Preliminary Hydrology Study

Butterfly Gardens

910 S. Mariposa Street
Burbank, California 91506

Prepared: December 22, 2023
Revised: May 1, 2024; October 3, 2024

Prepared for

Butterfly Gardens, LLC

Prepared by

KHR ASSOCIATES
Consulting Engineers - Surveyors - Planners

ATTESTATION

This study has been prepared under the direction of a duly Registered Civil Engineer in the State of California. The civil engineer signing below approves of the technical information included within this report along with recommendations and conclusions made.

James H. Kawamura, P.E.
Registered Civil Engineer No. C30560
Exp. 3/31/26

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APPENDIX

Section 1 Purpose and Scope

The hydrology study presents an analysis of the hydrologic effects that may be associated with the proposed multi-family residential development *Butterfly Gardens*. The study details the general project characteristics, design, criteria, and methodology applied to the analysis of the subject area in terms of drainage and associated conveyance and treatment facilities.

The plans and specifications in the drainage study are not for construction purposes. The contractor shall refer to final approved construction documents for plans and specifications.

Section 2 Project Information

2.1 Project Description

The proposed Butterfly Gardens residential development project entails the construction of a 5-story multi-family residential building with 40 condominium units and a 47 space partially subterranean parking garage on a 0.88-acre (38,361 square feet) site.

2.1.1 Project Location

The project site is located on 910 S Mariposa Street in the city of Burbank, California. Figure 1 below illustrates an aerial perspective of the project on-site area and surroundings and Figure 2 illustrates the vicinity map.

Figure 1 – Aerial Perspective of On-Site Area

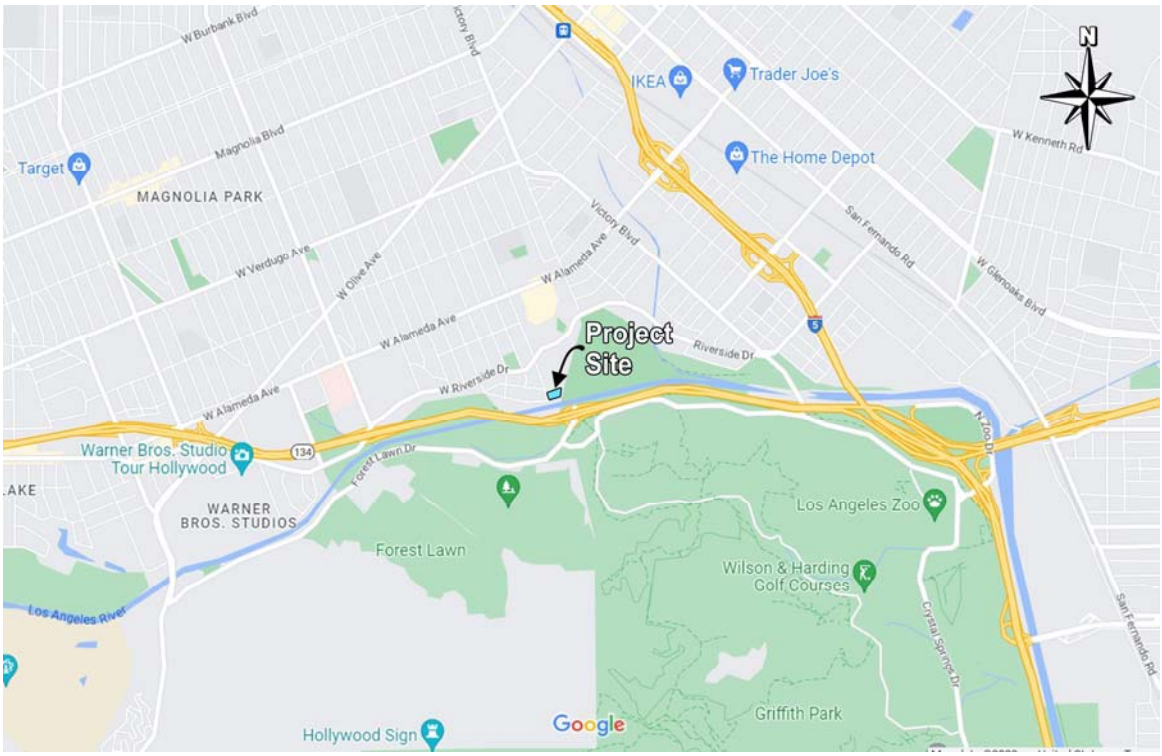


Figure 2 – Vicinity Map

2.2 Hydrologic Setting

This section summarizes the area's size and location in the context of the larger watershed perspective, topography, soil and vegetation conditions, amount of impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors to be protected specific to the project area's watershed.

2.2.1 Watershed

The proposed project is located within the 834 square mile Los Angeles River watershed. The receiving waters directly affected by the proposed development include Duarte Channel, Buena Vista Channel, Sawpit Wash, Rio Hondo Channel, Los Angeles River, Los Angeles River Estuary (Queensway Bay), and San Pedro Bay.

2.2.2 Existing Topography, Drainage Patterns, and Facilities (Narrative)

The project site is currently developed with covered stables, horse corrals, several single story structures, and natural ground. Surface water drainage at the site appears to be by sheet flow along the existing contours to the city streets or local area drains.

Runoff from a majority of the site sheet flows easterly into the adjacent property, and runoff from the remainder of the site sheet flows westerly to Mariposa Street, which flows to a LACFCD maintained catch basin on the westerly side of the street. The catch basin connects to a LACFCD maintained 36-inch reinforced concrete pipe (RCP) that discharges into the Los Angeles River.

2.2.3 Adjacent Land Use

The project site is bounded by a commercial site to the north, a powerline easement then Los Angeles Equestrian Center to the east, a horse corral structure, horse trail, and then Los Angeles River to the south, and Mariposa Street and single family residential to the west.

2.2.4 Soil Conditions

According to the Geotechnical report prepared by Geocon West, Inc. (dated January 10, 2023), the site has native soils consisting of Pleistocene to early Holocene age alluvium was encountered beneath the fill. The alluvial soils are characterized as slightly moist and very loose to very dense or very soft to hard. Groundwater was not encountered to the explored depth of 55.5 feet below grade.

2.2.5 Downstream Conditions

This section summarizes the existing downstream conditions and any conditions of concern with respect to erosion and/or sedimentation due to the proposed project.

Runoff flows westward into Mariposa Street, which is paved. Mariposa Street channels the runoff into a catch basin on its western side, which is maintained by LACFCD. The catch basin connects to a 36-inch reinforced concrete pipe (RCP) also maintained by LACFCD. This RCP eventually releases the runoff into a channelized portion the Los Angeles River.

2.2.6 Impervious Cover

The proposed project will have a net increase in total impervious area compared to that of the existing site conditions. The project site's existing conditions prior to dedication include approximately 16,355 square feet (0.37 acres) of impervious surfaces (37%) and 27,334 square feet (0.63 acres) of pervious surfaces (63%) on a 43,689 square feet (1.00 acres) site. The project site's existing conditions excluding the dedication area include approximately 15,679 square feet (0.36 acres) of impervious surfaces (41%) and 22,682 square feet (0.52 acres) of pervious surfaces (63%) on a 38,361 square feet (0.88 acres) site. The proposed residential development project will increases the site's overall total imperviousness percentage. For this preliminary report, calculations for the proposed site conditions assumed 37,861 square feet (0.87 acres) of impervious area (99%) and 500 square feet (0.01 acres) of landscaping as a worst case scenario.

2.3 Proposed Runoff Management Facilities

The proposed facilities managing runoff from the area include:

- An Aqua Swirl Hydrodynamic Separator used as a pretreatment device for the Low Impact Development (LID) Best Management Practices (BMPs).
- A proposed solid wall corrugated metal pipe used to detain the stormwater mitigation volume prior to infiltration by means of a drywell.
- A proposed MaxWell IV drywell that will infiltrate the stormwater mitigation volume to meet LID requirements.
- A proposed drainage system that includes drop inlets and storm drain pipes that will direct the runoff to a low flow (stormwater mitigation) and high flow (discharged offsite) stormwater diverter.
- A pump system to discharge high flows through a parkway culvert to face of curb in Mariposa Street.

Section 3 Design Criteria and Methodology

This section summarizes the design criteria and methodology applied during the drainage analysis of the project site. The design criteria and methodology follows the County of Los Angeles Drainage Design Manual (January 2006).

3.1 Design Criteria

3.1.1 Drainage Design Criteria

Local storm drain facilities have been designed to conform to standards found in the County of Los Angeles Drainage Design Manual.

3.2 Methodology

3.2.1 HydroCalc Software

The HydroCalc software, developed and provided by Los Angeles County Public Works, calculates various parameters using the modified rational method, which is an iterative process. The table below shows the input data that is entered into the program and the output data that is produced.

Input Data	**Output Data**
Area (ac)	Modeled (10-yr) Rainfall Depth (in)
Flow Path Length (ft)	Peak Intensity (in/hr)
Flow Path Slope (vft/hft)	Undeveloped Runoff Coefficient (Cu)
24-hr, 50-yr Rainfall Depth (in)	Developed Runoff Coefficient (Cd)
Percent Impervious (0.01-1.0)	Time of Concentration (min)
Soil Type (2-180)	Clear Peak Flow Rate (cfs)
Design Storm Frequency	Burned Peak Flow Rate (cfs)
Fire Factor	24-Hr Clear Runoff Volume (ac-ft)
	24-Hr Clear Runoff Volume (cu-ft)

Once the input data has been entered, HydroCalc then computes the output data using the following steps:

1. Assumes an initial time of concentration (T_c)

2. Uses the assumed T_c to calculate rainfall intensity (I_t) with the following equation:

$$I_t = I_{1440} \times (1440/t)^{0.47}$$

Where... t = assumed initial time of concentration (min)
I_t = rainfall intensity for the duration (in/hr)
I_{1440} = 24-hour rainfall intensity (in/hr)

3. Calculates impervious area and stormwater runoff coefficient using the following equation:

$$IMP = [\sum^{n}_{i=1}(IMP_i \times A_i)/A_T]$$

Where... IMP = site percent impervious
IMP_i = impervious area (i)
A_i = area, i (ft^2)
A_T = total project site area (ft^2)

$$C_d = (0.9 \times IMP) + (1.0 - IMP) \times C_u$$

Where... C_d = developed site stormwater runoff coefficient
IMP = site percent impervious
C_u = undeveloped site stormwater runoff coefficient
(Obtained from soil curve data)

4. Calculates the time of concentration (T_c) and compares it to the initial assumption using the following equation:

$$T_c = [0.31 \times L^{0.483}]/[(C_d \times I_t)^{0.519} \times S^{0.135}]$$

Where... T_c = time of concentration (min)
L = longest flow path length
C_d = developed site stormwater runoff coefficient
I_t = rainfall intensity for the duration (in/hr)
S = slope of longest flow path (ft/ft)

If the calculated T_c and the assumed T_c are more than 0.5 minutes apart then the process is repeated by rounding the calculated T_c to the nearest minute and using it as the assumed value. The process is complete once the calculated T_c and the assumed T_c are within 0.5 minutes of each other.

5. Peak flow rate is then calculated using the rational equation, as shown below:

$$Q = C \times I \times A$$

Where... Q = Peak discharge (cfs);
C = runoff coefficient, based on land use and soil type;
I = Rainfall intensity (in/hr);
A = watershed area (acre)

The runoff coefficient represents the ratio of rainfall that runs off the watershed versus the portion that infiltrates to the soil or is held in depression storage. The runoff coefficient is dependent on the land use coverage and soil type. The County of Los Angeles Drainage Design Manual methodology assumes hydrologic Soil Type 15 for this project site (See Appendix for Isohyet Map).

Peak discharges were computed for the 10-year hypothetical storm return frequency and the output results of the HydroCalc can be found in the appendix section of this report.

KHR reached out to the Los Angeles County Flood Control District (LACFCD) to determine if there is a flow restriction (Q Allowable) for connection of the project's storm drain system to the public system, and was given a flow restriction of 0.75 cfs for the 25-year storm event. The current design of the project does not allow for a connection to the MS4, but the information was requested in case there was an opportunity for connection.

Section 4 Hydrology and Drainage Analysis

This section summarizes the quantitative hydrologic analysis of the existing site.

4.1 Summary of Drainage Delineation

Existing Analysis

To analyze the existing conditions, the site was broken into one subarea: EX-A (see **Appendix 2** for the Existing Conditions Hydrology Map).

Runoff from subarea EX-A majority of the sheet flows easterly into the adjacent property, and runoff from the remainder of the site sheet flows westerly to Mariposa Street, which flows to a LACFCD maintained catch basin on the westerly side of the street. The catch basin connects to a LACFCD maintained 36-inch RCP that discharges into the Los Angeles River.

Proposed Analysis

To analyze the proposed conditions, the site was broken into one subarea: A (see **Appendix 4** for the Proposed Conditions Hydrology Map).

Runoff from Subarea P-A will be collected by a series of roof drains and drop inlets that drain into the project's on-site private storm drain system. The storm drain system will route the stormwater to a junction structure designed to divert low flows (stormwater mitigation volume) to the LID BMPs and high flows to be discharged off-site. The stormwater quality design flows are pre-treated by an Aqua-Swirl Hydrodynamic Separator prior to detention by a solid wall corrugated metal pipe (CMP) and infiltration into the underlying soils by means of a MaxWell IV drywell. Flows in excess of the stormwater volume to be mitigated bypass the LID BMPs and are directed to a pump system that ultimately discharges at curb face into Mariposa Street via a parkway culvert.

4.2 Summary of Results

The following tables summarize the results for the existing and proposed conditions of the project area for the 10-year, 25-year, and 50-year, 24-hour storm events (see **Appendix 3 and 5** for the HydroCalc Calculations).

The existing conditions results for the 10-year, 24-hour storm events for the project site are summarized in **Table 1**.

Table 1: Existing Conditions Hydrology

Subarea	Area (acres)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)
EX-A	0.88	1.35	1.98	2.35

The proposed conditions results for the 10-year, 24-hour storm events for the project site are summarized in **Table 2.**

Table 2: Proposed Conditions Hydrology

Subarea	Area (acres)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)
P-A	0.88	2.21	2.72	3.10

Due to an increase in imperviousness, the flow rate for the proposed condition will have a net increase than that of the existing condition. A pump system will be use to discharge the runoff through a parkway culvert into Mariposa Street.

4.3 Conclusion

Using a worst case scenario of 99% imperviousness, the proposed conditions has a higher on-site 25-year storm flow rate of 2.72 cfs compared to the existing on-site flow rate of 1.98 cfs due to an increase of imperviousness and the design of the proposed storm drain system. The infiltration system used for the stormwater quality design volume will reduce some of the project's proposed flow rate. The change in runoff from existing to proposed conditions, considering the onsite infiltration, is minimal and does not significantly impact the downstream storm drain system and receiving waters.

APPENDIX

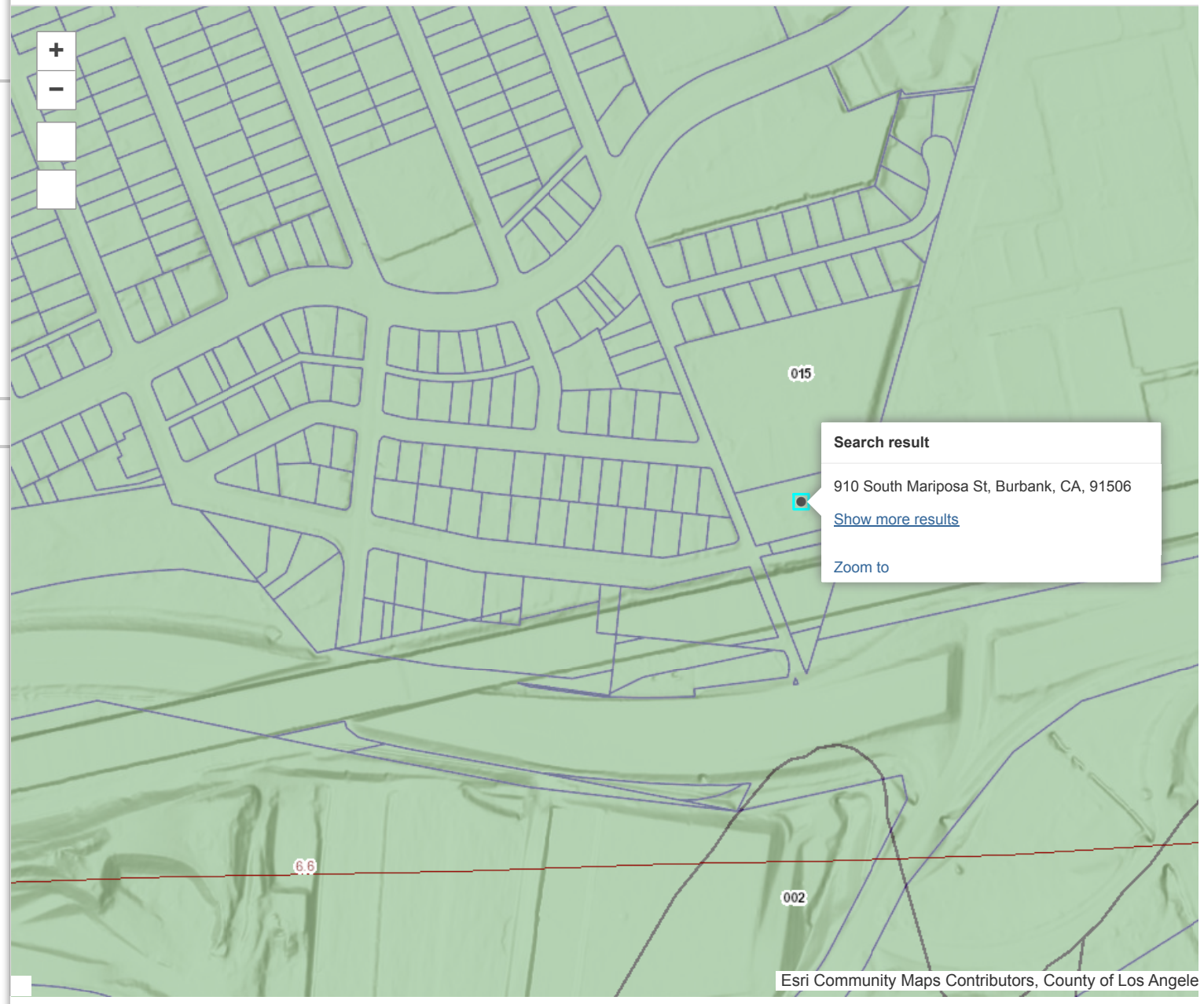
Appendix 1 – Soils Map

About | Legend | Layers

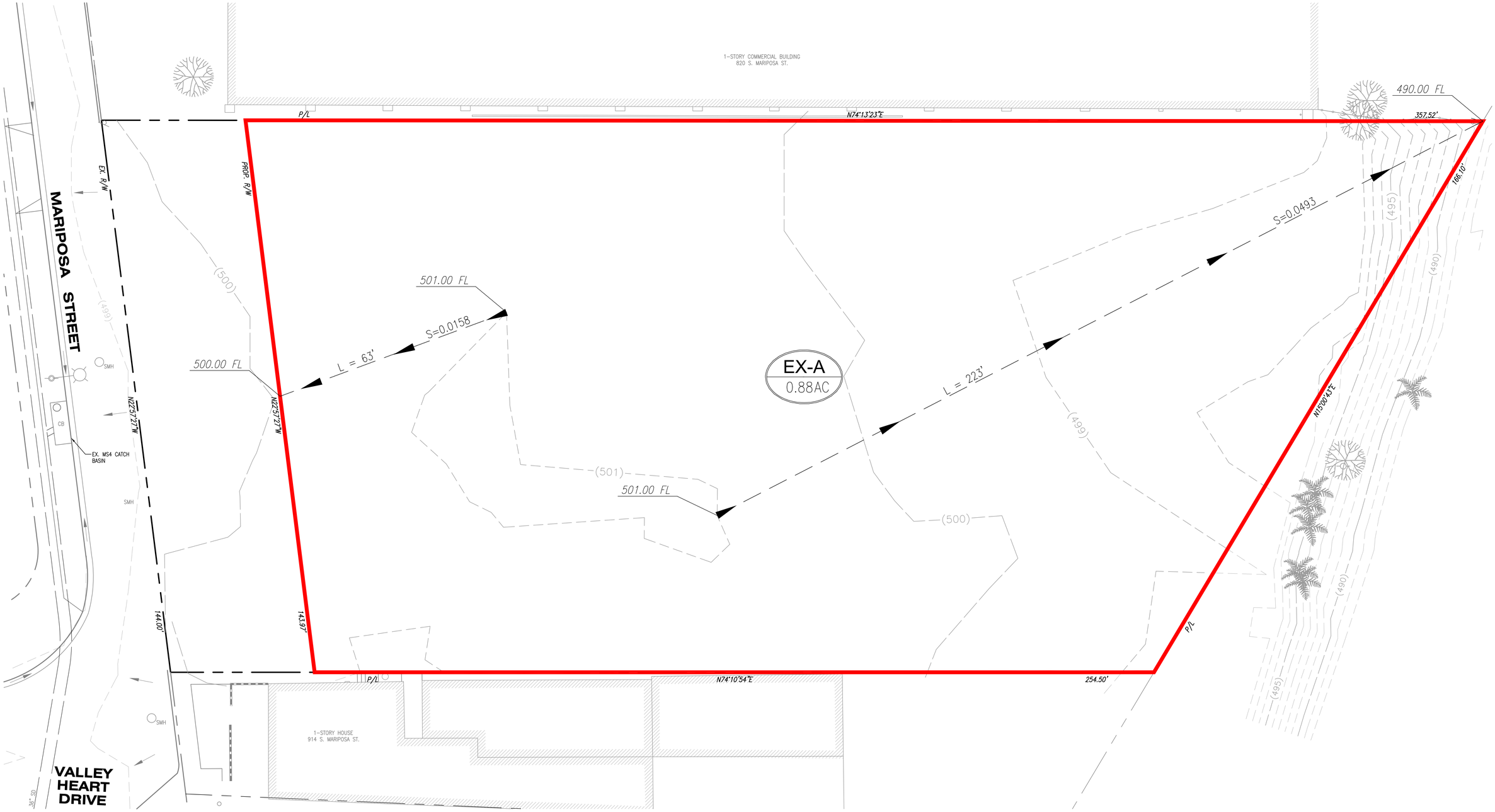
Layers

- [ ] Hydrology GIS
  - [ ] 50yr Two Tenths (Rainfall)
  - [ ] DPA Zones
  - [ ] Soils 2004
  - [ ] Final 85th Percentile, 24-hr Rainfall
  - [ ] 1-year, 1-hour Rainfall Intensity
  - [ ] Final 95th Percentile, 24-hr Rainfall
- [ ] LA County Parcels

LA County Hydrology Map



Appendix 2 – Existing Conditions Hydrology Map



LEGEND

- SUBAREA BOUNDARY
- SURFACE FLOW PATH ONSITE
- X / X.XXAC — SUBAREA LABEL

0 5 10 20 30

SCALE: 1"=10' DATE: 12/20/2023

BUTTERFLY GARDENS

BUTTERFLY GARDENS LLC

PRELIMINARY EXISTING HYDROLOGY MAP

910 S. MARIPOSA STREET, BURBANK, CALIFORNIA 91506

KHA ASSOCIATES
CONSULTING ENGINEERS/SURVEYORS/PLANNERS
17530 Von Karman Avenue - Suite 200 Tel (949) 756-6440
Irvine, California 92614

Appendix 3 – Existing Conditions Peak Flow Hydraulic Analysis

Peak Flow Hydrologic Analysis

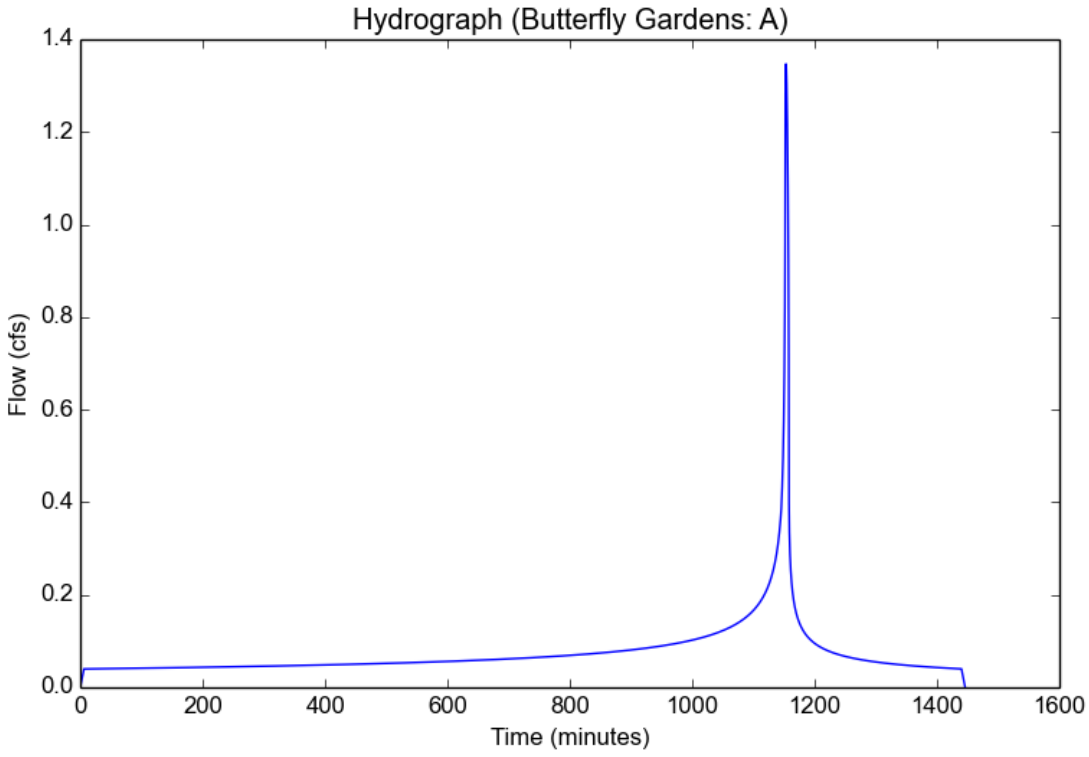
File location: C:/Users/Shiori/KHR Associates Dropbox/R Drive/Sanka Properties/Documents/Hydrology/Hydrology Calcs/Existing/EX-A - 10 yr.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Butterfly Gardens
Subarea ID	A
Area (ac)	0.88
Flow Path Length (ft)	223.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.41
Soil Type	15
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	2.6198
Undeveloped Runoff Coefficient (Cu)	0.3649
Developed Runoff Coefficient (Cd)	0.5843
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	1.347
Burned Peak Flow Rate (cfs)	1.347
24-Hr Clear Runoff Volume (ac-ft)	0.1518
24-Hr Clear Runoff Volume (cu-ft)	6613.2699



Peak Flow Hydrologic Analysis

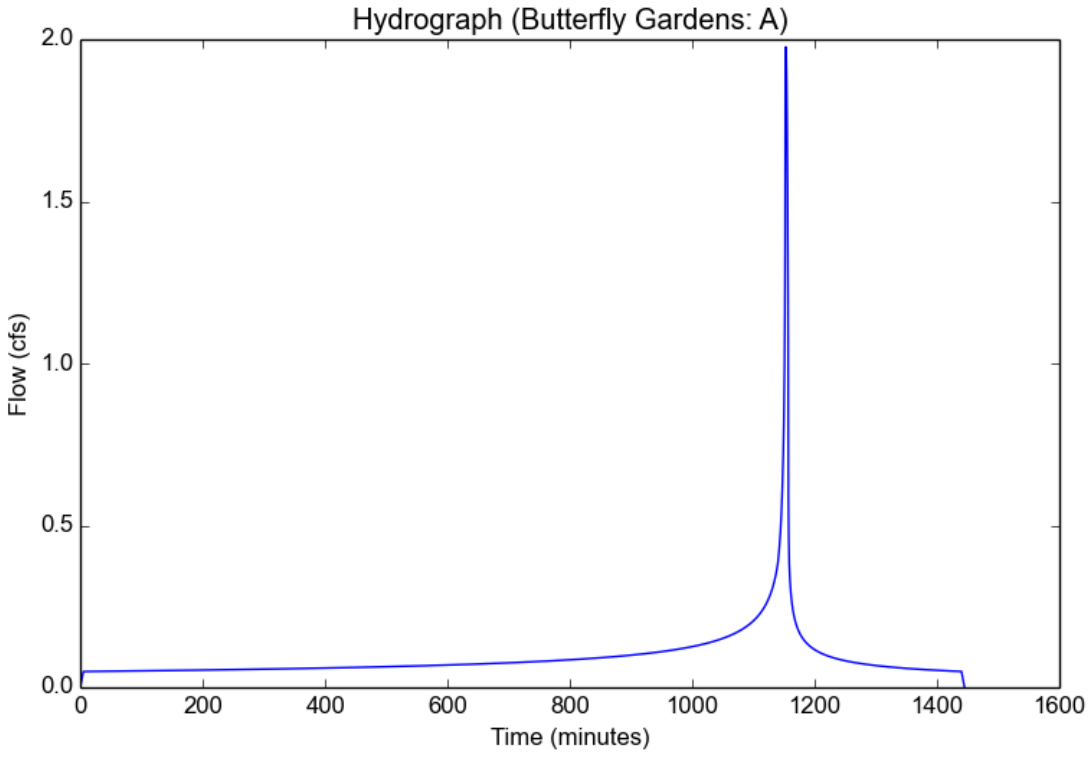
File location: C:/Users/Shiori/KHR Associates Dropbox/R Drive/Sanka Properties/Documents/Hydrology/Hydrology Calcs/Existing/EX-A - 25 yr.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Butterfly Gardens
Subarea ID	A
Area (ac)	0.88
Flow Path Length (ft)	223.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.41
Soil Type	15
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.8826
Peak Intensity (in/hr)	3.5097
Undeveloped Runoff Coefficient (Cu)	0.4594
Developed Runoff Coefficient (Cd)	0.64
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.9768
Burned Peak Flow Rate (cfs)	1.9768
24-Hr Clear Runoff Volume (ac-ft)	0.1882
24-Hr Clear Runoff Volume (cu-ft)	8199.7178



Peak Flow Hydrologic Analysis

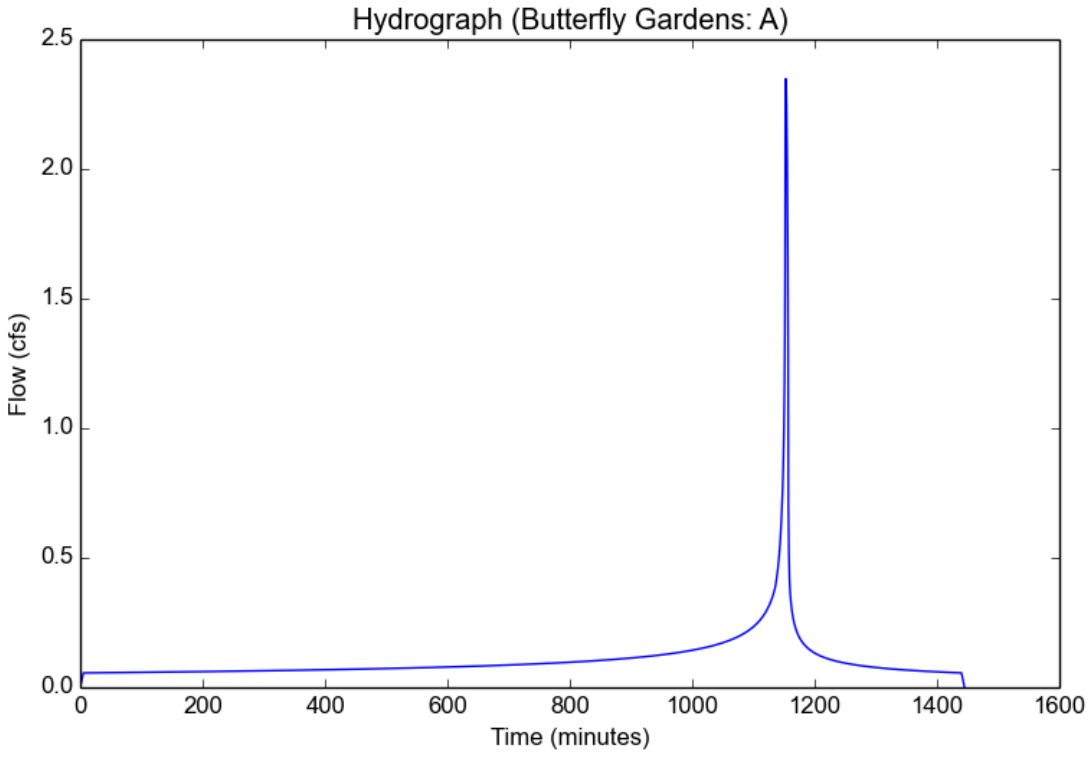
File location: C:/Users/Shiori/KHR Associates Dropbox/R Drive/Sanka Properties/Documents/Hydrology/Hydrology Calcs/Existing/EX-A - 50 yr.pdf
Version: HydroCalc 0.3.1-beta

Input Parameters

Project Name	Butterfly Gardens
Subarea ID	A
Area (ac)	0.88
Flow Path Length (ft)	223.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.41
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.7
Peak Intensity (in/hr)	3.9974
Undeveloped Runoff Coefficient (Cu)	0.506
Developed Runoff Coefficient (Cd)	0.6675
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.3482
Burned Peak Flow Rate (cfs)	2.3482
24-Hr Clear Runoff Volume (ac-ft)	0.2156
24-Hr Clear Runoff Volume (cu-ft)	9392.3943



Appendix 4 – Proposed Conditions Hydrology Map

1-STORY COMMERCIAL BUILDING
820 S. MARIPOSA ST.

PROP. DIVERSION JUNCTION STRUCTURE

PEAK FLOW BYPASS

STORMWATER PUMP

PROP. MAXWELL IV DRYWELL

WATER QUALITY OUTLET

PROP. 6' X 95' DETENTION CMP FOR LID

PROP. AQUA-SWIRL (PRETREATMENT)

PROP. SD

P/L

N74°13'23"E

357.52'

166.10

EX. R/W

PROP. R/W

MARIPOSA STREET

PROP. SD PARKWAY CULVERT OUTLET

(490)

SMH

CB

N22°57'27"W

PROP. SD POC TO MS4

P-A
0.88AC

N22°57'27"W

143.97'

144.00'

PROP. SD

PROP. SD

L = 228'

S = 0.0985

N15°00'43"E

P/L

(490)

(495)

P/L

N74°10'54"E

254.50'

SMH

1-STORY HOUSE
914 S. MARIPOSA ST.

VALLEY HEART DRIVE

36" SD

LEGEND

- SUBAREA BOUNDARY
- SURFACE FLOW PATH ONSITE
- X / X.XXAC. — SUBAREA LABEL

0 5 10 20 30

SCALE: 1"=10' DATE: 9/30/2024

BUTTERFLY GARDENS

BUTTERFLY GARDENS LLC

PRELIMINARY PROPOSED HYDROLOGY MAP

910 S. MARIPOSA STREET, BURBANK, CALIFORNIA 91506

KHR ASSOCIATES
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Irvine, California 92614

Appendix 5 – Proposed Conditions Peak Flow Hydraulic Analysis

Peak Flow Hydrologic Analysis

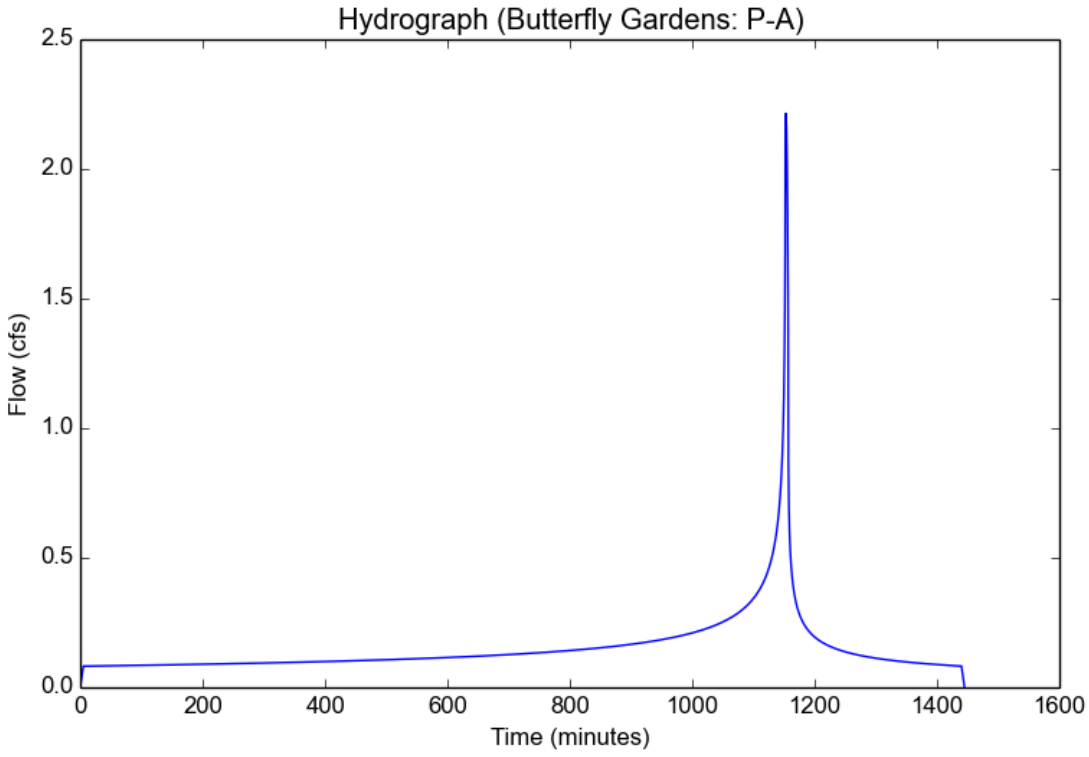
File location: C:/Users/Josh/KHR Associates Dropbox/R Drive/Sanka Properties/Mariposa-Burbank/Documents/Hydrology/Revised Report/Hydrology Cal
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Butterfly Gardens
Subarea ID	P-A
Area (ac)	0.88
Flow Path Length (ft)	228.0
Flow Path Slope (vft/hft)	0.0088
50-yr Rainfall Depth (in)	6.6
Percent Impervious	0.99
Soil Type	15
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7124
Peak Intensity (in/hr)	2.8115
Undeveloped Runoff Coefficient (Cu)	0.388
Developed Runoff Coefficient (Cd)	0.8949
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.2141
Burned Peak Flow Rate (cfs)	2.2141
24-Hr Clear Runoff Volume (ac-ft)	0.3058
24-Hr Clear Runoff Volume (cu-ft)	13318.7265



Peak Flow Hydrologic Analysis

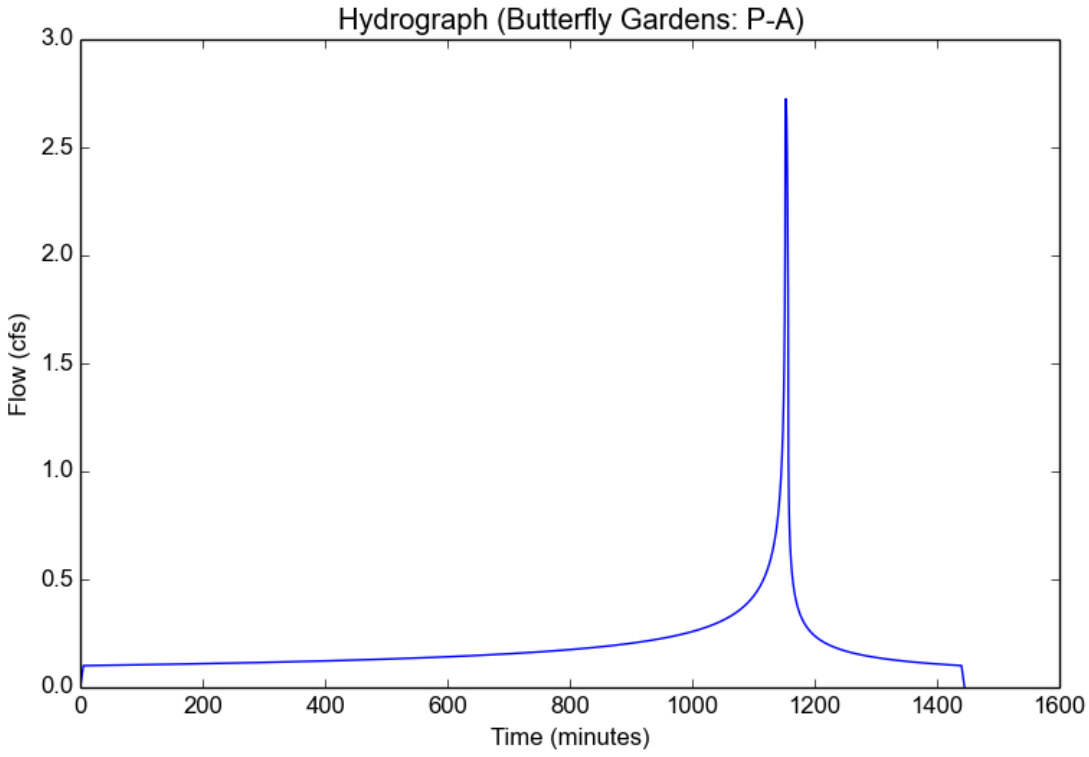
File location: C:/Users/Josh/KHR Associates Dropbox/R Drive/Sanka Properties/Mariposa-Burbank/Documents/Hydrology/Revised Report/Hydrology Cal
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Butterfly Gardens
Subarea ID	P-A
Area (ac)	0.88
Flow Path Length (ft)	228.0
Flow Path Slope (vft/hft)	0.0088
50-yr Rainfall Depth (in)	6.6
Percent Impervious	0.99
Soil Type	15
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.7948
Peak Intensity (in/hr)	3.4573
Undeveloped Runoff Coefficient (Cu)	0.4544
Developed Runoff Coefficient (Cd)	0.8955
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	2.7247
Burned Peak Flow Rate (cfs)	2.7247
24-Hr Clear Runoff Volume (ac-ft)	0.376
24-Hr Clear Runoff Volume (cu-ft)	16378.9251



Peak Flow Hydrologic Analysis

File location: C:/Users/Josh/KHR Associates Dropbox/R Drive/Sanka Properties/Mariposa-Burbank/Documents/Hydrology/Revised Report/Hydrology Cal
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Butterfly Gardens
Subarea ID	P-A
Area (ac)	0.88
Flow Path Length (ft)	228.0
Flow Path Slope (vft/hft)	0.0088
50-yr Rainfall Depth (in)	6.6
Percent Impervious	0.99
Soil Type	15
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.6
Peak Intensity (in/hr)	3.9377
Undeveloped Runoff Coefficient (Cu)	0.5003
Developed Runoff Coefficient (Cd)	0.896
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	3.1048
Burned Peak Flow Rate (cfs)	3.1048
24-Hr Clear Runoff Volume (ac-ft)	0.4283
24-Hr Clear Runoff Volume (cu-ft)	18655.6838