

CA ENGINEERING, INC.

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HYDROLOGY REPORT

(FOR CONCEPTUAL GRADING PLAN)

FOR

WALNUT AVE. INDUSTRIAL PROJECT

TRACT MAP No. 80302

City of Signal Hill

Date: April 22th, 2019

Revised: June 20th, 2019

Revised: August 20th, 2019

PLANS PREPARED UNDER THE SUPERVISION OF:



Fred Cornwell, P.E. - R.C.E 45591 8/20/2019
Date



Table of Contents

- 1.0 INTRODUCTION / PROJECT DESCRIPTION**
- 2.0 EXISTING DRAINAGE CONDITIONS**
- 3.0 PROPOSED DRAINAGE CONDITIONS**
- 4.0 HYDROLOGICAL AND SOIL DATA**
- 5.0 HYDROLOGY METHODOLOGY AND RESULTS**
- 6.0 WATER QUALITY**
- 7.0 FLOOD PLAIN DESIGNATION**
- 8.0 RESULTS/ CONCLUSION**
- 9.0 VICINITY MAP**

APPENDICES

APPENDIX A: EXISTING PEAK FLOW HYDROLOGIC ANALYSIS (85th PERCENTILE, 10 YEAR, AND 50 YEAR STORMS)

APPENDIX B: PROPOSED PEAK FLOW HYDROLOGIC ANALYSIS (85th PERCENTILE, 10 YEAR, AND 50 YEAR STORMS)

EXHIBITS

EXHIBIT A - EXISTING CONDITION HYDROLOGY MAP

EXHIBIT B - PROPOSED CONDITION HYDROLOGY MAP

EXHIBIT C – RAINFALL INTENSITY & SOILS MAP FOR 85th PERCENTILE AND 50 YEAR STORMS

EXHIBIT D – LID MAP

EXHIBIT E – FIRM MAP

1.0 INTRODUCTION

The purpose of this report is to present the hydrology analysis and drainage calculations prepared for Tentative Parcel Map 79278, located in the City of Signal Hill, California. This project proposes to construct nine industrial buildings totaling approximately 138,695 square feet on approximately 8.69 acres. This project would be considered an "Industrial/Commercial Development". This report will focus on the runoff volume and water quality conditions relative to the conceptual grading of the project. The on-site drainage systems will be sized pursuant to the Precise Grading plan and associated sub-areas.

2.0 EXISTING DRAINAGE CONDITIONS

The site is currently vacant and consists of three separate dirt areas which are separated by existing streets. The first northern most area is surrounded by Gundry Ave to the west, 21st street to the south, Walnut Ave. to the east, and an existing construction site to the north. There are commercial businesses to the west of Gundry Ave., while to the east of Walnut Ave. lies the American University of Health Sciences. The second area is south of 21st street and west of Walnut Avenue. The southwest border of the second area is surrounded by Jenni Rivera Memorial Park. The third area is surrounded by the American University of Health to the north, Walnut Ave. to the west, Gaviota Ave. to the east, and a intersection of 20th St. and Alamitos Ave. to the south.

The on-site drainage drains from the north to the south with a slight gradient to the west. The site is relatively flat with a gradual drop in elevation from the north-east corner to the south-west. There are existing catch basins located on 21st street and Walnut Ave. that connect to the existing storm drain system that runs along Walnut Ave. The existing drainage is directed into the existing catch basins via surface flows and street gutters.

3.0 PROPOSED DRAINAGE CONDITIONS

The proposed drainage pattern will perpetuate the existing patterns of the site being drained from the north to the south. For each area the onsite flows will be captured by catch basins and area drains which will be directed into 60" storage pipes via low-flow pipes. The water will then be pumped into Bio-planters for treatment and then released into the existing storm drain system via the bioplanter underdrains. During storm events when the hydraulic grade line exceeds the storage pipe, the water will overflow into the existing storm drains via high-flow pipes.

Per the LA County LID Manual requirements, each drainage area will contain 60" detention pipes that will be sized to completely store 1.5 times the 85th percentile storm runoff volume. Each area will also contain a biofiltration planter sized to treat the volume contained in the detention pipes. Both treated flows from the Bio-Planters and overflows during larger storm events will be directed to the existing storm drain system that runs along Walnut Ave.

The on-site storm drain system will be sized to accommodate the 10 year storm event via 24" conduits which will outlet to the existing storm drain system. 10 year storm rainfall values are calculated using Table 5.3.1 of the LA County Hydrology Manual. During a 50 year storm event, the on-site storage and high flow conduits may overflow and sheet flow into the existing storm drain system; the site may experience slight ponding during this larger storm event.

4.0 HYDROLOGICAL AND SOIL DATA

References used in this report were the following:

- Los Angeles County Flood Control District, Hydrology Manual.

The following data is from the on-line Department of Public Works Hydrology map for the project site:

- 50 year Rainfall Isohyet – 5.10 inches
- 10 year Rainfall Isohyet – 3.64 inches (via Table 5.3.1)
- Final 85th Percentile, 24-hr Rainfall – 0.59 inches
- Soils Group Classification – 014

5.0 HYDROLOGY METHODOLOGY AND RESULTS

We have utilized the HydroCalc 1.0.2 calculator downloaded from the Department of Public Works web site to determine the proposed and existing hydrological conditions of the project. The 50 year, 10 year, and 85th percentile storms were input to determine the proposed and existing storm hydrographs. See “Appendix A” and “Appendix B” for HydroCalc output results. The tables below summarize the peak flows and runoff volume results for each drainage area.

	Area	85th Percentile Storm Event		10 Year Storm Event		50 Year Storm Event	
		Peak Flow (cfs)	Runoff Volume (cf)	Peak Flow (cfs)	Runoff Volume (cf)	Peak Flow (cfs)	Runoff Volume (cf)
Existing	1	0.09	2,042	2.31	10,887	7.32	17,149
Existing	2	0.02	479	1.70	2,867	3.48	4,430
Existing	3	0.04	814	2.17	4,806	4.79	7,521
Existing	Total	0.15	3,335	6.18	18,560	15.59	29,100
Proposed	1	0.61	8,234	5.42	40,163	8.77	56,412
Proposed	2	0.23	3,634	2.17	17,778	3.68	25,047
Proposed	3	0.33	4,372	3.31	21,442	5.58	30,204
Proposed	Total	1.17	16,240	10.90	79,383	18.03	111,663
	Net	1.02	12,905	4.72	60,823	2.44	82,563

In the hydrographs it is shown that the peak flows are increased from the existing condition to the proposed condition. This is due to the increase of impervious area when compared to existing conditions. However, we have created more storage due to water quality requirements which will help mitigate the increase in volume for the storm events. Per the LID Map shown in Exhibit D, the proposed storage for water quality is a combined volume of 25,425 CF. This storage volume is greater than the net volume increase of 16,240 CF.

6.0 WATER QUALITY

Sample water quality calculations for drainage area 1 will be described below. Calculations for drainage areas 2 and 3 are shown on the LID Plan and are summarized in the table below.

As shown in the project's Low Impact Development (LID) plan (Exhibit D), a 60" detention pipe will store all runoff volume before it is pumped into and treated with biofiltration planters. The treated water will outlet into the existing storm drain system along Walnut Avenue. Per the LA County LID Manual requirements, the planters must have a maximum drawdown time of 96 hours.

For area 1, the Stormwater Quality Design Volume (SWQDv) is equal to the proposed 85th percentile runoff volume of 8,234 CF (see section 5.0). However, since the water is not being infiltrated there is a 50% penalty that results in a SWQDv of 12,351 CF. To help mitigate the 50 year storm event, the 60" detention pipe is sized to hold the SWQDv. The length of pipe required is shown below:

$$\begin{aligned} 5' \text{ pipe cross-sectional area} &= \pi r^2 = \pi(2.5)^2 = 19.63 \text{ cf/lf} \\ \text{Length of pipe required} &= \text{pipe volume} / \text{pipe area} = 12,351 \text{ cf} / 19.63 \text{ cf/lf} = 629 \text{ lf} \\ \text{Length of pipe provided} &= 634 \text{ lf} > 629 \text{ lf} \end{aligned}$$

The biofiltration planter sizing is based on a 96 hour drawdown time, the calculations are shown below:

$$\begin{aligned} \text{Biofiltration Area Required (sf)} &= \frac{\text{Storage Volume (cf)}}{\text{Infiltration Rate (in/hr)} * \text{Drawdown Time (hr)}} \\ &= \frac{634 \text{ lf} * 19.63 \text{ cf/lf}}{2.5 \text{ in/hr} * (1/12 \text{ ft/in}) * 96 \text{ hr}} \\ &= 623 \text{ sf} \end{aligned}$$

$$\text{Area Provided (sf)} = 679 \text{ sf} > 623 \text{ sf}$$

$$\begin{aligned} \text{Min. Pump Rate (gal/min)} &= \text{Volume To Be Treated (cf)} / \text{maximum drawdown time} \\ &= 12,450 \text{ cf} / (96 \text{ hr} * 60 \text{ min/hr}) \\ &= 2.16 \text{ cf/min} * (7.48 \text{ gal/min}) \\ &= 16.17 \text{ gal/min}^* \end{aligned}$$

*A pump rate of 17 gallons/minute will be used.

$$\begin{aligned} \text{Drawdown Time (maximum 96 hours)} &= \frac{\text{SWQDv/Volume To Be Treated (cf)}}{\text{Biofiltration Area (sf)} * \text{Biofiltration Rate (in/hr)}} \\ &= \frac{12,450 \text{ cf}}{679 \text{ sf} * (2.5 \text{ in/hr}) * (1 \text{ ft}/12 \text{ in})} \\ &= 88.05 \text{ hours} < 96 \text{ hours} \end{aligned}$$

Area	SWQDv (cf)	Storage Volume Required (cf) ~1.5*SWQDv	Length of 60" Pipe Required (lf)	Length of 60" Pipe Provided (lf)	Storage Pipe Volume Provided (cf)	Biotreatment Area Required (sf)	Biotreatment Area Provided (sf)	Minimum Pump Flow to Achieve 96 Hr Drawdown (gpm)	Pump Provided (gpm)
1	8,234	12,351	629	634	12,450	623	679	16.17	17.0
2	3,634	5,451	278	297	5,825	291	412	7.56	8.0
3	4,372	6,558	334	364	7,150	358	612	9.29	10.0

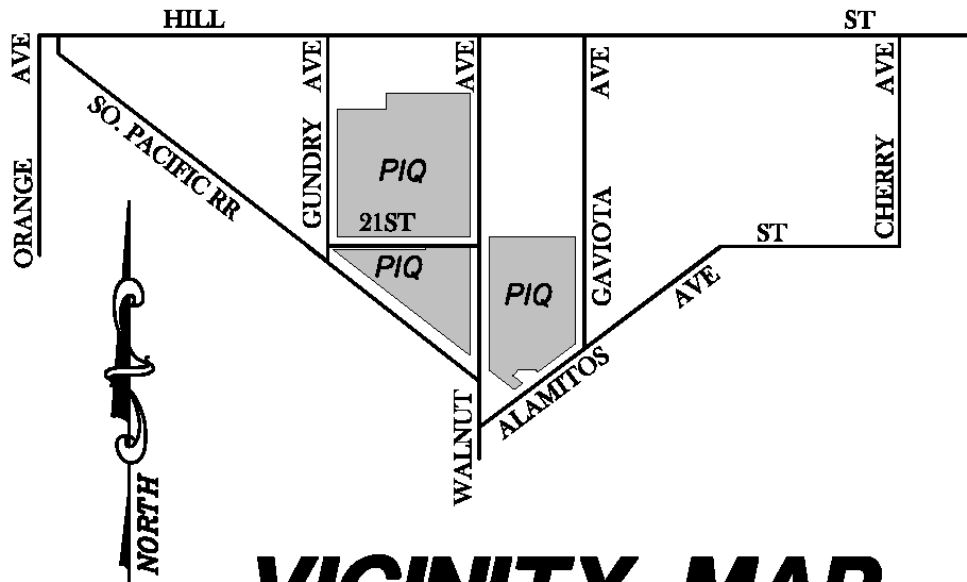
7.0 FLOOD PLAIN DESIGNATION

The site falls within a Zone “X” designation under the FEMA Map 06037C1970F, dated September 26, 2008. The site is an area of minimal flood hazard, and slightly overlaps an area with reduced flood risk due to levee.

8.0 CONCLUSION

Based upon the results of this report, it is concluded that the proposed facilities will adequately provide drainage conveyance in accordance with an 85th percentile storm event. The proposed facilities, with adequate maintenance, will convey flows safely through the site in accordance with the City of Signal Hill requirements. The flows will be detained in the storage pipes and then pumped into the biofiltration basins. The storage pipe will detain the 85th percentile storm while the basins will achieve a drawdown time of less than 96 hours. The onsite drainage system will also be sized to convey the 10-year storm to the existing storm drain system. In the event of a 50-year storm, the overflow runoff will be directed to existing storm drain system via sheet and gutter flows as well as the onsite storm drain system.

9.0 VICINITY MAP



VICINITY MAP

N.T.S.

APPENDICES

APPENDIX A: EXISTING PEAK FLOW HYDROLOGIC ANALYSIS (85th PERCENTILE, 10 YEAR, AND 50 YEAR STORMS)

Peak Flow Hydrologic Analysis

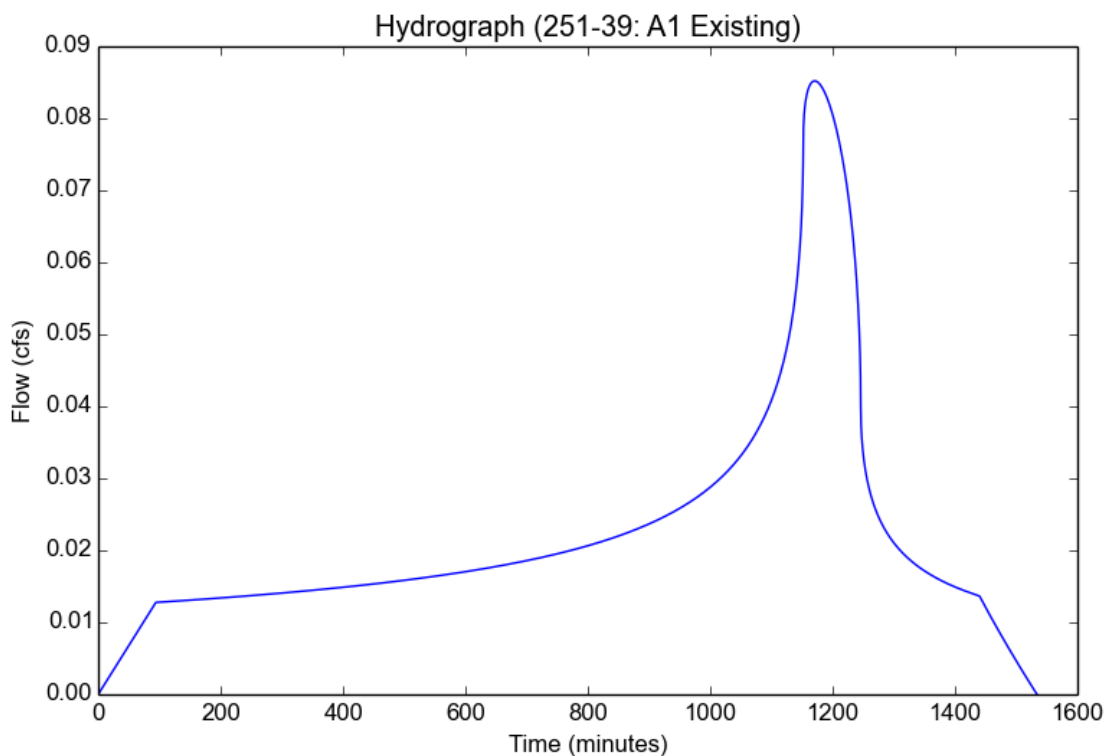
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A1 Existing
Area (ac)	4.61
Flow Path Length (ft)	755.0
Flow Path Slope (vft/hft)	0.0383
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.08
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1127
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.164
Time of Concentration (min)	94.0
Clear Peak Flow Rate (cfs)	0.0852
Burned Peak Flow Rate (cfs)	0.0852
24-Hr Clear Runoff Volume (ac-ft)	0.0469
24-Hr Clear Runoff Volume (cu-ft)	2041.5481



Peak Flow Hydrologic Analysis

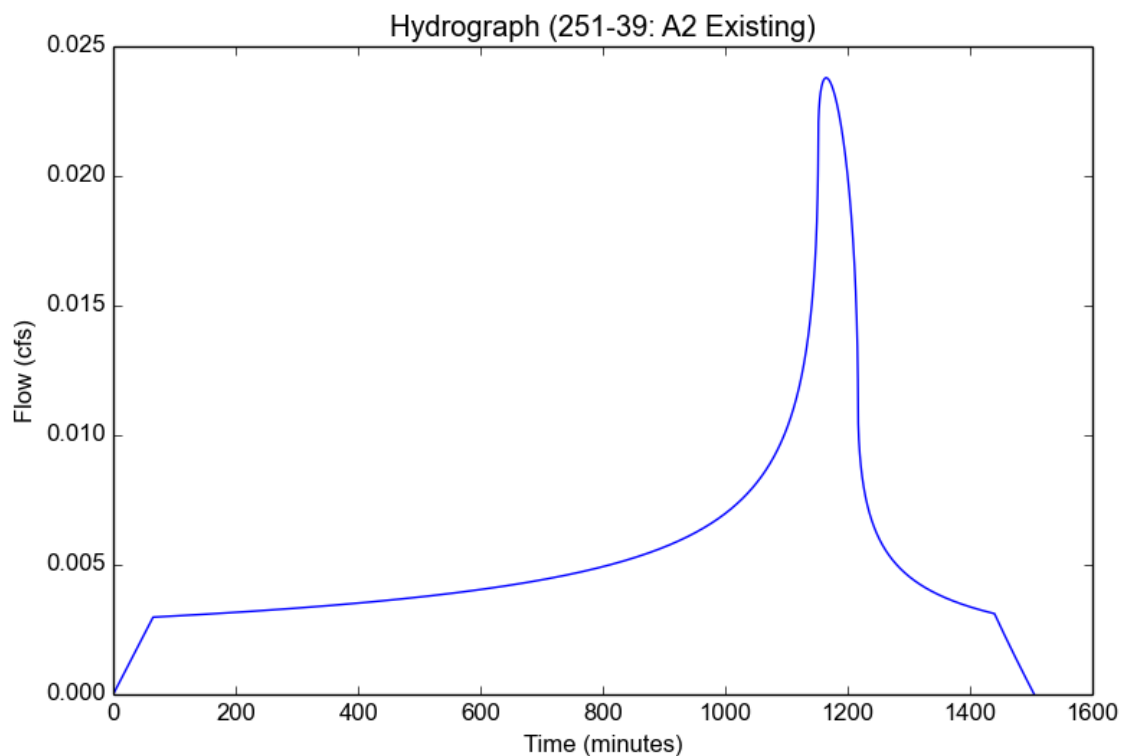
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A2 Existing
Area (ac)	1.53
Flow Path Length (ft)	270.0
Flow Path Slope (vft/hft)	0.0285
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.02
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.134
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.116
Time of Concentration (min)	65.0
Clear Peak Flow Rate (cfs)	0.0238
Burned Peak Flow Rate (cfs)	0.0238
24-Hr Clear Runoff Volume (ac-ft)	0.011
24-Hr Clear Runoff Volume (cu-ft)	479.2224



Peak Flow Hydrologic Analysis

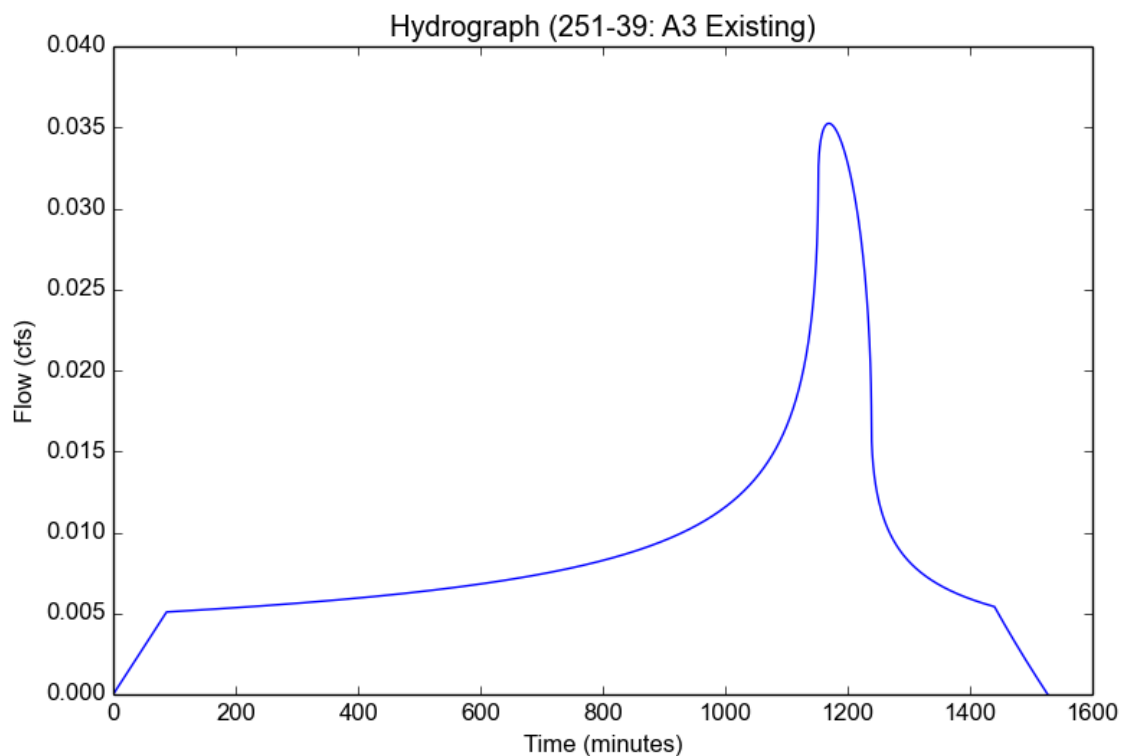
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A3 Existing
Area (ac)	2.6
Flow Path Length (ft)	490.0
Flow Path Slope (vft/hft)	0.0467
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.02
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1169
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.116
Time of Concentration (min)	87.0
Clear Peak Flow Rate (cfs)	0.0352
Burned Peak Flow Rate (cfs)	0.0352
24-Hr Clear Runoff Volume (ac-ft)	0.0187
24-Hr Clear Runoff Volume (cu-ft)	814.4017



Peak Flow Hydrologic Analysis

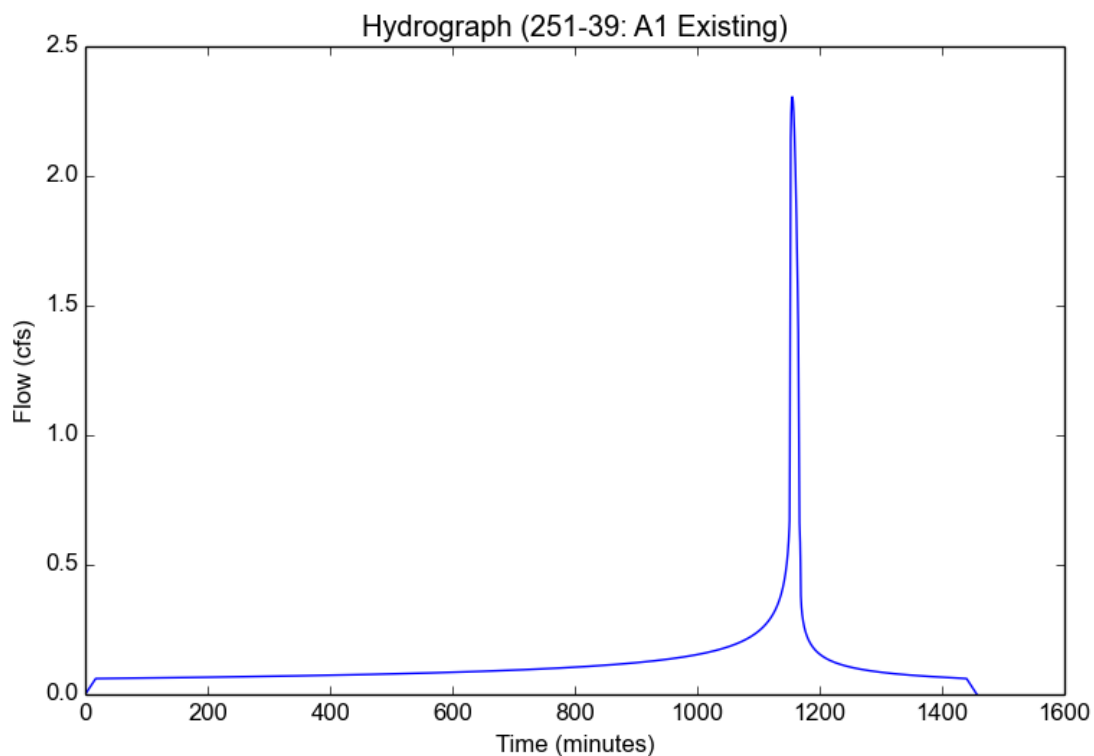
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A1 Existing
Area (ac)	4.61
Flow Path Length (ft)	755.0
Flow Path Slope (vft/hft)	0.0383
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.08
Soil Type	14
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	3.6414
Peak Intensity (in/hr)	1.2223
Undeveloped Runoff Coefficient (Cu)	0.3664
Developed Runoff Coefficient (Cd)	0.4091
Time of Concentration (min)	17.0
Clear Peak Flow Rate (cfs)	2.3053
Burned Peak Flow Rate (cfs)	2.3053
24-Hr Clear Runoff Volume (ac-ft)	0.2499
24-Hr Clear Runoff Volume (cu-ft)	10887.0197



Peak Flow Hydrologic Analysis

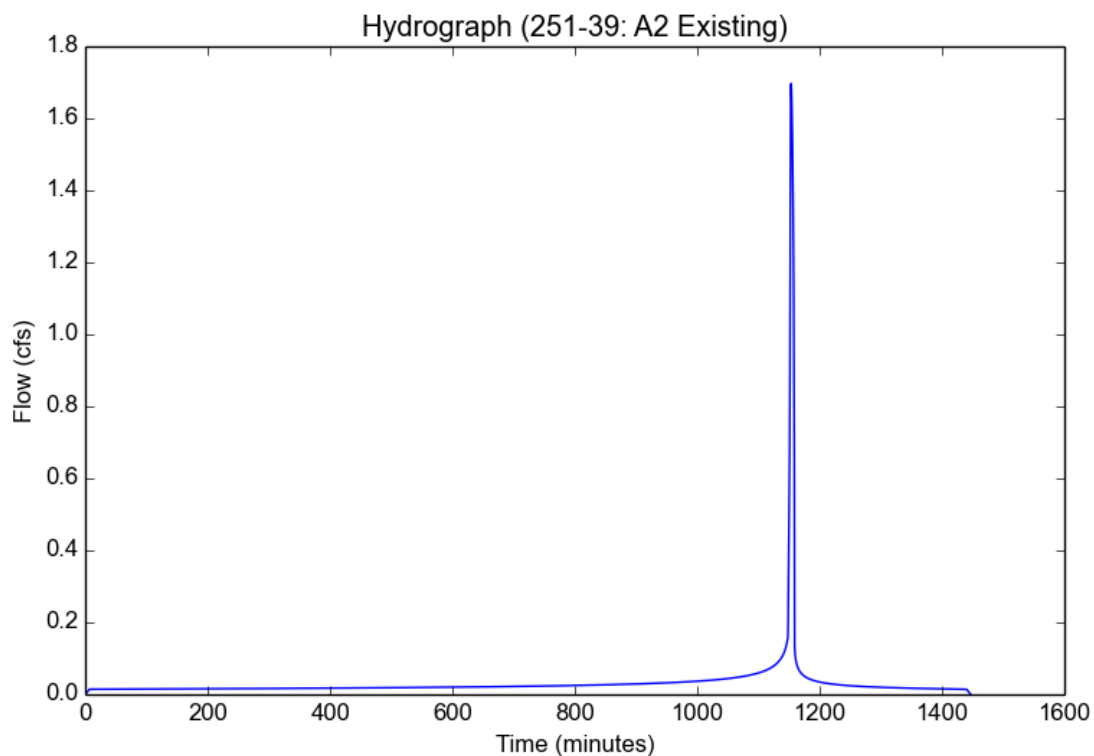
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A2 Existing
Area (ac)	1.53
Flow Path Length (ft)	270.0
Flow Path Slope (vft/hft)	0.0285
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.02
Soil Type	14
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	3.6414
Peak Intensity (in/hr)	1.8548
Undeveloped Runoff Coefficient (Cu)	0.5917
Developed Runoff Coefficient (Cd)	0.5979
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	1.6968
Burned Peak Flow Rate (cfs)	1.6968
24-Hr Clear Runoff Volume (ac-ft)	0.0658
24-Hr Clear Runoff Volume (cu-ft)	2866.629



Peak Flow Hydrologic Analysis

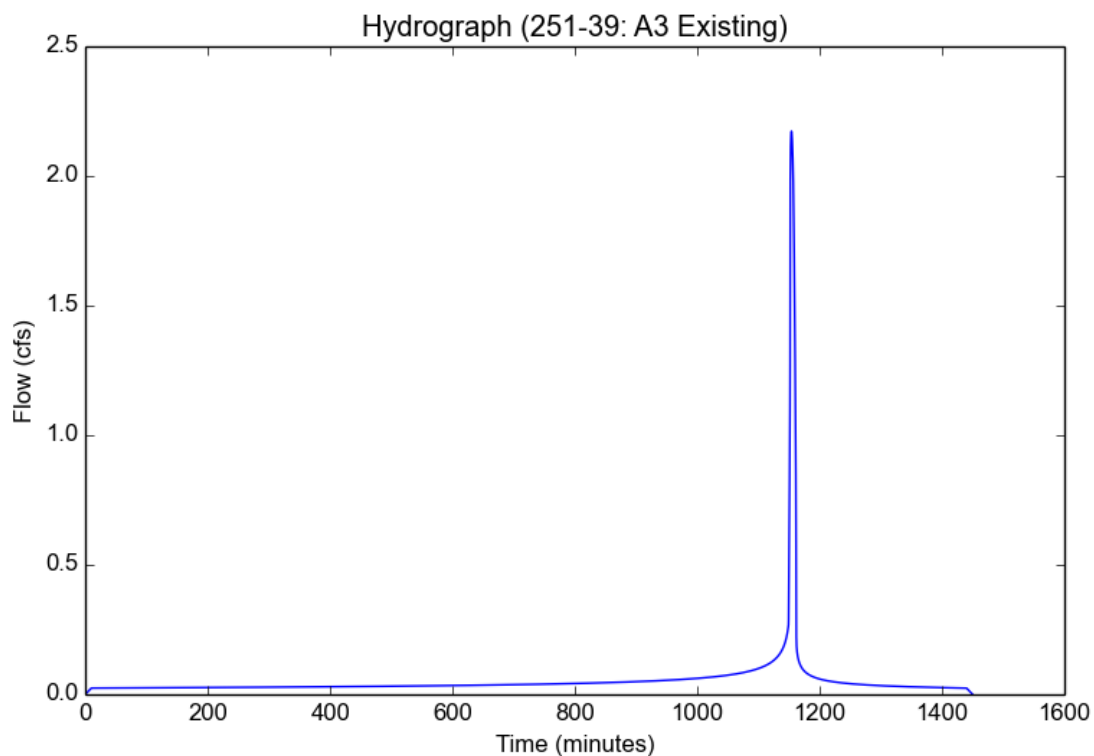
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A3 Existing
Area (ac)	2.6
Flow Path Length (ft)	490.0
Flow Path Slope (vft/hft)	0.0467
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.02
Soil Type	14
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	3.6414
Peak Intensity (in/hr)	1.5685
Undeveloped Runoff Coefficient (Cu)	0.5253
Developed Runoff Coefficient (Cd)	0.5328
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	2.1728
Burned Peak Flow Rate (cfs)	2.1728
24-Hr Clear Runoff Volume (ac-ft)	0.1103
24-Hr Clear Runoff Volume (cu-ft)	4806.1865



Peak Flow Hydrologic Analysis

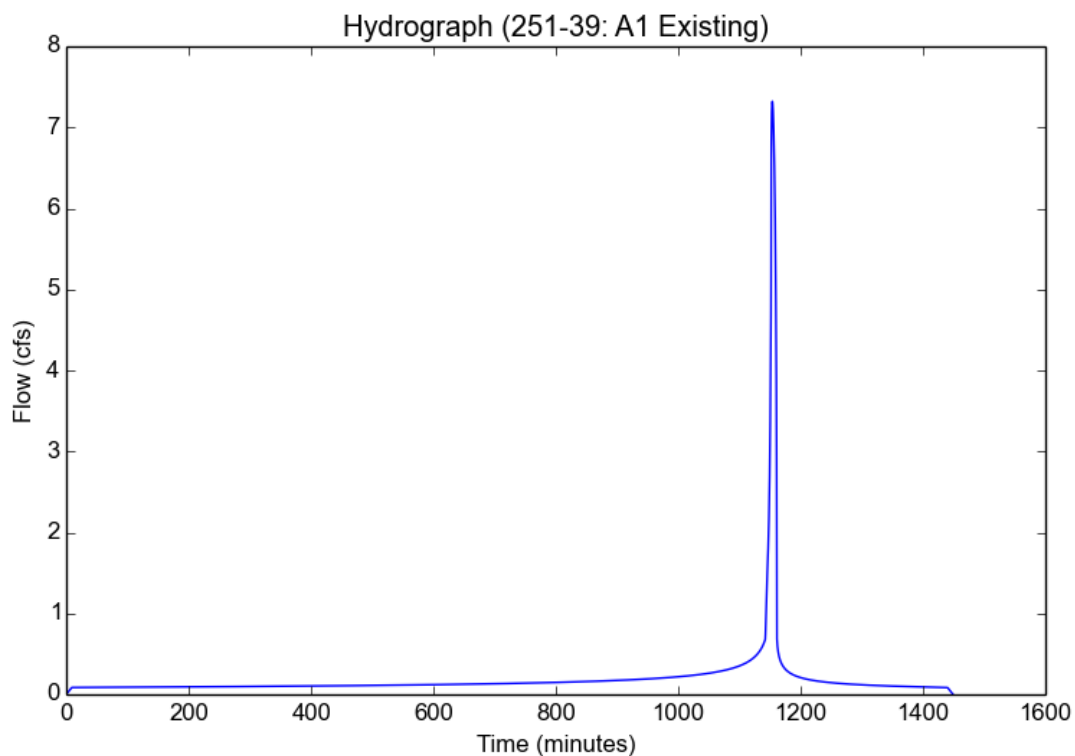
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A1 Existing
Area (ac)	4.61
Flow Path Length (ft)	755.0
Flow Path Slope (vft/hft)	0.0383
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.08
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.3083
Undeveloped Runoff Coefficient (Cu)	0.6696
Developed Runoff Coefficient (Cd)	0.688
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	7.3214
Burned Peak Flow Rate (cfs)	7.3214
24-Hr Clear Runoff Volume (ac-ft)	0.3937
24-Hr Clear Runoff Volume (cu-ft)	17148.7237



Peak Flow Hydrologic Analysis

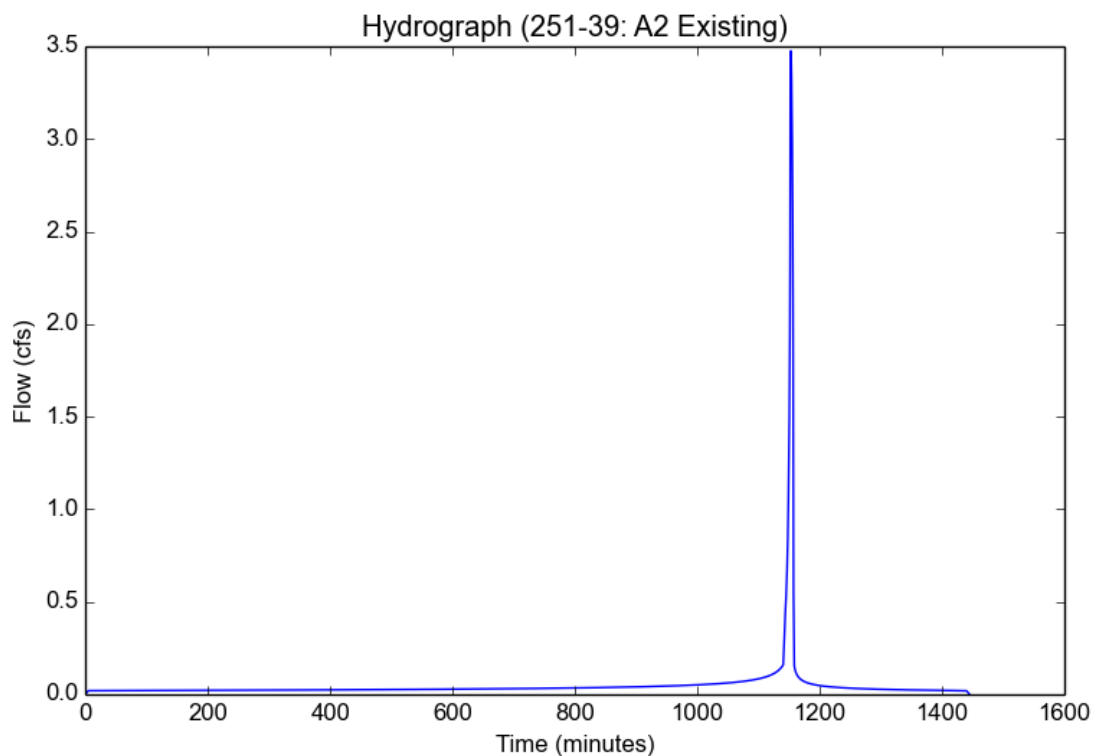
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A2 Existing
Area (ac)	1.53
Flow Path Length (ft)	270.0
Flow Path Slope (vft/hft)	0.0285
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.02
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	3.0428
Undeveloped Runoff Coefficient (Cu)	0.7435
Developed Runoff Coefficient (Cd)	0.7467
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.4761
Burned Peak Flow Rate (cfs)	3.4761
24-Hr Clear Runoff Volume (ac-ft)	0.1017
24-Hr Clear Runoff Volume (cu-ft)	4429.8358



Peak Flow Hydrologic Analysis

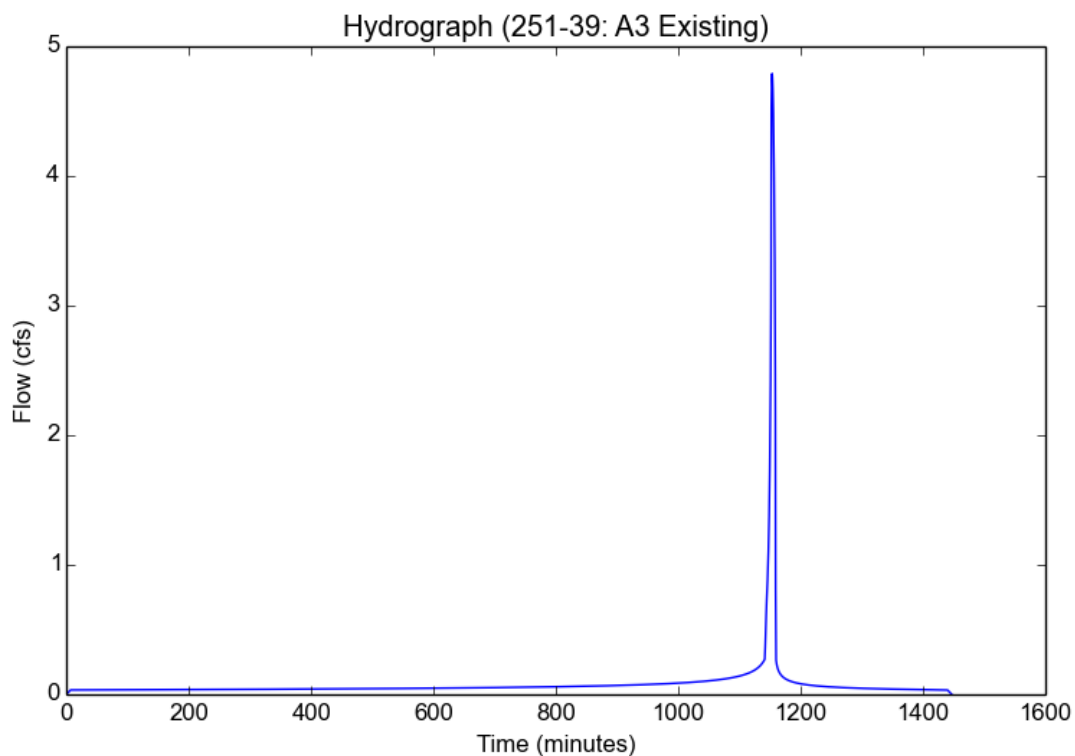
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A3 Existing
Area (ac)	2.6
Flow Path Length (ft)	490.0
Flow Path Slope (vft/hft)	0.0467
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.02
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.5977
Undeveloped Runoff Coefficient (Cu)	0.7054
Developed Runoff Coefficient (Cd)	0.7093
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	4.7905
Burned Peak Flow Rate (cfs)	4.7905
24-Hr Clear Runoff Volume (ac-ft)	0.1727
24-Hr Clear Runoff Volume (cu-ft)	7521.0432



APPENDIX B: PROPOSED PEAK FLOW HYDROLOGIC ANALYSIS (85th PERCENTILE, 10 YEAR, AND 50 YEAR STORMS)

Peak Flow Hydrologic Analysis

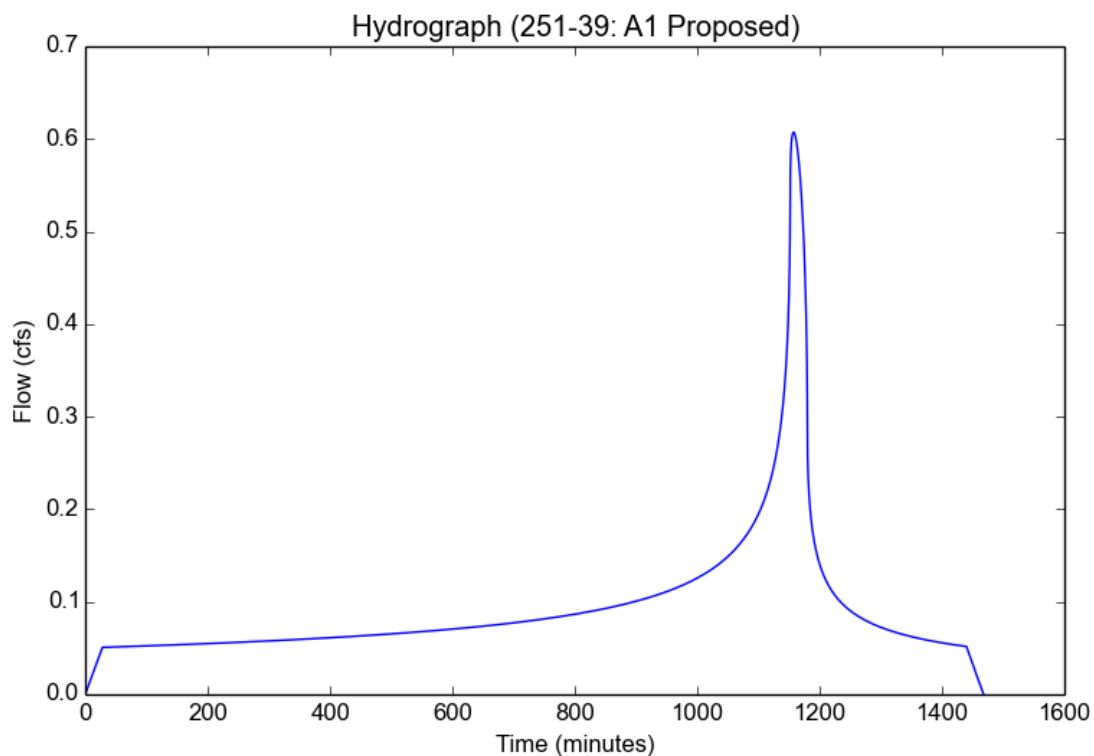
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A1 Proposed
Area (ac)	3.87
Flow Path Length (ft)	583.0
Flow Path Slope (vft/hft)	0.0335
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.86
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1991
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.788
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	0.6072
Burned Peak Flow Rate (cfs)	0.6072
24-Hr Clear Runoff Volume (ac-ft)	0.189
24-Hr Clear Runoff Volume (cu-ft)	8233.8942



Peak Flow Hydrologic Analysis

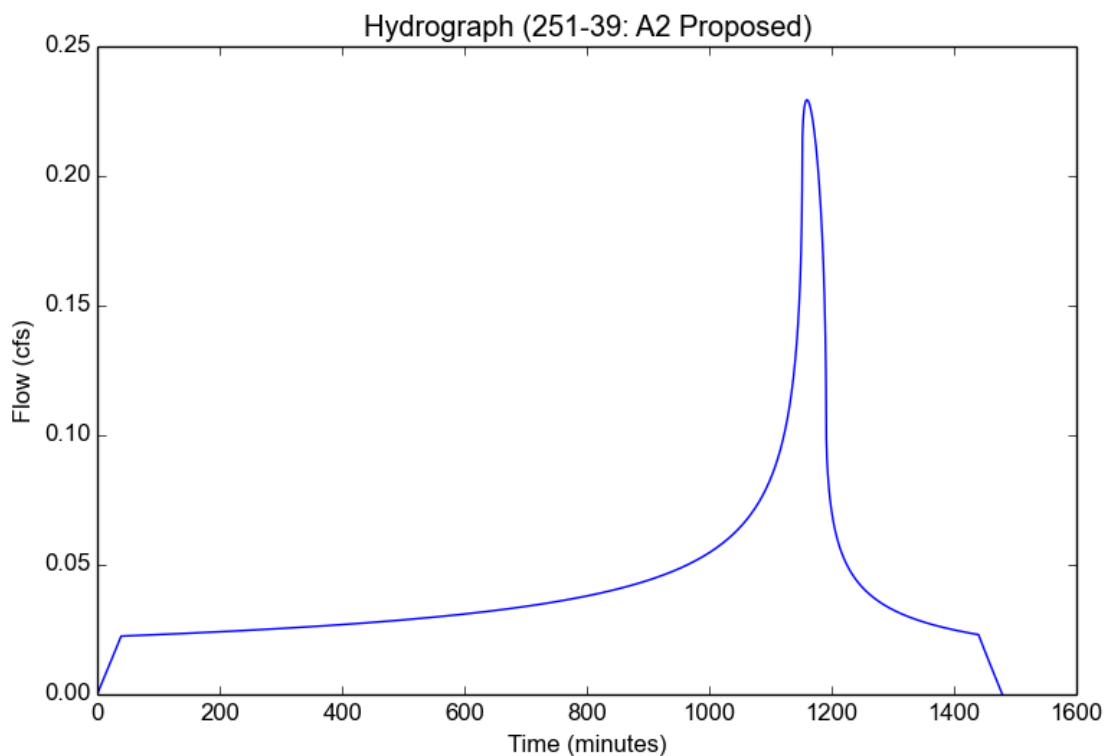
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A2 Proposed
Area (ac)	1.88
Flow Path Length (ft)	631.0
Flow Path Slope (vft/hft)	0.009
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.77
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1704
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	39.0
Clear Peak Flow Rate (cfs)	0.2294
Burned Peak Flow Rate (cfs)	0.2294
24-Hr Clear Runoff Volume (ac-ft)	0.0834
24-Hr Clear Runoff Volume (cu-ft)	3634.4869



Peak Flow Hydrologic Analysis

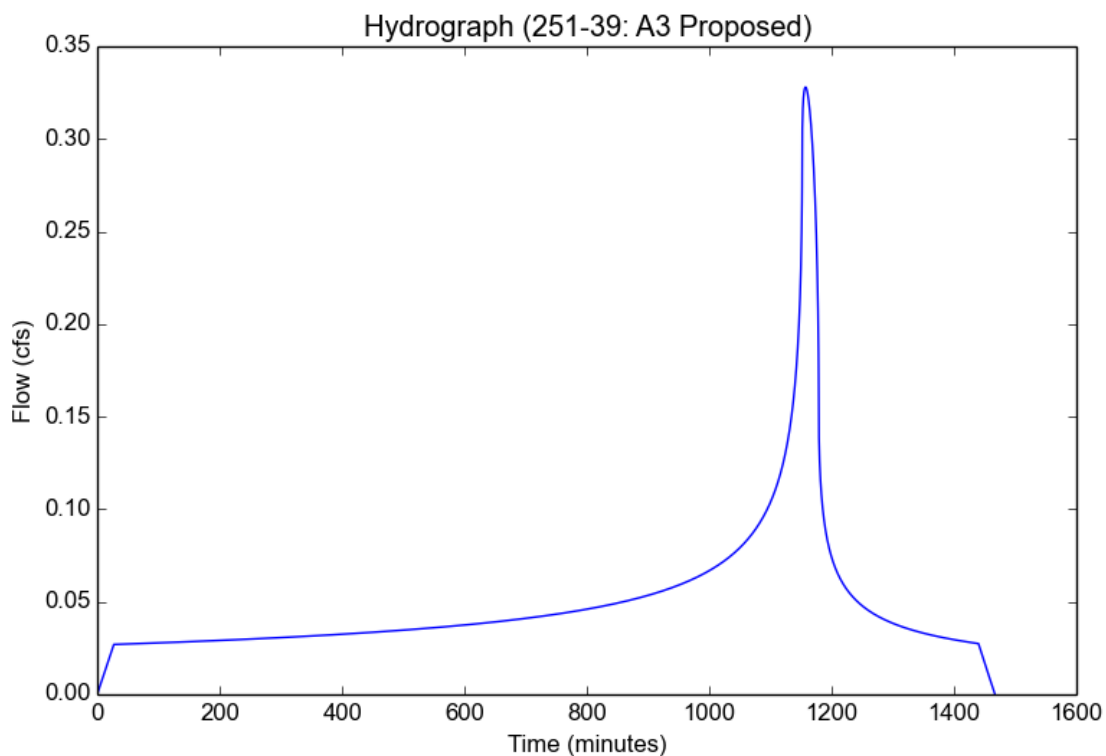
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A3 Proposed
Area (ac)	2.34
Flow Path Length (ft)	474.0
Flow Path Slope (vft/hft)	0.0338
85th Percentile Rainfall Depth (in)	0.75
Percent Impervious	0.74
Soil Type	14
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.2026
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.692
Time of Concentration (min)	27.0
Clear Peak Flow Rate (cfs)	0.328
Burned Peak Flow Rate (cfs)	0.328
24-Hr Clear Runoff Volume (ac-ft)	0.1004
24-Hr Clear Runoff Volume (cu-ft)	4372.0966



Peak Flow Hydrologic Analysis

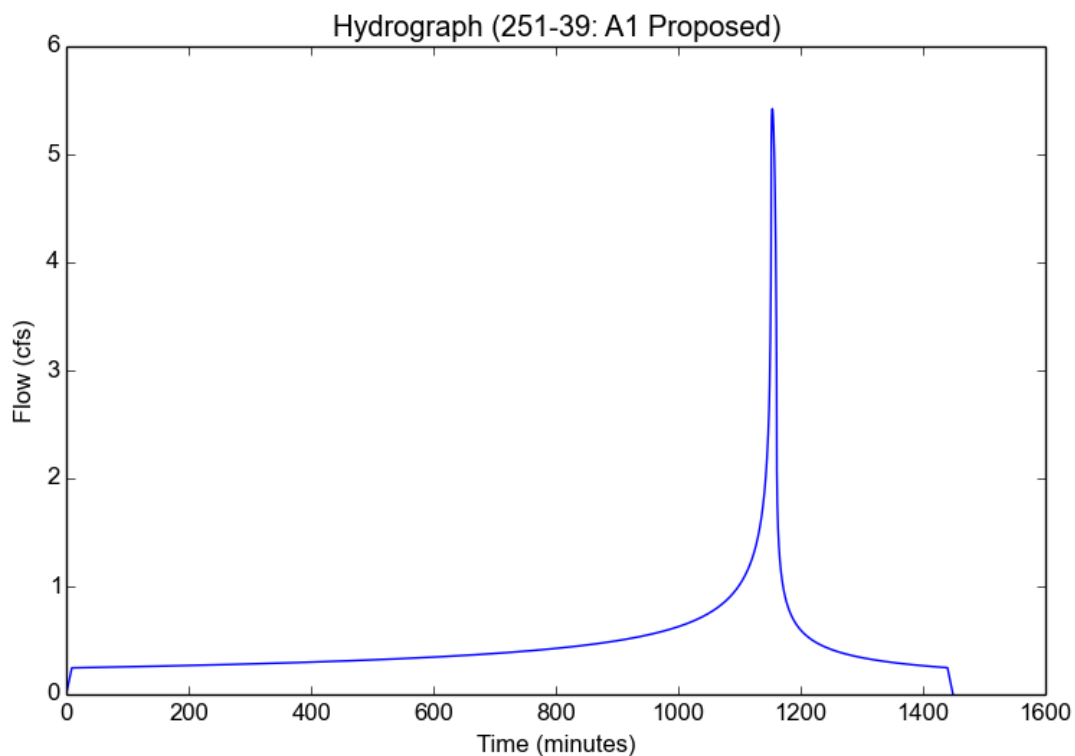
File location: S:/251-39 SIGNAL HILL/HYDROLOGY/NEW OUTPUT 8-20-19/Proposed-A1-10yr.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A1 Proposed
Area (ac)	3.87
Flow Path Length (ft)	583.0
Flow Path Slope (vft/hft)	0.0335
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.86
Soil Type	14
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	3.6414
Peak Intensity (in/hr)	1.6481
Undeveloped Runoff Coefficient (Cu)	0.5438
Developed Runoff Coefficient (Cd)	0.8501
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	5.4224
Burned Peak Flow Rate (cfs)	5.4224
24-Hr Clear Runoff Volume (ac-ft)	0.922
24-Hr Clear Runoff Volume (cu-ft)	40163.442



Peak Flow Hydrologic Analysis

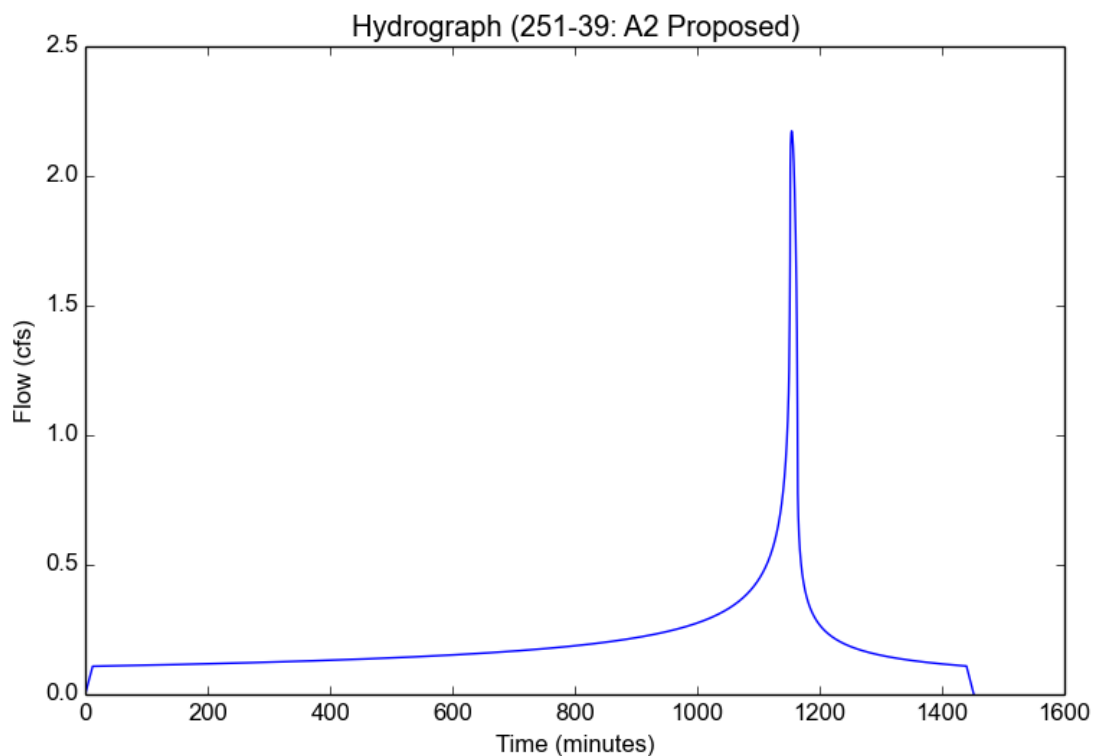
File location: S:/251-39 SIGNAL HILL/HYDROLOGY/NEW OUTPUT 8-20-19/Proposed-A2-10yr.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A2 Proposed
Area (ac)	1.88
Flow Path Length (ft)	631.0
Flow Path Slope (vft/hft)	0.009
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.77
Soil Type	14
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	3.6414
Peak Intensity (in/hr)	1.4397
Undeveloped Runoff Coefficient (Cu)	0.4783
Developed Runoff Coefficient (Cd)	0.803
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	2.1735
Burned Peak Flow Rate (cfs)	2.1735
24-Hr Clear Runoff Volume (ac-ft)	0.4081
24-Hr Clear Runoff Volume (cu-ft)	17777.6519



Peak Flow Hydrologic Analysis

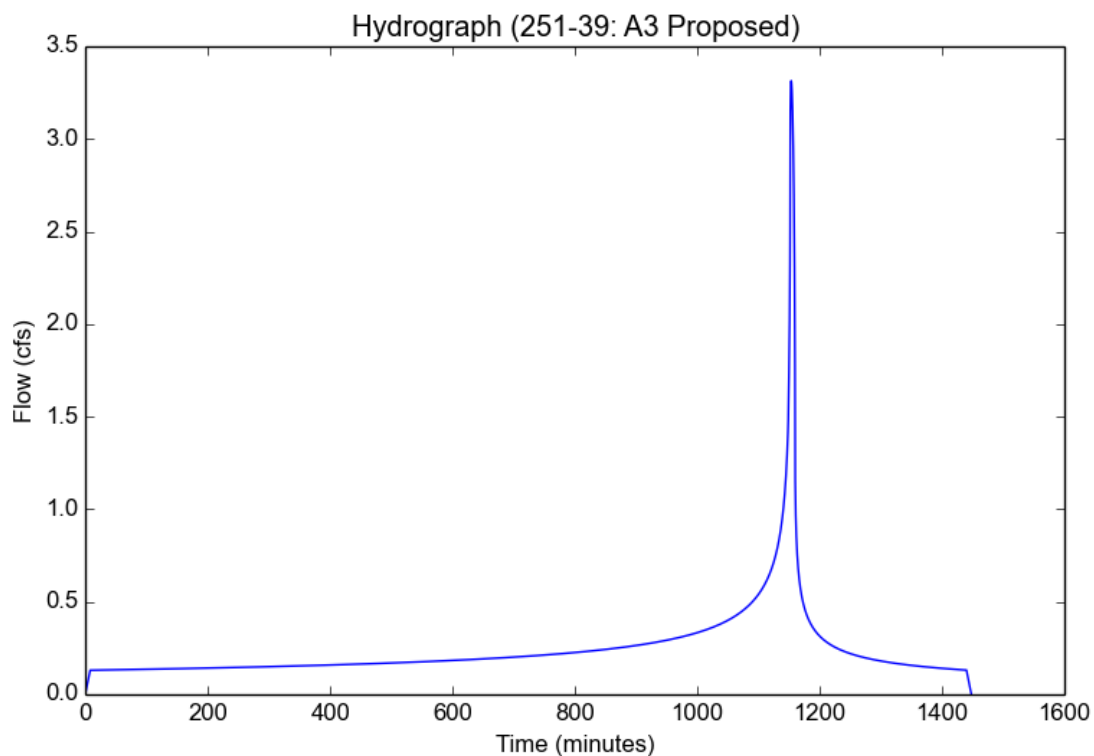
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A3 Proposed
Area (ac)	2.34
Flow Path Length (ft)	474.0
Flow Path Slope (vft/hft)	0.0338
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.74
Soil Type	14
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	3.6414
Peak Intensity (in/hr)	1.7419
Undeveloped Runoff Coefficient (Cu)	0.5656
Developed Runoff Coefficient (Cd)	0.813
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	3.3141
Burned Peak Flow Rate (cfs)	3.3141
24-Hr Clear Runoff Volume (ac-ft)	0.4922
24-Hr Clear Runoff Volume (cu-ft)	21441.7839



Peak Flow Hydrologic Analysis

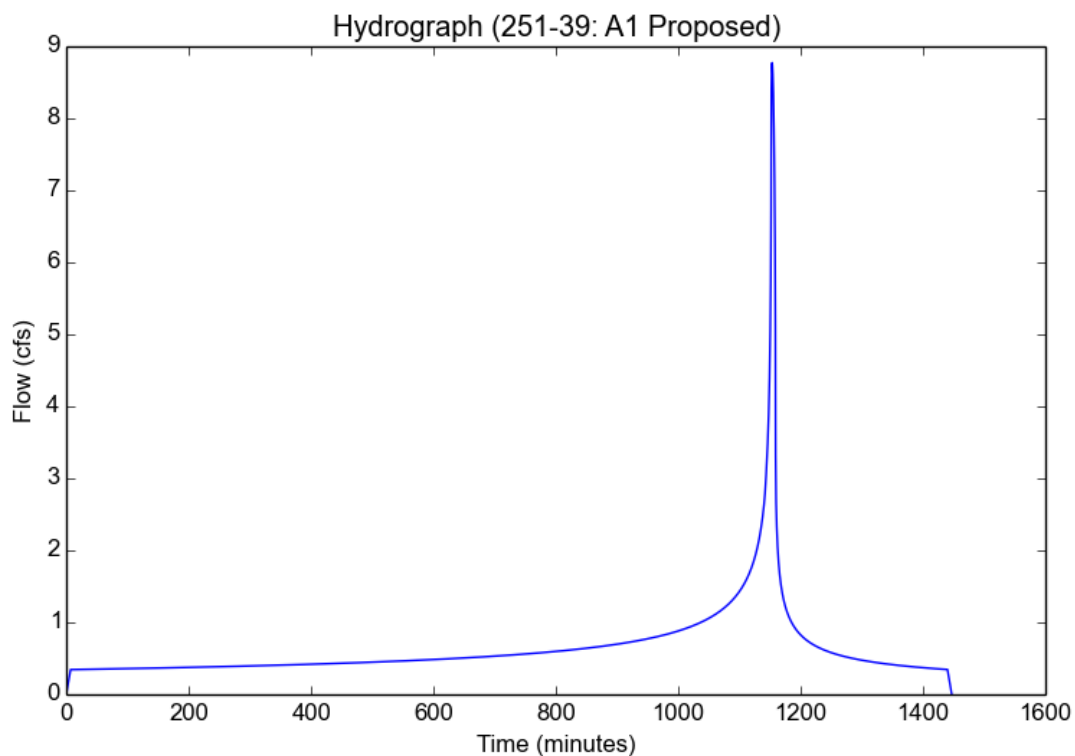
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A1 Proposed
Area (ac)	3.87
Flow Path Length (ft)	583.0
Flow Path Slope (vft/hft)	0.0335
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.86
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.5977
Undeveloped Runoff Coefficient (Cu)	0.7054
Developed Runoff Coefficient (Cd)	0.8728
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	8.774
Burned Peak Flow Rate (cfs)	8.774
24-Hr Clear Runoff Volume (ac-ft)	1.295
24-Hr Clear Runoff Volume (cu-ft)	56411.7571



Peak Flow Hydrologic Analysis

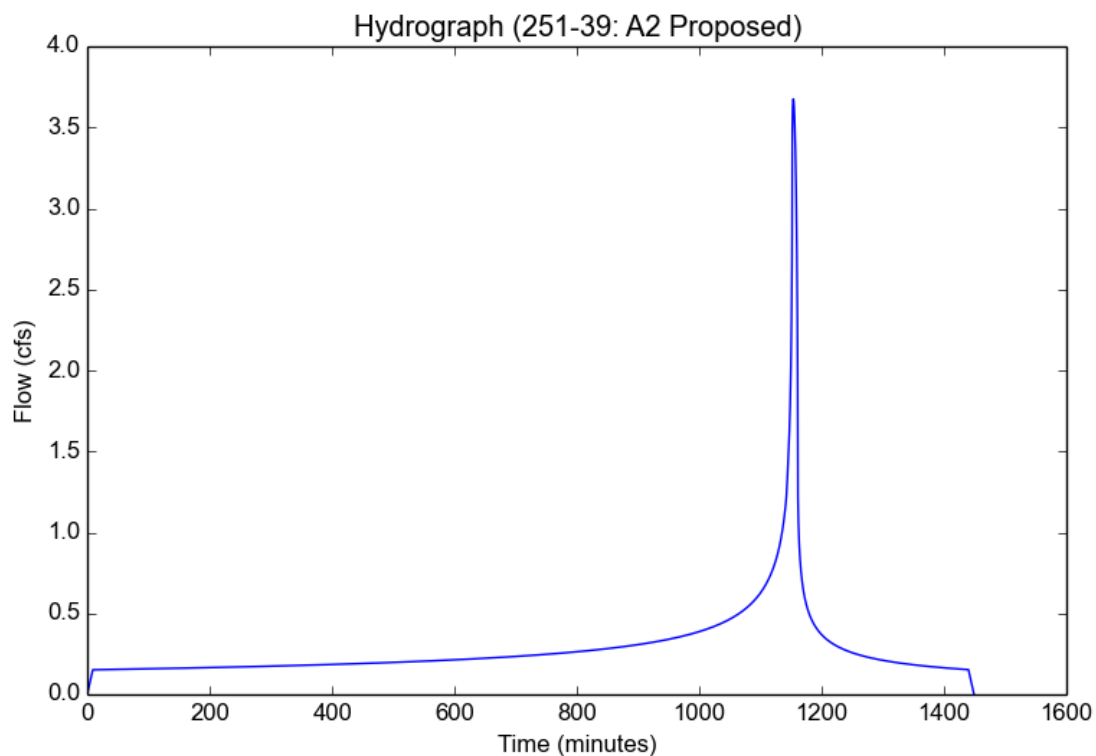
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A2 Proposed
Area (ac)	1.88
Flow Path Length (ft)	631.0
Flow Path Slope (vft/hft)	0.009
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.77
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.3083
Undeveloped Runoff Coefficient (Cu)	0.6696
Developed Runoff Coefficient (Cd)	0.847
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	3.6757
Burned Peak Flow Rate (cfs)	3.6757
24-Hr Clear Runoff Volume (ac-ft)	0.575
24-Hr Clear Runoff Volume (cu-ft)	25047.2152



Peak Flow Hydrologic Analysis

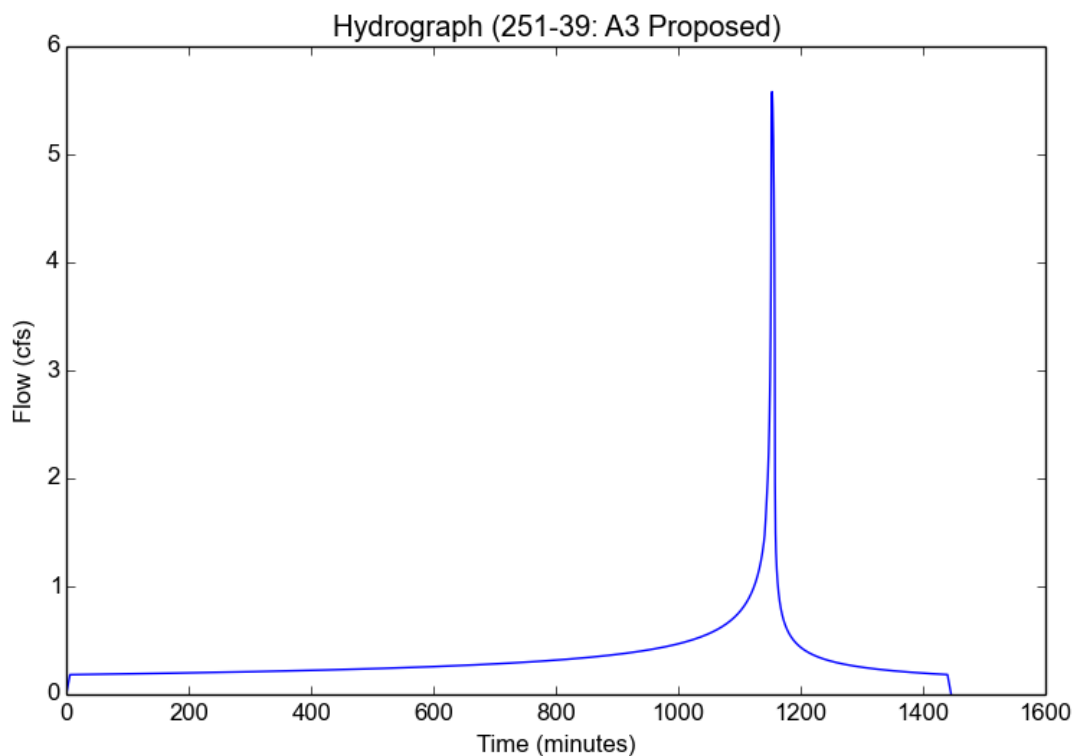
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Version: HydroCalc 1.0.2

Input Parameters

Project Name	251-39
Subarea ID	A3 Proposed
Area (ac)	2.34
Flow Path Length (ft)	474.0
Flow Path Slope (vft/hft)	0.0338
50-yr Rainfall Depth (in)	5.1
Percent Impervious	0.74
Soil Type	14
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

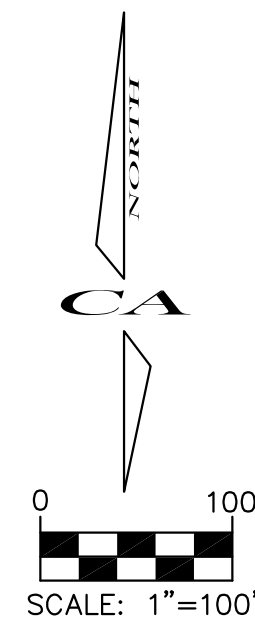
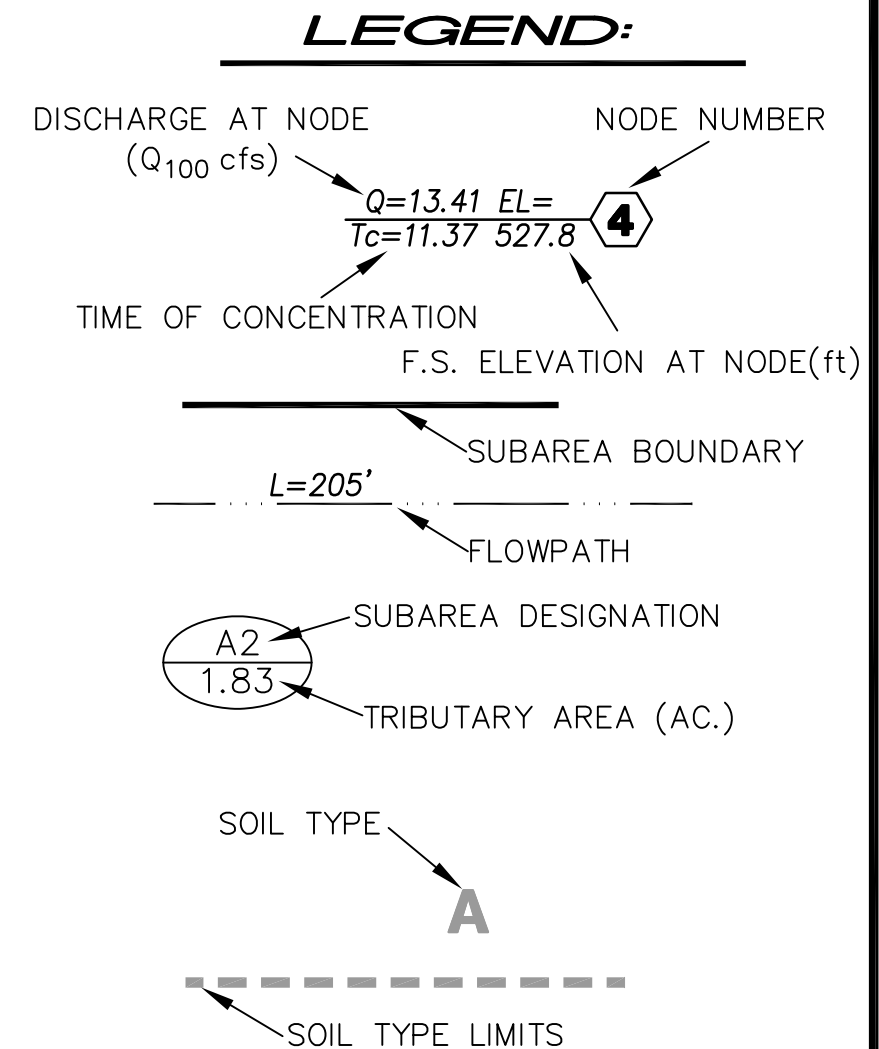
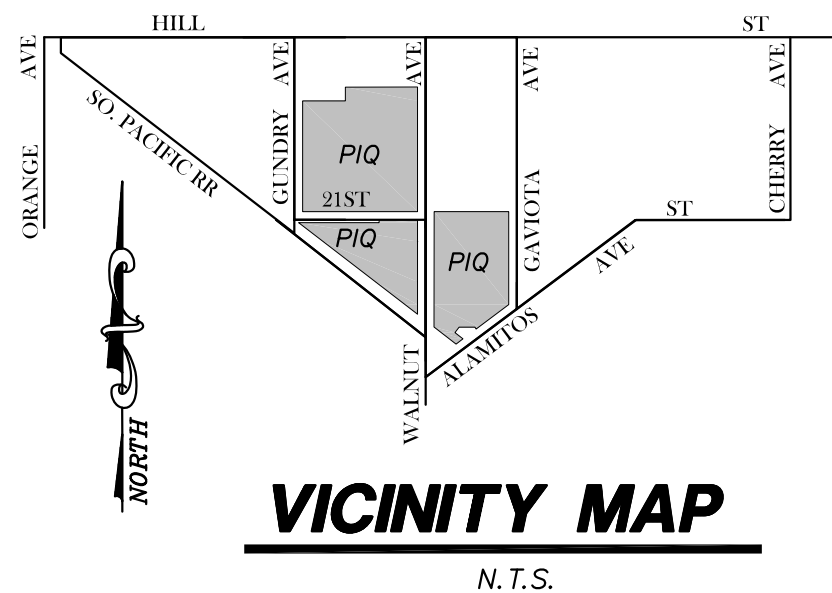
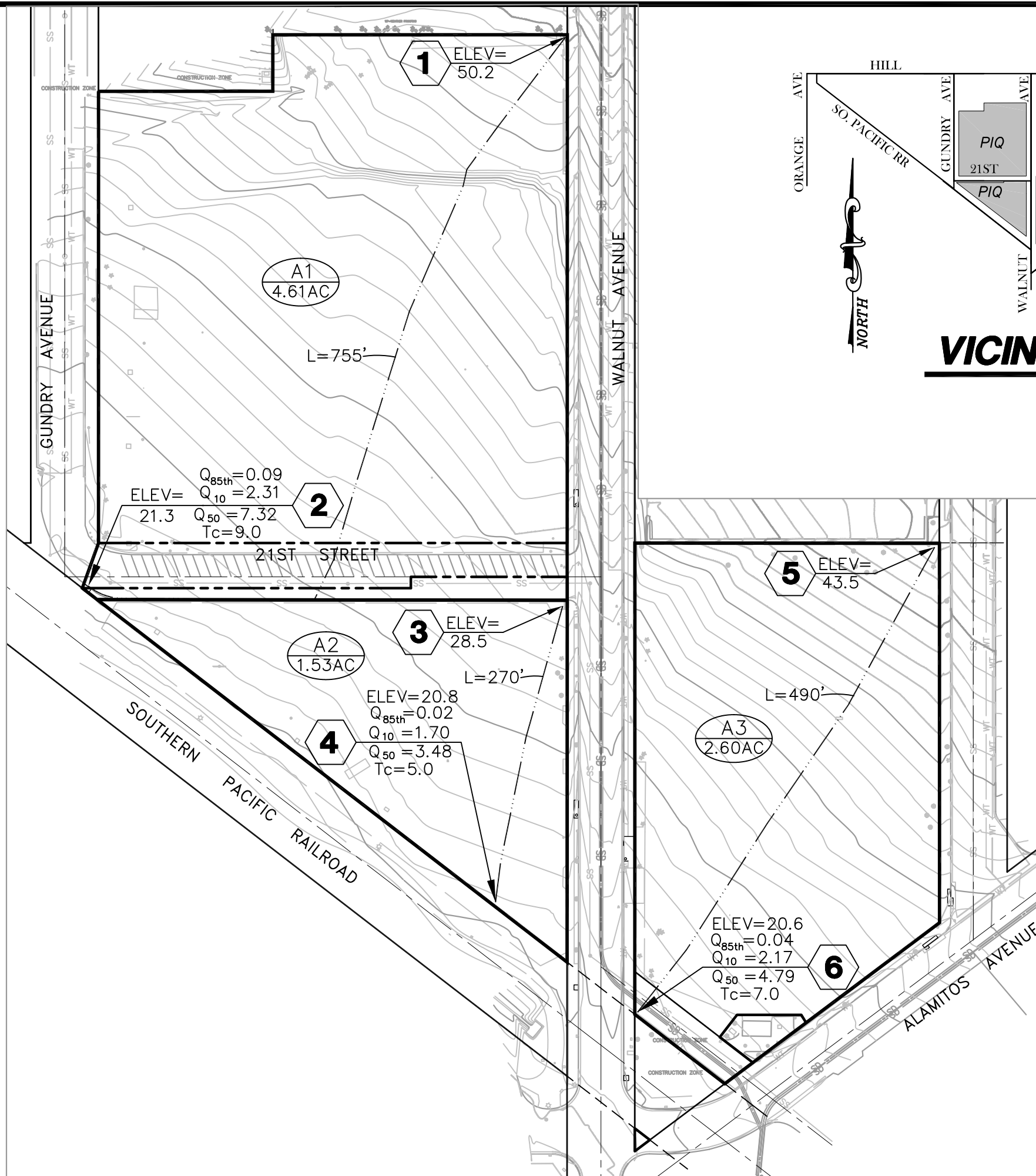
Output Results

Modeled (50-yr) Rainfall Depth (in)	5.1
Peak Intensity (in/hr)	2.7929
Undeveloped Runoff Coefficient (Cu)	0.7221
Developed Runoff Coefficient (Cd)	0.8538
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	5.5796
Burned Peak Flow Rate (cfs)	5.5796
24-Hr Clear Runoff Volume (ac-ft)	0.6934
24-Hr Clear Runoff Volume (cu-ft)	30204.3716



EXHIBITS

EXHIBIT A: EXISTING CONDITION HYDROLOGY MAP



CITY OF SIGNAL HILL

HYDROLOGY MAP
(EXISTING CONDITION)

2025-2185 WALNUT AVE.

EXHIBIT B: PROPOSED CONDITION HYDROLOGY MAP

EXHIBIT C: RAINFALL INTENSITY & SOILS MAP FOR 85th PERCENTILE AND 50 YEAR STORMS)



Hydrology Map

A GIS viewer application to view the data for the hydrology manual.

LAYERS

- ☒ 50yr Two Tenths (Rainfall)
- ☐ DPA Zones
- ☒ Soils 2004
- ☒ Final 85th Percentile, 24-hr Rainfall
- ☐ Final 95th Percentile, 24-hr Rainfall
- ☐ 1-year, 1-hour Rainfall Intensity

SEARCH

Enter Address, Cross Street, or Parcel No.:
 (ex: 900 S. Fremont Ave., Fremont@Valley,
 5342005904)

WALNUT AVE & 21ST ST, SIGNAL HILL

Search

Address Search Results:

WALNUT AVE AND 21ST ST SIGNAL HILL

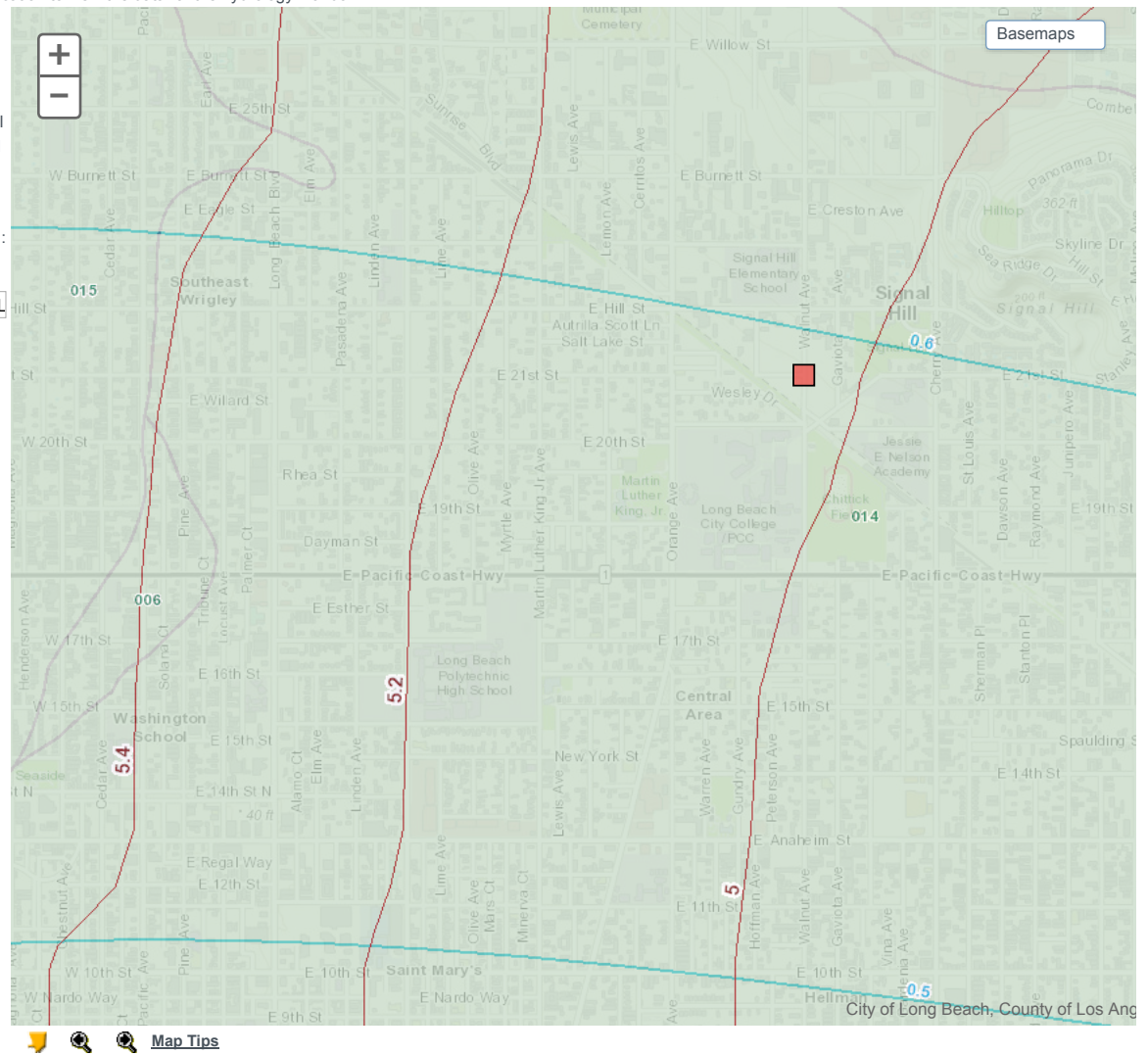
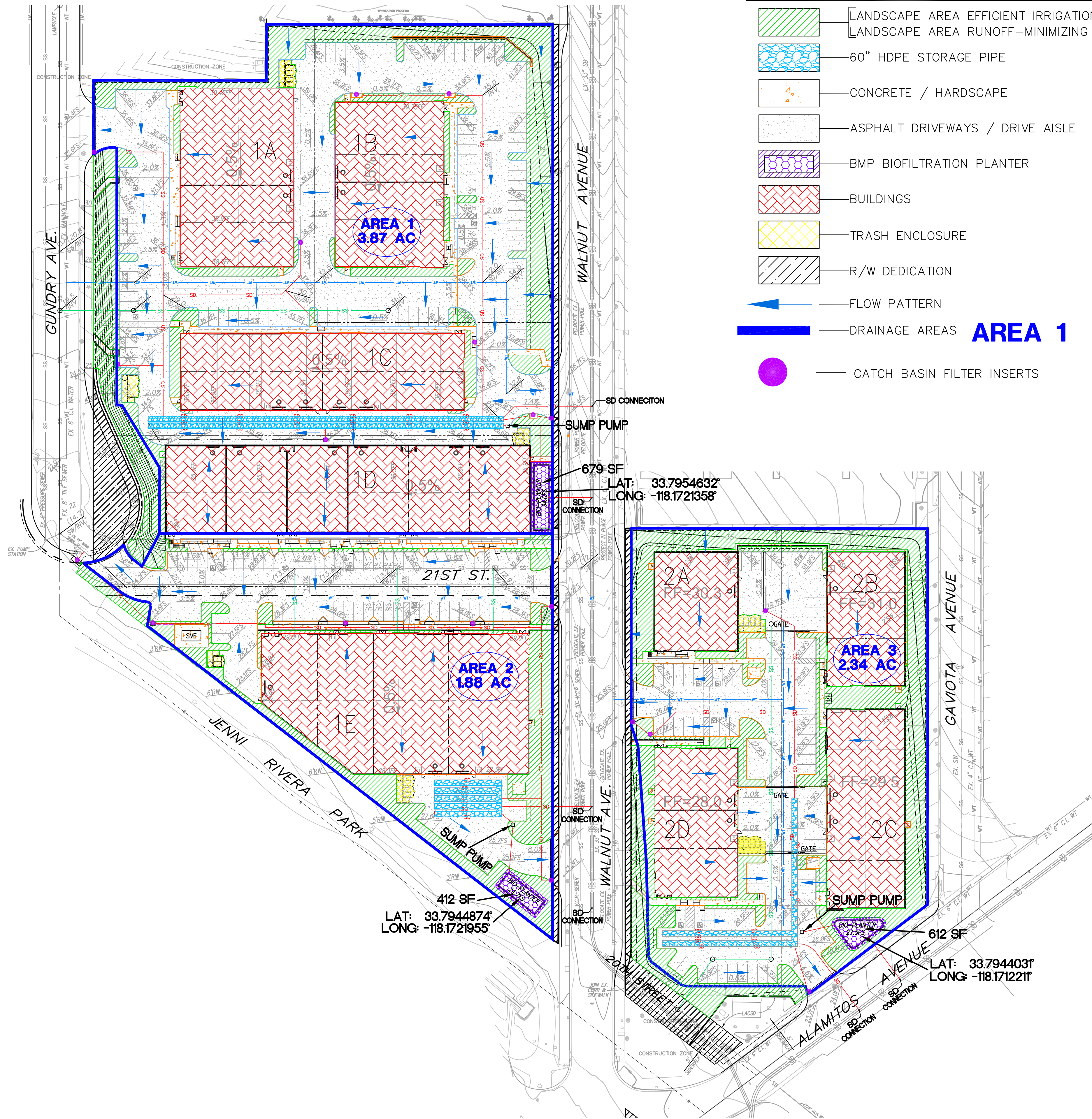


EXHIBIT D: LID MAP

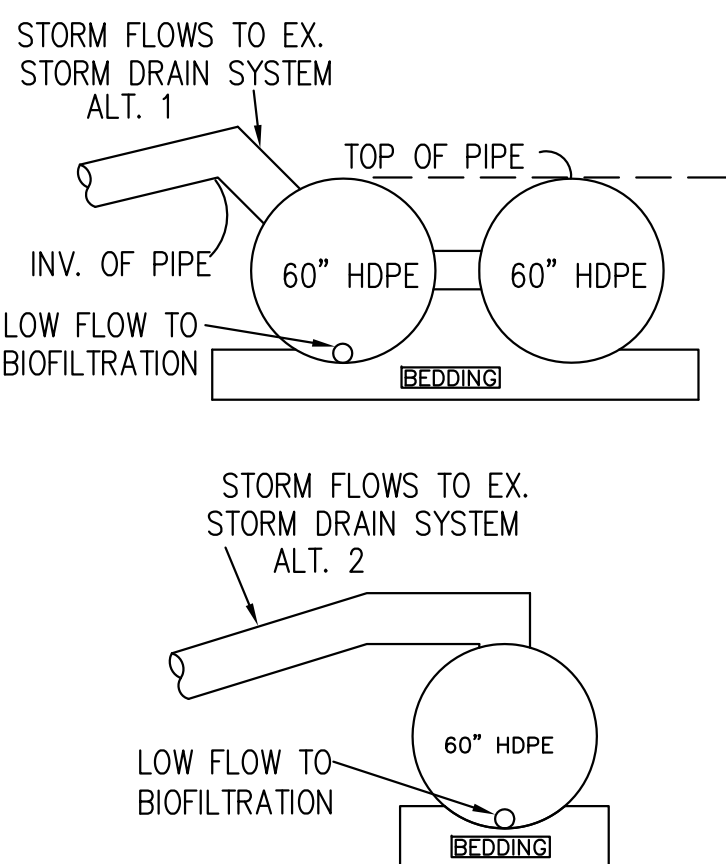


LEGEND STRUCTURAL / TREATMENT BMPS

- LANDSCAPE AREA EFFICIENT IRRIGATION
- LANDSCAPE AREA RUNOFF-MINIMIZING DESIGN
- 60" HDPE STORAGE PIPE
- CONCRETE / HARDSCAPE
- ASPHALT DRIVEWAYS / DRIVE AISLE
- BMP BIOFILTRATION PLANTER
- BUILDINGS
- TRASH ENCLOSURE
- R/W DEDICATION
- FLOW PATTERN
- DRAINAGE AREAS
- CATCH BASIN FILTER INSERTS

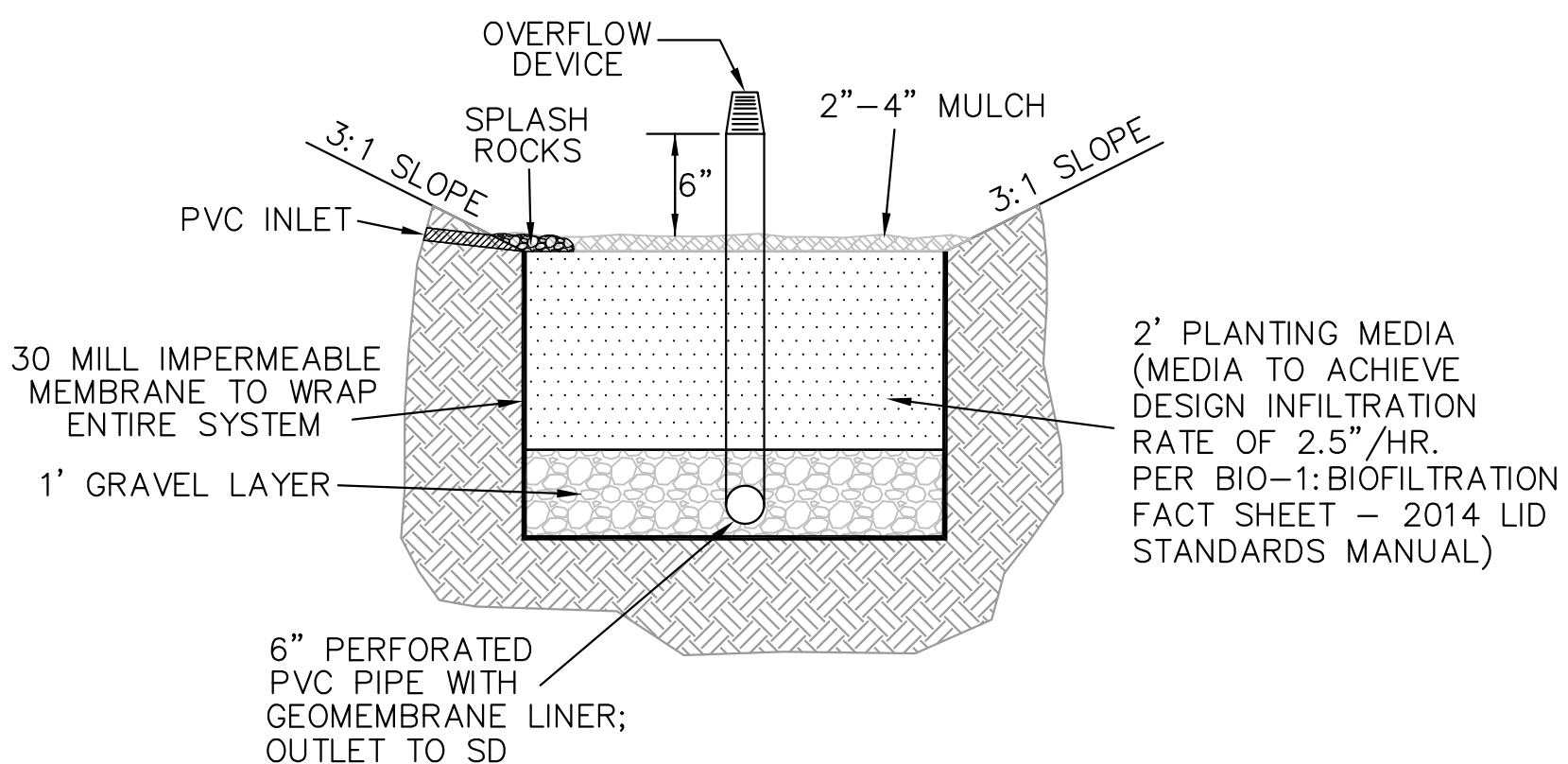
PROJECT DATA:
TOTAL SITE AREA OF PROPOSED DEVELOPMENT: 8.69 AC (378,514 SF)
R/W DEDICATION: 13,390 SF
BUILDING AREA: 138,695 SF
WALKWAYS/CONC. GUTTER AREAS: 10,085 SF
DRIVEWAYS / DRIVE AISLES: 133,867 SF
DRAINAGE AREA LANDSCAPE: 69,374 SF
SELF-RETAINING LANDSCAPE: 13,103 SF
LANDSCAPE PROVIDED: 82,477 SF (22% PERVIOUS AREA)
CURRENT USE: VACANT
PROPOSED USE: INDUSTRIAL
WATERSHED: LOS ANGELES RIVER

AREA	TOTAL AREA	L.S. AREA	IMP. AREA	% IMPERVIOUS
A1	168,386 SF	23,863 SF	144,523 SF	86%
A2	81,870 SF	18,733 SF	63,137 SF	77%
A3	101,765 SF	26,778 SF	74,987 SF	74%



DETENTION PIPES

N.T.S.

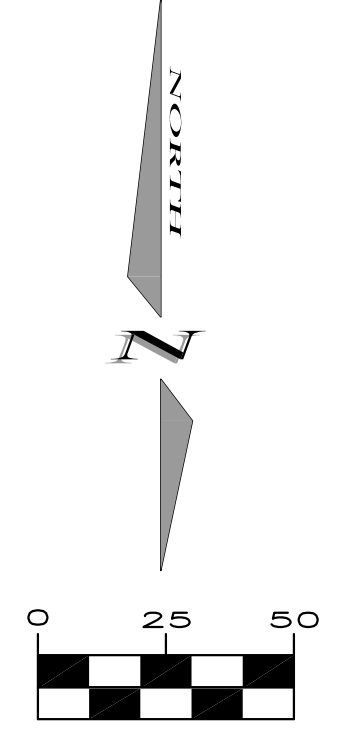


BIO-1: BIOFILTRATION PLANTER

AREA 1
(SWQDv) - 8,234 CF
REQUIRED (SWQDv)*1.5 - 12,351 CF
STORAGE PIPE VOLUME - 12,450 CF ~ 634 LF
BIOTREATMENT AREA REQUIRED:
96HR DRAWDOWN PER LID
VOLUME (CF) / ((2.5"/HR)*(1/12 FT/IN) * 96HR))
12,450 CF / (2.5"/HR)*(1/12 FT/IN) * 96HR = 623 SF
BIOTREATMENT AREA PROVIDED: 679 SF > 623 SF
PUMP REQUIREMENTS
MINIMUM FLOW (DRAW DOWN IN 96 HRS)
12,450 CF /96HRS
(12,450 CF*7.48GAL/CF) / (96HR*60MIN/HR) = 16.17 GPM
MAXIMUM FLOW (MAX FLOW THRU BIO-PLANTER)
679 SF*(2.5"/HR*(1/12 FT/IN)*(1/60 HR/MIN)*(7.48 GAL/CF)=17.64 GPM
USE 17.0 GPM PUMP

AREA 2
(SWQDv) - 3,634 CF
REQUIRED (SWQDv)*1.5 - 5,451 CF
STORAGE PIPE VOLUME - 5,825 CF ~ 297 LF
BIOTREATMENT AREA REQUIRED:
96HR DRAWDOWN PER LID
VOLUME (CF) / ((2.5"/HR)*(1/12 FT/IN) * 96HR))
5,825 CF / (2.5"/HR)*(1/12 FT/IN) * 96HR = 291 SF
BIOTREATMENT AREA PROVIDED: 412 SF > 291 SF
PUMP REQUIREMENTS
MINIMUM FLOW (DRAW DOWN IN 96 HRS)
5,825 CF /96HRS
(5,825 CF*7.48GAL/CF) / (96HR*60MIN/HR) = 7.56 GPM
MAXIMUM FLOW (MAX FLOW THRU BIO-PLANTER)
412 SF*(2.5"/HR*(1/12 FT/IN)*(1/60 HR/MIN)*(7.48 GAL/CF)=10.7 GPM
USE 8.0 GPM PUMP

AREA 3
(SWQDv) - 4,372 CF
REQUIRED (SWQDv)*1.5 - 6,558 CF
STORAGE PIPE VOLUME - 7,150 CF ~ 364 LF
BIOTREATMENT AREA REQUIRED:
96HR DRAWDOWN PER LID
VOLUME (CF) / ((2.5"/HR)*(1/12 FT/IN) * 96HR))
7,150 CF / (2.5"/HR)*(1/12 FT/IN) * 96HR = 358 SF
BIOTREATMENT AREA PROVIDED: 612 SF > 358 SF
PUMP REQUIREMENTS
MINIMUM FLOW (DRAW DOWN IN 96 HRS)
7,150 CF /96HRS
(7,150 CF*7.48GAL/CF) / (96HR*60MIN/HR) = 9.29 GPM
MAXIMUM FLOW (MAX FLOW THRU BIO-PLANTER)
612 SF*(2.5"/HR*(1/12 FT/IN)*(1/60 HR/MIN)*(7.48 GAL/CF)=15.90 GPM
USE 10.0 GPM PUMP



SCALE
1 inch = 50 ft.

N.T.S. PREPARED BY:

CA ENGINEERING, INC.
Planning • Engineering • Surveying
13821 NEWPORT AVE., STE 110
TUSTIN, CA 92780
949-724-9480 949-724-9484 FAX

LID SITE PLAN
E. 21ST ST & WALNUT AVE.
SIGNAL HILL, CA

SHEET
1
OF
1

EXHIBIT E: FIRM MAP

NOTES TO USERS

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

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

Coastal Base Flood Elevations 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, MD 20910-3282

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 derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1994 or later and from National Geospatial Intelligence Agency imagery produced at a scale of 1:4,000 from photography dated 2003 or later.

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.

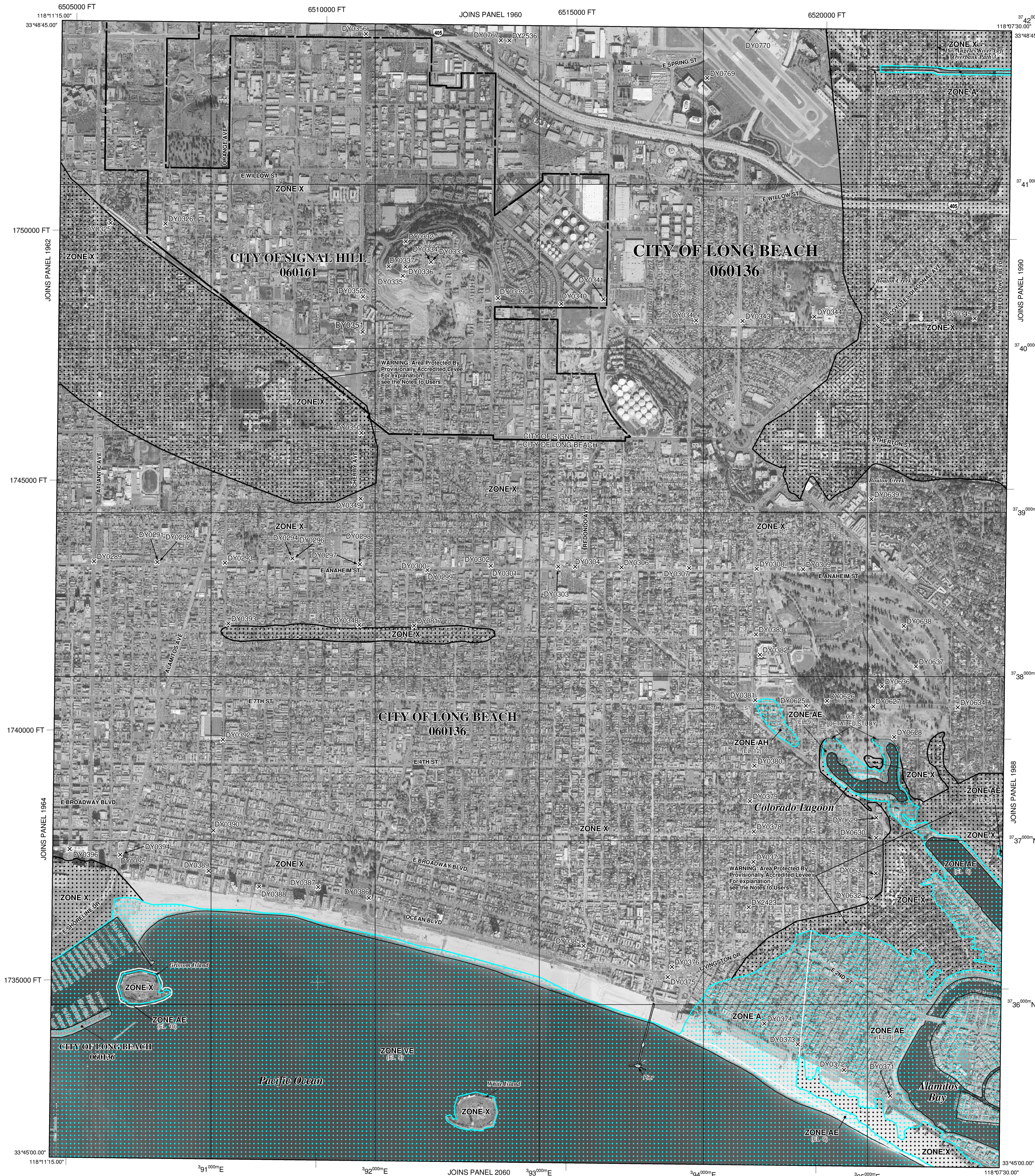
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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 1-800-358-9616 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://www.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/>.

WARNING: This levee, dike, or other structure has been provisionally accredited and mapped as providing protection from the 1-percent-annual-chance flood. To maintain accreditation, the levee owner or community is required to submit documentation necessary to comply with 44 CFR Section 65.10 by October 15, 2009. Because of the risk of overtopping or failure of the structure, communities should take proper precautions to protect lives and minimize damages in these areas, such as issuing an evacuation plan and encouraging property owners to purchase flood insurance.



LEGEND

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

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

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood 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 Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid values, zone 11

5000-foot grid ticks: California State Plane coordinate system, V zone (FPS/ZONE 0405), Lambert Conformal Conic

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

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

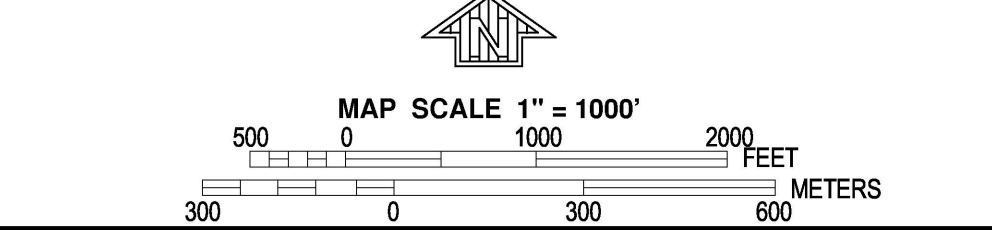
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

September 26, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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.



NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1970F
FIRM
FLOOD INSURANCE RATE MAP
LOS ANGELES COUNTY,
CALIFORNIA
AND INCORPORATED AREAS

PANEL 1970 OF 2350
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LONG BEACH, CITY OF	060136	1970	F
SIGNAL HILL, CITY OF	060161	1970	F

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
06037C1970F
EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency