CEQA DRAINAGE STUDY REPORT
FOR
TEN UNIT RESIDENTIAL SUBDIVISION (PDS2022-TM-5648)

at

1434 Montiel Road
Escondido, California

Prepared for:

Shub Estates LLC
10225 Barnes Canyon Road
San Diego, CA 92121
Tel.: (619) 297-8066

March 10, 2026
ABI Project No.: 22056

Prepared by:

ABI ENGINEERING CONSULTANTS, INC.
1701 E. Edinger Ave., Suite A9
Santa Ana, California 92705
Tel.: (888) 220-5596
Fax: (714) 866-417

TABLE OF CONTENTS

ATTACHMENT F

100-Year Storm Inflow and Outflow Hydrographs

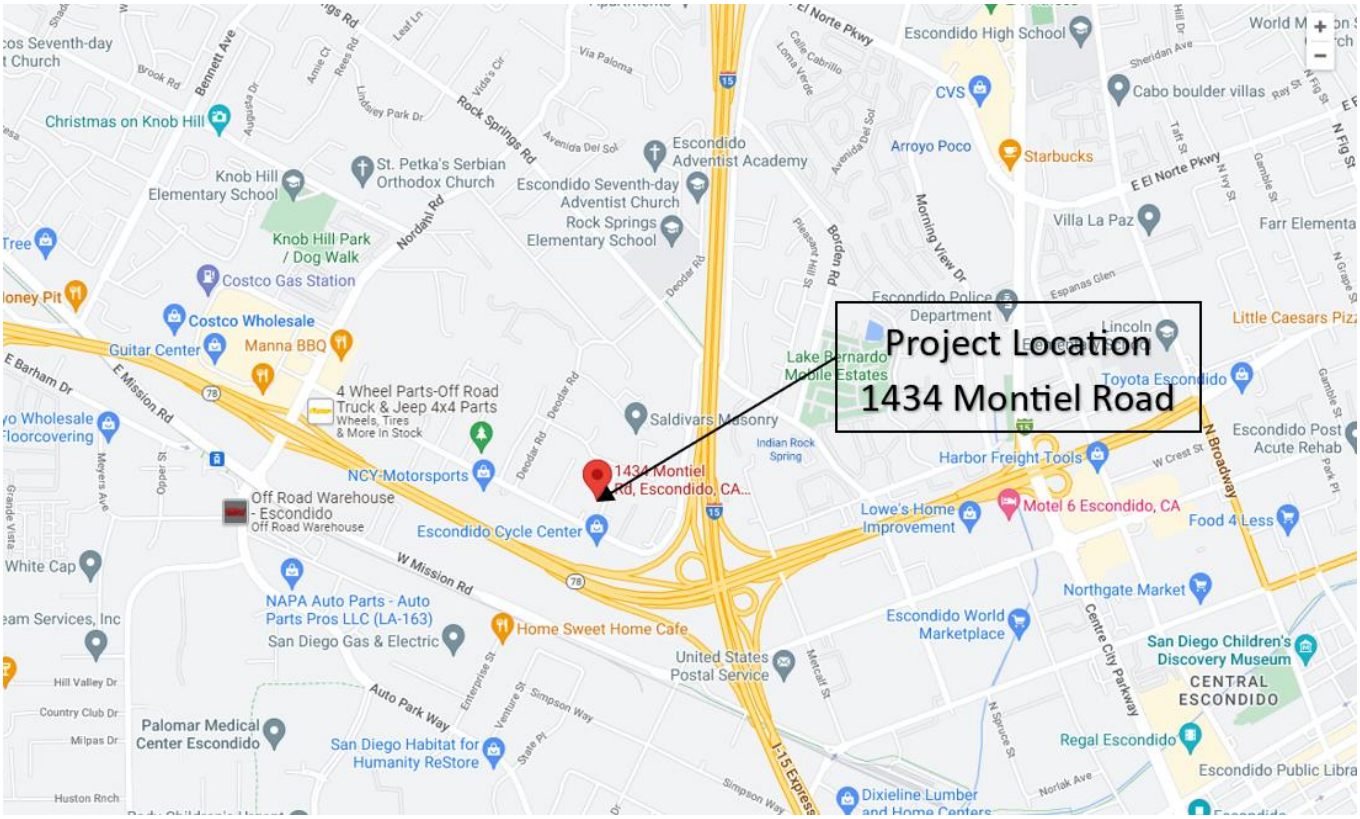
ATTACHMENT G

Hydrologic Soil Group Map
Rainfall Isopluvials for 100 years Rainfall Event – 6 hours and 24 hours map
Intensity-Duration Design Chart-Figure 3-1
Runoff Coefficients for urban areas-Table 3-1
Maximum Overland Flow length and Initial Time of Concentration Table 3-2
Rational Formula for Overland Time of Flow Nomograph Figure 3-3
Nomograph for Determination of Time of Concentration or Travel time for Natural Watersheds Figure 3-4
Computation of Effective Slope for Natural Watersheds Figure 3-5

1. PROJECT DESCRIPTION

The project is a new residential subdivision on 1.98-acre parcel located west of Via Teramo, approximately 250 feet north of Montiel Road in the County of San Diego. The project proposes subdivide the vacant parcel into ten (10) residential lots ranging in size from 6,360 to 8,899 square feet. Improvements include residential pads, Lot A (Private Road), internal private driveways, and public frontage work. Lot B (the Via Teramo frontage strip) will remain undisturbed. Additionally, the existing swale or flowline outside the western property boundary and the drainage ditch outside the northern boundary will be preserved and remain undisturbed. Total area of disturbance is approximately 1.92 acres. The site vicinity map is Figure 1. The existing condition and proposed subdivision map are in Attachment A

Figure 1 Vicinity Map



1.1 DECLARATION OF RESPONSIBLE DISCHARGE

DECLARATION OF RESPONSIBLE CHARGE:

I HEREBY DECLARE THAT I AM THE ENGINEER OF WORK FOR THIS PROJECT THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICIATIONS BY THE COUNTY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR PROJECT DESGIN.

ENGINEER OF WORK:
ABI ENGINEERING CONSULTANTS, INC
1701 EAST EDINGER AVENUE, SUITE A9
SANTA ANTA, CALIFORNIA 92705
TEL: (888) 220-5596 FAX: (714) 866-4171

DAYANAND BETTADAPURA, R.C.E 46505
REGISTRATION EXPIRES JUNE 30, 2027

03/04/2026
DATE

1.2 DRAINAGE PATTERNS

1.2.1 EXISTING DRAINAGE PATTERNS

The 1.98-acre project site is vacant and consists of native vegetation, including trees and shrubs. The site topography is characterized by a consistent 22-foot elevation relief, sloping from a high point of EL. 698 at the northeast corner to a low point of EL. 676 at the southwest corner. All stormwater generated within the property boundaries flows from the northeast toward the southwest, following this natural grade.

A concrete drainage ditch exists to the northeast of the property outside the boundary of this property. The drainage ditch conveys off-site runoff westward. The existing grades or an earthen swale located outside the western property boundary on the adjacent lots, directs offsite surface water runoff toward the regional low point at the southwest corner of the property area.

The small sliver of the parcel located at the southeast corner drains from north to south toward Montiel Road. This runoff is collected and directed south into the existing County-maintained storm drain system. These flows eventually discharge into Escondido Creek and terminate at the San Elijo Lagoon. The existing drainage patterns have been mapped (Attachment A) to ensure the design maintains the historic natural flow of the site and protects adjacent properties and downstream systems.

1.2.2 PROPOSED DRAINAGE PATTERNS

The project consists of a ten-unit residential subdivision of the existing 1.98-acre lot. The site has been subdivided into ten (10) residential lots 1 through 10, and includes Lot A, which is the internal private road for site access, and Lot B, which the strip of land extending along Via Teramo to its intersection with Montiel Road. The development includes site grading for building pads, construction of internal private driveways, utility installation, and structural stormwater BMPs.

Proposed drainage patterns follow the existing site topography, conveying on-site runoff from the northeast toward the southwest. Runoff from the residential pads, Lot A (Private Road), and other impervious surfaces are collected via drainage swales and a private storm drain system. These flows are directed toward biofiltration planter box (BMP #1) located at the southwestern low point of the site. BMP #1 has been sized for a Design Capture Volume to provide both water quality

treatment and hydromodification management. In the event of a peak storm overflow, runoff is piped to the existing drainage low point at the southwest corner of the property. This design ensures that post-development peak flow rates do not exceed pre-development levels. See Attachment A for existing condition and proposed development exhibits.

2. HYDROLOGY

2.1 HYDROLOGY DESCRIPTION

The *San Diego County Hydrology Manual* requires that the Rational Method beused for hydrologic analysis of a watershed up to but not exceeding 1.0 square-mile (640 acres). The Rational Method was used for this study because it satisfies the San Diego County design criteria.

The hydrology and hydraulic analyses for this project have been prepared using peak flow rates from the 100-year storm event.

The hydrologic analysis is performed to assess the impact of the proposed development on existing drainage patterns and to quantify any increase in runoff requiring mitigation.

The total project area is 1.98 acres. For this drainage analysis, a study area of 1.92 acres is evaluated. The existing site topography is analyzed using three basins (Basins A, B & C). Basins A and B encompass the 1.92-acre area where internal runoff flows to the low point at the southwest of the property. Basin C consists of the 0.06-acre area that will remain untouched in its existing, undisturbed condition.

For proposed improvements, the study area is analyzed using five basins (Basins A through E). Basins A through D encompass the 1.92 acre developed area, where all internal runoff is directed to the proposed biofiltration planter boxes for water quality and hydromodification mitigation. Basin E consists of the 0.06-acre untouched area, resulting in a total proposed study area of 1.92 acres. See Attachment 'A' for the drainage maps

2.1.1 Rational Method

The Rational Method formula was used to estimate the peak rate of runoff as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (Tc), which is the time required for water to flow from the most remote point of the basin to the location being analyzed.

$$Q = C * I * A$$

Where:

- Q = peak discharge (cfs)
- C = Runoff coefficient
- I = Average rainfall intensity (in/hr)
- A = drainage area (acres)

The hydrologic conditions were analyzed in accordance with the San Diego County design criteria as follows (See attachment B and C for pre and post development calculations):

Summary Table for Existing Condition -100-year storm event (without Q_{100} mitigation)

Table 1. Summary table for existing condition (without mitigation)

EXISTING CONDITION					
Basin	**Area (Acr)**	**C**	**Tc (min)**	**I (in/hr)**	**CFS-100 Yr**
A	1.87	0.25	8.7	6.08	2.844
B	0.05	0.25	8.7	6.08	0.076

Summary Table for Proposed Condition-100-year storm event (withoutQ_{100} mitigation)

Table 2. Summary table for proposed condition (without mitigation)

PROPOSED CONDITION					
Basin	**Area (Acr)**	**C**	**Tc (min)**	**I (in/hr)**	**CFS-100 Yr**
A	0.15	0.51	8.40	6.22	0.476
B	0.70	0.51	8.75	6.061	2.151
C	0.37	0.51	8.98	5.959	1.081
D	0.70	0.51	9.33	5.815	1.986

Runoff coefficients (C) are derived from Table 3-1 of the San Diego County Hydrology Manual. For the proposed condition, a C-value of 0.51 is utilized, corresponding to Medium Density Residential (7.3 DU/A or Less), which reflects the 10-lot subdivision layout and anticipated impervious surface coverage.

While the unmitigated proposed peak flow for the total site (5.694 CFS) represents an increase over the existing condition (2.920 CFS), the project implements a biofiltration planter box (BMP #1) for flow attenuation and water quality treatment. The planter boxes capture the 100-year peak flow and release it at a controlled rate of 2.445 CFS (see attachment D). Since this discharge is lower than the

site's original natural runoff of 2.920 CFS, the project effectively reduces peak flows. This ensures downstream areas are protected and meets all County requirements for hydromodification management.

Treated runoff and 100-year overflow are directed to riprap energy dissipator located at the southwest corner of the property. At this point, flows are discharged at the existing natural low-point location to maintain historical drainage patterns and prevent erosion. Detailed calculations for the Design Capture Volume (DCV) and the Stage-Storage-Discharge relationships are provided in the SWQMP and Mitigation sections of this report. See attachment E.

The total volume under the resulting hydrograph is equal to the following equation:

$$VOL = CP_6A$$

Where:

- VOL = Total runoff volume (acre-inches)
- C = Runoff coefficient (0.51 for Medium Density Residential)
- P_6 = 6-hour precipitation depth (3.30 inches)
- A = Drainage area (1.92 acres)

Considering the data input for this project we can establish that the Volume for the 6-hr storm event will be as follows:

$$VOL = 0.51(3.3\text{ in})1.92\text{ ac} = 3.23\text{ ac-in (11, 723 cubic feet)}$$

2.1.2 Rainfall Distribution

We are showing a 6-hour rainfall distribution consisting of blocks of rain over increments of time equal to T_C. The number of blocks is determined by rounding T_C to the nearest whole number of minutes, dividing 360 minutes (6 hours) by T_C, and rounding again to the nearest whole number. The blocks are distributed using a (2/3, 1/3) distribution in which the peak rainfall block is placed at the 4-hour time within the 6-hour rainfall duration. The additional blocks are distributed in a sequence alternating two blocks to the left and one block to the right of the 4-hour time.

Number of Rainfall blocks:

The total storm duration is 6 hours or 360 minutes. Divide it by T_C = 9.33 min.:

$$\text{Number of Blocks} = \frac{360}{9.33} = 38.58$$

There are 39 blocks of rainfall for this storm.

Place the Peak Rainfall Block:

Using the (2/3, 1/3 distribution):

- The peak rainfall block is centered at 4 hours (240 minutes).

Distribute the Remaining Rainfall Blocks:

Following the procedure:

- Place two blocks to the left of the peak (at 240 - 9.33 and 240 - 18.66 minutes).
- Place one block to the right of the peak (240 + 9.33 minutes).
- Alternate in this sequence until all 39 blocks are distributed.

Table 3. Rainfall Blocks Distribution

Block N	Time (T=N*Tc, minutes)	Total Rainfall (PT, inches)	Incremental Rainfall (Pn, inches)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	*240*	*0.81*	*0.81*	*5.21*	*5.10*
2	230.67	1.02	0.21	1.35	1.31
3	221.34	1.18	0.16	1.03	1
4	249.33	1.31	0.13	0.84	0.81
5	212.01	1.41	0.1	0.64	0.62
6	202.68	1.5	0.09	0.58	0.56
7	258.66	1.58	0.08	0.51	0.5
8	193.35	1.65	0.07	0.45	0.44
9	184.02	1.72	0.07	0.45	0.44
10	267.99	1.78	0.06	0.39	0.37
11	174.69	1.84	0.06	0.39	0.37
12	165.36	1.9	0.06	0.39	0.37
13	277.32	1.95	0.05	0.32	0.31
14	156.03	2	0.05	0.32	0.31
15	146.7	2.05	0.05	0.32	0.31
16	286.65	2.1	0.05	0.32	0.31
17	137.37	2.14	0.04	0.26	0.25
18	128.04	2.18	0.04	0.26	0.25

Block N	Time (T=N*Tc, minutes)	Total Rainfall (PT, inches)	Incremental Rainfall (Pn, inches)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
19	295.98	2.22	0.04	0.26	0.25
20	118.71	2.26	0.04	0.26	0.25
21	109.38	2.3	0.04	0.26	0.25
22	305.31	2.34	0.04	0.26	0.25
23	100.05	2.38	0.04	0.26	0.25
24	90.72	2.42	0.04	0.26	0.25
25	314.64	2.45	0.03	0.19	0.19
26	81.39	2.48	0.03	0.19	0.19
27	72.06	2.51	0.03	0.19	0.19
28	323.97	2.54	0.03	0.19	0.19
29	62.73	2.57	0.03	0.19	0.19
30	53.4	2.6	0.03	0.19	0.19
31	333.3	2.63	0.03	0.19	0.19
32	44.07	2.66	0.03	0.19	0.19
33	34.74	2.69	0.03	0.19	0.19
34	342.63	2.72	0.03	0.19	0.19
35	25.41	2.75	0.03	0.19	0.19
36	16.08	2.78	0.03	0.19	0.19
37	351.96	2.81	0.03	0.19	0.19
38	6.75	2.84	0.03	0.19	0.19
39	360	3.3	0.460*	0.06	0.06

*Note: The final block is adjusted to ensure the Total Rainfall matches the P6 depth of 3.30 inches per San Diego County Hydrology Manual standards.

2.1.3 Incremental Hydrographs

The peak flow amount from each block of rain is determined by the RM formula, Q = CIA, where I equals I_N (the actual rainfall intensity for the rainfall block). I_N is determined by dividing P_N by the actual time base of the block, T_C. The following equation shows this relationship:

$$I_N = \frac{60.PN}{TC}$$

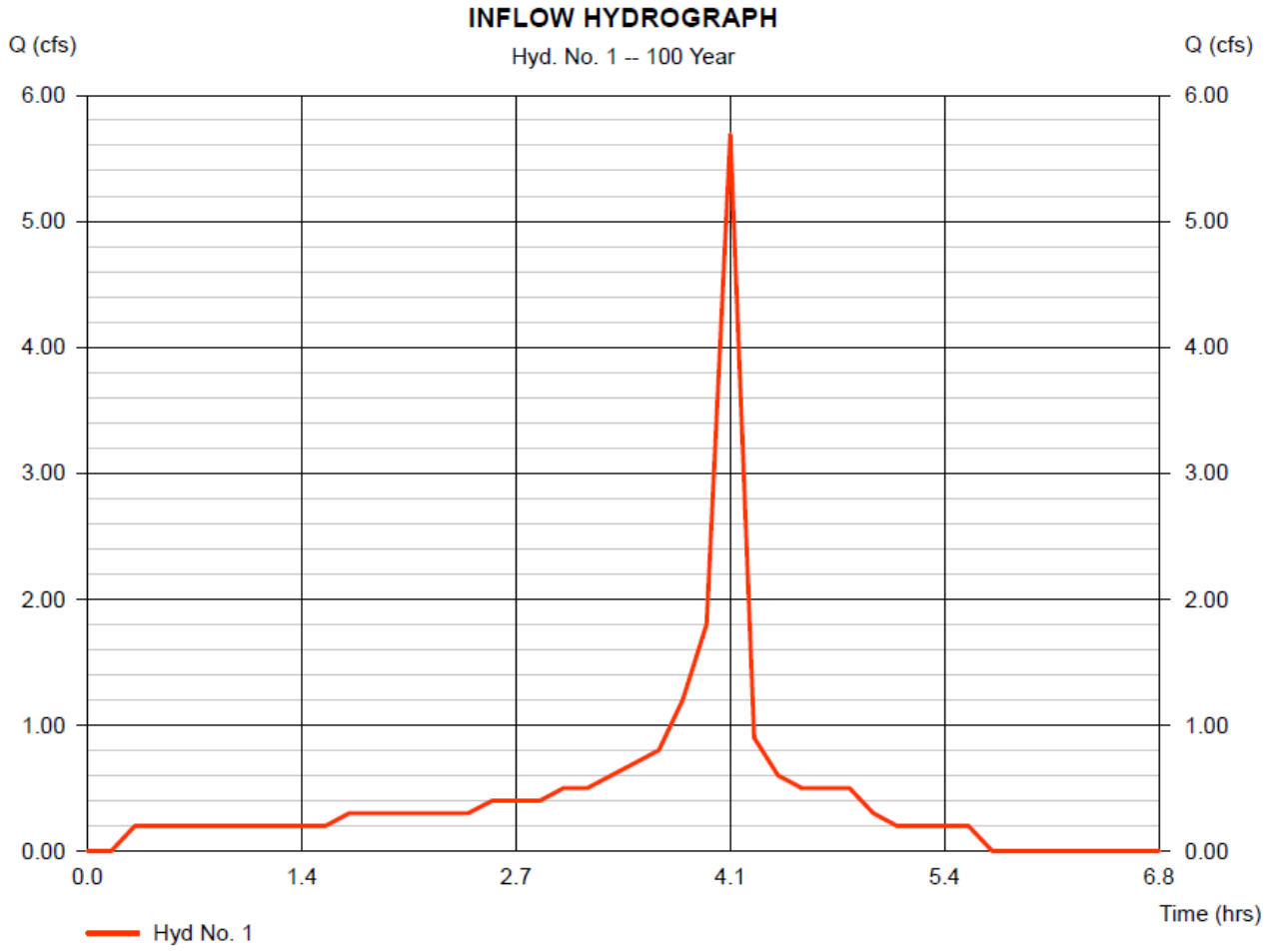
Where:

- I_N = average rainfall intensity for a duration equal to T_C in inches per hour

- P_N = rainfall amount for the block in inches
- T_C = time of concentration (9.33 minutes)

Finally, the overall hydrograph for the storm event is determined by adding all the hydrographs from each block of rain. Since the peak flow amount for each incremental hydrograph corresponds to a zero-flow amount from the previous and proceeding hydrographs, the inflow hydrograph can be plotted by connecting the peak flow amounts.

The incremental hydrograph can be summarized in the following graph. Table and Hydrograph report is attached (See Attachment F)



The peak flow values presented in the Incremental Hydrograph Distribution table are derived using the standard manual Rational Method (Equation 6-4). In addition to these manual calculations, the project utilized Hydraflow Hydrographs software to model the storm event and perform BMP routing. The more conservative peak flow generated by the modeling software was adopted for all

subsequent BMP sizing, spillway routing, and freeboard depth calculations.

2.1.4 SQWMP and Mitigation

The post-development project proposes a centralized Structural BMP to manage both Stormwater Quality Management Plan (SWQMP) requirements and drainage improvements.

- Structural BMP: A BMP is proposed at the southern portion of the project site to capture and treat runoff from the developed areas.
- Capacity and Dimensions: The BMP is designed with a surface area of approximately 2,350 sq-ft and a minimum length of 220 feet.
- Capture Volume: The facility is designed to provide a total Design Capture Volume (DCV) of 2,969 cubic feet.

Per the San Diego County BMP Design Manual, the design capture volume is calculated from the 85th percentile, 24-hour rain event. This value is determined using the San Diego County 85th percentile precipitation isohyetal map.

The 85th percentile, 24-hour rain event for this project site was determined to be 0.81 inches, which was utilized for all water quality and DCV calculations.

Table 4. Summary table for BMP

Name	Description	Effective C	Tc (min.)	85^{th} Percentile 24-hr storm depth	Area (ac)	DCV (cu-ft)
BMP 1 (Planter box)	Bio filtration	0.52	9.33	0.81	1.92	2,939

See Attachment E for the complete SWQMP Exhibit and Attachment A for BMP Exhibits.

Note: The BMP size is based on the 85th percentile storm for water quality (DCV), it also functions as a detention facility for larger peak flow events. For the 100-year rainfall event, any volume exceeding the BMP's capacity will be managed via the integrated overflow structures and directed toward the designated discharge points as shown in the project hydrology maps.

2.1.5 Detention Storage Routing Calculations

Detention routing calculations were performed for the proposed development to determine the peak flow attenuation for the 100-year storm. The following hydraulic characteristics of the BMP were established to determine the relationship between water depth, storage volume, and discharge capacity.

Outlet Rating Curve

The elevation-discharge relationship is established based on the primary and secondary outlet structures as detailed in the project design documents (see Attachment F). This relationship is critical for determining the rate at which the BMP releases stored runoff.

The discharge capacity for the BMP is calculated based on the available head above the outlet invert. For the lower stages of the BMP, the discharge is governed by the primary outlet pipe, utilizing the following orifice equation:

$$Q = C.A\sqrt{2gh}$$

Where:

- Q = Discharge (cfs)
- C = Discharge coefficient
- A = Cross-sectional area of the opening (sq-ft)
- g = Acceleration due to gravity (32.2 ft/s^2)
- h = Effective head (ft)

As the water surface elevation increases, the software-calculated rating curve accounts for transition into inlet or outlet control. For secondary overflow conditions (above the internal riser crest), the discharge follows the weir equation:

$$Q = C_{bcw}LH^{3/2}$$

Where:

- Q = Discharge (cfs)

- Cbcw = Broad-crested weir coefficient
- L = Length of the weir (ft)
- H = Depth of flow over the crest (ft)

The following table summarizes these calculations as derived from the Stage/Discharge Report (see attachment D).

Table 5. Outlet Rating Curve

Depth of Water (ft)	Flow Area (sq-ft)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Discharge (cfs)
0	0	0	0	0
0.5	0.49	1.95	0.25	0.423
1.05	1.18	3.12	0.38	1.571
1.54	1.77	4.71	0.38	2.445
2.04	1.77	4.71	0.38	7.416
2.53	1.77	4.71	0.38	10.84
3.03	1.77	4.71	0.38	12.40
3.53	1.77	4.71	0.38	13.78
4.03	1.77	4.71	0.38	15.01
5.5	1.77	4.71	0.38	18.25

Stage-Storage Relationship

The stage-storage relationship is determined by the geometric configuration of the proposed centralized BMP. Based on the Pond Report (see Attachment D), the BMP provides a uniform storage area across its 5.5-foot design depth. The cumulative volume is calculated using the average area method:

$$V_{1,2} = \frac{(A_1 + A_2)}{2}(h - h_1)$$

Table 6. Stage-Storage Curve

Depth (ft)	Planter Area (sq-ft)	Average Area (sq-ft)	Incremental Volume (cu-ft)	Cumulative Volume (cu-ft)
0	2,350	0	0	0
0.55	2,350	2,350	1,293	1,293
1.1	2,350	2,350	1,293	2,585
1.65	2,350	2,350	1,293	3,878
2.2	2,350	2,350	1,293	5,170
2.75	2,350	2,350	1,293	6,463
3.3	2,350	2,350	1,293	7,755
3.85	2,350	2,350	1,293	9,048
4.4	2,350	2,350	1,293	10,340
4.95	2,350	2,350	1,293	11,633
5.5	2,350	2,350	1,292	12,925

Storage Indication Method

With the inflow hydrograph and outlet characteristics established, the Storage Indication Method was used to determine the BMP's performance. This iterative routing process calculates the change in storage and outflow over time using the following equation:

$$\left(\frac{2S_{n+1}}{\Delta t} + O_{n+1}\right) = \left(\frac{2S_n}{\Delta t} - O_n\right) + (I_{n+}I_{n+1})$$

The following summary, derived from the Hydrograph Discharge Table (see Attachment D), shows the successful attenuation of the post-development peak flow.

Table 7. Storage Indication Method

Time (hrs)	Inflow (cfs)	Outflow (cfs)	Storage (cu-ft)	WSEL (ft)
0	0	0	0	680.35
1.05	0.2	0.19	587	680.60
2.1	0.3	0.30	940	680.75
3.15	0.5	0.48	1575	680.02
4.05 (Peak In)	**5.69**	2.09	3,055	681.65
4.20 (Peak Out)	0.90	**2.45**	3,618	681.89
5.1	0.2	0.38	1,410	680.95
6	0.06	0.06	118	680.40

This analysis demonstrates that the 100-year peak inflow of 5.69 cfs is successfully attenuated to a peak outflow of 2.45 cfs. This is achieved by utilizing a maximum storage volume of 3,618 cu-ft, which corresponds to a maximum water surface elevation (WSEL).

2.1.6 Detention Analysis

Based on the updated hydrologic analysis, detention is provided on-site to attenuate peak runoff from the developed area before it is discharged to the riprap energy dissipator located at the southwest boundary of the project. A centralized BMP is utilized to manage these flows, ensuring the post-development discharge does not exceed the capacity of the downstream system.

The maximum water surface stage during the 100-year storm event is calculated at an elevation that provides a total hydraulic head of 1.54 feet above the biofiltration surface, resulting in a total basin water depth of 5.50 feet including the subsurface storage layers. The results of the routing calculations for the 100-year storm event are summarized in the table below.

Table 8. Summary Table for Detention Analysis

DESCRIPTION	VALUE	UNIT
Maximum Detention Depth	5.5	Feet (FT)
Peak Inflow	5.69	Cubic Feet Per Second (CFS)
Maximum Storage Utilized	0.083 (3,618)	Acre-Feet (Cu-Ft)
Peak Outflow	2.45	Cubic Feet Per Second (CFS)
Max. Biofiltration Ponding Depth	1.54	Feet (FT)
Primary Outlet Size	1.5	Feet (FT)

A centralized BMP was used to mitigate stormwater runoff. This facility serves as a conjunctive use area designed to meet both water quality (pollutant control) and hydromodification requirements. The current configuration utilizes a primary 18-inch outlet and an overflow riser to safely manage extreme weather events.

The outfall is directed to a riprap pad designed to reduce flow velocities and prevent erosion at the discharge point.

2.1.7 Hydraulic Grade Line Calculations

Calculations were performed for the primary outlet pipe extending from the centralized BMP to the riprap energy dissipator located at the southwest part of the project. The peak 100-year storm discharge (Q) used for this analysis is 2.45 cfs, derived from the routing reservoir calculations in Section 2.1.5.

To determine the Hydraulic Grade Line (HGL), we first established the Energy Grade Line (EGL). The EGL is the sum of the downstream control elevation, friction losses (h_f), and minor structure losses (h_L):

$$EGL = EGL_o + h_f + h_L$$

Velocity Calculation:

The peak outflow (Q) from the BMP routing is 2.45 cfs. The primary outlet is an 18-inch (1.5 ft) reinforced concrete pipe (RCP).

- Flow Area (A) = $\pi(\frac{D^2}{4}) = 3.14(\frac{1.5^2}{4}) = 1.77$ sq-ft.

- Design Velocity (V) = Q / A = 2.45 / 1.77 = 1.38 ft/s.

Friction loss (h_f) is determined using the Darcy-Weisbach equation:

$$h_f = f(\frac{L}{D})(\frac{V^2}{2g})$$

- f (friction factor for RCP) = 0.019
- L (length of pipe to north outfall) = 45 ft
- D (diameter) = 1.5 ft
- g (gravity) = 32.2 ft/s²

$h_f = 0.019(\frac{45}{1.5})(\frac{1.38^2}{2x32.2}) = 0.017$ ft.

Minor losses:

- Entrance Loss (h_{ent}): $K_{ent}.(\frac{V^2}{2g}) = 0.5.(\frac{1.38^2}{2*32.2}) = 0.015$ ft
- Exit Loss (h_{ex}): $K_{ex}.(\frac{V^2}{2g}) = = 0.030$ ft
- Total Minor Losses (h_L): 0.015 + 0.030 = 0.045 ft

HGL Determination:

The HGL is calculated by working upstream from the discharge point at the riprap.

- Tailwater Control (Downstream Invert) = 680.35 ft.
- Total Head Loss ($h_f + h_L$) = 0.017 + 0.045 = 0.062 ft
- EGL = Downstream Elevation + h_f = 680.35 + 0.062 = 680.412 ft.
- Velocity Head = $\frac{V^2}{2g} = \frac{1.38^2}{64.4} = 0.030$ ft.
- HGL = EGL - Velocity Head = 680.412 - 0.030 = 680.382 ft.

The calculation confirms that the HGL (680.382 ft) is lower than the BMP's peak water surface elevation (681.89 ft), proving the system will drain efficiently by gravity.

2.1.8 Hydraulic Analysis

As mentioned before, current existing conditions include trees and shrubs. The site possesses a consistent gradient that directs runoff from the northeast to the southwest, draining towards Montiel Road. No stormwater runoff mitigation systems or connection points to the existing stormwater public drain system are present on site, necessitating a comprehensive mitigation strategy for the proposed development.

The proposed conditions consist of 10 lots totaling 83,635.20 SQ. FT., each featuring a hardscape pad, concrete driveway, and a cul-de-sac at the end of Street A. Post-project conditions offer stormwater runoff mitigation system consisting of a centralized detention and BMP that mitigates the entire site's runoff. The overflow now drains through an 18-inch primary outlet to a stabilized riprap energy dissipator located at the southwest boundary of the property.

2.1.9 Rip Rap Calculations

Project Details:

- Application: Stormwater Channel Protection / Outlet Energy Dissipator.
- Slope: 2:1 (Embankment slope).
- Soil Type: Type B.
- Rip Rap Dimensions: 14.25 ft width × 4.25 ft length (Updated to match site plan requirements).
- Outlet Diameter: 1.5 ft (18 inches).

Flow Velocity Calculation (V):

The velocity is calculated using the continuity equation based on the peak discharge from the 100-year storm routing (Q = 2.45 cfs from Section 2.15).

- Design Discharge (Q): 2.45 cfs.
- Outlet Area (A): 1.77 sq.ft
- Final Velocity (V): Q / A = 1.38 ft/s

Determine Riprap Size D_{50}:

Using Isbash's Equation to verify the stone stability for the calculated velocity:

- Velocity (V): 1.38 ft/s.
- Gravity (g): 32.2 ft/s².
- Specific Gravity of Rock (S): 2.65
- Calculation: $D_{50} = \frac{V^2}{(2g(S-1))} = \frac{1.38^2}{(2.32.2(2.65-1))} = 0.018$ ft
- Selected Stone Size (D_{50}): 3 inches (0.25 ft) (Standard Class 1 Riprap per SD County D-40).

Requirement of Riprap Thickness:

- Calculation: 1.5 X 3 inches = 4.5 inches
- Specified Thickness: 12 inches (1.0 ft) (Standard minimum for outfall protection).

Proposed Dimensions:

To ensure complete protection of the discharge channel area:

- Length (L): 4.25 ft.
- Width (W): 14.25 ft.

Riprap Volume and Weight Calculation:

- Volume = Area (Length × Width) X Thickness
- Area = 14.25 X 4.25 = 60.56 sq.ft
- Volume = 60.56 sq.ft X 1 ft = 60.56 cu.ft = 2.24 Cubic Yards
- Weight = 2.24CY X 1.35 tons/CY = 3.02 tons

The energy dissipator is sufficient. The actual exit velocity of 1.38 ft/s is lower than the 6.0 ft/s threshold for Class 1 Riprap and the 5.0 ft/s erosive threshold for native soils. The specified 14.25' x 4.25' apron ensures that discharge energy is fully dissipated before contacting native soil, satisfying the requirement for erosion mitigation.

3. CONCLUSIONS

Based on the findings of this study, the proposed development at 1434 Montiel Road will not result in a significant impact on the downstream drainage system or the surrounding environment. The site currently consists of natural terrain with an existing impervious area of approximately 0.06 acres (3.0%). The proposed 10-unit residential subdivision will increase the impervious coverage within the 1.92-acre study area. There is no existing inflow of offsite drainage onto this property.

Hydrologic calculations were performed in accordance with San Diego County standards. Under existing conditions, a 100-year storm event produces a peak flow of 2.92 cfs. Under the proposed conditions, the unmitigated peak flow generated by the site is 5.69 cfs. Therefore, the project incorporates a biofiltration planter box (BMP #1) designed to capture and treat the Design Capture Volume (DCV) of 2,939 cubic feet, as calculated for the 1.92-acre area. Through detention and controlled release, the final mitigated peak discharge from the site is reduced to 2.45 cfs from the existing peak flow of 2.92 cfs.

A hydraulic analysis of the discharge pipes was performed (See attachment C). The hydraulic analysis of the 18-inch outlet pipe, sized for the mitigated discharge of 2.45 cfs, provides an efficient gravity drainage system with a Hydraulic Grade Line (HGL) that remains below the BMP's peak water surface elevation. The drainage system for the development consists of a network of swales and pipes that convey the water to a biofiltration planter located at the southwest portion of the site. The drainage system is verified to convey the Rational Method peak of 3.71 cfs as detailed in the proposed 100 Year Hydrology report. The discharge point at the southwest corner of the property is protected by a riprap energy dissipator. To ensure erosion control, the riprap is sized based on the outlet velocity of 1.38 ft/s resulting from the mitigated flow.

A review of regional hazard mapping confirms that the project site is not located within any significant natural hazards zone. The site topography and soil characteristics indicate that the development is not situated on an active or prehistoric alluvial fan. Consequently, the proposed development is not subject to unique flooding or debris-flow hazards associated with these geological features.

In compliance with the San Diego County BMP Design Manual, the project implements Permanent Structural BMPs (Biofiltration) to treat runoff before it leaves the site. These measures are specifically designed to remove pollutants of concern typically associated with residential development. The analysis confirms that the project will not create substantial additional sources of polluted runoff or degrade downstream water quality.

The project has been designed to ensure that the concentrated discharge of stormwater will not result in adverse impacts on downstream properties. Because the mitigated peak discharge is lower than the pre-development flow, the project will not increase the risk of flooding or erosion. All site runoff is directed to the pre-existing natural low point at the southwest corner of the property, thus maintaining historical drainage pattern. By managing flows on-site and ensuring no diversion of water that would negatively affect adjacent landowners, the project satisfies the "Rule of Reasonable Use" and effectively protects downstream properties.

The analysis confirms that the proposed facilities will not cause existing or planned stormwater drainage systems to exceed capacity, nor will they modify the course of any stream or river. With the implementation of the specified biofiltration and erosion control measures, the project effectively manages runoff volume, rates, and pollutant loads, ensuring that the development meets all San Diego County CEQA requirements for hydromodification and water quality.

4. OPERATIONS AND MAINTENANCE

Planter Box with Underdrains:

Maintenance and regular inspections are important for the proper function of Planter Box with underdrains (Bioretention). Bioretention areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. In general, bioretention maintenance requirements are typical landscape care procedures, which include:

- Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years.
- 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. Properly designed facilities with appropriate flow velocities should not cause erosion except potentially during extreme events. If erosion occurs, the flow velocities and gradients within the bioretention area and energy dissipation and erosion protection strategies int the pretreatment area and flow entrance should be reassessed. If sediment is deposited in the bioretention area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.
- Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace them with more appropriate species.
- Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.
- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, bioretention facilities are in areas where phosphorus and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving water.
- In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two-to-three-inch depth at least once every two years.

- Analyze soil for fertility and pollutant levels if necessary. Bioretention soil media are designed to maintain long-term fertility and pollutant processing capability.
- Eliminate standing water to prevent vector breeding.
- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.

Landscape Management:

Landscape Maintenance includes several activities such as vegetation removal, pesticide/fertilizer applications, waste removal, pruning, watering, mowing, etc. Whenever possible, use mechanical methods of vegetation removal (e.g mowing with tractor type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical. Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
Mowing should not be performed if significant rain events are predicted. Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grass and shrubs. Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of it at a landfill (see waste management section of this fact sheet). Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Catch Basin Inspection:

Ensure that contaminated storm water is not discharged directly to inlets. Catch/Sediment basins should be inspected regularly to ensure debris does not accumulate far beyond the inlet's capacity. Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed. Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer. Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed. Keep accurate logs of the number of catch basins cleaned. Record the amount of waste collected.

Catchment Surface:

Inspect the catchment area very regularly, before and after the rainy season, to check the surface for debris and algae growth as well as obstructions, such as broken or dislodged roof tiles or cracks in the surface. Repair the catchment area as needed to maintain flows and minimize the loss of rainwater. Keep a clean roof and install appropriate debris removal devices on gutters. If the surface is dirty or has algae growth, disconnect downspouts from the rainwater system, wash the surface using plain or soapy water, treat to remove algae if necessary, and rinse thoroughly. Finally, reconnect the downspout.

Private Parking Spaces:

Keep the parking areas clean and orderly. Remove debris in a timely fashion. Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or Underground devices. Clear parking spaces at least once before the onset of the wet season.

Gutters And Downspouts:

Inspect gutters and downspouts regularly and check all clips and brackets to see if they are secure and unbroken; if not, repair. Check that the slope of gutters maintains positive drainage. Remove accumulated debris and clogs. Where vegetation overhangs gutters, inspect them every three months for leaf accumulation, rust, and mold, rain gutters and downspouts will be inspected and cleaned at least twice annually. If rust or mold is present and would adversely affect the intended use of the water, disconnect the downspouts from the storage tank and treat the gutters as needed to remove the rust and mold. Reconnect downspouts when work is completed. Trim trees and vines away from gutters to maintain a minimum 24-inch clear zone. Check downspout for animal intrusions, clogs, or overgrowth that could obstruct positive drainage.

Clean filters with warm soapy water or rinse well every three to six months. Check that the drop from gutter to downspout remains vertical. Run water in the downspouts and observe where the waterfalls. If most of the water does not land in the middle and towards the back of the leaf and debris filter screen on rain heads, adjust the location of the downspout. All debris removal devices should be installed and monitored according to manufacturers' instructions.

Trash Enclosure Maintenance:

Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run on and runoff with a berm. The waste containers or piles must be covered except when in use. Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating. Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain. Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge water to the street or storm drain. Transfer waste from damaged containers into safe containers. Take special care when loading or unloading waste to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Table 9. Summary of recommended operation and maintenance activities

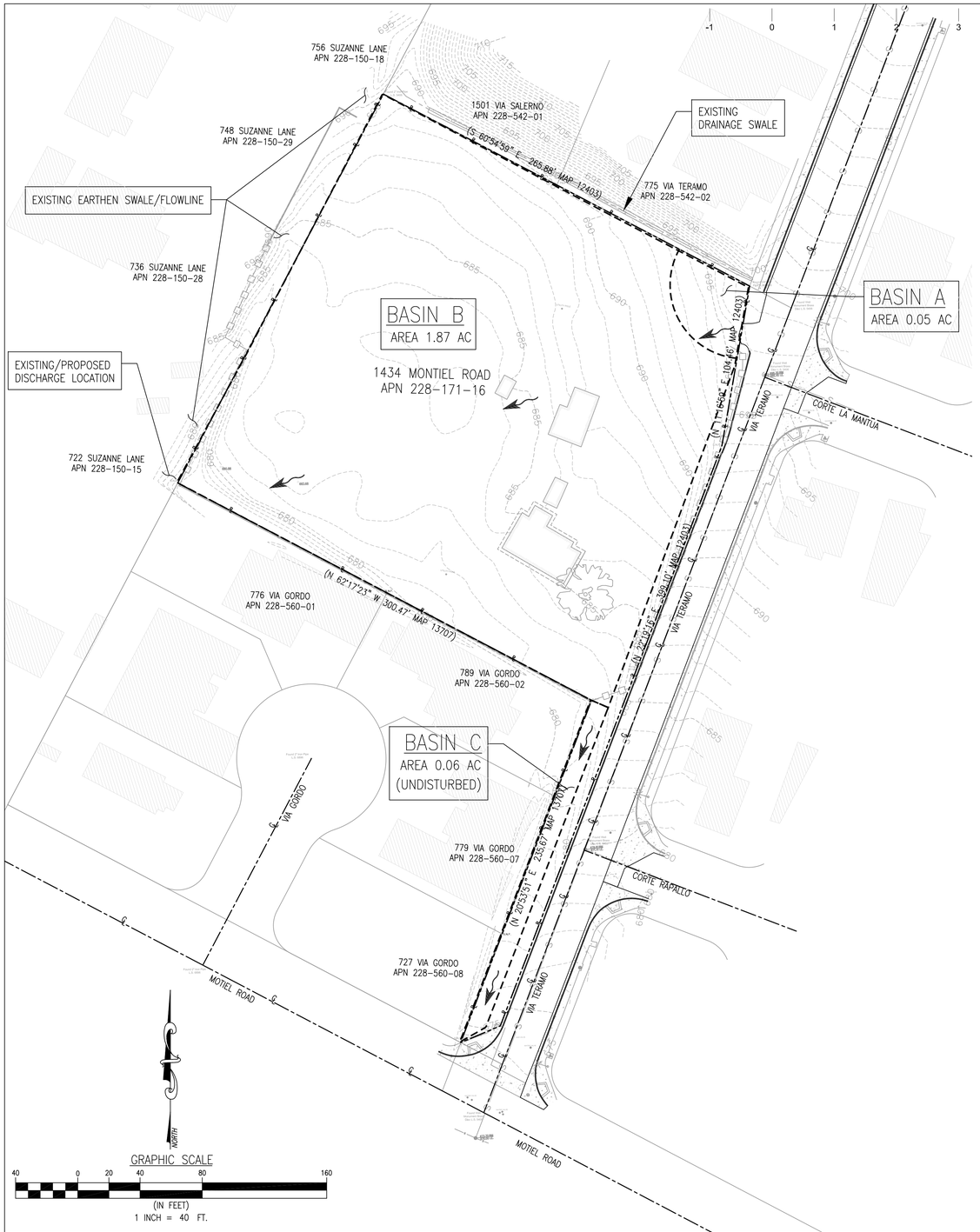
BMP	Inspection/ Maintenance Activity	Inspection/ Maintenance Frequency
Landscape areas	Landscape areas shall be maintained appropriately. Any eroded areas will be addressed to avoid damage to downside drainage. Inspection to occur regularly	Weekly landscape service
Catchment Surface	Inspect and repair or clean as necessary.	Semi-annually (begin and end of rain events)
Gutters	Inspect and repair or clean, as necessary. · Condition and security of clips and brackets. · Slope of gutters (positive drainage). · Condition of Screens and presence of debris or clogs.	Semi-annually, pre and post rain events

BMP	Inspection/ Maintenance Activity	Inspection/ Maintenance Frequency
	· The presence of trees or vines with 24 inches of gutters. · Flush gutters (and downspouts) once all debris is removed to wash away remaining dirt or debris.	
Downspouts	Inspect and repair or clean as necessary. · Animal intrusions or clogs. · Debris accumulation or damage. · Flush downspouts (and gutters) once all debris is removed to wash away remaining dirt or debris.	Semi-annually, pre and post rain events
Planter Box with Underdrains	Repair small, eroded areas and ruts by filling them with gravel. Overseed bare areas to reestablish vegetation. Remove accumulated fine sediments, dead leaves, and trash to restore surface permeability. Remove any evidence of visual contamination from floatable such as oil and grease. Remove sediment and debris accumulation near inlet and outlet structures to alleviate clogging.	Following any irrigation failures, large storms, and at minimum, or smi-annually. Monthly and pre & post rain events
	Periodically observe function under wet weather conditions. Repair structural damage to flow control structures including inlet, outlet, and overflow structures. (Major maintenance)	During rain events Semi-annually, pre & post rain events
	Take photographs before and after major maintenance.	When major maintenance is needed.

BMP	Inspection/ Maintenance Activity	Inspection/ Maintenance Frequency
Catch Basin Inspection	The owner is required to have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two-year period. Drainage facilities include catch basins (storm drain inlets) retention basin and open drainage channels and lift stations.	Semi-annually, pre & post rain events
Private parking lots	Sweep parking lot to minimize cleaning with water. Clean out oil/water/sand separators regularly, especially after heavy storms. Clean parking facilities on a regular basis to prevent accumulated waste and pollutants from being discharged into conveyance systems during rainy conditions.	Monthly, pre & post rain events
Trash Enclosures To Reduce Pollutant Introduction	Always keep the waste management area clean by sweeping and cleaning up spills immediately. Use dry methods when possible (e.g. sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.	Monthly and prior to rain season

ATTACHMENT A

Preliminary Grading Plan, Existing & Proposed Exhibits and Planter Box Detail



FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

-1 0 1 2 3 4 5 6 7 8 9 10

REGISTERED PROFESSIONAL ENGINEER
DAYANAND P. BETTADAPURA
NO. C46505
EXP. 6/30/2027
CIVIL
STATE OF CALIFORNIA

PLANS	BY	DATE
DESIGNED	JCW	----
CHECKED	DB	----

DAYA BETTADAPURA, C46505 — 04/16/2026 DATE

BASIN	EFFECTIVE C	Tc (min)	I (in/hr)	AREA (AC) TOTAL	QPEAK (CSF) TOTAL
A	0.25	8.70	6.08	1.87	2.844
B	0.25	8.70	6.08	0.05	0.076

LEGEND:

	PROPERTY LINE
	CENTER LINE
(XXX.XX)	EXISTING ELEVATION
W W	EXISTING WATER MAIN
S S	EXISTING SEWER MAIN
SD SD	EXISTING STORM DRAIN
G G	EXISTING GAS MAIN
	EXISTING EASEMENT
	EXISTING LINE FENCE
	EXISTING SWALE
	EXISTING FIRE HYDRANT
	EXISTING WATER VALVE
	EXISTING SEWER MANHOLE
	EXISTING STORM MANHOLE
	EXISTING STREET POLE
	EXISTING WATER METER
	EXISTING GAS METER
	EXISTING TREE
	EXISTING LANDSCAPE
	EXISTING CONCRETE
	EXISTING WALL

AC	ASPHALT CONCRETE
EP	EDGE OF PAVEMENT
FC	FINISHED CONCRETE
FF	FINISHED FLOOR
FG	FINISHED GRADE
FL	FLOWLINE
FS	FINISHED SURFACE
NG	NATURAL GRADE
TC	TOP OF CURB
TW	TOP OF WALL
TG	TOP OF GRATE
EG	EXISTING GRADE
PP	POWER POLE
EX	EXISTING

C:\Users\Jagadish\ABI\ABI - Projects\2022\22056 Montiel Road Escondido Parcel Subdivision NOAA\DRAINAGE STUDY CEQA\2026-02-27\Attachments\CAD\DRAINAGE EXHIBITS\DRAINAGE EXHIBITS.dwg Thursday, Apr. 16 2026 6:37pm Jagadish

PREPARED BY:
ABI ENGINEERING CONSULTANTS, INC.
1701 EAST EDINGER AVENUE, SUITE A9
SANTA ANA, CALIFORNIA 92705
TEL: (888) 220-5596 FAX: (714) 866-4171

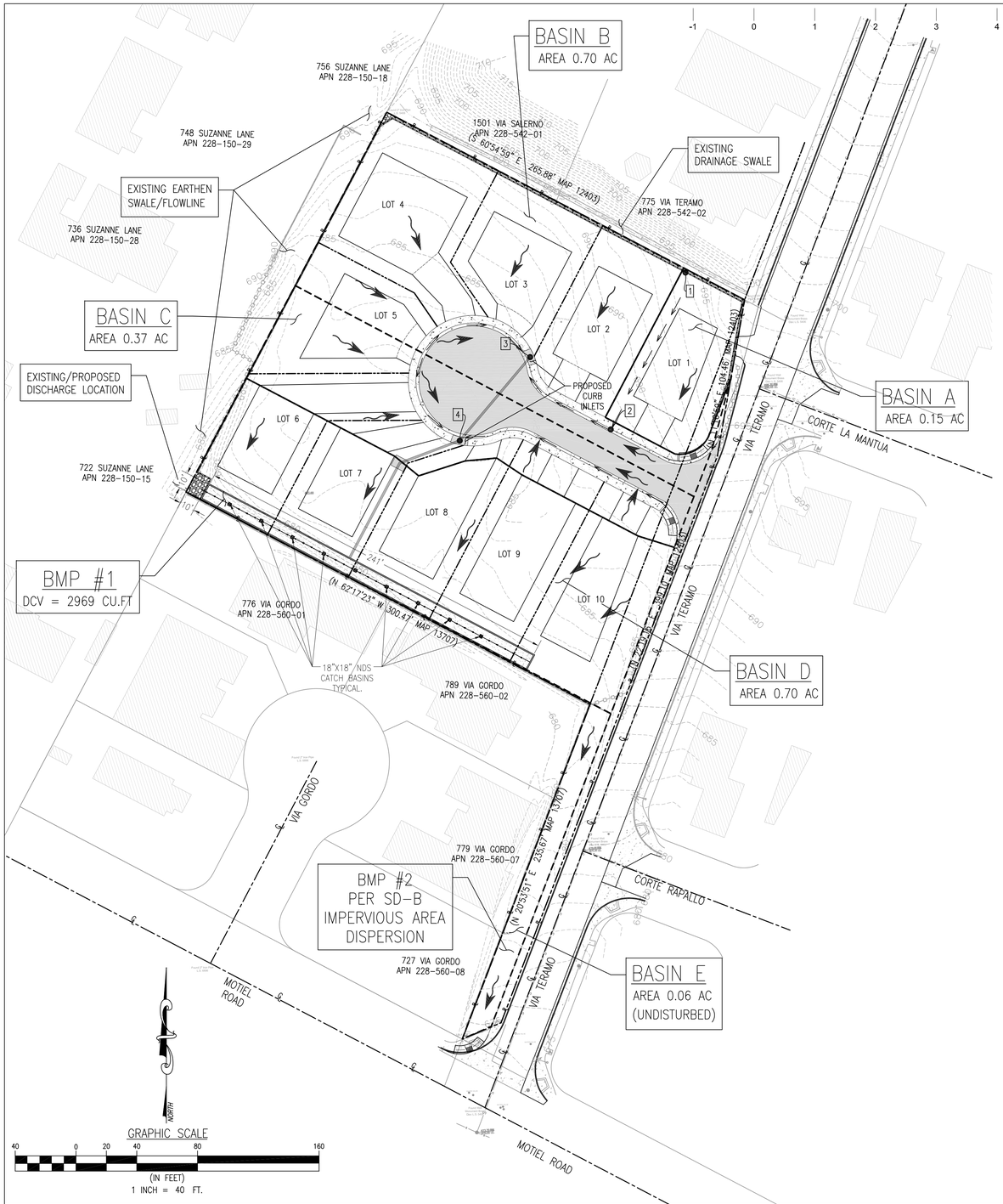
	REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX
XXXX N. XXXX E.
CONST. COMPL. _____
FIELD REVISIONS _____

1434 MONTIEL ROAD
ESCONDIDO CALIFORNIA
DRAINAGE REPORT EXHIBITS

EXISTING CONDITION EXHIBIT

SCALE: HOR. AS SHOWN VERT. AS SHOWN
W.A. 1234567 R.S. _____
SHEET 1 OF 2 SHEETS



FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

PLANS	BY	DATE
DESIGNED	JCW	----
CHECKED	DB	----

REGISTERED PROFESSIONAL ENGINEER
DAYANAND P. BETTADAPURA
NO. C46505
EXP. 6/30/2027
CIVIL
STATE OF CALIFORNIA

DAYA BETTADAPURA, C46505 — 04/16/2026 DATE

BASIN	EFFECTIVE C	Tc (min)	I (in/hr)	AREA (AC) TOTAL	QPEAK (CSF) TOTAL
A	0.51	8.40	6.220	0.15	0.476
B	0.51	8.75	6.061	0.70	2.151
C	0.51	8.98	5.959	0.37	1.081
D	0.51	9.33	5.815	0.70	1.986

LEGEND:

	PROPERTY LINE	AC	ASPHALT CONCRETE
	CENTER LINE	EP	EDGE OF PAVEMENT
	BASINS	FC	FINISHED CONCRETE
(XXX.XX)	EXISTING ELEVATION	FF	FINISHED FLOOR
W W	EXISTING WATER MAIN	FG	FINISHED GRADE
S S	EXISTING SEWER MAIN	FL	FLOWLINE
SD	EXISTING STORM DRAIN	FS	FINISHED SURFACE
G G	EXISTING GAS MAIN	NG	NATURAL GRADE
	EXISTING EASEMENT	TC	TOP OF CURB
	EXISTING LINE FENCE	TW	TOP OF WALL
	EXISTING SWALE	TG	TOP OF GRATE
	EXISTING FIRE HYDRANT	EG	EXISTING GRADE
W	EXISTING WATER VALVE	PP	POWER POLE
S	EXISTING SEWER MANHOLE	EX	EXISTING
SD	EXISTING STORM MANHOLE		
	EXISTING STREET POLE		
WM	EXISTING WATER METER		
GM	EXISTING GAS METER		
	PROPOSED FLOW DIRECTION		
	EXISTING TREE		
	EXISTING CONCRETE		
	PROPOSED CONCRETE		
	PROPOSED BMP		
	EXISTING WALL		
	PROPOSED WALL		

PREPARED BY: ABI ENGINEERING CONSULTANTS, INC.
1701 EAST EDINGER AVENUE, SUITE A9
SANTA ANA, CALIFORNIA 92705
TEL: (888) 220-5596 FAX: (714) 866-4171

	REVISIONS	BY	APPROVED	DATE

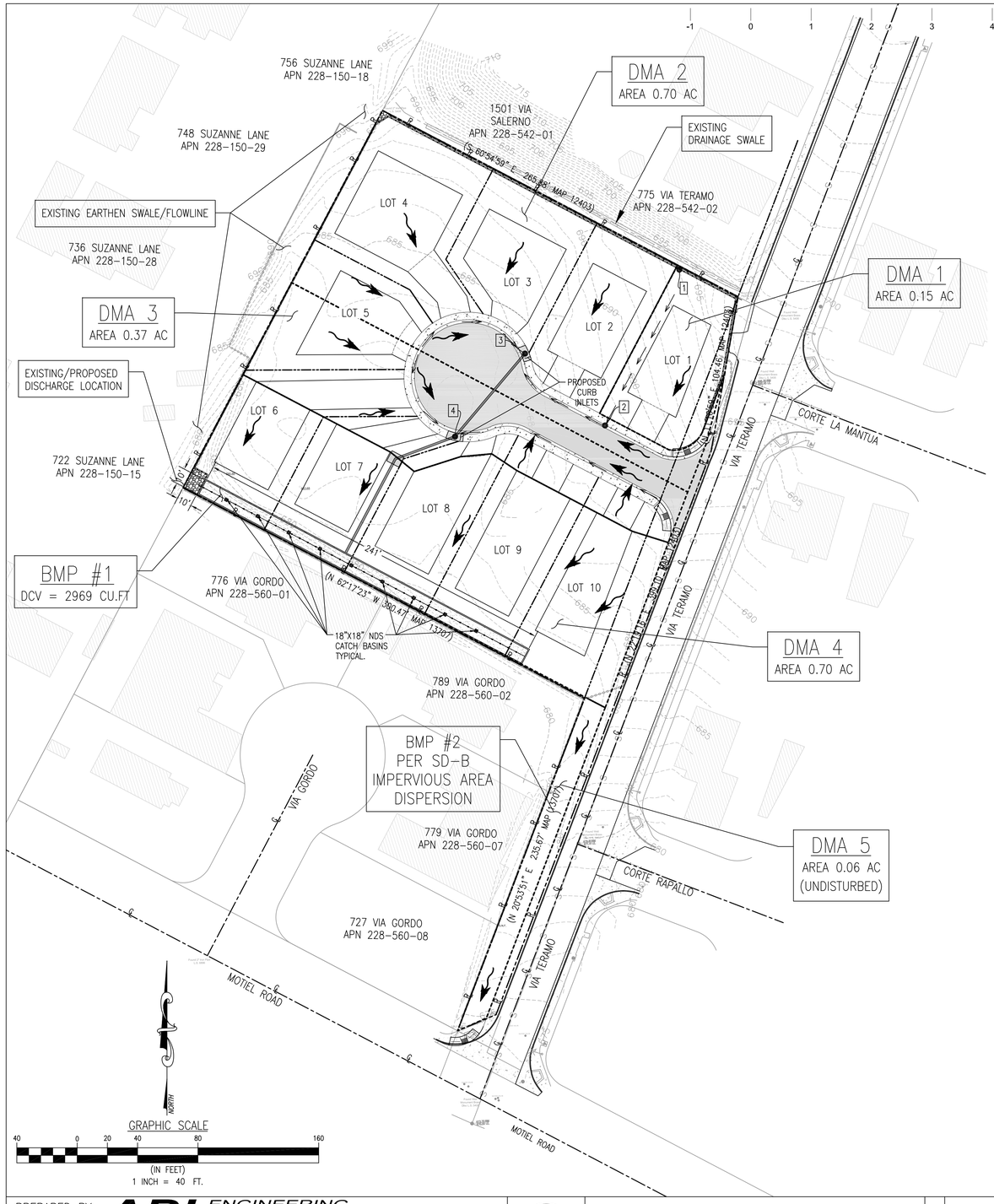
COORDINATE INDEX
XXXX N. XXXX E.
CONST. COMPL. _____
FIELD REVISIONS _____

1434 MONTIEL ROAD
ESCONDIDO CALIFORNIA
DRAINAGE REPORT EXHIBITS

PROPOSED CONDITION EXHIBIT

SCALE: HOR. AS SHOWN VERT. AS SHOWN
W.A. 1234567 R.S. _____
SHEET 2 OF 2 SHEETS

C:\Users\Jagadish\ABI\ABI - Projects\2022\22056 Montiel Road Escondido Parcel Subdivision NOAA\DRAINAGE STUDY CEQA\2026-02-27\Attachments\CAD\DRAINAGE EXHIBITS\DRAINAGE EXHIBITS.dwg Thursday, Apr. 16 2026 6:39pm Jagadish



FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

REGISTERED PROFESSIONAL ENGINEER
DAYANAND P. BETTADAPURA
NO. C46505
EXP. 6/30/2027
CIVIL
STATE OF CALIFORNIA

PLANS	BY	DATE
DESIGNED	JCW	----
CHECKED	DB	----

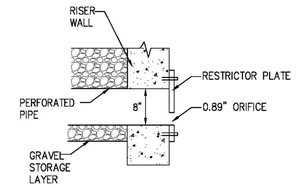
REGISTERED CIVIL ENGINEER — 04/16/2026 DATE

LEGEND

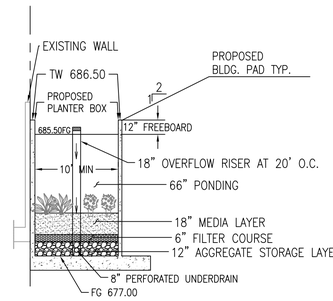
- FLOW LINE
- DIRECTION OF FLOW
- CATCH BASIN
- DMA BOUNDARY
- EXISTING WALL
- PROPOSED WALL

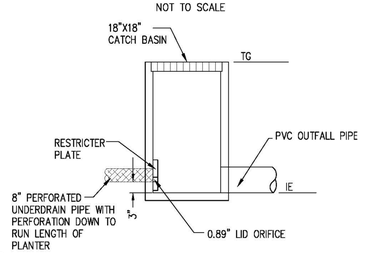
PATTERN LEGEND

- PLANTER BOX



BMP-1 ORIFICE DETAIL
NOT TO SCALE





BMP-1 BIOFILTRATION OUTLET STRUCTURE DETAIL
NOT TO SCALE

TYPICAL BMP SECTION
NOT TO SCALE

DMA #	AREA NAME	TOTAL LOT AREA	TOTAL IMPERVIOUS AREA (SF)	TOTAL IMPERVIOUS AREA (AC)	TOTAL PERVIOUS AREA (SF)	TOTAL PERVIOUS AREA (AC)	%IMPERVIOUS
1	LOT 1	6519	2506	0.0580	4013	0.0920	38
2	LOT 2	6565	3020	0.0690	3545	0.0810	46
2	LOT 3	6502	3048	0.0700	3454	0.0790	47
2	LOT 4	8914	4685	0.1080	4229	0.0970	53
2 & 3	LOT 5	6636	2904	0.0670	3732	0.0860	44
3 & 4	LOT 6	7764	3974	0.0910	3790	0.0870	51
3 & 4	LOT 7	6359	2994	0.0690	3365	0.0770	47
3 & 4	LOT 8	6727	3170	0.0730	3557	0.0820	47
3 & 4	LOT 9	8036	3937	0.0900	4099	0.0940	49
3 & 4	LOT 10	8243	3295	0.0760	4948	0.1140	40

*STREET AREAS ARE BEING ADDED INTO WORKSHEETS

DMA'S SUMMARY
NOT TO SCALE

NOTES:

1. SITES SOIL TYPE: HYDROLOGIC SOIL TYPE B
2. INFILTRATION RATE : 1.5 IN/HR
3. GROUNDWATER ENCOUNTERET AT A DEPTH OF 22.5 FT BELOW GROUND

PREPARED BY: ABI ENGINEERING CONSULTANTS, INC.
1701 EAST EDINGER AVENUE, SUITE A9
SANTA ANA, CALIFORNIA 92705
TEL: (888) 220-5596 FAX: (714) 866-4171

REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX
XXXX N. XXXX E.
CONST. COMPL. ____
FIELD REVISIONS ____

1434 MONTIEL ROAD
ESCONDIDO CALIFORNIA
DRAINAGE REPORT EXHIBITS
DMA EXHIBIT

SCALE: HOR. AS SHOWN VERT. AS SHOWN
W.A. 1234567 R.S. ____
SHEET 1 OF 1 SHEETS

C:\Users\Jagadish\ABI\ABI - Projects\2022\22056 Montiel Road Escondido Parcel Subdivision NOAA\SWQMP\2026-04-16\Attachments\CAD\DMA EXHIBITS\DMA EXHIBITS.dwg Thursday, Apr. 16 2026 5:57pm Jagadish

ATTACHMENT B

Existing 100-Year Rational Method Hydrology Study

EXISTING 100 HYDROLOGY
MONTIEL SUBDIVISION
25062DEV100.OUT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/25/26

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

Program License Serial Number 6720

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.300
24 hour precipitation(inches) = 6.000
P6/P24 = 55.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

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
[UNDISTURBED NATURAL TERRAIN]
(Permanent Open Space)
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Initial subarea total flow distance = 50.000(Ft.)
Highest elevation = 698.500(Ft.)
Lowest elevation = 692.500(Ft.)
Elevation difference = 6.000(Ft.) Slope = 12.000 %
Top of Initial Area Slope adjusted by User to 4.756 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 4.76 %, in a development type of
Permanent Open Space
In Accordance With Table 3-2
Initial Area Time of Concentration = 8.70 minutes
(for slope value of 5.00 %)
Rainfall intensity (I) = 6.083(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.250
Subarea runoff = 0.076(CFS)
Total initial stream area = 0.050(Ac.)

++
Process from Point/Station 2.000 to Point/Station 3.000
**** SUBAREA FLOW ADDITION ****

```
Rainfall intensity (I) =      6.083(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Time of concentration =     8.70 min.
Rainfall intensity =      6.083(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.250  CA =      0.480
Subarea runoff =      2.844(CFS) for      1.870(Ac.)
Total runoff =      2.920(CFS)   Total area =       1.920(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** IMPROVED CHANNEL TRAVEL TIME ****
_____________________________________________________________________________
Upstream point elevation =   692.500(Ft.)
Downstream point elevation =   676.000(Ft.)
Channel length thru subarea  =   334.000(Ft.)
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Manning's 'N'    = 0.020
Maximum depth of channel  =    0.100(Ft.)
Flow(q) thru subarea =      2.920(CFS)
Depth of flow =   0.080(Ft.), Average velocity =   2.597(Ft/s)
Channel flow top width =   18.023(Ft.)
Flow Velocity =    2.60(Ft/s)
Travel time  =    2.14 min.
Time of concentration =   10.84 min.
Critical depth =      0.112(Ft.)
End of computations, total study area =           1.920 (Ac.)
```

ATTACHMENT C

Proposed 100-Year Hydrology & Internal Pipe Hydraulic Calculations

PROPOSED 100 YEAR HYDROLOGY
MONTIEL SUBDIVISION
25062DEV100.OUT

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 01/22/26

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

Program License Serial Number 6720

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.300
24 hour precipitation(inches) = 6.000
P6/P24 = 55.0%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

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
[MEDIUM DENSITY RESIDENTIAL]
(7.3 DU/A or Less)
Impervious value, Ai = 0.400
Sub-Area C Value = 0.510
Initial subarea total flow distance = 100.000(Ft.)
Highest elevation = 691.150(Ft.)
Lowest elevation = 690.000(Ft.)
Elevation difference = 1.150(Ft.) Slope = 1.150 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of 1.15 %, in a development type of
7.3 DU/A or Less
In Accordance With Table 3-2
Initial Area Time of Concentration = 8.40 minutes
(for slope value of 1.00 %)
Rainfall intensity (I) = 6.222(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.510
Subarea runoff = 0.476(CFS)
Total initial stream area = 0.150(Ac.)

++
Process from Point/Station 2.000 to Point/Station 3.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 690.000(Ft.)
End of street segment elevation = 686.000(Ft.)
Length of street segment = 70.700(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 12.500(Ft.)
Distance from crown to crossfall grade break = 10.500(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 [1] side(s) of the street
Distance from curb to property line  =   5.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.560(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0200
Estimated mean flow rate at midpoint of street =      1.587(CFS)
Depth of flow =   0.213(Ft.), Average velocity =   3.372(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.168(Ft.)
Flow velocity =   3.37(Ft/s)
Travel time =    0.35 min.     TC =    8.75  min.
 Adding area flow to street
Rainfall intensity (I) =      6.061(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.510
Rainfall intensity =      6.061(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.510  CA =      0.434
Subarea runoff =      2.151(CFS) for      0.700(Ac.)
Total runoff =      2.627(CFS)        Total area =       0.850(Ac.)
Street flow at end of street =      2.627(CFS)
Half street flow at end of street =      2.627(CFS)
Depth of flow =   0.247(Ft.), Average velocity =   3.709(Ft/s)
Flow width (from curb towards crown)=   7.863(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   683.000(Ft.)
Downstream point/station elevation =   682.310(Ft.)
Pipe length  =    69.00(Ft.) Slope =   0.0100  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.627(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.627(CFS)
Normal flow depth in pipe =    7.66(In.)
Flow top width inside pipe =   11.53(In.)
Critical Depth =    8.33(In.)
Pipe flow velocity =      4.96(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =     8.98 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      5.959(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.510
Time of concentration =     8.98 min.
Rainfall intensity =      5.959(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.510  CA =      0.622
Subarea runoff =      1.081(CFS) for      0.370(Ac.)
```

```
Total runoff =      3.708(CFS)        Total area =       1.220(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   682.310(Ft.)
Downstream point/station elevation =   681.200(Ft.)
Pipe length  =   113.00(Ft.) Slope =   0.0098  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.708(CFS)
Given pipe size =     15.00(In.)
Calculated individual pipe flow  =     3.708(CFS)
Normal flow depth in pipe =    8.19(In.)
Flow top width inside pipe =   14.94(In.)
Critical Depth =    9.34(In.)
Pipe flow velocity =      5.41(Ft/s)
Travel time through pipe =    0.35 min.
Time of concentration (TC) =     9.33 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      5.815(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.510
Time of concentration =     9.33 min.
Rainfall intensity =      5.815(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.510  CA =      0.979
Subarea runoff =      1.986(CFS) for      0.700(Ac.)
Total runoff =      5.694(CFS)        Total area =       1.920(Ac.)
End of computations, total study area =           1.920 (Ac.)
```

ATTACHMENT D

Hydrograph Discharge & Outlet Routing Tables

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Feb 25, 2026

Hyd. No. 1

INFLOW HYDROGRAPH

Hydrograph type	= Manual	Peak discharge	= 5.690 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.05 hrs
Time interval	= 9 min	Hyd. volume	= 11,173 cuft

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (hrs)	Outflow (cfs)
0.30	0.200
0.45	0.200
0.60	0.200
0.75	0.200
0.90	0.200
1.05	0.200
1.20	0.200
1.35	0.200
1.50	0.200
1.65	0.300
1.80	0.300
1.95	0.300
2.10	0.300
2.25	0.300
2.40	0.300
2.55	0.400
2.70	0.400
2.85	0.400
3.00	0.500
3.15	0.500
3.30	0.600
3.45	0.700
3.60	0.800
3.75	1.200
3.90	1.800
4.05	5.690 <<
4.20	0.900
4.35	0.600
4.50	0.500
4.65	0.500
4.80	0.500
4.95	0.300
5.10	0.200
5.25	0.200
5.40	0.200
5.55	0.200

...End

Hydrograph Report

Hyd. No. 2

OUTFLOW HYDROGRAPH

Hydrograph type	= Reservoir	Peak discharge	= 2.445 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.20 hrs
Time interval	= 9 min	Hyd. volume	= 10,813 cuft
Inflow hyd. No.	= 1 - INFLOW HYDROGRAPH	Reservoir name	= <New Pond>
Max. Elevation	= 682.07 ft	Max. Storage	= 3,618 cuft

Storage Indication method used.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1.05	0.200	680.59	0.050	0.000	-----	-----	-----	-----	-----	-----	-----	0.050
1.20	0.200	680.62	0.082	0.000	-----	-----	-----	-----	-----	-----	-----	0.083
1.35	0.200	680.65	0.112	0.000	-----	-----	-----	-----	-----	-----	-----	0.112
1.50	0.200	680.66	0.135	0.000	-----	-----	-----	-----	-----	-----	-----	0.135
1.65	0.300	680.69	0.165	0.000	-----	-----	-----	-----	-----	-----	-----	0.166
1.80	0.300	680.71	0.205	0.000	-----	-----	-----	-----	-----	-----	-----	0.205
1.95	0.300	680.73	0.232	0.000	-----	-----	-----	-----	-----	-----	-----	0.232
2.10	0.300	680.75	0.253	0.000	-----	-----	-----	-----	-----	-----	-----	0.253
2.25	0.300	680.75	0.268	0.000	-----	-----	-----	-----	-----	-----	-----	0.268
2.40	0.300	680.76	0.278	0.000	-----	-----	-----	-----	-----	-----	-----	0.278
2.55	0.400	680.77	0.300	0.000	-----	-----	-----	-----	-----	-----	-----	0.301
2.70	0.400	680.79	0.332	0.000	-----	-----	-----	-----	-----	-----	-----	0.332
2.85	0.400	680.81	0.355	0.000	-----	-----	-----	-----	-----	-----	-----	0.355
3.00	0.500	680.82	0.387	0.000	-----	-----	-----	-----	-----	-----	-----	0.387
3.15	0.500	680.85	0.425	0.000	-----	-----	-----	-----	-----	-----	-----	0.425
3.30	0.600	680.87	0.469	0.000	-----	-----	-----	-----	-----	-----	-----	0.469
3.45	0.700	680.90	0.533	0.000	-----	-----	-----	-----	-----	-----	-----	0.533
3.60	0.800	680.94	0.613	0.000	-----	-----	-----	-----	-----	-----	-----	0.613
3.75	1.200	681.02	0.759	0.000	-----	-----	-----	-----	-----	-----	-----	0.759
3.90	1.800	681.15	1.050	0.000	-----	-----	-----	-----	-----	-----	-----	1.050
4.05	5.690 <<	681.65	2.088	0.000	-----	-----	-----	-----	-----	-----	-----	2.089
4.20	0.900	681.89 <<	2.444	0.000	-----	-----	-----	-----	-----	-----	-----	2.445 <<
4.35	0.600	681.56	1.914	0.000	-----	-----	-----	-----	-----	-----	-----	1.915
4.50	0.500	681.31	1.385	0.000	-----	-----	-----	-----	-----	-----	-----	1.385
4.65	0.500	681.15	1.033	0.000	-----	-----	-----	-----	-----	-----	-----	1.033
4.80	0.500	681.05	0.823	0.000	-----	-----	-----	-----	-----	-----	-----	0.823
4.95	0.300	680.97	0.661	0.000	-----	-----	-----	-----	-----	-----	-----	0.661
5.10	0.200	680.89	0.509	0.000	-----	-----	-----	-----	-----	-----	-----	0.509
5.25	0.200	680.83	0.401	0.000	-----	-----	-----	-----	-----	-----	-----	0.401
5.40	0.200	680.79	0.333	0.000	-----	-----	-----	-----	-----	-----	-----	0.334
5.55	0.200	680.77	0.291	0.000	-----	-----	-----	-----	-----	-----	-----	0.291
5.70	0.000	680.73	0.231	0.000	-----	-----	-----	-----	-----	-----	-----	0.231
5.85	0.000	680.69	0.164	0.000	-----	-----	-----	-----	-----	-----	-----	0.164
6.00	0.000	680.65	0.121	0.000	-----	-----	-----	-----	-----	-----	-----	0.121
6.15	0.000	680.63	0.090	0.000	-----	-----	-----	-----	-----	-----	-----	0.090
6.30	0.000	680.61	0.070	0.000	-----	-----	-----	-----	-----	-----	-----	0.070
6.45	0.000	680.60	0.055	0.000	-----	-----	-----	-----	-----	-----	-----	0.055
6.60	0.000	680.59	0.043	0.000	-----	-----	-----	-----	-----	-----	-----	0.043
6.75	0.000	680.58	0.034	0.000	-----	-----	-----	-----	-----	-----	-----	0.034
6.90	0.000	680.57	0.027	0.000	-----	-----	-----	-----	-----	-----	-----	0.027

...End

Pond Report

Pond No. 1 - <New Pond>

Pond Data

Trapezoid - Bottom L x W = 235.0 x 10.0 ft, Side slope = 0.00:1, Bottom elev. = 680.35 ft, Depth = 5.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	680.35	2,350	0	0
0.55	680.90	2,350	1,293	1,293
1.10	681.45	2,350	1,293	2,585
1.65	682.00	2,350	1,293	3,878
2.20	682.55	2,350	1,293	5,170
2.75	683.10	2,350	1,293	6,463
3.30	683.65	2,350	1,293	7,755
3.85	684.20	2,350	1,293	9,048
4.40	684.75	2,350	1,293	10,340
4.95	685.30	2,350	1,293	11,633
5.50	685.85	2,350	1,292	12,925

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.10	0.00	0.00
Span (in)	= 18.00	0.10	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 680.50	680.50	0.00	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 686.25	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	680.35	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.06	129	680.41	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.11	259	680.46	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.17	388	680.52	0.00 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.001
0.22	517	680.57	0.03 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.027
0.28	646	680.62	0.08 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.085
0.33	776	680.68	0.16 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.155
0.39	905	680.73	0.24 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.237
0.44	1,034	680.79	0.33 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.326
0.50	1,163	680.84	0.42 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.423
0.55	1,293	680.90	0.53 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.525
0.61	1,422	680.96	0.63 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.634
0.66	1,551	681.01	0.75 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.745
0.72	1,680	681.06	0.86 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.861
0.77	1,810	681.12	0.98 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.978
0.83	1,939	681.17	1.10 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.096
0.88	2,068	681.23	1.21 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.214
0.94	2,197	681.28	1.33 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.334
0.99	2,327	681.34	1.45 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.454
1.05	2,456	681.39	1.57 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.571
1.10	2,585	681.45	1.69 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.687
1.16	2,714	681.50	1.80 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.801
1.21	2,844	681.56	1.91 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.912
1.27	2,973	681.61	2.02 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.018
1.32	3,102	681.67	2.12 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.119
1.38	3,231	681.72	2.21 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.214
1.43	3,361	681.78	2.30 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.301
1.49	3,490	681.83	2.38 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.379
1.54	3,619	681.89	2.44 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.445
1.60	3,748	681.94	2.50 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.495
1.65	3,878	682.00	2.51 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.514
1.71	4,007	682.06	3.64 oc	0.00 ic	---	---	0.00	---	---	---	---	---	3.643
1.76	4,136	682.11	4.50 oc	0.00 ic	---	---	0.00	---	---	---	---	---	4.498
1.82	4,265	682.17	5.21 oc	0.00 ic	---	---	0.00	---	---	---	---	---	5.214

Continues on next page...

<New Pond>

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.87	4,395	682.22	5.84 oc	0.00 ic	---	---	0.00	---	---	---	---	---	5.842
1.93	4,524	682.28	6.41 oc	0.00 ic	---	---	0.00	---	---	---	---	---	6.410
1.98	4,653	682.33	6.93 oc	0.00 ic	---	---	0.00	---	---	---	---	---	6.931
2.04	4,782	682.38	7.42 oc	0.00 ic	---	---	0.00	---	---	---	---	---	7.416
2.09	4,912	682.44	7.87 oc	0.00 ic	---	---	0.00	---	---	---	---	---	7.871
2.15	5,041	682.49	8.30 oc	0.00 ic	---	---	0.00	---	---	---	---	---	8.300
2.20	5,170	682.55	8.71 oc	0.00 ic	---	---	0.00	---	---	---	---	---	8.710
2.26	5,299	682.61	9.10 oc	0.00 ic	---	---	0.00	---	---	---	---	---	9.100
2.31	5,429	682.66	9.47 oc	0.00 ic	---	---	0.00	---	---	---	---	---	9.474
2.37	5,558	682.72	9.83 oc	0.00 ic	---	---	0.00	---	---	---	---	---	9.834
2.42	5,687	682.77	10.18 oc	0.00 ic	---	---	0.00	---	---	---	---	---	10.18
2.48	5,816	682.83	10.52 oc	0.00 ic	---	---	0.00	---	---	---	---	---	10.52
2.53	5,946	682.88	10.84 oc	0.00 ic	---	---	0.00	---	---	---	---	---	10.84
2.59	6,075	682.93	11.04 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.04
2.64	6,204	682.99	11.22 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.22
2.70	6,333	683.04	11.40 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.40
2.75	6,463	683.10	11.57 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.57
2.81	6,592	683.16	11.74 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.74
2.86	6,721	683.21	11.91 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.91
2.92	6,850	683.27	12.08 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.08
2.97	6,980	683.32	12.24 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.24
3.03	7,109	683.37	12.40 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.40
3.08	7,238	683.43	12.56 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.56
3.14	7,367	683.48	12.72 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.72
3.19	7,497	683.54	12.87 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.87
3.25	7,626	683.59	13.03 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.03
3.30	7,755	683.65	13.18 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.18
3.36	7,884	683.71	13.33 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.33
3.41	8,014	683.76	13.48 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.48
3.47	8,143	683.81	13.63 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.63
3.52	8,272	683.87	13.77 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.77
3.58	8,401	683.92	13.91 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.92
3.63	8,531	683.98	14.06 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.06
3.69	8,660	684.03	14.20 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.20
3.74	8,789	684.09	14.34 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.34
3.80	8,918	684.14	14.48 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.48
3.85	9,048	684.20	14.61 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.61
3.91	9,177	684.25	14.75 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.75
3.96	9,306	684.31	14.88 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.88
4.02	9,435	684.36	15.02 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.02
4.07	9,565	684.42	15.15 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.15
4.13	9,694	684.47	15.28 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.28
4.18	9,823	684.53	15.41 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.41
4.23	9,952	684.58	15.54 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.54
4.29	10,082	684.64	15.66 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.66
4.34	10,211	684.69	15.79 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.79
4.40	10,340	684.75	15.92 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.92
4.46	10,469	684.81	16.04 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.04
4.51	10,599	684.86	16.16 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.17
4.57	10,728	684.92	16.29 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.29
4.62	10,857	684.97	16.41 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.41
4.67	10,986	685.03	16.53 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.53
4.73	11,116	685.08	16.65 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.65
4.78	11,245	685.13	16.77 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.77
4.84	11,374	685.19	16.89 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.89
4.89	11,503	685.24	17.00 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.01
4.95	11,633	685.30	17.12 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.12
5.01	11,762	685.36	17.24 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.24
5.06	11,891	685.41	17.35 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.35
5.12	12,020	685.47	17.47 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.47
5.17	12,150	685.52	17.58 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.58
5.22	12,279	685.58	17.69 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.69
5.28	12,408	685.63	17.81 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.81
5.33	12,537	685.68	17.92 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.92
5.39	12,667	685.74	18.03 ic	0.00 ic	---	---	0.00	---	---	---	---	---	18.03
5.44	12,796	685.79	18.14 ic	0.00 ic	---	---	0.00	---	---	---	---	---	18.14
5.50	12,925	685.85	18.25 ic	0.00 ic	---	---	0.00	---	---	---	---	---	18.25

...End

ATTACHMENT E

BMP Design Manual Compliance Worksheet and Hydromodification Management Plan (HMP) Modeling Report

County of San Diego Automated Stormwater Pollutant Control Worksheets
(Version 2.0)

WELCOME:

Welcome to the County of San Diego Automated Stormwater Pollutant Control Worksheets. These worksheets may be used to demonstrate compliance with stormwater pollutant control standards set forth in the 2013 MS4 Permit for Priority Development Projects and Green Street Projects.

INSTRUCTIONS:

General: To use this workbook, navigate to each of the worksheet tabs below and populate all yellow cells with project specific information. Yellow cells require user input, white cells are locked for editing and are automatically calculated, blue cells are also locked for editing and are automatically populated based on results from previous worksheet tabs, grey cells are items that do not require user input because of previous user inputs, orange cells represent warnings where supplemental information and/or revisions may be required for compliance. The worksheets are formatted to accommodate calculations for up to 10 drainage areas and associated BMPs. Each drainage area and BMP is represented as a discrete column with corresponding user inputs and calculations appearing in the rows below. Please note that projects with more than 10 drainage areas may need to use more than one workbook to accommodate the entire project.

Step 1. DCV: Provide the required inputs to determine the design capture volume for each PDP drainage area. The calculations in this worksheet determine the initial design capture volume and also apply any applicable reductions associated with site design techniques including dispersion to pervious surfaces, incorporation of tree wells, and incorporation of rain barrels.

Step 2. Retention Requirements: Provide required inputs to determine the minimum retention requirements for each drainage area.

Step 3. BMP Performance: Provide required inputs to determine the portion of the pollutant control performance standards that are satisfied by the proposed BMPs.

Reduced Size BMP Maintenance (optional): If BMPs with a footprint of less than 3% of the effective impervious tributary are proposed, provide required inputs to determine the anticipated frequency for major BMP maintenance activities.

DISCLAIMER:

The County of San Diego has developed this tool in an effort to streamline traditionally complex efforts associated with planning, design, submittal, and review of PDPs that are subject to stormwater pollutant control requirements set forth in the 2013 MS4 Permit. While the calculations performed herein are deemed to be in compliance with Permit requirements, applicants may elect to provide their own calculations. Use of this tool is optional and the County will not be held liable for any errors or other negative impacts associated with its use. In the event that the County performs updates to these worksheets, applicants that have not established reliance on previous versions of the worksheet via discretionary approval may be required to utilize the latest version of the worksheets. A summary of version releases is included below.

QUESTIONS:

-Questions relating to specific projects, submittal requirements, approval process, and/or policy-related issues should be directed your PDS Land Development Project Manager (link below).

PDS Land Development Project Manager

-General questions/comments on this worksheet may be directed to Charles Mohrlock in the County of San Diego Watershed Protection Program (link below).

charles.mohrlock@sdcounty.ca.gov

Automated Worksheet B.1: Calculation of Design Capture Volume (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	1										unitless
	2	85th Percentile 24-hr Storm Depth	0.81										inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)	43,890										sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)	40,290										sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?	No	No	No	No	No	No	No	No	No	No	yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)											sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	18	Number of Tree Wells Proposed per SD-A											#
	19	Average Mature Tree Canopy Diameter											ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	84,180	0	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	2,955	0	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface	0	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.52	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	2,955	0	0	0	0	0	0	0	0	0	cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
	34	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	35	Final Adjusted Runoff Factor	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	36	Final Effective Tributary Area	43,774	0	0	0	0	0	0	0	0	0	sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements	0	0	0	0	0	0	0	0	0	0	cubic-feet
	38	Final Design Capture Volume Tributary to BMP	2,955	0	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

Automated Worksheet B.2: Retention Requirements (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Basic Analysis	1	Drainage Basin ID or Name	1	-	-	-	-	-	-	-	-	-	unitless
	2	85th Percentile Rainfall Depth	0.81	-	-	-	-	-	-	-	-	-	inches
	3	Predominant NRCS Soil Type Within BMP Location	B										unitless
	4	Is proposed BMP location Restricted or Unrestricted for Infiltration Activities?	Restricted										unitless
	5	Nature of Restriction	n/a										unitless
	6	Do Minimum Retention Requirements Apply to this Project?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes/no
	7	Are Habitable Structures Greater than 9 Stories Proposed?	No										yes/no
Advanced Analysis	8	Has Geotechnical Engineer Performed an Infiltration Analysis?	Yes										yes/no
	9	Design Infiltration Rate Recommended by Geotechnical Engineer	1.500										in/hr
Result	10	Design Infiltration Rate Used To Determine Retention Requirements	0.000	-	-	-	-	-	-	-	-	-	in/hr
	11	Percent of Average Annual Runoff that Must be Retained within DMA	1.5%	-	-	-	-	-	-	-	-	-	percentage
	12	Fraction of DCV Requiring Retention	0.01	-	-	-	-	-	-	-	-	-	ratio
	13	Required Retention Volume	30	-	-	-	-	-	-	-	-	-	cubic-feet

No Warning Messages

Automated Worksheet B.3: BMP Performance (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
BMP Inputs	1	Drainage Basin ID or Name	1	-	-	-	-	-	-	-	-	-	sq-ft
	2	Design Infiltration Rate Recommended	0.000	-	-	-	-	-	-	-	-	-	in/hr
	3	Design Capture Volume Tributary to BMP	2,955	-	-	-	-	-	-	-	-	-	cubic-feet
	4	Is BMP Vegetated or Unvegetated?	Vegetated										unitless
	5	Is BMP Impermeably Lined or Unlined?	Lined										unitless
	6	Does BMP Have an Underdrain?	Underdrain										unitless
	7	Does BMP Utilize Standard or Specialized Media?	Standard										unitless
	8	Provided Surface Area	2,408										sq-ft
	9	Provided Surface Ponding Depth	12										inches
	10	Provided Soil Media Thickness	24										inches
	11	Provided Gravel Thickness (Total Thickness)	30										inches
	12	Underdrain Offset	3										inches
	13	Diameter of Underdrain or Hydromod Orifice (Select Smallest)	0.89										inches
	14	Specialized Soil Media Filtration Rate											in/hr
	15	Specialized Soil Media Pore Space for Retention											unitless
	16	Specialized Soil Media Pore Space for Biofiltration											unitless
	17	Specialized Gravel Media Pore Space											unitless
Retention Calculations	18	Volume Infiltrated Over 6 Hour Storm	0	0	0	0	0	0	0	0	0	0	cubic-feet
	19	Ponding Pore Space Available for Retention	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	unitless
	20	Soil Media Pore Space Available for Retention	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	unitless
	21	Gravel Pore Space Available for Retention (Above Underdrain)	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	22	Gravel Pore Space Available for Retention (Below Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	23	Effective Retention Depth	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	24	Fraction of DCV Retained (Independent of Drawdown Time)	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	25	Calculated Retention Storage Drawdown Time	120	0	0	0	0	0	0	0	0	0	hours
	26	Efficacy of Retention Processes	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	27	Volume Retained by BMP (Considering Drawdown Time)	535	0	0	0	0	0	0	0	0	0	cubic-feet
	28	Design Capture Volume Remaining for Biofiltration	2,420	0	0	0	0	0	0	0	0	0	cubic-feet
Biofiltration Calculations	29	Max Hydromod Flow Rate through Underdrain	0.0475	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	cfs
	30	Max Soil Filtration Rate Allowed by Underdrain Orifice	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	31	Soil Media Filtration Rate per Specifications	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	in/hr
	32	Soil Media Filtration Rate to be used for Sizing	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	in/hr
	33	Depth Biofiltered Over 6 Hour Storm	5.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	34	Ponding Pore Space Available for Biofiltration	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Soil Media Pore Space Available for Biofiltration	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	unitless
	36	Gravel Pore Space Available for Biofiltration (Above Underdrain)	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	unitless
	37	Effective Depth of Biofiltration Storage	27.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	38	Drawdown Time for Surface Ponding	14	0	0	0	0	0	0	0	0	0	hours
	39	Drawdown Time for Effective Biofiltration Depth	32	0	0	0	0	0	0	0	0	0	hours
	40	Total Depth Biofiltered	32.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	inches
	41	Option 1 - Biofilter 1.50 DCV: Target Volume	3,630	0	0	0	0	0	0	0	0	0	cubic-feet
	42	Option 1 - Provided Biofiltration Volume	3,630	0	0	0	0	0	0	0	0	0	cubic-feet
	43	Option 2 - Store 0.75 DCV: Target Volume	1,815	0	0	0	0	0	0	0	0	0	cubic-feet
	44	Option 2 - Provided Storage Volume	1,815	0	0	0	0	0	0	0	0	0	cubic-feet
	45	Portion of Biofiltration Performance Standard Satisfied	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
Result	46	Do Site Design Elements and BMPs Satisfy Annual Retention Requirements?	Yes	-	-	-	-	-	-	-	-	-	yes/no
	47	Overall Portion of Performance Standard Satisfied (BMP Efficacy Factor)	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ratio
	48	**Deficit of Effectively Treated Stormwater**	0	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	cubic-feet

No Warning Messages

Automated Worksheet B.4: Reduced Size BMP Maintenance Interval (V2.0)

Category	#	Description	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	Units
Drainage Basin Info	1	Drainage Basin ID or Name	-	-	-	-	-	-	-	-	-	-	unitless
	2	Final Effective Tributary Area	-	-	-	-	-	-	-	-	-	-	sq-ft
	3	Provided BMP Surface Area	-	-	-	-	-	-	-	-	-	-	sq-ft
Biofiltration Clogging Inputs	4	Average Annual Precipitation											inches
	5	Load to Clog (default =2.0)											lb/sq-ft
	6	TSS Pretreatment Efficacy											yes/no
	7	Percentage "Commercial"											percentage
	8	Percentage "Education"											percentage
	9	Percentage "Industrial"											percentage
	10	Percentage "Low Traffic Areas"											percentage
	11	Percentage "Multi-Family Residential"											percentage
	12	Percentage "Roof Areas"											percentage
	13	Percentage "Single Family Residential"											percentage
	14	Percentage "Transportation"											percentage
	15	Percentage "Vacant/Open Space"											percentage
	16	Percentage "Steep Hillslopes"											percentage
Result	17	Total Percentage of Above Land Uses	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	percentage
	18	Average TSS Concentration for Tributary After Pretreatment	0	0	0	0	0	0	0	0	0	0	mg/L
	19	Average Annual Runoff Volume	0	0	0	0	0	0	0	0	0	0	cubic-feet
	20	Average Annual TSS Load	0	0	0	0	0	0	0	0	0	0	lb/yr
	21	Available Sediment Storage within BMP	0	0	0	0	0	0	0	0	0	0	lb
	22	Anticipated Major Maintenance Frequency	-	-	-	-	-	-	-	-	-	-	years

No Warning Messages

County of San Diego Automated Worksheets for Significant Site Design BMPs (SSD-BMPs)
SD-A Tree Wells and SD-B Impervious Area Dispersion (Dispersion Areas)
(Version 1.0)

WELCOME:

Welcome to the County of San Diego Automated Worksheets for Significant Site Design BMPs. These worksheets may be used to demonstrate compliance with stormwater pollutant control standards and hydromodification flow control standards set forth in the 2013 MS4 Permit for Priority Development Projects (PDPs).

This workbook is intended for use to demonstrate compliance when significant site design BMPs (SSD-BMPs) are proposed. SSD-BMPs are passive treatment systems that include SD-A Tree Wells and SD-B Dispersion Areas. This worksheet does not support the use of underdrains in SD-A or SD-B. If underdrains are proposed, then continuous simlation modeling should be performed.

When structural BMPs (INF-1, INF-2, INF-3, PR-1, BF-1, BF-2) are proposed, a different workbook, "County of San Diego Automated Stormwater Pollutant Control Worksheets" must be used.

INSTRUCTIONS:

General: To use this workbook, navigate to each of the worksheet tabs below and populate all light green cells with project specific information. Light green cells require user input, white cells are locked for editing and are automatically calculated, bright green cells are also locked for editing and are automatically populated based on results from previous worksheet tabs, grey cells are items that do not require user input because of previous user inputs, orange cells represent warnings where supplemental information and/or revisions may be required for compliance. The worksheets are formatted to accommodate calculations for up to 10 drainage areas and associated BMPs. Each drainage area and BMP is represented as a discrete column with corresponding user inputs and calculations appearing in the rows below. Please note that projects with more than 10 drainage areas may need to use more than one workbook to accommodate the entire project.

Step 1. DCV: Provide the required inputs to determine the design capture volume (DCV) for each PDP drainage management area (DMA). The calculations in this worksheet determine the initial design capture volume and also apply any applicable reductions associated with dispersion to pervious surfaces and incorporation of rain barrels. For DMAs intended to satisfy pollutant control and hydromodification control (when applicable) requirements using Dispersion Areas alone (i.e., not in combination with Tree Wells), the data entered in this tab must provide sufficient pervious area to reduce the remaining DCV in Line 37 to zero. Note that the use of semi-pervious surfaces as dispersion area will not reduce DCV to zero, but the use of engineered pervious surfaces and/or natural pervious surfaces can. For DMAs intended to incorporate Tree Wells, the remaining DCV in Line 37 is the amount to be managed by Tree Wells.

Step 2. Dispersion Areas: [Projects that do not use Dispersion Areas skip this step and go on to Step 3.] When the project includes Dispersion Areas per SD-B, provide required inputs to demonstrate that the requirements for Dispersion Areas are satisfied. If the DMA will also use SD-A Tree Wells downstream of the Dispersion Area to satisfy pollutant control and hydromodification control (when applicable), continue to Step 3. Tree Wells.

Step 3. Tree Wells: [Projects that do not use Tree Wells do not use this Step.] When the project includes Tree Wells per SD-A, provide required inputs to demonstrate that the requirements for Tree Wells are satisfied.

DISCLAIMER:

The County of San Diego has developed this tool in an effort to streamline traditionally complex efforts associated with planning, design, submittal, and review of PDPs. While the calculations performed herein are deemed to be in compliance with 2013 MS4 Permit requirements, applicants may elect to provide their own calculations. Use of this tool is optional and the County will not be held liable for any errors or other negative impacts associated with its use. In the event that the County performs updates to these worksheets, applicants that have not established reliance on previous versions of the worksheet via discretionary approval may be required to utilize the latest version of the worksheets. A summary of version releases is included below.

QUESTIONS:

-Questions relating to specific projects, submittal requirements, approval process, and/or policy-related issues should be directed your PDS Land Development Project Manager (link below).

PDS Land Development Project Manager

-General questions/comments on this worksheet may be directed via email to BMP.Program@sdcounty.ca.gov with the subject line "SSD-BMP assistance."

SSD-BMP Automated Worksheet I-1: Step 1. Calculation of Design Capture Volume (V1.0)													
Category	**#**	**Description**	*i*	*ii*	*iii*	*iv*	*v*	*vi*	*vii*	*viii*	*ix*	*x*	**Units**
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name	2										unitless
	2	85th Percentile 24-hr Storm Depth	0.81										inches
	3	Is Hydromodification Control Applicable?	No										yes/no
	4	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)											sq-ft
	5	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)											sq-ft
	6	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)											sq-ft
	7	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)											sq-ft
	8	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)											sq-ft
	9	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)											sq-ft
	10	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)											sq-ft
SSD-BMPs Proposed	11	Does Tributary Incorporate Dispersion and/or Rain Barrels?	Yes										yes/no
	12	Does Tributary Incorporate Tree Wells?	No										yes/no
Dispersion Area & Rain Barrel Inputs (Optional)	13	Impervious Surfaces **Directed to Dispersion Area** per SD-B (Ci=0.90)	4,815										sq-ft
	14	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	15	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-B (Ci=0.10)	2,350										sq-ft
	16	Natural Type A Soil **Serving as Dispersion Area** per SD-B (Ci=0.10)											sq-ft
	17	Natural Type B Soil **Serving as Dispersion Area** per SD-B (Ci=0.14)											sq-ft
	18	Natural Type C Soil **Serving as Dispersion Area** per SD-B (Ci=0.23)											sq-ft
	19	Natural Type D Soil **Serving as Dispersion Area** per SD-B (Ci=0.30)											sq-ft
	20	Number of Rain Barrels Proposed per SD-E											#
	21	Average Rain Barrel Size											gal
Initial Runoff Factor Calculation	22	Total Tributary Area	7,165	0	0	0	0	0	0	0	0	0	sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	25	Initial Weighted Runoff Factor	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	26	Initial Design Capture Volume	310	0	0	0	0	0	0	0	0	0	cubic-feet
Dispersion Area Adjustment & Rain Barrel Adjustment	27	Total Impervious Area Dispersed to Pervious Surface	4,815	0	0	0	0	0	0	0	0	0	sq-ft
	28	Total Pervious Dispersion Area	2,350	0	0	0	0	0	0	0	0	0	sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area for DCV Reduction	2.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	ratio
	31	Runoff Factor After Dispersion Techniques	0.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	unitless
	32	Design Capture Volume After Dispersion Techniques	0	0	0	0	0	0	0	0	0	0	cubic-feet
	33	Total Rain Barrel Volume Reduction	0	0	0	0	0	0	0	0	0	0	cubic-feet
Results	34	Final Adjusted Runoff Factor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	unitless
	35	Final Effective Tributary Area	0	0	0	0	0	0	0	0	0	0	sq-ft
	36	Initial Design Capture Volume Retained by Dispersion Area and Rain Barrel(s)	310	0	0	0	0	0	0	0	0	0	cubic-feet
	37	Remaining Design Capture Volume Tributary to Tree Well(s)	0	0	0	0	0	0	0	0	0	0	cubic-feet

No Warning Messages

SSD-BMP Automated Worksheet I-2: Step 2. Dispersion Area Validation (V1.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Dispersion Area Inputs	1	Drainage Basin ID or Name	2	-	-	-	-	-	-	-	-	-	unitless
	2	Final Design Capture Volume (DCV)	0	-	-	-	-	-	-	-	-	-	cubic-feet
	3	Is Hydromodification Control Applicable?	No	-	-	-	-	-	-	-	-	-	yes/no
	4	Total Impervious Area Dispersed to Pervious Surface	4,815	-	-	-	-	-	-	-	-	-	sq-ft
	5	Total Engineered Pervious Surface and/or Natural Soil Dispersion Area (Does Not Include Semi-Pervious Surfaces Serving as Dispersion Area)	2,350	-	-	-	-	-	-	-	-	-	sq-ft
	6	Ratio of Dispersed Impervious Area to Total Engineered Pervious Surface and/or Natural Soil Dispersion Area	2.05	-	-	-	-	-	-	-	-	-	unitless
	7	Dispersion Area Length (Length of Sheet Flow Across Dispersion Area)	10										feet
	8	Dispersion Area Slope	1.0										%
	9	Thickness of Amended Soil	0										inches
	10	How is Flow Dispersed Across Width of Dispersion Area (definitions below*)?	Sheet Flow										unitless
Results	11	Is DCV Requirement Fully Satisfied by Dispersion Area?	Yes	-	-	-	-	-	-	-	-	-	yes/no
	12	Is Hydromodification Control Requirement Satisfied by Dispersion Area?	n/a	-	-	-	-	-	-	-	-	-	yes/no
	13	Are Dispersion Area Length, Slope, and Thickness of Amended Soil (when applicable) Adequate?	Yes	-	-	-	-	-	-	-	-	-	yes/no

No Warning Messages

Notes:

***How is Flow Dispersed Across Width of Pervious Dispersion Area?**

Sheet Flow:	Flow arrives as sheet flow across the width of the adjacent impervious area
Spreader(s):	Flow is discharged from flow spreader(s) across the width of the pervious area
Roof Drains:	Discharge from roof drains distributed across the width of the pervious area
Curb Cuts:	Discharge from curb cuts distributed across the width of the pervious area
Other:	Other (Describe in PDP SWQMP)

SSD-BMP Automated Worksheet I-3: Step 3. Tree Well Sizing (V1.0)

Category	#	Description	i	ii	iii	iv	v	vi	vii	viii	ix	x	Units
Standard Tree Well Inputs	1	Drainage Basin ID or Name	-	-	-	-	-	-	-	-	-	-	unitless
	2	Design Capture Volume Tributary to BMP	-	-	-	-	-	-	-	-	-	-	cubic-feet
	3	Is Hydromodification Control Applicable?	-	-	-	-	-	-	-	-	-	-	yes/no
	4	Predominant NRCS Soil Type Within Tree Well(s) Location											unitless
	5	Select a Tree Species for the Tree Well(s) Consistent with SD-A Tree Palette Table Note: Numbers shown in list are Tree Species Mature Canopy Diameters											unitless
	6	Tree Well(s) Soil Depth (Installation Depth) Must be 30, 36, 42, or 48 Inches; Select from Standard Depths**											inches
	7	Number of Identical* Tree Wells Proposed for this DMA											trees
	8	Proposed Width of Tree Well(s) Soil Installation for One (1) Tree											feet
	9	Proposed Length of Tree Well(s) Soil Installation for One (1) Tree											feet
Tree Data	10	Botanical Name of Tree Species	-	-	-	-	-	-	-	-	-	-	unitless
	11	Tree Species Mature Height per SD-A	-	-	-	-	-	-	-	-	-	-	feet
	12	Tree Species Mature Canopy Diameter per SD-A	-	-	-	-	-	-	-	-	-	-	feet
	13	Minimum Soil Volume Required In Tree Well (2 Cubic Feet Per Square Foot of Mature Tree Canopy Projection Area)	-	-	-	-	-	-	-	-	-	-	cubic-feet
	14	Credit Volume Per Tree	-	-	-	-	-	-	-	-	-	-	cubic-feet
Tree Well Sizing Calculations	15	DCV Multiplier To Meet Flow Control Requirements	-	-	-	-	-	-	-	-	-	-	unitless
	16	Required Retention Volume (RRV) To Meet Flow Control Requirements	-	-	-	-	-	-	-	-	-	-	cubic-feet
	17	Number of Trees Required	-	-	-	-	-	-	-	-	-	-	trees
	18	Total Area of Tree Well Soil Required for Each Tree	-	-	-	-	-	-	-	-	-	-	sq-ft
	19	Approximate Required Width of Tree Well Soil Area for Each Tree	-	-	-	-	-	-	-	-	-	-	feet
	20	Approximate Required Length of Tree Well Soil Area for Each Tree	-	-	-	-	-	-	-	-	-	-	feet
	21	Number of Trees Proposed for this DMA	-	-	-	-	-	-	-	-	-	-	trees
	22	Total Area of Tree Well Soil Proposed for Each Tree	-	-	-	-	-	-	-	-	-	-	sq-ft
	23	Minimum Spacing Between Multiple Trees To Meet Soil Area Requirements (when applicable)***	-	-	-	-	-	-	-	-	-	-	feet
Results	24	Are Tree Well Soil Installation Requirements Met?	-	-	-	-	-	-	-	-	-	-	yes/no
	25	Is Remaining DCV Requirement Fully Satisfied by Tree Well(s)?	-	-	-	-	-	-	-	-	-	-	yes/no
	26	Is Hydromodification Control Requirement Satisfied by Tree Well(s)?	-	-	-	-	-	-	-	-	-	-	yes/no

No Warning Messages

Notes:

*If using more than one mature canopy diameter within the same DMA, only the smallest mature canopy diameter should be entered. Alternatively, if more than one mature canopy diameter is proposed and/or the dimensions of multiple tree well installations will vary, separate DMAs may be delineated.

**If the actual proposed installation depth is not available in the table of standard depths, select the next lower depth.

***Tree Canopy or Agency Requirements May Also Influence the Minimum Spacing of Trees.

SDHM 3.1

PROJECT REPORT

General Model Information

Project Name:	25-062rev3
Site Name:	Montiel
Site Address:	1434 Montiel Road
City:	Escondido
Report Date:	4/8/2026
Gage:	ESCONDID
Data Start:	10/01/1964
Data End:	09/30/2004
Timestep:	Hourly
Precip Scale:	1.000
Version Date:	2021/06/28

POC Thresholds

Low Flow Threshold for POC1:	10 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
B,NatVeg,Flat	1.94
Pervious Total	1.94
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.94

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
B,NatVeg,Flat	0.94
Pervious Total	0.94

Impervious Land Use	acre
IMPERVIOUS-FLAT	1
Impervious Total	1
Basin Total	1.94

Element Flows To:

Surface	Interflow	Groundwater
Surface Biofilter 1	Surface Biofilter 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Biofilter 1

Bottom Length:		235.00 ft.
Bottom Width:		10.00 ft.
Material thickness of first layer:		0.25
Material type for first layer:		Mulch
Material thickness of second layer:		1.5
Material type for second layer:		ESM
Material thickness of third layer:		1.5
Material type for third layer:		GRAVEL
Underdrain used		
Underdrain Diameter (feet):		0.67
Orifice Diameter (in.):		0.89
Offset (in.):		3
Flow Through Underdrain (ac-ft.):		37.126
Total Outflow (ac-ft.):		40.2
Percent Through Underdrain:		92.35
Discharge Structure		
Riser Height:	5.25 ft.	
Riser Diameter:	12 in.	
Orifice 1 Diameter:	0.1 in.	Elevation:0.75 ft.

Element Flows To:
Outlet 1 Outlet 2

Biofilter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
677.00	0.0539	0.0000	0.0000	0.0000
677.10	0.0539	0.0017	0.0000	0.0000
677.21	0.0539	0.0034	0.0000	0.0000
677.31	0.0539	0.0051	0.0000	0.0000
677.42	0.0539	0.0068	0.0000	0.0000
677.52	0.0539	0.0084	0.0000	0.0000
677.63	0.0539	0.0101	0.0000	0.0000
677.73	0.0539	0.0118	0.0000	0.0000
677.84	0.0539	0.0135	0.0000	0.0000
677.94	0.0539	0.0152	0.0000	0.0000
678.04	0.0539	0.0169	0.0000	0.0000
678.15	0.0539	0.0186	0.0000	0.0000
678.25	0.0539	0.0203	0.0017	0.0000
678.36	0.0539	0.0220	0.0025	0.0000
678.46	0.0539	0.0237	0.0043	0.0000
678.57	0.0539	0.0253	0.0051	0.0000
678.67	0.0539	0.0270	0.0065	0.0000
678.77	0.0539	0.0294	0.0071	0.0000
678.88	0.0539	0.0317	0.0082	0.0000
678.98	0.0539	0.0340	0.0087	0.0000
679.09	0.0539	0.0364	0.0091	0.0000
679.19	0.0539	0.0387	0.0093	0.0000
679.30	0.0539	0.0411	0.0101	0.0000
679.40	0.0539	0.0434	0.0116	0.0000
679.51	0.0539	0.0457	0.0132	0.0000
679.61	0.0539	0.0481	0.0148	0.0000
679.71	0.0539	0.0504	0.0163	0.0000
679.82	0.0539	0.0527	0.0177	0.0000

679.92	0.0539	0.0551	0.0190	0.0000
680.03	0.0539	0.0574	0.0202	0.0000
680.13	0.0539	0.0598	0.0214	0.0000
680.24	0.0539	0.0621	0.0226	0.0000
680.25	0.0539	0.0624	0.0372	0.0000

Biofilter Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
3.2500	0.0539	0.0624	0.0000	0.2720	0.0000
3.3544	0.0539	0.0680	0.0000	0.2720	0.0000
3.4588	0.0539	0.0737	0.0000	0.3552	0.0000
3.5632	0.0539	0.0793	0.0000	0.3741	0.0000
3.6676	0.0539	0.0849	0.0000	0.3930	0.0000
3.7720	0.0539	0.0906	0.0000	0.4120	0.0000
3.8764	0.0539	0.0962	0.0000	0.4309	0.0000
3.9808	0.0539	0.1018	0.0000	0.4498	0.0000
4.0852	0.0539	0.1075	0.0001	0.4688	0.0000
4.1896	0.0539	0.1131	0.0001	0.4877	0.0000
4.2940	0.0539	0.1187	0.0001	0.5066	0.0000
4.3984	0.0539	0.1244	0.0002	0.5256	0.0000
4.5027	0.0539	0.1300	0.0002	0.5445	0.0000
4.6071	0.0539	0.1356	0.0002	0.5634	0.0000
4.7115	0.0539	0.1412	0.0002	0.5823	0.0000
4.8159	0.0539	0.1469	0.0002	0.6013	0.0000
4.9203	0.0539	0.1525	0.0003	0.6202	0.0000
5.0247	0.0539	0.1581	0.0003	0.6391	0.0000
5.1291	0.0539	0.1638	0.0003	0.6581	0.0000
5.2335	0.0539	0.1694	0.0003	0.6770	0.0000
5.3379	0.0539	0.1750	0.0003	0.6959	0.0000
5.4423	0.0539	0.1807	0.0003	0.7148	0.0000
5.5467	0.0539	0.1863	0.0003	0.7338	0.0000
5.6511	0.0539	0.1919	0.0003	0.7527	0.0000
5.7555	0.0539	0.1976	0.0004	0.7716	0.0000
5.8599	0.0539	0.2032	0.0004	0.7906	0.0000
5.9643	0.0539	0.2088	0.0004	0.8095	0.0000
6.0687	0.0539	0.2145	0.0004	0.8284	0.0000
6.1731	0.0539	0.2201	0.0004	0.8474	0.0000
6.2775	0.0539	0.2257	0.0004	0.8663	0.0000
6.3819	0.0539	0.2314	0.0004	0.8852	0.0000
6.4863	0.0539	0.2370	0.0004	0.9041	0.0000
6.5907	0.0539	0.2426	0.0004	0.9231	0.0000
6.6951	0.0539	0.2483	0.0004	0.9420	0.0000
6.7995	0.0539	0.2539	0.0005	0.9609	0.0000
6.9038	0.0539	0.2595	0.0005	0.9799	0.0000
7.0082	0.0539	0.2652	0.0005	0.9988	0.0000
7.1126	0.0539	0.2708	0.0005	1.0177	0.0000
7.2170	0.0539	0.2764	0.0005	1.0367	0.0000
7.3214	0.0539	0.2820	0.0005	1.0556	0.0000
7.4258	0.0539	0.2877	0.0005	1.0745	0.0000
7.5302	0.0539	0.2933	0.0005	1.0934	0.0000
7.6346	0.0539	0.2989	0.0005	1.1124	0.0000
7.7390	0.0539	0.3046	0.0005	1.1313	0.0000
7.8434	0.0539	0.3102	0.0005	1.1502	0.0000
7.9478	0.0539	0.3158	0.0005	1.1692	0.0000
8.0522	0.0539	0.3215	0.0005	1.1881	0.0000
8.1566	0.0539	0.3271	0.0006	1.2070	0.0000
8.2610	0.0539	0.3327	0.0006	1.2260	0.0000
8.3654	0.0539	0.3384	0.0006	1.2449	0.0000

8.4698	0.0539	0.3440	0.0006	1.2638	0.0000
8.5742	0.0539	0.3496	0.2143	1.2827	0.0000
8.6786	0.0539	0.3553	0.7761	1.3017	0.0000
8.7830	0.0539	0.3609	1.4142	1.3206	0.0000
8.8874	0.0539	0.3665	1.9161	1.3395	0.0000
8.9918	0.0539	0.3722	2.1884	1.3585	0.0000
9.0962	0.0539	0.3778	2.4325	1.3774	0.0000
9.2005	0.0539	0.3834	2.6368	1.3963	0.0000
9.3049	0.0539	0.3891	2.8264	1.4152	0.0000
9.4093	0.0539	0.3947	3.0041	1.4342	0.0000
9.5000	0.0539	0.3996	3.1718	1.4506	0.0000

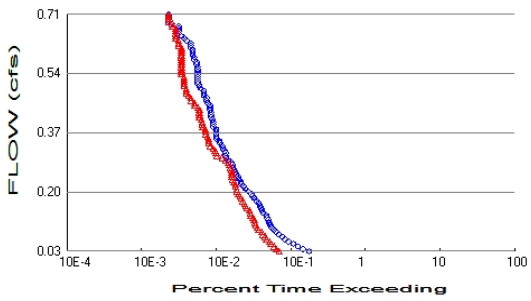
Surface Biofilter 1

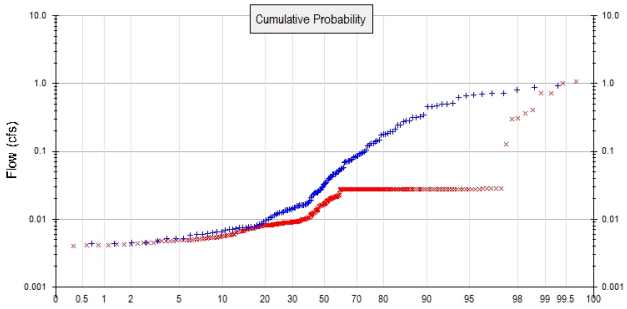
Element Flows To:

Outlet 1	Outlet 2
	Biofilter 1

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.94
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.94
Total Impervious Area: 1

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.282255
5 year	0.652671
10 year	0.714616
25 year	0.895149

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.027781
5 year	0.257666
10 year	0.678885
25 year	1.015043

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0282	613	246	40	Pass
0.0352	507	224	44	Pass
0.0421	437	208	47	Pass
0.0490	380	190	50	Pass
0.0560	323	182	56	Pass
0.0629	291	165	56	Pass
0.0698	269	159	59	Pass
0.0768	242	149	61	Pass
0.0837	224	143	63	Pass
0.0906	210	129	61	Pass
0.0976	193	125	64	Pass
0.1045	189	119	62	Pass
0.1114	180	115	63	Pass
0.1184	173	113	65	Pass
0.1253	169	110	65	Pass
0.1322	165	102	61	Pass
0.1392	150	100	66	Pass
0.1461	144	98	68	Pass
0.1530	139	90	64	Pass
0.1600	135	87	64	Pass
0.1669	131	84	64	Pass
0.1738	122	80	65	Pass
0.1808	114	76	66	Pass
0.1877	108	73	67	Pass
0.1946	105	70	66	Pass
0.2016	94	67	71	Pass
0.2085	88	66	75	Pass
0.2154	82	64	78	Pass
0.2224	76	64	84	Pass
0.2293	75	61	81	Pass
0.2362	72	58	80	Pass
0.2432	69	57	82	Pass
0.2501	65	57	87	Pass
0.2570	63	57	90	Pass
0.2640	61	57	93	Pass
0.2709	59	55	93	Pass
0.2778	58	53	91	Pass
0.2848	56	51	91	Pass
0.2917	51	47	92	Pass
0.2986	48	42	87	Pass
0.3056	47	36	76	Pass
0.3125	47	35	74	Pass
0.3194	45	34	75	Pass
0.3264	43	32	74	Pass
0.3333	42	29	69	Pass
0.3402	40	28	70	Pass
0.3472	39	28	71	Pass
0.3541	36	28	77	Pass
0.3610	35	27	77	Pass
0.3680	35	25	71	Pass
0.3749	35	25	71	Pass
0.3818	35	25	71	Pass
0.3888	32	23	71	Pass

0.3957	32	23	71	Pass
0.4026	32	23	71	Pass
0.4096	31	22	70	Pass
0.4165	30	21	70	Pass
0.4234	30	21	70	Pass
0.4304	30	21	70	Pass
0.4373	29	21	72	Pass
0.4442	29	20	68	Pass
0.4512	29	18	62	Pass
0.4581	27	18	66	Pass
0.4650	26	16	61	Pass
0.4720	26	16	61	Pass
0.4789	24	15	62	Pass
0.4858	24	14	58	Pass
0.4928	24	14	58	Pass
0.4997	22	14	63	Pass
0.5066	21	13	61	Pass
0.5136	20	13	65	Pass
0.5205	20	13	65	Pass
0.5274	20	13	65	Pass
0.5344	20	13	65	Pass
0.5413	20	12	60	Pass
0.5482	20	12	60	Pass
0.5552	20	12	60	Pass
0.5621	20	12	60	Pass
0.5690	19	12	63	Pass
0.5760	19	12	63	Pass
0.5829	18	12	66	Pass
0.5898	18	12	66	Pass
0.5968	17	12	70	Pass
0.6037	17	12	70	Pass
0.6106	17	12	70	Pass
0.6176	16	12	75	Pass
0.6245	16	11	68	Pass
0.6314	16	11	68	Pass
0.6384	14	11	78	Pass
0.6453	13	10	76	Pass
0.6522	12	10	83	Pass
0.6592	11	10	90	Pass
0.6661	11	10	90	Pass
0.6730	11	10	90	Pass
0.6799	11	9	81	Pass
0.6869	9	9	100	Pass
0.6938	8	8	100	Pass
0.7007	8	8	100	Pass
0.7077	8	8	100	Pass
0.7146	8	8	100	Pass

Water Quality

Drawdown Time Results

Pond: Surface Biofilter 1

Days	Stage(feet)	Percent of Total Run Time
1	N/A	N/A
2	N/A	N/A
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A

Maximum Stage: 5.500 Drawdown Time: Less than 1 day

Model Default Modifications

Total of 0 changes have been made.

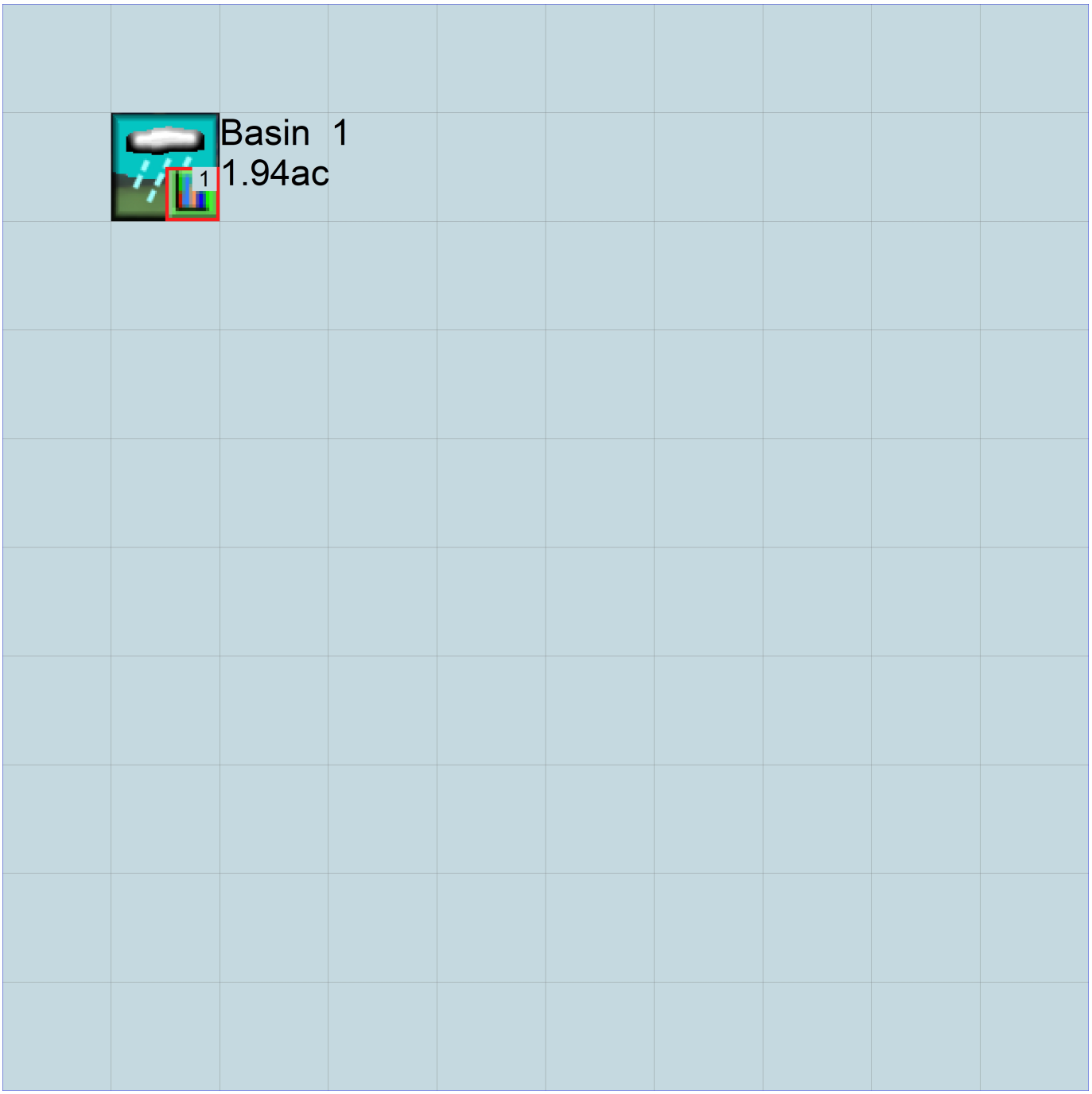
PERLND Changes

No PERLND changes have been made.

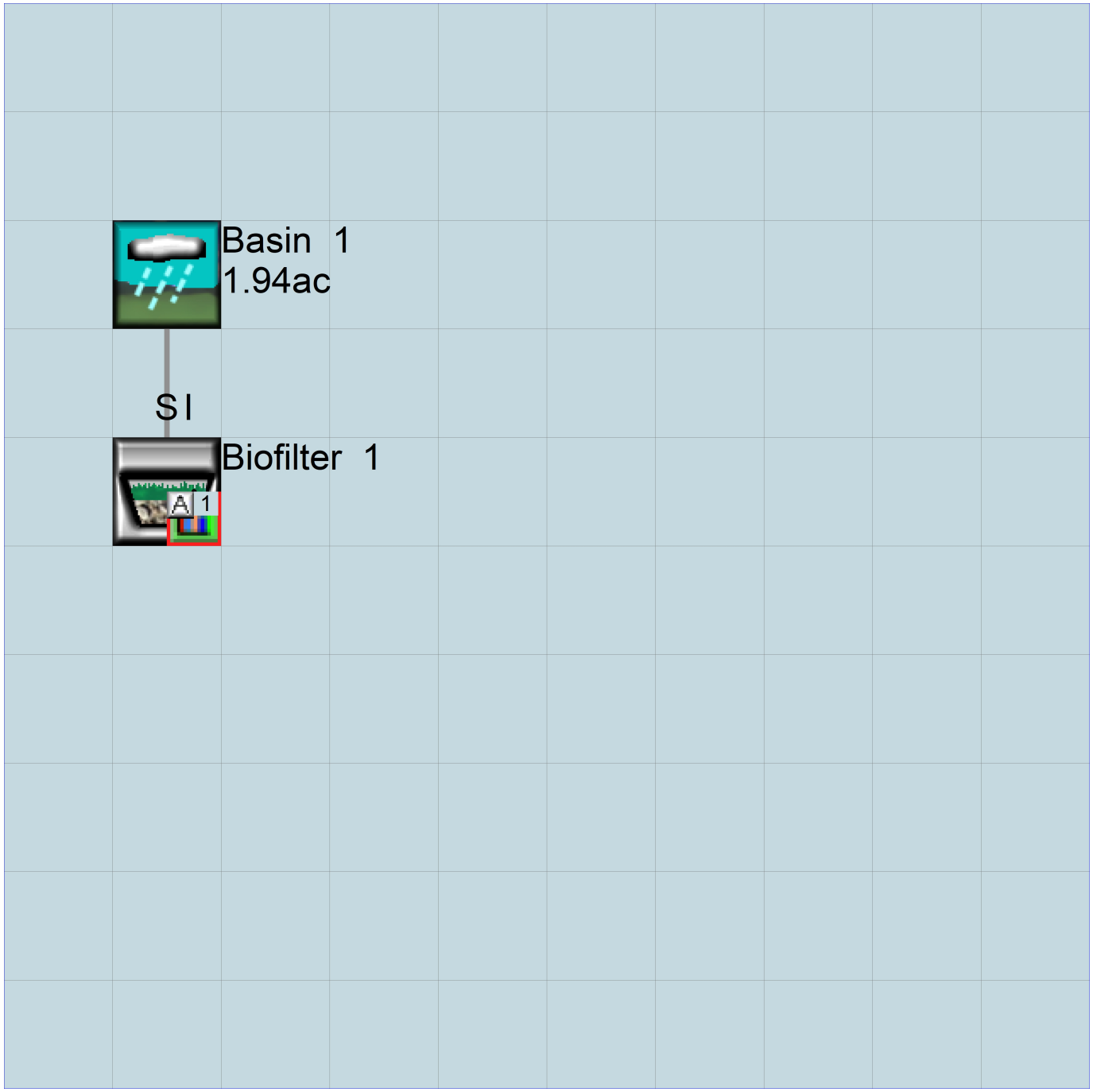
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1964 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   25-062rev3.wdm
MESSU       25   Mit25-062rev3.MES
            27   Mit25-062rev3.L61
            28   Mit25-062rev3.L62
            30   POC25-062rev31.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:60
      PERLND      10
      IMPLND       1
      GENER        2
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Surface Biofilter  1        MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   10      B,NatVeg,Flat          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   10         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   10         0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   10              0         4      0.07       100      0.05       2.5     0.915
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10              0         0         2         2         0      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                 ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10              0       0.6      0.04         1       0.3         0
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   10       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   10       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   10              0         0      0.01         0       0.4      0.01         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      IMPERVIOUS-FLAT        1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO
```

```
  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    1
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1           100      0.05     0.011       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  10                       0.94     RCHRES   1      2
PERLND  10                       0.94     RCHRES   1      3
IMPLND   1                          1     RCHRES   1      5

******Routing******
PERLND  10                       0.94     COPY     1     12
IMPLND   1                          1     COPY     1     15
PERLND  10                       0.94     COPY     1     13
RCHRES   1                          1     RCHRES   2      8
RCHRES   2                          1     COPY   501     16
RCHRES   1                          1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1
GENER    2 OUTPUT TIMSER      .0002778     RCHRES   1     EXTNL  OUTDGT 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                        in  out                             ***
    1     Surface Biofilte-004    2    1    1    1   28    0    1
    2     Biofilter  1            1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
```

```
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *      *  *  *  *  *        ***
    1        0  1  0  0    4  5  0  0  0       0  1  0  0  0       2  1  2  2  2
    2        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->      ***
    1              1      0.01       0.0     677.0       0.0       0.0
    2              2      0.04       0.0     677.0       0.0       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <--><--><--><--><--> *** <--><--><--><--><--><--><-->
    1            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL             4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Target Variable Names
***                  addr or                       addr or
***                 <------>                      <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2           =  2852.19
*** Compute remaining available pore space
  GENER   2                               vpo2           =  v2m2
  GENER   2                               vpo2          -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2           =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2           =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   33    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
```

```
0.000000  0.053949  0.000000  0.000000
0.104396  0.053949  0.001690  0.000000
0.208791  0.053949  0.003379  0.000000
0.313187  0.053949  0.005069  0.000000
0.417582  0.053949  0.006758  0.000000
0.521978  0.053949  0.008448  0.000000
0.626374  0.053949  0.010138  0.000000
0.730769  0.053949  0.011827  0.000000
0.835165  0.053949  0.013517  0.000000
0.939560  0.053949  0.015206  0.000000
1.043956  0.053949  0.016896  0.000000
1.148352  0.053949  0.018586  0.000000
1.252747  0.053949  0.020275  0.001695
1.357143  0.053949  0.021965  0.002543
1.461538  0.053949  0.023654  0.004271
1.565934  0.053949  0.025344  0.005135
1.670330  0.053949  0.027034  0.006454
1.774725  0.053949  0.029371  0.007114
1.879121  0.053949  0.031708  0.008163
1.983516  0.053949  0.034045  0.008687
2.087912  0.053949  0.036383  0.009086
2.192308  0.053949  0.038720  0.009286
2.296703  0.053949  0.041057  0.010138
2.401099  0.053949  0.043395  0.011579
2.505495  0.053949  0.045732  0.013175
2.609890  0.053949  0.048069  0.014756
2.714286  0.053949  0.050406  0.016260
2.818681  0.053949  0.052744  0.017672
2.923077  0.053949  0.055081  0.018997
3.027473  0.053949  0.057418  0.020244
3.131868  0.053949  0.059755  0.021424
3.236264  0.053949  0.062093  0.022561
3.250000  0.053949  0.065477  0.037231
END FTABLE  2
FTABLE      1
 61    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.053949  0.000000  0.000000  0.000000
0.104396  0.053949  0.005632  0.000000  0.271991
0.208791  0.053949  0.011264  0.000000  0.355182
0.313187  0.053949  0.016896  0.000000  0.374112
0.417582  0.053949  0.022528  0.000000  0.393042
0.521978  0.053949  0.028160  0.000000  0.411972
0.626374  0.053949  0.033792  0.000000  0.430901
0.730769  0.053949  0.039424  0.000000  0.449831
0.835165  0.053949  0.045056  0.000079  0.468761
0.939560  0.053949  0.050688  0.000118  0.487691
1.043956  0.053949  0.056320  0.000147  0.506621
1.148352  0.053949  0.061952  0.000171  0.525550
1.252747  0.053949  0.067584  0.000192  0.544480
1.357143  0.053949  0.073216  0.000211  0.563410
1.461538  0.053949  0.078848  0.000229  0.582340
1.565934  0.053949  0.084480  0.000245  0.601269
1.670330  0.053949  0.090112  0.000260  0.620199
1.774725  0.053949  0.095744  0.000275  0.639129
1.879121  0.053949  0.101376  0.000288  0.658059
1.983516  0.053949  0.107008  0.000301  0.676988
2.087912  0.053949  0.112640  0.000314  0.695918
2.192308  0.053949  0.118272  0.000326  0.714848
2.296703  0.053949  0.123904  0.000337  0.733778
2.401099  0.053949  0.129536  0.000349  0.752708
2.505495  0.053949  0.135168  0.000360  0.771637
2.609890  0.053949  0.140800  0.000370  0.790567
2.714286  0.053949  0.146432  0.000380  0.809497
2.818681  0.053949  0.152064  0.000390  0.828427
2.923077  0.053949  0.157696  0.000400  0.847356
3.027473  0.053949  0.163328  0.000410  0.866286
3.131868  0.053949  0.168960  0.000419  0.885216
3.236264  0.053949  0.174592  0.000428  0.904146
```

```
  3.340659  0.053949  0.180224  0.000437  0.923076
  3.445055  0.053949  0.185856  0.000445  0.942005
  3.549451  0.053949  0.191488  0.000454  0.960935
  3.653846  0.053949  0.197120  0.000462  0.979865
  3.758242  0.053949  0.202752  0.000471  0.998795
  3.862637  0.053949  0.208384  0.000479  1.017724
  3.967033  0.053949  0.214016  0.000487  1.036654
  4.071429  0.053949  0.219648  0.000495  1.055584
  4.175824  0.053949  0.225280  0.000502  1.074514
  4.280220  0.053949  0.230912  0.000510  1.093444
  4.384615  0.053949  0.236544  0.000517  1.112373
  4.489011  0.053949  0.242176  0.000525  1.131303
  4.593407  0.053949  0.247808  0.000532  1.150233
  4.697802  0.053949  0.253440  0.000539  1.169163
  4.802198  0.053949  0.259072  0.000546  1.188092
  4.906593  0.053949  0.264704  0.000553  1.207022
  5.010989  0.053949  0.270336  0.000560  1.225952
  5.115385  0.053949  0.275968  0.000567  1.244882
  5.219780  0.053949  0.281600  0.000574  1.263811
  5.324176  0.053949  0.287232  0.214325  1.282741
  5.428571  0.053949  0.292864  0.776139  1.301671
  5.532967  0.053949  0.298496  1.414214  1.320601
  5.637363  0.053949  0.304128  1.916131  1.339531
  5.741758  0.053949  0.309760  2.188445  1.358460
  5.846154  0.053949  0.315392  2.432473  1.377390
  5.950549  0.053949  0.321024  2.636822  1.396320
  6.054945  0.053949  0.326656  2.826433  1.415250
  6.159341  0.053949  0.332288  3.004098  1.434179
  6.250000  0.053949  0.337179  3.171826  1.450618
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.7            RCHRES   2     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   2 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1002 STAG     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1003 FLOW     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     12.1      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5
```

```
  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                RCHRES          INFLOW IVOL
  END MASS-LINK    8

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY            INPUT  MEAN
  END MASS-LINK   16

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY            INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages.

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

ATTACHMENT F

100-Year Storm Inflow and Outflow Hydrographs

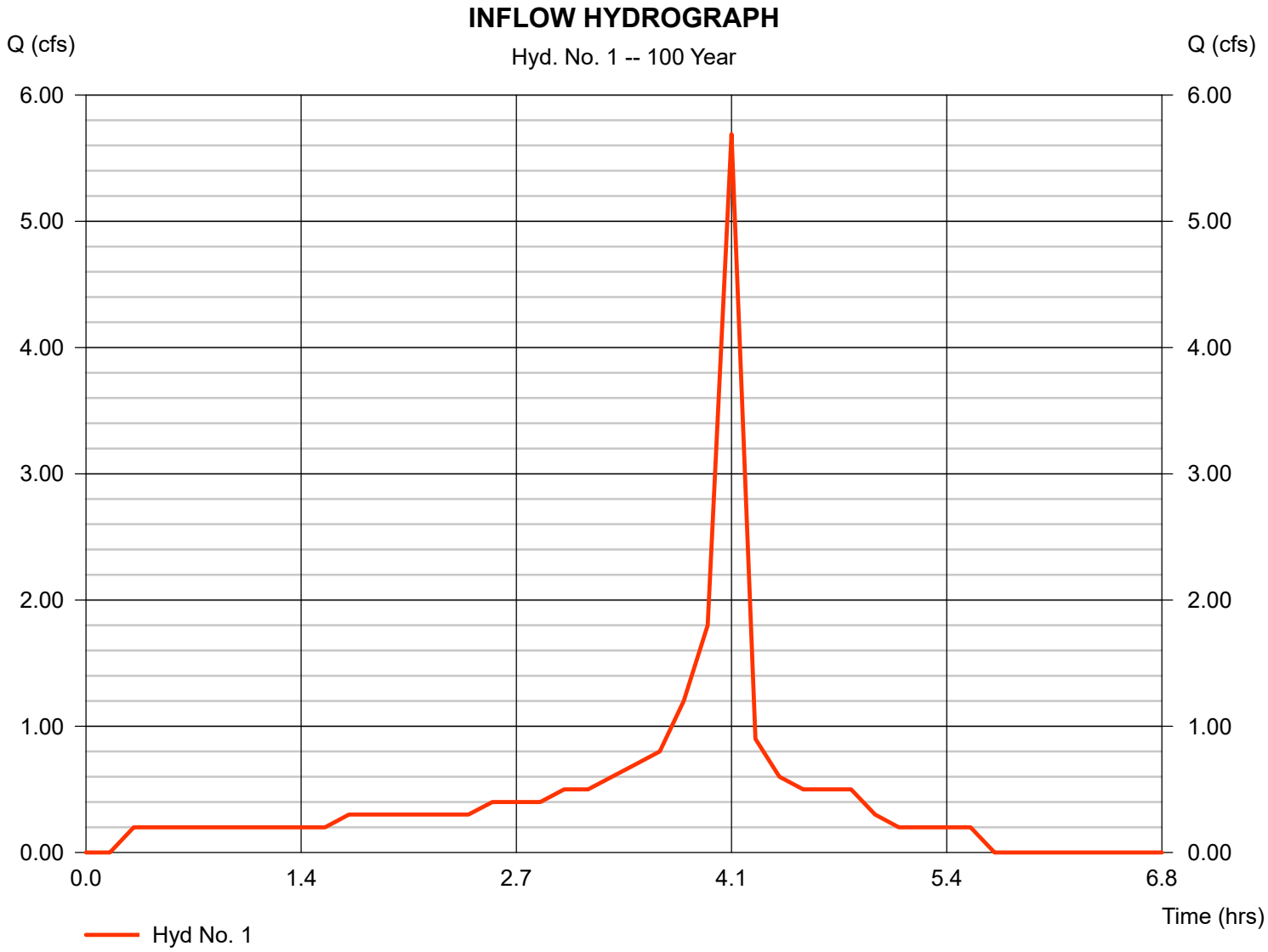
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Feb 25, 2026

Hyd. No. 1

INFLOW HYDROGRAPH

Hydrograph type	= Manual	Peak discharge	= 5.690 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.05 hrs
Time interval	= 9 min	Hyd. volume	= 11,173 cuft



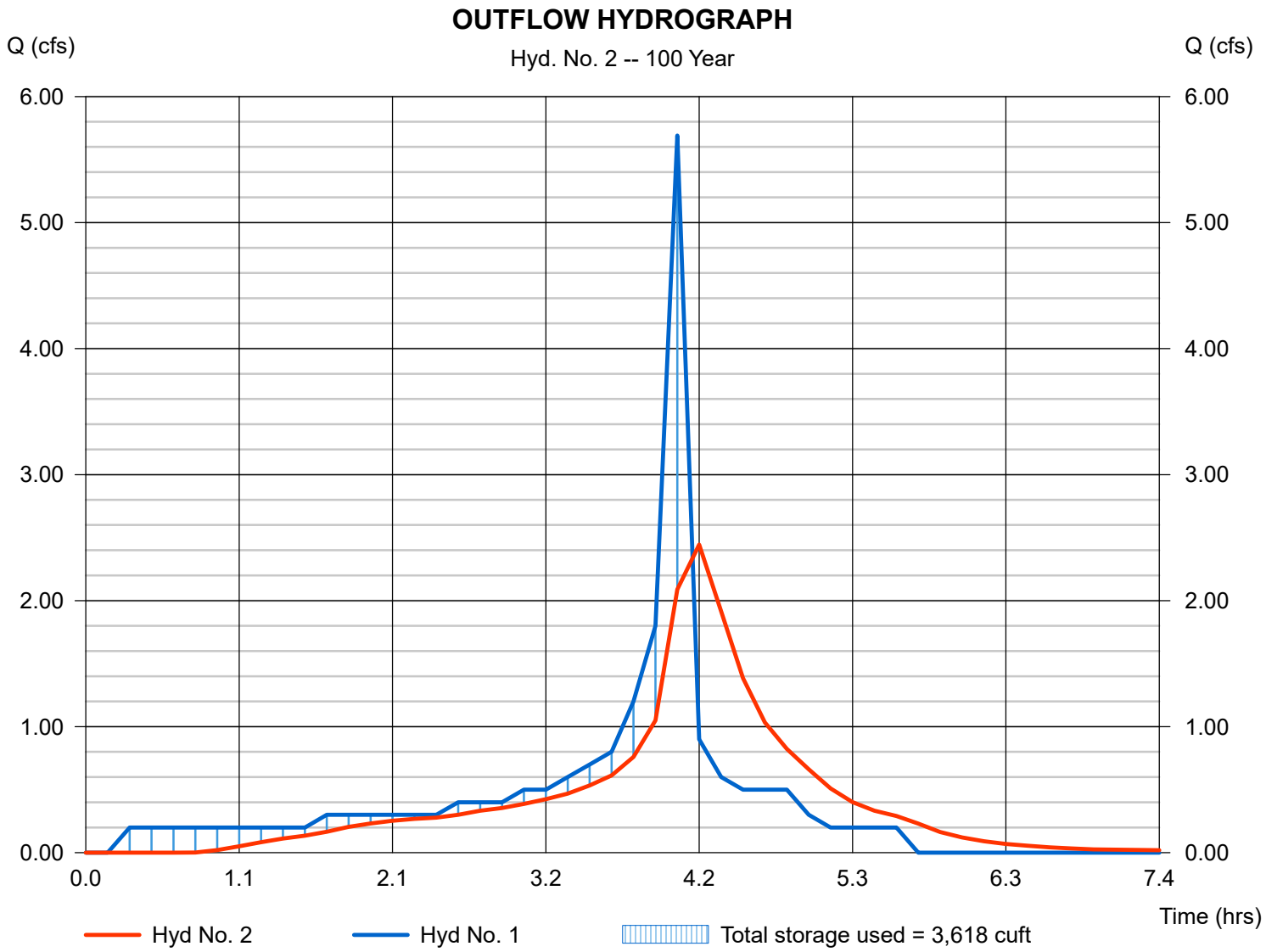
Hydrograph Report

Hyd. No. 2

OUTFLOW HYDROGRAPH

Hydrograph type	=	Reservoir	Peak discharge	=	2.445 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.20 hrs
Time interval	=	9 min	Hyd. volume	=	10,813 cuft
Inflow hyd. No.	=	1 - INFLOW HYDROGRAPH	Max. Elevation	=	682.07 ft
Reservoir name	=	<New Pond>	Max. Storage	=	3,618 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - <New Pond>

Pond Data

Trapezoid - Bottom L x W = 235.0 x 10.0 ft, Side slope = 0.00:1, Bottom elev. = 680.35 ft, Depth = 5.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	680.35	2,350	0	0
0.55	680.90	2,350	1,293	1,293
1.10	681.45	2,350	1,293	2,585
1.65	682.00	2,350	1,293	3,878
2.20	682.55	2,350	1,293	5,170
2.75	683.10	2,350	1,293	6,463
3.30	683.65	2,350	1,293	7,755
3.85	684.20	2,350	1,293	9,048
4.40	684.75	2,350	1,293	10,340
4.95	685.30	2,350	1,293	11,633
5.50	685.85	2,350	1,292	12,925

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.10	0.00	0.00
Span (in)	= 18.00	0.10	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 680.50	680.50	0.00	0.00
Length (ft)	= 5.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 686.25	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	680.35	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.06	129	680.41	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.11	259	680.46	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.17	388	680.52	0.00 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.001
0.22	517	680.57	0.03 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.027
0.28	646	680.62	0.08 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.085
0.33	776	680.68	0.16 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.155
0.39	905	680.73	0.24 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.237
0.44	1,034	680.79	0.33 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.326
0.50	1,163	680.84	0.42 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.423
0.55	1,293	680.90	0.53 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.525
0.61	1,422	680.96	0.63 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.634
0.66	1,551	681.01	0.75 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.745
0.72	1,680	681.06	0.86 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.861
0.77	1,810	681.12	0.98 oc	0.00 ic	---	---	0.00	---	---	---	---	---	0.978
0.83	1,939	681.17	1.10 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.096
0.88	2,068	681.23	1.21 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.214
0.94	2,197	681.28	1.33 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.334
0.99	2,327	681.34	1.45 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.454
1.05	2,456	681.39	1.57 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.571
1.10	2,585	681.45	1.69 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.687
1.16	2,714	681.50	1.80 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.801
1.21	2,844	681.56	1.91 oc	0.00 ic	---	---	0.00	---	---	---	---	---	1.912
1.27	2,973	681.61	2.02 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.018
1.32	3,102	681.67	2.12 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.119
1.38	3,231	681.72	2.21 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.214
1.43	3,361	681.78	2.30 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.301
1.49	3,490	681.83	2.38 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.379
1.54	3,619	681.89	2.44 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.445
1.60	3,748	681.94	2.50 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.495
1.65	3,878	682.00	2.51 oc	0.00 ic	---	---	0.00	---	---	---	---	---	2.514
1.71	4,007	682.06	3.64 oc	0.00 ic	---	---	0.00	---	---	---	---	---	3.643
1.76	4,136	682.11	4.50 oc	0.00 ic	---	---	0.00	---	---	---	---	---	4.498
1.82	4,265	682.17	5.21 oc	0.00 ic	---	---	0.00	---	---	---	---	---	5.214

Continues on next page...

<New Pond>

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.87	4,395	682.22	5.84 oc	0.00 ic	---	---	0.00	---	---	---	---	---	5.842
1.93	4,524	682.28	6.41 oc	0.00 ic	---	---	0.00	---	---	---	---	---	6.410
1.98	4,653	682.33	6.93 oc	0.00 ic	---	---	0.00	---	---	---	---	---	6.931
2.04	4,782	682.38	7.42 oc	0.00 ic	---	---	0.00	---	---	---	---	---	7.416
2.09	4,912	682.44	7.87 oc	0.00 ic	---	---	0.00	---	---	---	---	---	7.871
2.15	5,041	682.49	8.30 oc	0.00 ic	---	---	0.00	---	---	---	---	---	8.300
2.20	5,170	682.55	8.71 oc	0.00 ic	---	---	0.00	---	---	---	---	---	8.710
2.26	5,299	682.61	9.10 oc	0.00 ic	---	---	0.00	---	---	---	---	---	9.100
2.31	5,429	682.66	9.47 oc	0.00 ic	---	---	0.00	---	---	---	---	---	9.474
2.37	5,558	682.72	9.83 oc	0.00 ic	---	---	0.00	---	---	---	---	---	9.834
2.42	5,687	682.77	10.18 oc	0.00 ic	---	---	0.00	---	---	---	---	---	10.18
2.48	5,816	682.83	10.52 oc	0.00 ic	---	---	0.00	---	---	---	---	---	10.52
2.53	5,946	682.88	10.84 oc	0.00 ic	---	---	0.00	---	---	---	---	---	10.84
2.59	6,075	682.93	11.04 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.04
2.64	6,204	682.99	11.22 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.22
2.70	6,333	683.04	11.40 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.40
2.75	6,463	683.10	11.57 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.57
2.81	6,592	683.16	11.74 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.74
2.86	6,721	683.21	11.91 ic	0.00 ic	---	---	0.00	---	---	---	---	---	11.91
2.92	6,850	683.27	12.08 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.08
2.97	6,980	683.32	12.24 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.24
3.03	7,109	683.37	12.40 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.40
3.08	7,238	683.43	12.56 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.56
3.14	7,367	683.48	12.72 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.72
3.19	7,497	683.54	12.87 ic	0.00 ic	---	---	0.00	---	---	---	---	---	12.87
3.25	7,626	683.59	13.03 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.03
3.30	7,755	683.65	13.18 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.18
3.36	7,884	683.71	13.33 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.33
3.41	8,014	683.76	13.48 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.48
3.47	8,143	683.81	13.63 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.63
3.52	8,272	683.87	13.77 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.77
3.58	8,401	683.92	13.91 ic	0.00 ic	---	---	0.00	---	---	---	---	---	13.92
3.63	8,531	683.98	14.06 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.06
3.69	8,660	684.03	14.20 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.20
3.74	8,789	684.09	14.34 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.34
3.80	8,918	684.14	14.48 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.48
3.85	9,048	684.20	14.61 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.61
3.91	9,177	684.25	14.75 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.75
3.96	9,306	684.31	14.88 ic	0.00 ic	---	---	0.00	---	---	---	---	---	14.88
4.02	9,435	684.36	15.02 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.02
4.07	9,565	684.42	15.15 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.15
4.13	9,694	684.47	15.28 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.28
4.18	9,823	684.53	15.41 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.41
4.23	9,952	684.58	15.54 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.54
4.29	10,082	684.64	15.66 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.66
4.34	10,211	684.69	15.79 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.79
4.40	10,340	684.75	15.92 ic	0.00 ic	---	---	0.00	---	---	---	---	---	15.92
4.46	10,469	684.81	16.04 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.04
4.51	10,599	684.86	16.16 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.17
4.57	10,728	684.92	16.29 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.29
4.62	10,857	684.97	16.41 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.41
4.67	10,986	685.03	16.53 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.53
4.73	11,116	685.08	16.65 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.65
4.78	11,245	685.13	16.77 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.77
4.84	11,374	685.19	16.89 ic	0.00 ic	---	---	0.00	---	---	---	---	---	16.89
4.89	11,503	685.24	17.00 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.01
4.95	11,633	685.30	17.12 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.12
5.01	11,762	685.36	17.24 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.24
5.06	11,891	685.41	17.35 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.35
5.12	12,020	685.47	17.47 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.47
5.17	12,150	685.52	17.58 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.58
5.22	12,279	685.58	17.69 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.69
5.28	12,408	685.63	17.81 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.81
5.33	12,537	685.68	17.92 ic	0.00 ic	---	---	0.00	---	---	---	---	---	17.92
5.39	12,667	685.74	18.03 ic	0.00 ic	---	---	0.00	---	---	---	---	---	18.03
5.44	12,796	685.79	18.14 ic	0.00 ic	---	---	0.00	---	---	---	---	---	18.14
5.50	12,925	685.85	18.25 ic	0.00 ic	---	---	0.00	---	---	---	---	---	18.25

...End

Time (Min)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Total Discharge (Q)
0.00																																							0.06	**0.06**
9.33																																						0.19		**0.19**
18.67																																					0.19			**0.19**
28.00																																				0.19				**0.19**
37.33																																			0.19					**0.19**
46.67																																		0.19						**0.19**
56.00																																	0.19							**0.19**
65.33																																0.19								**0.19**
74.67																															0.19									**0.19**
84.00																														0.19										**0.19**
93.33																													0.19											**0.19**
102.67																												0.19												**0.19**
112.00																											0.19													**0.19**
121.33																										0.19															**0.19**
130.67																									0.25																**0.25**
140.00																								0.25																	**0.25**
149.33																							0.25																		**0.25**
158.67																						0.25																			**0.25**
168.00																					0.25																				**0.25**
177.33																				0.25																					**0.25**
186.67																			0.31																						**0.31**
196.00																		0.31																							**0.31**
205.33																	0.31																								**0.31**
214.67																0.31																									**0.31**
224.00															0.37																										**0.37**
233.33														0.37																											**0.37**
242.67	**5.05**																																								**5.05**
252.00		**1.31**																																							**1.31**
261.33			**1**																																						**1**
270.67				**0.81**																																					**0.81**
280.00					**0.62**																																				**0.62**
289.33						**0.56**																																			**0.56**
298.67							**0.5**																																		**0.5**
308.00								**0.44**																																		**0.44**
317.33									**0.44**																																	**0.44**
326.67										**0.37**																																**0.37**
336.00											**0.37**																															**0.37**
345.33												**0.37**																														**0.37**
354.67													**0.31**																													**0.31**

ATTACHMENT G

Hydrologic Soil Group Map

Rainfall Isopluvials for 100 years Rainfall Event – 6 hours and 24 hours map

Intensity-Duration Design Chart-Figure 3-1

Runoff Coefficients for urban areas-Table 3-1

Maximum Overland Flow length and Initial Time of Concentration Table 3-2

Rational Formula for Overland Time of Flow Nomograph Figure 3-3

Nomograph for Determination of Time of Concentration or Travel time for Natural Watersheds Figure 3-4

Computation of Effective Slope for Natural Watersheds Figure 3-5

County of San Diego Hydrology Manual

Soil Hydrologic Groups

Orange County

Riverside County

Imperial County

Mexico

Pacific Ocean

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'

33°30' 33°15' 33°00' 32°45' 32°30'

Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

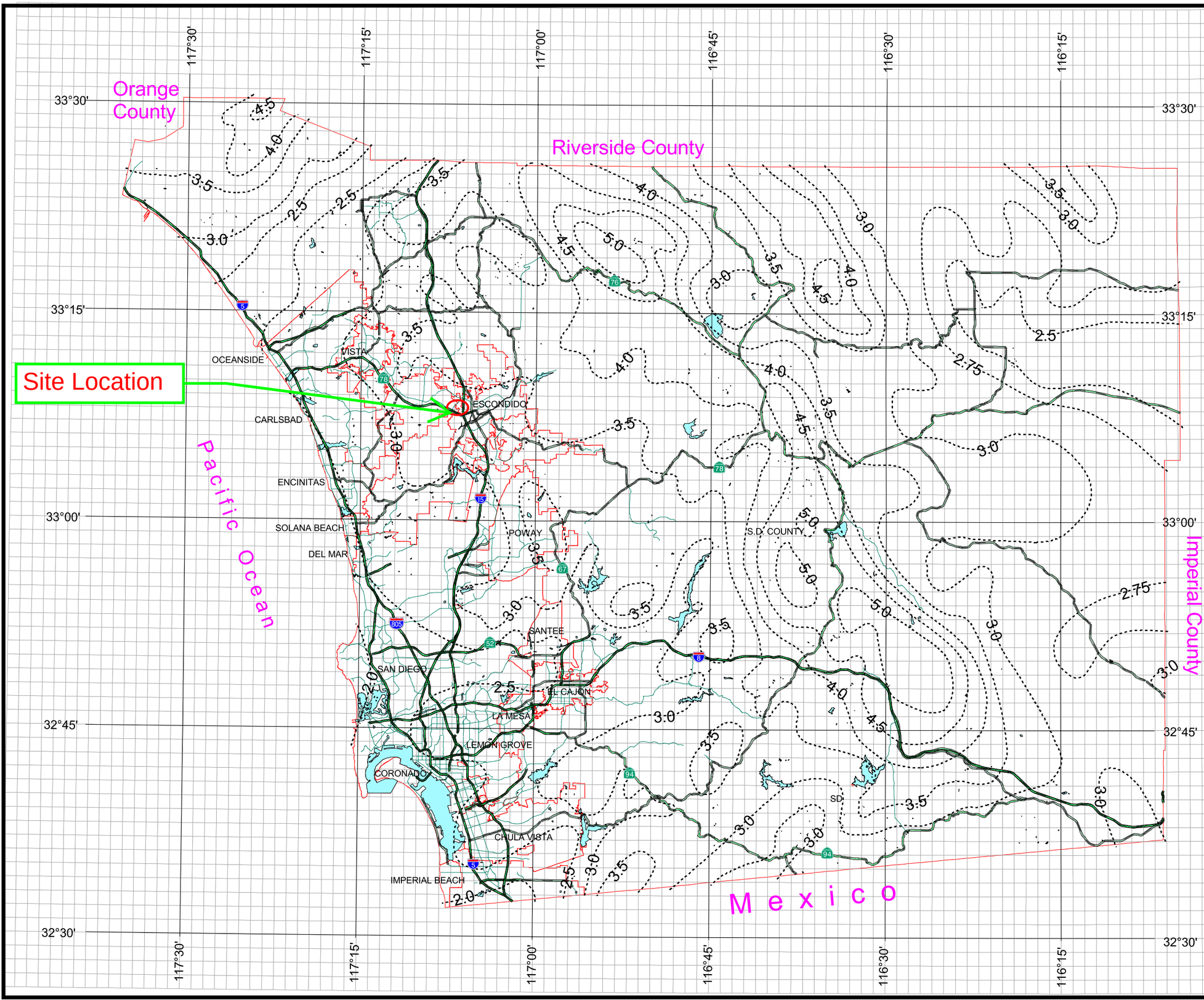
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Site Location

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

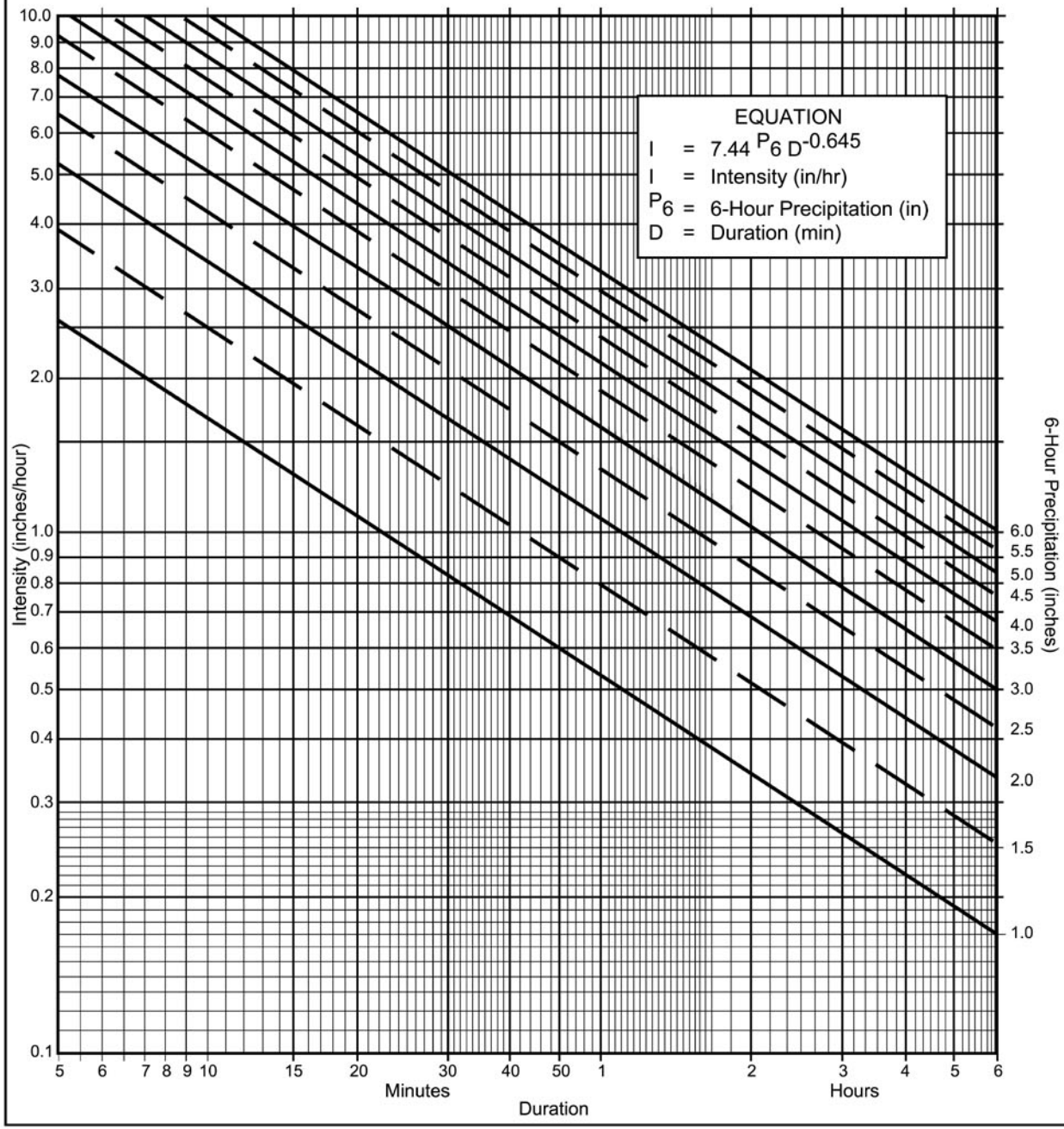
OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
SD
CHULA VISTA
IMPERIAL BEACH

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

N W E S

3 0 3 Miles

APPENDIX 3.0



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

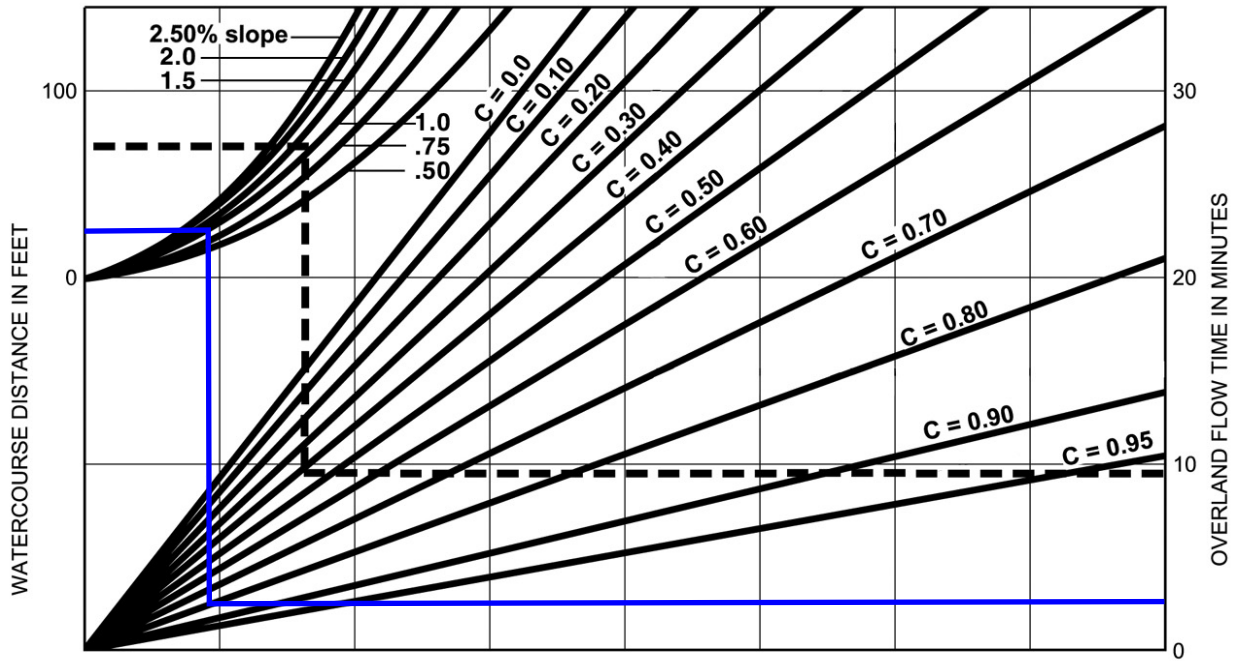
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



EXAMPLE:

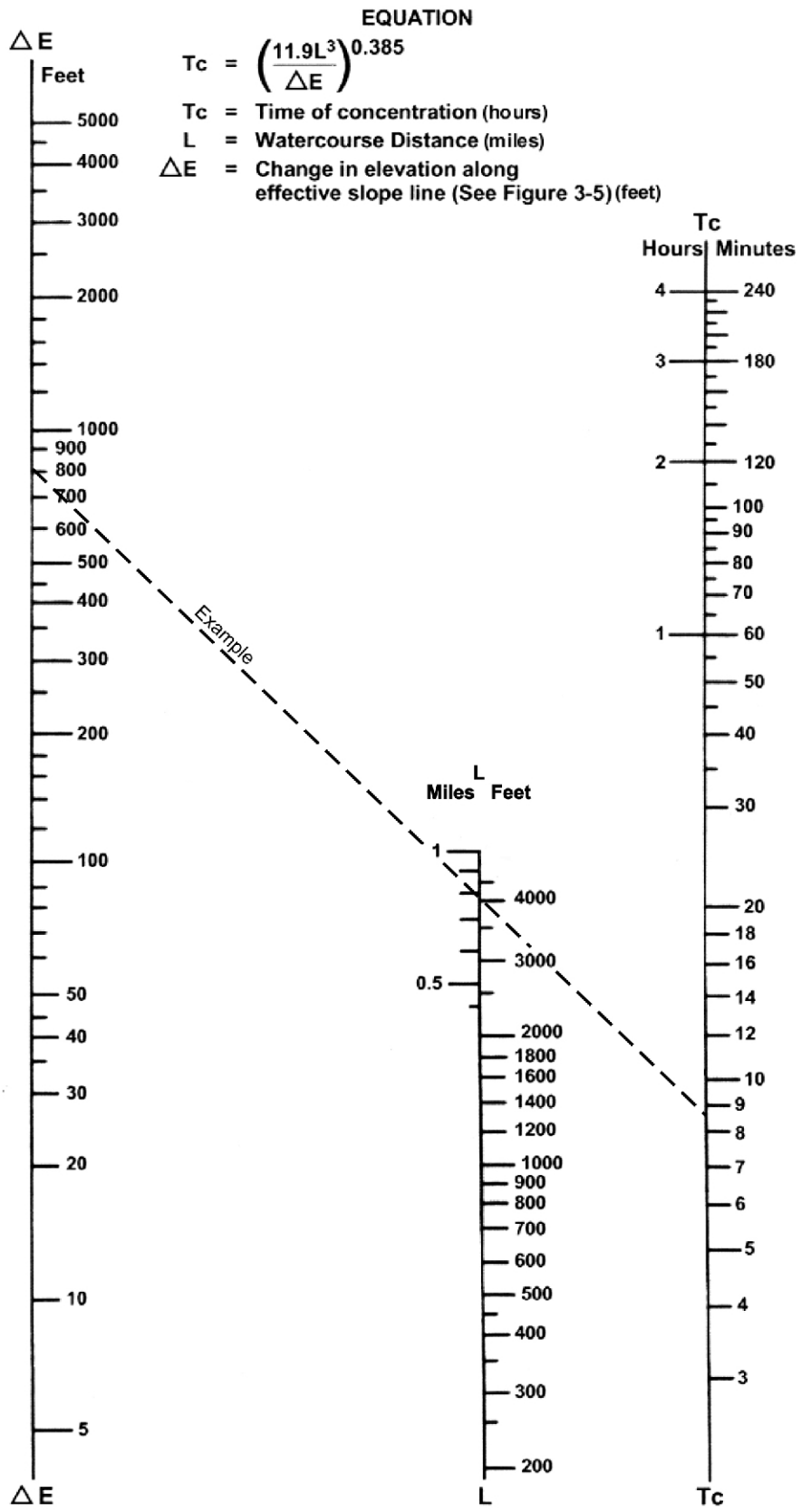
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

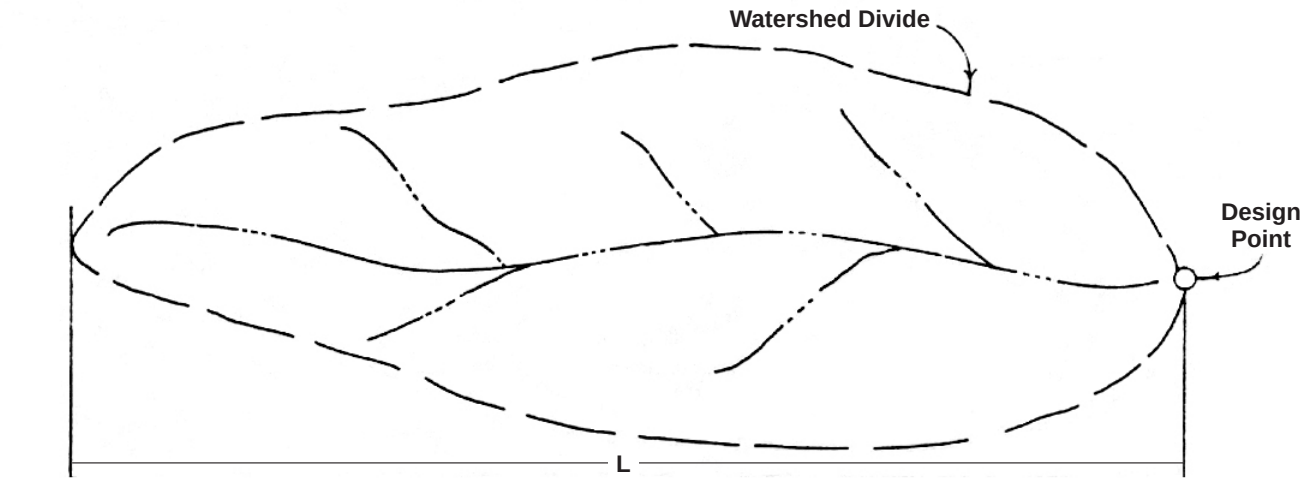
Rational Formula - Overland Time of Flow Nomograph

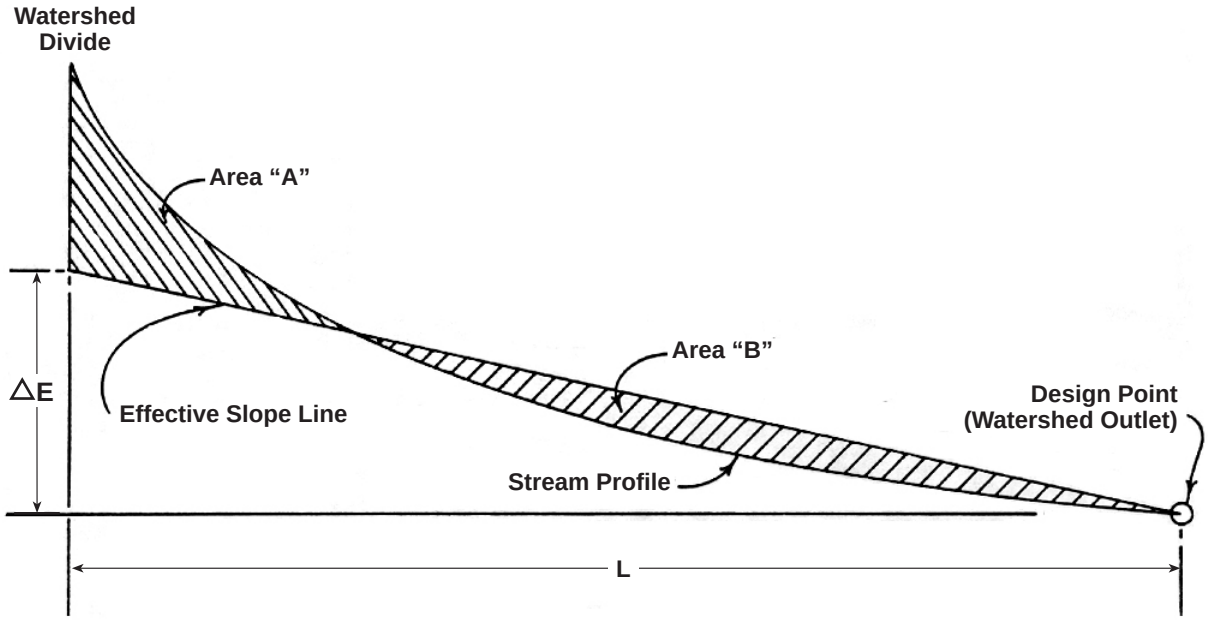


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds





Area "A" = Area "B"

SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Computation of Effective Slope for Natural Watersheds

3-5