HYDROLOGY AND HYDRAULIC ANALYSIS

For:

HWY 210 & Huntington SW
County of Los Angeles, California 91016
Grading Permit:

Project Name: Chick - fil - A Restaurant # 4698

Prepared for:
Chick-fil-A, Inc.
15635 Alton Parkway, Suite 350
Irvine, CA 92618

Prepared by:
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Prepared on: October 16, 2020

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1.0 PROJECT DESCRIPTION

1.1 PURPOSE

This drainage study provides an analysis of the existing and proposed hydrology characteristics for the improvements of a Chick-fil-A Restaurant. The project site is in a shopping center located at Antonio Parkway and Windmill Avenue. The project site is approximately 2.1 acres. The subject site is bounded on the north by Huntington Drive, on the east by Encino Avenue, and on the south by Alta Street and private property. The west is bounded by private property. See Appendix for Vicinity Map.

1.2 EXISTING SITE CONDITION

The site is zoned as Retail Corridor Mixed Use where restaurants are permitted by right in this zone. The existing site is occupied by a closed Claim Jumper restaurant, asphalt parking and drive lanes of approximately 79,485 square feet and landscaped area of approximately 12,841 square feet. The discharge flow is broken into five drainage sub-areas. Sub-area 100 sheet flows from the northwest to the southeast to an existing culvert. Sub-area 200 sheet flows from northwest to southeast into an existing culvert. Sub-areas 300 and 400 both drain to onsite area drains. Sub-area 500 drains to landscape areas around the building. Drainage from both culverts exits into Alta Street and is conveyed via gutters into a culvert at the east end of Alta Street. Drainage is then conveyed to Santa Anita Wash, which flows into the Rio Hondo Channel. The Rio Hondo Channel joins the Los Angeles River, ultimately ending in the Pacific Ocean.

1.3 PROPOSED SITE CONDITION

Based on Site plan prepared by CRHO Architecture (Project Architect), the existing building and parking area will be demolished to accommodate the construction of a new Chick-fil-A restaurant # 4698 building (approximately 4,562 square feet) and a new Starbucks restaurant building (approximately 2,200 square feet). The new Chick-fil-A building will be constructed approximately 38 ft. west of the easterly property line and approximately 35 ft south of the northerly property line. The proposed building will be a single-story wood frame structure with no basement or underground level. The new Starbucks building will be constructed approximately 19 ft east of the westerly property line and approximately 38 ft south of the northerly property line. Other planned improvements include for each building, new parking stalls, menu board signs, two new trash enclosures, and new concrete walkways (approximately 68,660 square feet), and new planter areas (approximately 23,666 square feet). The site can be accessed from Huntington Drive, Encino Avenue, or the neighboring property.

In the proposed condition the site has been divided into five drainage sub-areas. The runoff from sub-areas 100, 200, 300, and 400 is collected into onsite catch basins and

routed via underground storm drainpipes into underground infiltrators on the Chick-fil-A property. Once the system is full water will flow out of the catch basin located at node 401 and into Encino Avenue. The stormwater will flow from Encino Avenue to Alta Street and into the Santa Anita Wash, connect with the Rio Hondo Channel, which will convey the drainage to the Los Angeles River and finally the Pacific Ocean. The runoff from sub-areas 500, 600, and 700 is collected into onsite catch basins and routed via underground storm drainpipes into underground infiltrators on the Starbucks property. Once the system has reached capacity the runoff will flow from the catch basin located at node 501 and exit the site via an existing culvert. The culvert conveys drainage into the Alta Street, which then flows via surface flow into a channel at the end of Alta Street. The drainage is conveyed into the Santa Anita Wash, which connects to the Rio Hondo Channel, then joins the Los Angeles River and ultimately ends in the Pacific Ocean. Sub-area 800 is comprised entirely of landscaped area except for an existing wall. This area will be considered a self-treating area.

1.4 METHODOLOGY

This project should be designed for 10-year, 24-hour and 25-year, 24-hour rainfall event. As per the Los Angeles County Department of Public Works, the site is located near rainfall isohyet 6.8 in. as per 1-H1.30 MOUNT WILSON 50-YEAR 24-HOUR ISOYHET (See Appendix)

The total runoff from the site will be computed using the information given by the L.A.C.P.W. Hydrology Manual related to Soil Classification and 10-Year and 25-Year 24-Hour Isohyet for said site. The Isohyet is also utilized to determine the runoff when the Rational Formula is used. The Rational Formula assumes that the effective rainfall intensity over the site is equal to the intensity found at the time of concentration.

From LACDPW	Soil Classification Area:	006
Isohyet	Events:	10 Year and 25 Year-24-hour

Time of concentration

The time of concentration was computed using the HydroCalc program from LACDPW.

$$Tc = 10^{-0.507}\left(C_D I_X\right)^{-0.519} L^{0.483} s^{-0.135}$$

$C_D = (0.9 \text{ x Imp}) + [(1.0 - \text{Imp}) \text{ x } C_U)]$ If CD < C_U, use $C_D = C_U$

The discharge Q was computed using the Rational Formula.

1.5 TOTAL DISCHARGE SUMMARY

TOTAL SITE DISCHARGE		
STORM EVENT (YEAR)	EXISTING CONDITION (cfs)	PROPOSED CONDITON (cfs)
10	5.74	5.72
25	7.46	7.27

2.0 HYDROLOGY ANALYSIS

2.1 EXISTING CONDITION

Node 100 to Node 101

Area =1.151 acres
L = 376 ft. s = 0.0159 Tc = 6.00 min.

Q_{10} = 3.00 cfs. Q_{25} = 4.06 cfs.
I = 2.93 in/hr. I = 3.93 in/hr.

Node 200 to Node 201

Area =0.654 acres
L = 230 ft. s = 0.0186 Tc = 5.00 min.

Q_{10} = 1.87 cfs. Q_{25} = 2.31 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 300 to Node 301

Area =0.047 acres
L = 52 ft. s = 0.0119 Tc = 5.00 min.

Q_{10} = 0.13 cfs. Q_{25} = 0.16 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 400 to Node 401

Area =0.03 acres
L = 33 ft. s = 0.0206 Tc = 5.00 min.

Q_{10} = 0.08 cfs. Q_{25} = 0.10 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 500 to Node 501

Area =0.238 acres
L = 30 ft. s = 0.0613 Tc = 5.00 min.

Q_{10} = 0.66 cfs. Q_{25} = 0.83 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

2.2 PROPOSED CONDITION

Node 100 to Node 101

Area =0.581 acres
L = 368 ft. s = 0.007 Tc = 7.00 min.

Q_{10} = 1.40 cfs. Q_{25} = 1.87 cfs.
I = 2.73 in/hr. I = 3.60 in/hr.

Node 200 to Node 201

Area =0.27 acres
L = 138 ft. s = 0.0151 Tc = 5.00 min.

Q_{10} = 0.77 cfs. Q_{25} = 0.95 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 300 to Node 301

Area =0.230 acres
L = 162 ft. s = 0.0175 Tc = 5.00 min

Q_{10} = 0.66 cfs. Q_{25} = 0.81 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 400 to Node 401

Area =0.119 acres
L = 143 ft. s = 0.02 Tc = 5.00 min

Q_{10} = 0.33 cfs. Q_{25} = 0.42 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 500 to Node 501

Area =0.487 acres
L = 2.88 ft. s = 0.0131 Tc = 5.00 min

Q_{10} = 1.38 cfs. Q_{25} = 1.71 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 600 to Node 601

Area =0.205 acres
L = 180 ft. s = 0.0061 Tc = 5.00 min

Q_{10} = 0.57 cfs. Q_{25} = 0.72 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 700 to Node 701

Area =0. acres
L = 99 ft. s = 0.0147 Tc = 5.00 min

Q_{10} = 0.08 cfs. Q_{25} = 0.10 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

Node 800 to Node 801

Area =0.49 acres
L = 125 ft. s = 0.018 Tc = 5.00 min

Q_{10} = 0.53 cfs. Q_{25} = 0.69 cfs.
I = 3.19 in/hr. I = 3.93 in/hr.

TOTAL SITE RUNOFF DISCHARGE

EXISTING

Q_{10} = 3.00 + 1.87 + 0.13 + 0.08 + 0.66 = **5.74 cfs**

Q_{25} = 4.06 + 2.31 + 0.16 + 0.10 + 0.83 = **7.46 cfs**

PROPOSED

Q_{10} = 1.40 + 0.77 + 0.66 + 0.33 + 1.38 + 0.57 + 0.08 + 0.53 = **5.72 cfs**

Q_{25} = 1.87 + 0.95 + 0.81 + 0.42 + 1.71 + 0.72 + 0.10 + 0.69 = **7.27 cfs**

Q_{10} (PROPOSED) – Q_{10} (EXISTING)

5.72 cfs – 5.74 cfs = -0.02 cfs => DECREASE OF 0.02 cfs [0.3%]

Q_{25} (PROPOSED) – Q_{25} (EXISTING)

7.27 cfs – 7.46 cfs = -0.19 cfs => DECREASE OF 0.19 cfs [2.5%]

BUILDING PROTECTION

Chick-fil-A:

For building protection purposes, the water surface elevation NODE 201 will be 467.25' during a 100-yr storm event. This provides a difference of 1.24' below the finished floor of the building.

Starbucks:

For building protection purposes, the water surface elevation NODE 601 will be 468.61' during a 100-yr storm event. This provides a difference of 1.55' below the finished floor of the building.

2.3 CONCLUSION

The findings of this report show that no significant changes to the drainage of this site will occur. The existing site land use is a Claim Jumper Restaurant and parking lot and the proposed land use is a restaurant with a drive-thru. The amount of impervious surfaces has decreased in the proposed condition (80,117 sf Existing Cond., 68,882 sf Proposed Cond.).

The drainage pattern of the site will be maintained as it drains from northeast to southwest, although due to the addition of the building and drive-thru the subareas that make up the DMA are configured differently than in the existing condition. The site has been designed to allow for drainage to flow away from the building and be conveyed by drainage devices such as curb & gutters south to existing catch basins. The proposed condition of the site will maintain the site discharge into the public storm drain system through the culverts, therefore no re-routing of storm water will occur from this development project.

It was found that in both the 10 yr and 25 yr storm event analyses the peak runoff values were decreased from the existing site condition values by 0.3% and 2.5%.

It shall be noted that the most significant difference to the drainage of this site in the proposed condition is the addition of a storm water treatment system. Per State and County requirements this development project is required to install a Structural BMP for storm water treatment. Both sites will have an underground infiltration systems that will capture the Design Volume and allow for storage and infiltration of the runoff. In high flow storm events, the storm water will first enter the underground storage system, once full the system will back up to the lowest grates, which are located in the drive lane at Node 401 and Node 501. The storm water will then flow into Alta Street. See project WQMP for details.

2.4 HYDROCALC CALCULATIONS

Peak Flow Hydrologic Analysis

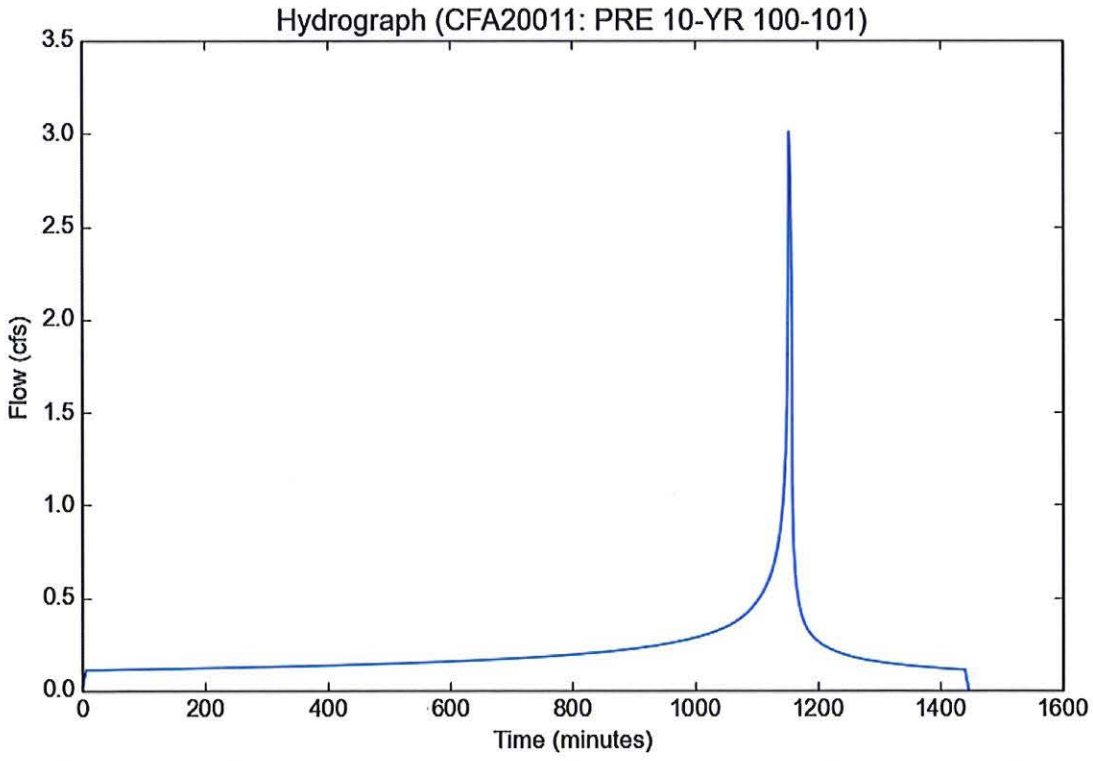
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 10-YR 100-101.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 10-YR 100-101
Area (ac)	1.151
Flow Path Length (ft)	376.0
Flow Path Slope (vft/hft)	0.0159
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.89
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	2.9326
Undeveloped Runoff Coefficient (Cu)	0.8175
Developed Runoff Coefficient (Cd)	0.8909
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	3.0072
Burned Peak Flow Rate (cfs)	3.0072
24-Hr Clear Runoff Volume (ac-ft)	0.4193
24-Hr Clear Runoff Volume (cu-ft)	18266.1644



Peak Flow Hydrologic Analysis

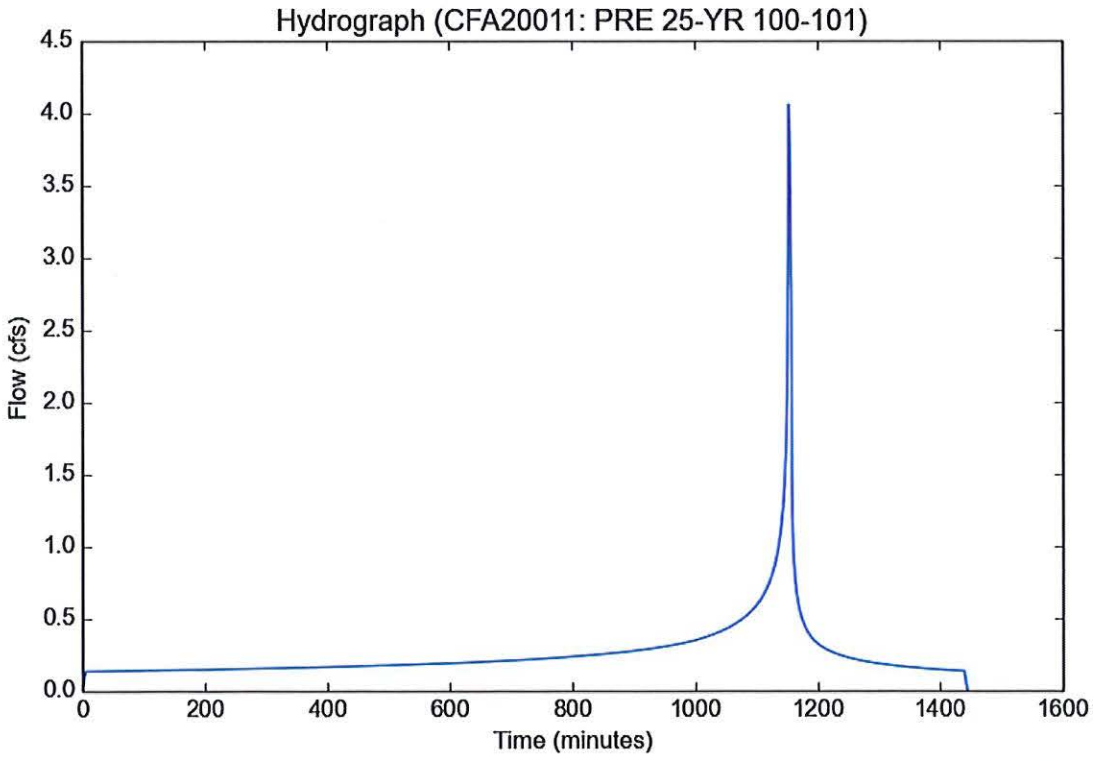
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 25-YR 100-101.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 25-YR 100-101
Area (ac)	1.151
Flow Path Length (ft)	376.0
Flow Path Slope (vft/hft)	0.0159
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.89
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8971
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	4.0568
Burned Peak Flow Rate (cfs)	4.0568
24-Hr Clear Runoff Volume (ac-ft)	0.5176
24-Hr Clear Runoff Volume (cu-ft)	22545.3306



Peak Flow Hydrologic Analysis

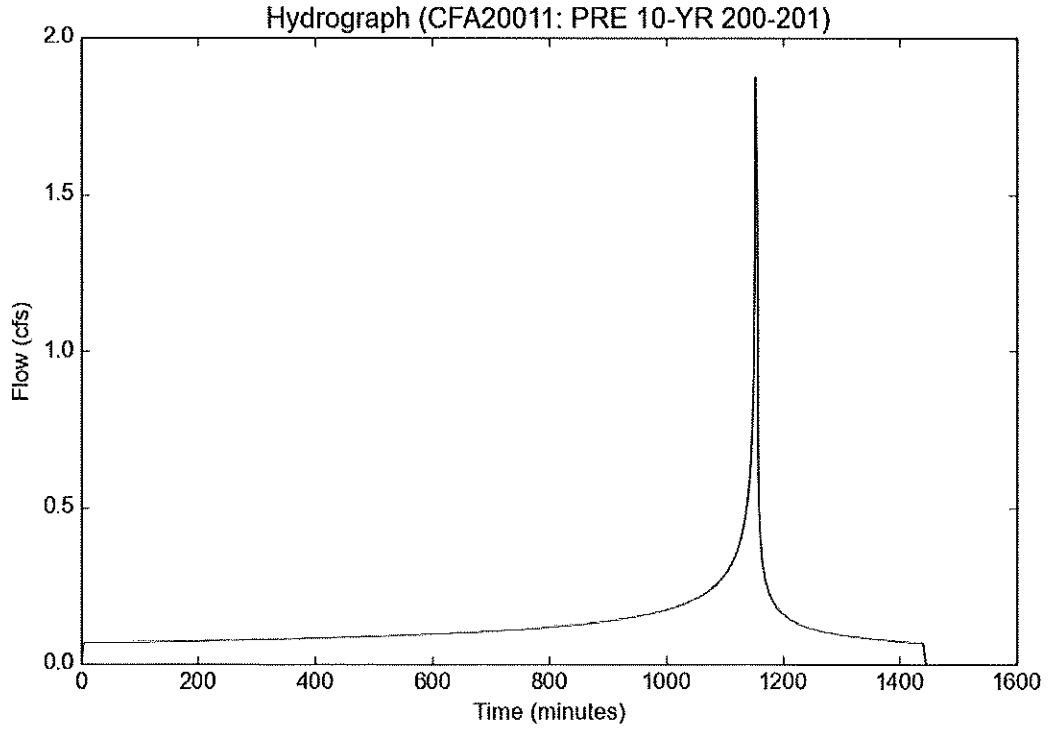
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 10-YR 200-201.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 10-YR 200-201
Area (ac)	0.654
Flow Path Length (ft)	230.0
Flow Path Slope (vft/hft)	0.0186
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.962
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8976
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.8755
Burned Peak Flow Rate (cfs)	1.8755
24-Hr Clear Runoff Volume (ac-ft)	0.2528
24-Hr Clear Runoff Volume (cu-ft)	11012.7198



Peak Flow Hydrologic Analysis

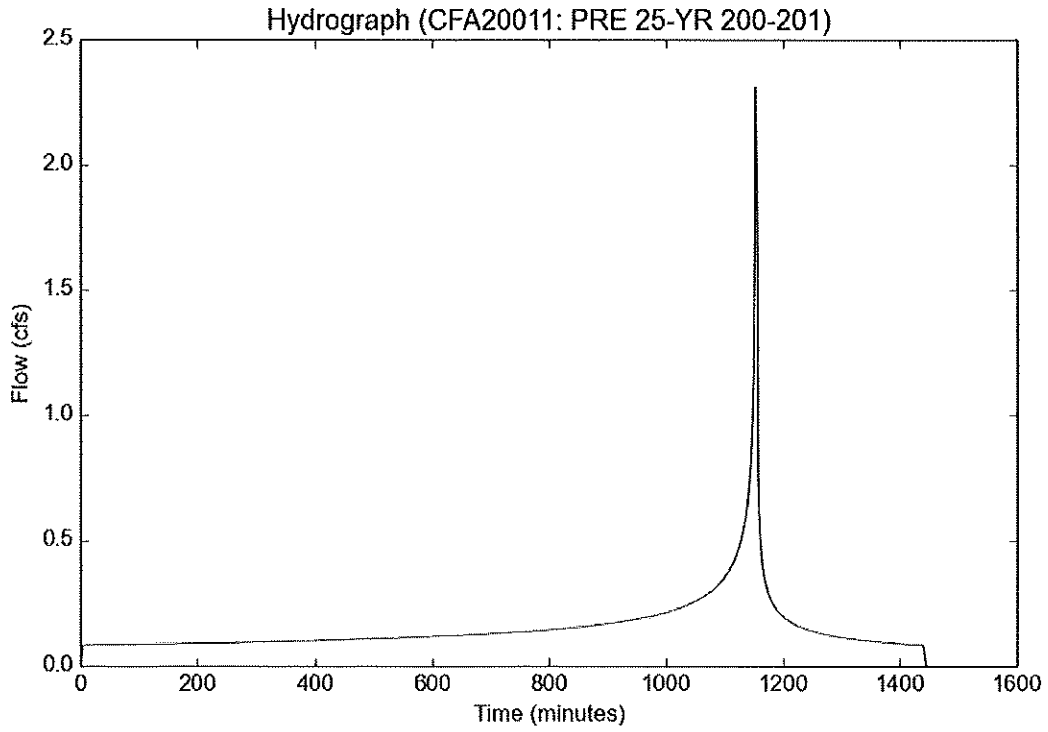
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 25-YR 200-201.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 25-YR 200-201
Area (ac)	0.654
Flow Path Length (ft)	230.0
Flow Path Slope (vft/hft)	0.0186
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.962
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.899
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.3099
Burned Peak Flow Rate (cfs)	2.3099
24-Hr Clear Runoff Volume (ac-ft)	0.3113
24-Hr Clear Runoff Volume (cu-ft)	13558.4794



Peak Flow Hydrologic Analysis

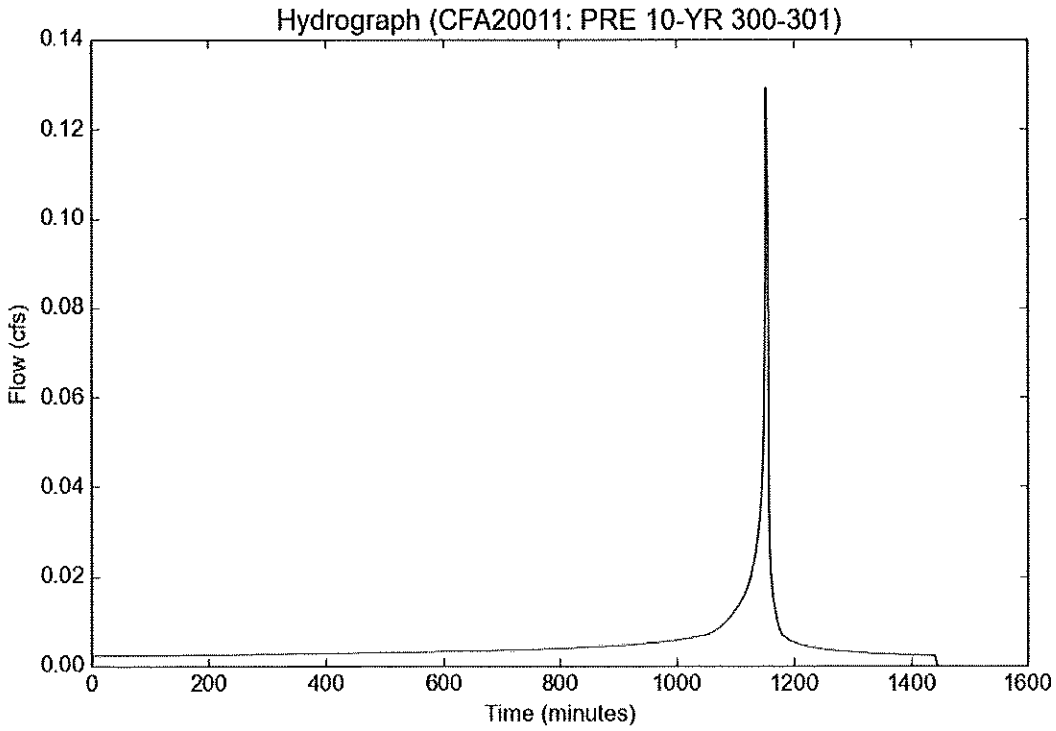
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 10-YR 300-301.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 10-YR 300-301
Area (ac)	0.047
Flow Path Length (ft)	52.0
Flow Path Slope (vft/hft)	0.0119
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.374
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8599
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.1291
Burned Peak Flow Rate (cfs)	0.1291
24-Hr Clear Runoff Volume (ac-ft)	0.0096
24-Hr Clear Runoff Volume (cu-ft)	419.6685



Peak Flow Hydrologic Analysis

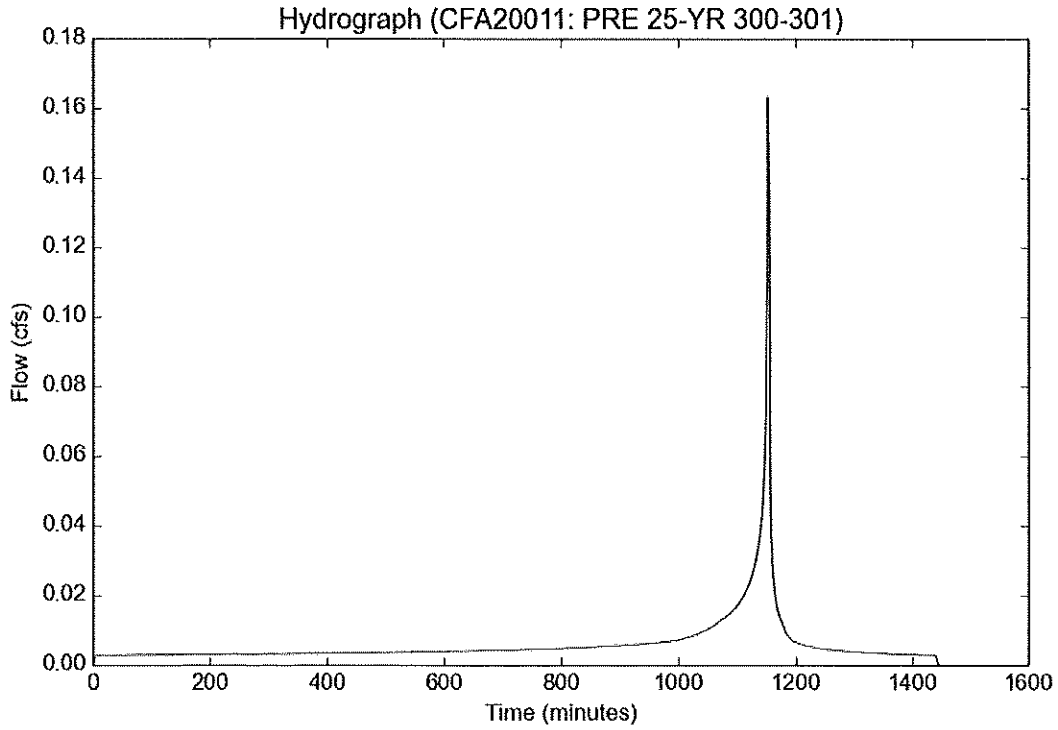
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 25-YR 300-301.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 25-YR 300-301
Area (ac)	0.047
Flow Path Length (ft)	52.0
Flow Path Slope (vft/hft)	0.0119
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.374
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8836
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.1632
Burned Peak Flow Rate (cfs)	0.1632
24-Hr Clear Runoff Volume (ac-ft)	0.0123
24-Hr Clear Runoff Volume (cu-ft)	535.2742



Peak Flow Hydrologic Analysis

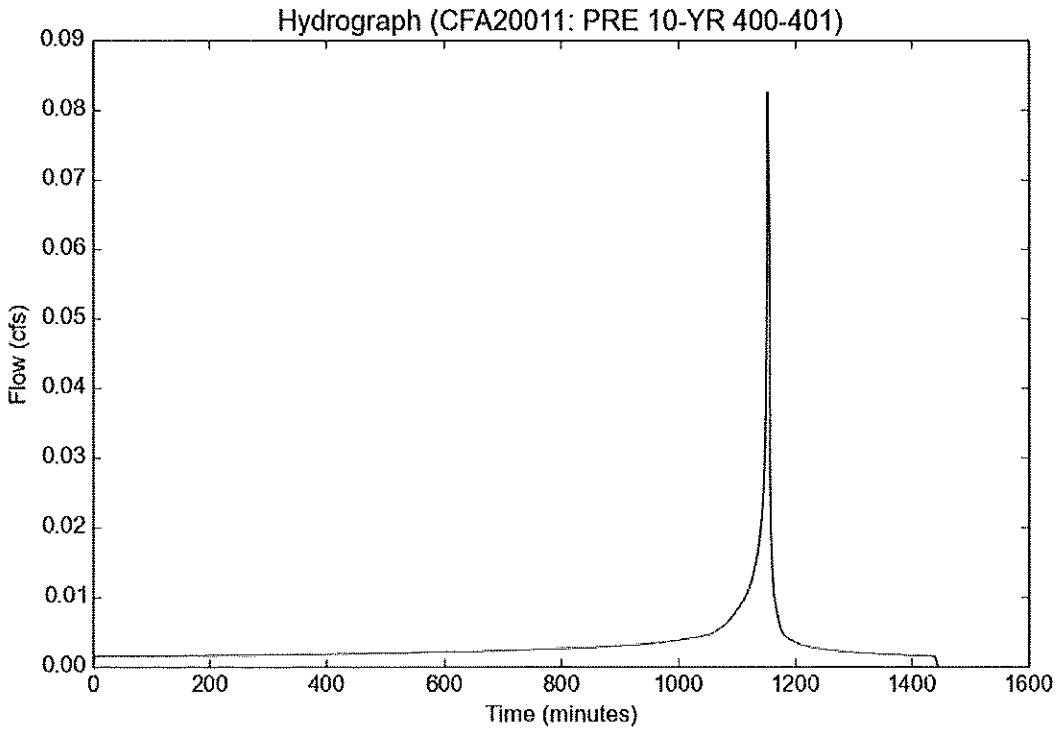
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 10-YR 400-401.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 10-YR 400-401
Area (ac)	0.03
Flow Path Length (ft)	33.0
Flow Path Slope (vft/hft)	0.0206
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.39
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8609
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.0825
Burned Peak Flow Rate (cfs)	0.0825
24-Hr Clear Runoff Volume (ac-ft)	0.0063
24-Hr Clear Runoff Volume (cu-ft)	274.3305



Peak Flow Hydrologic Analysis

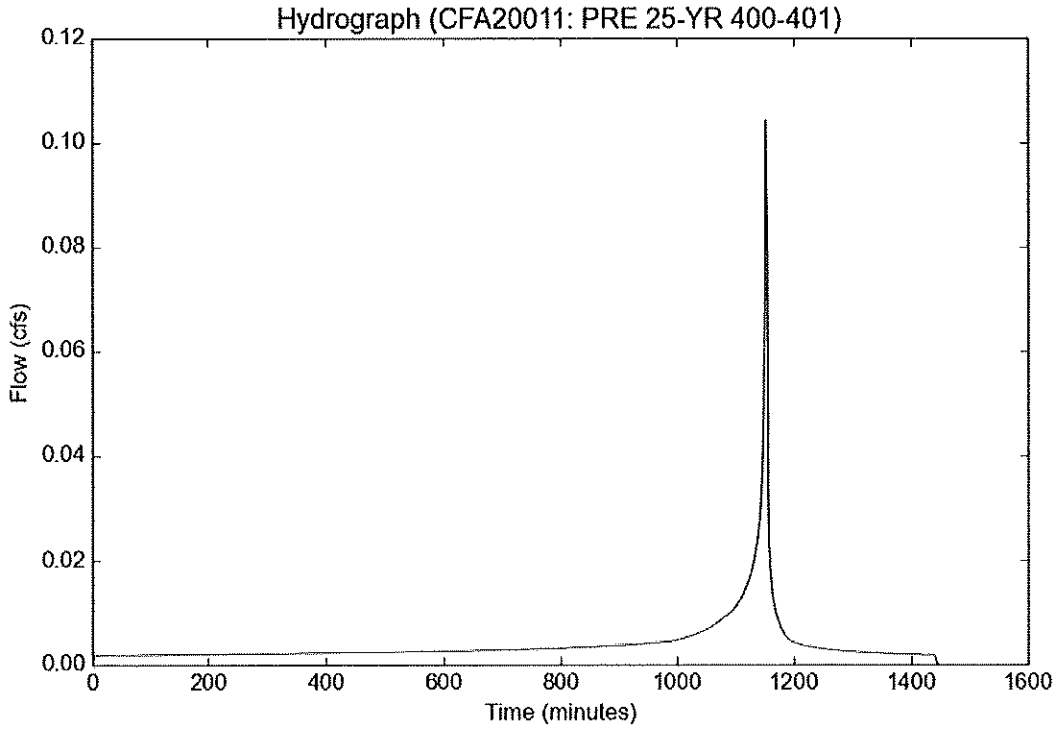
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 25-YR 400-401.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 25-YR 400-401
Area (ac)	0.03
Flow Path Length (ft)	33.0
Flow Path Slope (vft/hft)	0.0206
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.39
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.1042
Burned Peak Flow Rate (cfs)	0.1042
24-Hr Clear Runoff Volume (ac-ft)	0.008
24-Hr Clear Runoff Volume (cu-ft)	349.2912



Peak Flow Hydrologic Analysis

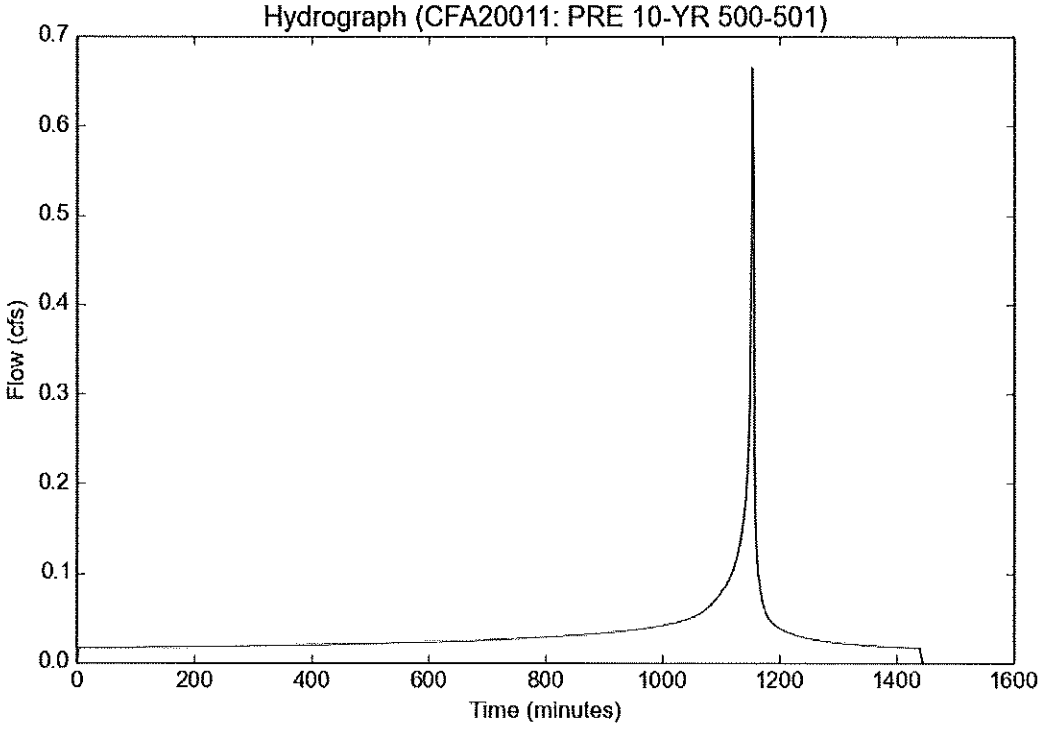
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/PRE/CFA20011 - PRE 10-YR 500-501.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 10-YR 500-501
Area (ac)	0.238
Flow Path Length (ft)	30.0
Flow Path Slope (vft/hft)	0.0613
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.595
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8741
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.6646
Burned Peak Flow Rate (cfs)	0.6646
24-Hr Clear Runoff Volume (ac-ft)	0.065
24-Hr Clear Runoff Volume (cu-ft)	2832.6895



Peak Flow Hydrologic Analysis

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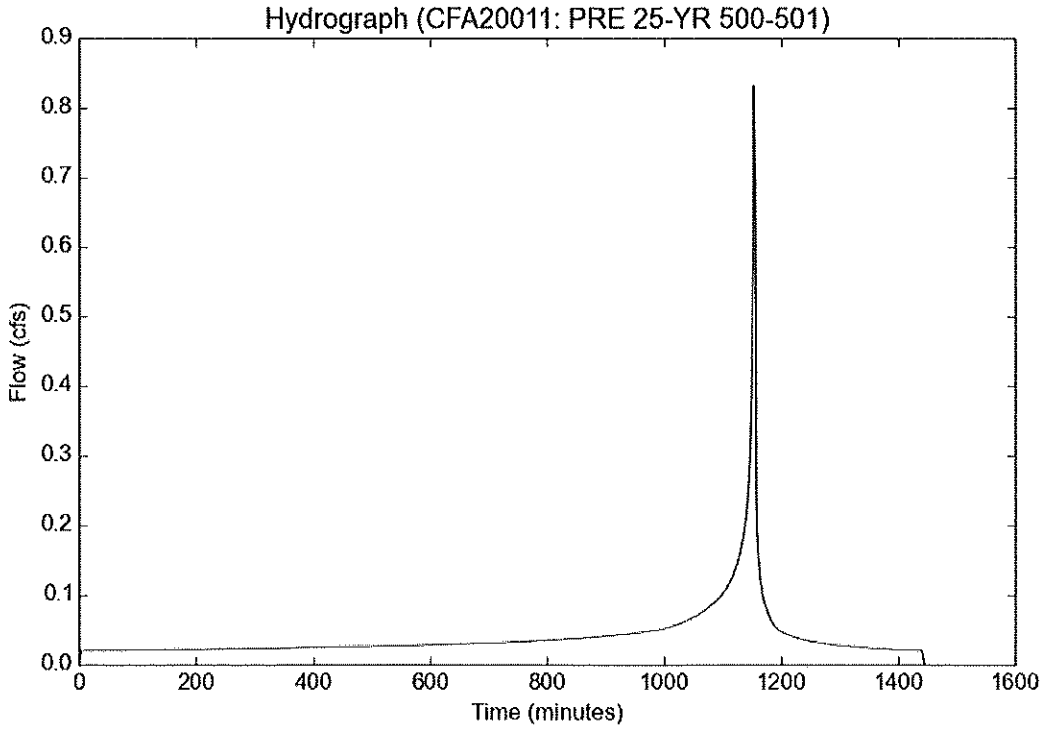
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	PRE 25-YR 500-501
Area (ac)	0.238
Flow Path Length (ft)	30.0
Flow Path Slope (vft/hft)	0.0613
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.595
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8894
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.8316
Burned Peak Flow Rate (cfs)	0.8316
24-Hr Clear Runoff Volume (ac-ft)	0.0814
24-Hr Clear Runoff Volume (cu-ft)	3546.2737



Peak Flow Hydrologic Analysis

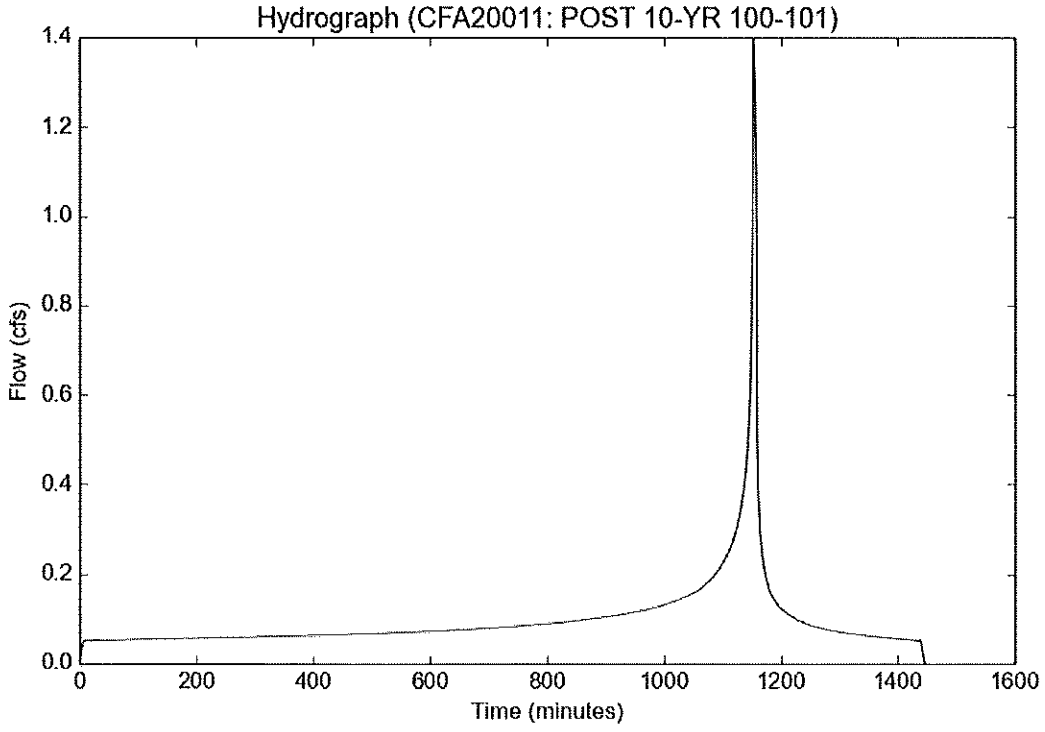
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 100-101.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 100-101
Area (ac)	0.581
Flow Path Length (ft)	368.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.809
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	2.7276
Undeveloped Runoff Coefficient (Cu)	0.8032
Developed Runoff Coefficient (Cd)	0.8815
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	1.397
Burned Peak Flow Rate (cfs)	1.397
24-Hr Clear Runoff Volume (ac-ft)	0.1971
24-Hr Clear Runoff Volume (cu-ft)	8586.4879



Peak Flow Hydrologic Analysis

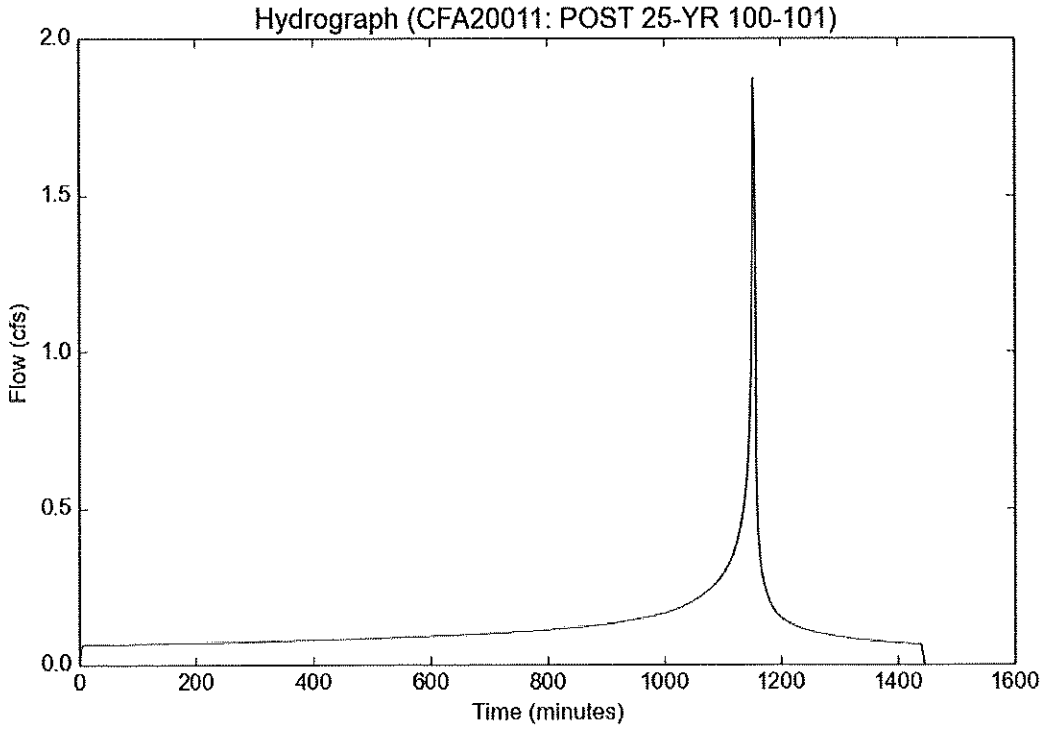
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 100-101.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 100-101
Area (ac)	0.581
Flow Path Length (ft)	368.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.809
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.6062
Undeveloped Runoff Coefficient (Cu)	0.8614
Developed Runoff Coefficient (Cd)	0.8926
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	1.8702
Burned Peak Flow Rate (cfs)	1.8702
24-Hr Clear Runoff Volume (ac-ft)	0.2441
24-Hr Clear Runoff Volume (cu-ft)	10632.1601



Peak Flow Hydrologic Analysis

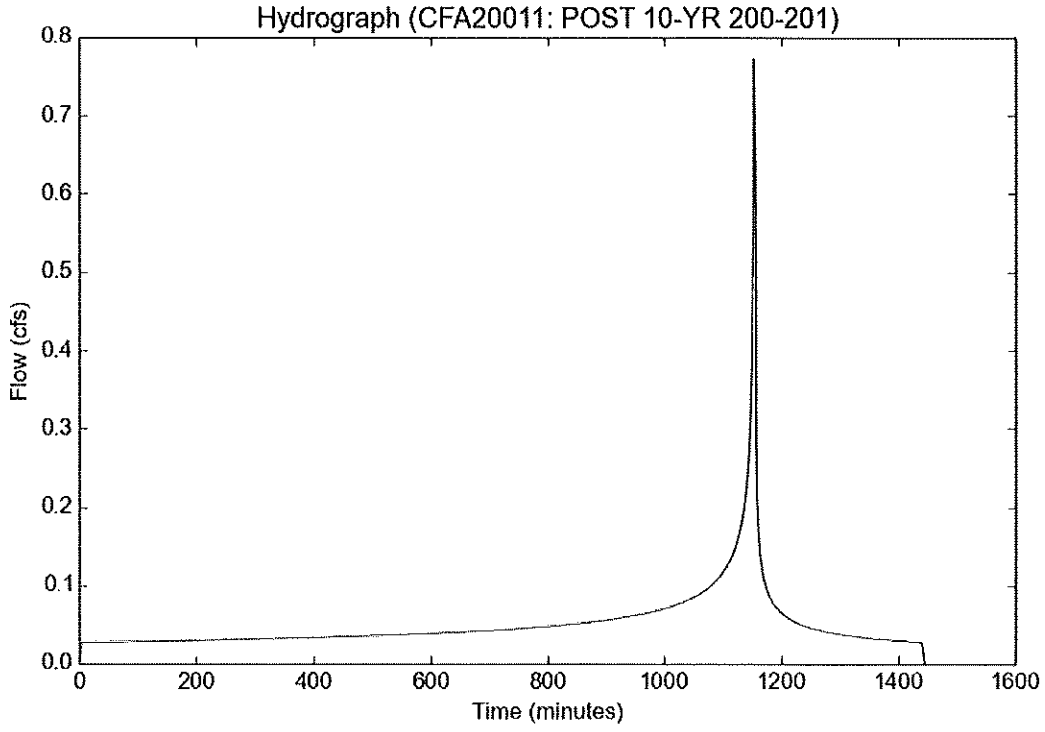
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 200-201.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 200-201
Area (ac)	0.27
Flow Path Length (ft)	138.0
Flow Path Slope (vft/hft)	0.0151
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.945
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8965
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.7733
Burned Peak Flow Rate (cfs)	0.7733
24-Hr Clear Runoff Volume (ac-ft)	0.103
24-Hr Clear Runoff Volume (cu-ft)	4484.79



Peak Flow Hydrologic Analysis

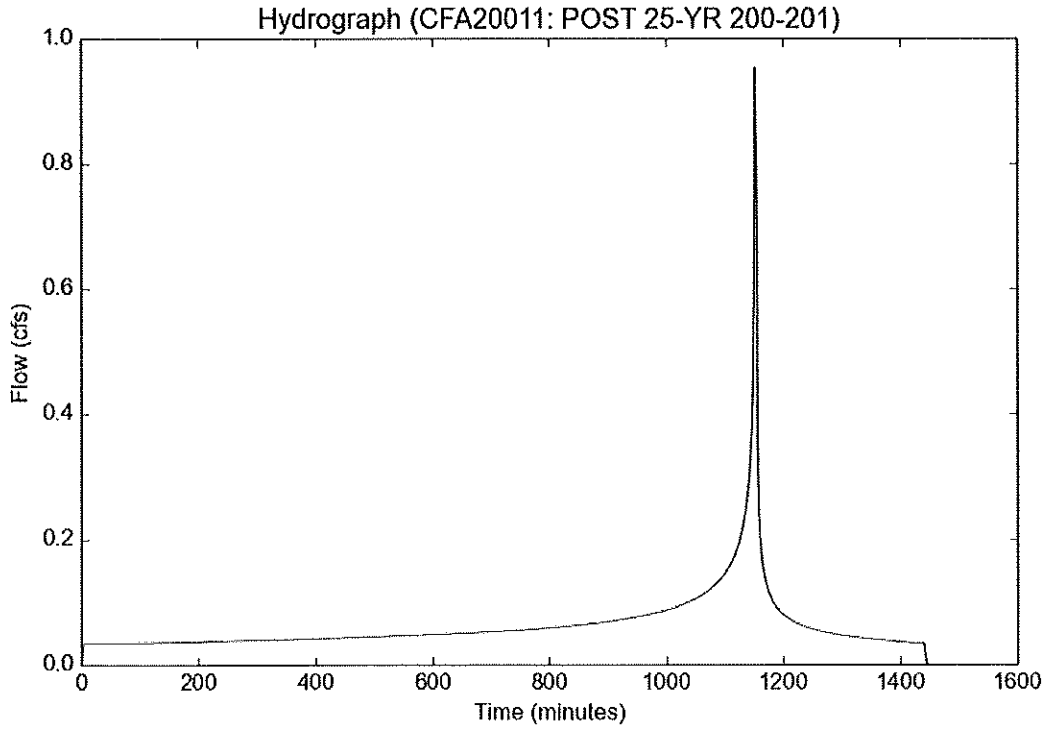
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 200-201.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 200-201
Area (ac)	0.27
Flow Path Length (ft)	138.0
Flow Path Slope (vft/hft)	0.0151
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.945
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8986
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.9532
Burned Peak Flow Rate (cfs)	0.9532
24-Hr Clear Runoff Volume (ac-ft)	0.1268
24-Hr Clear Runoff Volume (cu-ft)	5524.6063



Peak Flow Hydrologic Analysis

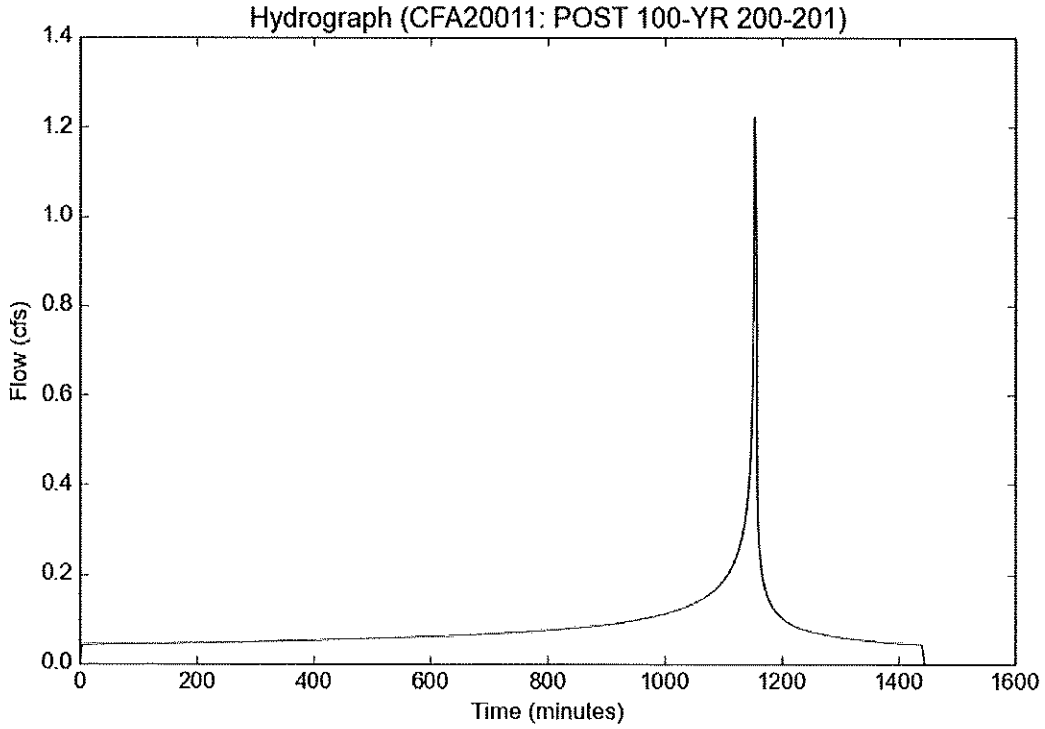
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 100-YR 200-201.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 100-YR 200-201
Area (ac)	0.27
Flow Path Length (ft)	138.0
Flow Path Slope (vft/hft)	0.0151
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.945
Soil Type	6
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	8.415
Peak Intensity (in/hr)	5.0206
Undeveloped Runoff Coefficient (Cu)	0.9151
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.22
Burned Peak Flow Rate (cfs)	1.22
24-Hr Clear Runoff Volume (ac-ft)	0.1625
24-Hr Clear Runoff Volume (cu-ft)	7078.7782



Peak Flow Hydrologic Analysis

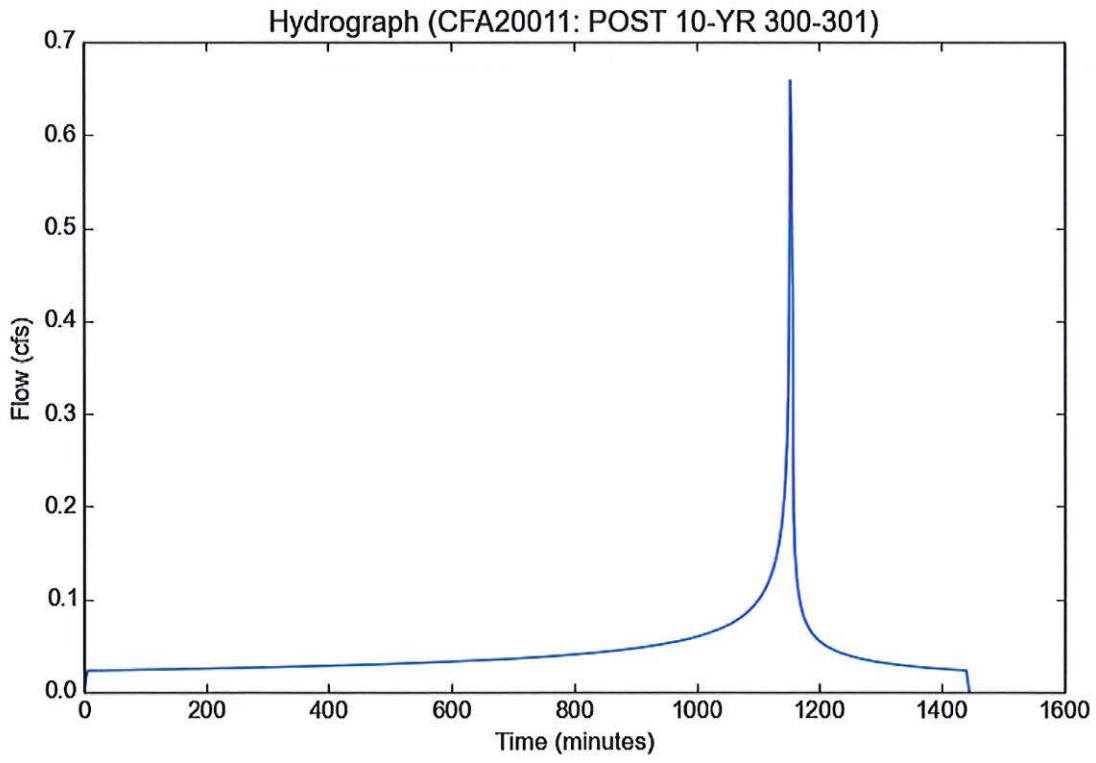
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 300-301.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 300-301
Area (ac)	0.23
Flow Path Length (ft)	162.0
Flow Path Slope (vft/hft)	0.0175
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.945
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8965
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.6588
Burned Peak Flow Rate (cfs)	0.6588
24-Hr Clear Runoff Volume (ac-ft)	0.0877
24-Hr Clear Runoff Volume (cu-ft)	3820.3767



Peak Flow Hydrologic Analysis

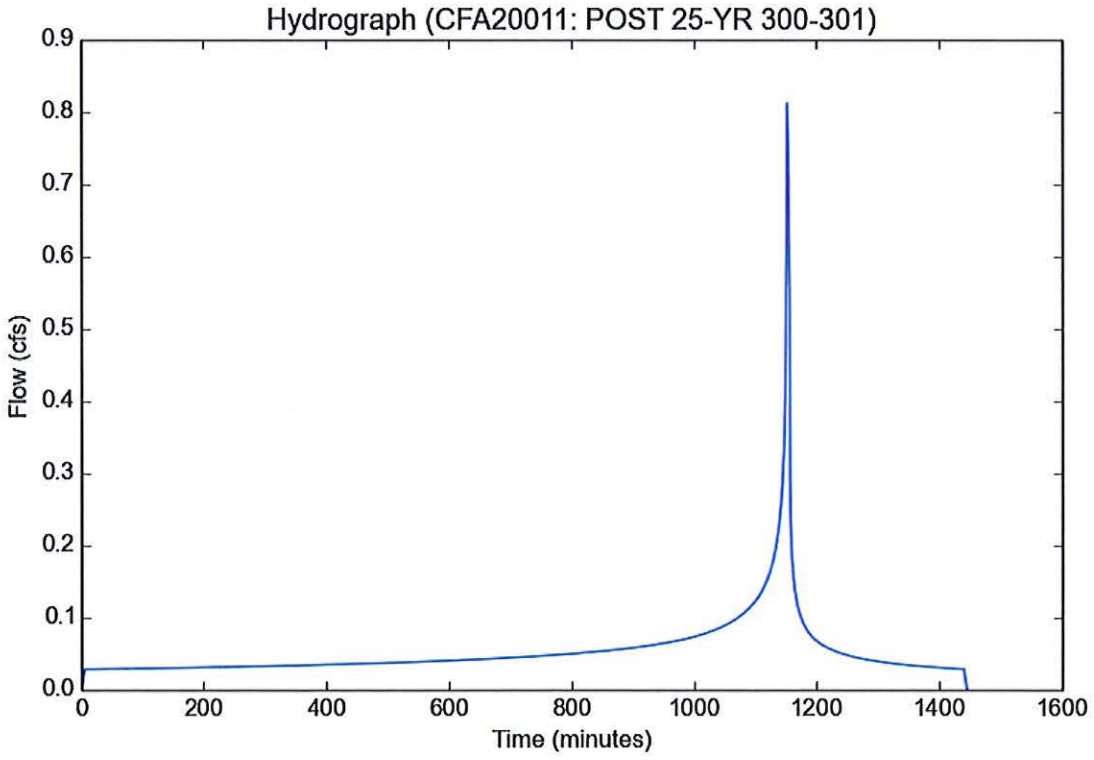
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 300-301.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 300-301
Area (ac)	0.23
Flow Path Length (ft)	162.0
Flow Path Slope (vft/hft)	0.0175
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.945
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8986
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.812
Burned Peak Flow Rate (cfs)	0.812
24-Hr Clear Runoff Volume (ac-ft)	0.108
24-Hr Clear Runoff Volume (cu-ft)	4706.1461



Peak Flow Hydrologic Analysis

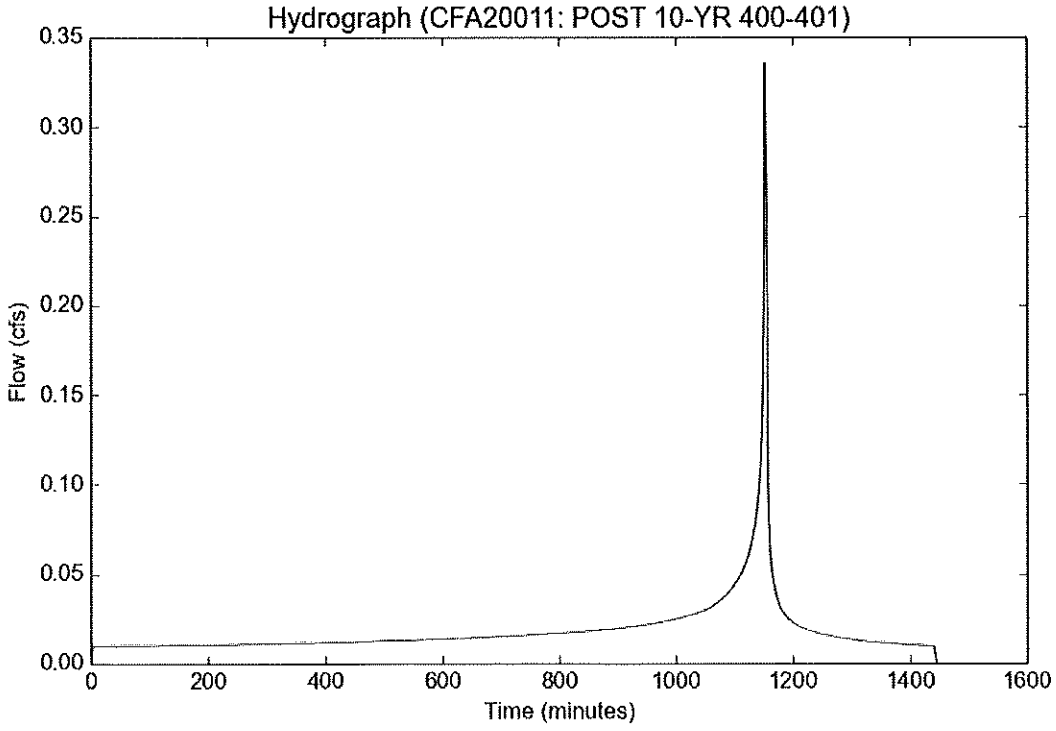
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 400-401.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 400-401
Area (ac)	0.119
Flow Path Length (ft)	143.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.73
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8827
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.3356
Burned Peak Flow Rate (cfs)	0.3356
24-Hr Clear Runoff Volume (ac-ft)	0.0375
24-Hr Clear Runoff Volume (cu-ft)	1632.4546



Peak Flow Hydrologic Analysis

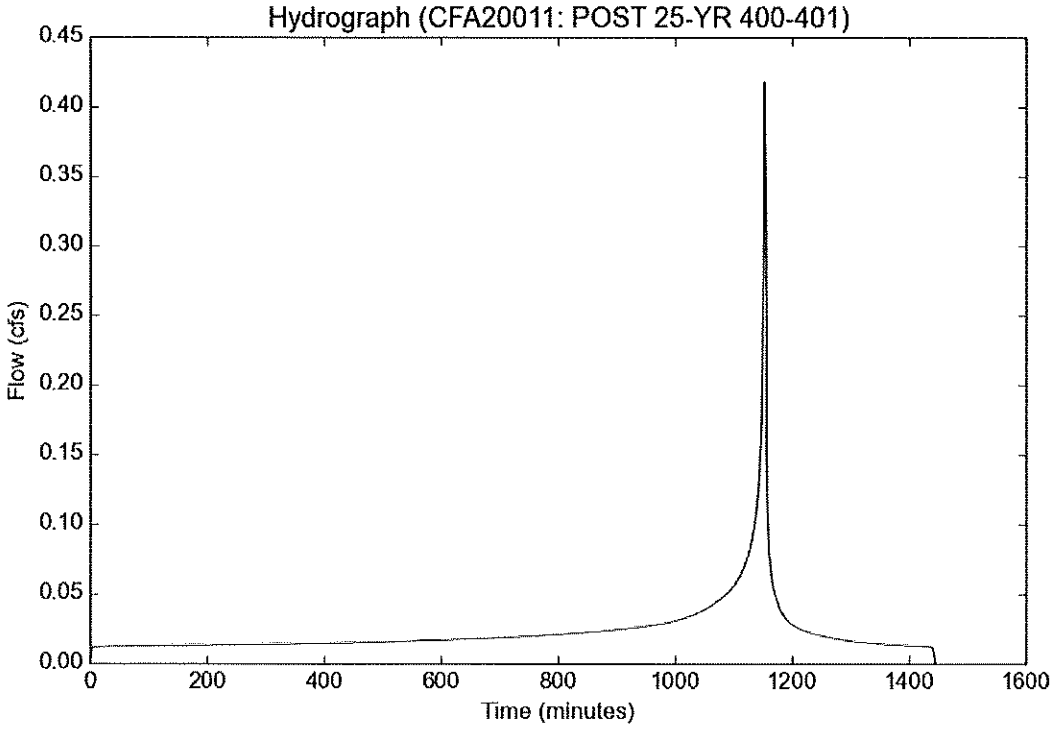
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 400-401.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 400-401
Area (ac)	0.119
Flow Path Length (ft)	143.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.73
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8929
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.4175
Burned Peak Flow Rate (cfs)	0.4175
24-Hr Clear Runoff Volume (ac-ft)	0.0466
24-Hr Clear Runoff Volume (cu-ft)	2028.3957



Peak Flow Hydrologic Analysis

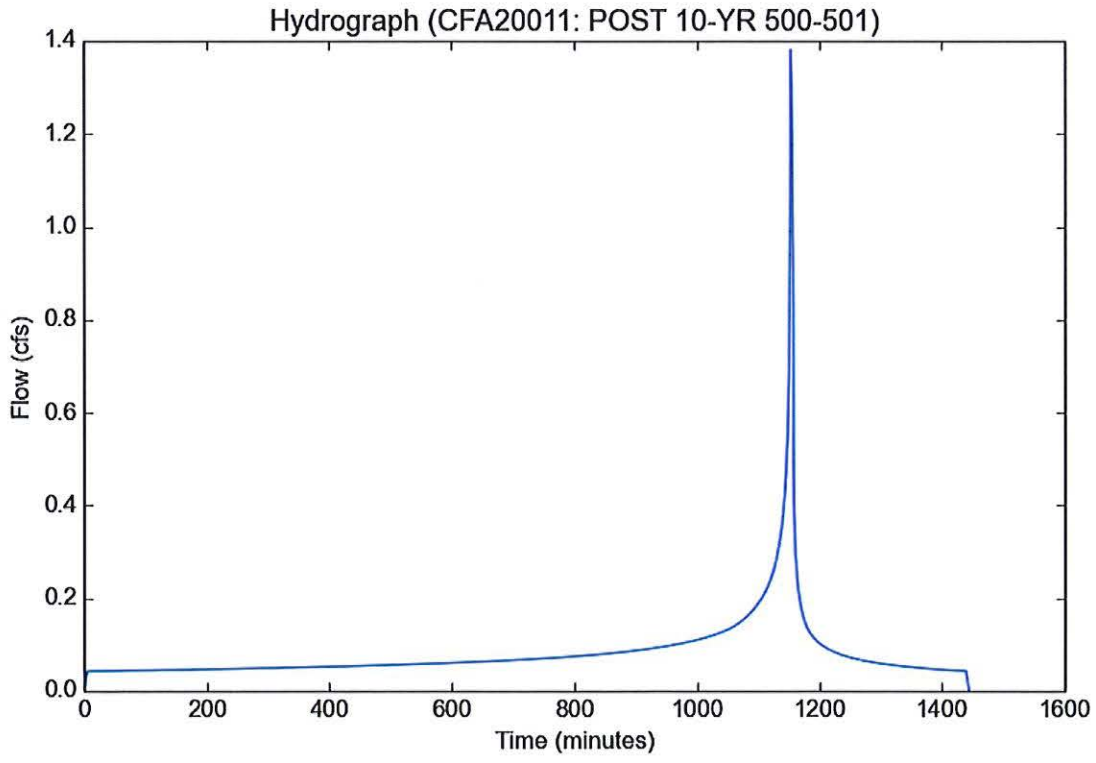
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 500-501.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 500-501
Area (ac)	0.487
Flow Path Length (ft)	288.0
Flow Path Slope (vft/hft)	0.0131
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.807
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8876
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.3811
Burned Peak Flow Rate (cfs)	1.3811
24-Hr Clear Runoff Volume (ac-ft)	0.1649
24-Hr Clear Runoff Volume (cu-ft)	7185.1625



Peak Flow Hydrologic Analysis

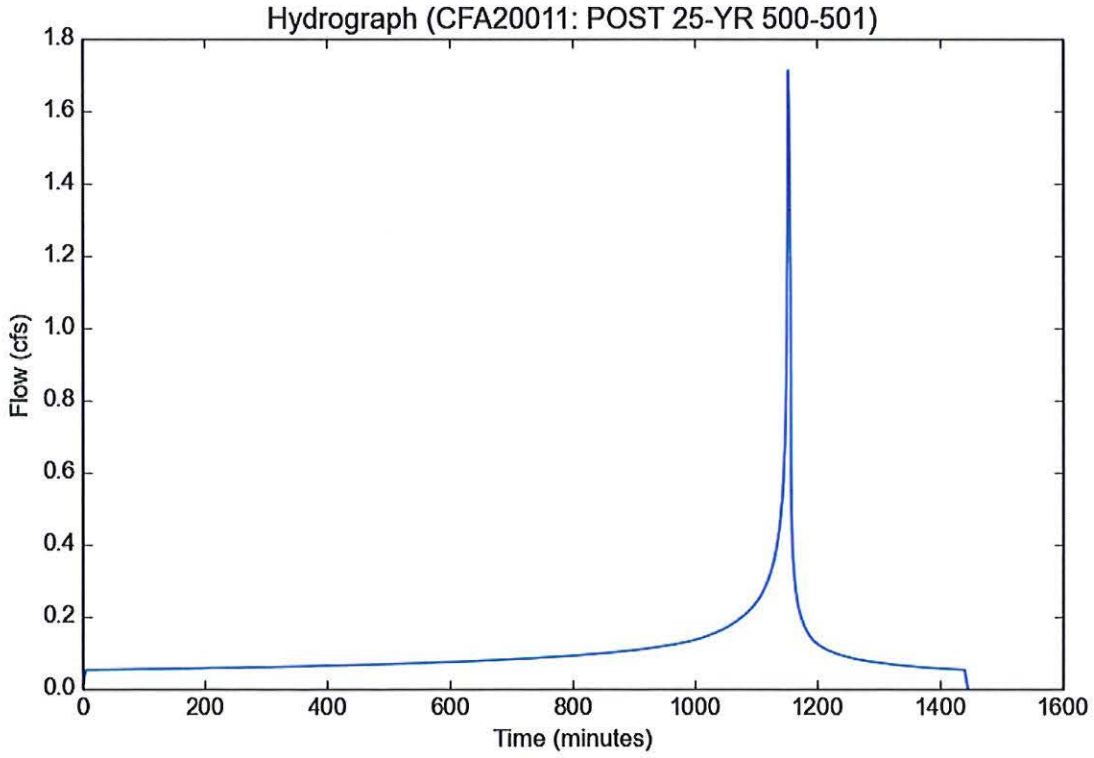
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 500-501.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 500-501
Area (ac)	0.487
Flow Path Length (ft)	288.0
Flow Path Slope (vft/hft)	0.0131
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.807
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8949
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.7123
Burned Peak Flow Rate (cfs)	1.7123
24-Hr Clear Runoff Volume (ac-ft)	0.2042
24-Hr Clear Runoff Volume (cu-ft)	8896.908



Peak Flow Hydrologic Analysis

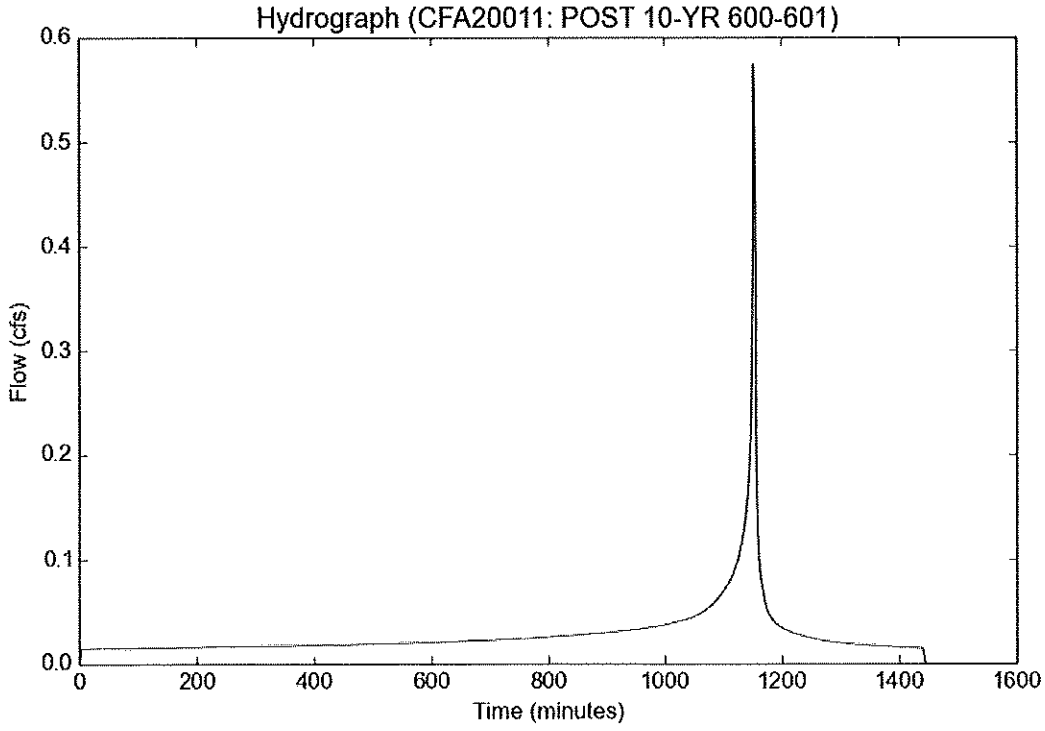
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 600-601.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 600-601
Area (ac)	0.205
Flow Path Length (ft)	180.0
Flow Path Slope (vft/hft)	0.0061
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.622
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8758
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.5736
Burned Peak Flow Rate (cfs)	0.5736
24-Hr Clear Runoff Volume (ac-ft)	0.0577
24-Hr Clear Runoff Volume (cu-ft)	2514.3796



Peak Flow Hydrologic Analysis

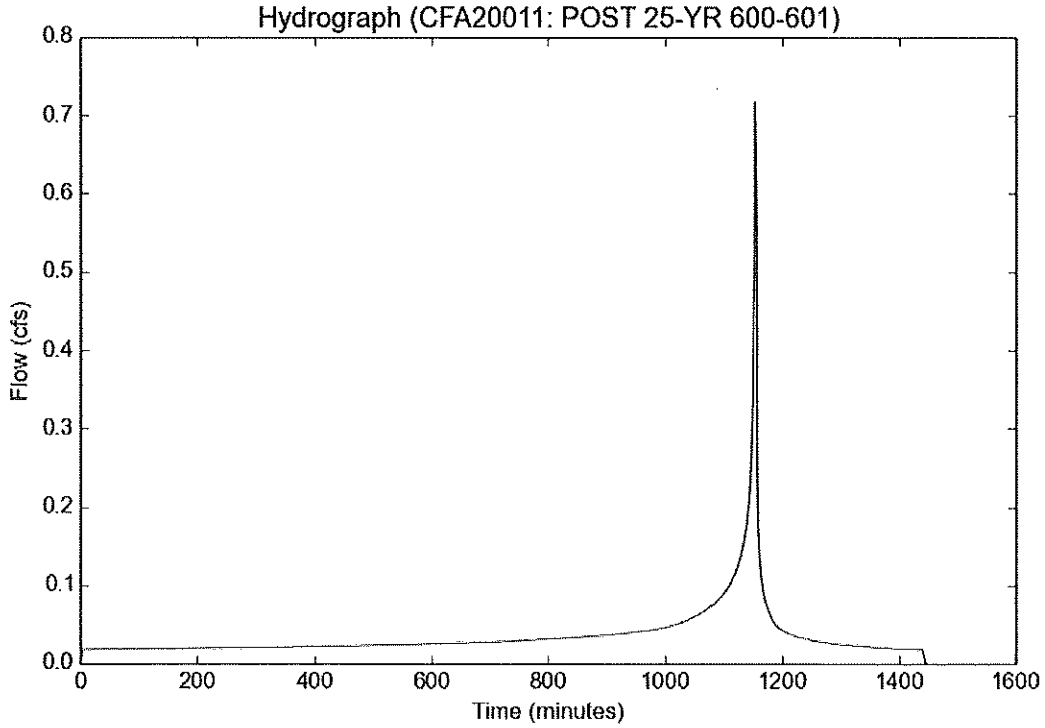
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 600-601.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 600-601
Area (ac)	0.205
Flow Path Length (ft)	180.0
Flow Path Slope (vft/hft)	0.0061
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.622
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8901
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.7169
Burned Peak Flow Rate (cfs)	0.7169
24-Hr Clear Runoff Volume (ac-ft)	0.0721
24-Hr Clear Runoff Volume (cu-ft)	3142.5098



Peak Flow Hydrologic Analysis

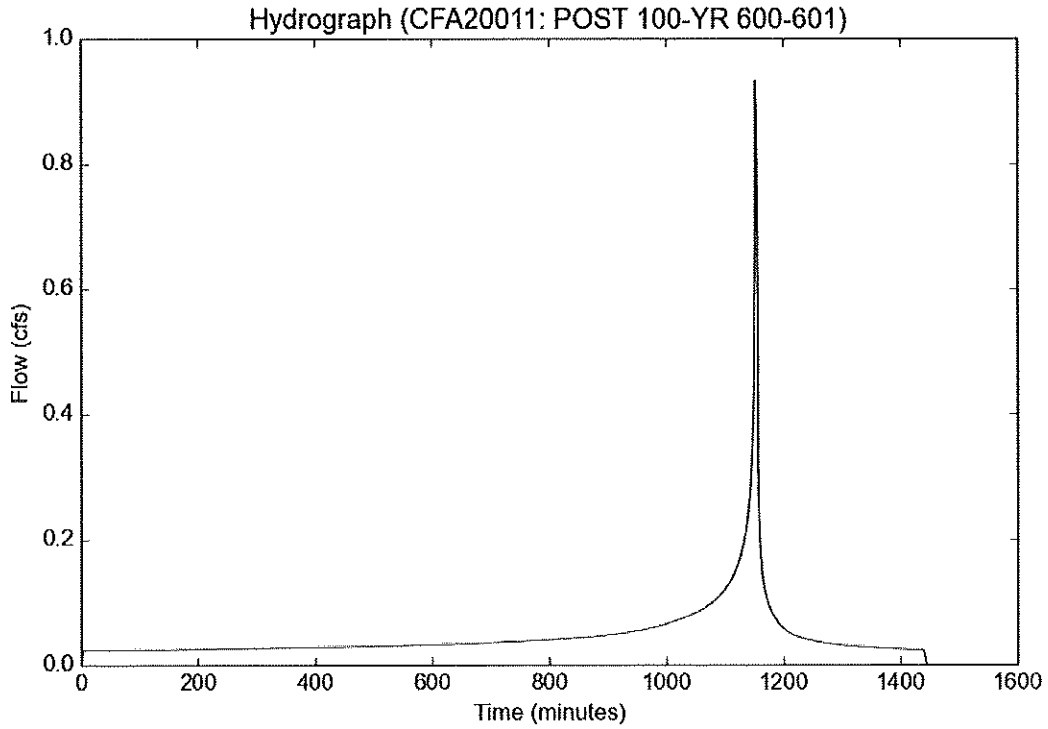
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 100-YR 600-601.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 100-YR 600-601
Area (ac)	0.205
Flow Path Length (ft)	180.0
Flow Path Slope (vft/hft)	0.0061
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.622
Soil Type	6
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	8.415
Peak Intensity (in/hr)	5.0206
Undeveloped Runoff Coefficient (Cu)	0.9151
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.9263
Burned Peak Flow Rate (cfs)	0.9263
24-Hr Clear Runoff Volume (ac-ft)	0.0944
24-Hr Clear Runoff Volume (cu-ft)	4114.2415



Peak Flow Hydrologic Analysis

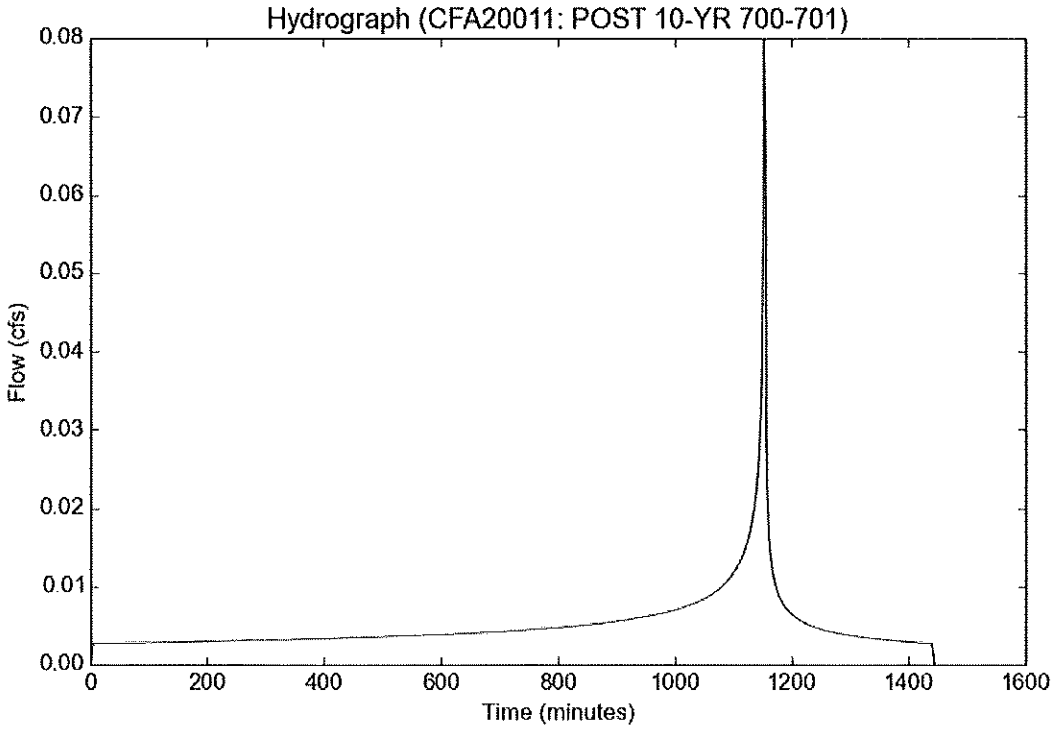
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 700-701.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 700-701
Area (ac)	0.028
Flow Path Length (ft)	99.0
Flow Path Slope (vft/hft)	0.0147
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.901
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8937
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.0799
Burned Peak Flow Rate (cfs)	0.0799
24-Hr Clear Runoff Volume (ac-ft)	0.0103
24-Hr Clear Runoff Volume (cu-ft)	448.5162



Peak Flow Hydrologic Analysis

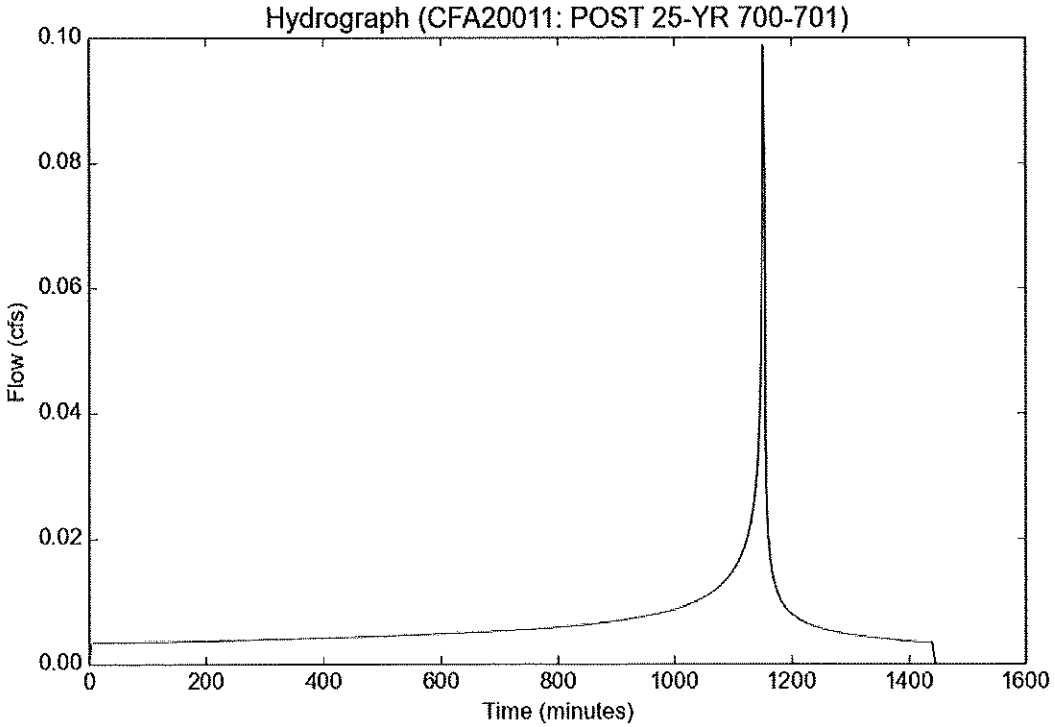
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 700-701.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 700-701
Area (ac)	0.028
Flow Path Length (ft)	99.0
Flow Path Slope (vft/hft)	0.0147
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.901
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.8974
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.0987
Burned Peak Flow Rate (cfs)	0.0987
24-Hr Clear Runoff Volume (ac-ft)	0.0127
24-Hr Clear Runoff Volume (cu-ft)	553.3467



Peak Flow Hydrologic Analysis

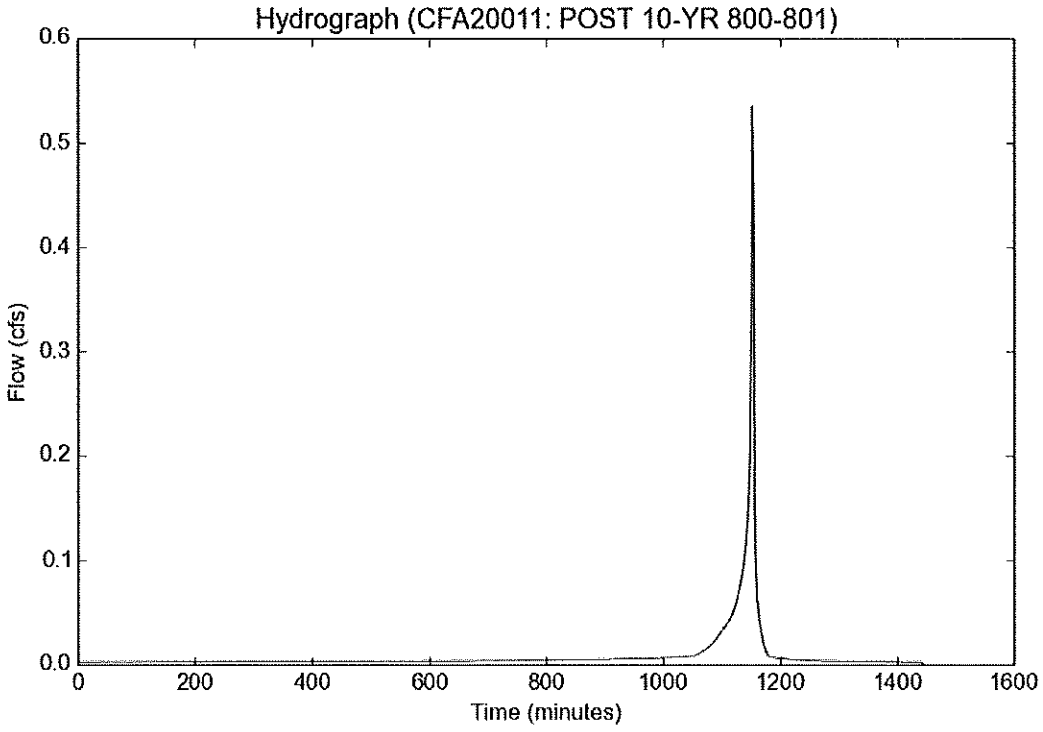
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 10-YR 800-801.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 10-YR 800-801
Area (ac)	0.2
Flow Path Length (ft)	125.0
Flow Path Slope (vft/hft)	0.018
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.01
Soil Type	6
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	5.355
Peak Intensity (in/hr)	3.1949
Undeveloped Runoff Coefficient (Cu)	0.836
Developed Runoff Coefficient (Cd)	0.8366
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.5346
Burned Peak Flow Rate (cfs)	0.5346
24-Hr Clear Runoff Volume (ac-ft)	0.0185
24-Hr Clear Runoff Volume (cu-ft)	806.5016



Peak Flow Hydrologic Analysis

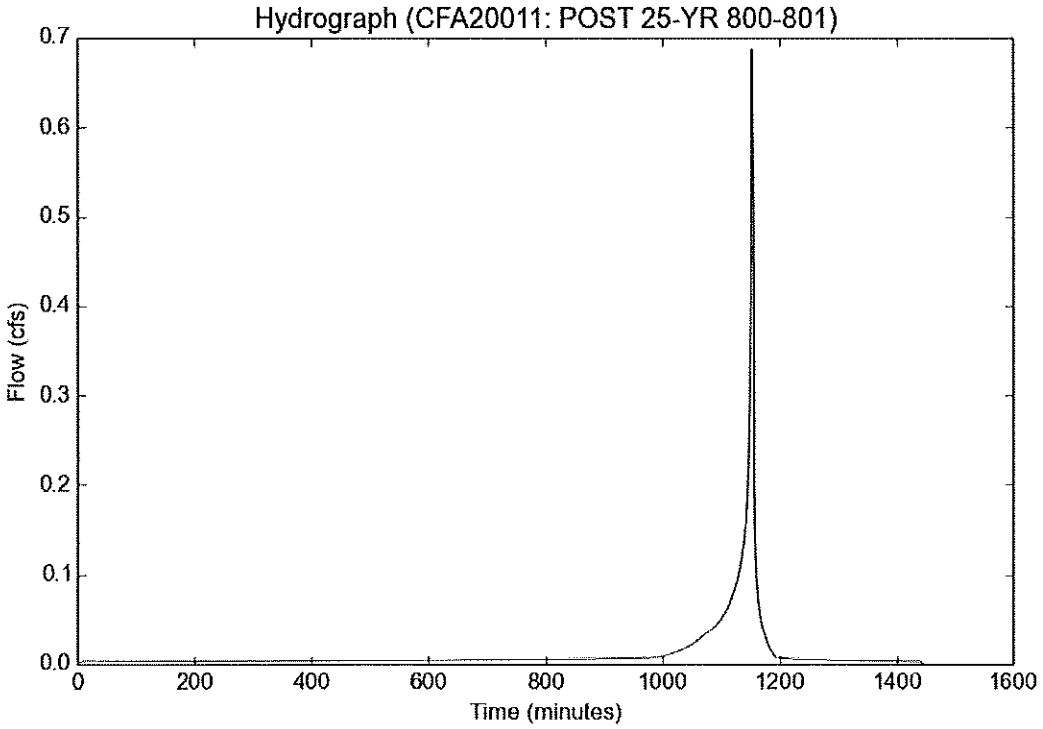
File location: P:/CFA20011/Reports/Hydrology/HydroCalc/POST/CFA20011 - POST 25-YR 800-801.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	CFA20011
Subarea ID	POST 25-YR 800-801
Area (ac)	0.2
Flow Path Length (ft)	125.0
Flow Path Slope (vft/hft)	0.018
50-yr Rainfall Depth (in)	7.5
Percent Impervious	0.01
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.585
Peak Intensity (in/hr)	3.9288
Undeveloped Runoff Coefficient (Cu)	0.8738
Developed Runoff Coefficient (Cd)	0.874
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.6868
Burned Peak Flow Rate (cfs)	0.6868
24-Hr Clear Runoff Volume (ac-ft)	0.0257
24-Hr Clear Runoff Volume (cu-ft)	1121.034



3.0 HYDRAULICS ANALYSIS

3.1 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 1 – NODE 101

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening ➔ 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor ➔ 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 1.87 cfs

$1.87 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.12 ft. = 1.45"← Depth of ponding over grated inlet # 1.

3.2 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 2 – NODE 201

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening ➔ 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor ➔ 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 0.95 cfs

$0.95 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.03 ft. = 0.37"← Depth of ponding over grated inlet # 2.

3.3 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 3 – NODE 301

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening → 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor → 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 0.81 cfs

$0.81 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.023 ft. = 0.27"← Depth of ponding over grated inlet # 3.

3.4 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 4 – NODE 401

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening → 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor → 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 0.42 cfs

$0.42 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.006 ft. = 0.07"← Depth of ponding over grated inlet # 4.

3.5 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 5 – NODE 501

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening → 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor → 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 1.71 cfs

$1.71 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.10 ft. = 1.21"← Depth of ponding over grated inlet # 5.

3.6 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 6 – NODE 501

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening → 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor → 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 0.72 cfs

$0.72 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.02 ft. = 0.21"← Depth of ponding over grated inlet # 6.

3.7 DEPTH OF PONDING OVER PROPOSED GRATE GRATED INLET# 7 – NODE 701

$Q_{25} = C\ A\ \sqrt{2Gh}$

A = Area of proposed 24" by 24" opening → 50% opening = 4 /2 = 2 sq-ft.

Assumed 50% clogging factor → 2 / 2 = 1.0 sf.
A = 1.0 sf
G = 32.2
C = 0.67
h = depth of water over the grated inlet

Q_{25} = 0.10 cfs

$0.10 = 0.67\ X\ 1.0\ \sqrt{2X\ 32.2\ X\ h}$

h = 0.0003 ft. = 0.004"← Depth of ponding over grated inlet # 7.

3.8 PIPE SIZE ANALYSIS FOR PIPE 1

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.670
   PIPE SLOPE(FEET/FEET) =  0.0230
   PIPEFLOW(CFS) =       0.95
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.46
   CRITICAL FLOW AREA(SQUARE FEET) =    0.260
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.620
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         8.89
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    3.673
   CRITICAL FLOW VELOCITY HEAD(FEET) =         0.21
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.42
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =         0.67
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.31
   FLOW AREA(SQUARE FEET) =     0.16
   FLOW TOP-WIDTH(FEET) =    0.668
   FLOW PRESSURE + MOMENTUM(POUNDS) =         12.38
   FLOW VELOCITY(FEET/SEC.) =         6.006
   FLOW VELOCITY HEAD(FEET) =         0.560
   HYDRAULIC DEPTH(FEET) =     0.24
   FROUDE NUMBER =    2.171
   SPECIFIC ENERGY(FEET) =         0.87
==========================================================================
```

3.9 PIPE SIZE ANALYSIS FOR PIPE 2

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.670
   PIPE SLOPE(FEET/FEET) =  0.0090
   PIPEFLOW(CFS) =       0.83
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.43
   CRITICAL FLOW AREA(SQUARE FEET) =    0.239
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.642
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          8.37
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    3.465
   CRITICAL FLOW VELOCITY HEAD(FEET) =          0.19
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.37
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =          0.62
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.38
   FLOW AREA(SQUARE FEET) =     0.20
   FLOW TOP-WIDTH(FEET) =    0.665
   FLOW PRESSURE + MOMENTUM(POUNDS) =          8.59
   FLOW VELOCITY(FEET/SEC.) =         4.077
   FLOW VELOCITY HEAD(FEET) =         0.258
   HYDRAULIC DEPTH(FEET) =     0.31
   FROUDE NUMBER =    1.299
   SPECIFIC ENERGY(FEET) =          0.63
==========================================================================
```

3.10 PIPE SIZE ANALYSIS FOR PIPE 3

```
**********************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
----------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.670
   PIPE SLOPE(FEET/FEET) =  0.0120
   PIPEFLOW(CFS) =       0.69
   MANNINGS FRICTION FACTOR = 0.011000
======================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.39
   CRITICAL FLOW AREA(SQUARE FEET) =    0.214
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.661
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          6.56
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    3.228
   CRITICAL FLOW VELOCITY HEAD(FEET) =          0.16
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.32
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =          0.55
======================================================================
   NORMAL-DEPTH FLOW INFORMATION:
----------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.31
   FLOW AREA(SQUARE FEET) =     0.16
   FLOW TOP-WIDTH(FEET) =    0.668
   FLOW PRESSURE + MOMENTUM(POUNDS) =          7.10
   FLOW VELOCITY(FEET/SEC.) =         4.341
   FLOW VELOCITY HEAD(FEET) =         0.293
   HYDRAULIC DEPTH(FEET) =     0.24
   FROUDE NUMBER =    1.568
   SPECIFIC ENERGY(FEET) =          0.60
======================================================================
```

3.11 PIPE SIZE ANALYSIS FOR PIPE 4

```
**************************************************************************
 >>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.830
   PIPE SLOPE(FEET/FEET) =  0.0090
   PIPEFLOW(CFS) =       1.52
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.55
   CRITICAL FLOW AREA(SQUARE FEET) =    0.383
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.783
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         17.49
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    3.969
   CRITICAL FLOW VELOCITY HEAD(FEET) =         0.24
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.49
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =         0.80
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.48
   FLOW AREA(SQUARE FEET) =     0.32
   FLOW TOP-WIDTH(FEET) =    0.821
   FLOW PRESSURE + MOMENTUM(POUNDS) =         18.04
   FLOW VELOCITY(FEET/SEC.) =         4.740
   FLOW VELOCITY HEAD(FEET) =         0.349
   HYDRAULIC DEPTH(FEET) =     0.39
   FROUDE NUMBER =    1.337
   SPECIFIC ENERGY(FEET) =         0.82
==========================================================================
```

3.12 PIPE SIZE ANALYSIS FOR PIPE 5

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  1.500
   PIPE SLOPE(FEET/FEET) =  0.0100
   PIPEFLOW(CFS) =       3.39
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.70
   CRITICAL FLOW AREA(SQUARE FEET) =    0.811
   CRITICAL FLOW TOP-WIDTH(FEET) =  1.497
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         42.45
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    4.178
   CRITICAL FLOW VELOCITY HEAD(FEET) =          0.27
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.54
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =          0.97
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.54
   FLOW AREA(SQUARE FEET) =     0.57
   FLOW TOP-WIDTH(FEET) =    1.437
   FLOW PRESSURE + MOMENTUM(POUNDS) =         47.20
   FLOW VELOCITY(FEET/SEC.) =         5.984
   FLOW VELOCITY HEAD(FEET) =         0.556
   HYDRAULIC DEPTH(FEET) =     0.39
   FROUDE NUMBER =    1.680
   SPECIFIC ENERGY(FEET) =         1.09
==========================================================================
```

3.13 PIPE SIZE ANALYSIS FOR PIPE 6

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  1.500
   PIPE SLOPE(FEET/FEET) =  0.0100
   PIPEFLOW(CFS) =       4.34
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.80
   CRITICAL FLOW AREA(SQUARE FEET) =    0.957
   CRITICAL FLOW TOP-WIDTH(FEET) =  1.497
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         58.45
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    4.537
   CRITICAL FLOW VELOCITY HEAD(FEET) =         0.32
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =    0.64
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =         1.12
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.61
   FLOW AREA(SQUARE FEET) =     0.68
   FLOW TOP-WIDTH(FEET) =    1.474
   FLOW PRESSURE + MOMENTUM(POUNDS) =         64.66
   FLOW VELOCITY(FEET/SEC.) =         6.401
   FLOW VELOCITY HEAD(FEET) =         0.636
   HYDRAULIC DEPTH(FEET) =     0.46
   FROUDE NUMBER =    1.663
   SPECIFIC ENERGY(FEET) =         1.25
==========================================================================
```

3.14 PIPE SIZE ANALYSIS FOR PIPE 7

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.670
   PIPE SLOPE(FEET/FEET) =  0.0150
   PIPEFLOW(CFS) =       0.72
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.40
   CRITICAL FLOW AREA(SQUARE FEET) =    0.220
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.657
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          6.94
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    3.280
   CRITICAL FLOW VELOCITY HEAD(FEET) =          0.17
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =    0.33
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =          0.57
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.30
   FLOW AREA(SQUARE FEET) =     0.15
   FLOW TOP-WIDTH(FEET) =    0.666
   FLOW PRESSURE + MOMENTUM(POUNDS) =          7.83
   FLOW VELOCITY(FEET/SEC.) =         4.767
   FLOW VELOCITY HEAD(FEET) =         0.353
   HYDRAULIC DEPTH(FEET) =     0.23
   FROUDE NUMBER =    1.764
   SPECIFIC ENERGY(FEET) =          0.65
==========================================================================
```

3.15 PIPE SIZE ANALYSIS FOR PIPE 8

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.500
   PIPE SLOPE(FEET/FEET) =  0.0050
   PIPEFLOW(CFS) =       0.10
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.16
   CRITICAL FLOW AREA(SQUARE FEET) =    0.052
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.463
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          0.58
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    1.908
   CRITICAL FLOW VELOCITY HEAD(FEET) =          0.06
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.11
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =          0.21
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.16
   FLOW AREA(SQUARE FEET) =     0.05
   FLOW TOP-WIDTH(FEET) =    0.464
   FLOW PRESSURE + MOMENTUM(POUNDS) =          0.58
   FLOW VELOCITY(FEET/SEC.) =         1.899
   FLOW VELOCITY HEAD(FEET) =         0.056
   HYDRAULIC DEPTH(FEET) =     0.11
   FROUDE NUMBER =    0.993
   SPECIFIC ENERGY(FEET) =          0.21
==========================================================================
```

3.16 PIPE SIZE ANALYSIS FOR PIPE 9

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.670
   PIPE SLOPE(FEET/FEET) =  0.0150
   PIPEFLOW(CFS) =       0.82
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.43
   CRITICAL FLOW AREA(SQUARE FEET) =    0.238
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.644
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =          8.25
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    3.449
   CRITICAL FLOW VELOCITY HEAD(FEET) =          0.18
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.37
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =          0.61
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.32
   FLOW AREA(SQUARE FEET) =     0.17
   FLOW TOP-WIDTH(FEET) =    0.669
   FLOW PRESSURE + MOMENTUM(POUNDS) =          9.24
   FLOW VELOCITY(FEET/SEC.) =         4.930
   FLOW VELOCITY HEAD(FEET) =         0.377
   HYDRAULIC DEPTH(FEET) =     0.25
   FROUDE NUMBER =    1.743
   SPECIFIC ENERGY(FEET) =          0.70
==========================================================================
```

3.17 PIPE SIZE ANALYSIS FOR PIPE 10

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  0.833
   PIPE SLOPE(FEET/FEET) =  0.0120
   PIPEFLOW(CFS) =       1.72
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.59
   CRITICAL FLOW AREA(SQUARE FEET) =    0.412
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.759
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         20.61
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    4.179
   CRITICAL FLOW VELOCITY HEAD(FEET) =         0.27
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.54
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =         0.86
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.47
   FLOW AREA(SQUARE FEET) =     0.32
   FLOW TOP-WIDTH(FEET) =    0.826
   FLOW PRESSURE + MOMENTUM(POUNDS) =         22.10
   FLOW VELOCITY(FEET/SEC.) =         5.449
   FLOW VELOCITY HEAD(FEET) =         0.461
   HYDRAULIC DEPTH(FEET) =     0.38
   FROUDE NUMBER =    1.554
   SPECIFIC ENERGY(FEET) =         0.93
==========================================================================
```

3.18 PIPE SIZE ANALYSIS FOR PIPE 11

```
**************************************************************************
>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<
--------------------------------------------------------------------------
   PIPE DIAMETER(FEET) =  1.000
   PIPE SLOPE(FEET/FEET) =  0.0150
   PIPEFLOW(CFS) =       2.54
   MANNINGS FRICTION FACTOR = 0.011000
==========================================================================
   CRITICAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   CRITICAL DEPTH(FEET) =     0.68
   CRITICAL FLOW AREA(SQUARE FEET) =    0.571
   CRITICAL FLOW TOP-WIDTH(FEET) =  0.931
   CRITICAL FLOW PRESSURE + MOMENTUM(POUNDS) =         32.59
   CRITICAL FLOW VELOCITY(FEET/SEC.) =    4.446
   CRITICAL FLOW VELOCITY HEAD(FEET) =         0.31
   CRITICAL FLOW HYDRAULIC DEPTH(FEET) =     0.61
   CRITICAL FLOW SPECIFIC ENERGY(FEET) =         0.99
==========================================================================
   NORMAL-DEPTH FLOW INFORMATION:
--------------------------------------------------------------------------
   NORMAL DEPTH(FEET) =     0.50
   FLOW AREA(SQUARE FEET) =     0.39
   FLOW TOP-WIDTH(FEET) =    1.000
   FLOW PRESSURE + MOMENTUM(POUNDS) =         37.29
   FLOW VELOCITY(FEET/SEC.) =         6.541
   FLOW VELOCITY HEAD(FEET) =         0.664
   HYDRAULIC DEPTH(FEET) =     0.39
   FROUDE NUMBER =    1.850
   SPECIFIC ENERGY(FEET) =         1.16
==========================================================================
```

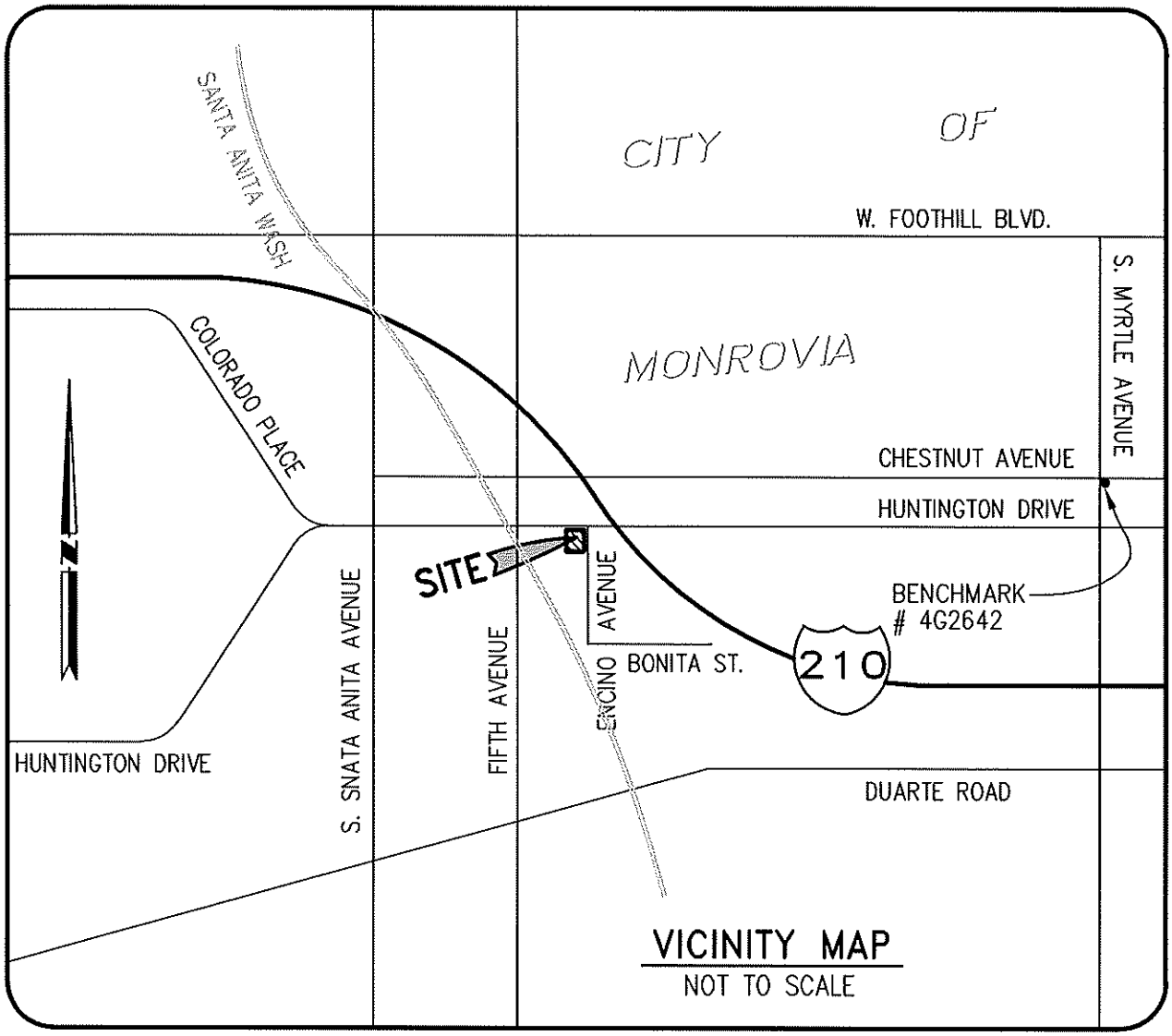
3.19 PIPE SIZE SUMMARY

Hydraulic Analysis					
Pipe Node	Diameter (ft)	Slope (%)	Pipe Flow (cfs)	Flow Velocity (ft/s)	Flow Hydraulic Depth (ft)
1	0.67	2.30	0.95	6.01	0.24
2	0.67	0.90	0.83	4.08	0.31
3	0.67	1.20	0.69	4.34	0.24
4	0.83	0.90	1.52	4.74	0.39
5	1.50	1.00	3.39	5.98	0.39
6	1.50	1.00	4.34	6.40	0.46
7	0.67	1.50	0.72	4.77	0.23
8	0.50	0.50	0.10	1.90	0.11
9	0.67	1.50	0.82	4.93	0.25
10	0.83	1.20	1.72	5.45	0.38
11	1.0	1.50	2.54	6.54	0.39

4.0 APPENDIX "A"

4.1 REFERENCE MAPS

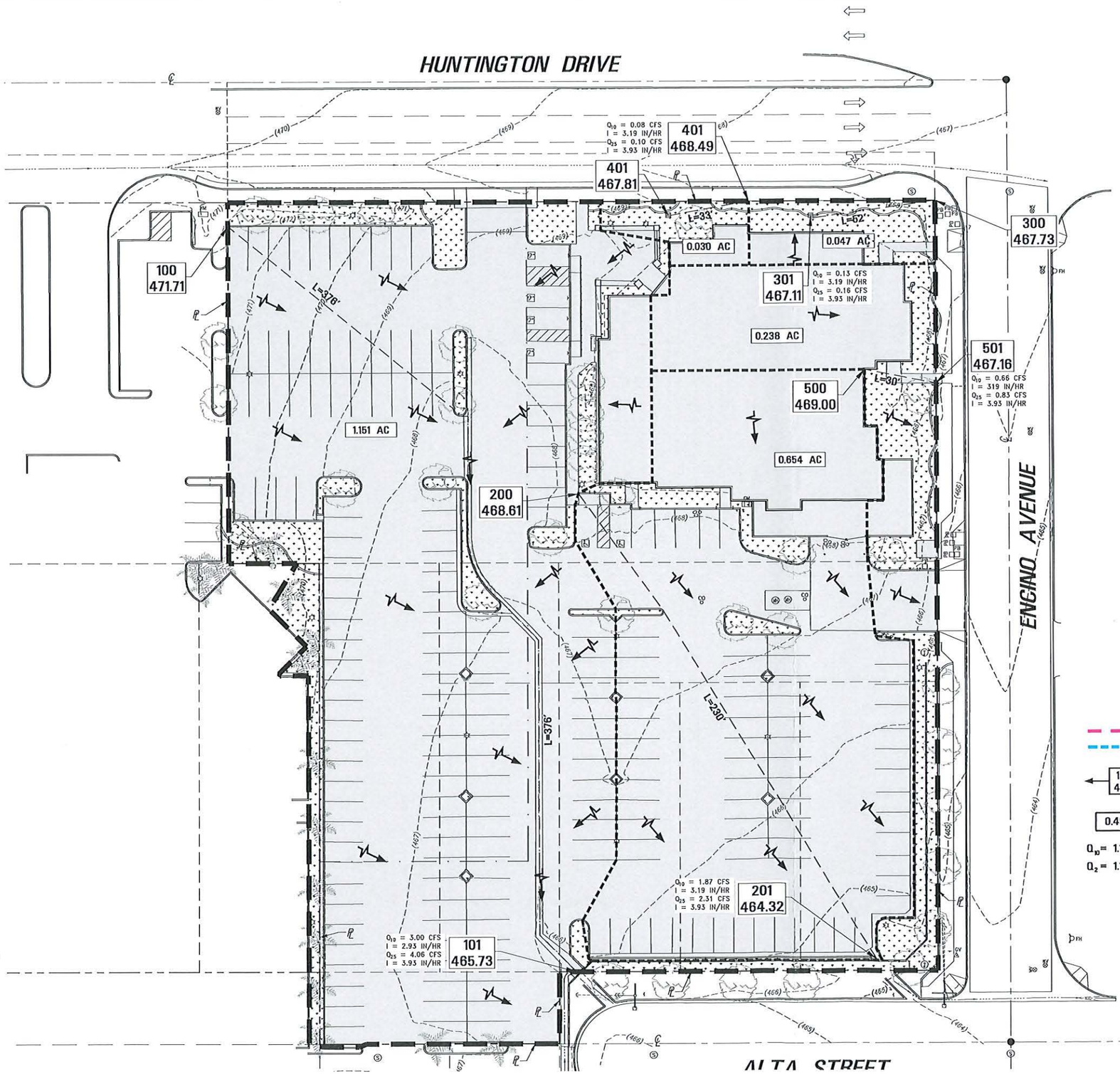
VICINITY MAP



VICINITY MAP

NOT TO SCALE

5.0 HYDROLOGY MAPS



NO.	REVISIONS	DATE

Prepared by:
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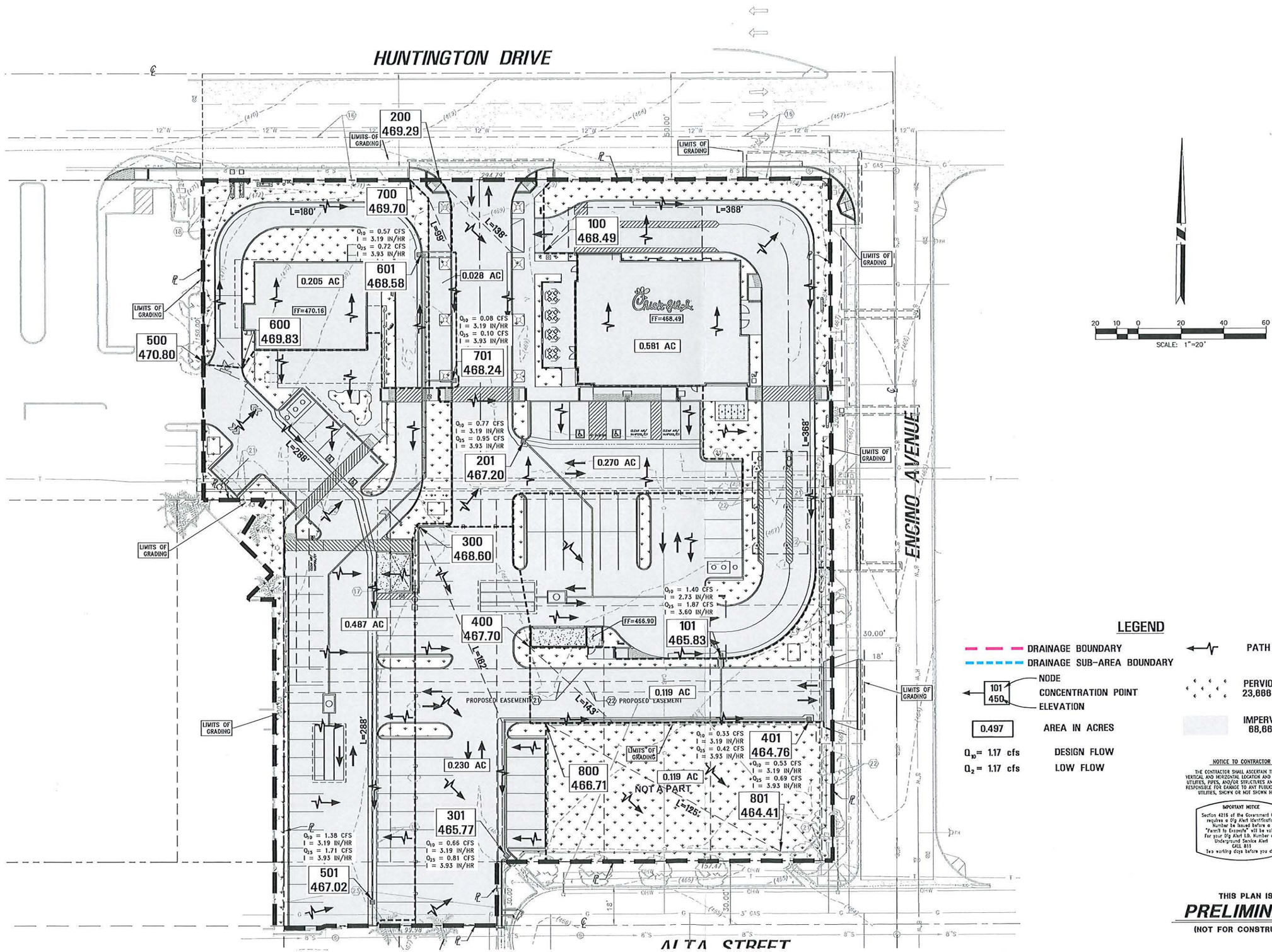
Civil Engineers and Land Surveyors
1915 W. Orangewood Ave., Suite 101, Orange, CA 92868 (714) 935-0255 TruxCW.com

PRE-HYDROLOGY MAP

CHICK-FIL-A STORE # 04698
820 HUNTINGTON DRIVE, CITY OF MONROVIA
COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

DATE	10/16/2020
DRAWN BY	SGC
CHECKED BY	RJD
JOB NO.	CFA20011
SHEET NO.	1 OF 2 SHEETS



LEGEND

- DRAINAGE BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- 101 / 450 — NODE / CONCENTRATION POINT / ELEVATION
- 0.497 — AREA IN ACRES
- Q_{10}= 1.17 cfs — DESIGN FLOW
- Q_2 = 1.17 cfs — LOW FLOW
- PATH OF FLOW
- PERVIOUS SURFACES 23,666 SF (0.54 AC)
- IMPERVIOUS SURFACES 68,660 SF (1.57 AC)

NOTICE TO CONTRACTOR

THE CONTRACTOR SHALL ASCERTAIN THE TRUE VERTICAL AND HORIZONTAL LOCATION AND SIZE OF ALL UTILITIES, PIPES, AND/OR STRUCTURES AND SHALL BE RESPONSIBLE FOR DAMAGE TO ANY PUBLIC OR PRIVATE UTILITIES, SHOWN OR NOT SHOWN HEREON.

IMPORTANT NOTICE

Section 4216 of the Government Code requires a Dig Alert Identification Number be issued before a "Permit to Excavate" will be valid. For your Dig Alert I.D. Number call Underground Service Alert CALL 811 Two working days before you dig.

THIS PLAN IS:

PRELIMINARY

(NOT FOR CONSTRUCTION)

NO.	REVISIONS	DATE

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POST-HYDROLOGY MAP

CHICK-FIL-A STORE # 04698

829 HUNTINGTON DRIVE, CITY OF MONROVIA
COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

DATE	10/16/2020
DRAWN BY	MME
CHECKED BY	RJD
JOB NO.	CFA20011
SHEET NO.	2 OF 2 SHEETS