049	0.0045	0.0004
122	0.0050	0.0045	0.0004
123	0.0050	0.0046	0.0004
124	0.0051	0.0046	0.0004
125	0.0051	0.0047	0.0005
126	0.0051	0.0047	0.0005
127	0.0052	0.0048	0.0005
128	0.0052	0.0048	0.0005
129	0.0053	0.0048	0.0005
130	0.0054	0.0049	0.0005
131	0.0054	0.0049	0.0005
132	0.0055	0.0050	0.0005
133	0.0055	0.0050	0.0005
134	0.0056	0.0051	0.0005

135	0.0057	0.0052	0.0005
136	0.0057	0.0052	0.0005
137	0.0058	0.0053	0.0005
138	0.0058	0.0053	0.0005
139	0.0059	0.0054	0.0005
140	0.0060	0.0054	0.0005
141	0.0061	0.0055	0.0005
142	0.0061	0.0056	0.0005
143	0.0062	0.0057	0.0005
144	0.0063	0.0057	0.0006
145	0.0077	0.0071	0.0007
146	0.0078	0.0071	0.0007
147	0.0079	0.0072	0.0007
148	0.0080	0.0073	0.0007
149	0.0081	0.0074	0.0007
150	0.0082	0.0075	0.0007
151	0.0083	0.0076	0.0007
152	0.0084	0.0077	0.0007
153	0.0086	0.0078	0.0008
154	0.0086	0.0079	0.0008
155	0.0088	0.0080	0.0008
156	0.0089	0.0081	0.0008
157	0.0091	0.0083	0.0008
158	0.0092	0.0084	0.0008
159	0.0094	0.0085	0.0008
160	0.0095	0.0086	0.0008
161	0.0097	0.0088	0.0009
162	0.0098	0.0089	0.0009
163	0.0100	0.0091	0.0009
164	0.0101	0.0093	0.0009
165	0.0104	0.0095	0.0009
166	0.0106	0.0096	0.0009
167	0.0108	0.0099	0.0010
168	0.0110	0.0100	0.0010
169	0.0118	0.0107	0.0010
170	0.0119	0.0109	0.0011
171	0.0123	0.0112	0.0011
172	0.0125	0.0114	0.0011
173	0.0130	0.0118	0.0011
174	0.0132	0.0120	0.0012
175	0.0137	0.0125	0.0012
176	0.0140	0.0128	0.0012
177	0.0146	0.0133	0.0013
178	0.0150	0.0136	0.0013
179	0.0157	0.0143	0.0014
180	0.0161	0.0147	0.0014
181	0.0171	0.0156	0.0015
182	0.0176	0.0161	0.0016
183	0.0189	0.0172	0.0017
184	0.0196	0.0179	0.0017
185	0.0184	0.0168	0.0016
186	0.0194	0.0177	0.0017
187	0.0220	0.0183	0.0037
188	0.0237	0.0183	0.0054
189	0.0292	0.0183	0.0109
190	0.0328	0.0183	0.0145
191	0.0464	0.0183	0.0282
192	0.0633	0.0183	0.0451
193	0.1898	0.0183	0.1715
194	0.0380	0.0183	0.0198
195	0.0258	0.0183	0.0075
196	0.0206	0.0183	0.0023
197	0.0204	0.0183	0.0021
198	0.0182	0.0166	0.0016
199	0.0166	0.0151	0.0015
200	0.0153	0.0140	0.0014
201	0.0143	0.0130	0.0013
202	0.0135	0.0123	0.0012
203	0.0128	0.0116	0.0011
204	0.0121	0.0111	0.0011
205	0.0112	0.0102	0.0010
206	0.0107	0.0098	0.0009
207	0.0103	0.0094	0.0009
208	0.0099	0.0090	0.0009
209	0.0096	0.0087	0.0008
210	0.0093	0.0084	0.0008

211	0.0090	0.0082	0.0008
212	0.0087	0.0079	0.0008
213	0.0085	0.0077	0.0007
214	0.0083	0.0075	0.0007
215	0.0081	0.0073	0.0007
216	0.0079	0.0072	0.0007
217	0.0063	0.0058	0.0006
218	0.0062	0.0056	0.0005
219	0.0060	0.0055	0.0005
220	0.0059	0.0054	0.0005
221	0.0057	0.0052	0.0005
222	0.0056	0.0051	0.0005
223	0.0055	0.0050	0.0005
224	0.0054	0.0049	0.0005
225	0.0053	0.0048	0.0005
226	0.0052	0.0047	0.0005
227	0.0051	0.0046	0.0004
228	0.0050	0.0046	0.0004
229	0.0049	0.0045	0.0004
230	0.0048	0.0044	0.0004
231	0.0047	0.0043	0.0004
232	0.0047	0.0043	0.0004
233	0.0046	0.0042	0.0004
234	0.0045	0.0041	0.0004
235	0.0045	0.0041	0.0004
236	0.0044	0.0040	0.0004
237	0.0043	0.0039	0.0004
238	0.0043	0.0039	0.0004
239	0.0042	0.0038	0.0004
240	0.0042	0.0038	0.0004
241	0.0041	0.0037	0.0004
242	0.0041	0.0037	0.0004
243	0.0040	0.0036	0.0004
244	0.0040	0.0036	0.0003
245	0.0039	0.0036	0.0003
246	0.0039	0.0035	0.0003
247	0.0038	0.0035	0.0003
248	0.0038	0.0034	0.0003
249	0.0037	0.0034	0.0003
250	0.0037	0.0034	0.0003
251	0.0036	0.0033	0.0003
252	0.0036	0.0033	0.0003
253	0.0036	0.0033	0.0003
254	0.0035	0.0032	0.0003
255	0.0035	0.0032	0.0003
256	0.0035	0.0032	0.0003
257	0.0034	0.0031	0.0003
258	0.0034	0.0031	0.0003
259	0.0034	0.0031	0.0003
260	0.0033	0.0030	0.0003
261	0.0033	0.0030	0.0003
262	0.0033	0.0030	0.0003
263	0.0032	0.0030	0.0003
264	0.0032	0.0029	0.0003
265	0.0032	0.0029	0.0003
266	0.0032	0.0029	0.0003
267	0.0031	0.0029	0.0003
268	0.0031	0.0028	0.0003
269	0.0031	0.0028	0.0003
270	0.0031	0.0028	0.0003
271	0.0030	0.0028	0.0003
272	0.0030	0.0027	0.0003
273	0.0030	0.0027	0.0003
274	0.0030	0.0027	0.0003
275	0.0029	0.0027	0.0003
276	0.0029	0.0027	0.0003
277	0.0029	0.0026	0.0003
278	0.0029	0.0026	0.0003
279	0.0029	0.0026	0.0003
280	0.0028	0.0026	0.0003
281	0.0028	0.0026	0.0002
282	0.0028	0.0025	0.0002
283	0.0028	0.0025	0.0002
284	0.0028	0.0025	0.0002
285	0.0027	0.0025	0.0002
286	0.0027	0.0025	0.0002

```
     287              0.0027           0.0025              0.0002
     288              0.0027           0.0024              0.0002
     ------------------------------------------------------------------------
     ------------------------------------------------------------------------
     Total soil rain loss =      1.60(In)
     Total effective rainfall =      0.45(In)
     Peak flow rate in flood hydrograph =     26.93(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))

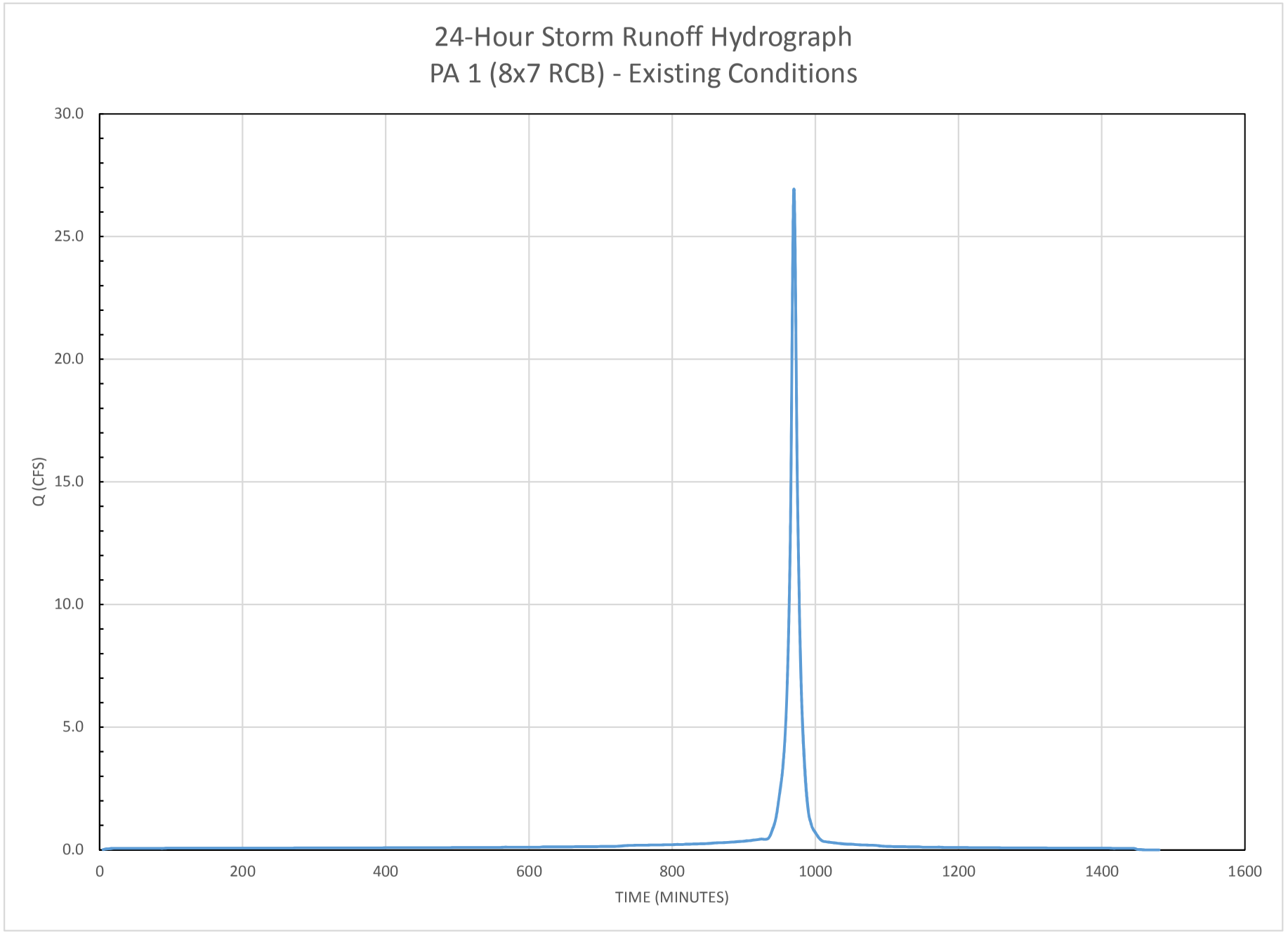
     ------------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        7.5      15.0      22.5      30.0
-------------------------------------------------------------------------
  0+ 5       0.0000      0.01  Q          |          |          |          |
  0+10       0.0003      0.04  Q          |          |          |          |
  0+15       0.0007      0.05  Q          |          |          |          |
  0+20       0.0011      0.06  Q          |          |          |          |
  0+25       0.0015      0.06  Q          |          |          |          |
  0+30       0.0019      0.06  Q          |          |          |          |
  0+35       0.0023      0.06  Q          |          |          |          |
  0+40       0.0027      0.06  Q          |          |          |          |
  0+45       0.0032      0.06  Q          |          |          |          |
  0+50       0.0036      0.06  Q          |          |          |          |
  0+55       0.0041      0.06  Q          |          |          |          |
  1+ 0       0.0045      0.06  Q          |          |          |          |
  1+ 5       0.0049      0.06  Q          |          |          |          |
  1+10       0.0054      0.06  Q          |          |          |          |
  1+15       0.0058      0.06  Q          |          |          |          |
  1+20       0.0063      0.06  Q          |          |          |          |
  1+25       0.0067      0.06  Q          |          |          |          |
  1+30       0.0071      0.06  Q          |          |          |          |
  1+35       0.0076      0.07  Q          |          |          |          |
  1+40       0.0080      0.07  Q          |          |          |          |
  1+45       0.0085      0.07  Q          |          |          |          |
  1+50       0.0089      0.07  Q          |          |          |          |
  1+55       0.0094      0.07  Q          |          |          |          |
  2+ 0       0.0099      0.07  Q          |          |          |          |
  2+ 5       0.0103      0.07  Q          |          |          |          |
  2+10       0.0108      0.07  Q          |          |          |          |
  2+15       0.0112      0.07  Q          |          |          |          |
  2+20       0.0117      0.07  Q          |          |          |          |
  2+25       0.0122      0.07  Q          |          |          |          |
  2+30       0.0126      0.07  Q          |          |          |          |
  2+35       0.0131      0.07  Q          |          |          |          |
  2+40       0.0136      0.07  Q          |          |          |          |
  2+45       0.0140      0.07  Q          |          |          |          |
  2+50       0.0145      0.07  Q          |          |          |          |
  2+55       0.0150      0.07  Q          |          |          |          |
  3+ 0       0.0155      0.07  Q          |          |          |          |
  3+ 5       0.0159      0.07  Q          |          |          |          |
  3+10       0.0164      0.07  Q          |          |          |          |
  3+15       0.0169      0.07  Q          |          |          |          |
  3+20       0.0174      0.07  Q          |          |          |          |
  3+25       0.0179      0.07  Q          |          |          |          |
  3+30       0.0184      0.07  Q          |          |          |          |
  3+35       0.0189      0.07  Q          |          |          |          |
  3+40       0.0194      0.07  Q          |          |          |          |
  3+45       0.0199      0.07  Q          |          |          |          |
  3+50       0.0204      0.07  QV         |          |          |          |
  3+55       0.0209      0.07  QV         |          |          |          |
  4+ 0       0.0214      0.07  QV         |          |          |          |
  4+ 5       0.0219      0.07  QV         |          |          |          |
  4+10       0.0224      0.07  QV         |          |          |          |
  4+15       0.0229      0.07  QV         |          |          |          |
  4+20       0.0234      0.07  QV         |          |          |          |
  4+25       0.0239      0.07  QV         |          |          |          |
  4+30       0.0244      0.07  QV         |          |          |          |
  4+35       0.0249      0.08  QV         |          |          |          |
  4+40       0.0254      0.08  QV         |          |          |          |
  4+45       0.0260      0.08  QV         |          |          |          |
  4+50       0.0265      0.08  QV         |          |          |          |
  4+55       0.0270      0.08  QV         |          |          |          |
```

5+ 0	0.0275	0.08	QV	|	|	|	|
5+ 5	0.0281	0.08	QV	|	|	|	|
5+10	0.0286	0.08	QV	|	|	|	|
5+15	0.0292	0.08	QV	|	|	|	|
5+20	0.0297	0.08	QV	|	|	|	|
5+25	0.0302	0.08	QV	|	|	|	|
5+30	0.0308	0.08	QV	|	|	|	|
5+35	0.0313	0.08	QV	|	|	|	|
5+40	0.0319	0.08	QV	|	|	|	|
5+45	0.0324	0.08	QV	|	|	|	|
5+50	0.0330	0.08	QV	|	|	|	|
5+55	0.0335	0.08	QV	|	|	|	|
6+ 0	0.0341	0.08	QV	|	|	|	|
6+ 5	0.0347	0.08	QV	|	|	|	|
6+10	0.0352	0.08	QV	|	|	|	|
6+15	0.0358	0.08	QV	|	|	|	|
6+20	0.0364	0.08	QV	|	|	|	|
6+25	0.0370	0.08	QV	|	|	|	|
6+30	0.0375	0.08	QV	|	|	|	|
6+35	0.0381	0.08	QV	|	|	|	|
6+40	0.0387	0.09	QV	|	|	|	|
6+45	0.0393	0.09	QV	|	|	|	|
6+50	0.0399	0.09	QV	|	|	|	|
6+55	0.0405	0.09	Q V	|	|	|	|
7+ 0	0.0411	0.09	Q V	|	|	|	|
7+ 5	0.0417	0.09	Q V	|	|	|	|
7+10	0.0423	0.09	Q V	|	|	|	|
7+15	0.0429	0.09	Q V	|	|	|	|
7+20	0.0435	0.09	Q V	|	|	|	|
7+25	0.0441	0.09	Q V	|	|	|	|
7+30	0.0447	0.09	Q V	|	|	|	|
7+35	0.0454	0.09	Q V	|	|	|	|
7+40	0.0460	0.09	Q V	|	|	|	|
7+45	0.0466	0.09	Q V	|	|	|	|
7+50	0.0473	0.09	Q V	|	|	|	|
7+55	0.0479	0.09	Q V	|	|	|	|
8+ 0	0.0485	0.09	Q V	|	|	|	|
8+ 5	0.0492	0.09	Q V	|	|	|	|
8+10	0.0498	0.09	Q V	|	|	|	|
8+15	0.0505	0.10	Q V	|	|	|	|
8+20	0.0512	0.10	Q V	|	|	|	|
8+25	0.0518	0.10	Q V	|	|	|	|
8+30	0.0525	0.10	Q V	|	|	|	|
8+35	0.0532	0.10	Q V	|	|	|	|
8+40	0.0538	0.10	Q V	|	|	|	|
8+45	0.0545	0.10	Q V	|	|	|	|
8+50	0.0552	0.10	Q V	|	|	|	|
8+55	0.0559	0.10	Q V	|	|	|	|
9+ 0	0.0566	0.10	Q V	|	|	|	|
9+ 5	0.0573	0.10	Q V	|	|	|	|
9+10	0.0580	0.10	Q V	|	|	|	|
9+15	0.0587	0.10	Q V	|	|	|	|
9+20	0.0594	0.10	Q V	|	|	|	|
9+25	0.0602	0.11	Q V	|	|	|	|
9+30	0.0609	0.11	Q V	|	|	|	|
9+35	0.0616	0.11	Q V	|	|	|	|
9+40	0.0624	0.11	Q V	|	|	|	|
9+45	0.0631	0.11	Q V	|	|	|	|
9+50	0.0639	0.11	Q V	|	|	|	|
9+55	0.0646	0.11	Q V	|	|	|	|
10+ 0	0.0654	0.11	Q V	|	|	|	|
10+ 5	0.0662	0.11	Q V	|	|	|	|
10+10	0.0670	0.11	Q V	|	|	|	|
10+15	0.0677	0.11	Q V	|	|	|	|
10+20	0.0685	0.12	Q V	|	|	|	|
10+25	0.0693	0.12	Q V	|	|	|	|
10+30	0.0701	0.12	Q V	|	|	|	|
10+35	0.0710	0.12	Q V	|	|	|	|
10+40	0.0718	0.12	Q V	|	|	|	|
10+45	0.0726	0.12	Q V	|	|	|	|
10+50	0.0735	0.12	Q V	|	|	|	|
10+55	0.0743	0.12	Q V	|	|	|	|
11+ 0	0.0752	0.12	Q V	|	|	|	|
11+ 5	0.0760	0.13	Q V	|	|	|	|
11+10	0.0769	0.13	Q V	|	|	|	|
11+15	0.0778	0.13	Q V	|	|	|	|

```
11+20       0.0787      0.13  Q  V      |          |          |          |
11+25       0.0796      0.13  Q  V      |          |          |          |
11+30       0.0805      0.13  Q   V     |          |          |          |
11+35       0.0814      0.13  Q   V     |          |          |          |
11+40       0.0823      0.14  Q   V     |          |          |          |
11+45       0.0833      0.14  Q   V     |          |          |          |
11+50       0.0842      0.14  Q   V     |          |          |          |
11+55       0.0852      0.14  Q   V     |          |          |          |
12+ 0       0.0862      0.14  Q   V     |          |          |          |
12+ 5       0.0872      0.15  Q   V     |          |          |          |
12+10       0.0883      0.16  Q   V     |          |          |          |
12+15       0.0895      0.17  Q   V     |          |          |          |
12+20       0.0908      0.18  Q   V     |          |          |          |
12+25       0.0920      0.18  Q   V     |          |          |          |
12+30       0.0933      0.19  Q   V     |          |          |          |
12+35       0.0946      0.19  Q   V     |          |          |          |
12+40       0.0959      0.19  Q   V     |          |          |          |
12+45       0.0972      0.19  Q   V     |          |          |          |
12+50       0.0986      0.20  Q   V     |          |          |          |
12+55       0.0999      0.20  Q   V     |          |          |          |
13+ 0       0.1013      0.20  Q    V    |          |          |          |
13+ 5       0.1027      0.20  Q    V    |          |          |          |
13+10       0.1041      0.21  Q    V    |          |          |          |
13+15       0.1056      0.21  Q    V    |          |          |          |
13+20       0.1071      0.21  Q    V    |          |          |          |
13+25       0.1086      0.22  Q    V    |          |          |          |
13+30       0.1101      0.22  Q    V    |          |          |          |
13+35       0.1116      0.22  Q    V    |          |          |          |
13+40       0.1132      0.23  Q    V    |          |          |          |
13+45       0.1148      0.23  Q    V    |          |          |          |
13+50       0.1164      0.24  Q    V    |          |          |          |
13+55       0.1181      0.24  Q    V    |          |          |          |
14+ 0       0.1198      0.25  Q    V    |          |          |          |
14+ 5       0.1215      0.25  Q     V   |          |          |          |
14+10       0.1233      0.26  Q     V   |          |          |          |
14+15       0.1252      0.27  Q     V   |          |          |          |
14+20       0.1271      0.28  Q     V   |          |          |          |
14+25       0.1291      0.29  Q     V   |          |          |          |
14+30       0.1311      0.29  Q     V   |          |          |          |
14+35       0.1332      0.30  Q     V   |          |          |          |
14+40       0.1353      0.31  Q     V   |          |          |          |
14+45       0.1375      0.32  Q     V   |          |          |          |
14+50       0.1398      0.33  Q     V   |          |          |          |
14+55       0.1422      0.34  Q      V  |          |          |          |
15+ 0       0.1446      0.35  Q      V  |          |          |          |
15+ 5       0.1471      0.37  Q      V  |          |          |          |
15+10       0.1498      0.38  Q      V  |          |          |          |
15+15       0.1525      0.40  Q      V  |          |          |          |
15+20       0.1554      0.42  Q      V  |          |          |          |
15+25       0.1584      0.44  Q      V  |          |          |          |
15+30       0.1614      0.43  Q       V |          |          |          |
15+35       0.1648      0.49  Q       V |          |          |          |
15+40       0.1704      0.81  |Q       V |          |          |          |
15+45       0.1793      1.30  |Q       V |          |          |          |
15+50       0.1949      2.27  |  Q     V|          |          |          |
15+55       0.2190      3.50  |   Q     V          |          |          |
16+ 0       0.2612      6.13  |       Q | V        |          |          |
16+ 5       0.3483     12.64  |         |    QV    |          |          |
16+10       0.5337     26.93  |         |          |     V    |    Q     |
16+15       0.6335     14.49  |         |       Q  |          |V         |
16+20       0.6818      7.01  |        Q|          |          |  V       |
16+25       0.7057      3.46  |   Q     |          |          |    V     |
16+30       0.7169      1.63  | Q       |          |          |    V     |
16+35       0.7236      0.97  |Q        |          |          |     V    |
16+40       0.7285      0.71  Q         |          |          |     V    |
16+45       0.7319      0.49  Q         |          |          |     V    |
16+50       0.7344      0.36  Q         |          |          |     V    |
16+55       0.7367      0.33  Q         |          |          |     V    |
17+ 0       0.7388      0.31  Q         |          |          |     V    |
17+ 5       0.7408      0.29  Q         |          |          |     V    |
17+10       0.7426      0.27  Q         |          |          |     V    |
17+15       0.7444      0.26  Q         |          |          |      V   |
17+20       0.7461      0.24  Q         |          |          |      V   |
17+25       0.7477      0.23  Q         |          |          |      V   |
17+30       0.7492      0.23  Q         |          |          |      V   |
17+35       0.7507      0.22  Q         |          |          |      V   |
```

17+40	0.7522	0.21	Q	|	|	|	V |
17+45	0.7536	0.20	Q	|	|	|	V |
17+50	0.7550	0.20	Q	|	|	|	V |
17+55	0.7563	0.19	Q	|	|	|	V |
18+ 0	0.7576	0.19	Q	|	|	|	V |
18+ 5	0.7588	0.18	Q	|	|	|	V |
18+10	0.7600	0.16	Q	|	|	|	V |
18+15	0.7610	0.15	Q	|	|	|	V |
18+20	0.7620	0.14	Q	|	|	|	V |
18+25	0.7629	0.14	Q	|	|	|	V |
18+30	0.7639	0.13	Q	|	|	|	V |
18+35	0.7648	0.13	Q	|	|	|	V |
18+40	0.7656	0.13	Q	|	|	|	V |
18+45	0.7665	0.13	Q	|	|	|	V |
18+50	0.7674	0.12	Q	|	|	|	V |
18+55	0.7682	0.12	Q	|	|	|	V |
19+ 0	0.7690	0.12	Q	|	|	|	V |
19+ 5	0.7698	0.12	Q	|	|	|	V |
19+10	0.7706	0.11	Q	|	|	|	V |
19+15	0.7714	0.11	Q	|	|	|	V |
19+20	0.7721	0.11	Q	|	|	|	V |
19+25	0.7729	0.11	Q	|	|	|	V |
19+30	0.7736	0.11	Q	|	|	|	V |
19+35	0.7743	0.11	Q	|	|	|	V |
19+40	0.7751	0.10	Q	|	|	|	V |
19+45	0.7758	0.10	Q	|	|	|	V |
19+50	0.7765	0.10	Q	|	|	|	V |
19+55	0.7771	0.10	Q	|	|	|	V |
20+ 0	0.7778	0.10	Q	|	|	|	V |
20+ 5	0.7785	0.10	Q	|	|	|	V |
20+10	0.7791	0.10	Q	|	|	|	V |
20+15	0.7798	0.09	Q	|	|	|	V |
20+20	0.7804	0.09	Q	|	|	|	V |
20+25	0.7811	0.09	Q	|	|	|	V |
20+30	0.7817	0.09	Q	|	|	|	V |
20+35	0.7823	0.09	Q	|	|	|	V |
20+40	0.7829	0.09	Q	|	|	|	V |
20+45	0.7835	0.09	Q	|	|	|	V |
20+50	0.7841	0.09	Q	|	|	|	V|
20+55	0.7847	0.09	Q	|	|	|	V|
21+ 0	0.7853	0.08	Q	|	|	|	V|
21+ 5	0.7859	0.08	Q	|	|	|	V|
21+10	0.7864	0.08	Q	|	|	|	V|
21+15	0.7870	0.08	Q	|	|	|	V|
21+20	0.7876	0.08	Q	|	|	|	V|
21+25	0.7881	0.08	Q	|	|	|	V|
21+30	0.7887	0.08	Q	|	|	|	V|
21+35	0.7892	0.08	Q	|	|	|	V|
21+40	0.7897	0.08	Q	|	|	|	V|
21+45	0.7903	0.08	Q	|	|	|	V|
21+50	0.7908	0.08	Q	|	|	|	V|
21+55	0.7913	0.08	Q	|	|	|	V|
22+ 0	0.7918	0.08	Q	|	|	|	V|
22+ 5	0.7924	0.07	Q	|	|	|	V|
22+10	0.7929	0.07	Q	|	|	|	V|
22+15	0.7934	0.07	Q	|	|	|	V|
22+20	0.7939	0.07	Q	|	|	|	V|
22+25	0.7944	0.07	Q	|	|	|	V|
22+30	0.7949	0.07	Q	|	|	|	V|
22+35	0.7953	0.07	Q	|	|	|	V|
22+40	0.7958	0.07	Q	|	|	|	V|
22+45	0.7963	0.07	Q	|	|	|	V|
22+50	0.7968	0.07	Q	|	|	|	V|
22+55	0.7973	0.07	Q	|	|	|	V|
23+ 0	0.7977	0.07	Q	|	|	|	V|
23+ 5	0.7982	0.07	Q	|	|	|	V|
23+10	0.7987	0.07	Q	|	|	|	V|
23+15	0.7991	0.07	Q	|	|	|	V|
23+20	0.7996	0.07	Q	|	|	|	V|
23+25	0.8000	0.07	Q	|	|	|	V|
23+30	0.8005	0.07	Q	|	|	|	V|
23+35	0.8009	0.06	Q	|	|	|	V|
23+40	0.8014	0.06	Q	|	|	|	V|
23+45	0.8018	0.06	Q	|	|	|	V|
23+50	0.8022	0.06	Q	|	|	|	V|
23+55	0.8027	0.06	Q	|	|	|	V|

```
   24+ 0       0.8031      0.06  Q          |          |          |         V|
   24+ 5       0.8035      0.06  Q          |          |          |         V|
   24+10       0.8036      0.02  Q          |          |          |         V|
   24+15       0.8037      0.01  Q          |          |          |         V|
   24+20       0.8037      0.00  Q          |          |          |         V|
   24+25       0.8038      0.00  Q          |          |          |         V|
   24+30       0.8038      0.00  Q          |          |          |         V|
   24+35       0.8038      0.00  Q          |          |          |         V|
   24+40       0.8038      0.00  Q          |          |          |          V
--------------------------------------------------------------------------
```


24-Hour Storm Runoff Hydrograph
PA 1 (8x7 RCB) - Existing Conditions
Q (CFS)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
200
400
600
800
1000
1200
1400
1600
TIME (MINUTES)

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

Study date 09/29/15 File Name EXPA1HYMW.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6103

PLANNING AREA 1 - 36" RCP
EXISTING CONDITIONS - HYDROMOD CALCULATIONS
2-YEAR 24-HOUR STORM
BY FUSCOE ENGINEERING

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
79.0	2.9	0.23	C	0.250	1.000	0.250
84.0	9.6	0.77	D	0.200	1.000	0.200

Area-averaged adjusted loss rate Fm (In/Hr) = 0.212

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
2.90	0.232	79.0	61.8	6.18	0.046
9.60	0.768	84.0	68.6	4.58	0.110

Area-averaged catchment yield fraction, Y = 0.095
Area-averaged low loss fraction, Yb = 0.905

++

Watercourse length = 1194.90(Ft.)
Length from concentration point to centroid = 549.94(Ft.)
Elevation difference along watercourse = 192.20(Ft.)
Mannings friction factor along watercourse = 0.030
Watershed area = 12.50(Ac.)
Catchment Lag time = 0.048 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 173.1820
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.212(In/Hr)
Average low loss rate fraction (Yb) = 0.905 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.190(In)
Computed peak 30-minute rainfall = 0.400(In)
Specified peak 1-hour rainfall = 0.530(In)
Computed peak 3-hour rainfall = 0.890(In)
Specified peak 6-hour rainfall = 1.220(In)
Specified peak 24-hour rainfall = 2.050(In)

Rainfall depth area reduction factors:
Using a total area of 12.50(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.190(In)

30-minute factor = 0.999 Adjusted rainfall = 0.400(In)
1-hour factor = 0.999 Adjusted rainfall = 0.530(In)
3-hour factor = 1.000 Adjusted rainfall = 0.890(In)
6-hour factor = 1.000 Adjusted rainfall = 1.220(In)
24-hour factor = 1.000 Adjusted rainfall = 2.050(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 151.17 (CFS))		
1	36.448	55.100
2	88.904	79.298
3	98.102	13.904
4	99.645	2.333
5	100.000	0.537

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.1899	0.1899
2	0.2533	0.0634
3	0.2997	0.0465
4	0.3378	0.0381
5	0.3706	0.0328
6	0.3998	0.0292
7	0.4256	0.0258
8	0.4493	0.0237
9	0.4713	0.0220
10	0.4919	0.0206
11	0.5113	0.0194
12	0.5297	0.0184
13	0.5501	0.0204
14	0.5697	0.0196
15	0.5886	0.0189
16	0.6068	0.0182
17	0.6244	0.0176
18	0.6415	0.0171
19	0.6581	0.0166
20	0.6742	0.0161
21	0.6899	0.0157
22	0.7053	0.0153
23	0.7202	0.0150
24	0.7348	0.0146
25	0.7491	0.0143
26	0.7632	0.0140
27	0.7769	0.0137
28	0.7903	0.0135
29	0.8035	0.0132
30	0.8165	0.0130
31	0.8293	0.0127
32	0.8418	0.0125
33	0.8541	0.0123
34	0.8662	0.0121
35	0.8782	0.0119
36	0.8899	0.0118
37	0.9011	0.0112
38	0.9121	0.0110
39	0.9229	0.0108
40	0.9336	0.0107
41	0.9442	0.0106
42	0.9546	0.0104
43	0.9649	0.0103
44	0.9750	0.0101
45	0.9850	0.0100
46	0.9949	0.0099
47	1.0047	0.0098
48	1.0144	0.0097
49	1.0240	0.0096
50	1.0334	0.0095
51	1.0428	0.0094
52	1.0520	0.0093
53	1.0612	0.0092
54	1.0703	0.0091

55	1.0792	0.0090
56	1.0881	0.0089
57	1.0969	0.0088
58	1.1056	0.0087
59	1.1143	0.0086
60	1.1228	0.0086
61	1.1313	0.0085
62	1.1397	0.0084
63	1.1480	0.0083
64	1.1563	0.0083
65	1.1645	0.0082
66	1.1726	0.0081
67	1.1806	0.0081
68	1.1886	0.0080
69	1.1966	0.0079
70	1.2044	0.0079
71	1.2122	0.0078
72	1.2200	0.0077
73	1.2263	0.0063
74	1.2325	0.0063
75	1.2387	0.0062
76	1.2449	0.0062
77	1.2510	0.0061
78	1.2571	0.0061
79	1.2631	0.0060
80	1.2690	0.0060
81	1.2750	0.0059
82	1.2808	0.0059
83	1.2866	0.0058
84	1.2924	0.0058
85	1.2982	0.0057
86	1.3039	0.0057
87	1.3095	0.0057
88	1.3151	0.0056
89	1.3207	0.0056
90	1.3262	0.0055
91	1.3317	0.0055
92	1.3372	0.0055
93	1.3426	0.0054
94	1.3480	0.0054
95	1.3534	0.0054
96	1.3587	0.0053
97	1.3640	0.0053
98	1.3692	0.0052
99	1.3744	0.0052
100	1.3796	0.0052
101	1.3848	0.0051
102	1.3899	0.0051
103	1.3950	0.0051
104	1.4000	0.0051
105	1.4050	0.0050
106	1.4100	0.0050
107	1.4150	0.0050
108	1.4199	0.0049
109	1.4248	0.0049
110	1.4297	0.0049
111	1.4346	0.0049
112	1.4394	0.0048
113	1.4442	0.0048
114	1.4490	0.0048
115	1.4537	0.0047
116	1.4584	0.0047
117	1.4631	0.0047
118	1.4678	0.0047
119	1.4724	0.0046
120	1.4771	0.0046
121	1.4817	0.0046
122	1.4862	0.0046
123	1.4908	0.0045
124	1.4953	0.0045
125	1.4998	0.0045
126	1.5043	0.0045
127	1.5088	0.0045
128	1.5132	0.0044
129	1.5176	0.0044
130	1.5220	0.0044

131	1.5264	0.0044
132	1.5307	0.0044
133	1.5351	0.0043
134	1.5394	0.0043
135	1.5437	0.0043
136	1.5479	0.0043
137	1.5522	0.0043
138	1.5564	0.0042
139	1.5606	0.0042
140	1.5648	0.0042
141	1.5690	0.0042
142	1.5732	0.0042
143	1.5773	0.0041
144	1.5814	0.0041
145	1.5855	0.0041
146	1.5896	0.0041
147	1.5937	0.0041
148	1.5977	0.0041
149	1.6018	0.0040
150	1.6058	0.0040
151	1.6098	0.0040
152	1.6137	0.0040
153	1.6177	0.0040
154	1.6217	0.0040
155	1.6256	0.0039
156	1.6295	0.0039
157	1.6334	0.0039
158	1.6373	0.0039
159	1.6412	0.0039
160	1.6450	0.0039
161	1.6489	0.0038
162	1.6527	0.0038
163	1.6565	0.0038
164	1.6603	0.0038
165	1.6641	0.0038
166	1.6679	0.0038
167	1.6716	0.0038
168	1.6754	0.0037
169	1.6791	0.0037
170	1.6828	0.0037
171	1.6865	0.0037
172	1.6902	0.0037
173	1.6939	0.0037
174	1.6975	0.0037
175	1.7012	0.0036
176	1.7048	0.0036
177	1.7084	0.0036
178	1.7120	0.0036
179	1.7156	0.0036
180	1.7192	0.0036
181	1.7228	0.0036
182	1.7263	0.0036
183	1.7299	0.0035
184	1.7334	0.0035
185	1.7369	0.0035
186	1.7404	0.0035
187	1.7439	0.0035
188	1.7474	0.0035
189	1.7509	0.0035
190	1.7544	0.0035
191	1.7578	0.0035
192	1.7612	0.0034
193	1.7647	0.0034
194	1.7681	0.0034
195	1.7715	0.0034
196	1.7749	0.0034
197	1.7783	0.0034
198	1.7817	0.0034
199	1.7850	0.0034
200	1.7884	0.0034
201	1.7917	0.0033
202	1.7950	0.0033
203	1.7984	0.0033
204	1.8017	0.0033
205	1.8050	0.0033
206	1.8083	0.0033

207	1.8116	0.0033
208	1.8148	0.0033
209	1.8181	0.0033
210	1.8213	0.0033
211	1.8246	0.0032
212	1.8278	0.0032
213	1.8310	0.0032
214	1.8343	0.0032
215	1.8375	0.0032
216	1.8407	0.0032
217	1.8438	0.0032
218	1.8470	0.0032
219	1.8502	0.0032
220	1.8533	0.0032
221	1.8565	0.0031
222	1.8596	0.0031
223	1.8628	0.0031
224	1.8659	0.0031
225	1.8690	0.0031
226	1.8721	0.0031
227	1.8752	0.0031
228	1.8783	0.0031
229	1.8814	0.0031
230	1.8844	0.0031
231	1.8875	0.0031
232	1.8906	0.0031
233	1.8936	0.0030
234	1.8966	0.0030
235	1.8997	0.0030
236	1.9027	0.0030
237	1.9057	0.0030
238	1.9087	0.0030
239	1.9117	0.0030
240	1.9147	0.0030
241	1.9177	0.0030
242	1.9207	0.0030
243	1.9236	0.0030
244	1.9266	0.0030
245	1.9295	0.0030
246	1.9325	0.0029
247	1.9354	0.0029
248	1.9384	0.0029
249	1.9413	0.0029
250	1.9442	0.0029
251	1.9471	0.0029
252	1.9500	0.0029
253	1.9529	0.0029
254	1.9558	0.0029
255	1.9587	0.0029
256	1.9615	0.0029
257	1.9644	0.0029
258	1.9673	0.0029
259	1.9701	0.0029
260	1.9730	0.0028
261	1.9758	0.0028
262	1.9786	0.0028
263	1.9814	0.0028
264	1.9843	0.0028
265	1.9871	0.0028
266	1.9899	0.0028
267	1.9927	0.0028
268	1.9955	0.0028
269	1.9983	0.0028
270	2.0010	0.0028
271	2.0038	0.0028
272	2.0066	0.0028
273	2.0093	0.0028
274	2.0121	0.0028
275	2.0148	0.0027
276	2.0176	0.0027
277	2.0203	0.0027
278	2.0230	0.0027
279	2.0257	0.0027
280	2.0285	0.0027
281	2.0312	0.0027
282	2.0339	0.0027

283	2.0366	0.0027
284	2.0393	0.0027
285	2.0419	0.0027
286	2.0446	0.0027
287	2.0473	0.0027
288	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0027	0.0024	0.0003
2	0.0027	0.0024	0.0003
3	0.0027	0.0024	0.0003
4	0.0027	0.0024	0.0003
5	0.0027	0.0024	0.0003
6	0.0027	0.0025	0.0003
7	0.0027	0.0025	0.0003
8	0.0027	0.0025	0.0003
9	0.0027	0.0025	0.0003
10	0.0027	0.0025	0.0003
11	0.0028	0.0025	0.0003
12	0.0028	0.0025	0.0003
13	0.0028	0.0025	0.0003
14	0.0028	0.0025	0.0003
15	0.0028	0.0025	0.0003
16	0.0028	0.0025	0.0003
17	0.0028	0.0025	0.0003
18	0.0028	0.0026	0.0003
19	0.0028	0.0026	0.0003
20	0.0028	0.0026	0.0003
21	0.0029	0.0026	0.0003
22	0.0029	0.0026	0.0003
23	0.0029	0.0026	0.0003
24	0.0029	0.0026	0.0003
25	0.0029	0.0026	0.0003
26	0.0029	0.0026	0.0003
27	0.0029	0.0026	0.0003
28	0.0029	0.0027	0.0003
29	0.0029	0.0027	0.0003
30	0.0030	0.0027	0.0003
31	0.0030	0.0027	0.0003
32	0.0030	0.0027	0.0003
33	0.0030	0.0027	0.0003
34	0.0030	0.0027	0.0003
35	0.0030	0.0027	0.0003
36	0.0030	0.0027	0.0003
37	0.0030	0.0027	0.0003
38	0.0030	0.0028	0.0003
39	0.0031	0.0028	0.0003
40	0.0031	0.0028	0.0003
41	0.0031	0.0028	0.0003
42	0.0031	0.0028	0.0003
43	0.0031	0.0028	0.0003
44	0.0031	0.0028	0.0003
45	0.0031	0.0028	0.0003
46	0.0031	0.0028	0.0003
47	0.0032	0.0029	0.0003
48	0.0032	0.0029	0.0003
49	0.0032	0.0029	0.0003
50	0.0032	0.0029	0.0003
51	0.0032	0.0029	0.0003
52	0.0032	0.0029	0.0003
53	0.0033	0.0029	0.0003
54	0.0033	0.0030	0.0003
55	0.0033	0.0030	0.0003
56	0.0033	0.0030	0.0003
57	0.0033	0.0030	0.0003
58	0.0033	0.0030	0.0003
59	0.0033	0.0030	0.0003
60	0.0034	0.0030	0.0003
61	0.0034	0.0031	0.0003
62	0.0034	0.0031	0.0003
63	0.0034	0.0031	0.0003
64	0.0034	0.0031	0.0003
65	0.0034	0.0031	0.0003

66	0.0035	0.0031	0.0003
67	0.0035	0.0031	0.0003
68	0.0035	0.0032	0.0003
69	0.0035	0.0032	0.0003
70	0.0035	0.0032	0.0003
71	0.0035	0.0032	0.0003
72	0.0036	0.0032	0.0003
73	0.0036	0.0032	0.0003
74	0.0036	0.0033	0.0003
75	0.0036	0.0033	0.0003
76	0.0036	0.0033	0.0003
77	0.0037	0.0033	0.0003
78	0.0037	0.0033	0.0003
79	0.0037	0.0033	0.0004
80	0.0037	0.0034	0.0004
81	0.0037	0.0034	0.0004
82	0.0038	0.0034	0.0004
83	0.0038	0.0034	0.0004
84	0.0038	0.0034	0.0004
85	0.0038	0.0035	0.0004
86	0.0038	0.0035	0.0004
87	0.0039	0.0035	0.0004
88	0.0039	0.0035	0.0004
89	0.0039	0.0035	0.0004
90	0.0039	0.0036	0.0004
91	0.0040	0.0036	0.0004
92	0.0040	0.0036	0.0004
93	0.0040	0.0036	0.0004
94	0.0040	0.0036	0.0004
95	0.0041	0.0037	0.0004
96	0.0041	0.0037	0.0004
97	0.0041	0.0037	0.0004
98	0.0041	0.0037	0.0004
99	0.0042	0.0038	0.0004
100	0.0042	0.0038	0.0004
101	0.0042	0.0038	0.0004
102	0.0043	0.0038	0.0004
103	0.0043	0.0039	0.0004
104	0.0043	0.0039	0.0004
105	0.0044	0.0039	0.0004
106	0.0044	0.0040	0.0004
107	0.0044	0.0040	0.0004
108	0.0044	0.0040	0.0004
109	0.0045	0.0041	0.0004
110	0.0045	0.0041	0.0004
111	0.0045	0.0041	0.0004
112	0.0046	0.0041	0.0004
113	0.0046	0.0042	0.0004
114	0.0046	0.0042	0.0004
115	0.0047	0.0042	0.0004
116	0.0047	0.0043	0.0004
117	0.0048	0.0043	0.0005
118	0.0048	0.0043	0.0005
119	0.0049	0.0044	0.0005
120	0.0049	0.0044	0.0005
121	0.0049	0.0045	0.0005
122	0.0050	0.0045	0.0005
123	0.0050	0.0045	0.0005
124	0.0051	0.0046	0.0005
125	0.0051	0.0046	0.0005
126	0.0051	0.0047	0.0005
127	0.0052	0.0047	0.0005
128	0.0052	0.0047	0.0005
129	0.0053	0.0048	0.0005
130	0.0054	0.0048	0.0005
131	0.0054	0.0049	0.0005
132	0.0055	0.0049	0.0005
133	0.0055	0.0050	0.0005
134	0.0056	0.0050	0.0005
135	0.0057	0.0051	0.0005
136	0.0057	0.0052	0.0005
137	0.0058	0.0052	0.0006
138	0.0058	0.0053	0.0006
139	0.0059	0.0054	0.0006
140	0.0060	0.0054	0.0006
141	0.0061	0.0055	0.0006

142	0.0061	0.0055	0.0006
143	0.0062	0.0056	0.0006
144	0.0063	0.0057	0.0006
145	0.0077	0.0070	0.0007
146	0.0078	0.0071	0.0007
147	0.0079	0.0072	0.0008
148	0.0080	0.0072	0.0008
149	0.0081	0.0073	0.0008
150	0.0082	0.0074	0.0008
151	0.0083	0.0075	0.0008
152	0.0084	0.0076	0.0008
153	0.0086	0.0077	0.0008
154	0.0086	0.0078	0.0008
155	0.0088	0.0080	0.0008
156	0.0089	0.0080	0.0008
157	0.0091	0.0082	0.0009
158	0.0092	0.0083	0.0009
159	0.0094	0.0085	0.0009
160	0.0095	0.0086	0.0009
161	0.0097	0.0088	0.0009
162	0.0098	0.0089	0.0009
163	0.0100	0.0091	0.0010
164	0.0101	0.0092	0.0010
165	0.0104	0.0094	0.0010
166	0.0106	0.0095	0.0010
167	0.0108	0.0098	0.0010
168	0.0110	0.0100	0.0010
169	0.0118	0.0106	0.0011
170	0.0119	0.0108	0.0011
171	0.0123	0.0112	0.0012
172	0.0125	0.0113	0.0012
173	0.0130	0.0117	0.0012
174	0.0132	0.0120	0.0013
175	0.0137	0.0124	0.0013
176	0.0140	0.0127	0.0013
177	0.0146	0.0132	0.0014
178	0.0150	0.0135	0.0014
179	0.0157	0.0142	0.0015
180	0.0161	0.0146	0.0015
181	0.0171	0.0155	0.0016
182	0.0176	0.0159	0.0017
183	0.0189	0.0171	0.0018
184	0.0196	0.0176	0.0020
185	0.0184	0.0166	0.0017
186	0.0194	0.0176	0.0018
187	0.0220	0.0176	0.0044
188	0.0237	0.0176	0.0061
189	0.0292	0.0176	0.0115
190	0.0328	0.0176	0.0152
191	0.0465	0.0176	0.0288
192	0.0634	0.0176	0.0457
193	0.1899	0.0176	0.1723
194	0.0381	0.0176	0.0204
195	0.0258	0.0176	0.0082
196	0.0206	0.0176	0.0030
197	0.0204	0.0176	0.0028
198	0.0182	0.0165	0.0017
199	0.0166	0.0150	0.0016
200	0.0153	0.0139	0.0015
201	0.0143	0.0129	0.0014
202	0.0135	0.0122	0.0013
203	0.0127	0.0115	0.0012
204	0.0121	0.0110	0.0012
205	0.0112	0.0101	0.0011
206	0.0107	0.0097	0.0010
207	0.0103	0.0093	0.0010
208	0.0099	0.0090	0.0009
209	0.0096	0.0087	0.0009
210	0.0093	0.0084	0.0009
211	0.0090	0.0081	0.0009
212	0.0087	0.0079	0.0008
213	0.0085	0.0077	0.0008
214	0.0083	0.0075	0.0008
215	0.0081	0.0073	0.0008
216	0.0079	0.0071	0.0007
217	0.0063	0.0057	0.0006

218	0.0062	0.0056	0.0006
219	0.0060	0.0054	0.0006
220	0.0059	0.0053	0.0006
221	0.0057	0.0052	0.0005
222	0.0056	0.0051	0.0005
223	0.0055	0.0050	0.0005
224	0.0054	0.0049	0.0005
225	0.0053	0.0048	0.0005
226	0.0052	0.0047	0.0005
227	0.0051	0.0046	0.0005
228	0.0050	0.0045	0.0005
229	0.0049	0.0044	0.0005
230	0.0048	0.0044	0.0005
231	0.0047	0.0043	0.0005
232	0.0047	0.0042	0.0004
233	0.0046	0.0042	0.0004
234	0.0045	0.0041	0.0004
235	0.0045	0.0040	0.0004
236	0.0044	0.0040	0.0004
237	0.0043	0.0039	0.0004
238	0.0043	0.0039	0.0004
239	0.0042	0.0038	0.0004
240	0.0042	0.0038	0.0004
241	0.0041	0.0037	0.0004
242	0.0041	0.0037	0.0004
243	0.0040	0.0036	0.0004
244	0.0040	0.0036	0.0004
245	0.0039	0.0035	0.0004
246	0.0039	0.0035	0.0004
247	0.0038	0.0034	0.0004
248	0.0038	0.0034	0.0004
249	0.0037	0.0034	0.0004
250	0.0037	0.0033	0.0004
251	0.0036	0.0033	0.0003
252	0.0036	0.0033	0.0003
253	0.0036	0.0032	0.0003
254	0.0035	0.0032	0.0003
255	0.0035	0.0032	0.0003
256	0.0035	0.0031	0.0003
257	0.0034	0.0031	0.0003
258	0.0034	0.0031	0.0003
259	0.0034	0.0030	0.0003
260	0.0033	0.0030	0.0003
261	0.0033	0.0030	0.0003
262	0.0033	0.0030	0.0003
263	0.0032	0.0029	0.0003
264	0.0032	0.0029	0.0003
265	0.0032	0.0029	0.0003
266	0.0032	0.0029	0.0003
267	0.0031	0.0028	0.0003
268	0.0031	0.0028	0.0003
269	0.0031	0.0028	0.0003
270	0.0031	0.0028	0.0003
271	0.0030	0.0027	0.0003
272	0.0030	0.0027	0.0003
273	0.0030	0.0027	0.0003
274	0.0030	0.0027	0.0003
275	0.0029	0.0027	0.0003
276	0.0029	0.0026	0.0003
277	0.0029	0.0026	0.0003
278	0.0029	0.0026	0.0003
279	0.0029	0.0026	0.0003
280	0.0028	0.0026	0.0003
281	0.0028	0.0025	0.0003
282	0.0028	0.0025	0.0003
283	0.0028	0.0025	0.0003
284	0.0028	0.0025	0.0003
285	0.0027	0.0025	0.0003
286	0.0027	0.0025	0.0003
287	0.0027	0.0024	0.0003
288	0.0027	0.0024	0.0003

Total soil rain loss = 1.59(In)
Total effective rainfall = 0.46(In)
Peak flow rate in flood hydrograph = 15.50(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	5.0	10.0	15.0	20.0
0+ 5	0.0001	0.01	Q				
0+10	0.0003	0.03	Q				
0+15	0.0006	0.04	Q				
0+20	0.0009	0.04	Q				
0+25	0.0011	0.04	Q				
0+30	0.0014	0.04	Q				
0+35	0.0017	0.04	Q				
0+40	0.0019	0.04	Q				
0+45	0.0022	0.04	Q				
0+50	0.0025	0.04	Q				
0+55	0.0027	0.04	Q				
1+ 0	0.0030	0.04	Q				
1+ 5	0.0033	0.04	Q				
1+10	0.0036	0.04	Q				
1+15	0.0038	0.04	Q				
1+20	0.0041	0.04	Q				
1+25	0.0044	0.04	Q				
1+30	0.0047	0.04	Q				
1+35	0.0050	0.04	Q				
1+40	0.0052	0.04	Q				
1+45	0.0055	0.04	Q				
1+50	0.0058	0.04	Q				
1+55	0.0061	0.04	Q				
2+ 0	0.0064	0.04	Q				
2+ 5	0.0067	0.04	Q				
2+10	0.0069	0.04	Q				
2+15	0.0072	0.04	Q				
2+20	0.0075	0.04	Q				
2+25	0.0078	0.04	Q				
2+30	0.0081	0.04	Q				
2+35	0.0084	0.04	Q				
2+40	0.0087	0.04	Q				
2+45	0.0090	0.04	Q				
2+50	0.0093	0.04	Q				
2+55	0.0096	0.04	Q				
3+ 0	0.0099	0.04	Q				
3+ 5	0.0102	0.04	Q				
3+10	0.0105	0.04	Q				
3+15	0.0108	0.04	Q				
3+20	0.0111	0.04	Q				
3+25	0.0114	0.04	Q				
3+30	0.0117	0.04	Q				
3+35	0.0120	0.04	Q				
3+40	0.0123	0.04	QV				
3+45	0.0126	0.04	QV				
3+50	0.0129	0.05	QV				
3+55	0.0132	0.05	QV				
4+ 0	0.0136	0.05	QV				
4+ 5	0.0139	0.05	QV				
4+10	0.0142	0.05	QV				
4+15	0.0145	0.05	QV				
4+20	0.0148	0.05	QV				
4+25	0.0152	0.05	QV				
4+30	0.0155	0.05	QV				
4+35	0.0158	0.05	QV				
4+40	0.0161	0.05	QV				
4+45	0.0165	0.05	QV				
4+50	0.0168	0.05	QV				
4+55	0.0171	0.05	QV				
5+ 0	0.0174	0.05	QV				
5+ 5	0.0178	0.05	QV				
5+10	0.0181	0.05	QV				
5+15	0.0184	0.05	QV				
5+20	0.0188	0.05	QV				
5+25	0.0191	0.05	QV				
5+30	0.0195	0.05	QV				

5+35	0.0198	0.05	QV	|	|	|	|
5+40	0.0201	0.05	QV	|	|	|	|
5+45	0.0205	0.05	QV	|	|	|	|
5+50	0.0208	0.05	QV	|	|	|	|
5+55	0.0212	0.05	QV	|	|	|	|
6+ 0	0.0215	0.05	QV	|	|	|	|
6+ 5	0.0219	0.05	QV	|	|	|	|
6+10	0.0222	0.05	QV	|	|	|	|
6+15	0.0226	0.05	QV	|	|	|	|
6+20	0.0230	0.05	QV	|	|	|	|
6+25	0.0233	0.05	QV	|	|	|	|
6+30	0.0237	0.05	QV	|	|	|	|
6+35	0.0241	0.05	QV	|	|	|	|
6+40	0.0244	0.05	Q V	|	|	|	|
6+45	0.0248	0.05	Q V	|	|	|	|
6+50	0.0252	0.05	Q V	|	|	|	|
6+55	0.0255	0.05	Q V	|	|	|	|
7+ 0	0.0259	0.05	Q V	|	|	|	|
7+ 5	0.0263	0.05	Q V	|	|	|	|
7+10	0.0267	0.06	Q V	|	|	|	|
7+15	0.0270	0.06	Q V	|	|	|	|
7+20	0.0274	0.06	Q V	|	|	|	|
7+25	0.0278	0.06	Q V	|	|	|	|
7+30	0.0282	0.06	Q V	|	|	|	|
7+35	0.0286	0.06	Q V	|	|	|	|
7+40	0.0290	0.06	Q V	|	|	|	|
7+45	0.0294	0.06	Q V	|	|	|	|
7+50	0.0298	0.06	Q V	|	|	|	|
7+55	0.0302	0.06	Q V	|	|	|	|
8+ 0	0.0306	0.06	Q V	|	|	|	|
8+ 5	0.0310	0.06	Q V	|	|	|	|
8+10	0.0314	0.06	Q V	|	|	|	|
8+15	0.0318	0.06	Q V	|	|	|	|
8+20	0.0322	0.06	Q V	|	|	|	|
8+25	0.0326	0.06	Q V	|	|	|	|
8+30	0.0331	0.06	Q V	|	|	|	|
8+35	0.0335	0.06	Q V	|	|	|	|
8+40	0.0339	0.06	Q V	|	|	|	|
8+45	0.0343	0.06	Q V	|	|	|	|
8+50	0.0348	0.06	Q V	|	|	|	|
8+55	0.0352	0.06	Q V	|	|	|	|
9+ 0	0.0356	0.06	Q V	|	|	|	|
9+ 5	0.0361	0.06	Q V	|	|	|	|
9+10	0.0365	0.06	Q V	|	|	|	|
9+15	0.0370	0.06	Q V	|	|	|	|
9+20	0.0374	0.07	Q V	|	|	|	|
9+25	0.0379	0.07	Q V	|	|	|	|
9+30	0.0383	0.07	Q V	|	|	|	|
9+35	0.0388	0.07	Q V	|	|	|	|
9+40	0.0393	0.07	Q V	|	|	|	|
9+45	0.0397	0.07	Q V	|	|	|	|
9+50	0.0402	0.07	Q V	|	|	|	|
9+55	0.0407	0.07	Q V	|	|	|	|
10+ 0	0.0412	0.07	Q V	|	|	|	|
10+ 5	0.0416	0.07	Q V	|	|	|	|
10+10	0.0421	0.07	Q V	|	|	|	|
10+15	0.0426	0.07	Q V	|	|	|	|
10+20	0.0431	0.07	Q V	|	|	|	|
10+25	0.0436	0.07	Q V	|	|	|	|
10+30	0.0441	0.07	Q V	|	|	|	|
10+35	0.0446	0.07	Q V	|	|	|	|
10+40	0.0452	0.08	Q V	|	|	|	|
10+45	0.0457	0.08	Q V	|	|	|	|
10+50	0.0462	0.08	Q V	|	|	|	|
10+55	0.0467	0.08	Q V	|	|	|	|
11+ 0	0.0473	0.08	Q V	|	|	|	|
11+ 5	0.0478	0.08	Q V	|	|	|	|
11+10	0.0484	0.08	Q V	|	|	|	|
11+15	0.0489	0.08	Q V	|	|	|	|
11+20	0.0495	0.08	Q V	|	|	|	|
11+25	0.0501	0.08	Q V	|	|	|	|
11+30	0.0506	0.08	Q V	|	|	|	|
11+35	0.0512	0.08	Q V	|	|	|	|
11+40	0.0518	0.09	Q V	|	|	|	|
11+45	0.0524	0.09	Q V	|	|	|	|
11+50	0.0530	0.09	Q V	|	|	|	|

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11+55       0.0536      0.09  Q   V     |          |          |          |
12+ 0       0.0542      0.09  Q   V     |          |          |          |
12+ 5       0.0549      0.10  Q   V     |          |          |          |
12+10       0.0556      0.11  Q   V     |          |          |          |
12+15       0.0564      0.11  Q   V     |          |          |          |
12+20       0.0572      0.11  Q   V     |          |          |          |
12+25       0.0580      0.12  Q   V     |          |          |          |
12+30       0.0588      0.12  Q   V     |          |          |          |
12+35       0.0596      0.12  Q   V     |          |          |          |
12+40       0.0604      0.12  Q   V     |          |          |          |
12+45       0.0613      0.12  Q    V    |          |          |          |
12+50       0.0621      0.12  Q    V    |          |          |          |
12+55       0.0630      0.12  Q    V    |          |          |          |
13+ 0       0.0639      0.13  Q    V    |          |          |          |
13+ 5       0.0647      0.13  Q    V    |          |          |          |
13+10       0.0656      0.13  Q    V    |          |          |          |
13+15       0.0666      0.13  Q    V    |          |          |          |
13+20       0.0675      0.13  Q    V    |          |          |          |
13+25       0.0684      0.14  Q    V    |          |          |          |
13+30       0.0694      0.14  Q    V    |          |          |          |
13+35       0.0704      0.14  Q    V    |          |          |          |
13+40       0.0714      0.14  Q    V    |          |          |          |
13+45       0.0724      0.15  Q    V    |          |          |          |
13+50       0.0734      0.15  Q     V   |          |          |          |
13+55       0.0745      0.15  Q     V   |          |          |          |
14+ 0       0.0755      0.16  Q     V   |          |          |          |
14+ 5       0.0766      0.16  Q     V   |          |          |          |
14+10       0.0778      0.17  Q     V   |          |          |          |
14+15       0.0790      0.17  Q     V   |          |          |          |
14+20       0.0802      0.18  Q     V   |          |          |          |
14+25       0.0815      0.18  Q     V   |          |          |          |
14+30       0.0828      0.19  Q     V   |          |          |          |
14+35       0.0841      0.19  Q     V   |          |          |          |
14+40       0.0855      0.20  Q      V  |          |          |          |
14+45       0.0869      0.20  Q      V  |          |          |          |
14+50       0.0883      0.21  Q      V  |          |          |          |
14+55       0.0898      0.22  Q      V  |          |          |          |
15+ 0       0.0914      0.23  Q      V  |          |          |          |
15+ 5       0.0930      0.24  Q      V  |          |          |          |
15+10       0.0947      0.25  Q      V  |          |          |          |
15+15       0.0965      0.26  Q      V  |          |          |          |
15+20       0.0984      0.28  Q       V |          |          |          |
15+25       0.1003      0.28  Q       V |          |          |          |
15+30       0.1022      0.27  Q       V |          |          |          |
15+35       0.1051      0.42  Q       V |          |          |          |
15+40       0.1100      0.71  |Q       V|          |          |          |
15+45       0.1182      1.18  | Q      V|          |          |          |
15+50       0.1309      1.85  |  Q      V          |          |          |
15+55       0.1513      2.97  |    Q    | V        |          |          |
16+ 0       0.1861      5.05  |         Q    V     |          |          |
16+ 5       0.2795     13.56  |          |    |  V   Q  |          |          |
16+10       0.3862     15.50  |          |    |         QV         |
16+15       0.4178      4.59  |         Q|    |         |    V     |
16+20       0.4283      1.52  |  Q       |    |         |     V    |
16+25       0.4327      0.64  |Q         |    |         |     V    |
16+30       0.4354      0.39  Q          |    |         |     V    |
16+35       0.4373      0.27  Q          |    |         |      V   |
16+40       0.4389      0.24  Q          |    |         |      V   |
16+45       0.4404      0.22  Q          |    |         |      V   |
16+50       0.4418      0.20  Q          |    |         |      V   |
16+55       0.4431      0.19  Q          |    |         |      V   |
17+ 0       0.4444      0.18  Q          |    |         |      V   |
17+ 5       0.4455      0.17  Q          |    |         |      V   |
17+10       0.4466      0.16  Q          |    |         |      V   |
17+15       0.4477      0.15  Q          |    |         |       V  |
17+20       0.4487      0.15  Q          |    |         |       V  |
17+25       0.4497      0.14  Q          |    |         |       V  |
17+30       0.4506      0.14  Q          |    |         |       V  |
17+35       0.4515      0.13  Q          |    |         |       V  |
17+40       0.4524      0.13  Q          |    |         |       V  |
17+45       0.4533      0.12  Q          |    |         |       V  |
17+50       0.4541      0.12  Q          |    |         |       V  |
17+55       0.4549      0.12  Q          |    |         |       V  |
18+ 0       0.4557      0.12  Q          |    |         |       V  |
18+ 5       0.4564      0.11  Q          |    |         |       V  |
18+10       0.4571      0.09  Q          |    |         |       V  |
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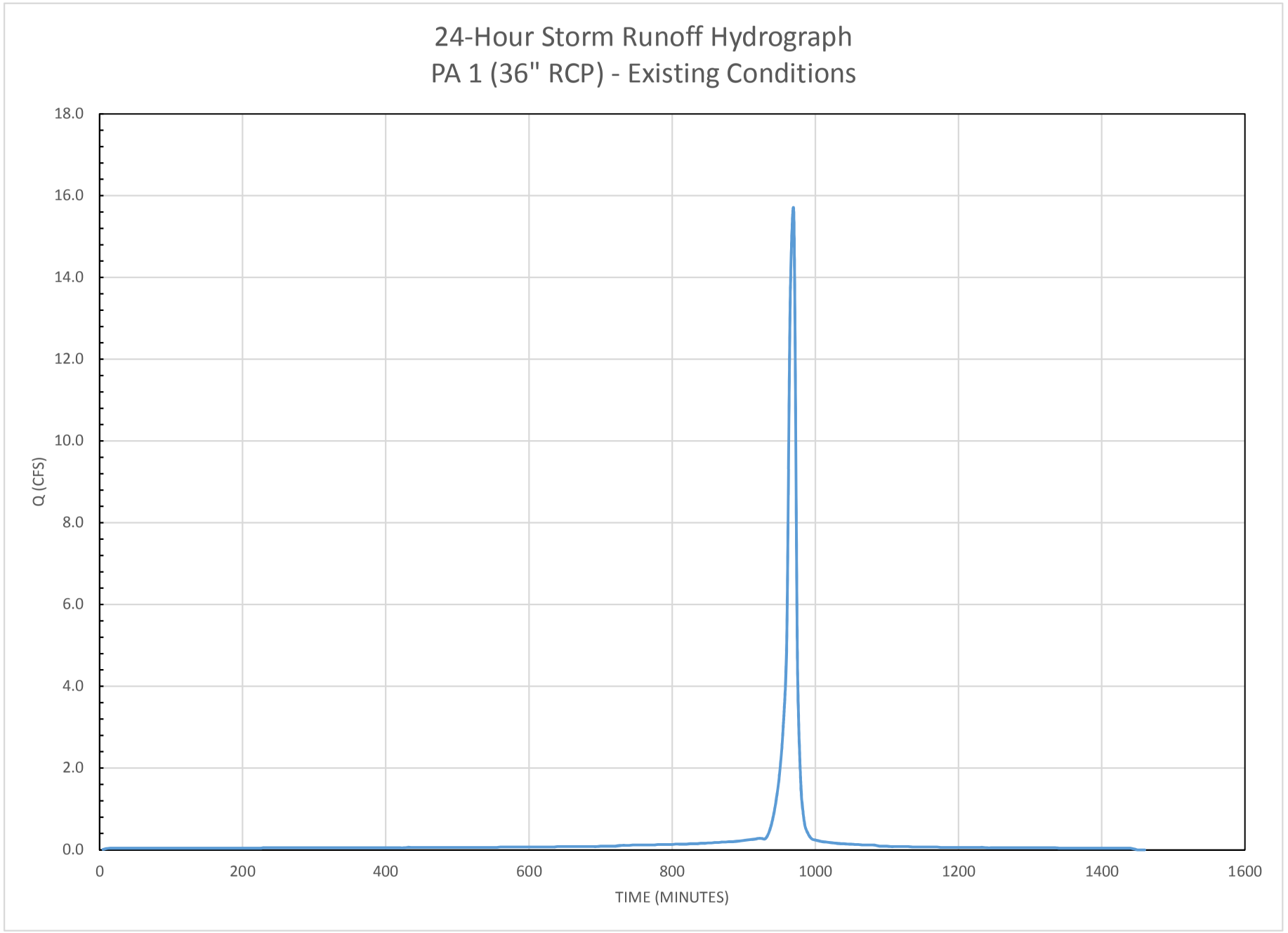
18+15	0.4577	0.09	Q	|	|	|	V |
18+20	0.4583	0.09	Q	|	|	|	V |
18+25	0.4589	0.08	Q	|	|	|	V |
18+30	0.4594	0.08	Q	|	|	|	V |
18+35	0.4600	0.08	Q	|	|	|	V |
18+40	0.4605	0.08	Q	|	|	|	V |
18+45	0.4610	0.08	Q	|	|	|	V |
18+50	0.4616	0.08	Q	|	|	|	V |
18+55	0.4621	0.07	Q	|	|	|	V |
19+ 0	0.4626	0.07	Q	|	|	|	V |
19+ 5	0.4631	0.07	Q	|	|	|	V |
19+10	0.4636	0.07	Q	|	|	|	V |
19+15	0.4640	0.07	Q	|	|	|	V |
19+20	0.4645	0.07	Q	|	|	|	V |
19+25	0.4650	0.07	Q	|	|	|	V |
19+30	0.4654	0.07	Q	|	|	|	V |
19+35	0.4659	0.06	Q	|	|	|	V |
19+40	0.4663	0.06	Q	|	|	|	V |
19+45	0.4667	0.06	Q	|	|	|	V |
19+50	0.4672	0.06	Q	|	|	|	V |
19+55	0.4676	0.06	Q	|	|	|	V |
20+ 0	0.4680	0.06	Q	|	|	|	V |
20+ 5	0.4684	0.06	Q	|	|	|	V |
20+10	0.4688	0.06	Q	|	|	|	V |
20+15	0.4692	0.06	Q	|	|	|	V |
20+20	0.4696	0.06	Q	|	|	|	V |
20+25	0.4700	0.06	Q	|	|	|	V |
20+30	0.4704	0.06	Q	|	|	|	V |
20+35	0.4708	0.06	Q	|	|	|	V |
20+40	0.4711	0.05	Q	|	|	|	V |
20+45	0.4715	0.05	Q	|	|	|	V |
20+50	0.4719	0.05	Q	|	|	|	V|
20+55	0.4723	0.05	Q	|	|	|	V|
21+ 0	0.4726	0.05	Q	|	|	|	V|
21+ 5	0.4730	0.05	Q	|	|	|	V|
21+10	0.4733	0.05	Q	|	|	|	V|
21+15	0.4737	0.05	Q	|	|	|	V|
21+20	0.4740	0.05	Q	|	|	|	V|
21+25	0.4744	0.05	Q	|	|	|	V|
21+30	0.4747	0.05	Q	|	|	|	V|
21+35	0.4750	0.05	Q	|	|	|	V|
21+40	0.4754	0.05	Q	|	|	|	V|
21+45	0.4757	0.05	Q	|	|	|	V|
21+50	0.4760	0.05	Q	|	|	|	V|
21+55	0.4763	0.05	Q	|	|	|	V|
22+ 0	0.4767	0.05	Q	|	|	|	V|
22+ 5	0.4770	0.05	Q	|	|	|	V|
22+10	0.4773	0.05	Q	|	|	|	V|
22+15	0.4776	0.05	Q	|	|	|	V|
22+20	0.4779	0.04	Q	|	|	|	V|
22+25	0.4782	0.04	Q	|	|	|	V|
22+30	0.4785	0.04	Q	|	|	|	V|
22+35	0.4788	0.04	Q	|	|	|	V|
22+40	0.4791	0.04	Q	|	|	|	V|
22+45	0.4794	0.04	Q	|	|	|	V|
22+50	0.4797	0.04	Q	|	|	|	V|
22+55	0.4800	0.04	Q	|	|	|	V|
23+ 0	0.4803	0.04	Q	|	|	|	V|
23+ 5	0.4806	0.04	Q	|	|	|	V|
23+10	0.4809	0.04	Q	|	|	|	V|
23+15	0.4812	0.04	Q	|	|	|	V|
23+20	0.4815	0.04	Q	|	|	|	V|
23+25	0.4817	0.04	Q	|	|	|	V|
23+30	0.4820	0.04	Q	|	|	|	V|
23+35	0.4823	0.04	Q	|	|	|	V|
23+40	0.4826	0.04	Q	|	|	|	V|
23+45	0.4828	0.04	Q	|	|	|	V|
23+50	0.4831	0.04	Q	|	|	|	V|
23+55	0.4834	0.04	Q	|	|	|	V|
24+ 0	0.4836	0.04	Q	|	|	|	V|
24+ 5	0.4838	0.02	Q	|	|	|	V|
24+10	0.4838	0.00	Q	|	|	|	V|
24+15	0.4838	0.00	Q	|	|	|	V|
24+20	0.4838	0.00	Q	|	|	|	V


24-Hour Storm Runoff Hydrograph
PA 1 (36" RCP) - Existing Conditions
Q (CFS)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
200
400
600
800
1000
1200
1400
1600
TIME (MINUTES)

Planning Area 2 (North Site)

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 07/17/15 File Name: CVEXRAT2.roc

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CIELO VISTA PROJECT
EXISTING CONDITION
2-YEAR 24-HOUR STORM EVENT
BY FUSCOE ENGINEERING

Program License Serial Number 6049

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

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Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.920
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.080
SCS curve number for soil(AMC 2) = 70.20
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.292(In/Hr)
Max Catchment Loss (Fm) = 0.292(In/Hr)
Initial subarea data:
Initial area flow distance = 251.130(Ft.)
Top (of initial area) elevation = 648.100(Ft.)
Bottom (of initial area) elevation = 640.000(Ft.)
Difference in elevation = 8.100(Ft.)
Slope = 0.03225 s(%)= 3.23
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.795 min.
Rainfall intensity = 1.320(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.701
Subarea runoff = 0.962(CFS)
Total initial stream area = 1.040(Ac.)

++

Process from Point/Station 202.000 to Point/Station 203.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 640.000(Ft.)
Downstream point elevation = 612.500(Ft.)
Channel length thru subarea = 757.140(Ft.)
Channel base width = 6.000(Ft.)
Slope or 'Z' of left channel bank = 2.000
Slope or 'Z' of right channel bank = 2.000
Estimated mean flow rate at midpoint of channel = 3.499(CFS)
Manning's 'N' = 0.045
Maximum depth of channel = 5.000(Ft.)
Flow(q) thru subarea = 3.499(CFS)
Depth of flow = 0.237(Ft.), Average velocity = 2.277(Ft/s)
Channel flow top width = 6.949(Ft.)
Flow Velocity = 2.28(Ft/s)
Travel time = 5.54 min.
Time of concentration = 18.34 min.

```
Critical depth =      0.215(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.690
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.310
SCS curve number for soil(AMC 2)  = 73.65
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.269(In/Hr)
Max Catchment Loss (Fm) =     0.269(In/Hr)
Rainfall intensity =      1.074(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.672
Subarea runoff =      5.005(CFS) for    7.230(Ac.)
Total runoff =      5.968(CFS)       Total area =        8.27(Ac.)
Area averaged Fm value =    0.272(In/Hr)
Depth of flow =   0.325(Ft.), Average velocity =   2.759(Ft/s)
Critical depth =      0.301(Ft.)
End of computations, total study area =            8.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number (AMC 2) =  73.2
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U n i t H y d r o g r a p h A n a l y s i s

Study date 07/20/15 File Name CVEXUNIT.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6049

CIELO VISTA PROJECT
EXISTING CONDITION
2-YEAR 24-HOUR STORM EVENT
BY FUSCOE ENGINEERING

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
57.0	6.0	0.72	B	0.300	1.000	0.300
78.0	2.3	0.28	D	0.200	1.000	0.200

Area-averaged adjusted loss rate Fm (In/Hr) = 0.272

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
5.95	0.719	57.0	37.0	17.03	0.057
2.32	0.281	78.0	60.6	6.50	0.038

Area-averaged catchment yield fraction, Y = 0.052
Area-averaged low loss fraction, Yb = 0.948
++
User entry of time of concentration = 0.310 (hours)
Watershed area = 8.27(Ac.)
Catchment Lag time = 0.248 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 33.6022
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.272(In/Hr)
Average low loss rate fraction (Yb) = 0.948 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.190(In)
Computed peak 30-minute rainfall = 0.400(In)
Specified peak 1-hour rainfall = 0.530(In)
Computed peak 3-hour rainfall = 0.890(In)
Specified peak 6-hour rainfall = 1.220(In)
Specified peak 24-hour rainfall = 2.050(In)

Rainfall depth area reduction factors:
Using a total area of 8.27(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.190(In)

30-minute factor = 1.000 Adjusted rainfall = 0.400(In)
1-hour factor = 1.000 Adjusted rainfall = 0.530(In)
3-hour factor = 1.000 Adjusted rainfall = 0.890(In)
6-hour factor = 1.000 Adjusted rainfall = 1.220(In)
24-hour factor = 1.000 Adjusted rainfall = 2.050(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 100.02 (CFS))	
1	2.487	2.488
2	10.895	8.409
3	30.731	19.838
4	59.961	29.235
5	71.964	12.005
6	79.566	7.603
7	85.014	5.449
8	89.115	4.102
9	92.239	3.124
10	94.601	2.363
11	96.290	1.689
12	97.512	1.223
13	98.140	0.628
14	98.531	0.391
15	98.871	0.340
16	99.125	0.254
17	99.340	0.215
18	99.603	0.263
19	99.787	0.184
20	99.907	0.120
21	100.000	0.094

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.1899	0.1899
2	0.2533	0.0634
3	0.2998	0.0465
4	0.3379	0.0381
5	0.3707	0.0328
6	0.3998	0.0292
7	0.4257	0.0258
8	0.4494	0.0237
9	0.4714	0.0220
10	0.4920	0.0206
11	0.5114	0.0194
12	0.5298	0.0184
13	0.5502	0.0204
14	0.5698	0.0196
15	0.5887	0.0189
16	0.6069	0.0182
17	0.6245	0.0176
18	0.6416	0.0171
19	0.6582	0.0166
20	0.6743	0.0161
21	0.6900	0.0157
22	0.7053	0.0153
23	0.7203	0.0150
24	0.7349	0.0146
25	0.7492	0.0143
26	0.7632	0.0140
27	0.7769	0.0137
28	0.7904	0.0135
29	0.8036	0.0132
30	0.8166	0.0130
31	0.8293	0.0127
32	0.8418	0.0125
33	0.8541	0.0123
34	0.8663	0.0121
35	0.8782	0.0119

36	0.8900	0.0118
37	0.9011	0.0112
38	0.9121	0.0110
39	0.9230	0.0108
40	0.9337	0.0107
41	0.9442	0.0105
42	0.9546	0.0104
43	0.9649	0.0103
44	0.9750	0.0101
45	0.9851	0.0100
46	0.9950	0.0099
47	1.0048	0.0098
48	1.0144	0.0097
49	1.0240	0.0096
50	1.0334	0.0095
51	1.0428	0.0094
52	1.0521	0.0093
53	1.0612	0.0092
54	1.0703	0.0091
55	1.0793	0.0090
56	1.0881	0.0089
57	1.0969	0.0088
58	1.1057	0.0087
59	1.1143	0.0086
60	1.1228	0.0086
61	1.1313	0.0085
62	1.1397	0.0084
63	1.1480	0.0083
64	1.1563	0.0083
65	1.1645	0.0082
66	1.1726	0.0081
67	1.1807	0.0081
68	1.1886	0.0080
69	1.1966	0.0079
70	1.2044	0.0079
71	1.2122	0.0078
72	1.2200	0.0077
73	1.2263	0.0063
74	1.2325	0.0063
75	1.2388	0.0062
76	1.2449	0.0062
77	1.2510	0.0061
78	1.2571	0.0061
79	1.2631	0.0060
80	1.2691	0.0060
81	1.2750	0.0059
82	1.2808	0.0059
83	1.2867	0.0058
84	1.2924	0.0058
85	1.2982	0.0057
86	1.3039	0.0057
87	1.3095	0.0057
88	1.3152	0.0056
89	1.3207	0.0056
90	1.3263	0.0055
91	1.3318	0.0055
92	1.3372	0.0055
93	1.3426	0.0054
94	1.3480	0.0054
95	1.3534	0.0054
96	1.3587	0.0053
97	1.3640	0.0053
98	1.3692	0.0052
99	1.3744	0.0052
100	1.3796	0.0052
101	1.3848	0.0051
102	1.3899	0.0051
103	1.3950	0.0051
104	1.4000	0.0051
105	1.4051	0.0050
106	1.4101	0.0050
107	1.4150	0.0050
108	1.4200	0.0049

109	1.4249	0.0049
110	1.4297	0.0049
111	1.4346	0.0049
112	1.4394	0.0048
113	1.4442	0.0048
114	1.4490	0.0048
115	1.4537	0.0047
116	1.4585	0.0047
117	1.4631	0.0047
118	1.4678	0.0047
119	1.4725	0.0046
120	1.4771	0.0046
121	1.4817	0.0046
122	1.4863	0.0046
123	1.4908	0.0045
124	1.4953	0.0045
125	1.4998	0.0045
126	1.5043	0.0045
127	1.5088	0.0045
128	1.5132	0.0044
129	1.5176	0.0044
130	1.5220	0.0044
131	1.5264	0.0044
132	1.5307	0.0044
133	1.5351	0.0043
134	1.5394	0.0043
135	1.5437	0.0043
136	1.5479	0.0043
137	1.5522	0.0043
138	1.5564	0.0042
139	1.5606	0.0042
140	1.5648	0.0042
141	1.5690	0.0042
142	1.5732	0.0042
143	1.5773	0.0041
144	1.5814	0.0041
145	1.5855	0.0041
146	1.5896	0.0041
147	1.5937	0.0041
148	1.5977	0.0041
149	1.6018	0.0040
150	1.6058	0.0040
151	1.6098	0.0040
152	1.6138	0.0040
153	1.6177	0.0040
154	1.6217	0.0040
155	1.6256	0.0039
156	1.6295	0.0039
157	1.6334	0.0039
158	1.6373	0.0039
159	1.6412	0.0039
160	1.6451	0.0039
161	1.6489	0.0038
162	1.6527	0.0038
163	1.6565	0.0038
164	1.6603	0.0038
165	1.6641	0.0038
166	1.6679	0.0038
167	1.6716	0.0038
168	1.6754	0.0037
169	1.6791	0.0037
170	1.6828	0.0037
171	1.6865	0.0037
172	1.6902	0.0037
173	1.6939	0.0037
174	1.6975	0.0037
175	1.7012	0.0036
176	1.7048	0.0036
177	1.7084	0.0036
178	1.7120	0.0036
179	1.7156	0.0036
180	1.7192	0.0036
181	1.7228	0.0036

182	1.7263	0.0036
183	1.7299	0.0035
184	1.7334	0.0035
185	1.7369	0.0035
186	1.7405	0.0035
187	1.7439	0.0035
188	1.7474	0.0035
189	1.7509	0.0035
190	1.7544	0.0035
191	1.7578	0.0035
192	1.7613	0.0034
193	1.7647	0.0034
194	1.7681	0.0034
195	1.7715	0.0034
196	1.7749	0.0034
197	1.7783	0.0034
198	1.7817	0.0034
199	1.7850	0.0034
200	1.7884	0.0034
201	1.7917	0.0033
202	1.7951	0.0033
203	1.7984	0.0033
204	1.8017	0.0033
205	1.8050	0.0033
206	1.8083	0.0033
207	1.8116	0.0033
208	1.8148	0.0033
209	1.8181	0.0033
210	1.8214	0.0033
211	1.8246	0.0032
212	1.8278	0.0032
213	1.8311	0.0032
214	1.8343	0.0032
215	1.8375	0.0032
216	1.8407	0.0032
217	1.8438	0.0032
218	1.8470	0.0032
219	1.8502	0.0032
220	1.8534	0.0032
221	1.8565	0.0031
222	1.8596	0.0031
223	1.8628	0.0031
224	1.8659	0.0031
225	1.8690	0.0031
226	1.8721	0.0031
227	1.8752	0.0031
228	1.8783	0.0031
229	1.8814	0.0031
230	1.8845	0.0031
231	1.8875	0.0031
232	1.8906	0.0031
233	1.8936	0.0030
234	1.8967	0.0030
235	1.8997	0.0030
236	1.9027	0.0030
237	1.9057	0.0030
238	1.9087	0.0030
239	1.9117	0.0030
240	1.9147	0.0030
241	1.9177	0.0030
242	1.9207	0.0030
243	1.9236	0.0030
244	1.9266	0.0030
245	1.9296	0.0030
246	1.9325	0.0029
247	1.9354	0.0029
248	1.9384	0.0029
249	1.9413	0.0029
250	1.9442	0.0029
251	1.9471	0.0029
252	1.9500	0.0029
253	1.9529	0.0029
254	1.9558	0.0029

255	1.9587	0.0029
256	1.9615	0.0029
257	1.9644	0.0029
258	1.9673	0.0029
259	1.9701	0.0029
260	1.9730	0.0028
261	1.9758	0.0028
262	1.9786	0.0028
263	1.9815	0.0028
264	1.9843	0.0028
265	1.9871	0.0028
266	1.9899	0.0028
267	1.9927	0.0028
268	1.9955	0.0028
269	1.9983	0.0028
270	2.0010	0.0028
271	2.0038	0.0028
272	2.0066	0.0028
273	2.0093	0.0028
274	2.0121	0.0028
275	2.0148	0.0027
276	2.0176	0.0027
277	2.0203	0.0027
278	2.0230	0.0027
279	2.0258	0.0027
280	2.0285	0.0027
281	2.0312	0.0027
282	2.0339	0.0027
283	2.0366	0.0027
284	2.0393	0.0027
285	2.0420	0.0027
286	2.0446	0.0027
287	2.0473	0.0027
288	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0027	0.0025	0.0001
2	0.0027	0.0025	0.0001
3	0.0027	0.0025	0.0001
4	0.0027	0.0026	0.0001
5	0.0027	0.0026	0.0001
6	0.0027	0.0026	0.0001
7	0.0027	0.0026	0.0001
8	0.0027	0.0026	0.0001
9	0.0027	0.0026	0.0001
10	0.0027	0.0026	0.0001
11	0.0028	0.0026	0.0001
12	0.0028	0.0026	0.0001
13	0.0028	0.0026	0.0001
14	0.0028	0.0026	0.0001
15	0.0028	0.0027	0.0001
16	0.0028	0.0027	0.0001
17	0.0028	0.0027	0.0001
18	0.0028	0.0027	0.0001
19	0.0028	0.0027	0.0001
20	0.0028	0.0027	0.0001
21	0.0029	0.0027	0.0001
22	0.0029	0.0027	0.0001
23	0.0029	0.0027	0.0001
24	0.0029	0.0027	0.0001
25	0.0029	0.0028	0.0002
26	0.0029	0.0028	0.0002
27	0.0029	0.0028	0.0002
28	0.0029	0.0028	0.0002
29	0.0029	0.0028	0.0002
30	0.0030	0.0028	0.0002
31	0.0030	0.0028	0.0002
32	0.0030	0.0028	0.0002
33	0.0030	0.0028	0.0002
34	0.0030	0.0028	0.0002

35	0.0030	0.0029	0.0002
36	0.0030	0.0029	0.0002
37	0.0030	0.0029	0.0002
38	0.0030	0.0029	0.0002
39	0.0031	0.0029	0.0002
40	0.0031	0.0029	0.0002
41	0.0031	0.0029	0.0002
42	0.0031	0.0029	0.0002
43	0.0031	0.0030	0.0002
44	0.0031	0.0030	0.0002
45	0.0031	0.0030	0.0002
46	0.0031	0.0030	0.0002
47	0.0032	0.0030	0.0002
48	0.0032	0.0030	0.0002
49	0.0032	0.0030	0.0002
50	0.0032	0.0030	0.0002
51	0.0032	0.0031	0.0002
52	0.0032	0.0031	0.0002
53	0.0033	0.0031	0.0002
54	0.0033	0.0031	0.0002
55	0.0033	0.0031	0.0002
56	0.0033	0.0031	0.0002
57	0.0033	0.0031	0.0002
58	0.0033	0.0031	0.0002
59	0.0033	0.0032	0.0002
60	0.0034	0.0032	0.0002
61	0.0034	0.0032	0.0002
62	0.0034	0.0032	0.0002
63	0.0034	0.0032	0.0002
64	0.0034	0.0032	0.0002
65	0.0034	0.0033	0.0002
66	0.0035	0.0033	0.0002
67	0.0035	0.0033	0.0002
68	0.0035	0.0033	0.0002
69	0.0035	0.0033	0.0002
70	0.0035	0.0033	0.0002
71	0.0035	0.0034	0.0002
72	0.0036	0.0034	0.0002
73	0.0036	0.0034	0.0002
74	0.0036	0.0034	0.0002
75	0.0036	0.0034	0.0002
76	0.0036	0.0034	0.0002
77	0.0037	0.0035	0.0002
78	0.0037	0.0035	0.0002
79	0.0037	0.0035	0.0002
80	0.0037	0.0035	0.0002
81	0.0037	0.0035	0.0002
82	0.0038	0.0036	0.0002
83	0.0038	0.0036	0.0002
84	0.0038	0.0036	0.0002
85	0.0038	0.0036	0.0002
86	0.0038	0.0036	0.0002
87	0.0039	0.0037	0.0002
88	0.0039	0.0037	0.0002
89	0.0039	0.0037	0.0002
90	0.0039	0.0037	0.0002
91	0.0040	0.0038	0.0002
92	0.0040	0.0038	0.0002
93	0.0040	0.0038	0.0002
94	0.0040	0.0038	0.0002
95	0.0041	0.0039	0.0002
96	0.0041	0.0039	0.0002
97	0.0041	0.0039	0.0002
98	0.0041	0.0039	0.0002
99	0.0042	0.0040	0.0002
100	0.0042	0.0040	0.0002
101	0.0042	0.0040	0.0002
102	0.0043	0.0040	0.0002
103	0.0043	0.0041	0.0002
104	0.0043	0.0041	0.0002
105	0.0044	0.0041	0.0002
106	0.0044	0.0041	0.0002
107	0.0044	0.0042	0.0002

108	0.0044	0.0042	0.0002
109	0.0045	0.0042	0.0002
110	0.0045	0.0043	0.0002
111	0.0045	0.0043	0.0002
112	0.0046	0.0043	0.0002
113	0.0046	0.0044	0.0002
114	0.0046	0.0044	0.0002
115	0.0047	0.0045	0.0002
116	0.0047	0.0045	0.0002
117	0.0048	0.0045	0.0002
118	0.0048	0.0045	0.0002
119	0.0049	0.0046	0.0003
120	0.0049	0.0046	0.0003
121	0.0049	0.0047	0.0003
122	0.0050	0.0047	0.0003
123	0.0050	0.0048	0.0003
124	0.0051	0.0048	0.0003
125	0.0051	0.0049	0.0003
126	0.0051	0.0049	0.0003
127	0.0052	0.0049	0.0003
128	0.0052	0.0050	0.0003
129	0.0053	0.0050	0.0003
130	0.0054	0.0051	0.0003
131	0.0054	0.0051	0.0003
132	0.0055	0.0052	0.0003
133	0.0055	0.0052	0.0003
134	0.0056	0.0053	0.0003
135	0.0057	0.0054	0.0003
136	0.0057	0.0054	0.0003
137	0.0058	0.0055	0.0003
138	0.0058	0.0055	0.0003
139	0.0059	0.0056	0.0003
140	0.0060	0.0057	0.0003
141	0.0061	0.0057	0.0003
142	0.0061	0.0058	0.0003
143	0.0062	0.0059	0.0003
144	0.0063	0.0059	0.0003
145	0.0077	0.0073	0.0004
146	0.0078	0.0074	0.0004
147	0.0079	0.0075	0.0004
148	0.0080	0.0076	0.0004
149	0.0081	0.0077	0.0004
150	0.0082	0.0078	0.0004
151	0.0083	0.0079	0.0004
152	0.0084	0.0080	0.0004
153	0.0086	0.0081	0.0004
154	0.0086	0.0082	0.0004
155	0.0088	0.0083	0.0005
156	0.0089	0.0084	0.0005
157	0.0091	0.0086	0.0005
158	0.0092	0.0087	0.0005
159	0.0094	0.0089	0.0005
160	0.0095	0.0090	0.0005
161	0.0097	0.0092	0.0005
162	0.0098	0.0093	0.0005
163	0.0100	0.0095	0.0005
164	0.0101	0.0096	0.0005
165	0.0104	0.0099	0.0005
166	0.0105	0.0100	0.0005
167	0.0108	0.0103	0.0006
168	0.0110	0.0104	0.0006
169	0.0118	0.0111	0.0006
170	0.0119	0.0113	0.0006
171	0.0123	0.0117	0.0006
172	0.0125	0.0119	0.0006
173	0.0130	0.0123	0.0007
174	0.0132	0.0125	0.0007
175	0.0137	0.0130	0.0007
176	0.0140	0.0133	0.0007
177	0.0146	0.0139	0.0008
178	0.0150	0.0142	0.0008
179	0.0157	0.0149	0.0008
180	0.0161	0.0153	0.0008

181	0.0171	0.0162	0.0009
182	0.0176	0.0167	0.0009
183	0.0189	0.0179	0.0010
184	0.0196	0.0186	0.0010
185	0.0184	0.0174	0.0010
186	0.0194	0.0184	0.0010
187	0.0220	0.0209	0.0011
188	0.0237	0.0225	0.0012
189	0.0292	0.0227	0.0065
190	0.0328	0.0227	0.0102
191	0.0465	0.0227	0.0238
192	0.0634	0.0227	0.0407
193	0.1899	0.0227	0.1673
194	0.0381	0.0227	0.0154
195	0.0258	0.0227	0.0032
196	0.0206	0.0195	0.0011
197	0.0204	0.0193	0.0011
198	0.0182	0.0173	0.0009
199	0.0166	0.0157	0.0009
200	0.0153	0.0145	0.0008
201	0.0143	0.0136	0.0007
202	0.0135	0.0128	0.0007
203	0.0127	0.0121	0.0007
204	0.0121	0.0115	0.0006
205	0.0112	0.0106	0.0006
206	0.0107	0.0101	0.0006
207	0.0103	0.0097	0.0005
208	0.0099	0.0094	0.0005
209	0.0096	0.0091	0.0005
210	0.0093	0.0088	0.0005
211	0.0090	0.0085	0.0005
212	0.0087	0.0083	0.0005
213	0.0085	0.0080	0.0004
214	0.0083	0.0078	0.0004
215	0.0081	0.0076	0.0004
216	0.0079	0.0075	0.0004
217	0.0063	0.0060	0.0003
218	0.0062	0.0058	0.0003
219	0.0060	0.0057	0.0003
220	0.0059	0.0056	0.0003
221	0.0057	0.0054	0.0003
222	0.0056	0.0053	0.0003
223	0.0055	0.0052	0.0003
224	0.0054	0.0051	0.0003
225	0.0053	0.0050	0.0003
226	0.0052	0.0049	0.0003
227	0.0051	0.0048	0.0003
228	0.0050	0.0047	0.0003
229	0.0049	0.0047	0.0003
230	0.0048	0.0046	0.0002
231	0.0047	0.0045	0.0002
232	0.0047	0.0044	0.0002
233	0.0046	0.0044	0.0002
234	0.0045	0.0043	0.0002
235	0.0045	0.0042	0.0002
236	0.0044	0.0042	0.0002
237	0.0043	0.0041	0.0002
238	0.0043	0.0041	0.0002
239	0.0042	0.0040	0.0002
240	0.0042	0.0039	0.0002
241	0.0041	0.0039	0.0002
242	0.0041	0.0038	0.0002
243	0.0040	0.0038	0.0002
244	0.0040	0.0037	0.0002
245	0.0039	0.0037	0.0002
246	0.0039	0.0037	0.0002
247	0.0038	0.0036	0.0002
248	0.0038	0.0036	0.0002
249	0.0037	0.0035	0.0002
250	0.0037	0.0035	0.0002
251	0.0036	0.0035	0.0002
252	0.0036	0.0034	0.0002
253	0.0036	0.0034	0.0002

254	0.0035	0.0034	0.0002
255	0.0035	0.0033	0.0002
256	0.0035	0.0033	0.0002
257	0.0034	0.0033	0.0002
258	0.0034	0.0032	0.0002
259	0.0034	0.0032	0.0002
260	0.0033	0.0032	0.0002
261	0.0033	0.0031	0.0002
262	0.0033	0.0031	0.0002
263	0.0032	0.0031	0.0002
264	0.0032	0.0030	0.0002
265	0.0032	0.0030	0.0002
266	0.0032	0.0030	0.0002
267	0.0031	0.0030	0.0002
268	0.0031	0.0029	0.0002
269	0.0031	0.0029	0.0002
270	0.0031	0.0029	0.0002
271	0.0030	0.0029	0.0002
272	0.0030	0.0029	0.0002
273	0.0030	0.0028	0.0002
274	0.0030	0.0028	0.0002
275	0.0029	0.0028	0.0002
276	0.0029	0.0028	0.0002
277	0.0029	0.0027	0.0001
278	0.0029	0.0027	0.0001
279	0.0029	0.0027	0.0001
280	0.0028	0.0027	0.0001
281	0.0028	0.0027	0.0001
282	0.0028	0.0026	0.0001
283	0.0028	0.0026	0.0001
284	0.0028	0.0026	0.0001
285	0.0027	0.0026	0.0001
286	0.0027	0.0026	0.0001
287	0.0027	0.0026	0.0001
288	0.0027	0.0025	0.0001

Total soil rain loss = 1.70(In)
Total effective rainfall = 0.35(In)
Peak flow rate in flood hydrograph = 5.99(CFS)

++

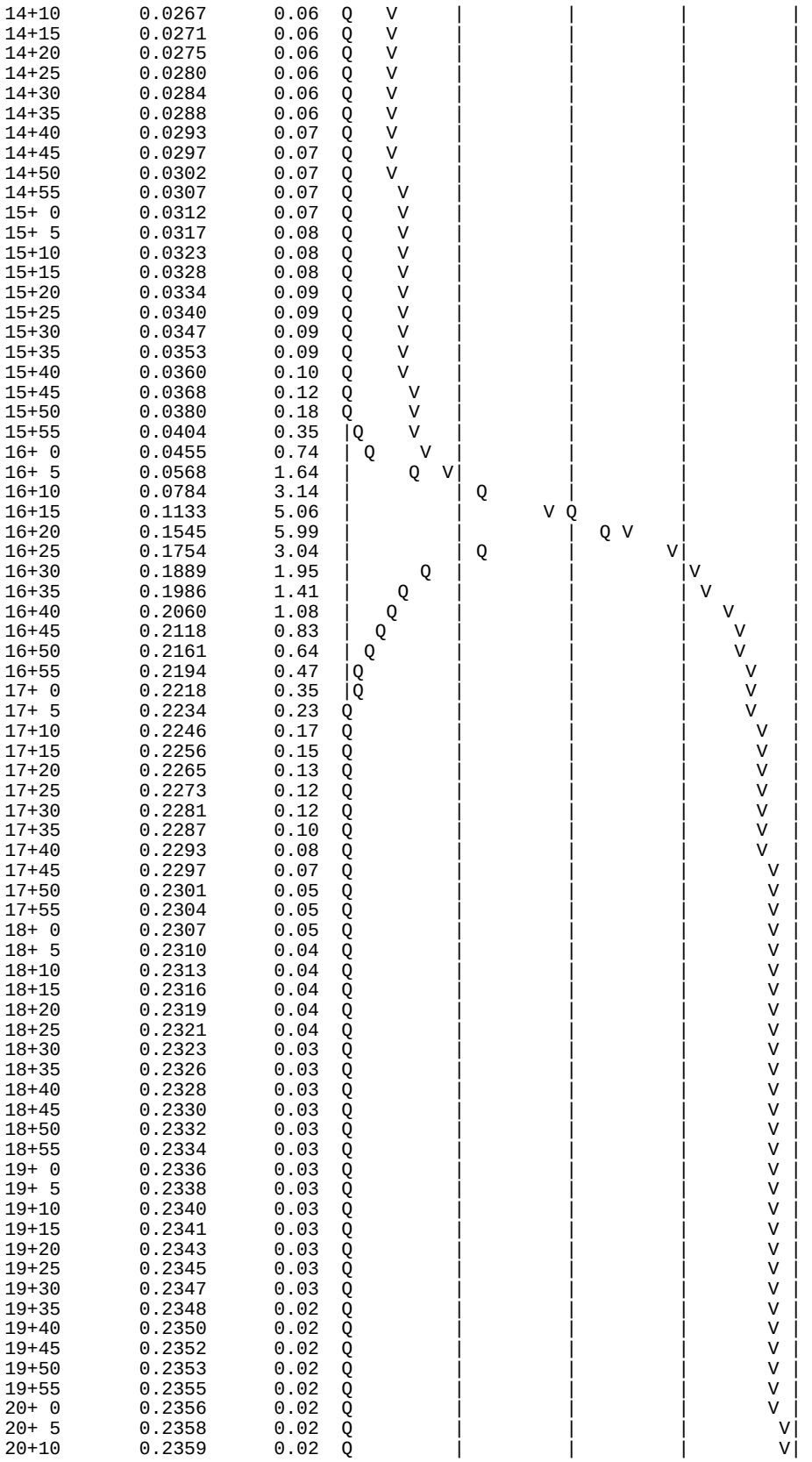
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

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	0.0000	0.00	Q	|	|	|	|
0+15	0.0000	0.00	Q	|	|	|	|
0+20	0.0001	0.01	Q	|	|	|	|
0+25	0.0002	0.01	Q	|	|	|	|
0+30	0.0002	0.01	Q	|	|	|	|
0+35	0.0003	0.01	Q	|	|	|	|
0+40	0.0004	0.01	Q	|	|	|	|
0+45	0.0005	0.01	Q	|	|	|	|
0+50	0.0006	0.01	Q	|	|	|	|
0+55	0.0007	0.01	Q	|	|	|	|
1+ 0	0.0008	0.01	Q	|	|	|	|
1+ 5	0.0009	0.01	Q	|	|	|	|
1+10	0.0010	0.01	Q	|	|	|	|
1+15	0.0011	0.01	Q	|	|	|	|
1+20	0.0012	0.01	Q	|	|	|	|
1+25	0.0013	0.01	Q	|	|	|	|
1+30	0.0014	0.01	Q	|	|	|	|
1+35	0.0015	0.01	Q	|	|	|	|
1+40	0.0016	0.01	Q	|	|	|	|
1+45	0.0017	0.01	Q	|	|	|	|
1+50	0.0018	0.01	Q	|	|	|	|
1+55	0.0019	0.01	Q	|	|	|	|

2+ 0	0.0020	0.01	Q				
2+ 5	0.0021	0.01	Q				
2+10	0.0022	0.01	Q				
2+15	0.0023	0.01	Q				
2+20	0.0024	0.01	Q				
2+25	0.0025	0.02	Q				
2+30	0.0026	0.02	Q				
2+35	0.0027	0.02	Q				
2+40	0.0028	0.02	Q				
2+45	0.0029	0.02	Q				
2+50	0.0030	0.02	Q				
2+55	0.0031	0.02	Q				
3+ 0	0.0032	0.02	Q				
3+ 5	0.0033	0.02	Q				
3+10	0.0034	0.02	Q				
3+15	0.0035	0.02	Q				
3+20	0.0036	0.02	Q				
3+25	0.0038	0.02	Q				
3+30	0.0039	0.02	Q				
3+35	0.0040	0.02	Q				
3+40	0.0041	0.02	Q				
3+45	0.0042	0.02	Q				
3+50	0.0043	0.02	Q				
3+55	0.0044	0.02	Q				
4+ 0	0.0045	0.02	Q				
4+ 5	0.0046	0.02	Q				
4+10	0.0047	0.02	Q				
4+15	0.0049	0.02	Q				
4+20	0.0050	0.02	Q				
4+25	0.0051	0.02	Q				
4+30	0.0052	0.02	Q				
4+35	0.0053	0.02	Q				
4+40	0.0054	0.02	Q				
4+45	0.0055	0.02	Q				
4+50	0.0057	0.02	Q				
4+55	0.0058	0.02	Q				
5+ 0	0.0059	0.02	Q				
5+ 5	0.0060	0.02	Q				
5+10	0.0061	0.02	QV				
5+15	0.0063	0.02	QV				
5+20	0.0064	0.02	QV				
5+25	0.0065	0.02	QV				
5+30	0.0066	0.02	QV				
5+35	0.0067	0.02	QV				
5+40	0.0069	0.02	QV				
5+45	0.0070	0.02	QV				
5+50	0.0071	0.02	QV				
5+55	0.0072	0.02	QV				
6+ 0	0.0074	0.02	QV				
6+ 5	0.0075	0.02	QV				
6+10	0.0076	0.02	QV				
6+15	0.0077	0.02	QV				
6+20	0.0079	0.02	QV				
6+25	0.0080	0.02	QV				
6+30	0.0081	0.02	QV				
6+35	0.0082	0.02	QV				
6+40	0.0084	0.02	QV				
6+45	0.0085	0.02	QV				
6+50	0.0086	0.02	QV				
6+55	0.0088	0.02	QV				
7+ 0	0.0089	0.02	QV				
7+ 5	0.0090	0.02	QV				
7+10	0.0092	0.02	QV				
7+15	0.0093	0.02	QV				
7+20	0.0094	0.02	QV				
7+25	0.0096	0.02	QV				
7+30	0.0097	0.02	QV				
7+35	0.0098	0.02	QV				
7+40	0.0100	0.02	QV				
7+45	0.0101	0.02	QV				
7+50	0.0103	0.02	QV				
7+55	0.0104	0.02	QV				
8+ 0	0.0105	0.02	QV				

```
 8+ 5      0.0107      0.02  QV        |         |         |         |
 8+10      0.0108      0.02  QV        |         |         |         |
 8+15      0.0110      0.02  QV        |         |         |         |
 8+20      0.0111      0.02  QV        |         |         |         |
 8+25      0.0113      0.02  QV        |         |         |         |
 8+30      0.0114      0.02  QV        |         |         |         |
 8+35      0.0116      0.02  QV        |         |         |         |
 8+40      0.0117      0.02  QV        |         |         |         |
 8+45      0.0119      0.02  QV        |         |         |         |
 8+50      0.0120      0.02  QV        |         |         |         |
 8+55      0.0122      0.02  Q V       |         |         |         |
 9+ 0      0.0123      0.02  Q V       |         |         |         |
 9+ 5      0.0125      0.02  Q V       |         |         |         |
 9+10      0.0126      0.02  Q V       |         |         |         |
 9+15      0.0128      0.02  Q V       |         |         |         |
 9+20      0.0130      0.02  Q V       |         |         |         |
 9+25      0.0131      0.02  Q V       |         |         |         |
 9+30      0.0133      0.02  Q V       |         |         |         |
 9+35      0.0134      0.02  Q V       |         |         |         |
 9+40      0.0136      0.02  Q V       |         |         |         |
 9+45      0.0138      0.02  Q V       |         |         |         |
 9+50      0.0139      0.02  Q V       |         |         |         |
 9+55      0.0141      0.02  Q V       |         |         |         |
10+ 0      0.0143      0.02  Q V       |         |         |         |
10+ 5      0.0144      0.02  Q V       |         |         |         |
10+10      0.0146      0.02  Q V       |         |         |         |
10+15      0.0148      0.03  Q V       |         |         |         |
10+20      0.0150      0.03  Q V       |         |         |         |
10+25      0.0151      0.03  Q V       |         |         |         |
10+30      0.0153      0.03  Q V       |         |         |         |
10+35      0.0155      0.03  Q V       |         |         |         |
10+40      0.0157      0.03  Q V       |         |         |         |
10+45      0.0159      0.03  Q V       |         |         |         |
10+50      0.0160      0.03  Q V       |         |         |         |
10+55      0.0162      0.03  Q V       |         |         |         |
11+ 0      0.0164      0.03  Q V       |         |         |         |
11+ 5      0.0166      0.03  Q V       |         |         |         |
11+10      0.0168      0.03  Q V       |         |         |         |
11+15      0.0170      0.03  Q V       |         |         |         |
11+20      0.0172      0.03  Q V       |         |         |         |
11+25      0.0174      0.03  Q V       |         |         |         |
11+30      0.0176      0.03  Q V       |         |         |         |
11+35      0.0178      0.03  Q V       |         |         |         |
11+40      0.0180      0.03  Q V       |         |         |         |
11+45      0.0182      0.03  Q  V      |         |         |         |
11+50      0.0184      0.03  Q  V      |         |         |         |
11+55      0.0186      0.03  Q  V      |         |         |         |
12+ 0      0.0188      0.03  Q  V      |         |         |         |
12+ 5      0.0190      0.03  Q  V      |         |         |         |
12+10      0.0193      0.03  Q  V      |         |         |         |
12+15      0.0195      0.03  Q  V      |         |         |         |
12+20      0.0198      0.04  Q  V      |         |         |         |
12+25      0.0200      0.04  Q  V      |         |         |         |
12+30      0.0203      0.04  Q  V      |         |         |         |
12+35      0.0206      0.04  Q  V      |         |         |         |
12+40      0.0208      0.04  Q  V      |         |         |         |
12+45      0.0211      0.04  Q  V      |         |         |         |
12+50      0.0214      0.04  Q  V      |         |         |         |
12+55      0.0217      0.04  Q  V      |         |         |         |
13+ 0      0.0220      0.04  Q  V      |         |         |         |
13+ 5      0.0223      0.04  Q  V      |         |         |         |
13+10      0.0226      0.04  Q  V      |         |         |         |
13+15      0.0229      0.05  Q  V      |         |         |         |
13+20      0.0233      0.05  Q  V      |         |         |         |
13+25      0.0236      0.05  Q  V      |         |         |         |
13+30      0.0239      0.05  Q  V      |         |         |         |
13+35      0.0242      0.05  Q   V     |         |         |         |
13+40      0.0246      0.05  Q   V     |         |         |         |
13+45      0.0249      0.05  Q   V     |         |         |         |
13+50      0.0253      0.05  Q   V     |         |         |         |
13+55      0.0256      0.05  Q   V     |         |         |         |
14+ 0      0.0260      0.05  Q   V     |         |         |         |
14+ 5      0.0264      0.05  Q   V     |         |         |         |
```


14+10 0.0267 0.06
14+15 0.0271 0.06
14+20 0.0275 0.06
14+25 0.0280 0.06
14+30 0.0284 0.06
14+35 0.0288 0.06
14+40 0.0293 0.07
14+45 0.0297 0.07
14+50 0.0302 0.07
14+55 0.0307 0.07
15+ 0 0.0312 0.07
15+ 5 0.0317 0.08
15+10 0.0323 0.08
15+15 0.0328 0.08
15+20 0.0334 0.09
15+25 0.0340 0.09
15+30 0.0347 0.09
15+35 0.0353 0.09
15+40 0.0360 0.10
15+45 0.0368 0.12
15+50 0.0380 0.18
15+55 0.0404 0.35
16+ 0 0.0455 0.74
16+ 5 0.0568 1.64
16+10 0.0784 3.14
16+15 0.1133 5.06
16+20 0.1545 5.99
16+25 0.1754 3.04
16+30 0.1889 1.95
16+35 0.1986 1.41
16+40 0.2060 1.08
16+45 0.2118 0.83
16+50 0.2161 0.64
16+55 0.2194 0.47
17+ 0 0.2218 0.35
17+ 5 0.2234 0.23
17+10 0.2246 0.17
17+15 0.2256 0.15
17+20 0.2265 0.13
17+25 0.2273 0.12
17+30 0.2281 0.12
17+35 0.2287 0.10
17+40 0.2293 0.08
17+45 0.2297 0.07
17+50 0.2301 0.05
17+55 0.2304 0.05
18+ 0 0.2307 0.05
18+ 5 0.2310 0.04
18+10 0.2313 0.04
18+15 0.2316 0.04
18+20 0.2319 0.04
18+25 0.2321 0.04
18+30 0.2323 0.03
18+35 0.2326 0.03
18+40 0.2328 0.03
18+45 0.2330 0.03
18+50 0.2332 0.03
18+55 0.2334 0.03
19+ 0 0.2336 0.03
19+ 5 0.2338 0.03
19+10 0.2340 0.03
19+15 0.2341 0.03
19+20 0.2343 0.03
19+25 0.2345 0.03
19+30 0.2347 0.03
19+35 0.2348 0.02
19+40 0.2350 0.02
19+45 0.2352 0.02
19+50 0.2353 0.02
19+55 0.2355 0.02
20+ 0 0.2356 0.02
20+ 5 0.2358 0.02
20+10 0.2359 0.02

```
  20+15      0.2361     0.02  Q          |          |          |          V|
  20+20      0.2362     0.02  Q          |          |          |          V|
  20+25      0.2364     0.02  Q          |          |          |          V|
  20+30      0.2365     0.02  Q          |          |          |          V|
  20+35      0.2367     0.02  Q          |          |          |          V|
  20+40      0.2368     0.02  Q          |          |          |          V|
  20+45      0.2370     0.02  Q          |          |          |          V|
  20+50      0.2371     0.02  Q          |          |          |          V|
  20+55      0.2372     0.02  Q          |          |          |          V|
  21+ 0      0.2374     0.02  Q          |          |          |          V|
  21+ 5      0.2375     0.02  Q          |          |          |          V|
  21+10      0.2376     0.02  Q          |          |          |          V|
  21+15      0.2378     0.02  Q          |          |          |          V|
  21+20      0.2379     0.02  Q          |          |          |          V|
  21+25      0.2380     0.02  Q          |          |          |          V|
  21+30      0.2381     0.02  Q          |          |          |          V|
  21+35      0.2383     0.02  Q          |          |          |          V|
  21+40      0.2384     0.02  Q          |          |          |          V|
  21+45      0.2385     0.02  Q          |          |          |          V|
  21+50      0.2386     0.02  Q          |          |          |          V|
  21+55      0.2388     0.02  Q          |          |          |          V|
  22+ 0      0.2389     0.02  Q          |          |          |          V|
  22+ 5      0.2390     0.02  Q          |          |          |          V|
  22+10      0.2391     0.02  Q          |          |          |          V|
  22+15      0.2392     0.02  Q          |          |          |          V|
  22+20      0.2393     0.02  Q          |          |          |          V|
  22+25      0.2395     0.02  Q          |          |          |          V|
  22+30      0.2396     0.02  Q          |          |          |          V|
  22+35      0.2397     0.02  Q          |          |          |          V|
  22+40      0.2398     0.02  Q          |          |          |          V|
  22+45      0.2399     0.02  Q          |          |          |          V|
  22+50      0.2400     0.02  Q          |          |          |          V|
  22+55      0.2401     0.02  Q          |          |          |          V|
  23+ 0      0.2402     0.02  Q          |          |          |          V|
  23+ 5      0.2403     0.02  Q          |          |          |          V|
  23+10      0.2404     0.02  Q          |          |          |          V|
  23+15      0.2405     0.02  Q          |          |          |          V|
  23+20      0.2406     0.02  Q          |          |          |          V|
  23+25      0.2407     0.01  Q          |          |          |          V|
  23+30      0.2408     0.01  Q          |          |          |          V|
  23+35      0.2409     0.01  Q          |          |          |          V|
  23+40      0.2411     0.01  Q          |          |          |          V|
  23+45      0.2412     0.01  Q          |          |          |          V|
  23+50      0.2413     0.01  Q          |          |          |          V|
  23+55      0.2413     0.01  Q          |          |          |          V|
  24+ 0      0.2414     0.01  Q          |          |          |          V|
  24+ 5      0.2415     0.01  Q          |          |          |          V|
  24+10      0.2416     0.01  Q          |          |          |          V|
  24+15      0.2417     0.01  Q          |          |          |          V|
  24+20      0.2417     0.01  Q          |          |          |          V|
  24+25      0.2418     0.00  Q          |          |          |          V|
  24+30      0.2418     0.00  Q          |          |          |          V|
  24+35      0.2418     0.00  Q          |          |          |          V|
  24+40      0.2418     0.00  Q          |          |          |          V|
  24+45      0.2418     0.00  Q          |          |          |          V|
  24+50      0.2418     0.00  Q          |          |          |          V|
  24+55      0.2418     0.00  Q          |          |          |          V|
  25+ 0      0.2418     0.00  Q          |          |          |          V|
  25+ 5      0.2418     0.00  Q          |          |          |          V|
  25+10      0.2418     0.00  Q          |          |          |          V|
  25+15      0.2418     0.00  Q          |          |          |          V|
  25+20      0.2418     0.00  Q          |          |          |          V|
  25+25      0.2418     0.00  Q          |          |          |          V|
  25+30      0.2418     0.00  Q          |          |          |          V|
  25+35      0.2418     0.00  Q          |          |          |          V|
  25+40      0.2418     0.00  Q          |          |          |           V
-------------------------------------------------------------------------
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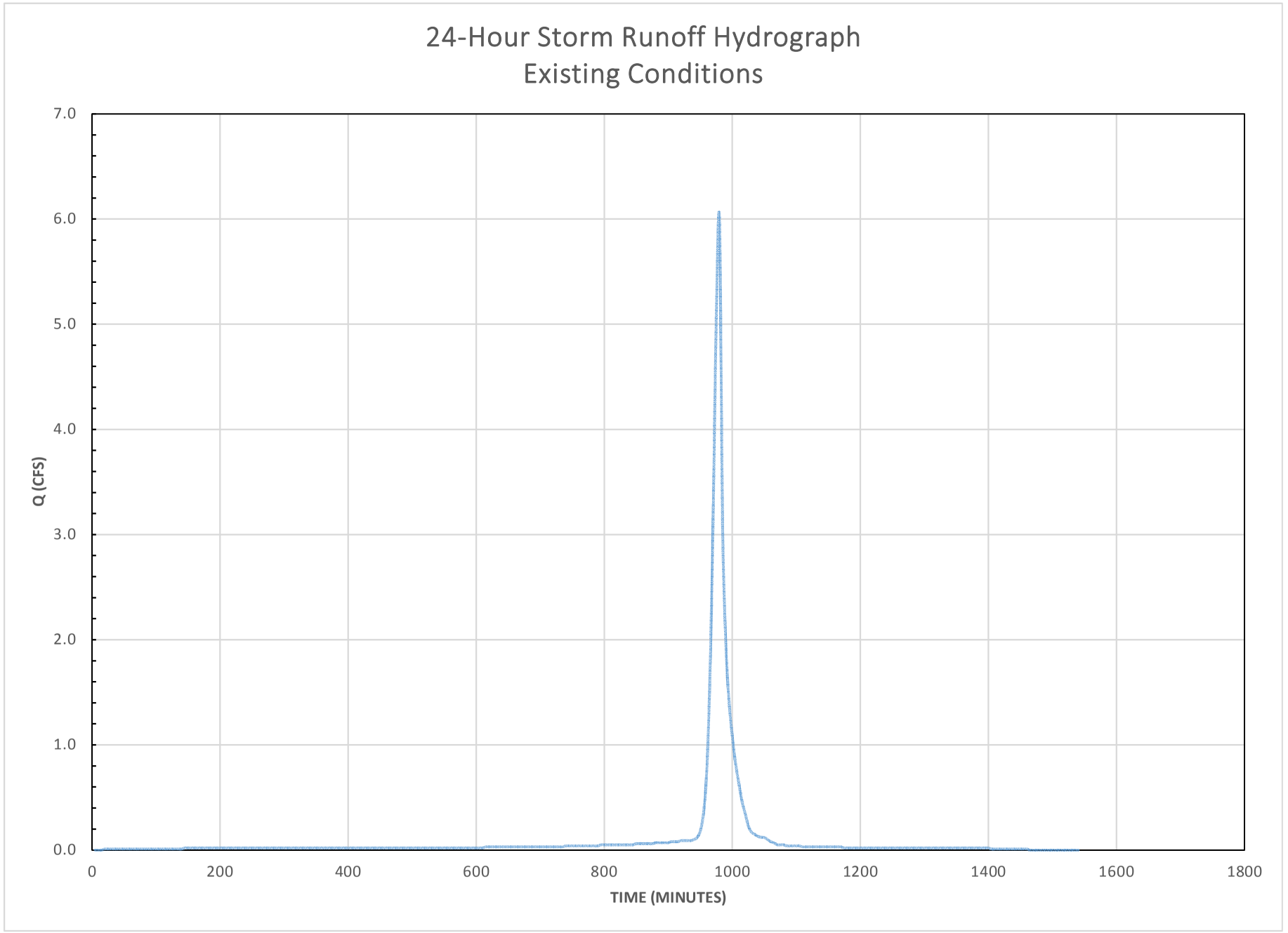

24-Hour Storm Runoff Hydrograph
Existing Conditions
Q (CFS)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
200
400
600
800
1000
1200
1400
1600
1800
TIME (MINUTES)

APPENDIX A.2

PROPOSED CONDITION HYDROLOGY CALCULATIONS FOR HYDROMODIFICATION (2-YEAR, 24-HOUR STORM)

Planning Area 1 (South Site)

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

Study date 09/29/15 File Name PRPA1HYME.out

++

Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6103

PLANNING AREA 1 - 8'x7' RCB
PROPOSED CONDITIONS - HYDROMOD CALCULATIONS
2-YEAR 24-HOUR STORM
BY FUSCOE ENGINEERING

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
56.0	3.9	0.12	B	0.300	0.600	0.180
69.0	2.2	0.07	C	0.250	0.600	0.150
75.0	25.7	0.81	D	0.200	0.600	0.120

Area-averaged adjusted loss rate Fm (In/Hr) = 0.129

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
2.34	0.074	56.0	36.0	17.78	0.068
1.56	0.049	98.0	98.0	0.20	0.890
1.32	0.042	69.0	49.8	10.08	0.000
0.88	0.028	98.0	98.0	0.20	0.890
15.42	0.485	75.0	57.0	7.54	0.018
10.28	0.323	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.369
Area-averaged low loss fraction, Yb = 0.631

++
Watercourse length = 2549.18(Ft.)
Length from concentration point to centroid = 1109.41(Ft.)
Elevation difference along watercourse = 186.10(Ft.)
Mannings friction factor along watercourse = 0.015
Watershed area = 31.80(Ac.)
Catchment Lag time = 0.049 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 171.1934
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.129(In/Hr)
Average low loss rate fraction (Yb) = 0.631 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.190(In)
Computed peak 30-minute rainfall = 0.400(In)
Specified peak 1-hour rainfall = 0.530(In)
Computed peak 3-hour rainfall = 0.890(In)
Specified peak 6-hour rainfall = 1.220(In)
Specified peak 24-hour rainfall = 2.050(In)

Rainfall depth area reduction factors:
Using a total area of 31.80(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.190(In)
30-minute factor = 0.999 Adjusted rainfall = 0.399(In)
1-hour factor = 0.999 Adjusted rainfall = 0.529(In)
3-hour factor = 1.000 Adjusted rainfall = 0.890(In)
6-hour factor = 1.000 Adjusted rainfall = 1.220(In)
24-hour factor = 1.000 Adjusted rainfall = 2.050(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 384.58 (CFS))		
1	35.976	138.356
2	88.604	202.399
3	98.016	36.197
4	99.610	6.130
5	100.000	1.499

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.1897	0.1897
2	0.2530	0.0633
3	0.2995	0.0464
4	0.3375	0.0380
5	0.3703	0.0328
6	0.3994	0.0291
7	0.4252	0.0258
8	0.4489	0.0237
9	0.4709	0.0220
10	0.4915	0.0206
11	0.5108	0.0194
12	0.5292	0.0184
13	0.5496	0.0204
14	0.5692	0.0196
15	0.5881	0.0189
16	0.6064	0.0182
17	0.6240	0.0176
18	0.6411	0.0171
19	0.6577	0.0166
20	0.6738	0.0162
21	0.6896	0.0157
22	0.7049	0.0153
23	0.7199	0.0150
24	0.7345	0.0146
25	0.7489	0.0143
26	0.7629	0.0140
27	0.7766	0.0137
28	0.7901	0.0135
29	0.8033	0.0132
30	0.8163	0.0130
31	0.8291	0.0128
32	0.8416	0.0125
33	0.8540	0.0123
34	0.8661	0.0121
35	0.8781	0.0120
36	0.8898	0.0118
37	0.9010	0.0112
38	0.9120	0.0110
39	0.9228	0.0108
40	0.9335	0.0107
41	0.9441	0.0106
42	0.9545	0.0104
43	0.9648	0.0103
44	0.9749	0.0101
45	0.9850	0.0100
46	0.9949	0.0099
47	1.0046	0.0098
48	1.0143	0.0097

49	1.0239	0.0096
50	1.0333	0.0095
51	1.0427	0.0094
52	1.0519	0.0093
53	1.0611	0.0092
54	1.0702	0.0091
55	1.0791	0.0090
56	1.0880	0.0089
57	1.0968	0.0088
58	1.1055	0.0087
59	1.1142	0.0086
60	1.1227	0.0086
61	1.1312	0.0085
62	1.1396	0.0084
63	1.1479	0.0083
64	1.1562	0.0083
65	1.1644	0.0082
66	1.1725	0.0081
67	1.1806	0.0081
68	1.1886	0.0080
69	1.1965	0.0079
70	1.2043	0.0079
71	1.2121	0.0078
72	1.2199	0.0077
73	1.2262	0.0063
74	1.2325	0.0063
75	1.2387	0.0062
76	1.2448	0.0062
77	1.2509	0.0061
78	1.2570	0.0061
79	1.2630	0.0060
80	1.2690	0.0060
81	1.2749	0.0059
82	1.2807	0.0059
83	1.2866	0.0058
84	1.2924	0.0058
85	1.2981	0.0057
86	1.3038	0.0057
87	1.3094	0.0057
88	1.3151	0.0056
89	1.3206	0.0056
90	1.3262	0.0055
91	1.3317	0.0055
92	1.3371	0.0055
93	1.3426	0.0054
94	1.3479	0.0054
95	1.3533	0.0054
96	1.3586	0.0053
97	1.3639	0.0053
98	1.3691	0.0052
99	1.3744	0.0052
100	1.3795	0.0052
101	1.3847	0.0051
102	1.3898	0.0051
103	1.3949	0.0051
104	1.3999	0.0051
105	1.4050	0.0050
106	1.4100	0.0050
107	1.4149	0.0050
108	1.4199	0.0049
109	1.4248	0.0049
110	1.4297	0.0049
111	1.4345	0.0049
112	1.4393	0.0048
113	1.4441	0.0048
114	1.4489	0.0048
115	1.4536	0.0047
116	1.4584	0.0047
117	1.4631	0.0047
118	1.4677	0.0047
119	1.4724	0.0046
120	1.4770	0.0046
121	1.4816	0.0046
122	1.4862	0.0046
123	1.4907	0.0045
124	1.4952	0.0045

125	1.4997	0.0045
126	1.5042	0.0045
127	1.5087	0.0045
128	1.5131	0.0044
129	1.5175	0.0044
130	1.5219	0.0044
131	1.5263	0.0044
132	1.5307	0.0044
133	1.5350	0.0043
134	1.5393	0.0043
135	1.5436	0.0043
136	1.5479	0.0043
137	1.5521	0.0043
138	1.5563	0.0042
139	1.5606	0.0042
140	1.5648	0.0042
141	1.5689	0.0042
142	1.5731	0.0042
143	1.5772	0.0041
144	1.5813	0.0041
145	1.5854	0.0041
146	1.5895	0.0041
147	1.5936	0.0041
148	1.5977	0.0041
149	1.6017	0.0040
150	1.6057	0.0040
151	1.6097	0.0040
152	1.6137	0.0040
153	1.6177	0.0040
154	1.6216	0.0040
155	1.6255	0.0039
156	1.6295	0.0039
157	1.6334	0.0039
158	1.6372	0.0039
159	1.6411	0.0039
160	1.6450	0.0039
161	1.6488	0.0038
162	1.6526	0.0038
163	1.6565	0.0038
164	1.6603	0.0038
165	1.6640	0.0038
166	1.6678	0.0038
167	1.6716	0.0038
168	1.6753	0.0037
169	1.6790	0.0037
170	1.6827	0.0037
171	1.6864	0.0037
172	1.6901	0.0037
173	1.6938	0.0037
174	1.6975	0.0037
175	1.7011	0.0036
176	1.7047	0.0036
177	1.7084	0.0036
178	1.7120	0.0036
179	1.7156	0.0036
180	1.7191	0.0036
181	1.7227	0.0036
182	1.7263	0.0036
183	1.7298	0.0035
184	1.7333	0.0035
185	1.7369	0.0035
186	1.7404	0.0035
187	1.7439	0.0035
188	1.7474	0.0035
189	1.7508	0.0035
190	1.7543	0.0035
191	1.7577	0.0035
192	1.7612	0.0034
193	1.7646	0.0034
194	1.7680	0.0034
195	1.7714	0.0034
196	1.7748	0.0034
197	1.7782	0.0034
198	1.7816	0.0034
199	1.7850	0.0034
200	1.7883	0.0034

201	1.7917	0.0033
202	1.7950	0.0033
203	1.7983	0.0033
204	1.8016	0.0033
205	1.8049	0.0033
206	1.8082	0.0033
207	1.8115	0.0033
208	1.8148	0.0033
209	1.8180	0.0033
210	1.8213	0.0033
211	1.8245	0.0032
212	1.8278	0.0032
213	1.8310	0.0032
214	1.8342	0.0032
215	1.8374	0.0032
216	1.8406	0.0032
217	1.8438	0.0032
218	1.8470	0.0032
219	1.8501	0.0032
220	1.8533	0.0032
221	1.8564	0.0031
222	1.8596	0.0031
223	1.8627	0.0031
224	1.8658	0.0031
225	1.8689	0.0031
226	1.8720	0.0031
227	1.8751	0.0031
228	1.8782	0.0031
229	1.8813	0.0031
230	1.8844	0.0031
231	1.8874	0.0031
232	1.8905	0.0031
233	1.8936	0.0030
234	1.8966	0.0030
235	1.8996	0.0030
236	1.9026	0.0030
237	1.9057	0.0030
238	1.9087	0.0030
239	1.9117	0.0030
240	1.9147	0.0030
241	1.9176	0.0030
242	1.9206	0.0030
243	1.9236	0.0030
244	1.9265	0.0030
245	1.9295	0.0030
246	1.9324	0.0029
247	1.9354	0.0029
248	1.9383	0.0029
249	1.9412	0.0029
250	1.9441	0.0029
251	1.9470	0.0029
252	1.9500	0.0029
253	1.9528	0.0029
254	1.9557	0.0029
255	1.9586	0.0029
256	1.9615	0.0029
257	1.9643	0.0029
258	1.9672	0.0029
259	1.9701	0.0029
260	1.9729	0.0028
261	1.9757	0.0028
262	1.9786	0.0028
263	1.9814	0.0028
264	1.9842	0.0028
265	1.9870	0.0028
266	1.9898	0.0028
267	1.9926	0.0028
268	1.9954	0.0028
269	1.9982	0.0028
270	2.0010	0.0028
271	2.0037	0.0028
272	2.0065	0.0028
273	2.0093	0.0028
274	2.0120	0.0028
275	2.0148	0.0027
276	2.0175	0.0027

277	2.0202	0.0027
278	2.0230	0.0027
279	2.0257	0.0027
280	2.0284	0.0027
281	2.0311	0.0027
282	2.0338	0.0027
283	2.0365	0.0027
284	2.0392	0.0027
285	2.0419	0.0027
286	2.0446	0.0027
287	2.0473	0.0027
288	2.0499	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0027	0.0017	0.0010
2	0.0027	0.0017	0.0010
3	0.0027	0.0017	0.0010
4	0.0027	0.0017	0.0010
5	0.0027	0.0017	0.0010
6	0.0027	0.0017	0.0010
7	0.0027	0.0017	0.0010
8	0.0027	0.0017	0.0010
9	0.0027	0.0017	0.0010
10	0.0027	0.0017	0.0010
11	0.0028	0.0017	0.0010
12	0.0028	0.0017	0.0010
13	0.0028	0.0018	0.0010
14	0.0028	0.0018	0.0010
15	0.0028	0.0018	0.0010
16	0.0028	0.0018	0.0010
17	0.0028	0.0018	0.0010
18	0.0028	0.0018	0.0010
19	0.0028	0.0018	0.0010
20	0.0028	0.0018	0.0011
21	0.0029	0.0018	0.0011
22	0.0029	0.0018	0.0011
23	0.0029	0.0018	0.0011
24	0.0029	0.0018	0.0011
25	0.0029	0.0018	0.0011
26	0.0029	0.0018	0.0011
27	0.0029	0.0018	0.0011
28	0.0029	0.0018	0.0011
29	0.0029	0.0019	0.0011
30	0.0030	0.0019	0.0011
31	0.0030	0.0019	0.0011
32	0.0030	0.0019	0.0011
33	0.0030	0.0019	0.0011
34	0.0030	0.0019	0.0011
35	0.0030	0.0019	0.0011
36	0.0030	0.0019	0.0011
37	0.0030	0.0019	0.0011
38	0.0030	0.0019	0.0011
39	0.0031	0.0019	0.0011
40	0.0031	0.0019	0.0011
41	0.0031	0.0019	0.0011
42	0.0031	0.0020	0.0011
43	0.0031	0.0020	0.0012
44	0.0031	0.0020	0.0012
45	0.0031	0.0020	0.0012
46	0.0031	0.0020	0.0012
47	0.0032	0.0020	0.0012
48	0.0032	0.0020	0.0012
49	0.0032	0.0020	0.0012
50	0.0032	0.0020	0.0012
51	0.0032	0.0020	0.0012
52	0.0032	0.0020	0.0012
53	0.0033	0.0021	0.0012
54	0.0033	0.0021	0.0012
55	0.0033	0.0021	0.0012
56	0.0033	0.0021	0.0012
57	0.0033	0.0021	0.0012
58	0.0033	0.0021	0.0012
59	0.0033	0.0021	0.0012

60	0.0034	0.0021	0.0012
61	0.0034	0.0021	0.0012
62	0.0034	0.0021	0.0013
63	0.0034	0.0021	0.0013
64	0.0034	0.0022	0.0013
65	0.0034	0.0022	0.0013
66	0.0035	0.0022	0.0013
67	0.0035	0.0022	0.0013
68	0.0035	0.0022	0.0013
69	0.0035	0.0022	0.0013
70	0.0035	0.0022	0.0013
71	0.0035	0.0022	0.0013
72	0.0036	0.0022	0.0013
73	0.0036	0.0023	0.0013
74	0.0036	0.0023	0.0013
75	0.0036	0.0023	0.0013
76	0.0036	0.0023	0.0013
77	0.0037	0.0023	0.0014
78	0.0037	0.0023	0.0014
79	0.0037	0.0023	0.0014
80	0.0037	0.0023	0.0014
81	0.0037	0.0024	0.0014
82	0.0038	0.0024	0.0014
83	0.0038	0.0024	0.0014
84	0.0038	0.0024	0.0014
85	0.0038	0.0024	0.0014
86	0.0038	0.0024	0.0014
87	0.0039	0.0024	0.0014
88	0.0039	0.0025	0.0014
89	0.0039	0.0025	0.0014
90	0.0039	0.0025	0.0015
91	0.0040	0.0025	0.0015
92	0.0040	0.0025	0.0015
93	0.0040	0.0025	0.0015
94	0.0040	0.0025	0.0015
95	0.0041	0.0026	0.0015
96	0.0041	0.0026	0.0015
97	0.0041	0.0026	0.0015
98	0.0041	0.0026	0.0015
99	0.0042	0.0026	0.0015
100	0.0042	0.0026	0.0015
101	0.0042	0.0027	0.0016
102	0.0043	0.0027	0.0016
103	0.0043	0.0027	0.0016
104	0.0043	0.0027	0.0016
105	0.0044	0.0027	0.0016
106	0.0044	0.0028	0.0016
107	0.0044	0.0028	0.0016
108	0.0044	0.0028	0.0016
109	0.0045	0.0028	0.0017
110	0.0045	0.0028	0.0017
111	0.0045	0.0029	0.0017
112	0.0046	0.0029	0.0017
113	0.0046	0.0029	0.0017
114	0.0046	0.0029	0.0017
115	0.0047	0.0030	0.0017
116	0.0047	0.0030	0.0017
117	0.0048	0.0030	0.0018
118	0.0048	0.0030	0.0018
119	0.0049	0.0031	0.0018
120	0.0049	0.0031	0.0018
121	0.0049	0.0031	0.0018
122	0.0050	0.0031	0.0018
123	0.0050	0.0032	0.0019
124	0.0051	0.0032	0.0019
125	0.0051	0.0032	0.0019
126	0.0051	0.0032	0.0019
127	0.0052	0.0033	0.0019
128	0.0052	0.0033	0.0019
129	0.0053	0.0034	0.0020
130	0.0054	0.0034	0.0020
131	0.0054	0.0034	0.0020
132	0.0055	0.0034	0.0020
133	0.0055	0.0035	0.0020
134	0.0056	0.0035	0.0021
135	0.0057	0.0036	0.0021

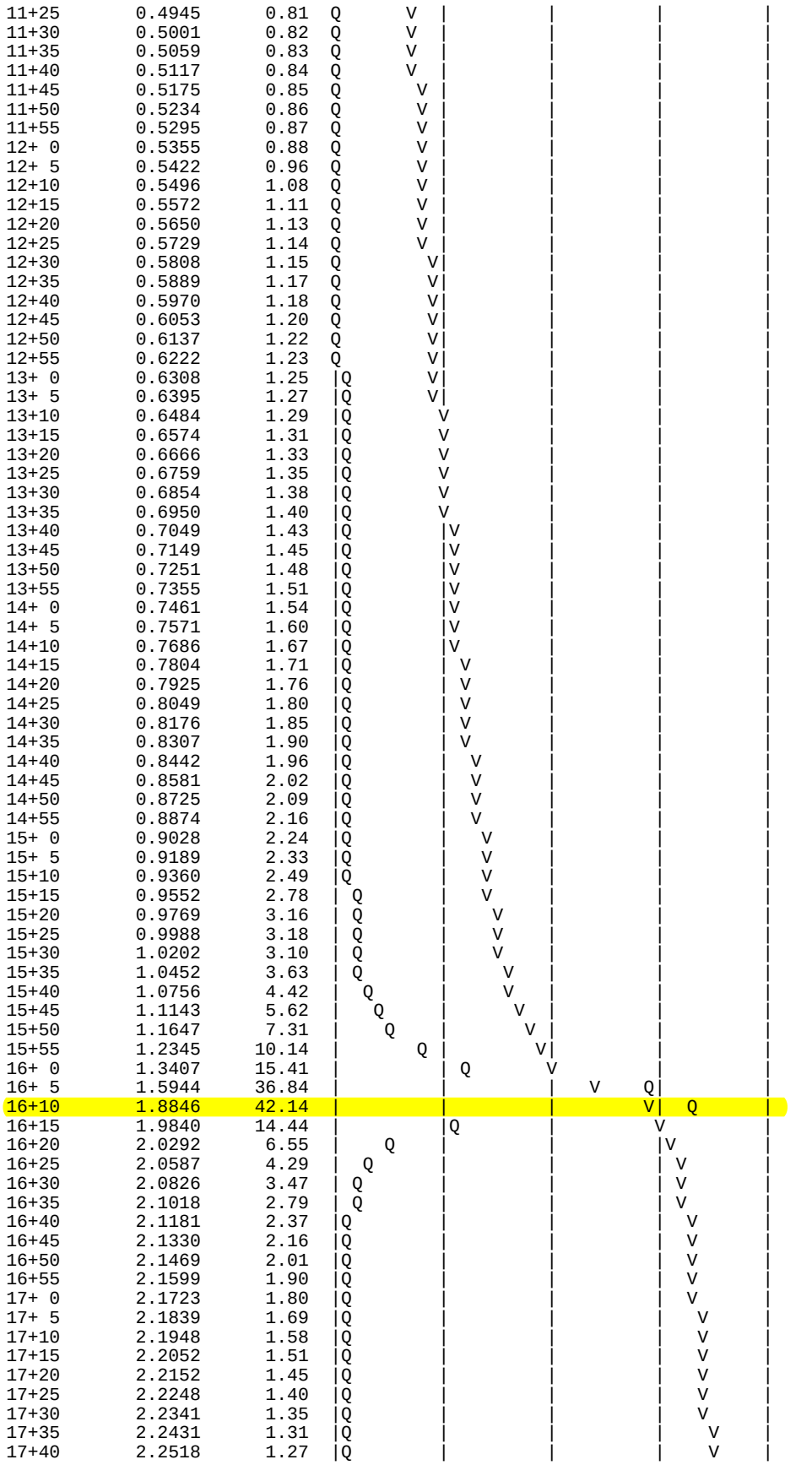
136	0.0057	0.0036	0.0021
137	0.0058	0.0036	0.0021
138	0.0058	0.0037	0.0022
139	0.0059	0.0037	0.0022
140	0.0060	0.0038	0.0022
141	0.0061	0.0038	0.0022
142	0.0061	0.0039	0.0023
143	0.0062	0.0039	0.0023
144	0.0063	0.0039	0.0023
145	0.0077	0.0049	0.0029
146	0.0078	0.0049	0.0029
147	0.0079	0.0050	0.0029
148	0.0080	0.0050	0.0030
149	0.0081	0.0051	0.0030
150	0.0082	0.0052	0.0030
151	0.0083	0.0053	0.0031
152	0.0084	0.0053	0.0031
153	0.0086	0.0054	0.0032
154	0.0086	0.0054	0.0032
155	0.0088	0.0055	0.0033
156	0.0089	0.0056	0.0033
157	0.0091	0.0057	0.0033
158	0.0092	0.0058	0.0034
159	0.0094	0.0059	0.0035
160	0.0095	0.0060	0.0035
161	0.0097	0.0061	0.0036
162	0.0098	0.0062	0.0036
163	0.0100	0.0063	0.0037
164	0.0101	0.0064	0.0037
165	0.0104	0.0066	0.0038
166	0.0106	0.0067	0.0039
167	0.0108	0.0068	0.0040
168	0.0110	0.0069	0.0041
169	0.0118	0.0074	0.0044
170	0.0120	0.0075	0.0044
171	0.0123	0.0078	0.0046
172	0.0125	0.0079	0.0046
173	0.0130	0.0082	0.0048
174	0.0132	0.0083	0.0049
175	0.0137	0.0087	0.0051
176	0.0140	0.0088	0.0052
177	0.0146	0.0092	0.0054
178	0.0150	0.0094	0.0055
179	0.0157	0.0099	0.0058
180	0.0162	0.0102	0.0060
181	0.0171	0.0108	0.0063
182	0.0176	0.0108	0.0069
183	0.0189	0.0108	0.0081
184	0.0196	0.0108	0.0088
185	0.0184	0.0108	0.0076
186	0.0194	0.0108	0.0086
187	0.0220	0.0108	0.0112
188	0.0237	0.0108	0.0129
189	0.0291	0.0108	0.0184
190	0.0328	0.0108	0.0220
191	0.0464	0.0108	0.0356
192	0.0633	0.0108	0.0525
193	0.1897	0.0108	0.1789
194	0.0380	0.0108	0.0272
195	0.0258	0.0108	0.0150
196	0.0206	0.0108	0.0098
197	0.0204	0.0108	0.0096
198	0.0182	0.0108	0.0074
199	0.0166	0.0105	0.0061
200	0.0153	0.0097	0.0057
201	0.0143	0.0090	0.0053
202	0.0135	0.0085	0.0050
203	0.0128	0.0080	0.0047
204	0.0121	0.0077	0.0045
205	0.0112	0.0070	0.0041
206	0.0107	0.0067	0.0040
207	0.0103	0.0065	0.0038
208	0.0099	0.0062	0.0037
209	0.0096	0.0060	0.0035
210	0.0093	0.0058	0.0034
211	0.0090	0.0057	0.0033

212	0.0087	0.0055	0.0032
213	0.0085	0.0053	0.0031
214	0.0083	0.0052	0.0031
215	0.0081	0.0051	0.0030
216	0.0079	0.0050	0.0029
217	0.0063	0.0040	0.0023
218	0.0062	0.0039	0.0023
219	0.0060	0.0038	0.0022
220	0.0059	0.0037	0.0022
221	0.0057	0.0036	0.0021
222	0.0056	0.0035	0.0021
223	0.0055	0.0035	0.0020
224	0.0054	0.0034	0.0020
225	0.0053	0.0033	0.0020
226	0.0052	0.0033	0.0019
227	0.0051	0.0032	0.0019
228	0.0050	0.0031	0.0018
229	0.0049	0.0031	0.0018
230	0.0048	0.0030	0.0018
231	0.0047	0.0030	0.0018
232	0.0047	0.0029	0.0017
233	0.0046	0.0029	0.0017
234	0.0045	0.0029	0.0017
235	0.0045	0.0028	0.0016
236	0.0044	0.0028	0.0016
237	0.0043	0.0027	0.0016
238	0.0043	0.0027	0.0016
239	0.0042	0.0027	0.0016
240	0.0042	0.0026	0.0015
241	0.0041	0.0026	0.0015
242	0.0041	0.0026	0.0015
243	0.0040	0.0025	0.0015
244	0.0040	0.0025	0.0015
245	0.0039	0.0025	0.0014
246	0.0039	0.0024	0.0014
247	0.0038	0.0024	0.0014
248	0.0038	0.0024	0.0014
249	0.0037	0.0023	0.0014
250	0.0037	0.0023	0.0014
251	0.0036	0.0023	0.0013
252	0.0036	0.0023	0.0013
253	0.0036	0.0023	0.0013
254	0.0035	0.0022	0.0013
255	0.0035	0.0022	0.0013
256	0.0035	0.0022	0.0013
257	0.0034	0.0022	0.0013
258	0.0034	0.0021	0.0013
259	0.0034	0.0021	0.0012
260	0.0033	0.0021	0.0012
261	0.0033	0.0021	0.0012
262	0.0033	0.0021	0.0012
263	0.0032	0.0020	0.0012
264	0.0032	0.0020	0.0012
265	0.0032	0.0020	0.0012
266	0.0032	0.0020	0.0012
267	0.0031	0.0020	0.0012
268	0.0031	0.0020	0.0011
269	0.0031	0.0019	0.0011
270	0.0031	0.0019	0.0011
271	0.0030	0.0019	0.0011
272	0.0030	0.0019	0.0011
273	0.0030	0.0019	0.0011
274	0.0030	0.0019	0.0011
275	0.0029	0.0019	0.0011
276	0.0029	0.0018	0.0011
277	0.0029	0.0018	0.0011
278	0.0029	0.0018	0.0011
279	0.0029	0.0018	0.0011
280	0.0028	0.0018	0.0010
281	0.0028	0.0018	0.0010
282	0.0028	0.0018	0.0010
283	0.0028	0.0017	0.0010
284	0.0028	0.0017	0.0010
285	0.0027	0.0017	0.0010
286	0.0027	0.0017	0.0010
287	0.0027	0.0017	0.0010

```
     288              0.0027           0.0017              0.0010
     ------------------------------------------------------------------------
     ------------------------------------------------------------------------
     Total soil rain loss =      1.08(In)
     Total effective rainfall =      0.97(In)
     Peak flow rate in flood hydrograph =     42.14(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))

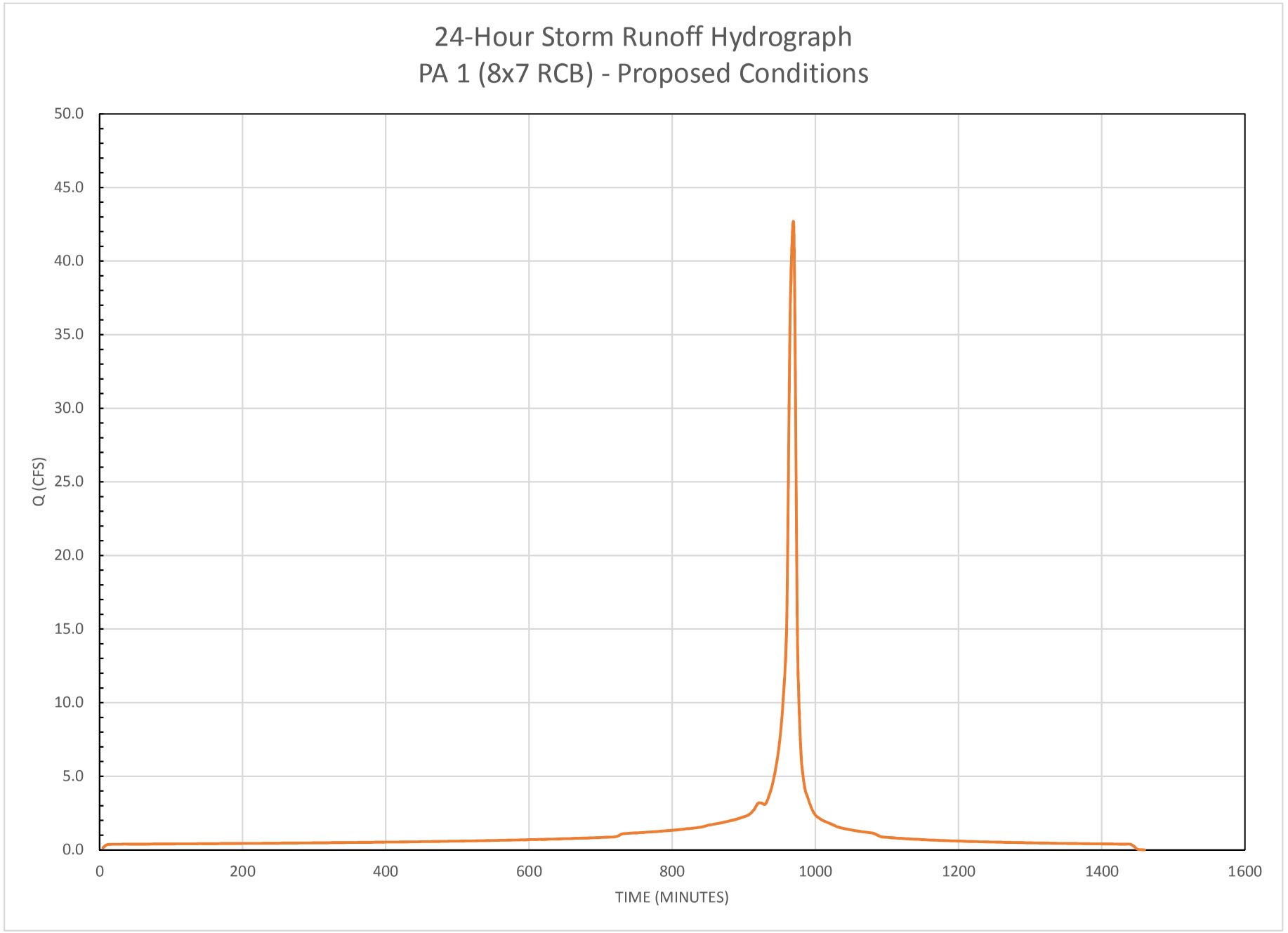
     ------------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       12.5      25.0      37.5      50.0
----------------------------------------------------------------------------
  0+ 5       0.0009      0.14  Q          |         |         |         |
  0+10       0.0033      0.34  Q          |         |         |         |
  0+15       0.0058      0.37  Q          |         |         |         |
  0+20       0.0084      0.38  Q          |         |         |         |
  0+25       0.0111      0.38  Q          |         |         |         |
  0+30       0.0137      0.38  Q          |         |         |         |
  0+35       0.0164      0.39  Q          |         |         |         |
  0+40       0.0190      0.39  Q          |         |         |         |
  0+45       0.0217      0.39  Q          |         |         |         |
  0+50       0.0244      0.39  Q          |         |         |         |
  0+55       0.0271      0.39  Q          |         |         |         |
  1+ 0       0.0298      0.39  Q          |         |         |         |
  1+ 5       0.0325      0.39  Q          |         |         |         |
  1+10       0.0352      0.39  Q          |         |         |         |
  1+15       0.0379      0.40  Q          |         |         |         |
  1+20       0.0407      0.40  Q          |         |         |         |
  1+25       0.0434      0.40  Q          |         |         |         |
  1+30       0.0462      0.40  Q          |         |         |         |
  1+35       0.0490      0.40  Q          |         |         |         |
  1+40       0.0517      0.40  Q          |         |         |         |
  1+45       0.0545      0.40  Q          |         |         |         |
  1+50       0.0573      0.41  Q          |         |         |         |
  1+55       0.0601      0.41  Q          |         |         |         |
  2+ 0       0.0629      0.41  Q          |         |         |         |
  2+ 5       0.0658      0.41  QV         |         |         |         |
  2+10       0.0686      0.41  QV         |         |         |         |
  2+15       0.0715      0.41  QV         |         |         |         |
  2+20       0.0743      0.42  QV         |         |         |         |
  2+25       0.0772      0.42  QV         |         |         |         |
  2+30       0.0801      0.42  QV         |         |         |         |
  2+35       0.0830      0.42  QV         |         |         |         |
  2+40       0.0859      0.42  QV         |         |         |         |
  2+45       0.0888      0.42  QV         |         |         |         |
  2+50       0.0917      0.43  QV         |         |         |         |
  2+55       0.0947      0.43  QV         |         |         |         |
  3+ 0       0.0976      0.43  QV         |         |         |         |
  3+ 5       0.1006      0.43  QV         |         |         |         |
  3+10       0.1035      0.43  QV         |         |         |         |
  3+15       0.1065      0.43  QV         |         |         |         |
  3+20       0.1095      0.44  QV         |         |         |         |
  3+25       0.1125      0.44  QV         |         |         |         |
  3+30       0.1156      0.44  QV         |         |         |         |
  3+35       0.1186      0.44  QV         |         |         |         |
  3+40       0.1216      0.44  QV         |         |         |         |
  3+45       0.1247      0.44  QV         |         |         |         |
  3+50       0.1278      0.45  QV         |         |         |         |
  3+55       0.1309      0.45  Q V        |         |         |         |
  4+ 0       0.1340      0.45  Q V        |         |         |         |
  4+ 5       0.1371      0.45  Q V        |         |         |         |
  4+10       0.1402      0.45  Q V        |         |         |         |
  4+15       0.1434      0.46  Q V        |         |         |         |
  4+20       0.1465      0.46  Q V        |         |         |         |
  4+25       0.1497      0.46  Q V        |         |         |         |
  4+30       0.1529      0.46  Q V        |         |         |         |
  4+35       0.1561      0.46  Q V        |         |         |         |
  4+40       0.1593      0.47  Q V        |         |         |         |
  4+45       0.1625      0.47  Q V        |         |         |         |
  4+50       0.1657      0.47  Q V        |         |         |         |
  4+55       0.1690      0.47  Q V        |         |         |         |
  5+ 0       0.1723      0.48  Q V        |         |         |         |
```

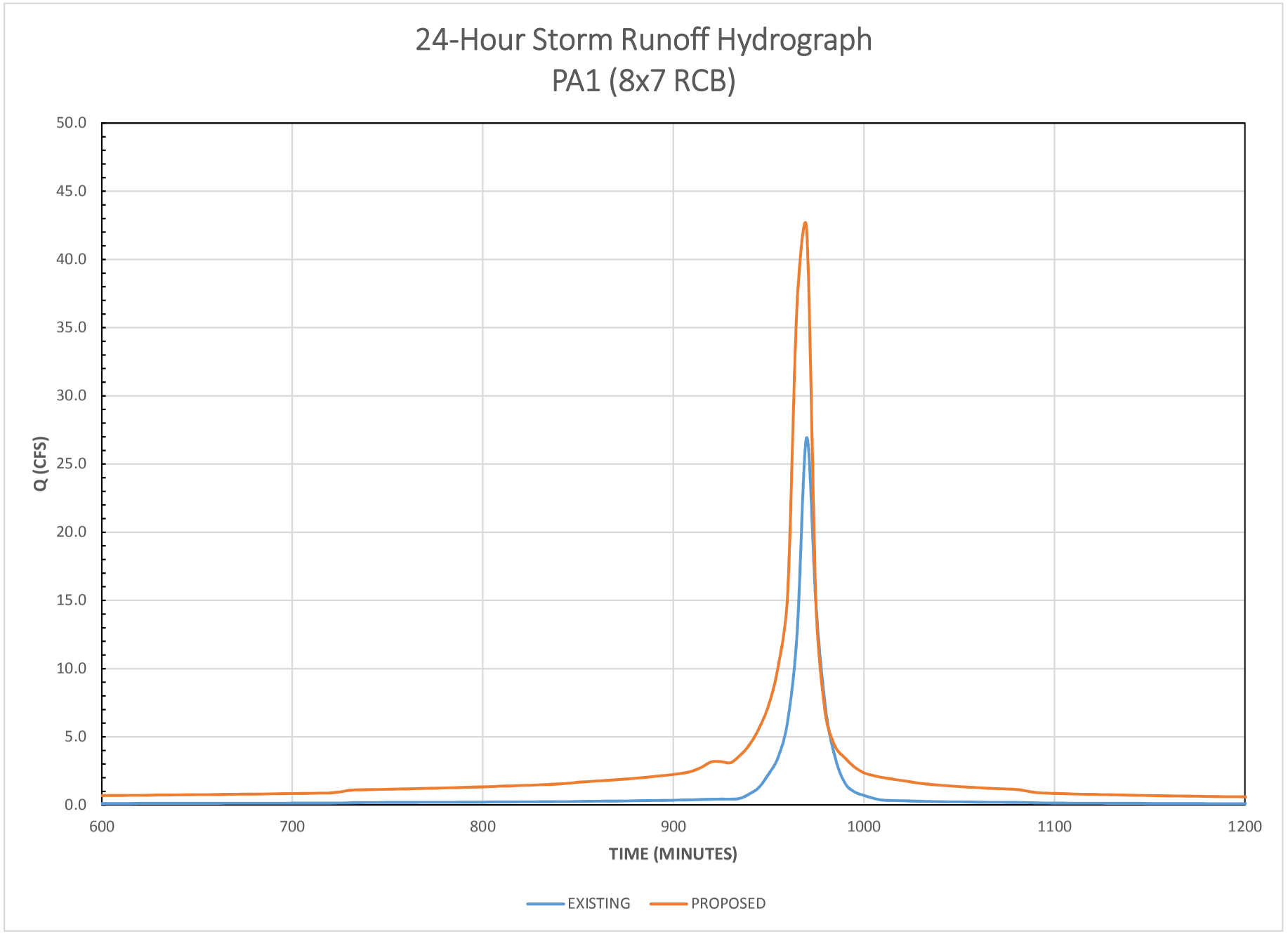
5+ 5	0.1756	0.48	Q V	|	|	|	|
5+10	0.1789	0.48	Q V	|	|	|	|
5+15	0.1822	0.48	Q V	|	|	|	|
5+20	0.1855	0.48	Q V	|	|	|	|
5+25	0.1889	0.49	Q V	|	|	|	|
5+30	0.1922	0.49	Q V	|	|	|	|
5+35	0.1956	0.49	Q V	|	|	|	|
5+40	0.1990	0.49	Q V	|	|	|	|
5+45	0.2024	0.50	Q V	|	|	|	|
5+50	0.2059	0.50	Q V	|	|	|	|
5+55	0.2093	0.50	Q V	|	|	|	|
6+ 0	0.2128	0.50	Q V	|	|	|	|
6+ 5	0.2163	0.51	Q V	|	|	|	|
6+10	0.2198	0.51	Q V	|	|	|	|
6+15	0.2233	0.51	Q V	|	|	|	|
6+20	0.2269	0.51	Q V	|	|	|	|
6+25	0.2304	0.52	Q V	|	|	|	|
6+30	0.2340	0.52	Q V	|	|	|	|
6+35	0.2376	0.52	Q V	|	|	|	|
6+40	0.2412	0.53	Q V	|	|	|	|
6+45	0.2449	0.53	Q V	|	|	|	|
6+50	0.2485	0.53	Q V	|	|	|	|
6+55	0.2522	0.53	Q V	|	|	|	|
7+ 0	0.2559	0.54	Q V	|	|	|	|
7+ 5	0.2596	0.54	Q V	|	|	|	|
7+10	0.2634	0.54	Q V	|	|	|	|
7+15	0.2671	0.55	Q V	|	|	|	|
7+20	0.2709	0.55	Q V	|	|	|	|
7+25	0.2747	0.55	Q V	|	|	|	|
7+30	0.2786	0.56	Q V	|	|	|	|
7+35	0.2824	0.56	Q V	|	|	|	|
7+40	0.2863	0.56	Q V	|	|	|	|
7+45	0.2902	0.57	Q V	|	|	|	|
7+50	0.2942	0.57	Q V	|	|	|	|
7+55	0.2981	0.57	Q V	|	|	|	|
8+ 0	0.3021	0.58	Q V	|	|	|	|
8+ 5	0.3061	0.58	Q V	|	|	|	|
8+10	0.3101	0.59	Q V	|	|	|	|
8+15	0.3142	0.59	Q V	|	|	|	|
8+20	0.3183	0.59	Q V	|	|	|	|
8+25	0.3224	0.60	Q V	|	|	|	|
8+30	0.3266	0.60	Q V	|	|	|	|
8+35	0.3307	0.61	Q V	|	|	|	|
8+40	0.3349	0.61	Q V	|	|	|	|
8+45	0.3392	0.61	Q V	|	|	|	|
8+50	0.3434	0.62	Q V	|	|	|	|
8+55	0.3477	0.62	Q V	|	|	|	|
9+ 0	0.3520	0.63	Q V	|	|	|	|
9+ 5	0.3564	0.63	Q V	|	|	|	|
9+10	0.3608	0.64	Q V	|	|	|	|
9+15	0.3652	0.64	Q V	|	|	|	|
9+20	0.3696	0.65	Q V	|	|	|	|
9+25	0.3741	0.65	Q V	|	|	|	|
9+30	0.3787	0.66	Q V	|	|	|	|
9+35	0.3832	0.66	Q V	|	|	|	|
9+40	0.3878	0.67	Q V	|	|	|	|
9+45	0.3924	0.67	Q V	|	|	|	|
9+50	0.3971	0.68	Q V	|	|	|	|
9+55	0.4018	0.68	Q V	|	|	|	|
10+ 0	0.4066	0.69	Q V	|	|	|	|
10+ 5	0.4114	0.70	Q V	|	|	|	|
10+10	0.4162	0.70	Q V	|	|	|	|
10+15	0.4211	0.71	Q V	|	|	|	|
10+20	0.4260	0.71	Q V	|	|	|	|
10+25	0.4310	0.72	Q V	|	|	|	|
10+30	0.4360	0.73	Q V	|	|	|	|
10+35	0.4410	0.73	Q V	|	|	|	|
10+40	0.4461	0.74	Q V	|	|	|	|
10+45	0.4513	0.75	Q V	|	|	|	|
10+50	0.4565	0.76	Q V	|	|	|	|
10+55	0.4618	0.76	Q V	|	|	|	|
11+ 0	0.4671	0.77	Q V	|	|	|	|
11+ 5	0.4724	0.78	Q V	|	|	|	|
11+10	0.4779	0.79	Q V	|	|	|	|
11+15	0.4833	0.80	Q V	|	|	|	|
11+20	0.4889	0.80	Q V	|	|	|	|



17+45	2.2603	1.23	Q	|	|	|	V |
17+50	2.2686	1.20	Q	|	|	|	V |
17+55	2.2766	1.17	Q	|	|	|	V |
18+ 0	2.2844	1.14	Q	|	|	|	V |
18+ 5	2.2916	1.04	Q	|	|	|	V |
18+10	2.2979	0.92	Q	|	|	|	V |
18+15	2.3039	0.87	Q	|	|	|	V |
18+20	2.3098	0.85	Q	|	|	|	V |
18+25	2.3155	0.83	Q	|	|	|	V |
18+30	2.3211	0.81	Q	|	|	|	V |
18+35	2.3266	0.79	Q	|	|	|	V |
18+40	2.3319	0.78	Q	|	|	|	V |
18+45	2.3372	0.76	Q	|	|	|	V |
18+50	2.3423	0.75	Q	|	|	|	V |
18+55	2.3474	0.73	Q	|	|	|	V |
19+ 0	2.3523	0.72	Q	|	|	|	V |
19+ 5	2.3572	0.71	Q	|	|	|	V |
19+10	2.3620	0.69	Q	|	|	|	V |
19+15	2.3667	0.68	Q	|	|	|	V |
19+20	2.3713	0.67	Q	|	|	|	V |
19+25	2.3759	0.66	Q	|	|	|	V |
19+30	2.3804	0.65	Q	|	|	|	V |
19+35	2.3848	0.64	Q	|	|	|	V |
19+40	2.3891	0.63	Q	|	|	|	V |
19+45	2.3934	0.62	Q	|	|	|	V |
19+50	2.3976	0.61	Q	|	|	|	V |
19+55	2.4018	0.61	Q	|	|	|	V |
20+ 0	2.4059	0.60	Q	|	|	|	V |
20+ 5	2.4100	0.59	Q	|	|	|	V |
20+10	2.4140	0.58	Q	|	|	|	V |
20+15	2.4179	0.57	Q	|	|	|	V |
20+20	2.4218	0.57	Q	|	|	|	V |
20+25	2.4257	0.56	Q	|	|	|	V |
20+30	2.4295	0.55	Q	|	|	|	V |
20+35	2.4333	0.55	Q	|	|	|	V |
20+40	2.4370	0.54	Q	|	|	|	V |
20+45	2.4407	0.53	Q	|	|	|	V |
20+50	2.4443	0.53	Q	|	|	|	V |
20+55	2.4479	0.52	Q	|	|	|	V |
21+ 0	2.4515	0.52	Q	|	|	|	V |
21+ 5	2.4550	0.51	Q	|	|	|	V |
21+10	2.4585	0.51	Q	|	|	|	V |
21+15	2.4619	0.50	Q	|	|	|	V |
21+20	2.4653	0.50	Q	|	|	|	V |
21+25	2.4687	0.49	Q	|	|	|	V |
21+30	2.4721	0.49	Q	|	|	|	V |
21+35	2.4754	0.48	Q	|	|	|	V |
21+40	2.4787	0.48	Q	|	|	|	V |
21+45	2.4819	0.47	Q	|	|	|	V |
21+50	2.4851	0.47	Q	|	|	|	V |
21+55	2.4883	0.46	Q	|	|	|	V |
22+ 0	2.4915	0.46	Q	|	|	|	V |
22+ 5	2.4947	0.46	Q	|	|	|	V |
22+10	2.4978	0.45	Q	|	|	|	V |
22+15	2.5008	0.45	Q	|	|	|	V|
22+20	2.5039	0.44	Q	|	|	|	V|
22+25	2.5069	0.44	Q	|	|	|	V|
22+30	2.5099	0.44	Q	|	|	|	V|
22+35	2.5129	0.43	Q	|	|	|	V|
22+40	2.5159	0.43	Q	|	|	|	V|
22+45	2.5188	0.43	Q	|	|	|	V|
22+50	2.5217	0.42	Q	|	|	|	V|
22+55	2.5246	0.42	Q	|	|	|	V|
23+ 0	2.5275	0.42	Q	|	|	|	V|
23+ 5	2.5304	0.41	Q	|	|	|	V|
23+10	2.5332	0.41	Q	|	|	|	V|
23+15	2.5360	0.41	Q	|	|	|	V|
23+20	2.5388	0.40	Q	|	|	|	V|
23+25	2.5415	0.40	Q	|	|	|	V|
23+30	2.5443	0.40	Q	|	|	|	V|
23+35	2.5470	0.40	Q	|	|	|	V|
23+40	2.5497	0.39	Q	|	|	|	V|
23+45	2.5524	0.39	Q	|	|	|	V|
23+50	2.5551	0.39	Q	|	|	|	V|
23+55	2.5577	0.39	Q	|	|	|	V|
24+ 0	2.5604	0.38	Q	|	|	|	V|

```
   24+ 5       2.5621      0.24  Q          |          |          |          V|
   24+10       2.5624      0.04  Q          |          |          |          V|
   24+15       2.5624      0.01  Q          |          |          |          V|
   24+20       2.5624      0.00  Q          |          |          |          V|
-------------------------------------------------------------------------------
```


24-Hour Storm Runoff Hydrograph
PA 1 (8x7 RCB) - Proposed Conditions
Q (CFS)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
200
400
600
800
1000
1200
1400
1600
TIME (MINUTES)


24-Hour Storm Runoff Hydrograph
PA1 (8x7 RCB)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Q (CFS)
600
700
800
900
1000
1100
1200
TIME (MINUTES)
EXISTING
PROPOSED

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

Study date 09/29/15 File Name PRPA1HYMW.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6103

PLANNING AREA 1 - 36" RCP
PROPOSED CONDITIONS - HYDROMOD CALCULATIONS
2-YEAR 24-HOUR STORM
BY FUSCOE ENGINEERING

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	1.4	0.61	C	0.250	0.900	0.225
75.0	0.9	0.39	D	0.200	0.900	0.180

Area-averaged adjusted loss rate Fm (In/Hr) = 0.207

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
1.26	0.548	69.0	49.8	10.08	0.000
0.14	0.061	98.0	98.0	0.20	0.890
0.81	0.352	75.0	57.0	7.54	0.018
0.09	0.039	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.095
Area-averaged low loss fraction, Yb = 0.905

++
Watercourse length = 1033.25(Ft.)
Length from concentration point to centroid = 628.93(Ft.)
Elevation difference along watercourse = 116.00(Ft.)
Mannings friction factor along watercourse = 0.025
Watershed area = 2.30(Ac.)
Catchment Lag time = 0.043 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 194.9175
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.207(In/Hr)
Average low loss rate fraction (Yb) = 0.905 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.190(In)
Computed peak 30-minute rainfall = 0.400(In)
Specified peak 1-hour rainfall = 0.530(In)
Computed peak 3-hour rainfall = 0.890(In)
Specified peak 6-hour rainfall = 1.220(In)
Specified peak 24-hour rainfall = 2.050(In)

Rainfall depth area reduction factors:
Using a total area of 2.30(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.190(In)
30-minute factor = 1.000 Adjusted rainfall = 0.400(In)
1-hour factor = 1.000 Adjusted rainfall = 0.530(In)
3-hour factor = 1.000 Adjusted rainfall = 0.890(In)
6-hour factor = 1.000 Adjusted rainfall = 1.220(In)
24-hour factor = 1.000 Adjusted rainfall = 2.050(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 27.82 (CFS))	
1	41.245	11.472
2	91.739	14.045
3	98.783	1.959
4	100.000	0.339

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.1900	0.1900
2	0.2534	0.0634
3	0.2999	0.0465
4	0.3379	0.0381
5	0.3708	0.0328
6	0.4000	0.0292
7	0.4258	0.0258
8	0.4495	0.0237
9	0.4715	0.0220
10	0.4921	0.0206
11	0.5115	0.0194
12	0.5299	0.0184
13	0.5503	0.0204
14	0.5699	0.0196
15	0.5888	0.0189
16	0.6070	0.0182
17	0.6246	0.0176
18	0.6417	0.0171
19	0.6583	0.0166
20	0.6744	0.0161
21	0.6901	0.0157
22	0.7054	0.0153
23	0.7204	0.0150
24	0.7350	0.0146
25	0.7493	0.0143
26	0.7633	0.0140
27	0.7770	0.0137
28	0.7905	0.0135
29	0.8037	0.0132
30	0.8166	0.0130
31	0.8294	0.0127
32	0.8419	0.0125
33	0.8542	0.0123
34	0.8663	0.0121
35	0.8782	0.0119
36	0.8900	0.0118
37	0.9012	0.0112
38	0.9122	0.0110
39	0.9230	0.0108
40	0.9337	0.0107
41	0.9442	0.0105
42	0.9547	0.0104
43	0.9649	0.0103
44	0.9751	0.0101
45	0.9851	0.0100
46	0.9950	0.0099
47	1.0048	0.0098
48	1.0145	0.0097
49	1.0240	0.0096
50	1.0335	0.0095
51	1.0428	0.0094
52	1.0521	0.0093
53	1.0612	0.0092

54	1.0703	0.0091
55	1.0793	0.0090
56	1.0882	0.0089
57	1.0970	0.0088
58	1.1057	0.0087
59	1.1143	0.0086
60	1.1229	0.0086
61	1.1313	0.0085
62	1.1397	0.0084
63	1.1481	0.0083
64	1.1563	0.0083
65	1.1645	0.0082
66	1.1726	0.0081
67	1.1807	0.0081
68	1.1887	0.0080
69	1.1966	0.0079
70	1.2045	0.0079
71	1.2123	0.0078
72	1.2200	0.0077
73	1.2263	0.0063
74	1.2326	0.0063
75	1.2388	0.0062
76	1.2449	0.0062
77	1.2510	0.0061
78	1.2571	0.0061
79	1.2631	0.0060
80	1.2691	0.0060
81	1.2750	0.0059
82	1.2809	0.0059
83	1.2867	0.0058
84	1.2925	0.0058
85	1.2982	0.0057
86	1.3039	0.0057
87	1.3096	0.0057
88	1.3152	0.0056
89	1.3208	0.0056
90	1.3263	0.0055
91	1.3318	0.0055
92	1.3372	0.0055
93	1.3427	0.0054
94	1.3481	0.0054
95	1.3534	0.0054
96	1.3587	0.0053
97	1.3640	0.0053
98	1.3693	0.0052
99	1.3745	0.0052
100	1.3796	0.0052
101	1.3848	0.0051
102	1.3899	0.0051
103	1.3950	0.0051
104	1.4001	0.0051
105	1.4051	0.0050
106	1.4101	0.0050
107	1.4150	0.0050
108	1.4200	0.0049
109	1.4249	0.0049
110	1.4298	0.0049
111	1.4346	0.0049
112	1.4394	0.0048
113	1.4442	0.0048
114	1.4490	0.0048
115	1.4538	0.0047
116	1.4585	0.0047
117	1.4632	0.0047
118	1.4678	0.0047
119	1.4725	0.0046
120	1.4771	0.0046
121	1.4817	0.0046
122	1.4863	0.0046
123	1.4908	0.0045
124	1.4953	0.0045
125	1.4999	0.0045
126	1.5043	0.0045
127	1.5088	0.0045
128	1.5132	0.0044
129	1.5176	0.0044

130	1.5220	0.0044
131	1.5264	0.0044
132	1.5308	0.0044
133	1.5351	0.0043
134	1.5394	0.0043
135	1.5437	0.0043
136	1.5480	0.0043
137	1.5522	0.0043
138	1.5564	0.0042
139	1.5607	0.0042
140	1.5649	0.0042
141	1.5690	0.0042
142	1.5732	0.0042
143	1.5773	0.0041
144	1.5814	0.0041
145	1.5855	0.0041
146	1.5896	0.0041
147	1.5937	0.0041
148	1.5978	0.0041
149	1.6018	0.0040
150	1.6058	0.0040
151	1.6098	0.0040
152	1.6138	0.0040
153	1.6178	0.0040
154	1.6217	0.0040
155	1.6256	0.0039
156	1.6296	0.0039
157	1.6335	0.0039
158	1.6373	0.0039
159	1.6412	0.0039
160	1.6451	0.0039
161	1.6489	0.0038
162	1.6527	0.0038
163	1.6566	0.0038
164	1.6604	0.0038
165	1.6641	0.0038
166	1.6679	0.0038
167	1.6717	0.0038
168	1.6754	0.0037
169	1.6791	0.0037
170	1.6828	0.0037
171	1.6865	0.0037
172	1.6902	0.0037
173	1.6939	0.0037
174	1.6976	0.0037
175	1.7012	0.0036
176	1.7048	0.0036
177	1.7085	0.0036
178	1.7121	0.0036
179	1.7157	0.0036
180	1.7192	0.0036
181	1.7228	0.0036
182	1.7264	0.0036
183	1.7299	0.0035
184	1.7334	0.0035
185	1.7370	0.0035
186	1.7405	0.0035
187	1.7440	0.0035
188	1.7475	0.0035
189	1.7509	0.0035
190	1.7544	0.0035
191	1.7578	0.0035
192	1.7613	0.0034
193	1.7647	0.0034
194	1.7681	0.0034
195	1.7715	0.0034
196	1.7749	0.0034
197	1.7783	0.0034
198	1.7817	0.0034
199	1.7851	0.0034
200	1.7884	0.0034
201	1.7917	0.0033
202	1.7951	0.0033
203	1.7984	0.0033
204	1.8017	0.0033
205	1.8050	0.0033

206	1.8083	0.0033
207	1.8116	0.0033
208	1.8149	0.0033
209	1.8181	0.0033
210	1.8214	0.0033
211	1.8246	0.0032
212	1.8278	0.0032
213	1.8311	0.0032
214	1.8343	0.0032
215	1.8375	0.0032
216	1.8407	0.0032
217	1.8439	0.0032
218	1.8470	0.0032
219	1.8502	0.0032
220	1.8534	0.0032
221	1.8565	0.0031
222	1.8597	0.0031
223	1.8628	0.0031
224	1.8659	0.0031
225	1.8690	0.0031
226	1.8721	0.0031
227	1.8752	0.0031
228	1.8783	0.0031
229	1.8814	0.0031
230	1.8845	0.0031
231	1.8875	0.0031
232	1.8906	0.0031
233	1.8936	0.0030
234	1.8967	0.0030
235	1.8997	0.0030
236	1.9027	0.0030
237	1.9057	0.0030
238	1.9087	0.0030
239	1.9117	0.0030
240	1.9147	0.0030
241	1.9177	0.0030
242	1.9207	0.0030
243	1.9237	0.0030
244	1.9266	0.0030
245	1.9296	0.0030
246	1.9325	0.0029
247	1.9355	0.0029
248	1.9384	0.0029
249	1.9413	0.0029
250	1.9442	0.0029
251	1.9471	0.0029
252	1.9500	0.0029
253	1.9529	0.0029
254	1.9558	0.0029
255	1.9587	0.0029
256	1.9616	0.0029
257	1.9644	0.0029
258	1.9673	0.0029
259	1.9701	0.0029
260	1.9730	0.0028
261	1.9758	0.0028
262	1.9787	0.0028
263	1.9815	0.0028
264	1.9843	0.0028
265	1.9871	0.0028
266	1.9899	0.0028
267	1.9927	0.0028
268	1.9955	0.0028
269	1.9983	0.0028
270	2.0011	0.0028
271	2.0038	0.0028
272	2.0066	0.0028
273	2.0094	0.0028
274	2.0121	0.0028
275	2.0149	0.0027
276	2.0176	0.0027
277	2.0203	0.0027
278	2.0231	0.0027
279	2.0258	0.0027
280	2.0285	0.0027
281	2.0312	0.0027

282	2.0339	0.0027
283	2.0366	0.0027
284	2.0393	0.0027
285	2.0420	0.0027
286	2.0447	0.0027
287	2.0473	0.0027
288	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0027	0.0024	0.0003
2	0.0027	0.0024	0.0003
3	0.0027	0.0024	0.0003
4	0.0027	0.0024	0.0003
5	0.0027	0.0024	0.0003
6	0.0027	0.0025	0.0003
7	0.0027	0.0025	0.0003
8	0.0027	0.0025	0.0003
9	0.0027	0.0025	0.0003
10	0.0027	0.0025	0.0003
11	0.0028	0.0025	0.0003
12	0.0028	0.0025	0.0003
13	0.0028	0.0025	0.0003
14	0.0028	0.0025	0.0003
15	0.0028	0.0025	0.0003
16	0.0028	0.0025	0.0003
17	0.0028	0.0025	0.0003
18	0.0028	0.0026	0.0003
19	0.0028	0.0026	0.0003
20	0.0028	0.0026	0.0003
21	0.0029	0.0026	0.0003
22	0.0029	0.0026	0.0003
23	0.0029	0.0026	0.0003
24	0.0029	0.0026	0.0003
25	0.0029	0.0026	0.0003
26	0.0029	0.0026	0.0003
27	0.0029	0.0026	0.0003
28	0.0029	0.0027	0.0003
29	0.0029	0.0027	0.0003
30	0.0030	0.0027	0.0003
31	0.0030	0.0027	0.0003
32	0.0030	0.0027	0.0003
33	0.0030	0.0027	0.0003
34	0.0030	0.0027	0.0003
35	0.0030	0.0027	0.0003
36	0.0030	0.0027	0.0003
37	0.0030	0.0027	0.0003
38	0.0030	0.0028	0.0003
39	0.0031	0.0028	0.0003
40	0.0031	0.0028	0.0003
41	0.0031	0.0028	0.0003
42	0.0031	0.0028	0.0003
43	0.0031	0.0028	0.0003
44	0.0031	0.0028	0.0003
45	0.0031	0.0028	0.0003
46	0.0031	0.0028	0.0003
47	0.0032	0.0029	0.0003
48	0.0032	0.0029	0.0003
49	0.0032	0.0029	0.0003
50	0.0032	0.0029	0.0003
51	0.0032	0.0029	0.0003
52	0.0032	0.0029	0.0003
53	0.0033	0.0029	0.0003
54	0.0033	0.0030	0.0003
55	0.0033	0.0030	0.0003
56	0.0033	0.0030	0.0003
57	0.0033	0.0030	0.0003
58	0.0033	0.0030	0.0003
59	0.0033	0.0030	0.0003
60	0.0034	0.0030	0.0003
61	0.0034	0.0031	0.0003
62	0.0034	0.0031	0.0003
63	0.0034	0.0031	0.0003
64	0.0034	0.0031	0.0003

65	0.0034	0.0031	0.0003
66	0.0035	0.0031	0.0003
67	0.0035	0.0031	0.0003
68	0.0035	0.0032	0.0003
69	0.0035	0.0032	0.0003
70	0.0035	0.0032	0.0003
71	0.0035	0.0032	0.0003
72	0.0036	0.0032	0.0003
73	0.0036	0.0032	0.0003
74	0.0036	0.0033	0.0003
75	0.0036	0.0033	0.0003
76	0.0036	0.0033	0.0003
77	0.0037	0.0033	0.0003
78	0.0037	0.0033	0.0003
79	0.0037	0.0033	0.0004
80	0.0037	0.0034	0.0004
81	0.0037	0.0034	0.0004
82	0.0038	0.0034	0.0004
83	0.0038	0.0034	0.0004
84	0.0038	0.0034	0.0004
85	0.0038	0.0035	0.0004
86	0.0038	0.0035	0.0004
87	0.0039	0.0035	0.0004
88	0.0039	0.0035	0.0004
89	0.0039	0.0035	0.0004
90	0.0039	0.0036	0.0004
91	0.0040	0.0036	0.0004
92	0.0040	0.0036	0.0004
93	0.0040	0.0036	0.0004
94	0.0040	0.0036	0.0004
95	0.0041	0.0037	0.0004
96	0.0041	0.0037	0.0004
97	0.0041	0.0037	0.0004
98	0.0041	0.0037	0.0004
99	0.0042	0.0038	0.0004
100	0.0042	0.0038	0.0004
101	0.0042	0.0038	0.0004
102	0.0043	0.0038	0.0004
103	0.0043	0.0039	0.0004
104	0.0043	0.0039	0.0004
105	0.0044	0.0039	0.0004
106	0.0044	0.0040	0.0004
107	0.0044	0.0040	0.0004
108	0.0044	0.0040	0.0004
109	0.0045	0.0041	0.0004
110	0.0045	0.0041	0.0004
111	0.0045	0.0041	0.0004
112	0.0046	0.0041	0.0004
113	0.0046	0.0042	0.0004
114	0.0046	0.0042	0.0004
115	0.0047	0.0042	0.0004
116	0.0047	0.0043	0.0004
117	0.0048	0.0043	0.0005
118	0.0048	0.0043	0.0005
119	0.0049	0.0044	0.0005
120	0.0049	0.0044	0.0005
121	0.0049	0.0045	0.0005
122	0.0050	0.0045	0.0005
123	0.0050	0.0045	0.0005
124	0.0051	0.0046	0.0005
125	0.0051	0.0046	0.0005
126	0.0051	0.0047	0.0005
127	0.0052	0.0047	0.0005
128	0.0052	0.0047	0.0005
129	0.0053	0.0048	0.0005
130	0.0054	0.0048	0.0005
131	0.0054	0.0049	0.0005
132	0.0055	0.0049	0.0005
133	0.0055	0.0050	0.0005
134	0.0056	0.0050	0.0005
135	0.0057	0.0051	0.0005
136	0.0057	0.0052	0.0005
137	0.0058	0.0052	0.0006
138	0.0058	0.0053	0.0006
139	0.0059	0.0054	0.0006
140	0.0060	0.0054	0.0006

141	0.0061	0.0055	0.0006
142	0.0061	0.0055	0.0006
143	0.0062	0.0056	0.0006
144	0.0063	0.0057	0.0006
145	0.0077	0.0070	0.0007
146	0.0078	0.0071	0.0007
147	0.0079	0.0072	0.0008
148	0.0080	0.0072	0.0008
149	0.0081	0.0073	0.0008
150	0.0082	0.0074	0.0008
151	0.0083	0.0075	0.0008
152	0.0084	0.0076	0.0008
153	0.0086	0.0077	0.0008
154	0.0086	0.0078	0.0008
155	0.0088	0.0080	0.0008
156	0.0089	0.0080	0.0008
157	0.0091	0.0082	0.0009
158	0.0092	0.0083	0.0009
159	0.0094	0.0085	0.0009
160	0.0095	0.0086	0.0009
161	0.0097	0.0088	0.0009
162	0.0098	0.0089	0.0009
163	0.0100	0.0091	0.0010
164	0.0101	0.0092	0.0010
165	0.0104	0.0094	0.0010
166	0.0105	0.0095	0.0010
167	0.0108	0.0098	0.0010
168	0.0110	0.0100	0.0010
169	0.0118	0.0106	0.0011
170	0.0119	0.0108	0.0011
171	0.0123	0.0111	0.0012
172	0.0125	0.0113	0.0012
173	0.0130	0.0117	0.0012
174	0.0132	0.0119	0.0013
175	0.0137	0.0124	0.0013
176	0.0140	0.0127	0.0013
177	0.0146	0.0132	0.0014
178	0.0150	0.0135	0.0014
179	0.0157	0.0142	0.0015
180	0.0161	0.0146	0.0015
181	0.0171	0.0155	0.0016
182	0.0176	0.0159	0.0017
183	0.0189	0.0171	0.0018
184	0.0196	0.0173	0.0023
185	0.0184	0.0166	0.0018
186	0.0194	0.0173	0.0021
187	0.0220	0.0173	0.0047
188	0.0237	0.0173	0.0064
189	0.0292	0.0173	0.0119
190	0.0328	0.0173	0.0155
191	0.0465	0.0173	0.0292
192	0.0634	0.0173	0.0461
193	0.1900	0.0173	0.1727
194	0.0381	0.0173	0.0208
195	0.0258	0.0173	0.0085
196	0.0206	0.0173	0.0033
197	0.0204	0.0173	0.0031
198	0.0182	0.0165	0.0017
199	0.0166	0.0150	0.0016
200	0.0153	0.0139	0.0015
201	0.0143	0.0129	0.0014
202	0.0135	0.0122	0.0013
203	0.0127	0.0115	0.0012
204	0.0121	0.0110	0.0012
205	0.0112	0.0101	0.0011
206	0.0107	0.0097	0.0010
207	0.0103	0.0093	0.0010
208	0.0099	0.0090	0.0009
209	0.0096	0.0087	0.0009
210	0.0093	0.0084	0.0009
211	0.0090	0.0081	0.0009
212	0.0087	0.0079	0.0008
213	0.0085	0.0077	0.0008
214	0.0083	0.0075	0.0008
215	0.0081	0.0073	0.0008
216	0.0079	0.0071	0.0007

217	0.0063	0.0057	0.0006
218	0.0062	0.0056	0.0006
219	0.0060	0.0054	0.0006
220	0.0059	0.0053	0.0006
221	0.0057	0.0052	0.0005
222	0.0056	0.0051	0.0005
223	0.0055	0.0050	0.0005
224	0.0054	0.0049	0.0005
225	0.0053	0.0048	0.0005
226	0.0052	0.0047	0.0005
227	0.0051	0.0046	0.0005
228	0.0050	0.0045	0.0005
229	0.0049	0.0044	0.0005
230	0.0048	0.0044	0.0005
231	0.0047	0.0043	0.0005
232	0.0047	0.0042	0.0004
233	0.0046	0.0042	0.0004
234	0.0045	0.0041	0.0004
235	0.0045	0.0040	0.0004
236	0.0044	0.0040	0.0004
237	0.0043	0.0039	0.0004
238	0.0043	0.0039	0.0004
239	0.0042	0.0038	0.0004
240	0.0042	0.0038	0.0004
241	0.0041	0.0037	0.0004
242	0.0041	0.0037	0.0004
243	0.0040	0.0036	0.0004
244	0.0040	0.0036	0.0004
245	0.0039	0.0035	0.0004
246	0.0039	0.0035	0.0004
247	0.0038	0.0034	0.0004
248	0.0038	0.0034	0.0004
249	0.0037	0.0034	0.0004
250	0.0037	0.0033	0.0004
251	0.0036	0.0033	0.0003
252	0.0036	0.0033	0.0003
253	0.0036	0.0032	0.0003
254	0.0035	0.0032	0.0003
255	0.0035	0.0032	0.0003
256	0.0035	0.0031	0.0003
257	0.0034	0.0031	0.0003
258	0.0034	0.0031	0.0003
259	0.0034	0.0030	0.0003
260	0.0033	0.0030	0.0003
261	0.0033	0.0030	0.0003
262	0.0033	0.0030	0.0003
263	0.0032	0.0029	0.0003
264	0.0032	0.0029	0.0003
265	0.0032	0.0029	0.0003
266	0.0032	0.0029	0.0003
267	0.0031	0.0028	0.0003
268	0.0031	0.0028	0.0003
269	0.0031	0.0028	0.0003
270	0.0031	0.0028	0.0003
271	0.0030	0.0027	0.0003
272	0.0030	0.0027	0.0003
273	0.0030	0.0027	0.0003
274	0.0030	0.0027	0.0003
275	0.0029	0.0027	0.0003
276	0.0029	0.0026	0.0003
277	0.0029	0.0026	0.0003
278	0.0029	0.0026	0.0003
279	0.0029	0.0026	0.0003
280	0.0028	0.0026	0.0003
281	0.0028	0.0025	0.0003
282	0.0028	0.0025	0.0003
283	0.0028	0.0025	0.0003
284	0.0028	0.0025	0.0003
285	0.0027	0.0025	0.0003
286	0.0027	0.0025	0.0003
287	0.0027	0.0024	0.0003
288	0.0027	0.0024	0.0003

Total soil rain loss = 1.58(In)
Total effective rainfall = 0.47(In)

Peak flow rate in flood hydrograph = 2.76(CFS)

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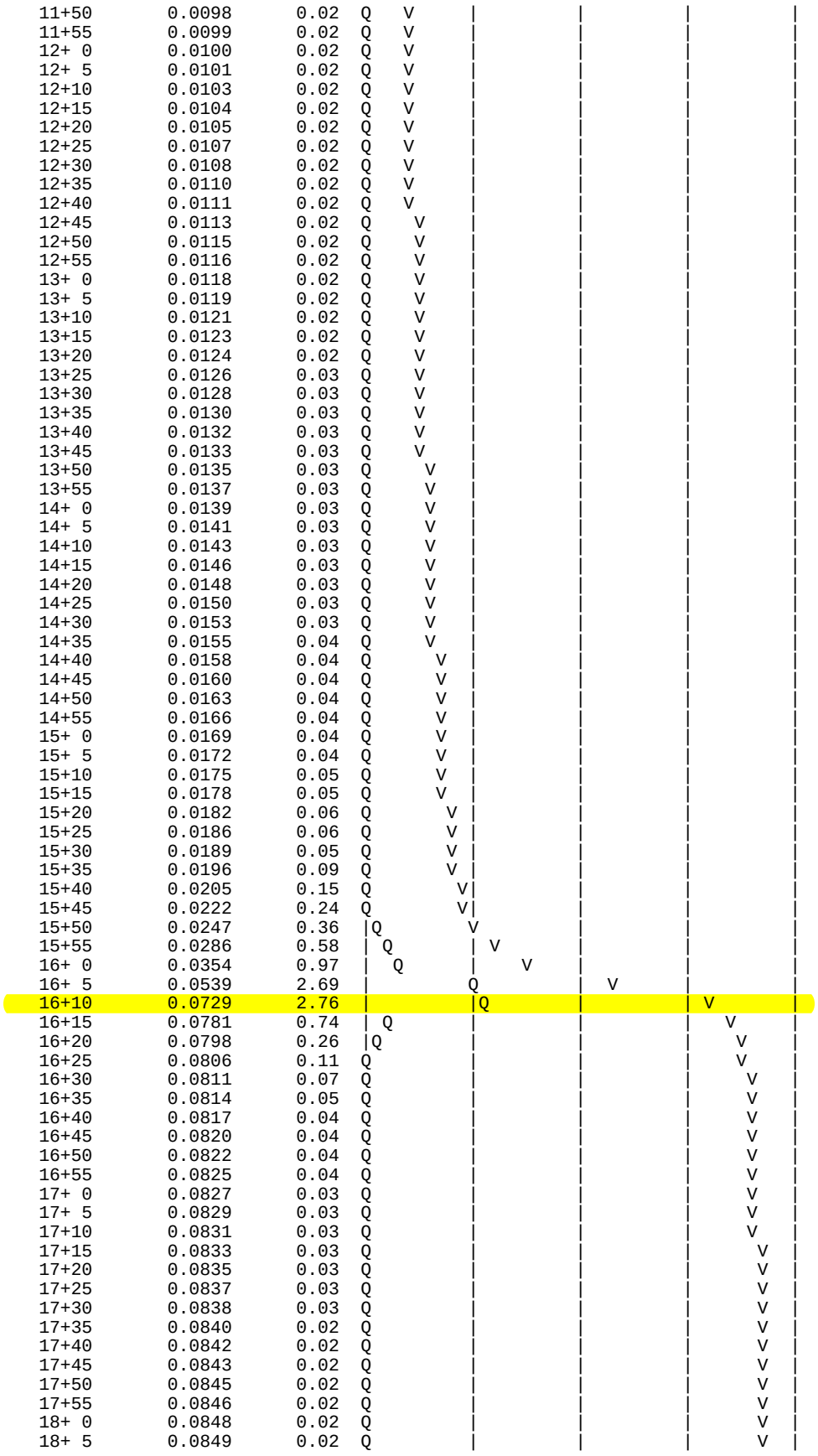
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

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	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0001	0.01	Q				
0+20	0.0002	0.01	Q				
0+25	0.0002	0.01	Q				
0+30	0.0003	0.01	Q				
0+35	0.0003	0.01	Q				
0+40	0.0004	0.01	Q				
0+45	0.0004	0.01	Q				
0+50	0.0005	0.01	Q				
0+55	0.0005	0.01	Q				
1+ 0	0.0006	0.01	Q				
1+ 5	0.0006	0.01	Q				
1+10	0.0007	0.01	Q				
1+15	0.0007	0.01	Q				
1+20	0.0008	0.01	Q				
1+25	0.0008	0.01	Q				
1+30	0.0009	0.01	Q				
1+35	0.0009	0.01	Q				
1+40	0.0010	0.01	Q				
1+45	0.0010	0.01	Q				
1+50	0.0011	0.01	Q				
1+55	0.0011	0.01	Q				
2+ 0	0.0012	0.01	Q				
2+ 5	0.0012	0.01	Q				
2+10	0.0013	0.01	Q				
2+15	0.0013	0.01	Q				
2+20	0.0014	0.01	Q				
2+25	0.0014	0.01	Q				
2+30	0.0015	0.01	Q				
2+35	0.0016	0.01	Q				
2+40	0.0016	0.01	Q				
2+45	0.0017	0.01	Q				
2+50	0.0017	0.01	Q				
2+55	0.0018	0.01	Q				
3+ 0	0.0018	0.01	Q				
3+ 5	0.0019	0.01	Q				
3+10	0.0019	0.01	Q				
3+15	0.0020	0.01	Q				
3+20	0.0020	0.01	Q				
3+25	0.0021	0.01	Q				
3+30	0.0022	0.01	Q				
3+35	0.0022	0.01	Q				
3+40	0.0023	0.01	QV				
3+45	0.0023	0.01	QV				
3+50	0.0024	0.01	QV				
3+55	0.0024	0.01	QV				
4+ 0	0.0025	0.01	QV				
4+ 5	0.0026	0.01	QV				
4+10	0.0026	0.01	QV				
4+15	0.0027	0.01	QV				
4+20	0.0027	0.01	QV				
4+25	0.0028	0.01	QV				
4+30	0.0029	0.01	QV				
4+35	0.0029	0.01	QV				
4+40	0.0030	0.01	QV				
4+45	0.0030	0.01	QV				
4+50	0.0031	0.01	QV				
4+55	0.0032	0.01	QV				
5+ 0	0.0032	0.01	QV				
5+ 5	0.0033	0.01	QV				
5+10	0.0033	0.01	QV				
5+15	0.0034	0.01	QV				
5+20	0.0035	0.01	QV				
5+25	0.0035	0.01	QV				

5+30	0.0036	0.01	QV	|	|	|	|
5+35	0.0037	0.01	QV	|	|	|	|
5+40	0.0037	0.01	QV	|	|	|	|
5+45	0.0038	0.01	QV	|	|	|	|
5+50	0.0038	0.01	QV	|	|	|	|
5+55	0.0039	0.01	QV	|	|	|	|
6+ 0	0.0040	0.01	QV	|	|	|	|
6+ 5	0.0040	0.01	QV	|	|	|	|
6+10	0.0041	0.01	QV	|	|	|	|
6+15	0.0042	0.01	QV	|	|	|	|
6+20	0.0042	0.01	QV	|	|	|	|
6+25	0.0043	0.01	QV	|	|	|	|
6+30	0.0044	0.01	QV	|	|	|	|
6+35	0.0044	0.01	QV	|	|	|	|
6+40	0.0045	0.01	Q V	|	|	|	|
6+45	0.0046	0.01	Q V	|	|	|	|
6+50	0.0046	0.01	Q V	|	|	|	|
6+55	0.0047	0.01	Q V	|	|	|	|
7+ 0	0.0048	0.01	Q V	|	|	|	|
7+ 5	0.0048	0.01	Q V	|	|	|	|
7+10	0.0049	0.01	Q V	|	|	|	|
7+15	0.0050	0.01	Q V	|	|	|	|
7+20	0.0051	0.01	Q V	|	|	|	|
7+25	0.0051	0.01	Q V	|	|	|	|
7+30	0.0052	0.01	Q V	|	|	|	|
7+35	0.0053	0.01	Q V	|	|	|	|
7+40	0.0053	0.01	Q V	|	|	|	|
7+45	0.0054	0.01	Q V	|	|	|	|
7+50	0.0055	0.01	Q V	|	|	|	|
7+55	0.0056	0.01	Q V	|	|	|	|
8+ 0	0.0056	0.01	Q V	|	|	|	|
8+ 5	0.0057	0.01	Q V	|	|	|	|
8+10	0.0058	0.01	Q V	|	|	|	|
8+15	0.0059	0.01	Q V	|	|	|	|
8+20	0.0059	0.01	Q V	|	|	|	|
8+25	0.0060	0.01	Q V	|	|	|	|
8+30	0.0061	0.01	Q V	|	|	|	|
8+35	0.0062	0.01	Q V	|	|	|	|
8+40	0.0063	0.01	Q V	|	|	|	|
8+45	0.0063	0.01	Q V	|	|	|	|
8+50	0.0064	0.01	Q V	|	|	|	|
8+55	0.0065	0.01	Q V	|	|	|	|
9+ 0	0.0066	0.01	Q V	|	|	|	|
9+ 5	0.0067	0.01	Q V	|	|	|	|
9+10	0.0067	0.01	Q V	|	|	|	|
9+15	0.0068	0.01	Q V	|	|	|	|
9+20	0.0069	0.01	Q V	|	|	|	|
9+25	0.0070	0.01	Q V	|	|	|	|
9+30	0.0071	0.01	Q V	|	|	|	|
9+35	0.0072	0.01	Q V	|	|	|	|
9+40	0.0072	0.01	Q V	|	|	|	|
9+45	0.0073	0.01	Q V	|	|	|	|
9+50	0.0074	0.01	Q V	|	|	|	|
9+55	0.0075	0.01	Q V	|	|	|	|
10+ 0	0.0076	0.01	Q V	|	|	|	|
10+ 5	0.0077	0.01	Q V	|	|	|	|
10+10	0.0078	0.01	Q V	|	|	|	|
10+15	0.0079	0.01	Q V	|	|	|	|
10+20	0.0079	0.01	Q V	|	|	|	|
10+25	0.0080	0.01	Q V	|	|	|	|
10+30	0.0081	0.01	Q V	|	|	|	|
10+35	0.0082	0.01	Q V	|	|	|	|
10+40	0.0083	0.01	Q V	|	|	|	|
10+45	0.0084	0.01	Q V	|	|	|	|
10+50	0.0085	0.01	Q V	|	|	|	|
10+55	0.0086	0.01	Q V	|	|	|	|
11+ 0	0.0087	0.01	Q V	|	|	|	|
11+ 5	0.0088	0.01	Q V	|	|	|	|
11+10	0.0089	0.01	Q V	|	|	|	|
11+15	0.0090	0.01	Q V	|	|	|	|
11+20	0.0091	0.02	Q V	|	|	|	|
11+25	0.0092	0.02	Q V	|	|	|	|
11+30	0.0093	0.02	Q V	|	|	|	|
11+35	0.0094	0.02	Q V	|	|	|	|
11+40	0.0095	0.02	Q V	|	|	|	|
11+45	0.0097	0.02	Q V	|	|	|	|


11+50 0.0098 0.02
11+55 0.0099 0.02
12+ 0 0.0100 0.02
12+ 5 0.0101 0.02
12+10 0.0103 0.02
12+15 0.0104 0.02
12+20 0.0105 0.02
12+25 0.0107 0.02
12+30 0.0108 0.02
12+35 0.0110 0.02
12+40 0.0111 0.02
12+45 0.0113 0.02
12+50 0.0115 0.02
12+55 0.0116 0.02
13+ 0 0.0118 0.02
13+ 5 0.0119 0.02
13+10 0.0121 0.02
13+15 0.0123 0.02
13+20 0.0124 0.02
13+25 0.0126 0.03
13+30 0.0128 0.03
13+35 0.0130 0.03
13+40 0.0132 0.03
13+45 0.0133 0.03
13+50 0.0135 0.03
13+55 0.0137 0.03
14+ 0 0.0139 0.03
14+ 5 0.0141 0.03
14+10 0.0143 0.03
14+15 0.0146 0.03
14+20 0.0148 0.03
14+25 0.0150 0.03
14+30 0.0153 0.03
14+35 0.0155 0.04
14+40 0.0158 0.04
14+45 0.0160 0.04
14+50 0.0163 0.04
14+55 0.0166 0.04
15+ 0 0.0169 0.04
15+ 5 0.0172 0.04
15+10 0.0175 0.05
15+15 0.0178 0.05
15+20 0.0182 0.06
15+25 0.0186 0.06
15+30 0.0189 0.05
15+35 0.0196 0.09
15+40 0.0205 0.15
15+45 0.0222 0.24
15+50 0.0247 0.36
15+55 0.0286 0.58
16+ 0 0.0354 0.97
16+ 5 0.0539 2.69
16+10 0.0729 2.76
16+15 0.0781 0.74
16+20 0.0798 0.26
16+25 0.0806 0.11
16+30 0.0811 0.07
16+35 0.0814 0.05
16+40 0.0817 0.04
16+45 0.0820 0.04
16+50 0.0822 0.04
16+55 0.0825 0.04
17+ 0 0.0827 0.03
17+ 5 0.0829 0.03
17+10 0.0831 0.03
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17+30 0.0838 0.03
17+35 0.0840 0.02
17+40 0.0842 0.02
17+45 0.0843 0.02
17+50 0.0845 0.02
17+55 0.0846 0.02
18+ 0 0.0848 0.02
18+ 5 0.0849 0.02

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   18+10       0.0850      0.02  Q          |          |          |       V  |
   18+15       0.0851      0.02  Q          |          |          |       V  |
   18+20       0.0853      0.02  Q          |          |          |       V  |
   18+25       0.0854      0.02  Q          |          |          |       V  |
   18+30       0.0855      0.02  Q          |          |          |        V |
   18+35       0.0856      0.01  Q          |          |          |        V |
   18+40       0.0857      0.01  Q          |          |          |        V |
   18+45       0.0858      0.01  Q          |          |          |        V |
   18+50       0.0859      0.01  Q          |          |          |        V |
   18+55       0.0860      0.01  Q          |          |          |        V |
   19+ 0       0.0860      0.01  Q          |          |          |        V |
   19+ 5       0.0861      0.01  Q          |          |          |        V |
   19+10       0.0862      0.01  Q          |          |          |        V |
   19+15       0.0863      0.01  Q          |          |          |        V |
   19+20       0.0864      0.01  Q          |          |          |        V |
   19+25       0.0865      0.01  Q          |          |          |        V |
   19+30       0.0866      0.01  Q          |          |          |        V |
   19+35       0.0866      0.01  Q          |          |          |        V |
   19+40       0.0867      0.01  Q          |          |          |        V |
   19+45       0.0868      0.01  Q          |          |          |        V |
   19+50       0.0869      0.01  Q          |          |          |        V |
   19+55       0.0870      0.01  Q          |          |          |        V |
   20+ 0       0.0870      0.01  Q          |          |          |        V |
   20+ 5       0.0871      0.01  Q          |          |          |        V |
   20+10       0.0872      0.01  Q          |          |          |        V |
   20+15       0.0873      0.01  Q          |          |          |        V |
   20+20       0.0873      0.01  Q          |          |          |        V |
   20+25       0.0874      0.01  Q          |          |          |        V |
   20+30       0.0875      0.01  Q          |          |          |        V |
   20+35       0.0876      0.01  Q          |          |          |        V |
   20+40       0.0876      0.01  Q          |          |          |        V |
   20+45       0.0877      0.01  Q          |          |          |        V |
   20+50       0.0878      0.01  Q          |          |          |         V|
   20+55       0.0878      0.01  Q          |          |          |         V|
   21+ 0       0.0879      0.01  Q          |          |          |         V|
   21+ 5       0.0880      0.01  Q          |          |          |         V|
   21+10       0.0880      0.01  Q          |          |          |         V|
   21+15       0.0881      0.01  Q          |          |          |         V|
   21+20       0.0881      0.01  Q          |          |          |         V|
   21+25       0.0882      0.01  Q          |          |          |         V|
   21+30       0.0883      0.01  Q          |          |          |         V|
   21+35       0.0883      0.01  Q          |          |          |         V|
   21+40       0.0884      0.01  Q          |          |          |         V|
   21+45       0.0885      0.01  Q          |          |          |         V|
   21+50       0.0885      0.01  Q          |          |          |         V|
   21+55       0.0886      0.01  Q          |          |          |         V|
   22+ 0       0.0886      0.01  Q          |          |          |         V|
   22+ 5       0.0887      0.01  Q          |          |          |         V|
   22+10       0.0888      0.01  Q          |          |          |         V|
   22+15       0.0888      0.01  Q          |          |          |         V|
   22+20       0.0889      0.01  Q          |          |          |         V|
   22+25       0.0889      0.01  Q          |          |          |         V|
   22+30       0.0890      0.01  Q          |          |          |         V|
   22+35       0.0890      0.01  Q          |          |          |         V|
   22+40       0.0891      0.01  Q          |          |          |         V|
   22+45       0.0891      0.01  Q          |          |          |         V|
   22+50       0.0892      0.01  Q          |          |          |         V|
   22+55       0.0893      0.01  Q          |          |          |         V|
   23+ 0       0.0893      0.01  Q          |          |          |         V|
   23+ 5       0.0894      0.01  Q          |          |          |         V|
   23+10       0.0894      0.01  Q          |          |          |         V|
   23+15       0.0895      0.01  Q          |          |          |         V|
   23+20       0.0895      0.01  Q          |          |          |         V|
   23+25       0.0896      0.01  Q          |          |          |         V|
   23+30       0.0896      0.01  Q          |          |          |         V|
   23+35       0.0897      0.01  Q          |          |          |         V|
   23+40       0.0897      0.01  Q          |          |          |         V|
   23+45       0.0898      0.01  Q          |          |          |         V|
   23+50       0.0898      0.01  Q          |          |          |         V|
   23+55       0.0899      0.01  Q          |          |          |         V|
   24+ 0       0.0899      0.01  Q          |          |          |         V|
   24+ 5       0.0899      0.00  Q          |          |          |         V|
   24+10       0.0900      0.00  Q          |          |          |         V|
   24+15       0.0900      0.00  Q          |          |          |         V|
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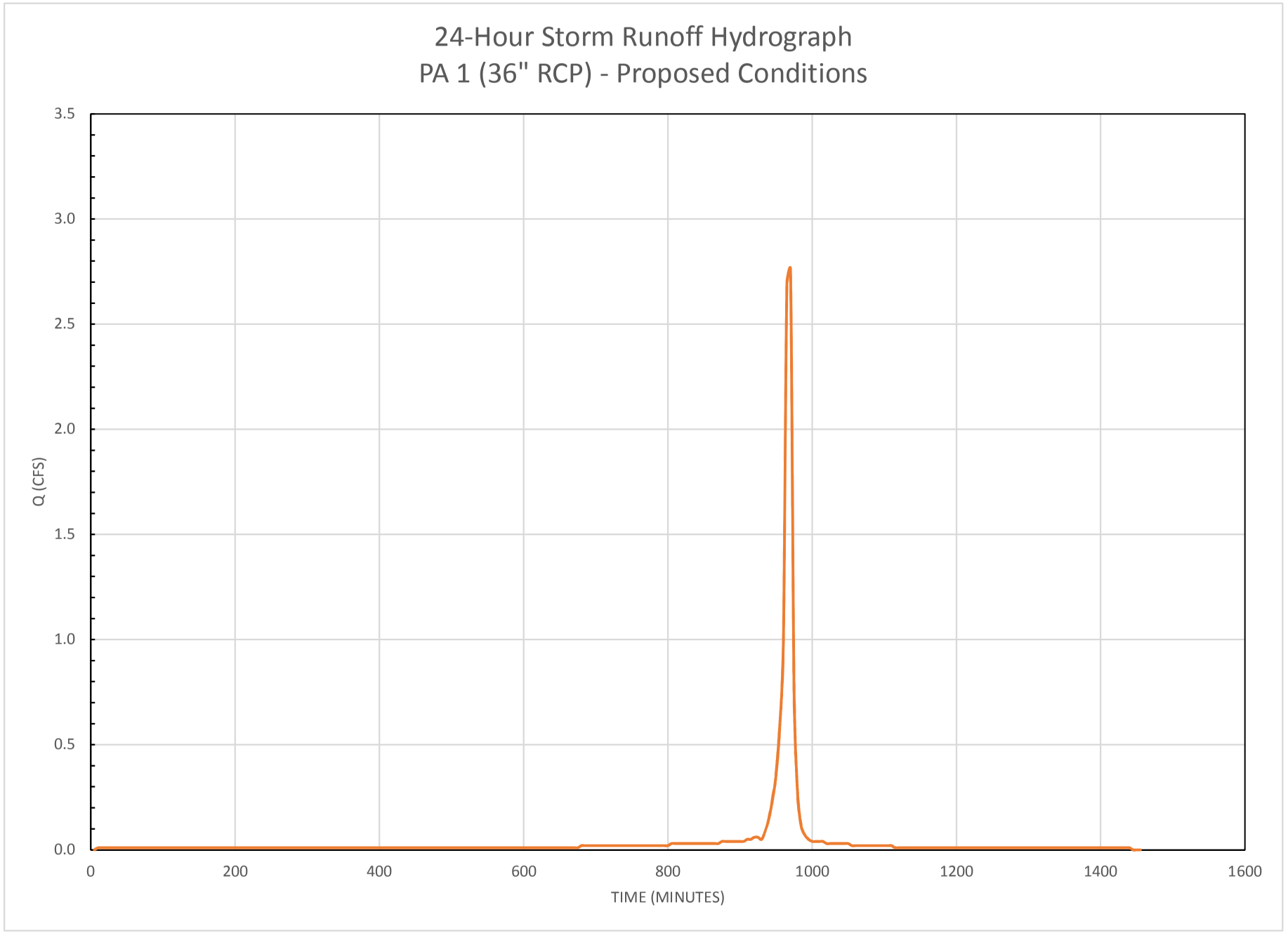
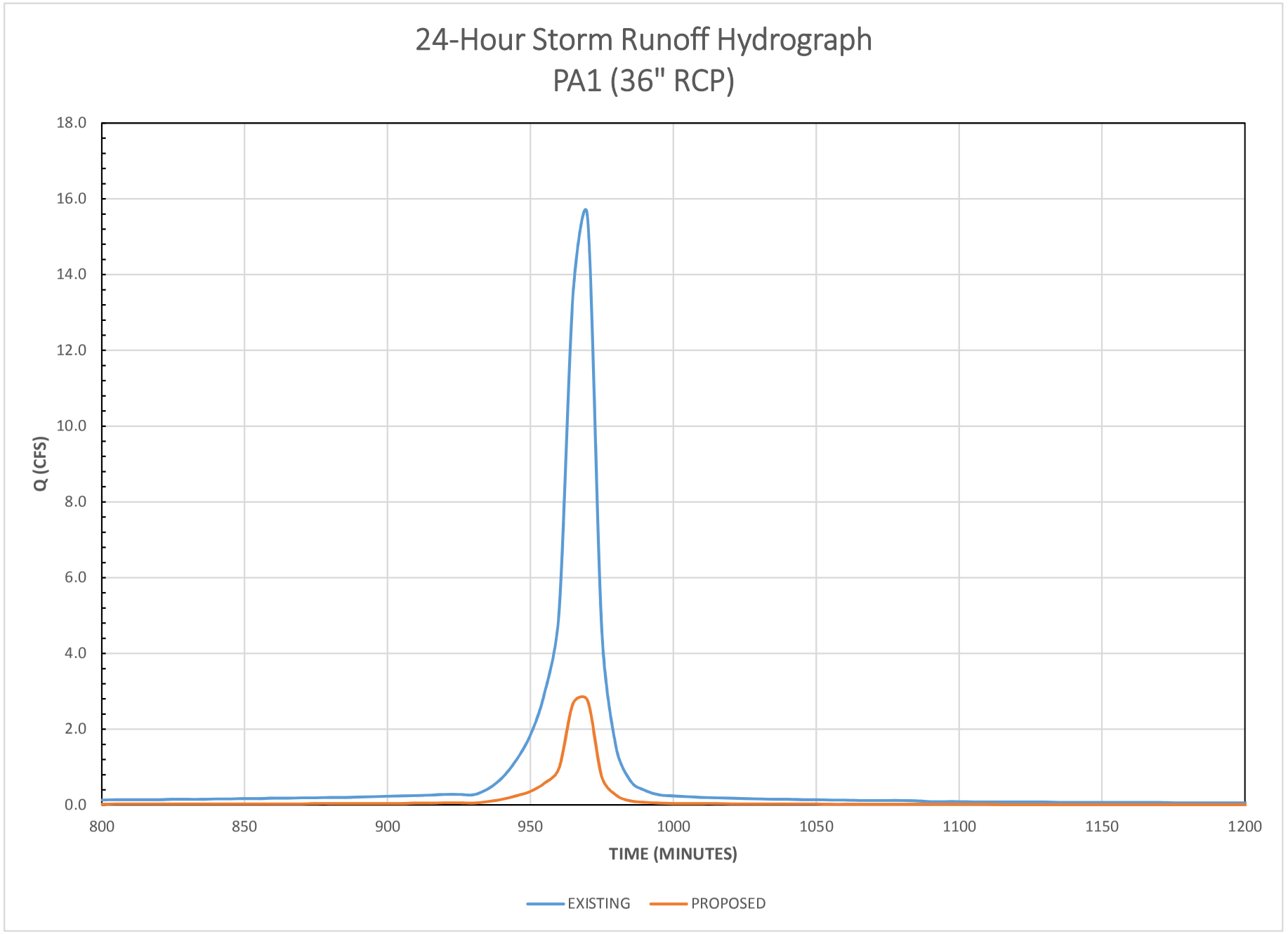

24-Hour Storm Runoff Hydrograph
PA 1 (36" RCP) - Proposed Conditions
Q (CFS)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
1400
1600
TIME (MINUTES)


24-Hour Storm Runoff Hydrograph
PA1 (36" RCP)
Q (CFS)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
800
850
900
950
1000
1050
1100
1150
1200
TIME (MINUTES)
EXISTING
PROPOSED

Planning Area 2 (North Site)

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 07/20/15 File Name: CVPRRAT.roc

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CIELO VISTA PROJECT
PROPOSED CONDITION
2-YEAR 24-HOUR STORM EVENT
BY FUSCOE ENGINEERING

Program License Serial Number 6049

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

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Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.710
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.290
SCS curve number for soil(AMC 2) = 61.51
Pervious ratio(Ap) = 0.6000 Max loss rate(Fp)= 0.271(In/Hr)
Max Catchment Loss (Fm) = 0.163(In/Hr)
Initial subarea data:
Initial area flow distance = 222.220(Ft.)
Top (of initial area) elevation = 678.000(Ft.)
Bottom (of initial area) elevation = 675.000(Ft.)
Difference in elevation = 3.000(Ft.)
Slope = 0.01350 s(%)= 1.35
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.463 min.
Rainfall intensity = 1.673(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.813
Subarea runoff = 0.598(CFS)
Total initial stream area = 0.440(Ac.)

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Process from Point/Station 202.000 to Point/Station 203.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 675.000(Ft.)
End of street segment elevation = 647.200(Ft.)
Length of street segment = 503.480(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 22.000(Ft.)
Distance from crown to crossfall grade break = 18.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 10.000(Ft.)
Slope from curb to property line (v/hz) = 0.025
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0150
Manning's N from gutter to grade break = 0.0150

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 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      4.405(CFS)
Depth of flow =   0.251(Ft.), Average velocity =   4.294(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.215(Ft.)
Flow velocity =   4.29(Ft/s)
Travel time =    1.95 min.     TC =   10.42  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.660
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.340
SCS curve number for soil(AMC 2)  = 62.46
Pervious ratio(Ap) = 0.6000  Max loss rate(Fp)=     0.266(In/Hr)
Max Catchment Loss (Fm) =     0.160(In/Hr)
Rainfall intensity =      1.485(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.803
Subarea runoff =      7.466(CFS) for    6.320(Ac.)
Total runoff =      8.065(CFS)       Total area =        6.76(Ac.)
Area averaged Fm value =    0.160(In/Hr)
Street flow at end of street =      8.065(CFS)
Half street flow at end of street =      4.032(CFS)
Depth of flow =   0.294(Ft.), Average velocity =   4.863(Ft/s)
Flow width (from curb towards crown)=   8.382(Ft.)


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Process from Point/Station      203.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   641.200(Ft.)
Downstream point/station elevation =   622.000(Ft.)
Pipe length  =   218.79(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.065(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     8.065(CFS)
Normal flow depth in pipe =    5.62(In.)
Flow top width inside pipe =   20.33(In.)
Critical Depth =   12.13(In.)
Pipe flow velocity =     14.40(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =    10.67 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      206.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.760(Ac.)
Runoff from this stream =      8.065(CFS)
Time of concentration =   10.67 min.
Rainfall intensity =     1.465(In/Hr)
Area averaged loss rate (Fm) =    0.1598(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.850
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.150
SCS curve number for soil(AMC 2)  = 79.65
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.285(In/Hr)
Max Catchment Loss (Fm) =     0.285(In/Hr)
Initial subarea data:
Initial area flow distance =   249.120(Ft.)
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Top (of initial area) elevation =   679.000(Ft.)
Bottom (of initial area) elevation =   650.000(Ft.)
Difference in elevation =    29.000(Ft.)
Slope =    0.11641  s(%)=      11.64
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.337 min.
Rainfall intensity =      1.816(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.759
Subarea runoff =      0.289(CFS)
Total initial stream area =        0.210(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   648.200(Ft.)
Downstream point/station elevation =   622.000(Ft.)
Pipe length  =   729.39(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.289(CFS)
Given pipe size =     48.00(In.)
Calculated individual pipe flow  =     0.289(CFS)
Normal flow depth in pipe =    1.19(In.)
Flow top width inside pipe =   14.91(In.)
Critical depth could not be calculated.
Pipe flow velocity =      3.51(Ft/s)
Travel time through pipe =    3.46 min.
Time of concentration (TC) =    10.80 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.300(In/Hr)
Max Catchment Loss (Fm) =     0.300(In/Hr)
Time of concentration =    10.80 min.
Rainfall intensity =      1.455(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.716
Subarea runoff =      0.701(CFS) for    0.740(Ac.)
Total runoff =      0.990(CFS)       Total area =        0.95(Ac.)
Area averaged Fm value =    0.297(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.950(Ac.)
Runoff from this stream =      0.990(CFS)
Time of concentration =   10.80 min.
Rainfall intensity =     1.455(In/Hr)
Area averaged loss rate (Fm) =    0.2967(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream  Area  Flow rate      TC     Fm       Rainfall Intensity
 No.    (Ac.)   (CFS)       (min) (In/Hr)     (In/Hr)


1      6.76     8.065     10.67    0.160      1.465
2      0.95     0.990     10.80    0.297      1.455
Qmax(1) =
          1.000 *    1.000 *     8.065) +
          1.009 *    0.988 *     0.990) + =       9.052
```

```
Qmax(2) =
          0.992 *    1.000 *     8.065) +
          1.000 *    1.000 *     0.990) + =       8.993

Total of 2 streams to confluence:
Flow rates before confluence point:
       8.065       0.990
Maximum flow rates at confluence using above data:
        9.052        8.993
Area of streams before confluence:
        6.760        0.950
Effective area values after confluence:
        7.699        7.710
Results of confluence:
Total flow rate =      9.052(CFS)
Time of concentration =    10.671 min.
Effective stream area after confluence =      7.699(Ac.)
Study area average Pervious fraction(Ap) =  0.649
Study area average soil loss rate(Fm) =    0.177(In/Hr)
Study area total (this main stream) =       7.71(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   622.000(Ft.)
Downstream point/station elevation =   612.000(Ft.)
Pipe length  =   203.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.052(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.052(CFS)
Normal flow depth in pipe =    8.65(In.)
Flow top width inside pipe =   14.82(In.)
Critical Depth =   13.89(In.)
Pipe flow velocity =     12.36(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =    10.94 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      207.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.300(In/Hr)
Max Catchment Loss (Fm) =     0.300(In/Hr)
Time of concentration =    10.94 min.
Rainfall intensity =      1.444(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.785
Subarea runoff =      0.315(CFS) for    0.570(Ac.)
Total runoff =      9.367(CFS)       Total area =        8.27(Ac.)
Area averaged Fm value =    0.185(In/Hr)
End of computations, total study area =            8.28 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.673
Area averaged SCS curve number (AMC 2) =  65.3
```

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

Study date 07/20/15 File Name CVPRUNIT2.out

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Orange County Unit Hydrograph Hydrology Method
Manual Date(s) - October 1986, November 1996

Program License Serial Number 6049

CIELO VISTA PROJECT
PROPOSED CONDITION
2-YEAR 24-HOUR STORM EVENT
BY FUSCOE ENGINEERING

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used
++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	Area (Ac.)	Area Fraction	Soil Group	Fp (In/Hr)	Ap (dec.)	Fm (In/Hr)
56.0	6.0	0.72	B	0.300	0.600	0.180
75.0	2.3	0.28	D	0.200	0.600	0.120

Area-averaged adjusted loss rate Fm (In/Hr) = 0.163

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC1)	S	Pervious Yield Fr
3.57	0.432	56.0	36.0	17.78	0.068
2.38	0.288	98.0	98.0	0.20	0.890
1.39	0.168	75.0	57.0	7.54	0.018
0.93	0.112	98.0	98.0	0.20	0.890

Area-averaged catchment yield fraction, Y = 0.388
Area-averaged low loss fraction, Yb = 0.612
++
User entry of time of concentration = 0.180 (hours)
Watershed area = 8.27(Ac.)
Catchment Lag time = 0.144 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 57.8704
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.163(In/Hr)
Average low loss rate fraction (Yb) = 0.612 (decimal)
FOOTHILL S-Graph Selected
Computed peak 5-minute rainfall = 0.190(In)
Computed peak 30-minute rainfall = 0.400(In)
Specified peak 1-hour rainfall = 0.530(In)
Computed peak 3-hour rainfall = 0.890(In)
Specified peak 6-hour rainfall = 1.220(In)
Specified peak 24-hour rainfall = 2.050(In)

Rainfall depth area reduction factors:
Using a total area of 8.27(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.190(In)
30-minute factor = 1.000 Adjusted rainfall = 0.400(In)
1-hour factor = 1.000 Adjusted rainfall = 0.530(In)
3-hour factor = 1.000 Adjusted rainfall = 0.890(In)
6-hour factor = 1.000 Adjusted rainfall = 1.220(In)
24-hour factor = 1.000 Adjusted rainfall = 2.050(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 100.02 (CFS))	
1	5.297	5.298
2	34.628	29.336
3	69.724	35.101
4	82.516	12.795
5	89.900	7.385
6	94.486	4.587
7	97.148	2.662
8	98.305	1.157
9	98.904	0.599
10	99.313	0.409
11	99.715	0.402
12	99.928	0.213
13	100.000	0.072

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.1899	0.1899
2	0.2533	0.0634
3	0.2998	0.0465
4	0.3379	0.0381
5	0.3707	0.0328
6	0.3998	0.0292
7	0.4257	0.0258
8	0.4494	0.0237
9	0.4714	0.0220
10	0.4920	0.0206
11	0.5114	0.0194
12	0.5298	0.0184
13	0.5502	0.0204
14	0.5698	0.0196
15	0.5887	0.0189
16	0.6069	0.0182
17	0.6245	0.0176
18	0.6416	0.0171
19	0.6582	0.0166
20	0.6743	0.0161
21	0.6900	0.0157
22	0.7053	0.0153
23	0.7203	0.0150
24	0.7349	0.0146
25	0.7492	0.0143
26	0.7632	0.0140
27	0.7769	0.0137
28	0.7904	0.0135
29	0.8036	0.0132
30	0.8166	0.0130
31	0.8293	0.0127
32	0.8418	0.0125
33	0.8541	0.0123
34	0.8663	0.0121
35	0.8782	0.0119
36	0.8900	0.0118
37	0.9011	0.0112
38	0.9121	0.0110
39	0.9230	0.0108
40	0.9337	0.0107
41	0.9442	0.0105

42	0.9546	0.0104
43	0.9649	0.0103
44	0.9750	0.0101
45	0.9851	0.0100
46	0.9950	0.0099
47	1.0048	0.0098
48	1.0144	0.0097
49	1.0240	0.0096
50	1.0334	0.0095
51	1.0428	0.0094
52	1.0521	0.0093
53	1.0612	0.0092
54	1.0703	0.0091
55	1.0793	0.0090
56	1.0881	0.0089
57	1.0969	0.0088
58	1.1057	0.0087
59	1.1143	0.0086
60	1.1228	0.0086
61	1.1313	0.0085
62	1.1397	0.0084
63	1.1480	0.0083
64	1.1563	0.0083
65	1.1645	0.0082
66	1.1726	0.0081
67	1.1807	0.0081
68	1.1886	0.0080
69	1.1966	0.0079
70	1.2044	0.0079
71	1.2122	0.0078
72	1.2200	0.0077
73	1.2263	0.0063
74	1.2325	0.0063
75	1.2388	0.0062
76	1.2449	0.0062
77	1.2510	0.0061
78	1.2571	0.0061
79	1.2631	0.0060
80	1.2691	0.0060
81	1.2750	0.0059
82	1.2808	0.0059
83	1.2867	0.0058
84	1.2924	0.0058
85	1.2982	0.0057
86	1.3039	0.0057
87	1.3095	0.0057
88	1.3152	0.0056
89	1.3207	0.0056
90	1.3263	0.0055
91	1.3318	0.0055
92	1.3372	0.0055
93	1.3426	0.0054
94	1.3480	0.0054
95	1.3534	0.0054
96	1.3587	0.0053
97	1.3640	0.0053
98	1.3692	0.0052
99	1.3744	0.0052
100	1.3796	0.0052
101	1.3848	0.0051
102	1.3899	0.0051
103	1.3950	0.0051
104	1.4000	0.0051
105	1.4051	0.0050
106	1.4101	0.0050
107	1.4150	0.0050
108	1.4200	0.0049
109	1.4249	0.0049
110	1.4297	0.0049
111	1.4346	0.0049
112	1.4394	0.0048
113	1.4442	0.0048
114	1.4490	0.0048

115	1.4537	0.0047
116	1.4585	0.0047
117	1.4631	0.0047
118	1.4678	0.0047
119	1.4725	0.0046
120	1.4771	0.0046
121	1.4817	0.0046
122	1.4863	0.0046
123	1.4908	0.0045
124	1.4953	0.0045
125	1.4998	0.0045
126	1.5043	0.0045
127	1.5088	0.0045
128	1.5132	0.0044
129	1.5176	0.0044
130	1.5220	0.0044
131	1.5264	0.0044
132	1.5307	0.0044
133	1.5351	0.0043
134	1.5394	0.0043
135	1.5437	0.0043
136	1.5479	0.0043
137	1.5522	0.0043
138	1.5564	0.0042
139	1.5606	0.0042
140	1.5648	0.0042
141	1.5690	0.0042
142	1.5732	0.0042
143	1.5773	0.0041
144	1.5814	0.0041
145	1.5855	0.0041
146	1.5896	0.0041
147	1.5937	0.0041
148	1.5977	0.0041
149	1.6018	0.0040
150	1.6058	0.0040
151	1.6098	0.0040
152	1.6138	0.0040
153	1.6177	0.0040
154	1.6217	0.0040
155	1.6256	0.0039
156	1.6295	0.0039
157	1.6334	0.0039
158	1.6373	0.0039
159	1.6412	0.0039
160	1.6451	0.0039
161	1.6489	0.0038
162	1.6527	0.0038
163	1.6565	0.0038
164	1.6603	0.0038
165	1.6641	0.0038
166	1.6679	0.0038
167	1.6716	0.0038
168	1.6754	0.0037
169	1.6791	0.0037
170	1.6828	0.0037
171	1.6865	0.0037
172	1.6902	0.0037
173	1.6939	0.0037
174	1.6975	0.0037
175	1.7012	0.0036
176	1.7048	0.0036
177	1.7084	0.0036
178	1.7120	0.0036
179	1.7156	0.0036
180	1.7192	0.0036
181	1.7228	0.0036
182	1.7263	0.0036
183	1.7299	0.0035
184	1.7334	0.0035
185	1.7369	0.0035
186	1.7405	0.0035
187	1.7439	0.0035

188	1.7474	0.0035
189	1.7509	0.0035
190	1.7544	0.0035
191	1.7578	0.0035
192	1.7613	0.0034
193	1.7647	0.0034
194	1.7681	0.0034
195	1.7715	0.0034
196	1.7749	0.0034
197	1.7783	0.0034
198	1.7817	0.0034
199	1.7850	0.0034
200	1.7884	0.0034
201	1.7917	0.0033
202	1.7951	0.0033
203	1.7984	0.0033
204	1.8017	0.0033
205	1.8050	0.0033
206	1.8083	0.0033
207	1.8116	0.0033
208	1.8148	0.0033
209	1.8181	0.0033
210	1.8214	0.0033
211	1.8246	0.0032
212	1.8278	0.0032
213	1.8311	0.0032
214	1.8343	0.0032
215	1.8375	0.0032
216	1.8407	0.0032
217	1.8438	0.0032
218	1.8470	0.0032
219	1.8502	0.0032
220	1.8534	0.0032
221	1.8565	0.0031
222	1.8596	0.0031
223	1.8628	0.0031
224	1.8659	0.0031
225	1.8690	0.0031
226	1.8721	0.0031
227	1.8752	0.0031
228	1.8783	0.0031
229	1.8814	0.0031
230	1.8845	0.0031
231	1.8875	0.0031
232	1.8906	0.0031
233	1.8936	0.0030
234	1.8967	0.0030
235	1.8997	0.0030
236	1.9027	0.0030
237	1.9057	0.0030
238	1.9087	0.0030
239	1.9117	0.0030
240	1.9147	0.0030
241	1.9177	0.0030
242	1.9207	0.0030
243	1.9236	0.0030
244	1.9266	0.0030
245	1.9296	0.0030
246	1.9325	0.0029
247	1.9354	0.0029
248	1.9384	0.0029
249	1.9413	0.0029
250	1.9442	0.0029
251	1.9471	0.0029
252	1.9500	0.0029
253	1.9529	0.0029
254	1.9558	0.0029
255	1.9587	0.0029
256	1.9615	0.0029
257	1.9644	0.0029
258	1.9673	0.0029
259	1.9701	0.0029
260	1.9730	0.0028

261	1.9758	0.0028
262	1.9786	0.0028
263	1.9815	0.0028
264	1.9843	0.0028
265	1.9871	0.0028
266	1.9899	0.0028
267	1.9927	0.0028
268	1.9955	0.0028
269	1.9983	0.0028
270	2.0010	0.0028
271	2.0038	0.0028
272	2.0066	0.0028
273	2.0093	0.0028
274	2.0121	0.0028
275	2.0148	0.0027
276	2.0176	0.0027
277	2.0203	0.0027
278	2.0230	0.0027
279	2.0258	0.0027
280	2.0285	0.0027
281	2.0312	0.0027
282	2.0339	0.0027
283	2.0366	0.0027
284	2.0393	0.0027
285	2.0420	0.0027
286	2.0446	0.0027
287	2.0473	0.0027
288	2.0500	0.0027

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0027	0.0016	0.0010
2	0.0027	0.0016	0.0010
3	0.0027	0.0016	0.0010
4	0.0027	0.0016	0.0010
5	0.0027	0.0017	0.0010
6	0.0027	0.0017	0.0011
7	0.0027	0.0017	0.0011
8	0.0027	0.0017	0.0011
9	0.0027	0.0017	0.0011
10	0.0027	0.0017	0.0011
11	0.0028	0.0017	0.0011
12	0.0028	0.0017	0.0011
13	0.0028	0.0017	0.0011
14	0.0028	0.0017	0.0011
15	0.0028	0.0017	0.0011
16	0.0028	0.0017	0.0011
17	0.0028	0.0017	0.0011
18	0.0028	0.0017	0.0011
19	0.0028	0.0017	0.0011
20	0.0028	0.0017	0.0011
21	0.0029	0.0017	0.0011
22	0.0029	0.0018	0.0011
23	0.0029	0.0018	0.0011
24	0.0029	0.0018	0.0011
25	0.0029	0.0018	0.0011
26	0.0029	0.0018	0.0011
27	0.0029	0.0018	0.0011
28	0.0029	0.0018	0.0011
29	0.0029	0.0018	0.0011
30	0.0030	0.0018	0.0011
31	0.0030	0.0018	0.0012
32	0.0030	0.0018	0.0012
33	0.0030	0.0018	0.0012
34	0.0030	0.0018	0.0012
35	0.0030	0.0018	0.0012
36	0.0030	0.0018	0.0012
37	0.0030	0.0019	0.0012
38	0.0030	0.0019	0.0012
39	0.0031	0.0019	0.0012
40	0.0031	0.0019	0.0012

41	0.0031	0.0019	0.0012
42	0.0031	0.0019	0.0012
43	0.0031	0.0019	0.0012
44	0.0031	0.0019	0.0012
45	0.0031	0.0019	0.0012
46	0.0031	0.0019	0.0012
47	0.0032	0.0019	0.0012
48	0.0032	0.0019	0.0012
49	0.0032	0.0020	0.0012
50	0.0032	0.0020	0.0012
51	0.0032	0.0020	0.0013
52	0.0032	0.0020	0.0013
53	0.0033	0.0020	0.0013
54	0.0033	0.0020	0.0013
55	0.0033	0.0020	0.0013
56	0.0033	0.0020	0.0013
57	0.0033	0.0020	0.0013
58	0.0033	0.0020	0.0013
59	0.0033	0.0020	0.0013
60	0.0034	0.0021	0.0013
61	0.0034	0.0021	0.0013
62	0.0034	0.0021	0.0013
63	0.0034	0.0021	0.0013
64	0.0034	0.0021	0.0013
65	0.0034	0.0021	0.0013
66	0.0035	0.0021	0.0013
67	0.0035	0.0021	0.0013
68	0.0035	0.0021	0.0014
69	0.0035	0.0021	0.0014
70	0.0035	0.0022	0.0014
71	0.0035	0.0022	0.0014
72	0.0036	0.0022	0.0014
73	0.0036	0.0022	0.0014
74	0.0036	0.0022	0.0014
75	0.0036	0.0022	0.0014
76	0.0036	0.0022	0.0014
77	0.0037	0.0022	0.0014
78	0.0037	0.0022	0.0014
79	0.0037	0.0023	0.0014
80	0.0037	0.0023	0.0014
81	0.0037	0.0023	0.0015
82	0.0038	0.0023	0.0015
83	0.0038	0.0023	0.0015
84	0.0038	0.0023	0.0015
85	0.0038	0.0023	0.0015
86	0.0038	0.0024	0.0015
87	0.0039	0.0024	0.0015
88	0.0039	0.0024	0.0015
89	0.0039	0.0024	0.0015
90	0.0039	0.0024	0.0015
91	0.0040	0.0024	0.0015
92	0.0040	0.0024	0.0015
93	0.0040	0.0025	0.0016
94	0.0040	0.0025	0.0016
95	0.0041	0.0025	0.0016
96	0.0041	0.0025	0.0016
97	0.0041	0.0025	0.0016
98	0.0041	0.0025	0.0016
99	0.0042	0.0026	0.0016
100	0.0042	0.0026	0.0016
101	0.0042	0.0026	0.0016
102	0.0043	0.0026	0.0017
103	0.0043	0.0026	0.0017
104	0.0043	0.0026	0.0017
105	0.0044	0.0027	0.0017
106	0.0044	0.0027	0.0017
107	0.0044	0.0027	0.0017
108	0.0044	0.0027	0.0017
109	0.0045	0.0027	0.0017
110	0.0045	0.0028	0.0017
111	0.0045	0.0028	0.0018
112	0.0046	0.0028	0.0018
113	0.0046	0.0028	0.0018

114	0.0046	0.0028	0.0018
115	0.0047	0.0029	0.0018
116	0.0047	0.0029	0.0018
117	0.0048	0.0029	0.0019
118	0.0048	0.0029	0.0019
119	0.0049	0.0030	0.0019
120	0.0049	0.0030	0.0019
121	0.0049	0.0030	0.0019
122	0.0050	0.0030	0.0019
123	0.0050	0.0031	0.0020
124	0.0051	0.0031	0.0020
125	0.0051	0.0031	0.0020
126	0.0051	0.0032	0.0020
127	0.0052	0.0032	0.0020
128	0.0052	0.0032	0.0020
129	0.0053	0.0033	0.0021
130	0.0054	0.0033	0.0021
131	0.0054	0.0033	0.0021
132	0.0055	0.0033	0.0021
133	0.0055	0.0034	0.0021
134	0.0056	0.0034	0.0022
135	0.0057	0.0035	0.0022
136	0.0057	0.0035	0.0022
137	0.0058	0.0035	0.0022
138	0.0058	0.0036	0.0023
139	0.0059	0.0036	0.0023
140	0.0060	0.0036	0.0023
141	0.0061	0.0037	0.0024
142	0.0061	0.0037	0.0024
143	0.0062	0.0038	0.0024
144	0.0063	0.0038	0.0024
145	0.0077	0.0047	0.0030
146	0.0078	0.0048	0.0030
147	0.0079	0.0048	0.0031
148	0.0080	0.0049	0.0031
149	0.0081	0.0050	0.0032
150	0.0082	0.0050	0.0032
151	0.0083	0.0051	0.0032
152	0.0084	0.0051	0.0033
153	0.0086	0.0052	0.0033
154	0.0086	0.0053	0.0034
155	0.0088	0.0054	0.0034
156	0.0089	0.0054	0.0034
157	0.0091	0.0055	0.0035
158	0.0092	0.0056	0.0036
159	0.0094	0.0057	0.0036
160	0.0095	0.0058	0.0037
161	0.0097	0.0059	0.0038
162	0.0098	0.0060	0.0038
163	0.0100	0.0061	0.0039
164	0.0101	0.0062	0.0039
165	0.0104	0.0064	0.0040
166	0.0105	0.0065	0.0041
167	0.0108	0.0066	0.0042
168	0.0110	0.0067	0.0043
169	0.0118	0.0072	0.0046
170	0.0119	0.0073	0.0046
171	0.0123	0.0075	0.0048
172	0.0125	0.0077	0.0049
173	0.0130	0.0079	0.0050
174	0.0132	0.0081	0.0051
175	0.0137	0.0084	0.0053
176	0.0140	0.0086	0.0054
177	0.0146	0.0089	0.0057
178	0.0150	0.0092	0.0058
179	0.0157	0.0096	0.0061
180	0.0161	0.0099	0.0063
181	0.0171	0.0105	0.0066
182	0.0176	0.0108	0.0068
183	0.0189	0.0115	0.0073
184	0.0196	0.0120	0.0076
185	0.0184	0.0113	0.0071
186	0.0194	0.0119	0.0075

187	0.0220	0.0135	0.0085
188	0.0237	0.0136	0.0101
189	0.0292	0.0136	0.0156
190	0.0328	0.0136	0.0192
191	0.0465	0.0136	0.0329
192	0.0634	0.0136	0.0498
193	0.1899	0.0136	0.1763
194	0.0381	0.0136	0.0245
195	0.0258	0.0136	0.0122
196	0.0206	0.0126	0.0080
197	0.0204	0.0125	0.0079
198	0.0182	0.0111	0.0071
199	0.0166	0.0101	0.0064
200	0.0153	0.0094	0.0059
201	0.0143	0.0087	0.0056
202	0.0135	0.0082	0.0052
203	0.0127	0.0078	0.0049
204	0.0121	0.0074	0.0047
205	0.0112	0.0068	0.0043
206	0.0107	0.0065	0.0042
207	0.0103	0.0063	0.0040
208	0.0099	0.0061	0.0038
209	0.0096	0.0059	0.0037
210	0.0093	0.0057	0.0036
211	0.0090	0.0055	0.0035
212	0.0087	0.0053	0.0034
213	0.0085	0.0052	0.0033
214	0.0083	0.0051	0.0032
215	0.0081	0.0049	0.0031
216	0.0079	0.0048	0.0031
217	0.0063	0.0039	0.0025
218	0.0062	0.0038	0.0024
219	0.0060	0.0037	0.0023
220	0.0059	0.0036	0.0023
221	0.0057	0.0035	0.0022
222	0.0056	0.0034	0.0022
223	0.0055	0.0034	0.0021
224	0.0054	0.0033	0.0021
225	0.0053	0.0032	0.0021
226	0.0052	0.0032	0.0020
227	0.0051	0.0031	0.0020
228	0.0050	0.0031	0.0019
229	0.0049	0.0030	0.0019
230	0.0048	0.0030	0.0019
231	0.0047	0.0029	0.0018
232	0.0047	0.0029	0.0018
233	0.0046	0.0028	0.0018
234	0.0045	0.0028	0.0018
235	0.0045	0.0027	0.0017
236	0.0044	0.0027	0.0017
237	0.0043	0.0026	0.0017
238	0.0043	0.0026	0.0017
239	0.0042	0.0026	0.0016
240	0.0042	0.0025	0.0016
241	0.0041	0.0025	0.0016
242	0.0041	0.0025	0.0016
243	0.0040	0.0024	0.0016
244	0.0040	0.0024	0.0015
245	0.0039	0.0024	0.0015
246	0.0039	0.0024	0.0015
247	0.0038	0.0023	0.0015
248	0.0038	0.0023	0.0015
249	0.0037	0.0023	0.0014
250	0.0037	0.0023	0.0014
251	0.0036	0.0022	0.0014
252	0.0036	0.0022	0.0014
253	0.0036	0.0022	0.0014
254	0.0035	0.0022	0.0014
255	0.0035	0.0021	0.0014
256	0.0035	0.0021	0.0013
257	0.0034	0.0021	0.0013
258	0.0034	0.0021	0.0013
259	0.0034	0.0021	0.0013

260	0.0033	0.0020	0.0013
261	0.0033	0.0020	0.0013
262	0.0033	0.0020	0.0013
263	0.0032	0.0020	0.0013
264	0.0032	0.0020	0.0012
265	0.0032	0.0019	0.0012
266	0.0032	0.0019	0.0012
267	0.0031	0.0019	0.0012
268	0.0031	0.0019	0.0012
269	0.0031	0.0019	0.0012
270	0.0031	0.0019	0.0012
271	0.0030	0.0019	0.0012
272	0.0030	0.0018	0.0012
273	0.0030	0.0018	0.0012
274	0.0030	0.0018	0.0011
275	0.0029	0.0018	0.0011
276	0.0029	0.0018	0.0011
277	0.0029	0.0018	0.0011
278	0.0029	0.0018	0.0011
279	0.0029	0.0017	0.0011
280	0.0028	0.0017	0.0011
281	0.0028	0.0017	0.0011
282	0.0028	0.0017	0.0011
283	0.0028	0.0017	0.0011
284	0.0028	0.0017	0.0011
285	0.0027	0.0017	0.0011
286	0.0027	0.0017	0.0011
287	0.0027	0.0017	0.0010
288	0.0027	0.0016	0.0010

Total soil rain loss = 1.09(In)
Total effective rainfall = 0.96(In)
Peak flow rate in flood hydrograph = 8.01(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	0.0003	0.04	Q	|	|	|	|
0+15	0.0008	0.07	Q	|	|	|	|
0+20	0.0014	0.09	Q	|	|	|	|
0+25	0.0020	0.09	Q	|	|	|	|
0+30	0.0027	0.10	Q	|	|	|	|
0+35	0.0034	0.10	Q	|	|	|	|
0+40	0.0041	0.10	Q	|	|	|	|
0+45	0.0048	0.10	Q	|	|	|	|
0+50	0.0056	0.11	Q	|	|	|	|
0+55	0.0063	0.11	Q	|	|	|	|
1+ 0	0.0070	0.11	Q	|	|	|	|
1+ 5	0.0078	0.11	Q	|	|	|	|
1+10	0.0085	0.11	Q	|	|	|	|
1+15	0.0092	0.11	Q	|	|	|	|
1+20	0.0100	0.11	Q	|	|	|	|
1+25	0.0107	0.11	Q	|	|	|	|
1+30	0.0115	0.11	Q	|	|	|	|
1+35	0.0122	0.11	Q	|	|	|	|
1+40	0.0130	0.11	Q	|	|	|	|
1+45	0.0137	0.11	Q	|	|	|	|
1+50	0.0145	0.11	Q	|	|	|	|
1+55	0.0153	0.11	Q	|	|	|	|
2+ 0	0.0160	0.11	Q	|	|	|	|
2+ 5	0.0168	0.11	QV	|	|	|	|
2+10	0.0176	0.11	QV	|	|	|	|
2+15	0.0183	0.11	QV	|	|	|	|
2+20	0.0191	0.11	QV	|	|	|	|
2+25	0.0199	0.11	QV	|	|	|	|

2+30	0.0207	0.11	QV	|	|	|	|
2+35	0.0215	0.11	QV	|	|	|	|
2+40	0.0223	0.11	QV	|	|	|	|
2+45	0.0231	0.12	QV	|	|	|	|
2+50	0.0238	0.12	QV	|	|	|	|
2+55	0.0246	0.12	QV	|	|	|	|
3+ 0	0.0254	0.12	QV	|	|	|	|
3+ 5	0.0263	0.12	QV	|	|	|	|
3+10	0.0271	0.12	QV	|	|	|	|
3+15	0.0279	0.12	QV	|	|	|	|
3+20	0.0287	0.12	QV	|	|	|	|
3+25	0.0295	0.12	QV	|	|	|	|
3+30	0.0303	0.12	QV	|	|	|	|
3+35	0.0311	0.12	QV	|	|	|	|
3+40	0.0320	0.12	QV	|	|	|	|
3+45	0.0328	0.12	QV	|	|	|	|
3+50	0.0336	0.12	Q V	|	|	|	|
3+55	0.0345	0.12	Q V	|	|	|	|
4+ 0	0.0353	0.12	Q V	|	|	|	|
4+ 5	0.0362	0.12	Q V	|	|	|	|
4+10	0.0370	0.12	Q V	|	|	|	|
4+15	0.0379	0.12	Q V	|	|	|	|
4+20	0.0387	0.12	Q V	|	|	|	|
4+25	0.0396	0.12	Q V	|	|	|	|
4+30	0.0404	0.13	Q V	|	|	|	|
4+35	0.0413	0.13	Q V	|	|	|	|
4+40	0.0422	0.13	Q V	|	|	|	|
4+45	0.0431	0.13	Q V	|	|	|	|
4+50	0.0439	0.13	Q V	|	|	|	|
4+55	0.0448	0.13	Q V	|	|	|	|
5+ 0	0.0457	0.13	Q V	|	|	|	|
5+ 5	0.0466	0.13	Q V	|	|	|	|
5+10	0.0475	0.13	Q V	|	|	|	|
5+15	0.0484	0.13	Q V	|	|	|	|
5+20	0.0493	0.13	Q V	|	|	|	|
5+25	0.0502	0.13	Q V	|	|	|	|
5+30	0.0511	0.13	Q V	|	|	|	|
5+35	0.0520	0.13	Q V	|	|	|	|
5+40	0.0530	0.13	Q V	|	|	|	|
5+45	0.0539	0.13	Q V	|	|	|	|
5+50	0.0548	0.14	Q V	|	|	|	|
5+55	0.0558	0.14	Q V	|	|	|	|
6+ 0	0.0567	0.14	Q V	|	|	|	|
6+ 5	0.0577	0.14	Q V	|	|	|	|
6+10	0.0586	0.14	Q V	|	|	|	|
6+15	0.0596	0.14	Q V	|	|	|	|
6+20	0.0605	0.14	Q V	|	|	|	|
6+25	0.0615	0.14	Q V	|	|	|	|
6+30	0.0625	0.14	Q V	|	|	|	|
6+35	0.0634	0.14	Q V	|	|	|	|
6+40	0.0644	0.14	Q V	|	|	|	|
6+45	0.0654	0.14	Q V	|	|	|	|
6+50	0.0664	0.14	Q V	|	|	|	|
6+55	0.0674	0.14	Q V	|	|	|	|
7+ 0	0.0684	0.15	Q V	|	|	|	|
7+ 5	0.0694	0.15	Q V	|	|	|	|
7+10	0.0704	0.15	Q V	|	|	|	|
7+15	0.0714	0.15	Q V	|	|	|	|
7+20	0.0725	0.15	Q V	|	|	|	|
7+25	0.0735	0.15	Q V	|	|	|	|
7+30	0.0745	0.15	Q V	|	|	|	|
7+35	0.0756	0.15	Q V	|	|	|	|
7+40	0.0766	0.15	Q V	|	|	|	|
7+45	0.0777	0.15	Q V	|	|	|	|
7+50	0.0788	0.15	Q V	|	|	|	|
7+55	0.0798	0.16	Q V	|	|	|	|
8+ 0	0.0809	0.16	Q V	|	|	|	|
8+ 5	0.0820	0.16	Q V	|	|	|	|
8+10	0.0831	0.16	Q V	|	|	|	|
8+15	0.0842	0.16	Q V	|	|	|	|
8+20	0.0853	0.16	Q V	|	|	|	|
8+25	0.0864	0.16	Q V	|	|	|	|
8+30	0.0875	0.16	Q V	|	|	|	|

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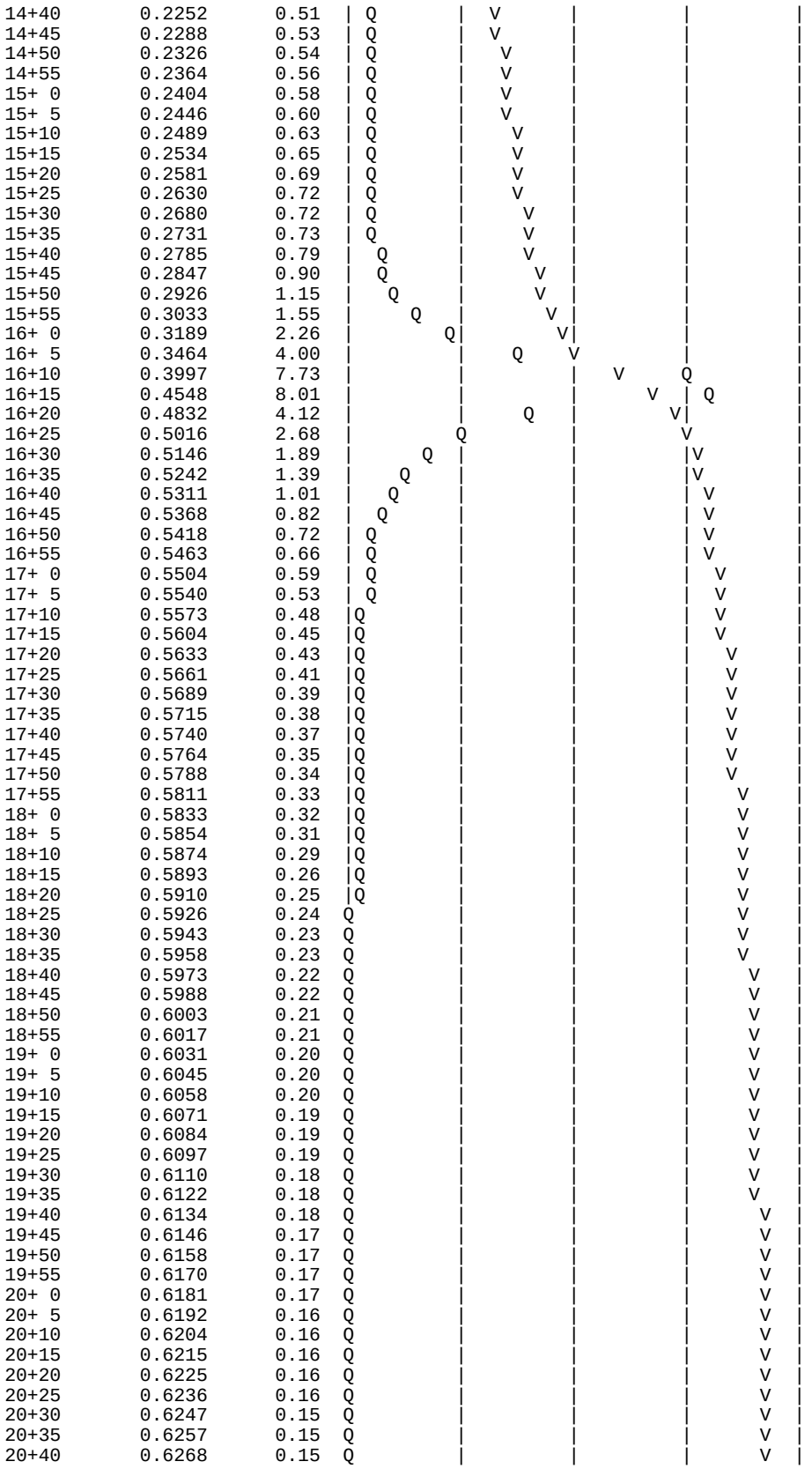
 8+35      0.0886      0.16  Q    V    |         |         |         |
 8+40      0.0898      0.16  Q    V    |         |         |         |
 8+45      0.0909      0.17  Q    V    |         |         |         |
 8+50      0.0921      0.17  Q    V    |         |         |         |
 8+55      0.0932      0.17  Q    V    |         |         |         |
 9+ 0      0.0944      0.17  Q    V    |         |         |         |
 9+ 5      0.0956      0.17  Q    V    |         |         |         |
 9+10      0.0968      0.17  Q    V    |         |         |         |
 9+15      0.0980      0.17  Q    V    |         |         |         |
 9+20      0.0992      0.17  Q    V    |         |         |         |
 9+25      0.1004      0.18  Q     V   |         |         |         |
 9+30      0.1016      0.18  Q     V   |         |         |         |
 9+35      0.1028      0.18  Q     V   |         |         |         |
 9+40      0.1041      0.18  Q     V   |         |         |         |
 9+45      0.1053      0.18  Q     V   |         |         |         |
 9+50      0.1066      0.18  Q     V   |         |         |         |
 9+55      0.1079      0.18  Q     V   |         |         |         |
10+ 0      0.1091      0.19  Q     V   |         |         |         |
10+ 5      0.1104      0.19  Q     V   |         |         |         |
10+10      0.1117      0.19  Q     V   |         |         |         |
10+15      0.1130      0.19  Q     V   |         |         |         |
10+20      0.1144      0.19  Q     V   |         |         |         |
10+25      0.1157      0.19  Q     V   |         |         |         |
10+30      0.1171      0.20  Q      V  |         |         |         |
10+35      0.1184      0.20  Q      V  |         |         |         |
10+40      0.1198      0.20  Q      V  |         |         |         |
10+45      0.1212      0.20  Q      V  |         |         |         |
10+50      0.1226      0.20  Q      V  |         |         |         |
10+55      0.1240      0.21  Q      V  |         |         |         |
11+ 0      0.1254      0.21  Q      V  |         |         |         |
11+ 5      0.1269      0.21  Q      V  |         |         |         |
11+10      0.1283      0.21  Q      V  |         |         |         |
11+15      0.1298      0.21  Q      V  |         |         |         |
11+20      0.1313      0.22  Q      V  |         |         |         |
11+25      0.1328      0.22  Q       V |         |         |         |
11+30      0.1343      0.22  Q       V |         |         |         |
11+35      0.1359      0.22  Q       V |         |         |         |
11+40      0.1374      0.23  Q       V |         |         |         |
11+45      0.1390      0.23  Q       V |         |         |         |
11+50      0.1406      0.23  Q       V |         |         |         |
11+55      0.1422      0.23  Q       V |         |         |         |
12+ 0      0.1438      0.24  Q       V |         |         |         |
12+ 5      0.1455      0.24  Q       V |         |         |         |
12+10      0.1473      0.26  |Q       V |         |         |         |
12+15      0.1493      0.28  |Q        V|         |         |         |
12+20      0.1513      0.29  |Q        V|         |         |         |
12+25      0.1533      0.30  |Q        V|         |         |         |
12+30      0.1555      0.31  |Q        V|         |         |         |
12+35      0.1576      0.31  |Q        V|         |         |         |
12+40      0.1598      0.32  |Q        V|         |         |         |
12+45      0.1620      0.32  |Q        V|         |         |         |
12+50      0.1642      0.33  |Q        V|         |         |         |
12+55      0.1665      0.33  |Q         V         |         |         |
13+ 0      0.1688      0.33  |Q         V         |         |         |
13+ 5      0.1712      0.34  |Q         V         |         |         |
13+10      0.1735      0.34  |Q         V         |         |         |
13+15      0.1759      0.35  |Q         V         |         |         |
13+20      0.1784      0.36  |Q         V         |         |         |
13+25      0.1809      0.36  |Q         V         |         |         |
13+30      0.1834      0.37  |Q          |V        |         |         |
13+35      0.1860      0.37  |Q          |V        |         |         |
13+40      0.1886      0.38  |Q          |V        |         |         |
13+45      0.1912      0.39  |Q          |V        |         |         |
13+50      0.1939      0.39  |Q          |V        |         |         |
13+55      0.1967      0.40  |Q          |V        |         |         |
14+ 0      0.1995      0.41  |Q          | V       |         |         |
14+ 5      0.2024      0.42  |Q          | V       |         |         |
14+10      0.2054      0.43  |Q          | V       |         |         |
14+15      0.2085      0.45  |Q          | V       |         |         |
14+20      0.2116      0.46  |Q          | V       |         |         |
14+25      0.2149      0.47  |Q          | V       |         |         |
14+30      0.2182      0.48  |Q          |  V      |         |         |
14+35      0.2217      0.50  |Q          |  V      |         |         |
```


14+40 0.2252 0.51
14+45 0.2288 0.53
14+50 0.2326 0.54
14+55 0.2364 0.56
15+ 0 0.2404 0.58
15+ 5 0.2446 0.60
15+10 0.2489 0.63
15+15 0.2534 0.65
15+20 0.2581 0.69
15+25 0.2630 0.72
15+30 0.2680 0.72
15+35 0.2731 0.73
15+40 0.2785 0.79
15+45 0.2847 0.90
15+50 0.2926 1.15
15+55 0.3033 1.55
16+ 0 0.3189 2.26
16+ 5 0.3464 4.00
16+10 0.3997 7.73
16+15 0.4548 8.01
16+20 0.4832 4.12
16+25 0.5016 2.68
16+30 0.5146 1.89
16+35 0.5242 1.39
16+40 0.5311 1.01
16+45 0.5368 0.82
16+50 0.5418 0.72
16+55 0.5463 0.66
17+ 0 0.5504 0.59
17+ 5 0.5540 0.53
17+10 0.5573 0.48
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18+ 0 0.5833 0.32
18+ 5 0.5854 0.31
18+10 0.5874 0.29
18+15 0.5893 0.26
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18+40 0.5973 0.22
18+45 0.5988 0.22
18+50 0.6003 0.21
18+55 0.6017 0.21
19+ 0 0.6031 0.20
19+ 5 0.6045 0.20
19+10 0.6058 0.20
19+15 0.6071 0.19
19+20 0.6084 0.19
19+25 0.6097 0.19
19+30 0.6110 0.18
19+35 0.6122 0.18
19+40 0.6134 0.18
19+45 0.6146 0.17
19+50 0.6158 0.17
19+55 0.6170 0.17
20+ 0 0.6181 0.17
20+ 5 0.6192 0.16
20+10 0.6204 0.16
20+15 0.6215 0.16
20+20 0.6225 0.16
20+25 0.6236 0.16
20+30 0.6247 0.15
20+35 0.6257 0.15
20+40 0.6268 0.15

```
  20+45       0.6278      0.15  Q         |         |         |      V  |
  20+50       0.6288      0.15  Q         |         |         |      V  |
  20+55       0.6298      0.15  Q         |         |         |       V |
  21+ 0       0.6308      0.14  Q         |         |         |       V |
  21+ 5       0.6318      0.14  Q         |         |         |       V |
  21+10       0.6327      0.14  Q         |         |         |       V |
  21+15       0.6337      0.14  Q         |         |         |       V |
  21+20       0.6346      0.14  Q         |         |         |       V |
  21+25       0.6356      0.14  Q         |         |         |       V |
  21+30       0.6365      0.13  Q         |         |         |       V |
  21+35       0.6374      0.13  Q         |         |         |       V |
  21+40       0.6383      0.13  Q         |         |         |       V |
  21+45       0.6392      0.13  Q         |         |         |       V |
  21+50       0.6401      0.13  Q         |         |         |       V |
  21+55       0.6410      0.13  Q         |         |         |       V |
  22+ 0       0.6419      0.13  Q         |         |         |       V |
  22+ 5       0.6428      0.13  Q         |         |         |       V |
  22+10       0.6436      0.13  Q         |         |         |       V |
  22+15       0.6445      0.12  Q         |         |         |       V |
  22+20       0.6453      0.12  Q         |         |         |       V |
  22+25       0.6462      0.12  Q         |         |         |        V|
  22+30       0.6470      0.12  Q         |         |         |        V|
  22+35       0.6478      0.12  Q         |         |         |        V|
  22+40       0.6486      0.12  Q         |         |         |        V|
  22+45       0.6495      0.12  Q         |         |         |        V|
  22+50       0.6503      0.12  Q         |         |         |        V|
  22+55       0.6511      0.12  Q         |         |         |        V|
  23+ 0       0.6519      0.12  Q         |         |         |        V|
  23+ 5       0.6526      0.11  Q         |         |         |        V|
  23+10       0.6534      0.11  Q         |         |         |        V|
  23+15       0.6542      0.11  Q         |         |         |        V|
  23+20       0.6550      0.11  Q         |         |         |        V|
  23+25       0.6557      0.11  Q         |         |         |        V|
  23+30       0.6565      0.11  Q         |         |         |        V|
  23+35       0.6572      0.11  Q         |         |         |        V|
  23+40       0.6580      0.11  Q         |         |         |        V|
  23+45       0.6587      0.11  Q         |         |         |        V|
  23+50       0.6595      0.11  Q         |         |         |        V|
  23+55       0.6602      0.11  Q         |         |         |        V|
  24+ 0       0.6609      0.11  Q         |         |         |        V|
  24+ 5       0.6616      0.10  Q         |         |         |        V|
  24+10       0.6621      0.07  Q         |         |         |        V|
  24+15       0.6623      0.03  Q         |         |         |        V|
  24+20       0.6624      0.02  Q         |         |         |        V|
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  24+30       0.6626      0.01  Q         |         |         |        V|
  24+35       0.6626      0.00  Q         |         |         |        V|
  24+40       0.6626      0.00  Q         |         |         |        V|
  24+45       0.6626      0.00  Q         |         |         |        V|
  24+50       0.6626      0.00  Q         |         |         |        V|
  24+55       0.6626      0.00  Q         |         |         |        V|
  25+ 0       0.6626      0.00  Q         |         |         |        V|
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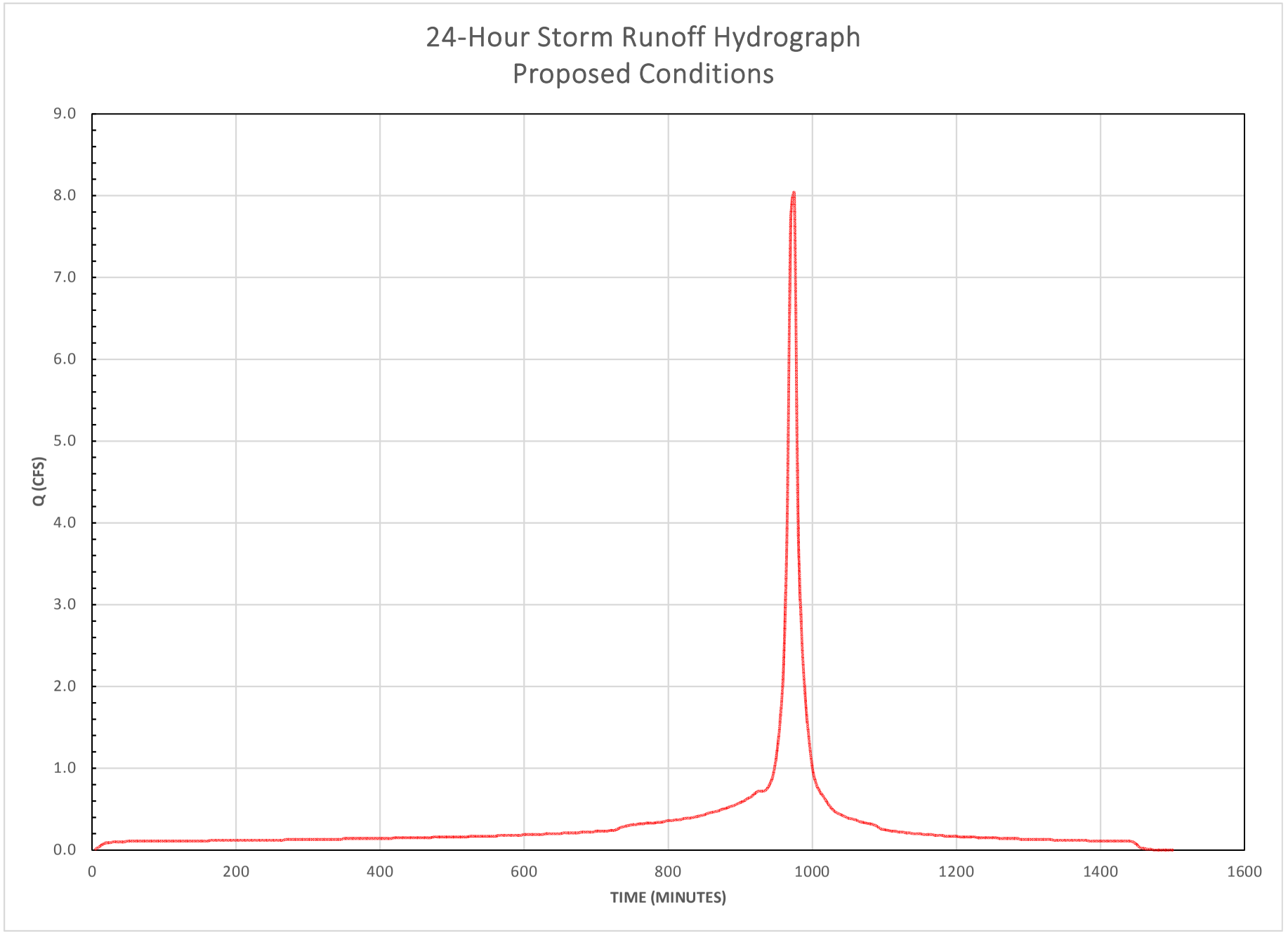
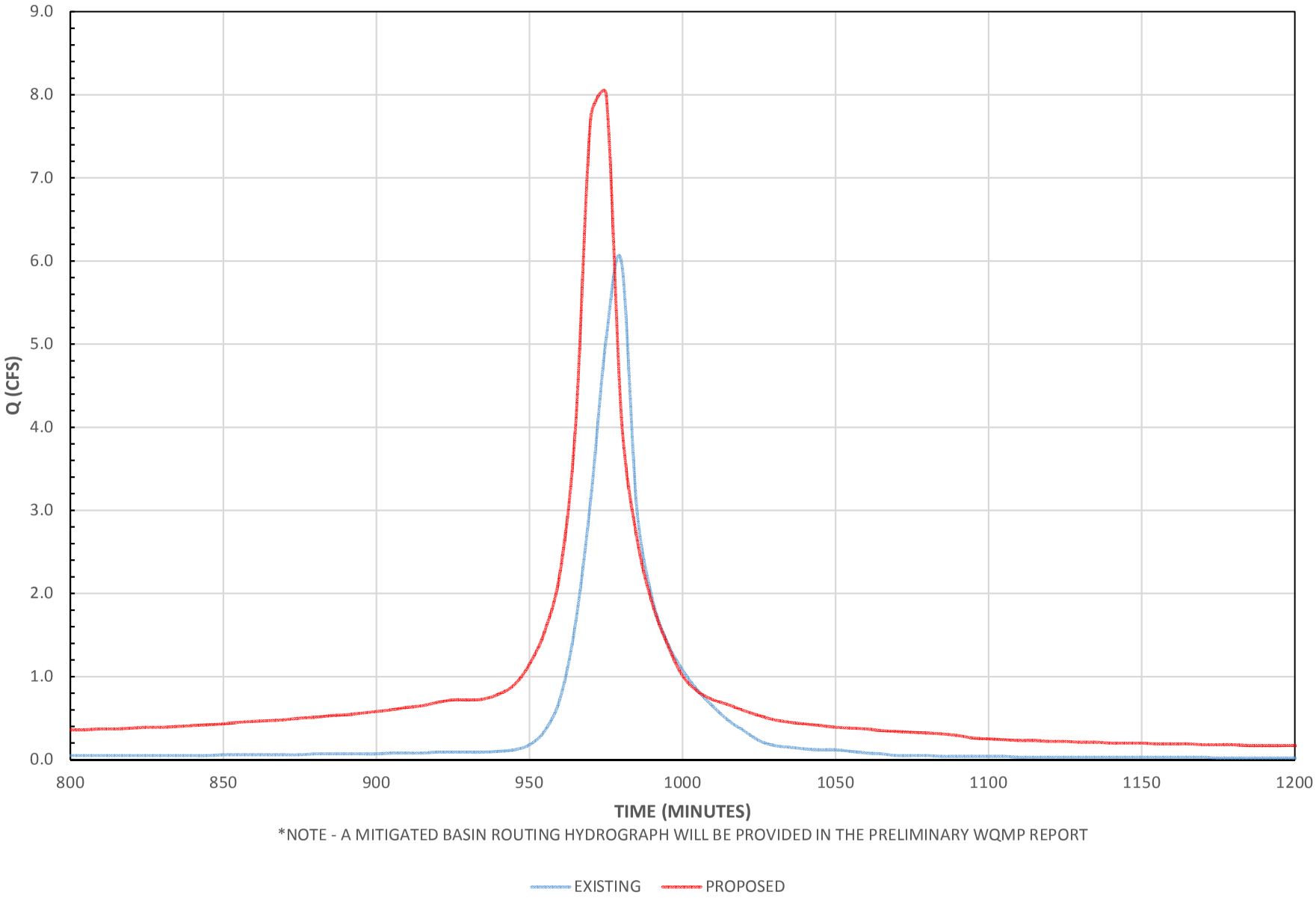

24-Hour Storm Runoff Hydrograph
Proposed Conditions
Q (CFS)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
200
400
600
800
1000
1200
1400
1600
TIME (MINUTES)

24-Hour Storm Runoff Hydrograph



*NOTE - A MITIGATED BASIN ROUTING HYDROGRAPH WILL BE PROVIDED IN THE PRELIMINARY WQMP REPORT

APPENDIX B

NOTICE OF TRANSFER OF RESPONSIBILITY

NOTICE OF TRANSFER OF RESPONSIBILITY

WATER QUALITY MANAGEMENT PLAN

CIELO VISTA
TENTATIVE TRACT 17341
APN: 351-031-05 AND 351-031-17

Submission of this Notice Of Transfer of Responsibility constitutes notice to the County of Orange/City of Yorba Linda that responsibility for the Water Quality Management Plan ("WQMP") for the subject property identified below, and implementation of that plan, is being transferred from the Previous Owner (and his/her agent) of the site (or a portion thereof) to the New Owner, as further described below.

I. Previous Owner/ Previous Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

II. Information about Site Transferred

Name of Project (if applicable):	
Title of WQMP Applicable to site:	
Street Address of Site (if applicable):	
Planning Area (PA) and/ or Tract Number(s) for Site:	Lot Numbers (if Site is a portion of a tract):
Date WQMP Prepared (and revised if applicable):	

III. New Owner/ New Responsible Party Information

Company/ Individual Name:		Contact Person:	
Street Address:		Title:	
City:	State:	ZIP:	Phone:

IV. Ownership Transfer Information

General Description of Site Transferred to New Owner:	General Description of Portion of Project/ Parcel Subject to WQMP Retained by Owner (if any):
Lot/ Tract Numbers of Site Transferred to New Owner:	
Remaining Lot/ Tract Numbers Subject to WQMP Still Held by Owner (if any):	
Date of Ownership Transfer:	

Note: When the Previous Owner is transferring a Site that is a portion of a larger project/ parcel addressed by the WQMP, as opposed to the entire project/parcel addressed by the WQMP, the General Description of the Site transferred and the remainder of the project/ parcel no transferred shall be set forth as maps attached to this notice. These maps shall show those portions of a project/ parcel addressed by the WQMP that are transferred to the New Owner (the Transferred Site), those portions retained by the Previous Owner, and those portions previously transferred by Previous Owner. Those portions retained by Previous Owner shall be labeled as "Previously Transferred".

V. Purpose of Notice of Transfer

The purposes of this Notice of Transfer of Responsibility are: 1) to track transfer of responsibility for implementation and amendment of the WQMP when property to which the WQMP is transferred from the Previous Owner to the New Owner, and 2) to facilitate notification to a transferee of property subject to a WQMP that such New Order is now the Responsible Party of record for the WQMP for those portions of the site that it owns.

VI. Certifications

A. Previous Owner

I certify under penalty of law that I am no longer the owner of the Transferred Site as described in Section II above. I have provided the New Owner with a copy of the WQMP applicable to the Transferred Site that the New Owner is acquiring from the Previous Owner.

Printed Name of Previous Owner Representative:	Title:
Signature of Previous Owner Representative:	Date:

B. New Owner

I certify under penalty of law that I am the owner of the Transferred Site, as described in Section II above, that I have been provided a copy of the WQMP, and that I have informed myself and understand the New Owner's responsibilities related to the WQMP, its implementation, and Best Management Practices associated with it. I understand that by signing this notice, the New Owner is accepting all ongoing responsibilities for implementation and amendment of the WQMP for the Transferred Site, which the New Owner has acquired from the Previous Owner.

Printed Name of New Owner Representative:	Title:

Signature:	Date:

APPENDIX C

EDUCATIONAL MATERIALS
(RESERVED FOR PRELIMINARY/FINAL WQMP)

APPENDIX D

BMP MAINTENANCE SUPPLEMENT / O&M PLAN

Infiltration Facility Operations and Maintenance

General Requirements

Infiltration facility maintenance should include frequent inspections to ensure that water infiltrates into the subsurface completely within the recommended infiltration time of 72 hours or less after a storm (see Appendix E for guidance on facility inspection and Appendix F for an infiltration inspection and maintenance checklist).

Maintenance and regular inspections are of primary importance if infiltration basins and trenches are to continue to function as originally designed. A specific maintenance plan shall be developed specific to each facility outlining the schedule and scope of maintenance operations, as well as the documentation and reporting requirements. The following are general maintenance requirements:

1. Regular inspection should determine if the sediment pretreatment structures require routine maintenance.

2. If water is noticed in the basin more than 72 hours after a major storm or in the observation well of the infiltration trench more than 48 hours after a major storm, the infiltration facility may be clogged. Maintenance activities triggered by a potentially clogged facility include:

    - Check for debris/sediment accumulation, rake surface and remove sediment (if any) and evaluate potential sources of sediment and vegetative or other debris (e.g., embankment erosion, channel scour, overhanging trees, etc). If suspected upland sources are outside of the County's jurisdiction, additional pretreatment operations (e.g., trash racks, vegetated swales, etc.) may be necessary.

    - For basins, removal of the top layer of native soil may be required to restore infiltrative capacity.

    - For trenches, assess the condition of the top aggregate layer for sediment buildup and crusting. Remove top layer of pea gravel and replace. If slow draining conditions persist, entire trench may need to be excavated and replaced.

3. Any debris or algae growth located on top of the infiltration facility should be removed and disposed of properly.

4. Facilities should be inspected annually. Trash and debris should be removed as needed, but at least annually prior to the beginning of the wet season.

5. Site vegetation should be maintained as frequently as necessary to maintain the aesthetic appearance of the site, and as follows:

    - Vegetation, large shrubs, or trees that limit access or interfere with basin operation should be pruned or removed.

- Slope areas that have become bare should be revegetated and eroded areas should be regraded prior to being revegetated.
- Grass should be mowed to 4"-9" high and grass clippings should be removed.
- Fallen leaves and debris from deciduous plant foliage should be raked and removed.
- Invasive vegetation, such as Alligatorweed (*Alternanthera philoxeroides*), Halogeton (*Halogeton glomeratus*), Spotted Knapweed (*Centaurea maculosa*), Giant Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Perennial Pepperweed (*Lepidium latifolium*), and Yellow Starthistle (*Centaurea solstitalis*) must be removed and replaced with non-invasive species. Invasive species should never contribute more than 25% of the vegetated area. For more information on invasive weeds, including biology and control of listed weeds, look at the "encycloweedia" located at the California Department of Food and Agriculture website at http://www.cdfa.ca.gov/wma or the California Invasive Plant Council website at http://portal.cal-ipc.org/weedlist. .
- Dead vegetation should be removed if it exceeds 10% of area coverage. Vegetation should be replaced immediately to maintain cover density and control erosion where soils are exposed.

6. For infiltration basins, sediment buildup exceeding 50% of the forebay sediment storage capacity, as indicated by the steel markers, should be removed. Sediment from the remainder of the basin should be removed when 6 inches of sediment accumulates. Sediments should be tested for toxic substance accumulation in compliance with current disposal requirements if visual or olfactory indications of pollution are noticed. If toxic substances are encountered at concentrations exceeding thresholds of Title 22, Section 66261 of the California Code of Regulations, the sediment must be disposed of in a hazardous waste landfill and the source of the contaminated sediments should be investigated and mitigated to the extent possible.

7. Following sediment removal activities, replanting and/or reseeding of vegetation may be required for reestablishment.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for infiltration facilities is shown in Table 6-1. Detailed routine and major maintenance standards are listed in Tables 6-2 and 6-3.

Table 6-1: Infiltration Facility Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Remove trash and debris as required • Repair and reseed erosion near inlet if necessary • Remove any visual evidence of contamination from floatables such as oil and grease • Clean under-drain (if present) and outlet piping to alleviate ponding and restore infiltrative capacity. • Remove minor sediment accumulation, debris and obstructions near inlet and outlet structures as needed • Mow routinely to maintain ideal grass height and to suppress weeds • Periodically observe function under wet weather conditions • Take photographs before and after maintenance (encouraged)
Major Maintenance	• Clean out under-drains if present to alleviate ponding. Replace media if ponding or loss of infiltrative capacity persists and revegetate • Repair structural damage to flow control structures including inlet, outlet and overflow structures • De-thatch grass to remove accumulated sediment and aerate compacted areas to promote infiltration

Table 6-2: Routine Maintenance – Infiltration Facilities

Defect	**Conditions When Maintenance Is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Trash & Debris	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (one standard garbage can). In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.	Annually prior to wet season. After major storm events (>0.75 in/24 hrs) if spot checks indicate widespread damage/ maintenance needs. Litter removal is dependent on site conditions and desired aesthetics and should be done at a frequency to meet those objectives.
Inlet Erosion	Visible evidence of erosion occurring near inlet structures.	Eroded areas repaired/reseeded	
Visual Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present.	
Slow Drain Time	Standing water long after storm has passed (after 48 to 72 hours), or visual inspection of wells (if available) indicates that design drain times are not being achieved.	Water drains within 48 to 72 hours. Drainage pipe is cleared, accumulated litter on surface is removed, and top 1-2" of soil is raked or replaced.	
Inlets Blocked	Trash and debris or sediment blocking inlet structures.	Inlets clear and free of trash and debris.	
Appearance of Poisonous, Noxious or Nuisance Vegetation	Excessive grass and weed growth. Noxious weeds, woody vegetation establishing, Turf growing over rock filter.	Vegetation is mowed or trimmed to restore function. Weeds are removed to prevent noxious and nuisance plants from becoming established.	Monthly (or as dictated by agreement between County and landscape contractor).

Table 6-3: Major Maintenance – Infiltration Facilities

Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Frequency
Standing Water	Standing water long after storm has passed (after 24 to 48 hours), or visual inspection of wells (if available) indicates that design drain times are not being achieved	Design infiltration rate restored, either through excavation and filter media replacement or surface sediment removal. If applicable, underdrain cleaned, reset or replaced.	As needed

Bioretention Operations and Maintenance

General Requirements

Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant removal capabilities. In general, bioretention maintenance requirements are typical landscape care procedures and include:

1. Watering: Plants should be selected to be drought tolerant and not require watering after establishment (2 to 3 years). Watering may be required during prolonged dry periods after plants are established.

2. Erosion control: Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred (see Appendix E for guidance on facility inspection and Appendix F for a bioretention inspection and maintenance checklist). Properly designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems occur the following should be reassessed: (1) flow velocities and gradients within the cell, and (2) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance. If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits.

3. Plant material: Depending on aesthetic requirements, occasional pruning and removing of dead plant material may be necessary. Replace all dead plants and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species. Periodic weeding is necessary until plants are established. The weeding schedule should become less frequent if the appropriate plant species and planting density have been used and, as a result, undesirable plants excluded.

4. Nutrient and pesticides: The soil mix and plants are selected for optimum fertility, plant establishment, and growth. Nutrient and pesticide inputs should not be required and may degrade the pollutant processing capability of the bioretention area, as well as contribute pollutant loads to receiving waters. By design, bioretention facilities are located in areas where phosphorous and nitrogen levels are often elevated and these should not be limiting nutrients. If in question, have soil analyzed for fertility.

5. Mulch: Replace mulch annually in bioretention facilities where heavy metal deposition is likely (e.g., contributing areas that include industrial and auto dealer/repair parking lots and roads). In residential lots or other areas where metal deposition is not a concern, replace or add mulch as needed to maintain a 2 to 3 inch depth at least once every two years.

6. Soil: Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems. Replacing mulch in bioretention facilities where heavy metal

deposition is likely provides an additional level of protection for prolonged performance. If in question, have soil analyzed for fertility and pollutant levels.

Maintenance Standards

A summary of the routine and major maintenance activities recommended for bioretention areas is shown in Table 5-1. Detailed Routine and major maintenance standards are listed in Tables 5-2 and 5-3.

Table 5-1: Bioretention Routine and Major Maintenance Quick Guide

Inspection and Maintenance Activities Summary	
Routine Maintenance	• Repair small eroded areas and ruts by filling with gravel. Overseed bare areas to reestablish vegetation • Remove trash and debris and rake surface soils to mitigate ponding • Remove accumulated fine sediments, dead leaves and trash to restore surface permeability • Remove any evidence of visual contamination from floatables such as oil and grease • Eradicate weeds and prune back excess plant growth that interferes with facility operation. Remove invasive vegetation and replace with non-invasive species • Remove sediment and debris accumulation near inlet and outlet structures to alleviate clogging • Clean and reset flow spreaders (if present) as needed to restore original function • Mow routinely to maintain ideal grass height and to suppress weeds • Periodically observe function under wet weather conditions
Major Maintenance	• Repair structural damage to flow control structures including inlet, outlet and overflow structures • Clean out under-drain, if present, to alleviate ponding. Replace media if ponding or loss of infiltrative capacity persists and revegetate • Regrade and revegetate to repair damage from severe erosion/scour channelization and to restore sheet flow • Take photographs before and after major maintenance (encouraged)

Table 5-2: Routine Maintenance – Bioretention

Defect or Problem	**Condition When Maintenance is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Erosion	Splash pads or spreader incorrectly placed; eroded or scoured areas due to flow channelization, or higher flows.	No erosion on surface of basin. No erosion or scouring evident. For ruts or bare areas less than 12 inches wide, damaged areas repaired by filling with crushed gravel. The grass will creep in over the rock in time.	Annually prior to wet season. After major storm events (>0.75 in/24 hrs) if spot checks of some basins indicate widespread damage/ maintenance needs
Standing Water	When water stands in the basin between storms and does not drain freely (with 36- 48 hours after storm event).	Water drains completely from basin as designed and surface is clear of trash and debris. Underdrains (if installed) are cleared.	
Loss of Surface Permeability	Accumulation of fine sediments, dead leaves, trash and other debris on surface	Surface permeability restored. Surface layer removed and replaced with fresh mulch.	
Visual Contaminants and Pollution	Any visual evidence of oil, gasoline, contaminants or other pollutants.	No visual contaminants or pollutants present.	Monthly (or as dictated by agreement between County and landscape contractor
Vegetation	Weeds, excessive plant growth, plants interfering with basin operation, plants diseased or dying	Basin tidy, plants healthy and pruned. Any plants that interfere with function are removed. Invasive or non-acclimated plants replaced.	
Inlet/Overflow	Inlet/outlet areas clogged with sediment and/or debris.	Material removed so that there is no clogging or blockage of the inlet or overflow area.	
Trash and Debris	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (one standard garbage can).	Trash and debris removed and facility looks well kept.	

Table 5-3: Major Maintenance – Bioretention

Defect or Problem	**Condition When Maintenance is Needed**	**Results Expected When Maintenance Is Performed**	**Frequency**
Standing water	When water stands in the basin between storms and does not drain freely (with 36- 48 hours after storm event).	Filter media (sand, gravel, and topsoil) and vegetation removed and replaced.	Annually prior to wet season
Erosion/ Scouring	Bare spots greater than 12 inches	No erosion on surface of basin. Large bare areas are regraded and reseeded/replanted.	As needed

APPENDIX E

CONDITIONS OF APPROVAL
(RESERVED FOR FINAL WQMP)

APPENDIX F

INFILTRATION TEST RESULTS
(RESERVED FOR PRELIMINARY/FINAL WQMP)