DRAINAGE REPORT

FOR

MAPLEVIEW RESIDENTIAL

LAKESIDE, CALIFORNIA

APN# 390-048-20-00

PROJECT NUMBER: TBD

September 19, 2022

Prepared By:

NAJARS Engineering
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Santee, CA 92071
(619) 971-7514

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 specifications 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 design.

_____

Bashar G. Najar R.C.E. 78159 Date

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LIST OF APPENDICES

1.0 GENEARL PROJECT INFORMATION

1.1 Project Site Information

Project Name: Mapleview Residential

Total Analyzed Area: 22,860sf (0.52ac)

Total Area of Disturbance: 22,860sf (0.52ac)

Project Address: 12830 Mapleview St, Lakeside, CA 92040

Latitude/Longitude: 32.864330, -116.915611

Flood Plain Status:
Per FEMA Panel 06073C1656G, the flood map for this project and is located outside of the 1% and 0.2% annual chance floodplains. No floodplain issues are anticipated for this Project.

1.2 Project Description

This storm drain report has been prepared as part of the major grading permit submittal requirements for the development of the Mapleview Residence project. The proposed improvements include a multi-family residential facility with associated hardscape and landscaping. The project is bounded by Mapleview Street to the south, and multi-family residence to the east, west and north of the property in Lakeside California (See Figure 1, Vicinity Map). Total site area is approximately 22,860sf (0.52ac).

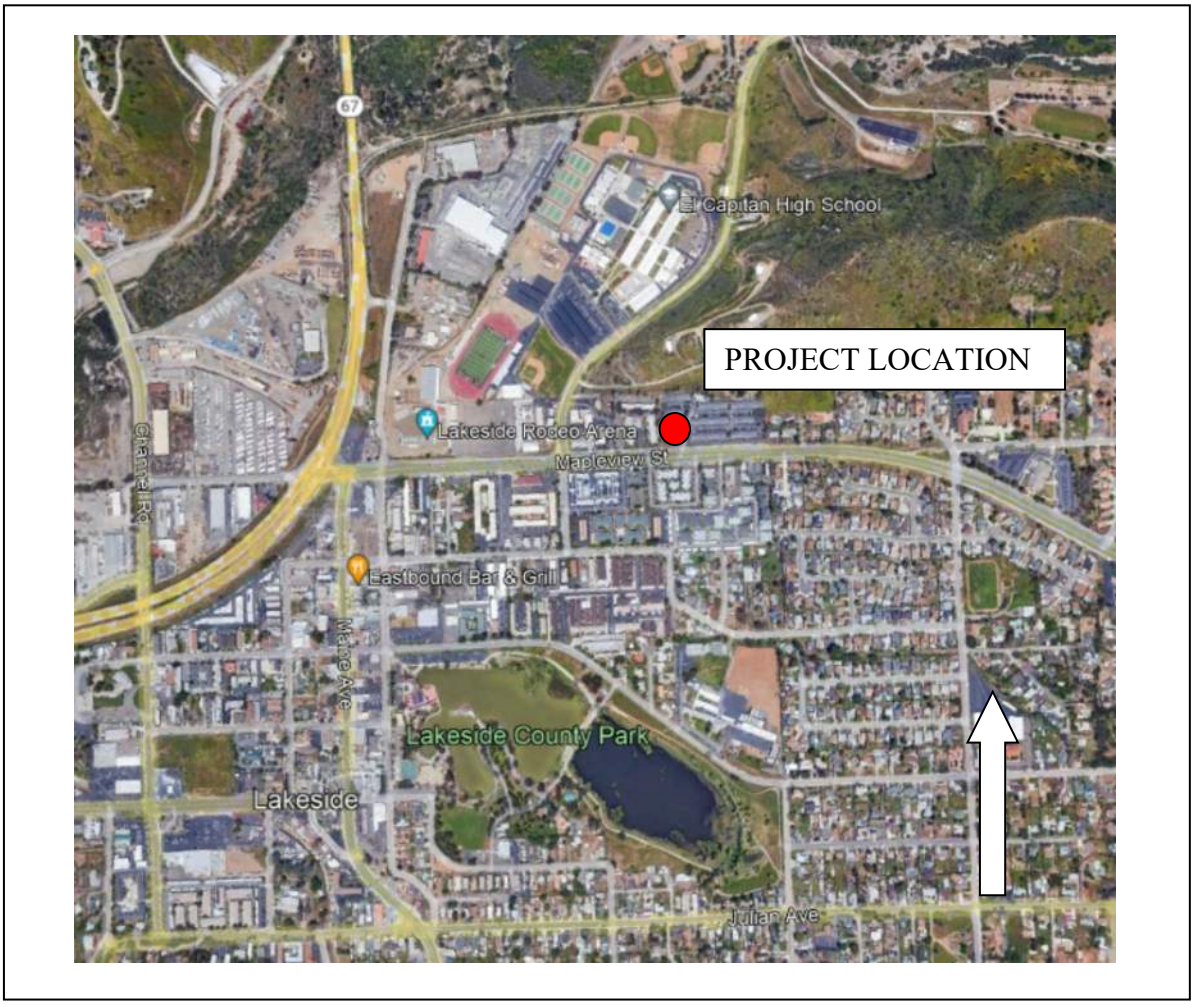


Figure 2 – Vicinity Map N.T.S.

1.3 Existing Conditions

The current project site consists of a two single-family residence (to be demolished), associated hardscape (demolish portion of the deteriorated asphalt pavement driveway), and landscaping (remove portion associated with limit of disturbance). The site has two (2) discharge location that eventually meet up and confluence in an existing storm drain system southwest of the site (POC-1). The runoff from the larger westerly sub-basin (EX-1) subbasin of the site surface flows to a concrete brow ditch located on the neighboring property to the west. Where flow is then conveyed into the existing storm drain system through a headwall. The second, smaller sub-basin is named EX-2, it drains south to an existing inlet located in Mapleview Street. The flow then confluences with the flow from PR-1 at an existing manhole southwest of the site. This confluence point is called POC-1.

1.4 Proposed Conditions

The proposed development includes the demolition of the existing two single-family residences, associated hardscape and landscaping to create a larger pad for a new multi-family residence, associated hardscape and landscaping. Surface runoff from the westerly two sub-basins (PR-1 & PR-2) is conveyed by curb and gutters to two (2) proposed inlets. The proposed storm drain system then conveys stormwater to a proprietary treatment BMP and underground detention facility located on the south side of the lot. The detention facility discharges directly into the existing storm drain system under Mapleview Street. The easterly sub-basin (PR-3) drains south toward an existing inlet located in Mapleview Street. The flow then confluences with the flow from PR-1 & PR-2 at a proposed manhole southwest of the site. This confluence point is the same as the existing condition and is called POC-1.

1.5 Water Quality

The Project is considered a Priority Development Project (PDP) per the thresholds listed in the County's BMP Design Manual. Hydromodification (HMP) and treatment requirements are met by the project, the details of which can be viewed under the Project's PDP SWQMP.

The County has a conjunctive use requirement for facilities designed to meet more then one stormwater requirement. As such, HMP volumes and depths will be considered in the 100-year peak flow attenuation analysis.

1.6 Floodplain

The Project is located outside of the 1% and 0.2% annual chance floodplains per FIRM Map Panel 06073C1656G. This zone is outside of a floodway or 100-year floodplain. The FIRMette can be viewed in Appendix A.

2.0 DESIGN CRITERIA

2.1 Methodology

This drainage report has been prepared in accordance with current County of San Diego regulations and procedures. All proposed pipes, catch basins, curbs and gutters, were designed to intercept and convey the 100-year storm. The Modified Rational Method was used to compute the anticipated runoff. See Calculation Tables and appendices for design calculations. The following references have been used in preparation of this report:

(1) San Diego County Hydrology Manual, June 2003.
(2) San Diego County Hydraulic Design Manual, September 2014.
(3) NRCS TR-55 Manual, June 1986.
(4) County of San Diego D.P.W. Procedure Manual for the Preparation and Checking of Street Improvement and Grading Plans, December 1998.
(5) Handbook of Hydraulics, E.F. Brater & H.W. King, 6th Ed., 1976.
(6) Open Channel Hydraulics, V.T. Chow, 1959.

2.2 The Rational Method

The Rational Method was used to determine the 100-year design storm for the total project site for both the existing and proposed condition. This analysis was conducted to determine the increase in 100-year peak flow rate due to the increase in impervious area. This value will be used to design an attenuation facility.

The RM formula estimates the peak rate of runoff at any location in a watershed 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.

$$Q = CIA$$

Where:

Q = Peak discharge, cfs

C = runoff coefficient, proportion of the rainfall that runs off the surface

I = average rainfall intensity for a duration equal to the Time of Concentration for the area, inches per hour

A = drainage area contribution to the design location, acres

Runoff Coefficient:

Table 3-1 from the San Diego County Hydrology Manual SDCHM, (See Appendix B) lists the estimated runoff coefficients for urban areas.

The runoff coefficients are based on land use and soil type. Soil type is determined from the Soil Hydrologic Soil Map (from the USGS Web Soil Survey, See Appendix C). Soil type 'D' will be used. Natural areas (pervious) will use a C=0.35, while developed area (impervious) will use a C=0.90

"C" is calculated by tabulating the weighted value of the pervious and impervious areas for each drainage basin. The weighted "C" value can then be determined for each drainage and is used for the existing and proposed comparison for the total project site.

An inflated C value of 0.9 was used to determine a conservative max flow rate for the proposed pipes and curb inlet.

Rainfall Intensity:

The rainfall intensity (I) is the rainfall in inches per hour (in/hr) for a duration equal to the Time of Concentration for a selected storm frequency. The rainfall intensity can be determined from Figure 3-2 *Intensity-Duration Design Chart* and Isopluvial maps (Found in Appendix B).

$$I = 7.44*P6*D-0.645$$

Where:

I = Intensity (in/hr)

P6 = 6-hour precipitation (in)

D = Duration (min)

Area:

The project area and flow paths for both the existing and proposed Rational Method comparison can be viewed in Appendix C. The drainage areas used to generate a maximum flow rate for hydraulic design of the storm drain and curb inlet can be viewed in Appendix D.

Time of Concentration:

The Time of Concentration (Tc) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The Tc is composed of two components: initial time of concentration (Ti) and travel time (Tt). Methods of computation for Ti and Tt are discussed below. For the rational Method, the Tc at any point within the drainage area is given by:

$Tc = Ti + Tt$

The Ti is the time required for runoff to travel across the surface of the most remote subarea in the study. The initial time of concentration for the project for both the existing and proposed condition was found using Table 3-2 of the SDCHM *Maximum Overland Flow Length & Initial Time of Concentration.* The project is considered an *"*office professions/commercial," land use and the sheet flow slope is 0.5%.

The Tt is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial subarea to the point of interest. The travel time for the existing condition was determined using Figure 3-7 of the NRSC TR-55 Manual *Average Velocities for Estimating Travel Time for Shallow Concentrated Flow.* This method was used to determine the velocity of the storm water flowing over the existing paved surface.

Figure 3-7of the SDCHM *Manning's Equation Nomograph* was used to determine the velocity of storm water traveling through the proposed PVC pipe system. This velocity was then used to determine the travel time for the proposed condition.

If the computed Tc is less than 5 minutes, use 5 minutes for computing the peak discharge.

2.3 Pipe Hydraulics

The proposed pipe network was analyzed with Autodesk's *Hydraflow Storm Sewers Extension* to confirm that they met the County's standards per section 3.2.1 of the San Diego County Hydraulic Design Manual (HDM):

a. Storm drains conveying flow within the right-of-way of a public road, or across a public road (i.e., across the centerline of a roadway) shall have the capacity to convey the peak discharge from a 100-year design event.
b. The conduit shall convey the design flow with the hydraulic grade line (HGL) maintaining a minimum freeboard of 1.0 ft below the ground surface or gutter flow line during the design event.

The pipe hydraulic calculations can be found in Appendix D.

2.5 Detention Calcs

Stage-storage-discharge calculations were performed using The Autodesk's *Hydraflow Hydrographs Extension.* The software allows users to create hydrographs and route them through detention structures.

The proposed 100-year peak flow hydrograph was created using the County's *Rick Rat Hydro* Program. Rational method data was inputted into the program and a hydrograph was generated. This hydrograph was manually inputted into *Hydraflow Hydrographs Extension* and routed through the bioretention basin. into the program using the software's rational method hydrograph generator.

Due to the County's conjunctive use requirement, the detention analysis must only consider volume and height above the hydromodification (HMP) volume. The HMP volume and depth are 2,165 cubic feet and 1.5 feet respectively. The HMP analysis was conducted using the County's *BMP Sizing Spreadsheet*, which can be viewed in the Project's SWQMP.

The 100-year peak flow attenuation calculations and vault dimensions can be found in Appendix E.

3.0 Results and Conclusion

3.1 Hydrology

The Project proposes an increase of 10,756sf of impervious area and a subsequent increase in 100-year peak flow runoff at discharge point 1 (POC-1) of 1.37cfs. A summary of these results by drainage area ID and discharge location can be viewed in Table 1 and Table 2 below.

Table 1: Hydrology Analysis - 100-year Storm Event							
Existing Condition							
Drainage Basin Name	Area (Sf)	Area (Ac)	C	Tc (min)	P6	I (in/hr)	Q100 (cfs)
EX-1	22,005	0.51	0.51	6.0	2.9	6.79	1.75
EX-2	855	0.02	0.79	5.0	2.9	7.64	0.12
						Total (POC-1)	1.87
Proposed Condition							
PR-1	13,260	0.30	0.82	5.0	2.9	7.64	1.90
PR-2	8,710	0.20	0.81	5.0	2.9	7.64	1.23
PR-3	890	0.02	0.73	5.0	2.9	7.64	0.10
						Total (POC-1)	3.25

Table 2: Summary Table			
Point of Compliance	Existing Q100 (cfs)	Proposed Q100 Unmitigated (cfs)	Proposed Q100 Mitigated (cfs)
POC-1	1.87	3.25	0.82

3.2 Storm Drains

Per the results of the *Hydraflow Storm Sewers Extension* analysis, the proposed private storm drains can convey the 100-year storm event into and out of the bioretention basin, without surcharging. The location of each storm drain line is depicted identified in Figure 2.

The profile of each pipe and hydraulic grade line can be viewed in Figure 3 & 4 below. Detailed *Hydraflow Storm Sewers Extension* outputs can be found in Appendix D.

Figure 2 – Storm Drain Locations

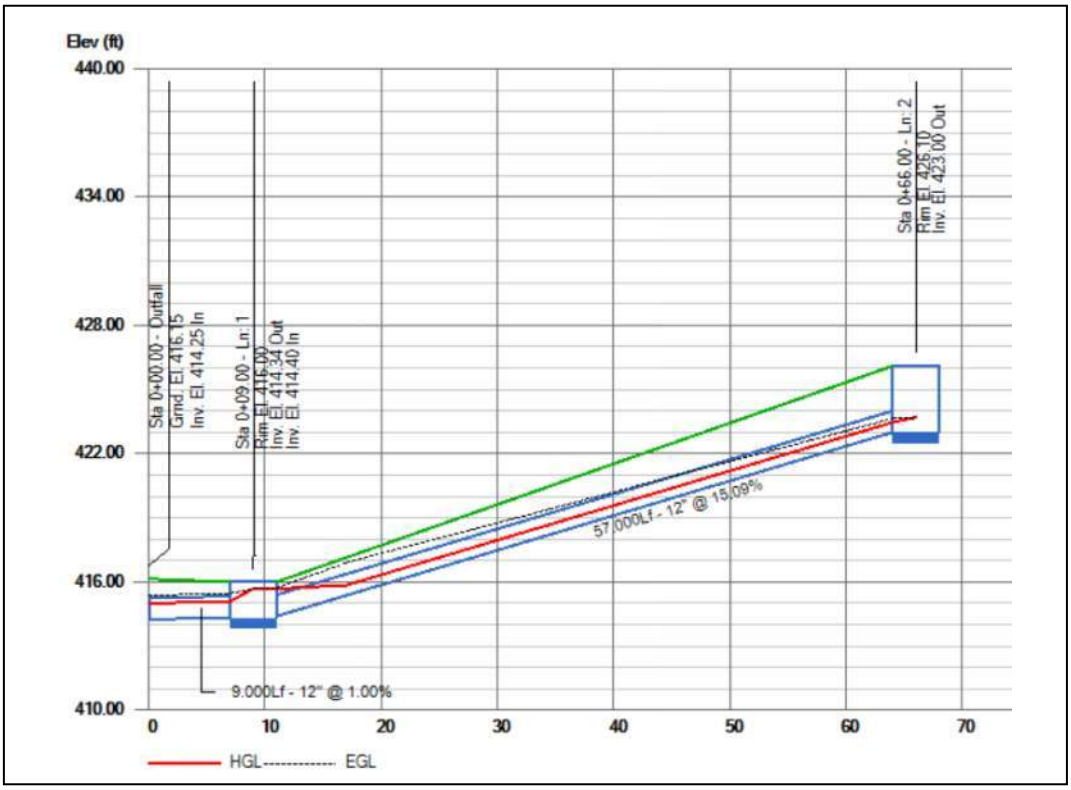


Figure 3: Storm Drain Profile – SD-1

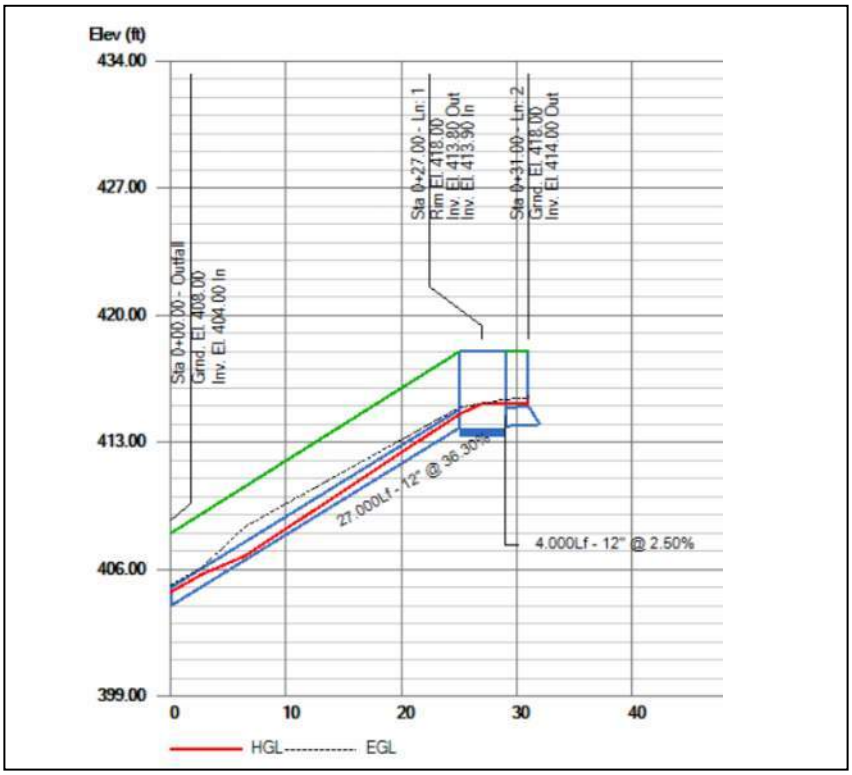


Figure 4: Storm Drain Profile – SD-2

3.3 Detention Analysis

The project increases the 100-year peak flow rate at the southwesterly discharge location (POC-1) from 1.87 cfs (existing) to 3.25 cfs (proposed); which is an increase of 1.38 cfs.

A 100-year flow attenuation structure was designed to attenuate the 100-year peak flow from sub-basins PR-1 & PR-2; from 3.13 cfs down to 0.72 cfs. The peak 100-year inflow hydrograph generated from *RickRat Hydro,* shows a total volume of 4,383 cubic feet. See Appendix E and figure 5 below.

The peak flow from PR-3 is smaller than the existing sub-basin (EX-2) and no attenuation is required. The floe from this sub-basin is allowed to discharge into the existing cub inlet within Mapleview.

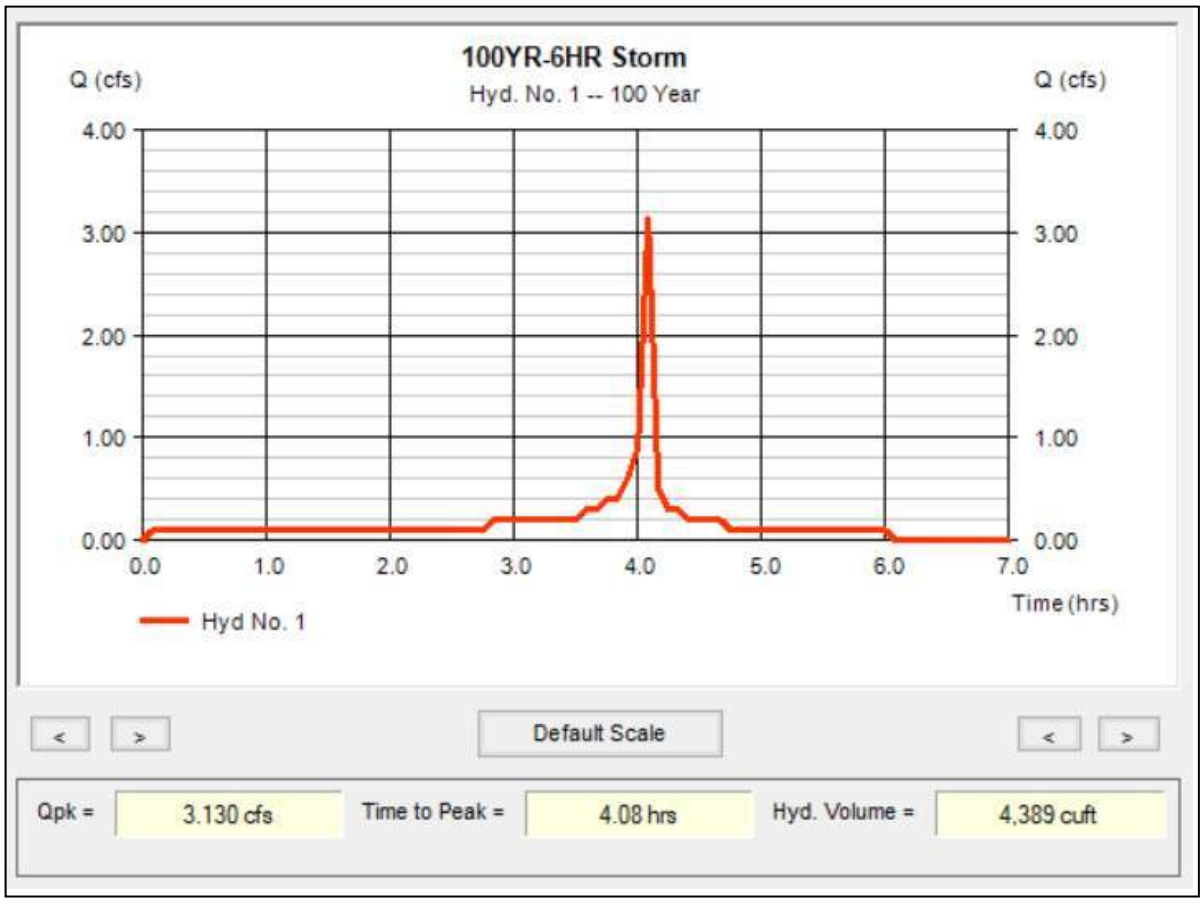


Figure 5: Unmitigated 100-year Inflow Hydrograph

Per the County's *Conjunctive Use Facilities for Stormwater Management and Flood Control* (January 1, 2021), the treatment and hydromodification ponding layer were excluded from the 100-year peak flow attenuation analysis. A stage-storage-discharge model was created using *Hydraflow Hydrograph Extensions*. The underground storage vaults' highest HMP depth was used as the datum for the "bottom," of the basin and all

volume/depth below this point was excluded from the analysis. This effectively isolated the volume and ponding layer for 100-year peak flow attenuation analysis.

The relevant elevations and design information for the proposed underground storage vault can be viewed in Table 3 and Figure 6 below.

Table 3: 100-year Flow Attenuation Design Information			
Approx. Elevation	Stage (ft)	Storage (cf)	Structure Note
414	0	0	Top of HMP Layer
415.5	1.5	3,100	T.G. of 24" x 24" riser
416	2	4,190	Top of Freeboard

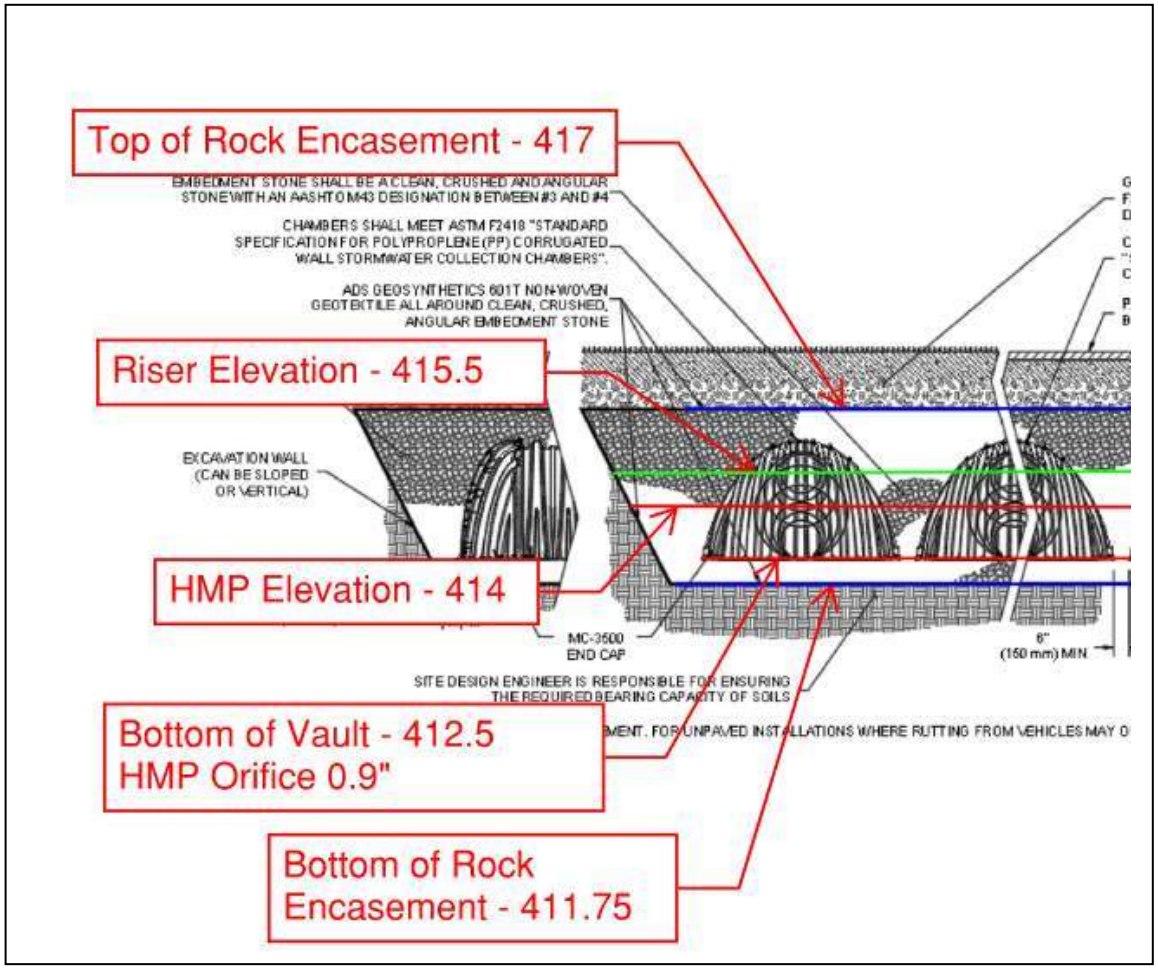


Figure 6: Bioretention - Conjunctive Use Detail

The inflow peak 100-year hydrograph (3.13 cfs) was routed through the bioretention basin and attenuated to a basin outflow of 0.70 cfs. This vault outflow combines with driveway flow from PR-3 to be 0.82 cfs, which is less than the existing condition flow rate of 1.87 cfs.

The results of the analysis can be viewed in Figure 7. Detailed *Hydraflow* outputs can be viewed in Appendix E.

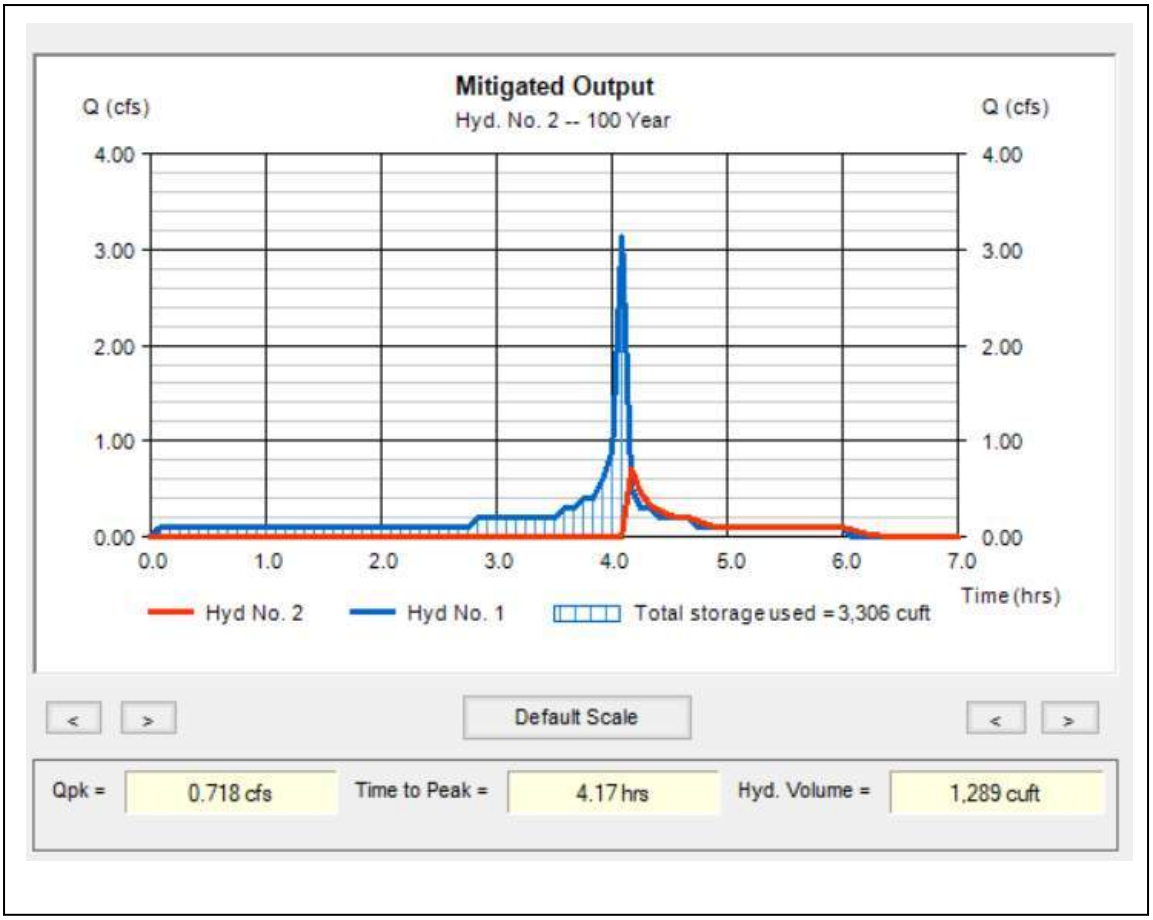


Figure 7: Mitigated 100-year Outflow Hydrograph

3.4 Conclusion

The project will increase the 100-year peak flow rate at the southeast corner of the site (POC-1). The proposed ADS vault system will detain the 100-year peak flow to a level below the existing condition. The project's proposed storm drain system is sized to convey the 100-year peak flow rate safely to the existing discharge point. The Project will not have any negative impacts on surrounding properties or the County's storm drain system.

APPENDIX A

FEMA/FIRM Map

possible updated or additional flood hazard information.

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

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

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

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

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

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

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

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

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

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

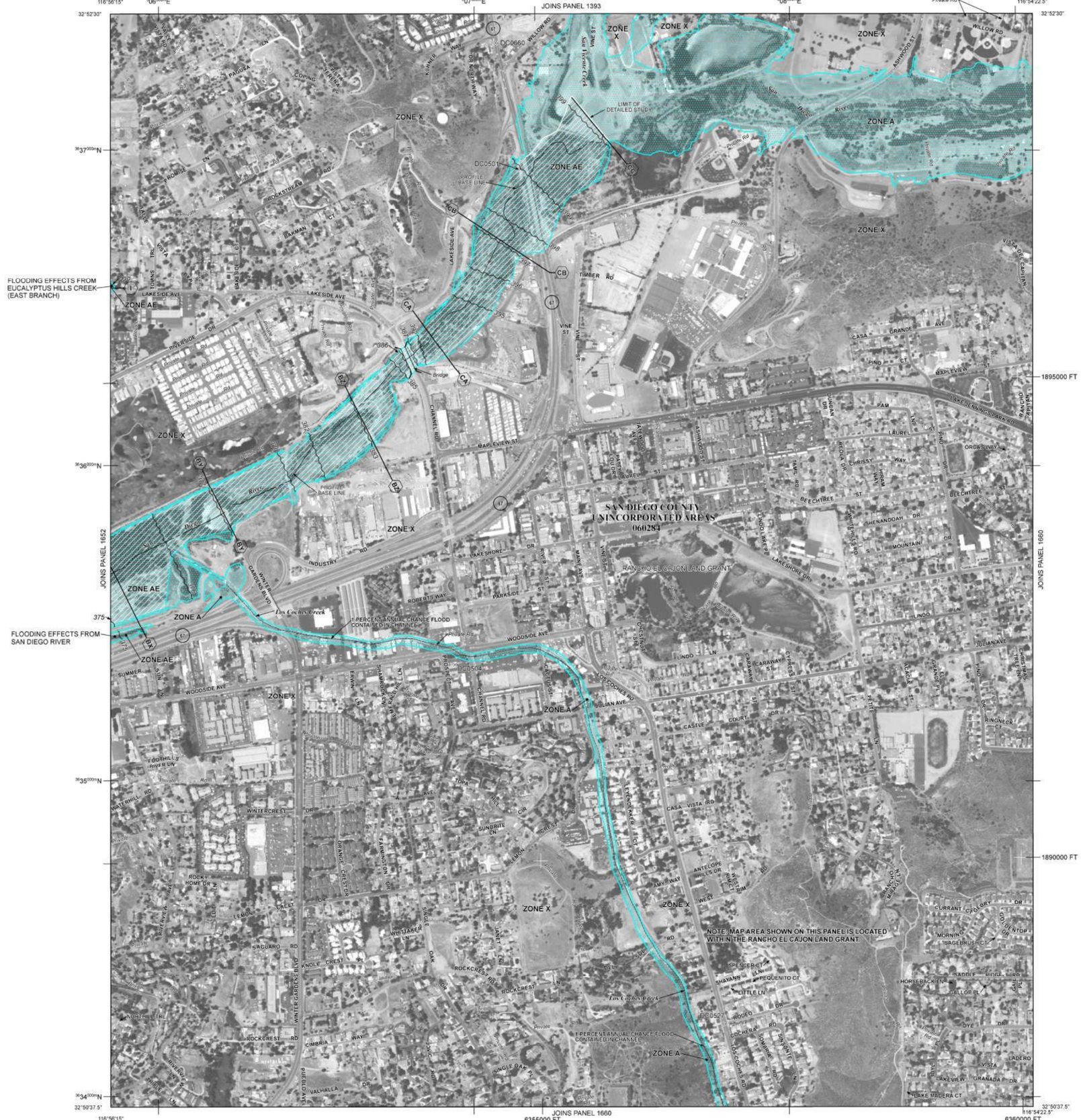
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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

Contact the **FEMA Map Service Center** at 1-877-FEMA MAP (1-877-336-2627) for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

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



ZONE A
No Base Flood Elevations determined.

ZONE AE
Base Flood Elevations determined.

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

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

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

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

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

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

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

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

OTHER AREAS
ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A–A — Cross section line
- 23–23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4275000mE — 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 FT — 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
May 16, 2012 – to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to update map elevations to North American Vertical Datum of 1988.

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

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

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1656G

FIRM
FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1656 OF 2375
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN DIEGO COUNTY	060284	1656	G

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

MAP NUMBER
06073C1656G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

APPENDIX B

San Diego County
Hydrology Manual & TR-55 Excerpts

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.

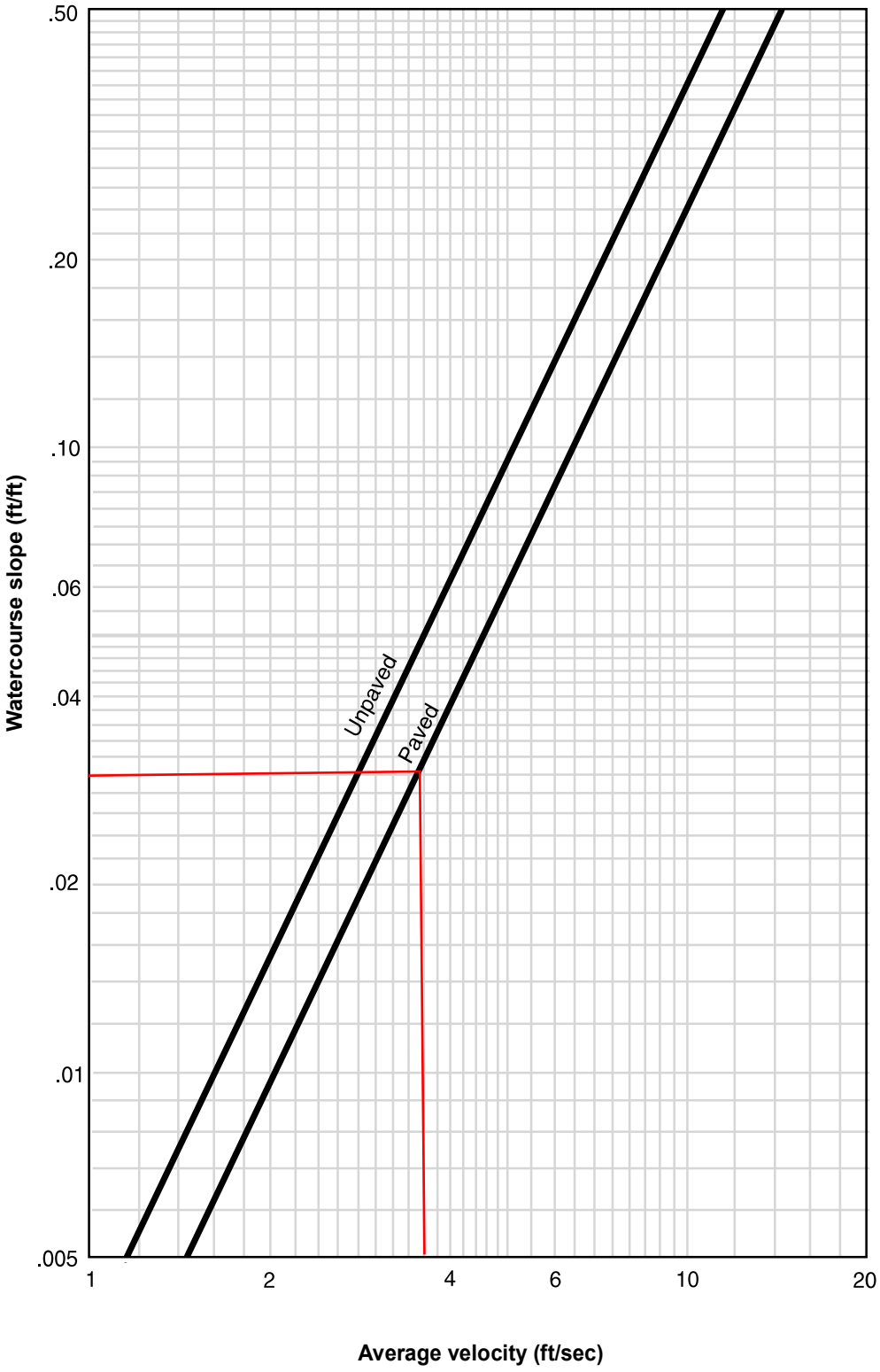
Table 3-2

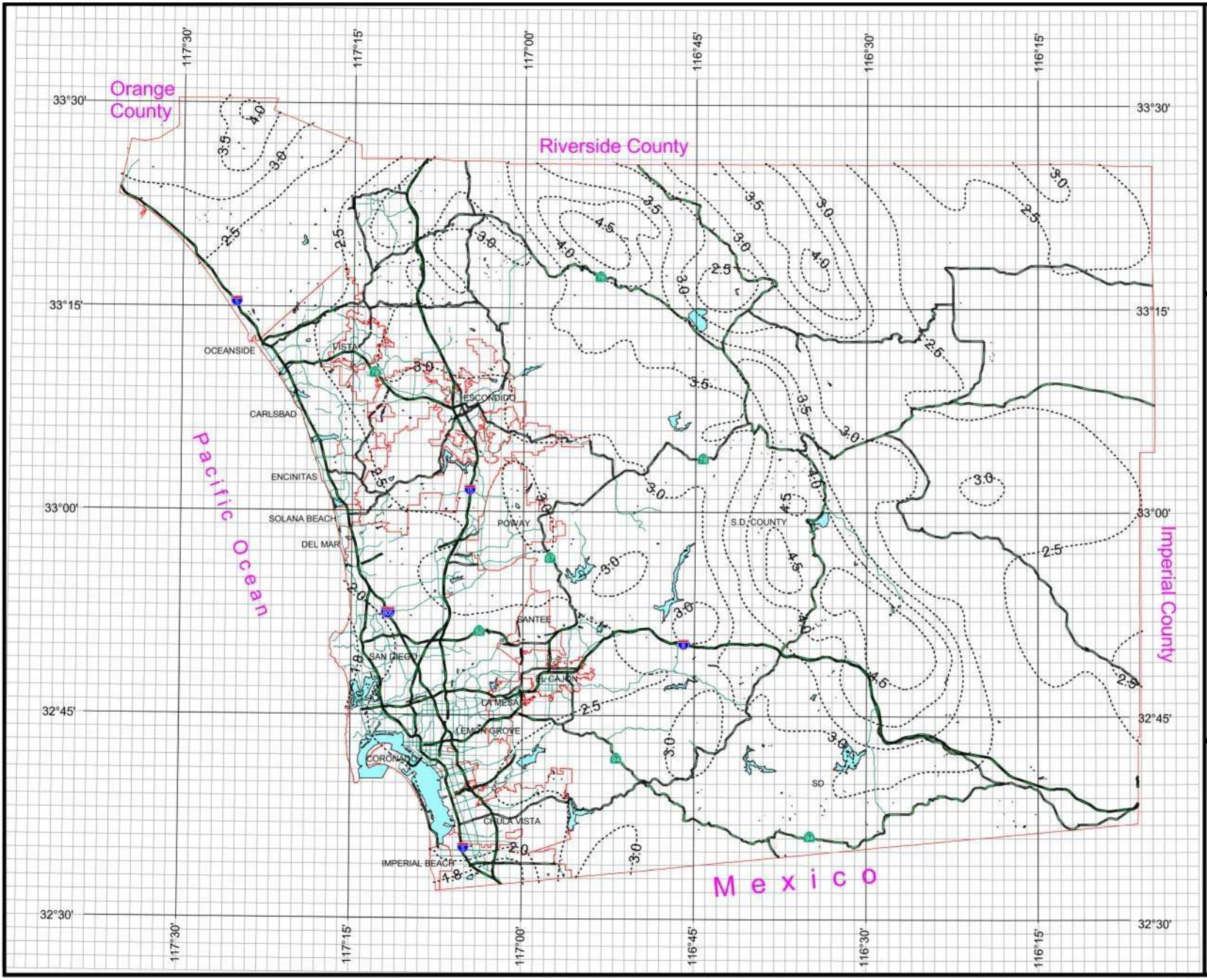
MAXIMUM OVERLAND FLOW LENGTH (L_M)
& INITIAL TIME OF CONCENTRATION (T_i)

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

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow





County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

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We Have San Diego Covered!

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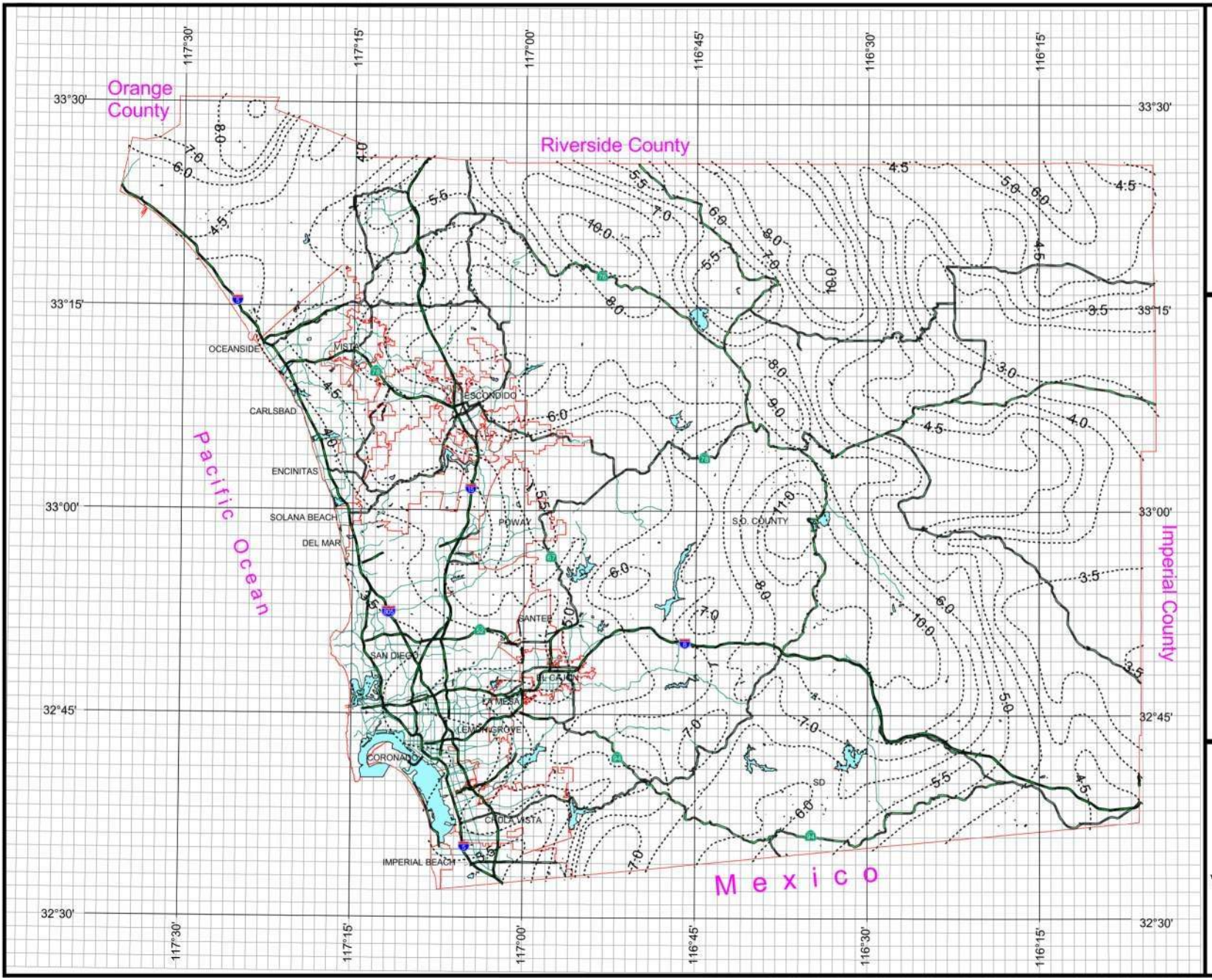
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works Geographic Information Services

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3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

PROJET LOCATION - 2.9

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

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

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

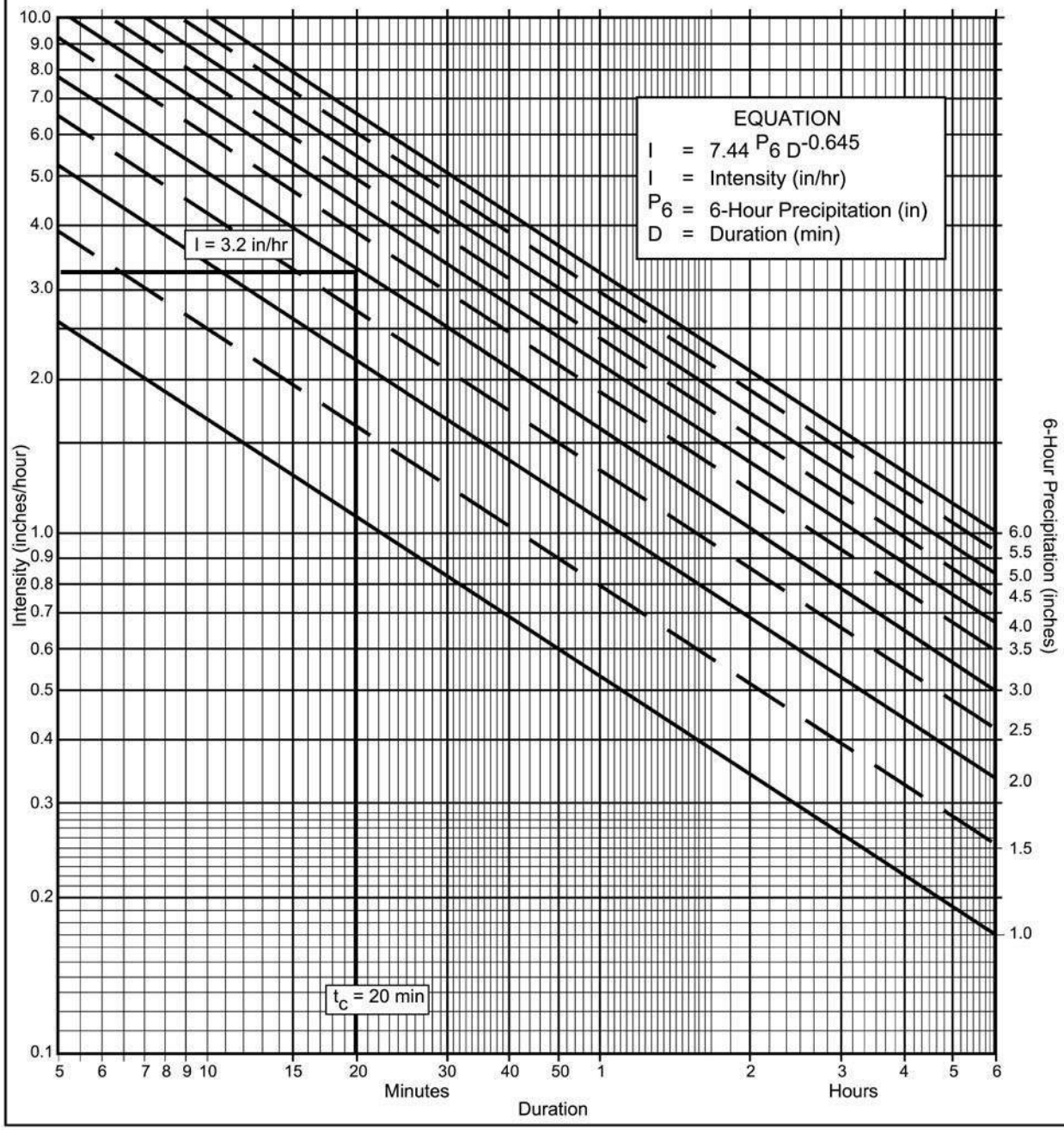
117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



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 50 year

(b) P_6 = 3 in., P_{24} = 5.5 , $\frac{P_6}{P_{24}}$ = 54.5 %(2)

(c) Adjusted P_6(2) = 3 in.

(d) t_x = 20 min.

(e) I = 3.2 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 - Example

FIGURE 3-2

APPENDIX C

Hydrology Calculations & Exhibits

Hydrology Analysis - 100-year Storm Event							
Existing Condition							
Drainage Basin Name	Area (Sf)	Area (Ac)	C	Tc (min)	P6	I (in/hr)	Q100 (cfs)
EX-1	22,005	0.51	0.51	6.0	2.9	6.79	1.75
EX-2	855	0.02	0.79	5.0	2.9	7.64	0.12
						Total (POC-1)	1.87
Proposed Condition							
PR-1	13,260	0.30	0.82	5.0	2.9	7.64	1.90
PR-2	8,710	0.20	0.81	5.0	2.9	7.64	1.23
PR-3	890	0.02	0.73	5.0	2.9	7.64	0.11
						Total (POC-1)	3.25

Summary Table			
Point of Compliance	Existing Q100 (cfs)	Proposed Q100 Unmitigated (cfs)	Proposed Q100 Mitigated (cfs)
POC-1	1.87	3.25	0.82

	Total	Pervious	Impervious	Total	Pervious	Impervious	C Value
EX-1	22,005	16,105	5,900	0.51	0.37	0.14	0.51
EX-2	855	230	625	0.02	0.01	0.01	0.79
Total	22,860	16,335	6,525	0.52	0.38	0.15	0.52
	Total	Pervious	Impervious	Total	Pervious	Impervious	C Value
PR-1	13,260	2,970	10,290	0.30	0.07	0.24	0.82
PR-2	8,710	2,060	6,650	0.20	0.05	0.15	0.81
PR-3	890	320	570	0.02	0.01	0.01	0.73
Total	22,860	5,350	17,510	0.52	0.12	0.40	0.81

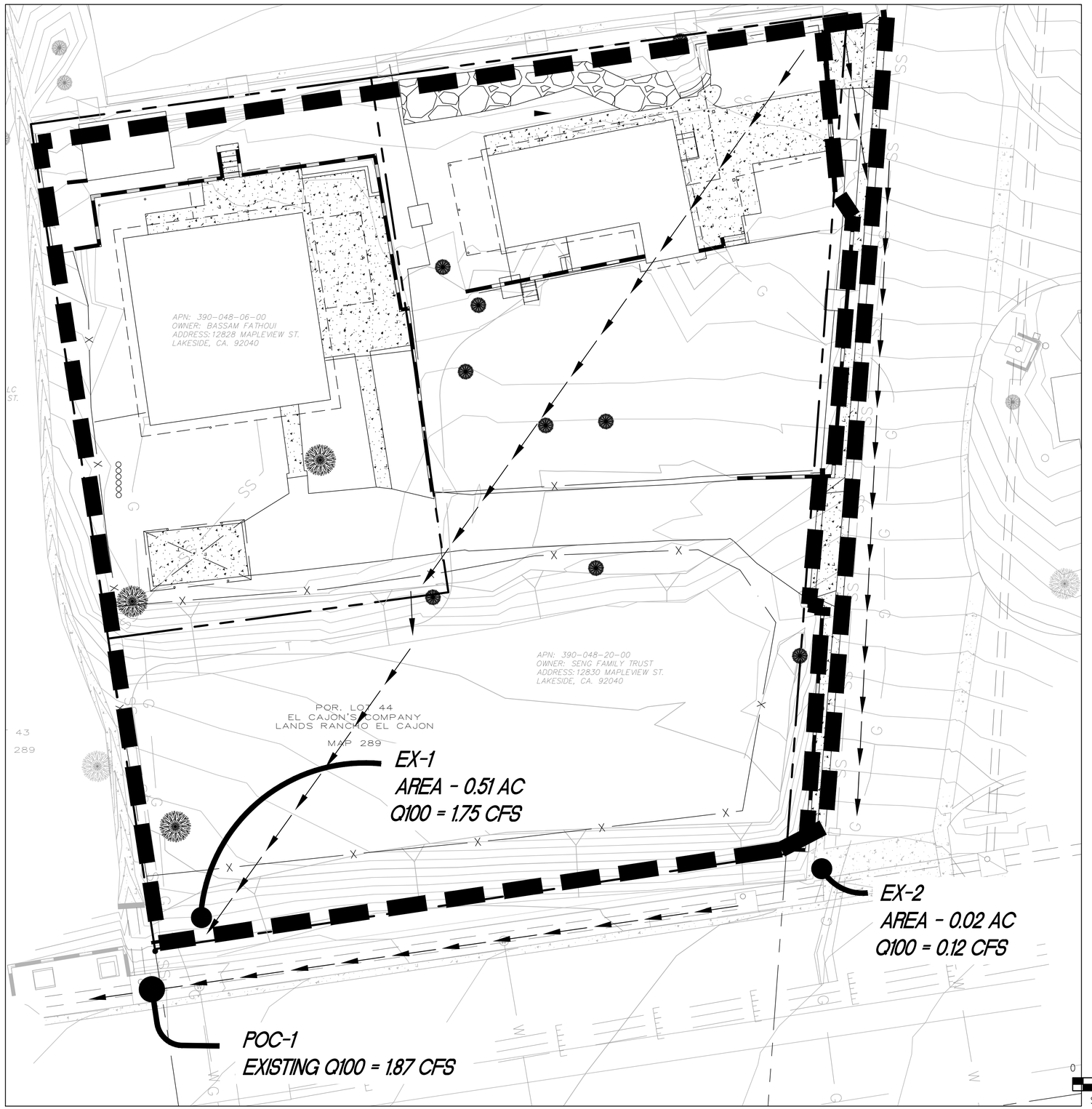
Time of Concentration											
Drainage Basin Name	Total Watercourse Distance (ft)	Initial Time of Concentration[1]		Travel Time							Time of Contrantration[4]
		Lm (ft)	Ti (min)	Concentrated Flow Path (ft)	Top Elevation (ft)	Bottom Elevation (ft)	Slope	Overland Flow Velocity[2] (ft/sec)	Pipe Flow Velocity[3] (ft/sec)	Tt (min)	Tc = Ti =Tt
EX-1	235	100	5.6	135	425	407	0.133	5.5	-	0.4	6.0
EX-2	150	100	2.7	50	420	411	0.180	9.0	-	0.1	2.8
DA-1	199	95	3.5	104	428	426	0.019	3.0	-	0.6	4.1
DA-2	150	95	3.5	55	417	416	0.027	3.5	-	0.3	3.8
DA-3	150	100	2.7	50	420	411	0.180	9.0	-	0.1	2.8

1 - Table 3-2 *Maximume overland flow length and intial time of contration* per San Diego County Hydrology Manual. Value assumes O/P Commercial or G. Commerical with a slope fo 1%

2 - Figure 3-1 *Avergae velocities for estimating travel time for shallow contreatered flow* per NRCS TR-55 Manual

3 - Figure 3-7 Manning's Equation Nomograph per San Diego County Hydrology Manual.

4 - Minimume Tc is 5 minutes



LEGEND:

BASIN NO. EX-1

BASIN LIMIT

DIRECTION OF FLOW

NOTES:

UNDERLYING HYDROLOGIC SOIL TYPE: C

DEPTH TO GROUNDWATER: TBD

NO EXISTING NATURAL HYDROLOGIC FEATURES

N

0 20' 40'

SCALE: 1"= 20'

WARNING

0 1/2 1

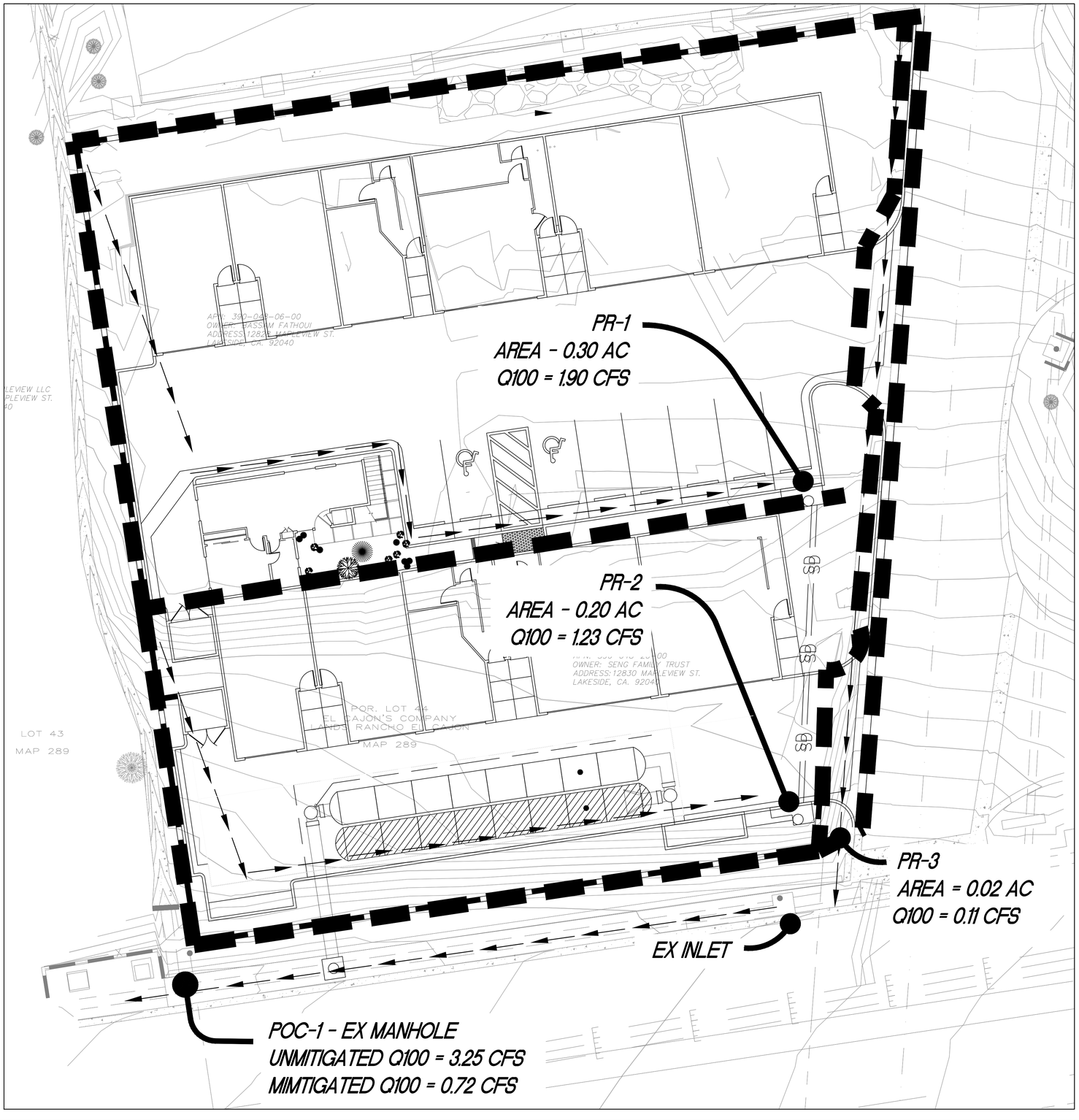
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

EXISTING DRAINAGE EXHIBIT

MAPLEVIEW

LOT 44 OF PM 289

Plotted – 9/18/2022 8:47:19 PM :: Saved – 9/17/2022 10:10:47 PM :: C:\Users\ctlea\OneDrive\Desktop\Mapleview\DWG\HYDRO-E.dwg :: ctlea



LEGEND:

BASIN NO. EX-1

BASIN LIMIT

DIRECTION OF FLOW

NOTES:

UNDERLYING HYDROLOGIC SOIL TYPE: C

DEPTH TO GROUNDWATER: TBD

NO EXISTING NATURAL HYDROLOGIC FEATURES

N

0 20' 40'

SCALE: 1"= 20'

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

PROPOSED DRAINAGE EXHIBIT

MAPLEVIEW

LOT 44 OF PM 289

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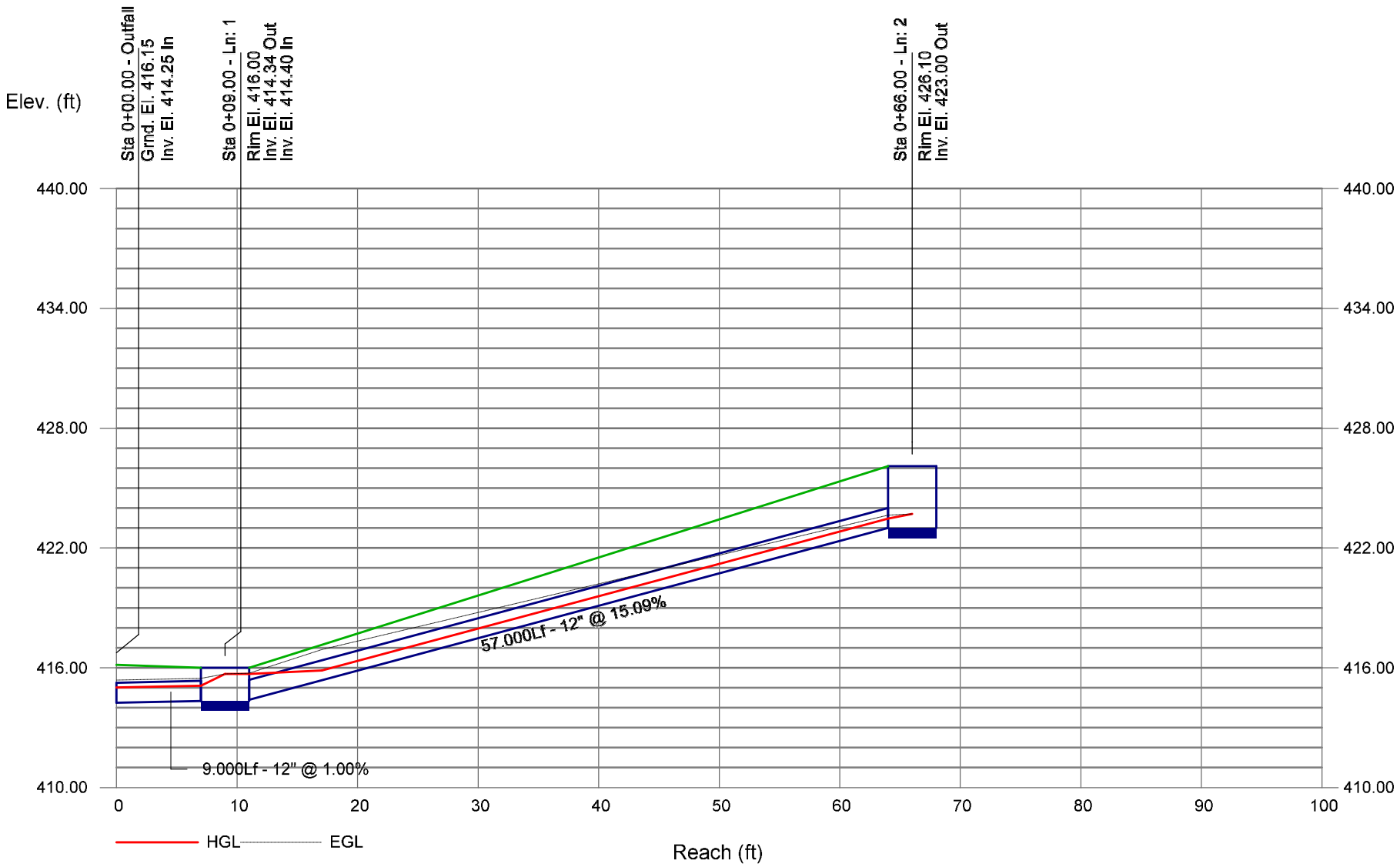
APPENDIX D

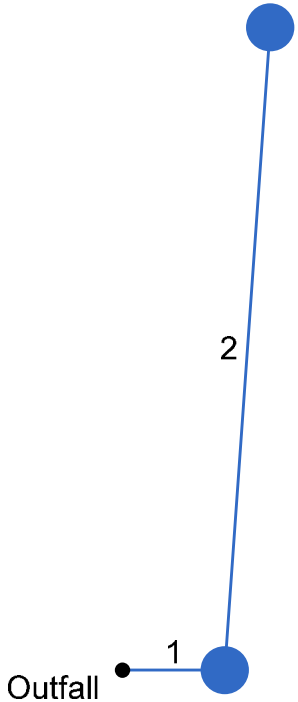
Hydraulic Analysis (Storm Drains)

Storm Sewer Profile

Proj. file: SD-1.stm



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: SD-1.stm	Number of lines: 2	Date: 9/17/2022

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)	
1	0.64	0.64	Sag	0.20	0.50	0.90	3.56	0.76	0.050	0.020	4.00	0.000	0.76	0.76**	Outfall	0.00	187.43	415.38	415.69 i	0.308	
2	0.36	0.36	1	0.20	0.50	0.90	13.83	0.47	0.050	0.020	4.00	-85.964	1.00	0.47**	1	0.00	191.44	415.73	423.71 i	7.975	

Project File: SD-1.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
3.13	n/a	n/a	....	....	....	416.15	416.00	0.29	Sag	11.38	2.00	415.01	415.10	415.69 i	....	....	0.00	1.90	0.29	100
1.23	n/a	n/a	....	....	....	416.00	426.10	0.23	Sag	8.51	2.00	415.69	423.47 j	423.71 i	415.73	415.86	0.00	1.23	0.23	100

Project File: SD-1.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID	
	Sag		0.0	0.00	0.00	414.25	414.34	....	....	0.00	0.00	1.50	Curb	1.90	352	317	299		
	Sag		0.0	0.00	0.00	414.40	423.00	5.70	2.34	0.18	1.06	1.00	Curb	1.23	1,696	1,526	1,442		

Project File: SD-1.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: Known Qs only. ; i Inlet control; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
9.000	12	1.00	Cir	0.0	....	0.013	n/a	176.48	0.04	0.00	1.90	0.00	12	0.00	12	0.00	0.00	0.00	0.6	4.0	0.00	0.00
57.000	12	15.09	Cir	0.0	....	0.013	n/a	233.34	0.61	0.00	1.23	0.00	12	0.00	12	0.00	0.00	0.00	0.0	4.0	0.00	0.00

Project File: SD-1.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	4.90	4.89	0.37	0.37	4.90	0.90	0.66	5.75
0.00	2.49	1.57	0.04	0.18	3.41	0.60	2.10	38.69

Project File: SD-1.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

Hydraulic Grade Line Computations

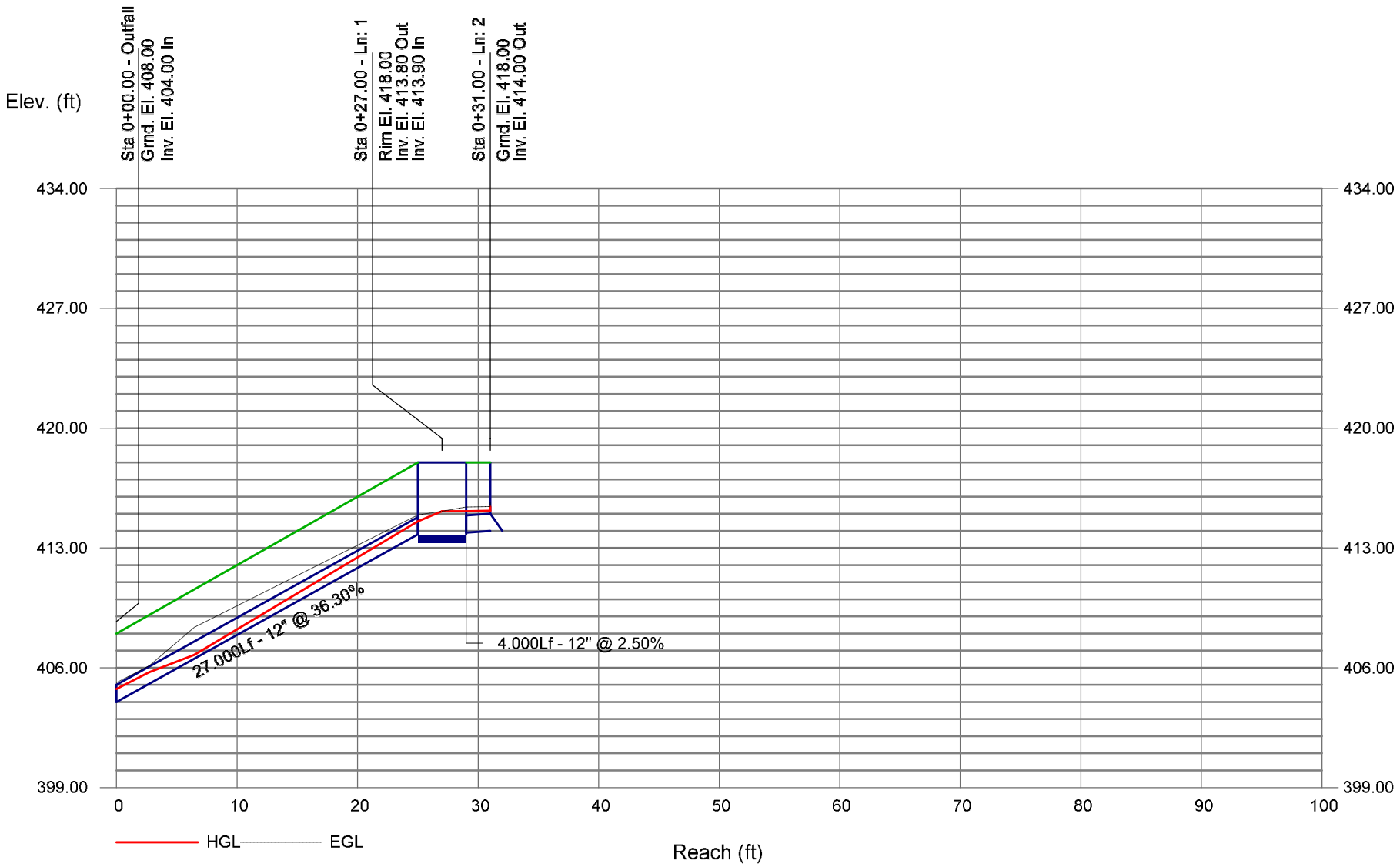
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	12	3.13	414.25	415.01	0.76	0.64	4.89	0.37	415.38	n/a	9.000	414.34	415.10	0.76**	0.64	4.90	0.37	415.47i	n/a	n/a	n/a	1.50	n/a
2	12	1.23	414.40	415.69	1.00	0.36	1.57	0.04	415.73	n/a	57.000	423.00	423.47 j	0.47**	0.36	3.41	0.18	423.65i	n/a	n/a	n/a	1.00	n/a

Project File: SD-1.stm | Number of lines: 2 | Run Date: 9/17/2022

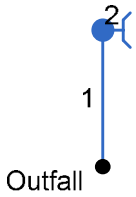
Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: SD-2.stm



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: SD-2.stm	Number of lines: 2	Date: 9/17/2022

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)	
1	0.64	0.64	n/a	0.20	0.50	0.90	21.46	0.75	....	....	....	-90.000	0.76	0.75**	Outfall	0.00	178.43	405.13	415.14 i	10.013	
2	0.79	0.79	1	0.20	0.50	0.90	5.63	0.75	....	....	....	90.000	1.00	1.00	1	0.00	182.43	415.39	415.42	0.030	

Project File: SD-2.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
3.11	n/a	n/a	....	....	....	408.00	418.00	....	....	....	....	404.76	414.56 j	415.14 i	405.74	406.76	0.00	0.01	....	....
3.10	0.758	0.758	....	....	....	418.00	418.00	....	....	....	....	415.14	415.17	415.42	....	....	0.00	3.10	....	100

Project File: SD-2.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID	
	Sag		0.0	0.00	0.00	404.00	413.80	2.70	3.77	0.37	1.61	1.00	MH	0.01	930	837	791		
	Sag		0.0	0.00	0.00	413.90	414.00	....	....	0.00	0.00	1.00	Hdwall	3.10	119	107	101		

Project File: SD-2.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: Known Qs only. ; i Inlet control; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
27.000	12	36.30	Cir	....	....	0.013	n/a	203.48	0.11	....	....	....	12	0.00	12	0.00	0.00	0.00	0.0	....	0.00	0.00
4.000	12	2.50	Cir	....	....	0.013	0.24	203.48	0.02	0.00	3.10	0.00	12	0.00	12	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: SD-2.stm | Number of lines: 2 | Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)	
0.00	4.87	4.86	0.37	0.37	4.89	3.00	3.20	17.23	
0.00	3.95	3.95	0.24	0.24	3.95	3.10	3.00	3.14	

Project File: SD-2.stm	Number of lines: 2	Date: 9/17/2022

NOTES: i Inlet control; ** Critical depth

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	12	3.11	404.00	404.76	0.76	0.64	4.86	0.37	405.13	n/a	27.000	413.80	414.56 j	0.75**	0.64	4.89	0.37	414.93i	n/a	n/a	n/a	1.00	n/a
2	12	3.10	413.90	415.14	1.00	0.79	3.95	0.24	415.39	0.758	4.000	414.00	415.17	1.00	0.79	3.95	0.24	415.42	0.758	0.758	0.030	1.00	0.24

Project File: SD-2.stm | Number of lines: 2 | Run Date: 9/17/2022

Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

APPENDIX E

Hydraulic Analysis
(100-year Peak Flow Attenuation)

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	5500 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(20 ft. x 100 ft.)

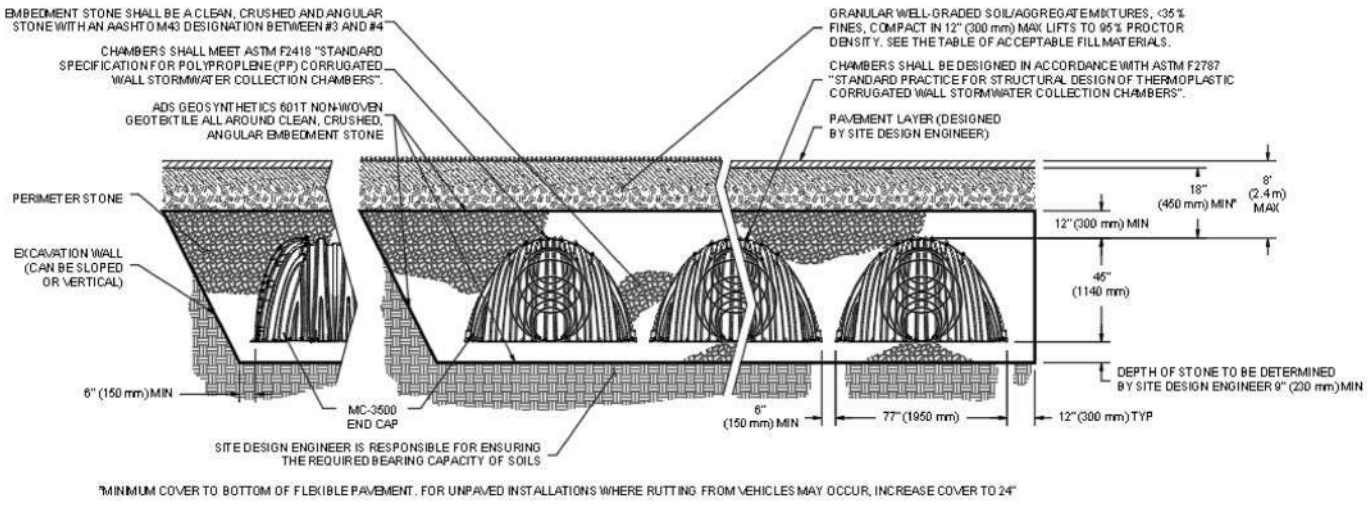
Results

System Volume and Bed Size

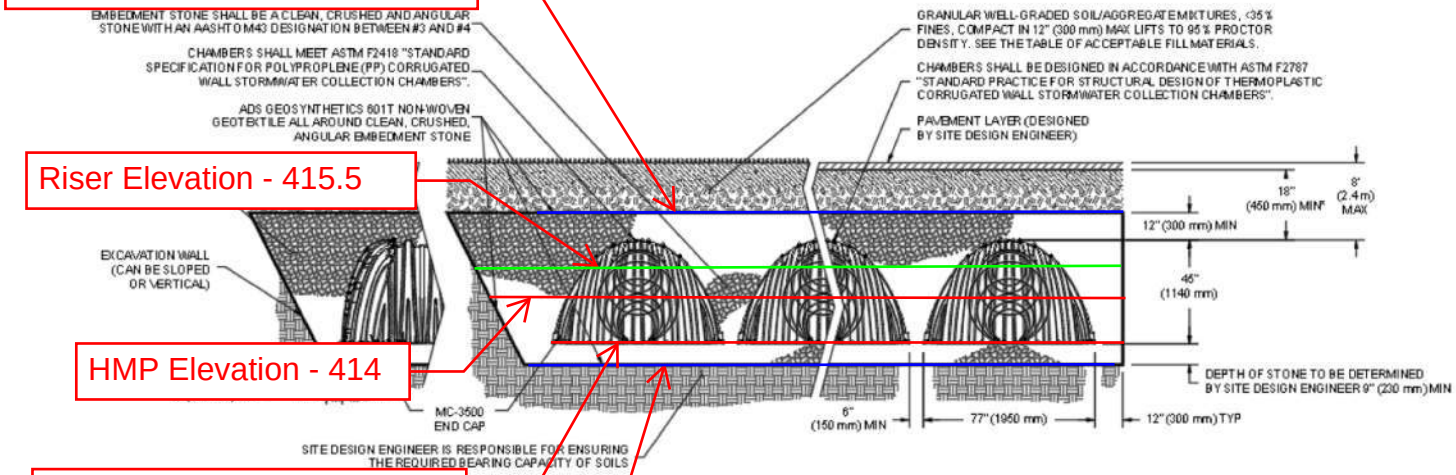
Installed Storage Volume:	5355.36 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	26
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	102.85 ft.
Maximum Width:	15.93 ft.
Approx. Bed Size Required:	1638.71 square ft.

System Components

Amount Of Stone Required:	226 cubic yards
Volume Of Excavation (Not Including Fill):	334 cubic yards
Total Non-woven Geotextile Required:	612 square yards
Woven Geotextile Required (excluding Isolator Row):	17 square yards
Woven Geotextile Required (Isolator Row):	114 square yards
Total Woven Geotextile Required:	130 square yards



Top of Rock Encasement - 417



Riser Elevation - 415.5

HMP Elevation - 414

Bottom of Vault - 412.5
HMP Orifice 0.9"

Bottom of Rock Encasement - 411.75

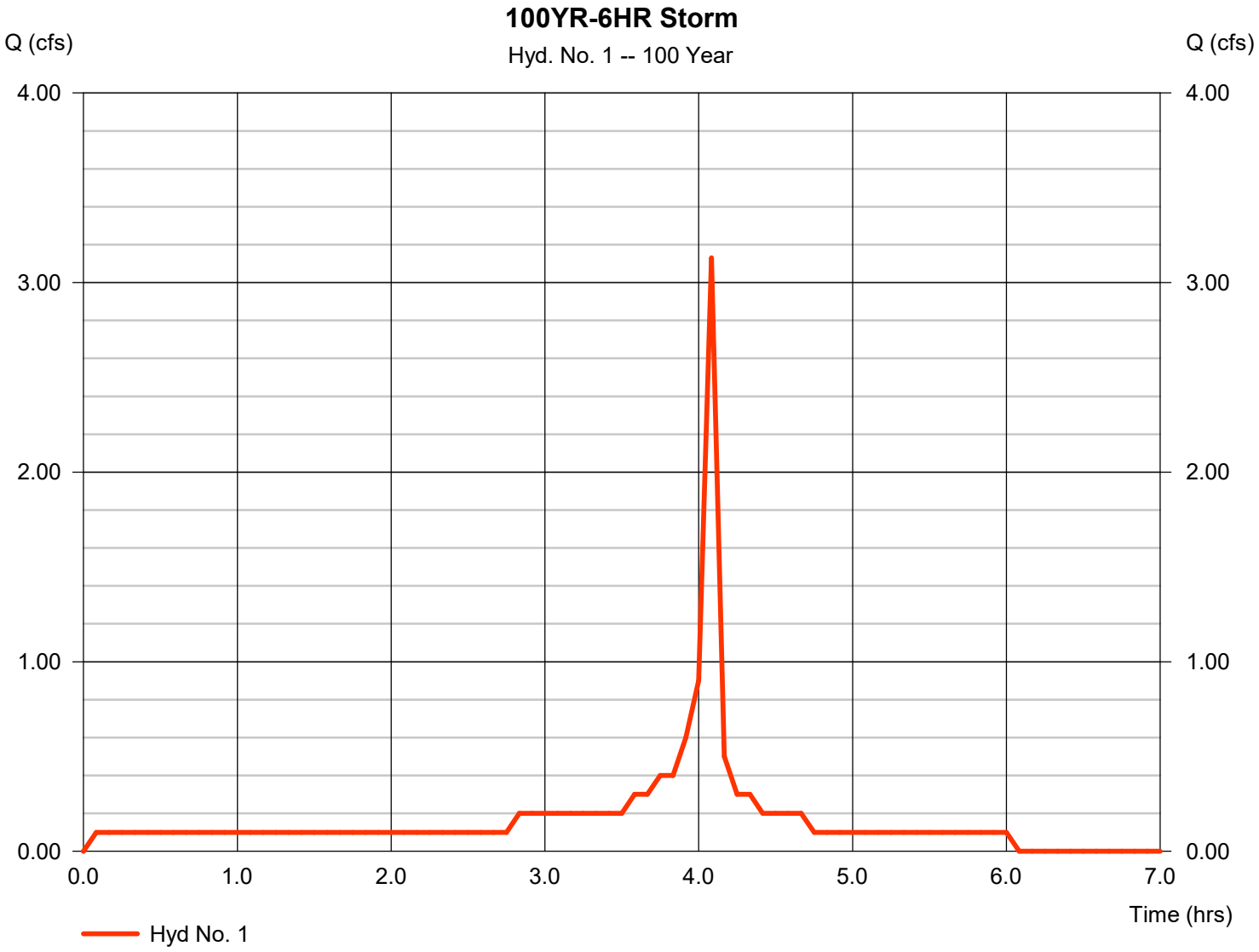
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Saturday, 09 / 17 / 2022

Hyd. No. 1

100YR-6HR Storm

Hydrograph type	= Manual	Peak discharge	= 3.130 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.08 hrs
Time interval	= 5 min	Hyd. volume	= 4,389 cuft



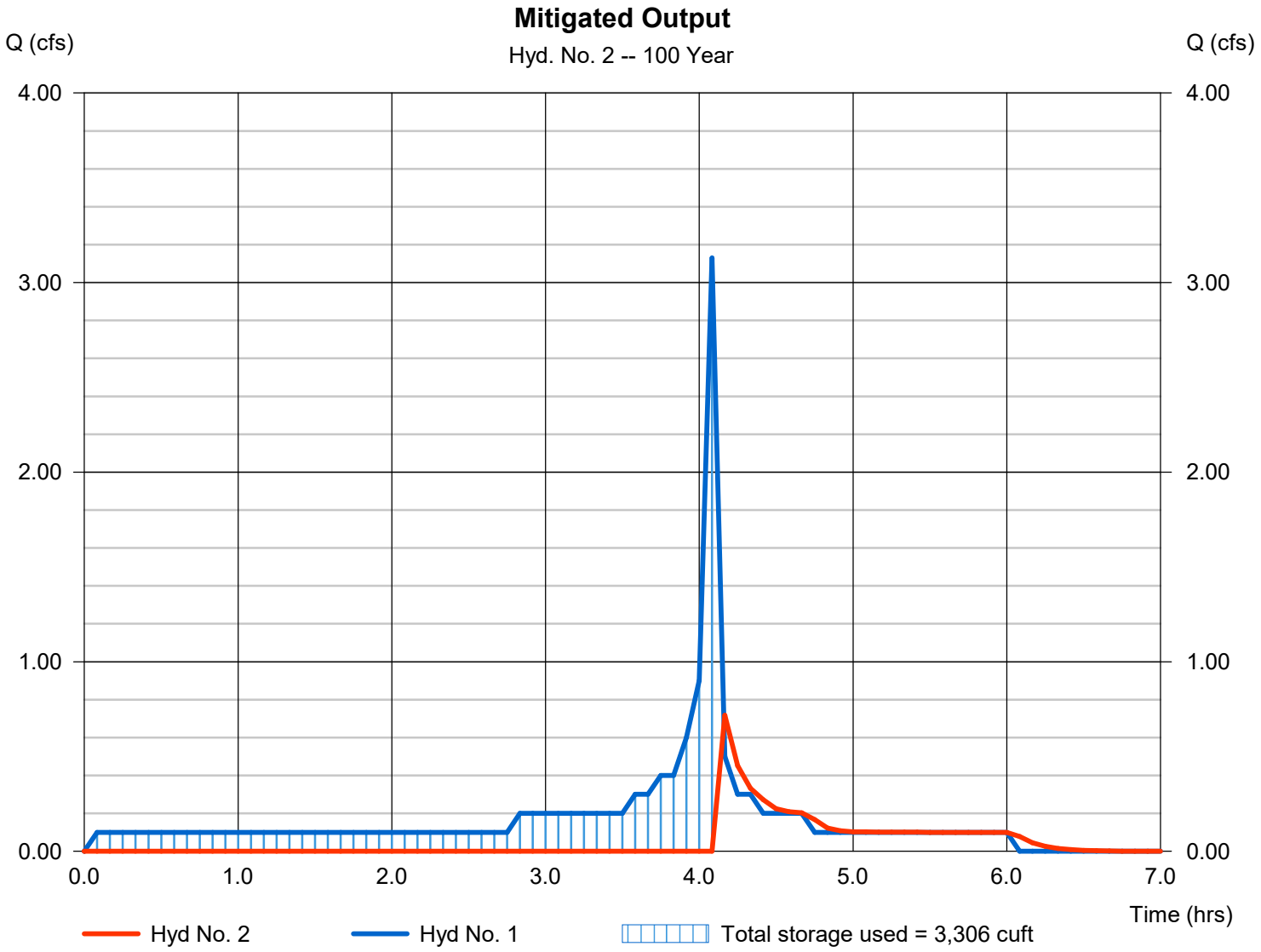
Hydrograph Report

Hyd. No. 2

Mitigated Output

Hydrograph type	=	Reservoir	Peak discharge	=	0.718 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.17 hrs
Time interval	=	5 min	Hyd. volume	=	1,289 cuft
Inflow hyd. No.	=	1 - 100YR-6HR Storm	Max. Elevation	=	415.61 ft
Reservoir name	=	ADS Vault - 100 Detention	Max. Storage	=	3,306 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - ADS Vault - 100 Detention

Pond Data

UG Chambers -Invert elev. = 414.00 ft, Rise x Span = 2.00 x 3.00 ft, Barrel Len = 103.00 ft, No. Barrels = 2, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 414.00 ft, Width = 15.30 ft, Height = 3.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	414.00	n/a	0	0
0.30	414.30	n/a	634	634
0.60	414.60	n/a	631	1,266
0.90	414.90	n/a	624	1,890
1.20	415.20	n/a	613	2,503
1.50	415.50	n/a	597	3,100
1.80	415.80	n/a	571	3,671
2.10	416.10	n/a	519	4,190
2.40	416.40	n/a	491	4,681
2.70	416.70	n/a	491	5,172
3.00	417.00	n/a	491	5,662

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	0.00	0.00
Span (in)	= 18.00	0.90	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 414.00	414.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 415.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)
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).