Appendix F Preliminary Hydrology Report

Appendix

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PRELIMINARY HYDROLOGY REPORT

FOR

CORNERSTONE BIBLE CHURCH

400 Glendora Avenue
Glendora, CA 91741

Prepared by:

STRUCTURAL ENGINEERING • CIVIL ENGINEERING • SURVEYING • LAND PLANNING

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BWE Job #: 12605us

Date: October 2020

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Proposed Condition Hydrology Map

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1. Purpose

The purpose of this Hydrology Report is to analyze and address the storm water quantity impacts due to the proposed redevelopment of the Cornerstone Bible Church. This report will also design and recommend sizes for the associated drainage facilities and storm runoff conveyance system.

To determine the impacts of the proposed redevelopment on the existing drainage pattern, the pre- and post- development peak flow rates are analyzed and compared for the 2, 25, & 50 year 24-hour duration storm events using the Modified Rational Methods of Analysis. HydroCalc computer program is utilized for this purpose.

This development is a private development project and is subject to the requirements of the Urban Flood level of protection per section 4.3 of the hydrology manual. Urban Flood is runoff from a 25 year frequency design storm. Therefore, proposed drainage facilities such as detention basins are designed based on the 25 year 24-hr frequency storm. The proposed storm drain conveyance system is designed to convey the runoff due to 50 year 24-hr storm. 2 year 24-hr storm event is also analyzed to comply with the County's hydromodification infeasibility requirements. This report is prepared in accordance with the requirements of the Los Angeles County Hydrology Manual dated 2006.

2. Project Location

The project site is located in the City of Glendora, County of Los Angeles and State of California. The site is bounded by Vista Bonita Avenue on the east, Glendora Avenue on the west, Whitcomb Avenue on the south, and Public Alley on the north.

Refer to Appendix A for Vicinity and Imagery Maps.

3. Existing Condition

The project site was previously developed and comprised of a double story Church building, paved parking, a modular structure, concrete walkways, and children's play area. The topography of the majority site area is relatively flat (1-2%) and generally slopes from north to south and east to west directions. Runoff from the easterly portion of the site flows south to Whitcomb Avenue. Similarly, the runoff from the westerly portion of the site surface flows to Whitcomb Avenue as well as Glendora Avenue. The runoff from the site ultimately discharges to County's storm drain system through existing curb inlets and storm drain pipes situated within Whitcomb and Glendora Avenues. This storm drain system originates from offsite drainage area and discharges to Dalton Wash situated southerly side of the site. Dalton Wash ultimately discharges into the San Gabriel River via Walnut Creek.

The runoff originating from the site concentrates near the two existing inlets situated within Whitcomb and Glendora Avenues. These locations are identified as drainage analysis points 1 & 2 in the existing condition hydrology map.

Refer to Appendix B for Existing Condition Hydrology Map.

4. Proposed Improvements

The existing church building will be preserved. The proposed development will consist of a large single story building and two smaller structures, new parking lot with ADA parking stalls, walkways, new play area, and landscaping. Parking lots are situated at the easterly side of the site which replaces the existing residential buildings.

The site design also includes construction of storm drain conveyance system, detention basin, planters, and landscape areas. The project will also include associated improvements such as curbs, walkways, and utilities. The Low Impact Development (LID) strategies are also designed to mimic the existing drainage pattern.

The majority site runoff surface flows south to Whitcomb Avenue. A new storm drain system is also proposed for the collection and conveyance of the site runoff.

The existing drainage pattern will be maintained in the proposed condition to the maximum extent feasible There are two runoff exit points for the site runoff in the proposed condition which are identified as exit points 1 and 2 in the proposed condition hydrology map.

See Appendix C for Proposed Conditions Hydrology Calculations and Map.

5. Soil Characteristics

The soil of the site is classified as Type 006, as shown on figure LACDPW 1-H1.32. See in Appendix D for details.

6. Methodology

The hydrologic methods used in the study are based on the procedures described in the Los Angeles County Department of Public Works Hydrology Manual. A computer model named HydroCalc Version 0.3.0-beta is utilized to analyze the hydrology for the site. This computer model of the modified rational method analysis allows user to enter information such as rainfall depth, drainage area, slope, and percent imperviousness in the model. This computer model has the capability of computing the peak flow rate and volume based on the above information.

The site is located in the City of Glendora. The rainfall depth for 50-year 24-hour duration is obtained from Los Angeles County Hydrology Map (GIS viewer application to view LID & hydrology manual). The rainfall depth for the site is determined to be 7.55 inches. The 2-year 24-hour storm event rainfall depth of 2.554" is obtained by multiplying the 50 year value by a factor of 0.387. Similarly, the 25-year 24-hour storm event rainfall depth of 6.628" is obtained by multiplying the 50 year value by a factor of 0.878. 85th percentile rainfall depth is determined to be 1" for the site. These factors are obtained from LA County hydrology manual section 5.3, Rainfall Isohytes.

7. Calculations

HydroCalc Version 0.3.0-beta computer program, is used to determine peak flow rates and volume from the site for both existing and proposed conditions. The results are summarized in Table 7-1 & 2 for comparison purpose. The detailed calculations/results for existing and proposed conditions analysis are located in Appendices B and C respectively.

Table 7-1: Existing Condition Peak Flow Rates & Volume Summary

Basin #	Area (ac)	% Impervious	50 yr-24 hr Storm		25 yr-24 hr Storm		2 yr-24 hr Storm		*85th Percentile, Q/SWQDv	
			Q (cfs)	V (cft)	Q (cfs)	V (cft)	Q (cfs)	V (cft)	Q (cfs)	V (cft)
A-1	0.64	45.0%	2.58	9,452	1.95	6,999	0.11	1,197	0.09	1,059
A-2	0.64	75.0%	2.59	12,836	1.97	9,764	0.19	1,825	0.16	1,613
Total	**1.28**		**5.17**	**22,288**	**3.92**	**16,763**	**0.30**	**3,022**	**0.25**	**2,672**

Table 7-2: Proposed Condition Peak Flow Rates & Volume Summary

Basin #	Area (ac)	% Impervious	50 yr-24 hr Storm		25 yr-24 hr Storm		2 yr-24 hr Storm		*85th Percentile, Q/SWQDv	
			Q (cfs)	V (cft)	Q (cfs)	V (cft)	Q (cfs)	V (cft)	Q (cfs)	V (cft)
A-1	0.67	72.0%	2.72	13,083	2.06	9,932	0.19	1,845	0.16	1,631
A-2	0.61	75.0%	2.47	12,234	1.88	9,306	0.18	1,738	0.15	1,537
Total	**1.28**		**5.19**	**25,317**	**3.94**	**19,238**	**0.37**	**3,583**	**0.31**	**3,168**

Difference			**0.02**	**3,029**	**0.02**	**2,475**	**0.07**	**561**	**0.06**	**496**

Due to the proposed redevelopment, the overall unmitigated runoff generated from the 50 year 24-hr storm event can be expected to increase by 0.02 cfs. The unmitigated peak flow rates for the 25 year and 2 year storm event can be expected to increase by 0.02 and 0.07 cfs respectively. The storm volumes due to 50 and 25 year 24-hr storm events are anticipated to be increased by 3,029 and 2,475 cft respectively. Similarly, the volume due to the 2 year 24-hr storm event is expected to increase by 561 cft in the proposed condition. The volume increase is mainly due to the increase in impervious area in the proposed condition. For flood control purpose, only the peak flow rate mitigation is considered. Since the peak flow rate increase is very small for all storm events further attenuation of peak flow rate is not proposed.

Site is categorized as designated project and is required to manage hydromodification impact due to the redevelopment. Compliance with the hydromodification will require to perform the frequency analyses of the receiving channel downstream. The frequency analyses, require to analyze changes in flow velocity, volume, and depth/width of flow for all natural system using HEC-RAS, to demonstrate compliance with hydromodification requirements and identify drainage impacts on off-site property. This type of analyses will require an intensive study of an offsite natural receiving system which is beyond the scope of this service. For a redevelopment project with small redevelopment footprint, performing frequency and sediment transport analyses of the downstream receiving system is not practicable. Therefore, the site is seeking for infeasibility of hydromodification implementation by controlling peak flow rate due to 2-year, 24-hour rainfall frequency. Since the actual infiltration rate for the site is not available the volume reduction for 2-year, 24-hour rainfall frequency cannot be determined.

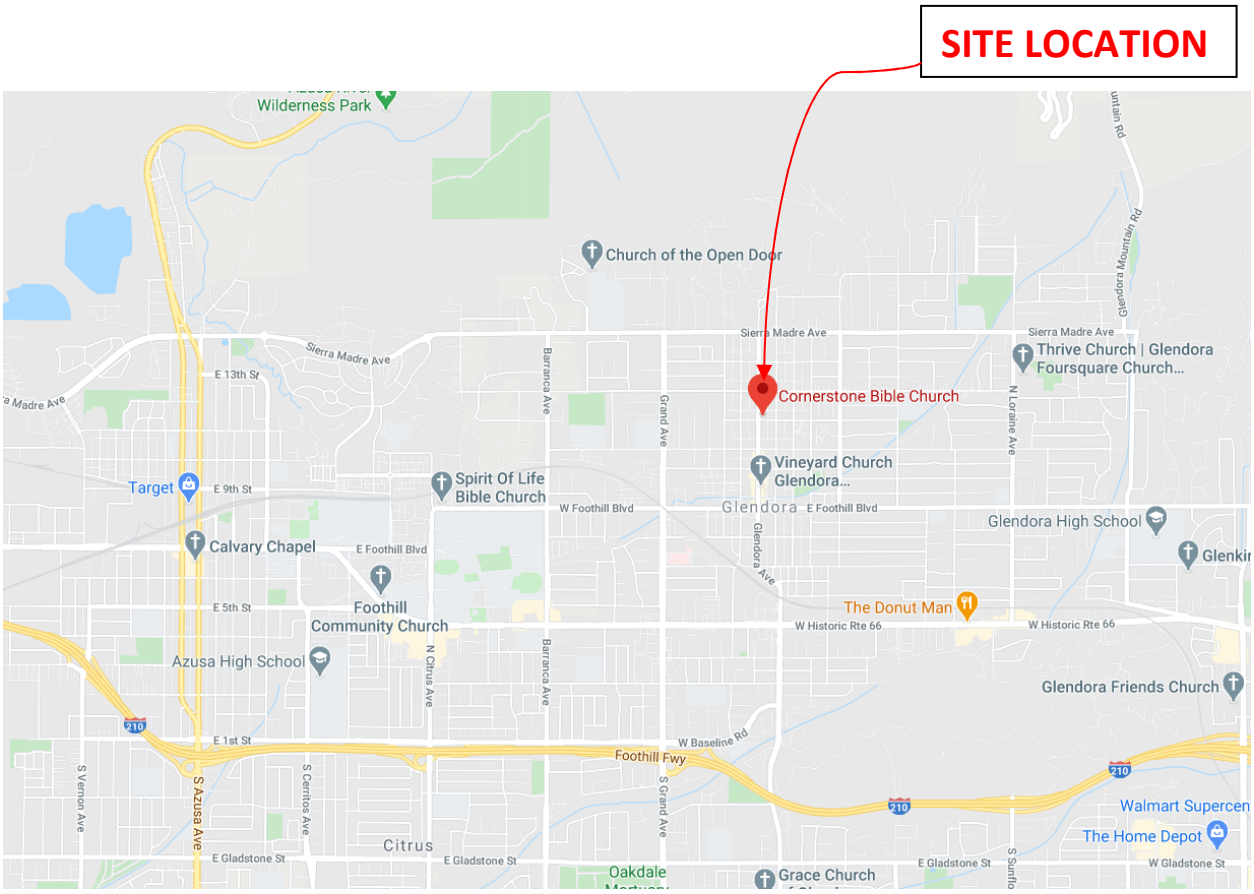
8. Conclusions

Storm water runoff from the site is collected and conveyed via a network of storm drain system consisting of roof downspouts, swales, planters, storm drain pipes, and retention vault. Underground retention vault is proposed to retain/mitigate volume due to 85th percentile storm event (storm water quality volume – SWQDv). The volume of the vault is also checked to comply with the infeasibility of hydromodification requirements. The storm drain system is designed to convey the peak flow rate due to 50, year, 24-hr storm event.

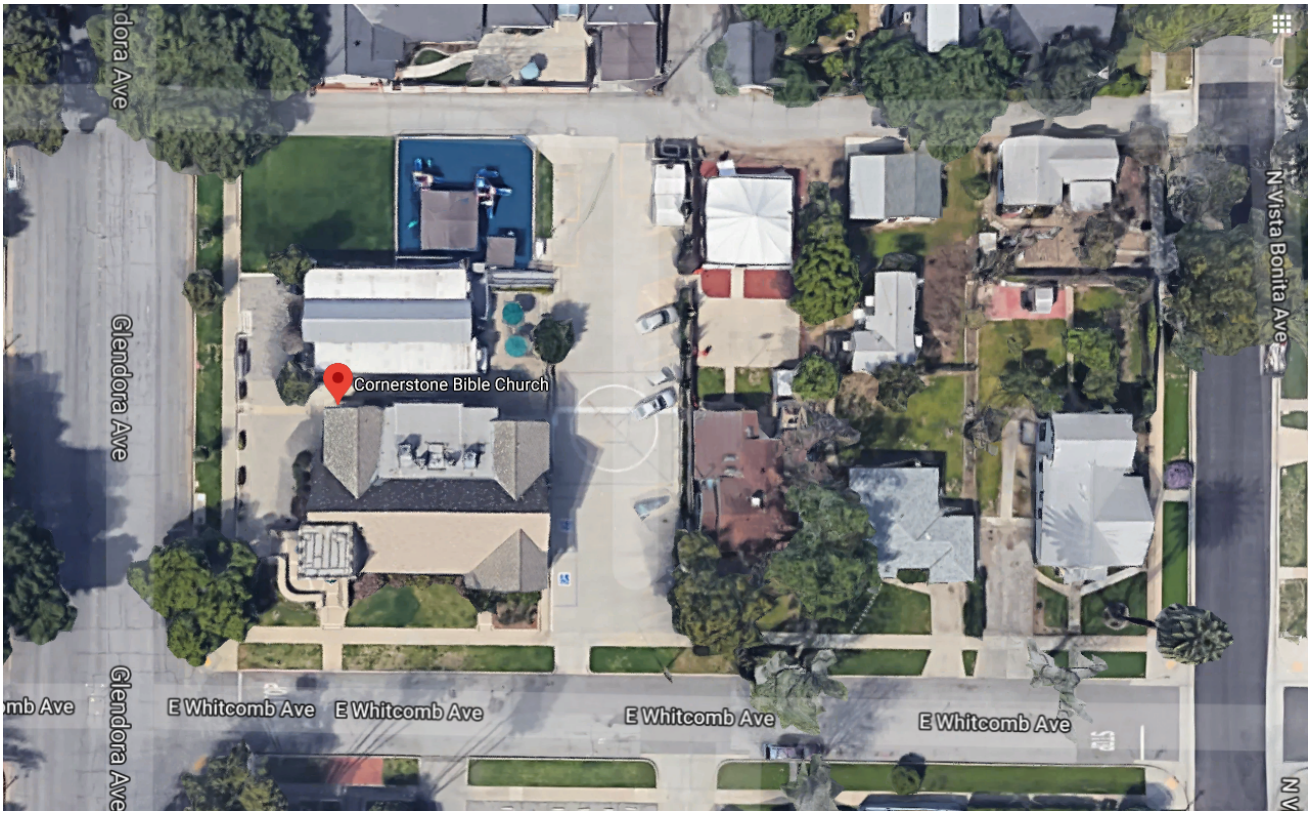
In the proposed condition the peak flow rate from the site is anticipated to be maintained. Therefore, no adverse drainage impact is anticipated due to the proposed redevelopment.

9. References

County of Los Angeles, Hydrology Manual dated 2006.



VICINITY MAP


Glendora Ave
Cornerstone Bible Church
N Vista Bonita Ave
E Whitcomb Ave
E Whitcomb Ave
E Whitcomb Ave
E Whitcomb Ave
Glendora Ave

IMAGERY MAP

APPENDIX A:

Site Vicinity Map
Site Imagery Map

APPENDIX B:

Existing Condition Hydrology Calculations
Existing Conditions Hydrology Map

Peak Flow Hydrologic Analysis

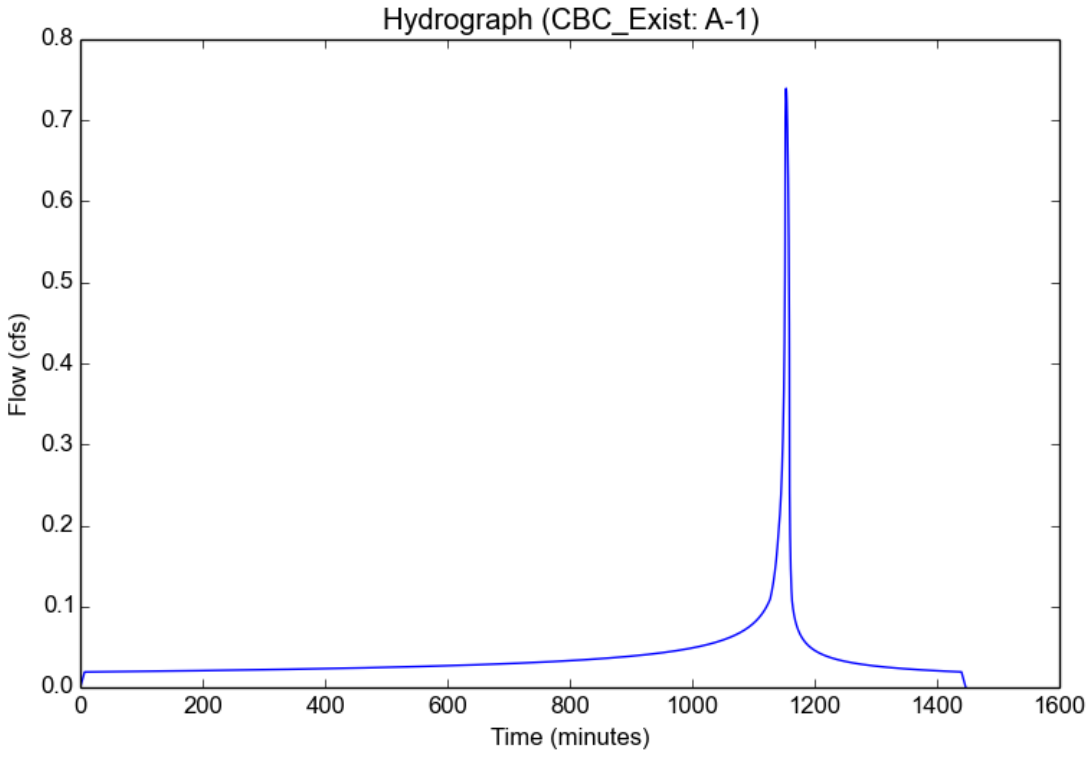
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/CBC_Exist F
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-1
Area (ac)	0.64
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.45
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.4883
Undeveloped Runoff Coefficient (Cu)	0.6752
Developed Runoff Coefficient (Cd)	0.7764
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.7395
Burned Peak Flow Rate (cfs)	0.7395
24-Hr Clear Runoff Volume (ac-ft)	0.0753
24-Hr Clear Runoff Volume (cu-ft)	3281.9673



Peak Flow Hydrologic Analysis

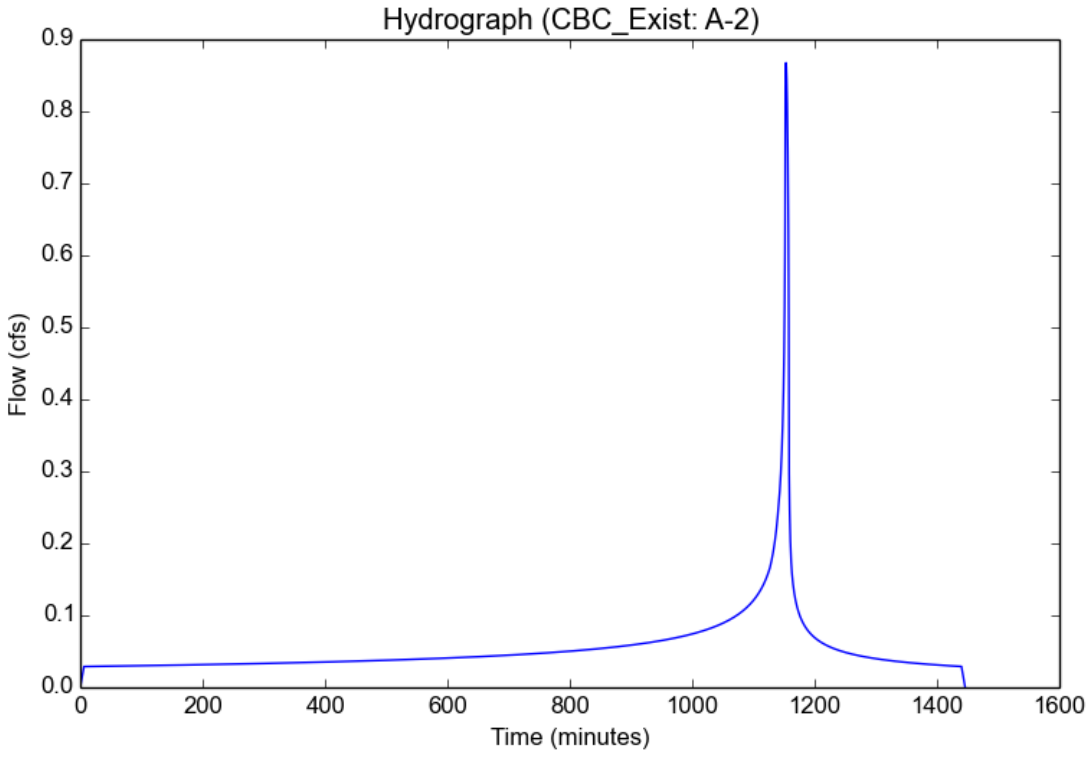
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/CBC_Exist F
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-2
Area (ac)	0.64
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.6001
Undeveloped Runoff Coefficient (Cu)	0.6884
Developed Runoff Coefficient (Cd)	0.8471
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.8675
Burned Peak Flow Rate (cfs)	0.8675
24-Hr Clear Runoff Volume (ac-ft)	0.1101
24-Hr Clear Runoff Volume (cu-ft)	4796.8406



Peak Flow Hydrologic Analysis

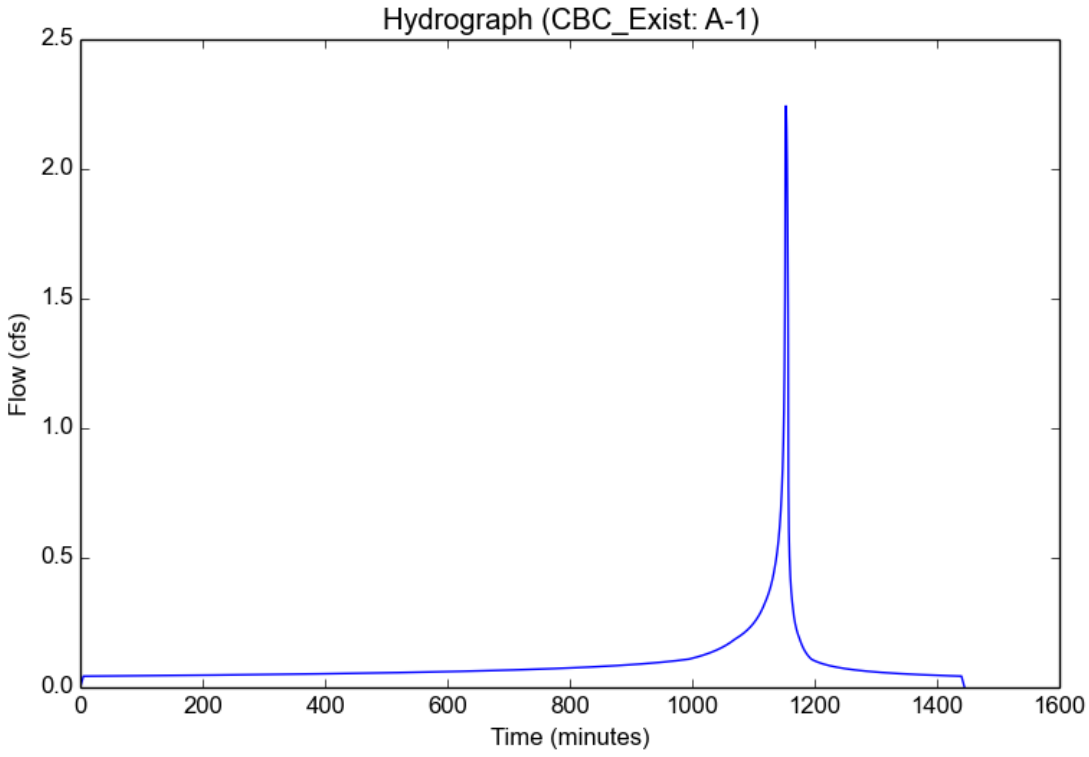
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/25 yr flow/CBC_Exist
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-1
Area (ac)	0.64
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.45
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.6289
Peak Intensity (in/hr)	3.955
Undeveloped Runoff Coefficient (Cu)	0.8748
Developed Runoff Coefficient (Cd)	0.8861
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.2429
Burned Peak Flow Rate (cfs)	2.2429
24-Hr Clear Runoff Volume (ac-ft)	0.1865
24-Hr Clear Runoff Volume (cu-ft)	8123.7247



Peak Flow Hydrologic Analysis

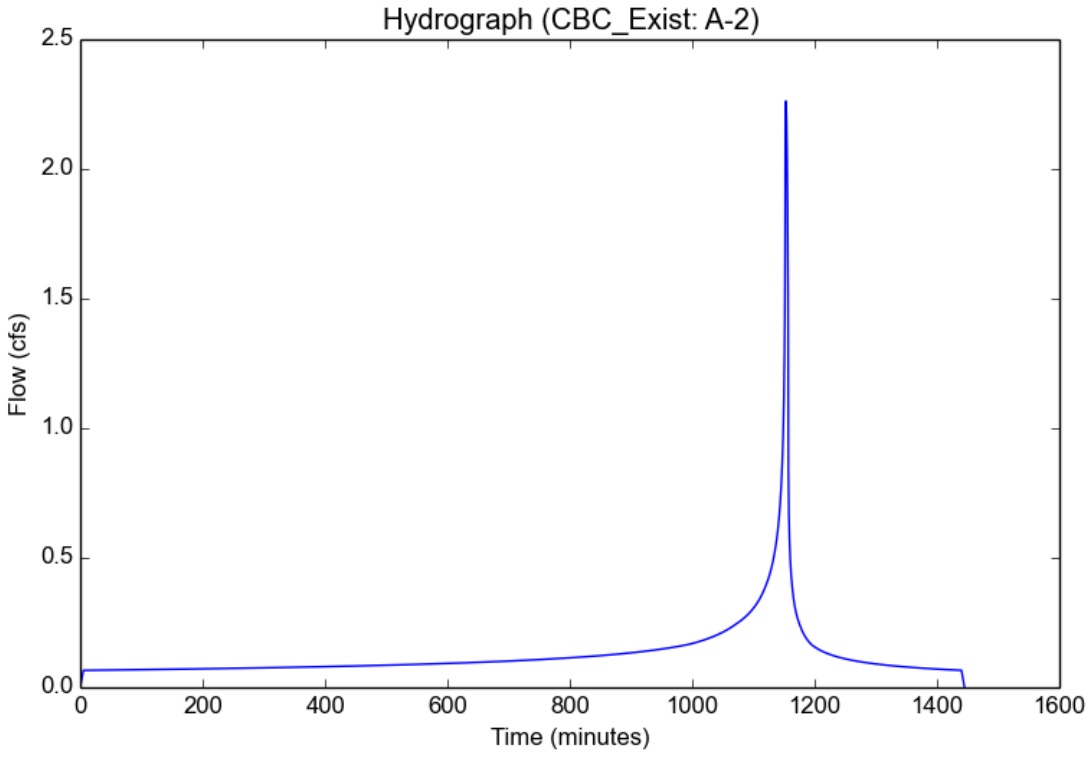
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/25 yr flow/CBC_Exist
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-2
Area (ac)	0.64
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.6289
Peak Intensity (in/hr)	3.955
Undeveloped Runoff Coefficient (Cu)	0.8748
Developed Runoff Coefficient (Cd)	0.8937
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.2621
Burned Peak Flow Rate (cfs)	2.2621
24-Hr Clear Runoff Volume (ac-ft)	0.2569
24-Hr Clear Runoff Volume (cu-ft)	11190.252



Peak Flow Hydrologic Analysis

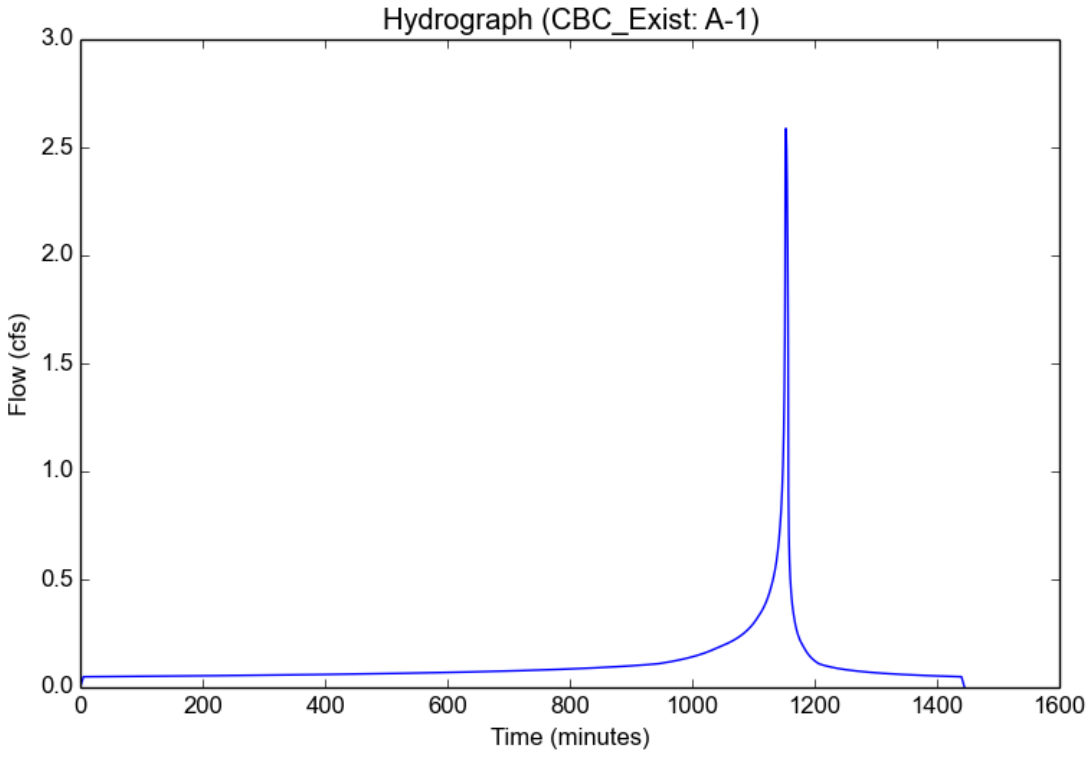
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/50 yr flow/CBC_Exist
Version: HydroCalc 1.0.3

Input Parameters

Project Name	CBC_Exist
Subarea ID	A-1
Area (ac)	0.64
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.45
Soil Type	6
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.55
Peak Intensity (in/hr)	4.5045
Undeveloped Runoff Coefficient (Cu)	0.8958
Developed Runoff Coefficient (Cd)	0.8977
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.5879
Burned Peak Flow Rate (cfs)	2.5879
24-Hr Clear Runoff Volume (ac-ft)	0.217
24-Hr Clear Runoff Volume (cu-ft)	9452.6857



Peak Flow Hydrologic Analysis

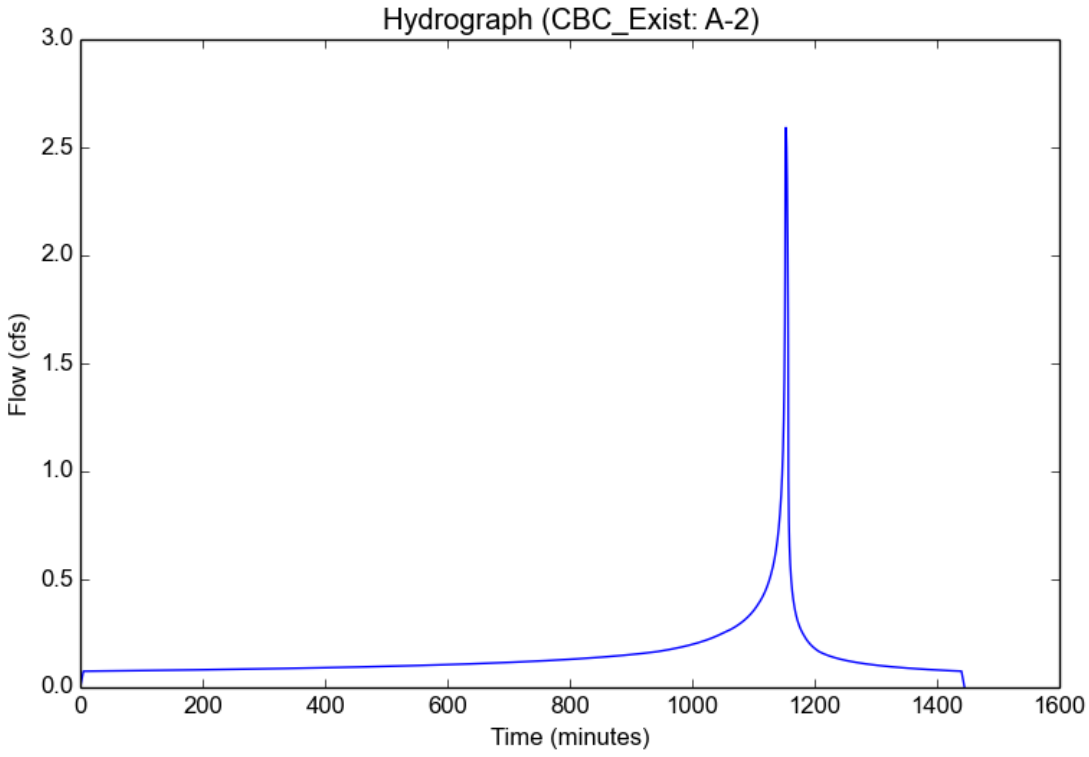
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/50 yr flow/CBC_Exist
Version: HydroCalc 1.0.3

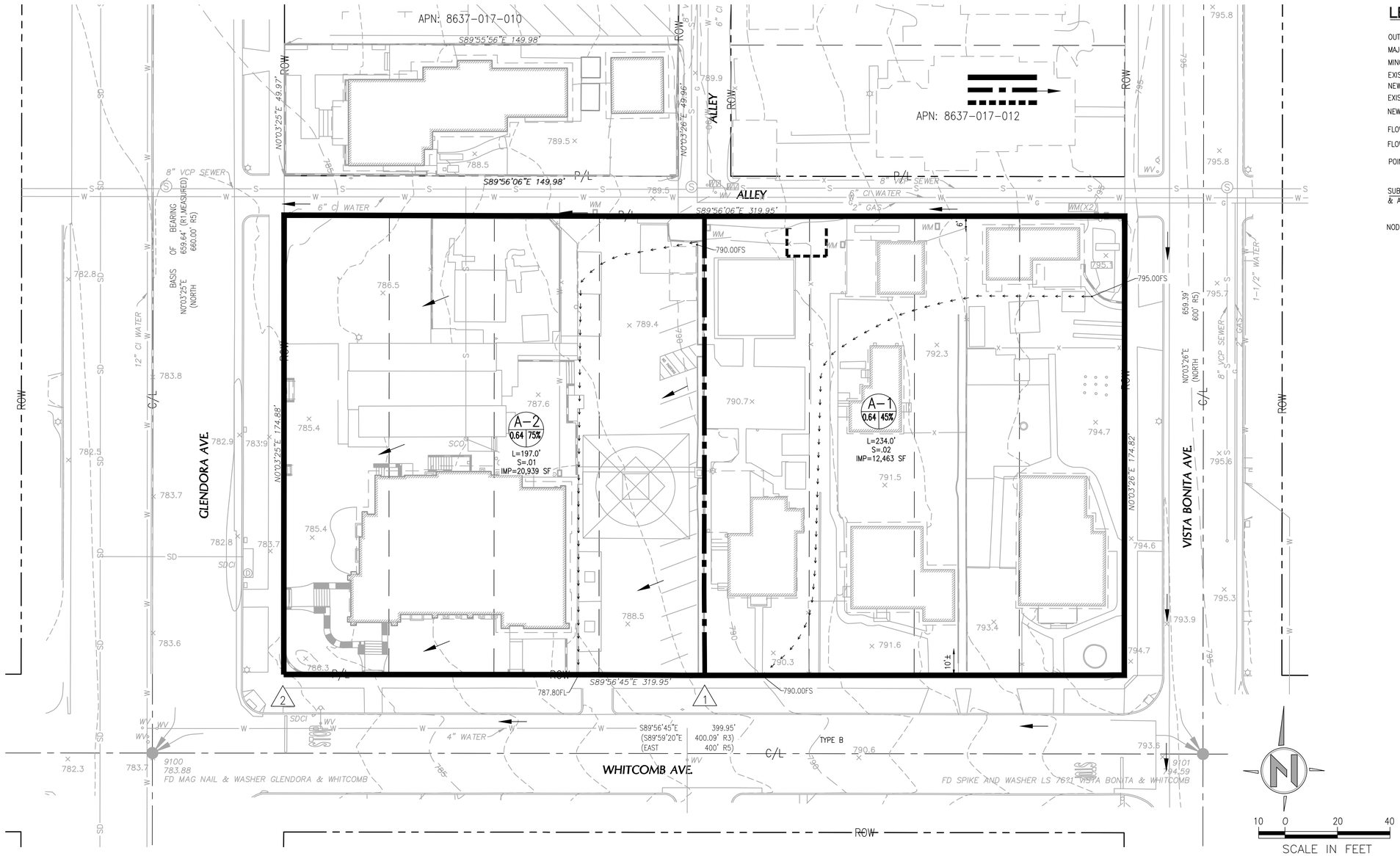
Input Parameters

Project Name	CBC_Exist
Subarea ID	A-2
Area (ac)	0.64
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.55
Peak Intensity (in/hr)	4.5045
Undeveloped Runoff Coefficient (Cu)	0.8958
Developed Runoff Coefficient (Cd)	0.8989
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.5916
Burned Peak Flow Rate (cfs)	2.5916
24-Hr Clear Runoff Volume (ac-ft)	0.2947
24-Hr Clear Runoff Volume (cu-ft)	12836.1398





LEGEND

	SYMBOL
OUTER BASIN BOUNDARY	
MAJOR BASIN BOUNDARY	
MINOR BASIN BOUNDARY	
EXISTING STORM DRAIN	SD
NEW STORM DRAIN	SD
EXISTING CONTOUR	XXX
NEW CONTOUR	XXX
FLOW DIRECTION	
FLOW PATH	
POINT OF COMPLIANCE	1
SUB-BASIN MARKER & AREA (AC)	A-1 0.81 90%
NODE/CONTOUR ELEVATION	313.00FL 310.00IE

BCW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

BCW ARCHITECTS | 2999 WASHINGTON BLVD - OGDEN, UT 84401 | PH: 801-618-3463 | www.BCWSERVICES.com

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PROFESSIONAL ENGINEER ☆ REGISTERED ☆ STATE OF CALIFORNIA
A. SLAWSON MICHAEL
No. C 65627
Exp. 12-31-20
CIVIL

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9449 BALBOA AVE. STE 270
SAN DIEGO, CA 92123 619.299.5550

SHEET TITLE:
CIVIL SITE PLAN
PHASE 1

PROJECT: AC457 GLENDORA ORIGINAL ISSUE: 01/0

SHEET NUMBER:
C-1.1

DO NOT SCALE DRAWING

PLOT: M:\PROJECTS\12500\12605US.00 CORNERSTONE BIBLE CHURCH\DWGS\EXHIBITS\DRAINAGE\12605 EX-HYDRO.DWG Mon 0C 8/28/2020 4:47 PM

APPENDIX C:

Proposed Condition Hydrology Calculations
Proposed Conditions Hydrology Map

Peak Flow Hydrologic Analysis

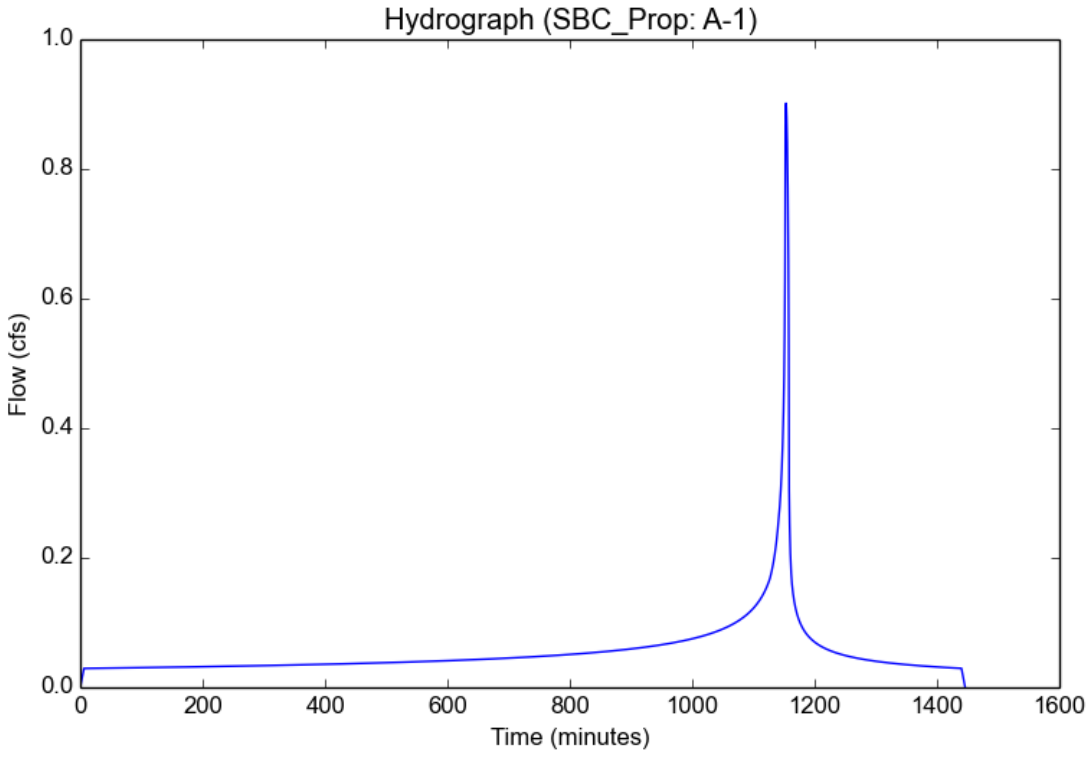
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/SBC_Prop R
Version: HydroCalc 1.0.3

Input Parameters

Project Name	SBC_Prop
Subarea ID	A-1
Area (ac)	0.67
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.72
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.6001
Undeveloped Runoff Coefficient (Cu)	0.6884
Developed Runoff Coefficient (Cd)	0.8408
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.9013
Burned Peak Flow Rate (cfs)	0.9013
24-Hr Clear Runoff Volume (ac-ft)	0.1116
24-Hr Clear Runoff Volume (cu-ft)	4863.165



Peak Flow Hydrologic Analysis

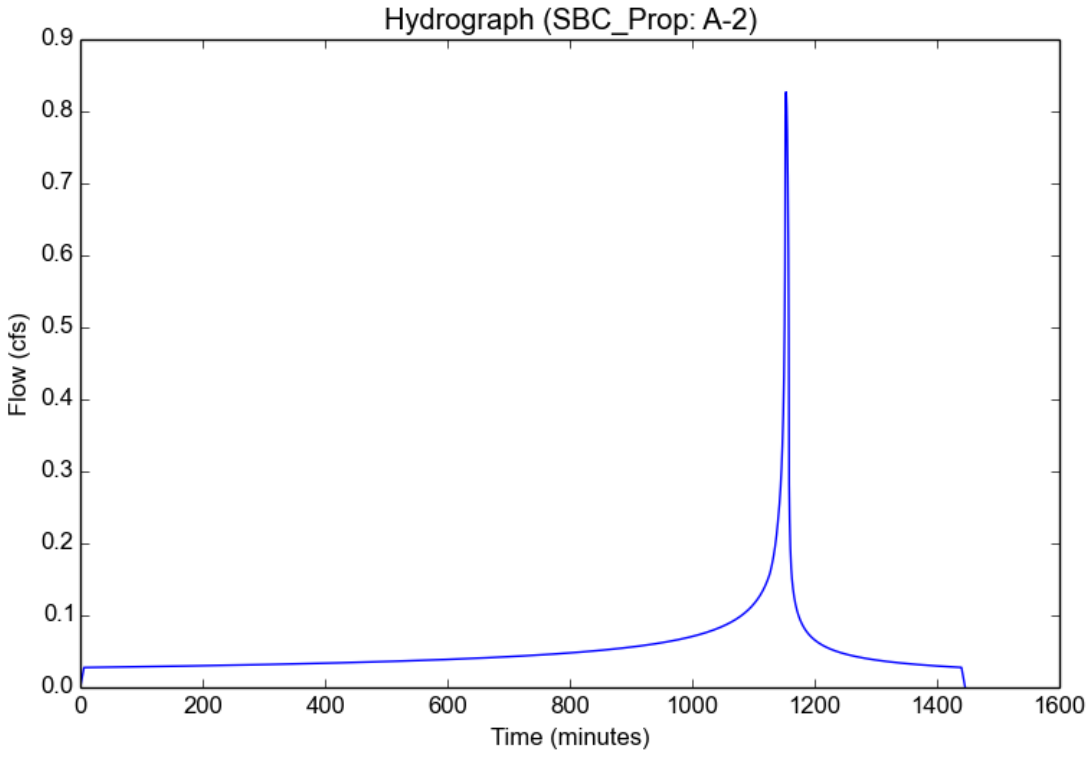
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/2 yr flow/SBC_Prop R
Version: HydroCalc 1.0.3

Input Parameters

Project Name	SBC_Prop
Subarea ID	A-2
Area (ac)	0.61
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.9219
Peak Intensity (in/hr)	1.6001
Undeveloped Runoff Coefficient (Cu)	0.6884
Developed Runoff Coefficient (Cd)	0.8471
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	0.8268
Burned Peak Flow Rate (cfs)	0.8268
24-Hr Clear Runoff Volume (ac-ft)	0.105
24-Hr Clear Runoff Volume (cu-ft)	4571.9887



Peak Flow Hydrologic Analysis

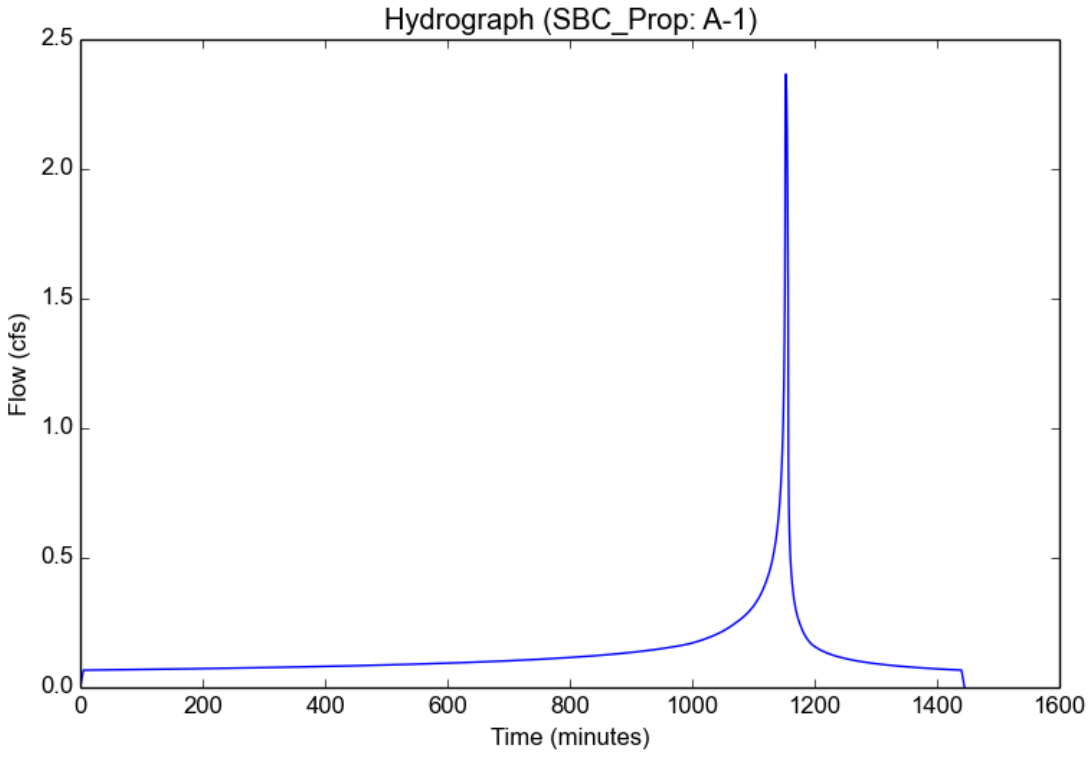
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/25 yr flow/SBC_Prop
Version: HydroCalc 1.0.3

Input Parameters

Project Name	SBC_Prop
Subarea ID	A-1
Area (ac)	0.67
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.72
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.6289
Peak Intensity (in/hr)	3.955
Undeveloped Runoff Coefficient (Cu)	0.8748
Developed Runoff Coefficient (Cd)	0.8929
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.3661
Burned Peak Flow Rate (cfs)	2.3661
24-Hr Clear Runoff Volume (ac-ft)	0.2616
24-Hr Clear Runoff Volume (cu-ft)	11393.768



Peak Flow Hydrologic Analysis

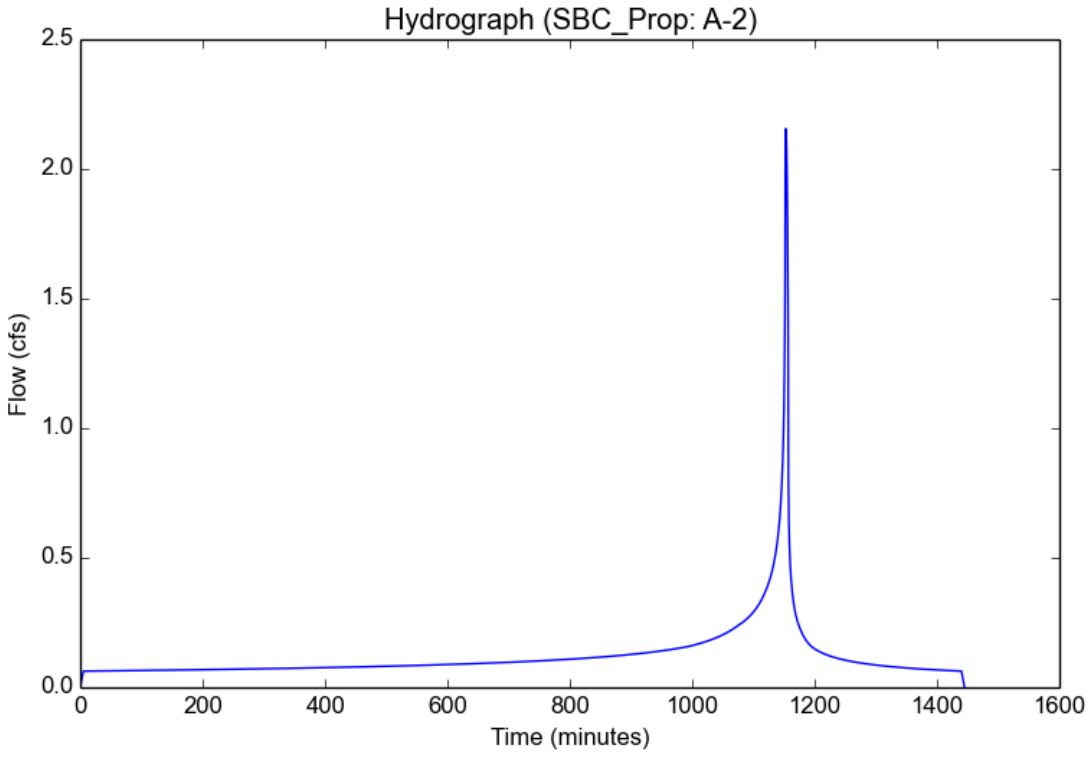
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/25 yr flow/SBC_Prop
Version: HydroCalc 1.0.3

Input Parameters

Project Name	SBC_Prop
Subarea ID	A-2
Area (ac)	0.61
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	6.6289
Peak Intensity (in/hr)	3.955
Undeveloped Runoff Coefficient (Cu)	0.8748
Developed Runoff Coefficient (Cd)	0.8937
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.1561
Burned Peak Flow Rate (cfs)	2.1561
24-Hr Clear Runoff Volume (ac-ft)	0.2449
24-Hr Clear Runoff Volume (cu-ft)	10665.7089



Peak Flow Hydrologic Analysis

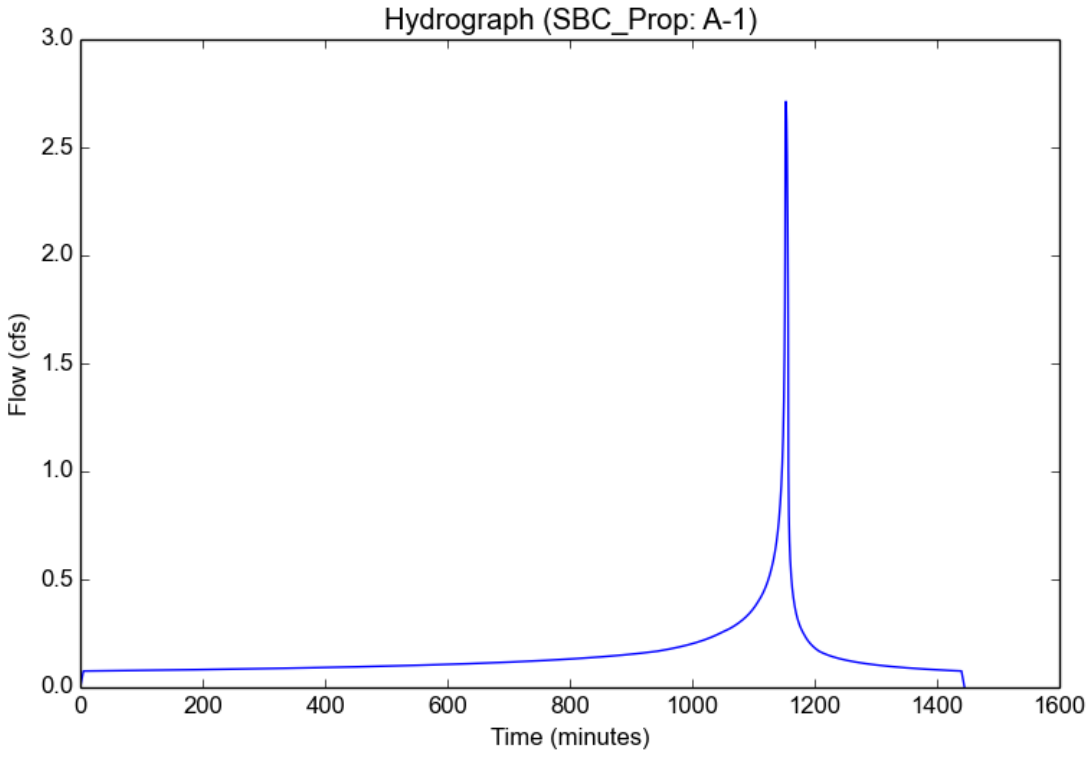
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/50 yr flow/SBC_Prop
Version: HydroCalc 1.0.3

Input Parameters

Project Name	SBC_Prop
Subarea ID	A-1
Area (ac)	0.67
Flow Path Length (ft)	234.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.72
Soil Type	6
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.55
Peak Intensity (in/hr)	4.5045
Undeveloped Runoff Coefficient (Cu)	0.8958
Developed Runoff Coefficient (Cd)	0.8988
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.7127
Burned Peak Flow Rate (cfs)	2.7127
24-Hr Clear Runoff Volume (ac-ft)	0.3004
24-Hr Clear Runoff Volume (cu-ft)	13083.6285



Peak Flow Hydrologic Analysis

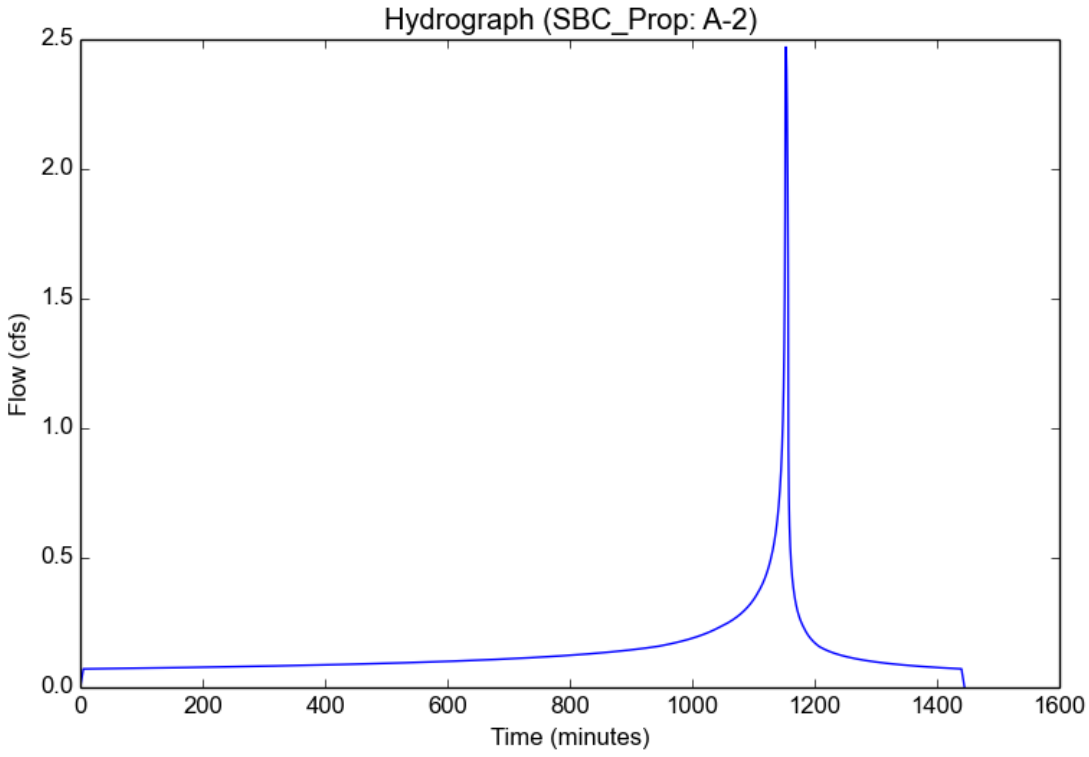
File location: M:/Projects/12500/12605US.2.00 Cornerstone Bible Church/Documents/Reports/Hydrology/2020-08 report-wip/Calcs/50 yr flow/SBC_Prop
Version: HydroCalc 1.0.3

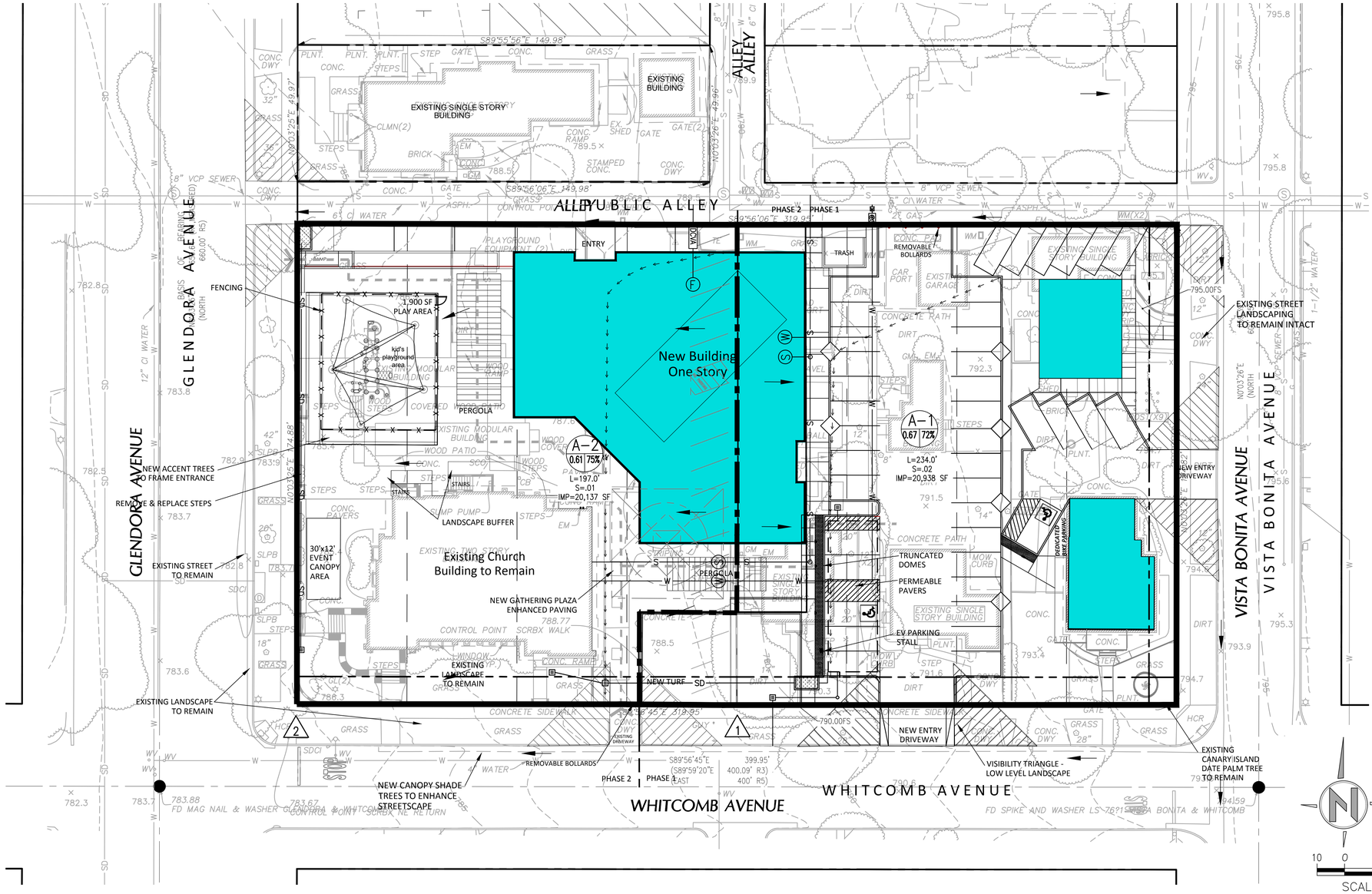
Input Parameters

Project Name	SBC_Prop
Subarea ID	A-2
Area (ac)	0.61
Flow Path Length (ft)	197.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	7.55
Percent Impervious	0.75
Soil Type	6
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.55
Peak Intensity (in/hr)	4.5045
Undeveloped Runoff Coefficient (Cu)	0.8958
Developed Runoff Coefficient (Cd)	0.8989
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.4701
Burned Peak Flow Rate (cfs)	2.4701
24-Hr Clear Runoff Volume (ac-ft)	0.2809
24-Hr Clear Runoff Volume (cu-ft)	12234.4457





LEGEND

	SYMBOL
OUTER BASIN BOUNDARY	
MAJOR BASIN BOUNDARY	
MINOR BASIN BOUNDARY	
EXISTING STORM DRAIN	SD
NEW STORM DRAIN	SD
EXISTING CONTOUR	XXX
NEW CONTOUR	XXX
FLOW DIRECTION	
FLOW PATH	
POINT OF COMPLIANCE	1
SUB-BASIN MARKER & AREA (AC)	A-1 0.81 90%
NODE/CONTOUR ELEVATION	313.00FL 310.00IE

BGW ERICKSON-HALL
Building Buildings. Building Lives.

REV	DATE	DESCRIPTION
0	10-25-19	PLANNING SUBMISSION

PROJECT:
CORNERSTONE BIBLE CHURCH
400 N. GLENDORA AVE.
GLENDORA, CA 91741

BGW ARCHITECTS|2909 WASHINGTON BLVD - OGDEN, UT 84401|PH: 801-618-3463|www.BGWSERVICES.com

SEAL:
PROFESSIONAL ENGINEER
MICHAEL A. SLAWSON
No. C 58697
Exp. 12-31-20
CIVIL
REGISTERED
STATE OF CALIFORNIA

SHEET TITLE:

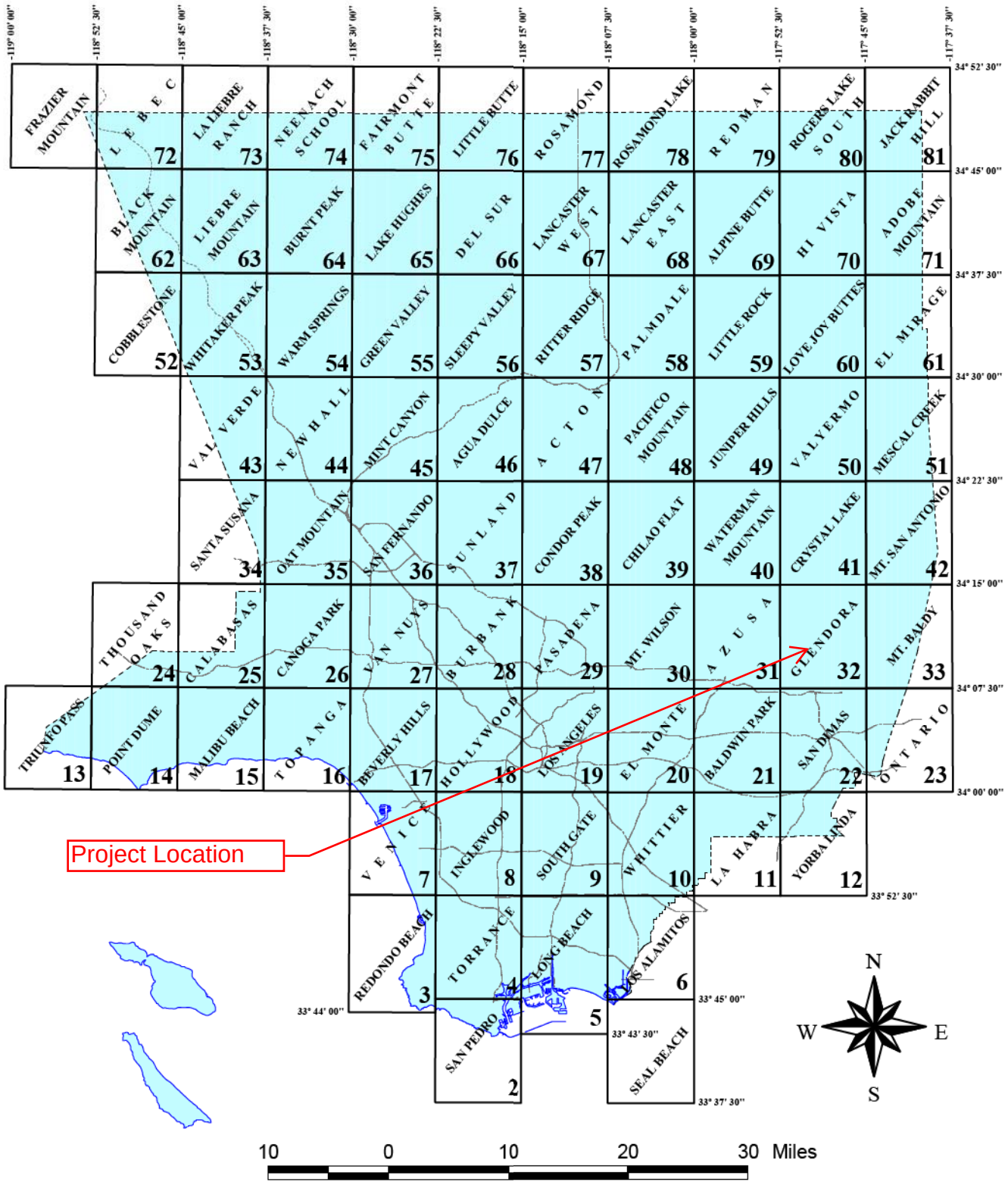
PROJECT: AC457 GLENDORA ORIGINAL ISSUE: OCT

SHEET NUMBER:

DO NOT SCALE DRAWING

APPENDIX D:

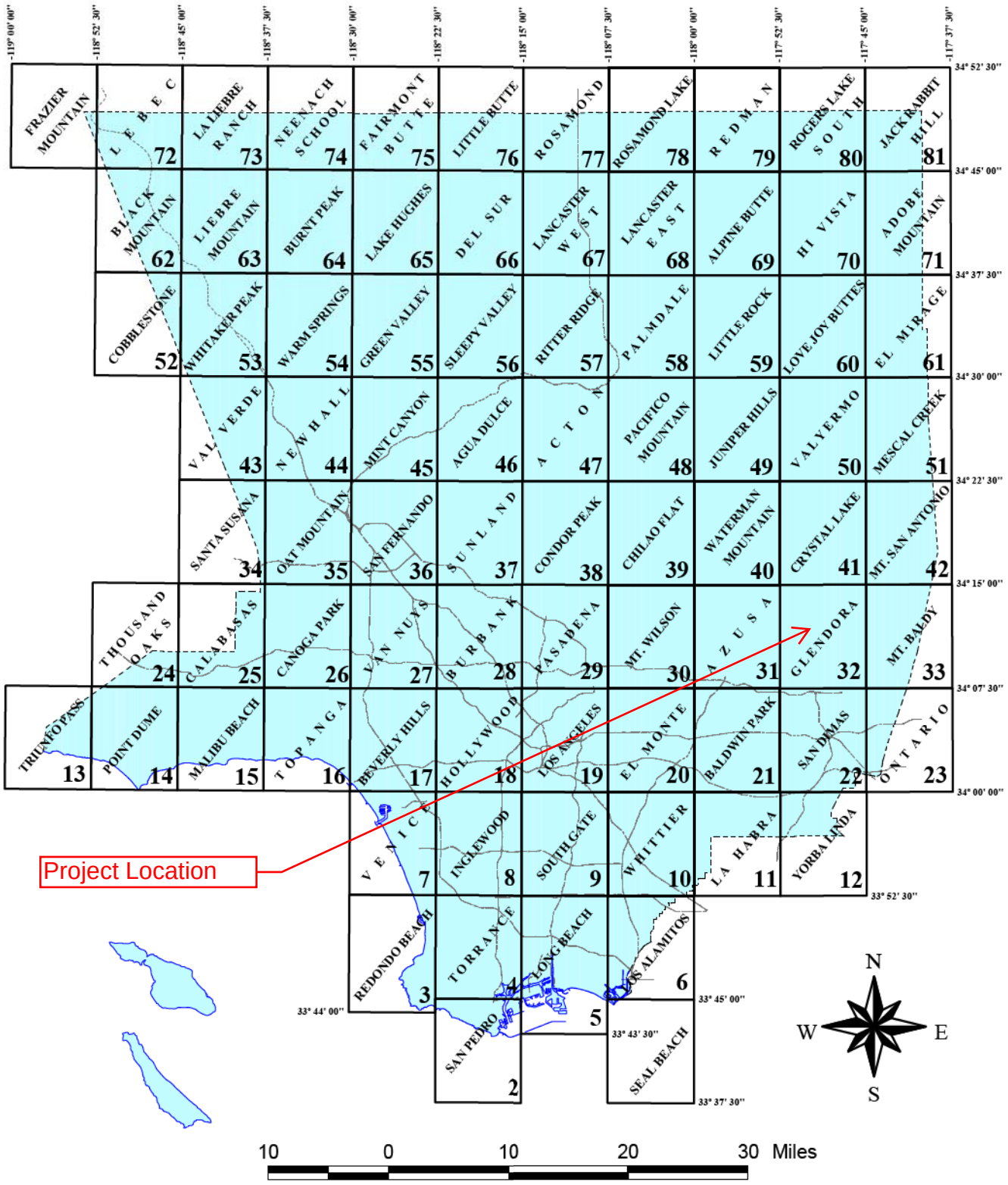
Excerpts from Hydrology Manual



INDEX ISOHYETAL MAP

50-YEAR 24-HOUR ISOHYET

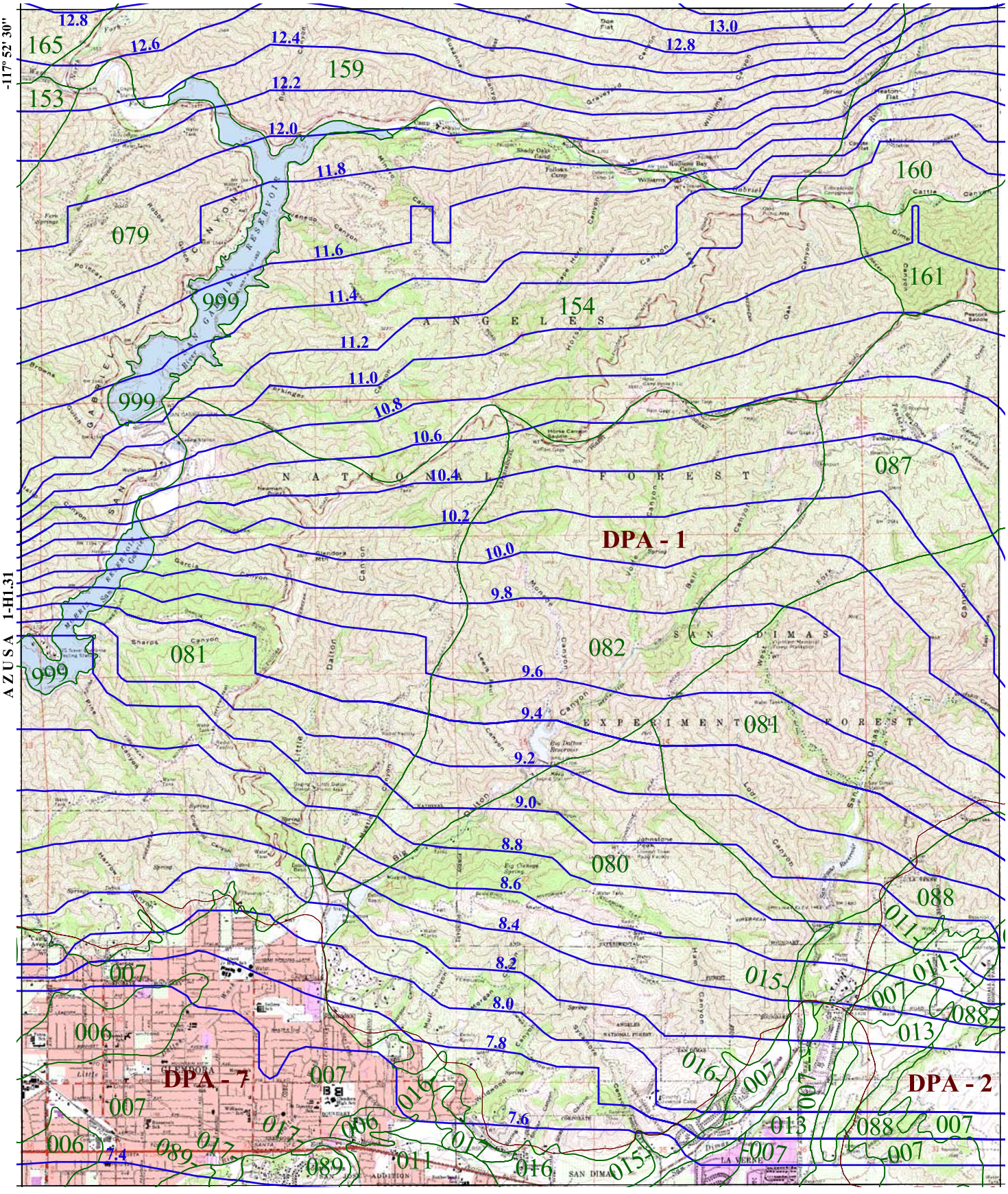
BASED ON USGS QUADRANGLE



HYDROLOGIC MAP INDEX

SOIL CLASSIFICATION AREA

BASED ON USGS QUADRANGLE


34° 15' 00"
CRYSTAL LAKE 1-H1.41
-117° 52' 30"
AZUSA 1-H1.31
MOUNT BALDY 1-H1.33
-117° 45' 00"
SAN DIMAS 1-H1.22
34° 07' 30"
DPA - 1
DPA - 2
DPA - 7
12.8
12.6
12.4
12.2
12.0
11.8
11.6
11.4
11.2
11.0
10.8
10.6
10.4
10.2
10.0
9.8
9.6
9.4
9.2
9.0
8.8
8.6
8.4
8.2
8.0
7.8
7.6
7.4
165
153
159
079
999
154
160
161
087
081
082
080
088
007
006
011
015
016
017
089
013
N
S
E
W
016 SOIL CLASSIFICATION AREA
7.2 INCHES OF RAINFALL
DPA - 6 DEBRIS POTENTIAL AREA
1 0 1 2 Miles
25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714
GLENDORA
50-YEAR 24-HOUR ISOHYET
1-H1.32
LOS ANGELES COUNTY PUBLIC WORKS
Public Service That Works

Sumps with drainage from roadways require special care. If flows reach the sump by following the roadway from upstream, use the Capital Flood on all areas upstream of the sump that drain to the roadway. The roadway must carry the Capital Flood capacity with a water surface elevation below the private property line. Otherwise, drainage facilities must be added beneath the roadway. See the Los Angeles County Highway Design Manual[1], and Chapter 44 of the Land Development Division Guidelines.

Culverts

The Capital Flood level of protection applies to all culverts under major and secondary highways.

Tributary Areas Subject to Burning

Canyons and mountainous areas within the County of Los Angeles are subject to burning. The Capital Flood applies to all areas likely to remain in a natural state, regardless of size. Burned canyons and mountainous areas also add debris to the runoff. Therefore, flow from "burned" areas must be "bulked." Bulking reflects increases in runoff volumes and peak flows related to inclusion and transport of sediment and debris.

Section 6.3 discusses the development of burned watershed hydrology. Section 3.3 of the Public Works' Sedimentation Manual contains information on bulking flows.

4.3 URBAN FLOOD PROTECTION

All drainage facilities in developed areas not covered under the Capital Flood protection conditions must meet the Urban Flood level of protection. The Urban Flood is runoff from a 25-year frequency design storm falling on a saturated watershed. A 25-year frequency design storm has a probability of 1/25 of being equaled or exceeded in any year.

Street flow due to the urban flood may not exceed the private property line elevation. However, runoff can be conveyed in drains under the street and on the street surface. Urban Flood runoff is allowed to flow in the street to the point where the flow reaches the street capacity at the property line. Depth analysis is to be started at the upstream end of the watershed. The flow should be split to allow conveyance in the street and in a drain below the street when flows exceed street capacity. Drains must at least carry flow

from the 10-year frequency design storm. See the Los Angeles County Highway Design Manual[1] and Chapter 44 of the Land Development Division Guidelines for road design requirements.

The street or highway must carry the balance of the 25-year frequency design storm below the property line. The drain may carry more flow to lower the water surface on the street to below the private property line or meet other requirements for vehicular or pedestrian traffic. See the Los Angeles County Highway Design Manual for the traffic requirements[1]. The maximum allowable pipe diameter for hydrology studies is 96 inches. Beyond this size, choose a rectangular channel conveyance. Figure 4.3.1 provides an example of street flow.

Figure 4.3.1
Street Flow After 1938 Storm

4.4 PROBABLE MAXIMUM FLOOD PROTECTION

The Probable Maximum Flood (PMF) results from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region[2]. The Probable Maximum Precipitation[3] (PMP) represents the greatest depth of rainfall theoretically possible for a

Frequency	Multiplication Factor
2-yr	0.387
5-yr	0.584
10-yr	0.714
25-yr	0.878
50-yr	1.000
100-yr	1.122
500-yr	1.402

Table 5.3.1
Rainfall Frequency Multiplication Factors

Appendix B contains isohyetal maps for the 50-year, 24-hour rainfall depth. The isohyetal contour lines are spaced at intervals of two-tenths of an inch. The spatial rainfall distributions for the county design storms were converted to grid data for use with Geographic Information System (GIS) compatible hydrologic models.

5.4 DESIGN STORM

The three components of the design storm include the IDF equation, the unit hyetograph curve, and the isohyets. These components are used to define the design storm for a particular location and frequency. As an example, consider the 25-year design storm for the Palmer Canyon watershed in Figure 5.4.1. Subarea 1A of this watershed, shown in Figure 5.4.2, will be used for the sample calculations.

1. Compute the area between successive isohyetal lines and multiply by the average of the isohyet values. Table 5.4.1 shows the areas between isohyets for Subarea 1A.

2. The sum of these precipitation-area values divided by the total subarea area provides the area weighted average rainfall depth. The average rainfall should be calculated to the nearest two-tenths of an inch. Table 5.4.1 contains the calculations for the isohyetal values in this subarea.

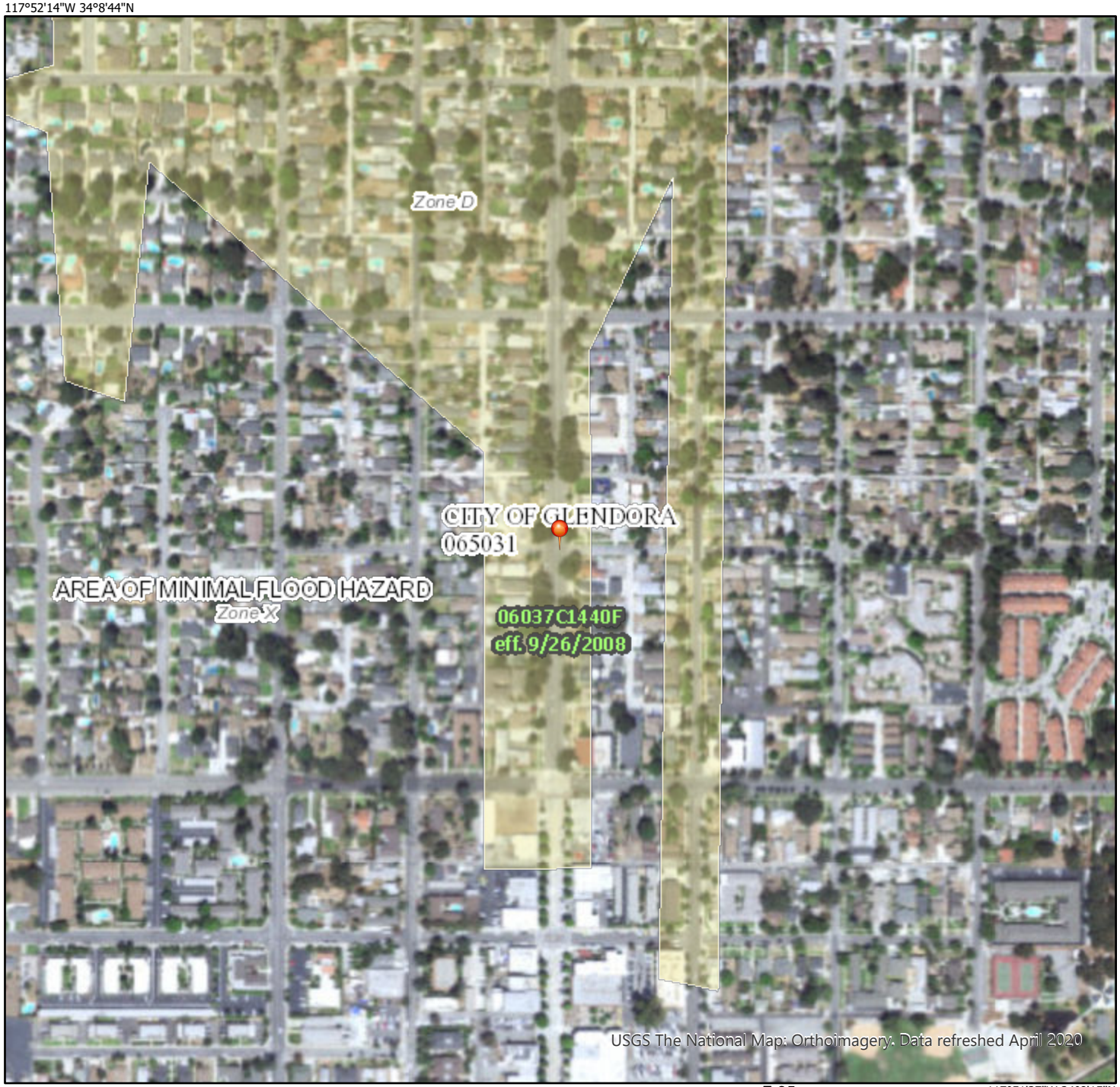
It may be noted that for small subareas, the isohyet nearest the centroid of the subarea usually equals the design depth. Selecting the isohyets nearest the subarea centroid is an acceptable method for determining the design rainfall for subareas of approximately 40 acres.

APPENDIX E:

FEMA Flood Plain Map

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/3/2020 at 11:49 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.