APPENDIX H

Low Impact Development and Hydrology Report

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LOW IMPACT DEVELOPMENT (LID) & HYDROLOGY REPORT

La Brea Tar Pits Design and Renovation

5801 Wilshire Boulevard Los Angeles, California 90036

KPFF Job # 1900236

June 2023

OWNER:

Natural History Museum of Los Angeles County
5801 Wilshire Boulevard Los Angeles,
California 90036

PREPARED BY:

KPFF Consulting Engineers
700 South Flower Street, Suite 2100
Los Angeles, CA 90017
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References

County of Los Angeles Department of Public Works Low Impact Development Standards Manual dated February 2014

County of Los Angeles Department of Public Works Hydrology Manual dated January 2006

I. Project Description

The project consists of enhancing the existing La Brea Tar Pits site for the Natural History Museum of Los Angeles County. This redesign is comprised of a new pedestrian path that connects the entire site, an expansion of the existing George C. Page Museum (referred to as Page Museum hereafter), new entry canopies and pavilion plazas on Wilshire Boulevard and Sixth Street, landscape and infrastructure improvements, and a new community lawn. An alternative to the originally proposed Page Museum expansion is being evaluated that would reduce the contact with the Page Museum and enlarge the central lawn and parking lot. The total project site is approximately 15.1 acres or 58,192 square feet. The overall permeability of the site will be reduced in the proposed condition, however the site will remain over 50% permeable.

II. Purpose and Scope

Although the project is located within the limits of the City of Los Angeles (LA), the site is owned by LA County and therefore LA County is the Authority Having Jurisdiction (AHJ) for all work within the property limits. Any work in the public right of way would be subject to City of LA permitting requirements and review.

The proposed project is currently in schematic design. Due to the early nature of this design, modifications to the site plan, building footprint, and drainage calculations are anticipated between this study and the final permitted version. As a requirement of the permitting process, the project will be required to provide a current Low Impact Development (LID) and Hydrology report for County review and approval in order to validate that the final design conforms to all stormwater requirements. The purpose of this report is to evaluate the potential impacts to stormwater quality and quantity as a result of the proposed project and to demonstrate the feasibility of integrating adequate mitigation measures.

III. Drainage Concept

A. Existing Drainage

Currently, the existing project site is 68.1% pervious. For the purposes of analyzing hydrology in this study, the streets adjacent have been included in the studied area; therefore, the overall permeability of the existing hydrology study area is 59.3%. There are a few different drainage patterns on the site. In general, the site is highest on the southeast corner at the intersection of Wilshire Boulevard and Curson Avenue and slopes to the northwest of the project site towards Sixth Street and Ogden Drive. The north edge of the site slopes towards Sixth Street where runoff flows to the street gutter and ultimately to existing curb inlets located in the street. Similarly, east of the Page Museum, the landscaping slopes east towards Curson Avenue where the runoff drains north to Sixth Street. A portion of the roof runoff generated by the Page Museum also discharges directly to Curson. Within the central core of the site, area drains and catch basins collect surface runoff and discharge to an existing natural channel running through the site referred to as Oil Creek. Oil Creek ultimately drains to an existing 30-inch storm drain that connects south into a City of LA mainline located in Wilshire Boulevard. A small portion of the southeast corner of the site drains directly to Wilshire Boulevard where it is collected by existing curb inlets. Lastly, the project site includes Tar Lake, where the naturally occurring groundwater level is visible as surface water. The runoff from the southern portion of the project site drains into the Lake Pit.

Refer to Exhibit 1 – Existing Hydrology for the existing drainage area map.

B. Proposed Drainage

The proposed development is divided into four drainage management areas, corresponding with the four outfalls described above. In the proposed condition, three of the drainage management areas include biofiltration planters designed in accordance with Low Impact Development requirements (refer to "Low Impact Development" section, below):

- Drainage Area 1, which consists of runoff from the northwest portion of the site and expansion of the Page Museum, drains to Biofiltration Planter 1 and overflows to Oil Creek.
- Drainage Area 2, which consists of runoff from the parking lot and the Page Museum and the area to the east of it, drains to Biofiltration Planter 2 and overflows to Sixth Street.
- Drainage Area 3, which consists of the southern portion of the site, drains to Biofiltration Planter 3 and overflows to Tar Lake.

Drainage Area 4 consists of runoff that drains to Wilshire Blvd. Because the proposed grading intends to convey all onsite drainage to onsite stormwater management systems prior to discharging offsite, the proposed area that drains to Wilshire is comprised entirely of public right-of-way and therefore Low Impact Development stormwater management will not be required.

Refer to Exhibit 2 – Proposed Hydrology for the proposed drainage area map.

IV. Low Impact Development (LID)

The LID standards provide guidance for the implementation of stormwater quality control measures to reduce the volume of stormwater runoff and potential pollutants. These stormwater quality control measures are designed to receive the first flush event, which are the small and frequent storm events and the initial volume of stormwater runoff of the larger storm events.

A. Methodology

Calculation results are based on the Los Angeles County Department of Public Works' *Low Impact Development Standards Manual* dated February 2014. Calculations were done using the Los Angeles County approved Hydrocalc software program. HydroCalc uses the modified rational method as outlined in the Los Angeles County Public Works Department Hydrology Manual. The input requirements for HydroCalc include the drainage area, soil type, percent imperviousness, length of flow path, slope of flow path, and rainfall isohyet. HydroCalc can provide results for a range of storm events. Soil type information and rain fall depth were taken from the Los Angeles Department of Public Works Hydrology Maps. Methods for calculating Low Impact Development (LID) flow rates and volumes are based on the 85th percentile storm event, which is 1.1 inch, 24-hour storm event.

Refer to Appendix A for both soil classification Map and 85th Percentile rain fall depth.

B. Structural Best Management Practices (BMPs)

Due to the nature of the site's tar sands as well as the presence of high groundwater, infiltration is not feasible for the project. Additionally, due to the need for drought tolerant plant species, we anticipate that the irrigation demand will not be high enough to meet the 96-hour drawdown requirement for a Capture & Reuse system. Therefore, we anticipate using biofiltration to meet the LID mitigation requirements for the project.

A biofiltration planter is a shallow vegetated planter that is designed to receive and detain stormwater runoff from the building and site, filter the runoff, and eventually discharge the filtered runoff to the public storm drain system. Planters are sized to treat 150% of the required 85th percentile storm, mitigated stormwater volume. In order to protect the amended soil within the planters from tar infiltration as well as prevent high ground water from flooding the planters, the project is proposing closed bottom planters with an underdrain.

As discussed previously in this report, the onsite portion of the project site is divided into 3 drainage management areas which each include a biofiltration planter sized for the tributary area. The table below summarizes the site LID calculation.

LID Summary					
Drainage Area	**% Impervious**	**Area (ac)**	**SWQDv (cu-ft)**	**Planter Area Required (sf)**	**Planter Area Provided (sf)**
DA-1	32.96	7.07	15,271.93	4,038.00	6,495.00
DA-2	75.37	4.06	16,952.81	3,619.00	6,379.00
DA-3	30.87	2.30	4,816.95	1,048.00	10,130.00

Refer to Exhibit 4 – Low Impact Development (LID) for the drainage area map and BMP locations and Appendix B for LID calculations.

C. Non-Structural BMPs

In addition to the structural BMPs proposed, the project will incorporate the following non-structural BMPs.

1. Open Paved Areas and Planter Areas

a. Regular sweeping of all open and planter areas, at a minimum, on a weekly basis in order to prevent dispersal of pollutants that may collect on those surfaces.

b. Regular pruning of the trees and shrubs in the planter areas to avoid formation of dried leaves and twigs, which are normally blown by the wind during windy days. These dried leaves are likely to clog the surface inlets of the drainage system when rain comes, which would result in flooding of the surrounding area due to reduced flow capacities of the inlets.

c. Trash and recycling containers shall be used such that, if they are to be located outside or apart from the principal structure, are fully enclosed and watertight in order to prevent contact of storm water with waste matter, which can be a potential source of bacteria and other pollutants in runoff. These containers shall be emptied and the wastes disposed of properly on a regular basis.

2. Education and Training

Annual training of employees on property management and proper methods of handling and disposal of waste shall be provided. Employees should understand the on-site BMPs and their maintenance requirements.

3. Landscape Management

Landscaping shall be maintained using minimum or no pesticides.

4. Litter Control

An adequate number of trash receptacles will be provided and inspected regularly. Leaky receptacles will be prepared or replaced. Receptacles shall be covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post “no hazardous materials” signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site.

5. Housekeeping of Loading Docks

Loaded and unloaded items shall be moved indoors as soon as possible.

6. Catch Basin Inspection

Stormwater pollution prevention information shall be provided. Owner shall be made aware that the following is to be followed: “Property owner shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create potential discharge to storm drains.” Catch basins shall be inspected regularly.

7. Design and Construct Trash and Waste Storage Areas to Reduce Pollutant Introduction

Trash and waste will be handled and stored for pickup adjacent to the loading dock. This limits the potential introduction of pollutants into the site. Trash and waste pickup will occur regularly.

8. Use Efficient Irrigation Systems & Landscaping Design

Landscape is generally designed to provide an efficient and continuous irrigation system. Landscape areas are designed to include plants that are friendly to the climate of Los Angeles.

9. Storm Drain Stencil Signage

Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language to prevent dumping of improper materials into the urban runoff conveyance system.

10. Monitoring and Maintenance

a. All BMPs shall be operated, monitored, and maintained for the life of the project and at a minimum, all structural BMPs shall be inspected, cleaned-out, and where necessary, repaired, at the following minimum frequencies: 1) prior to October 15th each year; 2) during each month between October 15th and April 15th of each year and, 3) at least twice during the dry season (between April 16 and October 14 of every year).

b. Debris and other water pollutants removed from structural BMPs during cleanout shall be contained and disposed of in a proper manner.

c. The drainage system and the associated structures and BMPs shall be maintained according to manufacturer's specification to ensure maximum pollutant removal efficiencies.

V. Hydrology

A. Methodology

The following hydrology calculations follow the LA County Hydrology Manual methodology with respect to return period. Because one of the purposes of this report is to identify impacts to existing or planned storm drain systems and because a portion of the downstream storm drain system includes the conveyance capacity of existing streets, the 25-year rain event was used for analysis. The flows and volumes are calculated based on the modified rational method outlined by the Los Angeles County Public Works Department Hydrology Manual using the Los Angeles County approved Hydrocalc software. Hydrocalc uses the 50-year rainfall depth as an input and then automatically calculates the 25-year depth.

The proposed flows and volumes are then evaluated with respect to the existing flows and volumes and the delta is reviewed with respect to the planned storm drain infrastructure.

Refer to Appendix A for both soil classification Map and 50-Year rain fall depth.

B. Hydrology Results

The proposed condition will decrease the overall permeability of the project. When looking at the hydrology study area, which includes both the project site and a portion of the adjacent streets, the overall permeability decreases from 59.3% to 51.9%. (Note: the permeability for the hydrology study section of this report is lower than the permeability shown in the LID section, since LID is focusing on the project parcel area only, and the hydrology study is looking at an expanded area that includes a portion of the public right-of-way.)

When considering Drainage Area 1, the peak flow that is conveyed to the creek will decrease from 21.19 cfs to 14.94 cfs, which is a reduction in peak flow of 6.22 cfs. The total volume of runoff will decrease from 73,087 cu-ft to 52,244 cu-ft, which is a net decrease of 20,843 cu-ft.

In Drainage Area 2, where the runoff is conveyed from Curson Avenue to Sixth Street, the peak flow of stormwater runoff increases from 5.36 cfs to 7.49 cfs, which is an increase of 2.13 cfs. The total volume of runoff will increase from 43,826 cu-ft to 79,015 cu-ft for a net increase of 35,189 cu-ft. According to the City of Los Angeles Bureau of Engineering Manual, Part G – Storm Drain

Design (Manual), dated June 1973, the permeability of individual sites is not calculated based on existing conditions but is instead based on the City's Master Plan of Zoning. In the Manual, large-scale developed sites have an assumed impermeability of at least 50%, with many of the adjacent parcels falling into a category where 100% impermeability is assumed. Although the proposed project will result in an increase in impermeability, the proposed impermeability is only 40.5%, which is still less than the assumed value used for the design of the downstream infrastructure. (Note: in this case, it is appropriate to use the permeability of the project site only for the purposes of comparison and not the permeability of the larger study area that includes the public streets. Per the City's manual, street area is analyzed separately from the private properties.) As such, the proposed runoff is not anticipated to exceed the capacity of the existing storm drain conveyance system.

In Drainage Area 3, the peak flow that is conveyed to Tar Lake will increase from 9.65 cfs in the existing condition to 10.78 cfs in the proposed condition, which is an increase of 1.13 cfs. The total volume of runoff increases from 17,673 cu-ft to 21,893 cu-ft, which is a net increase of 4,310 cu-ft. Due to the natural detention capabilities of the lake, much of this increase in flow is anticipated to be retained by the lake. It is also our understanding that the Natural History Museum has an agreement with the City of Los Angeles to discharge a portion of the lake water to the sanitary sewer system, due to the water quality impact of the tar. We understand that the flow of discharge to the sewer system is metered and monitored to avoid downstream impacts to the sewer system. Because of this, it is unlikely that the increase in total runoff volume from the 25-year storm will cause the lake to overflow. However, because of the observed seasonal fluctuation in the water elevation, it is difficult to quantify the total retention capacity of the lake. As a conservative approach, therefore, we have considered the impact to downstream systems if the full increase in runoff volume were to overflow the lake. In this condition, the runoff would ultimately discharge to Wilshire Blvd. Since Drainage Area 4 also drains to Wilshire, the combined impact is discussed below.

In Drainage Area 4, the peak flow that is conveyed directly to Wilshire Blvd decreases from 1.61 cfs in the existing condition to 1.35 cfs in the proposed condition, which is a decrease of 0.26 cfs. The volume will decrease from 11,350 cu-ft to 9,567 cu-ft for a net decrease of 1,784 cu-ft. When combined with the maximum increase from Drainage Area 3, the total maximum increase in peak flow would be 12.13 cfs and the total maximum increase in runoff volume would be 31,550 cu-ft. As previously discussed, the conveyance capacity of Wilshire Blvd is designed per the City of LA's Manual based on an assumed permeability for the project site. Since the proposed permeability is less than the standard assumed permeability, the downstream system should have adequate capacity to accommodate the additional flow.

The 25-year existing and proposed peak flows and runoff volumes for the site are summarized in the table below.

Hydrology Summary			
Drainage Area	**Existing**	**Proposed**	**Delta**
DA-1			
Area (ac)	8.59	7.07	(1.52)
% Permeability	58.56	67.04	8.48
Peak Flow (cfs)	21.19	14.97	(6.22)
Volume (cu-ft)	73,086.58	52,243.53	(20,843.05)
DA-2			
Area (ac)	4.51	5.69	1.18
% Permeability	49.00	17.57	(31.43)
Peak Flow (cfs)	5.36	7.49	2.13
Volume (cu-ft)	43,826.33	79,014.93	35,188.60
DA-3			
Area (ac)	3.59	4.01	0.42
% Permeability	85.79	81.55	(4.24)
Peak Flow (cfs)	9.65	10.78	1.13
Volume (cu-ft)	17,673.44	21,982.98	4,309.54
DA-4			
Area (ac)	0.7	0.59	(0.11)
% Permeability	0	0	-
Peak Flow (cfs)	1.61	1.35	(0.26)
Volume (cu-ft)	11,350.44	9,566.80	(1,783.64)

Refer to Appendix D for Existing Hydrology Calculations and Appendix F for Proposed Hydrology Calculations.

VI. Alternate 4

An alternative to the proposed plan (referred to as Alternate 4) is being evaluated for the purposes of the Environmental Impact Report (EIR), which considers an alternate geometry to the building addition. The differences in Alternative 4 and the proposed site plan are as follows: reducing the expansion of the Page Museum to reduce the visual and physical impacts, which would decrease the proposed building footprint, expanding the parking lot, and expanding the central lawn, which would preserve a larger portion of the existing berm on the west side of the Page Museum. The overall permeability of the site in Alternate 4 is 52.5% compared with 59.5% permeability in the base analysis. When looking at the overall hydrology study area, which includes a portion of the adjacent streets, Alternate 4 has an overall permeability of 50.7%, compared to 51.9% permeability in the base analysis.

A. Low Impact Development (LID)

The drainage area limits follow the same final discharge location as the base analysis plan, with slightly altered interior limits. Following the same methodology as the proposed plan, the Alternate 4 site will be able to accommodate Low Impact Development Strategies. See table below for the summary of results.

LID Summary - Alternate 4					
Drainage Area	**% Impervious**	**Area (ac)**	**SWQDv (cu-ft)**	**Planter Area Required (sf)**	**Planter Area Provided (sf)**
DA-1	34.96	6.75	15,224.39	3,248.00	6,495.00
DA-2	80.87	6.01	26,664.89	5,689.00	6,580.00
DA-3	31.17	2.31	4,870.41	1,060.00	10,130.00

Refer to Exhibit 5 – Alternate 4 Low Impact Development (LID) for the drainage area map and BMP locations and Appendix C for Alternate 4 LID calculations.

B. Hydrology

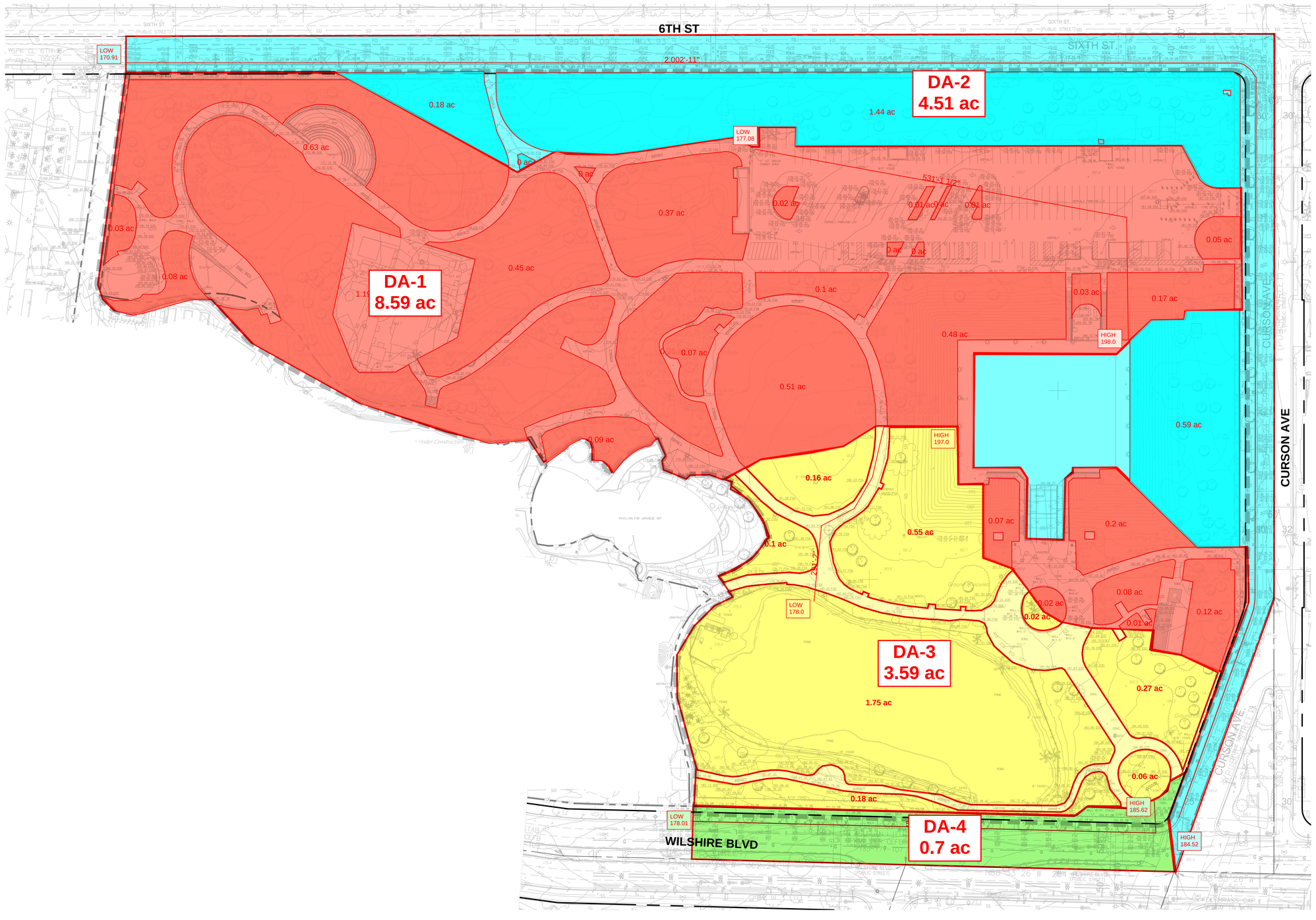
The methodology for hydrologic analysis is the same for Alternate 4 as described above for the base analysis. Because the permeability is slightly less in Alternate 4 than in the base analysis site plan, the peak flows and runoff volumes are slightly increased. However, the overall permeability is still higher than the assumed permeability used in the City's street design, therefore the additional flow is not anticipated to exceed the capacity of the existing storm drain systems.

The 25-year existing and proposed peak flows and runoff volumes for the Alternate 4 site are summarized in the table below.

Hydrology Summary – Alternate 4			
Drainage Area	**Existing**	**Alternate 4**	**Delta**
DA-1			
Area (ac)	8.59	6.75	(1.84)
% Permeability	58.56	65.04	6.48
Peak Flow (cfs)	21.19	14.30	(6.89)
Volume (cu-ft)	73,086.58	51,662.05	(21,424.53)
DA-2			
Area (ac)	4.51	6.01	1.50
% Permeability	49.00	19.13	(29.87)
Peak Flow (cfs)	5.36	7.88	2.53
Volume (cu-ft)	43,826.33	82,216.47	38,390.14
DA-3			
Area (ac)	3.59	4.01	0.42
% Permeability	85.79	81.55	(4.24)
Peak Flow (cfs)	9.65	10.78	1.13
Volume (cu-ft)	17,673.44	21,982.98	4,309.54
DA-4			
Area (ac)	0.7	0.59	(0.11)
% Permeability	0	0	-
Peak Flow (cfs)	1.61	1.35	(0.26)
Volume (cu-ft)	11,350.44	9,566.80	(1,783.64)

Refer to Exhibit 3 – Alternate 4 Proposed Hydrology for the drainage area map, Appendix D for Existing Hydrology Calculations, and Appendix F for Alternate 4 Proposed Hydrology calculations.

Exhibits



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REVISIONS

DATE		ISSUED FOR

DATE	06.14.2023
PROJECT NUMBER	1900236
DESIGNED BY	JB
DRAWN BY	TA
CHECKED BY	KS
SCALE	AS SPECIFIED

KEY MAP

PROJECT DESCRIPTION

LA BREA TAR PITS DESIGN MASTER PLAN

5801 WILSHIRE BOULEVARD
LOS ANGELES, CA 90036

DRAWING TITLE

EXISTING HYDROLOGY EXHIBIT

SHEET NUMBER (EXHIBIT NUMBER)

EXHB-01

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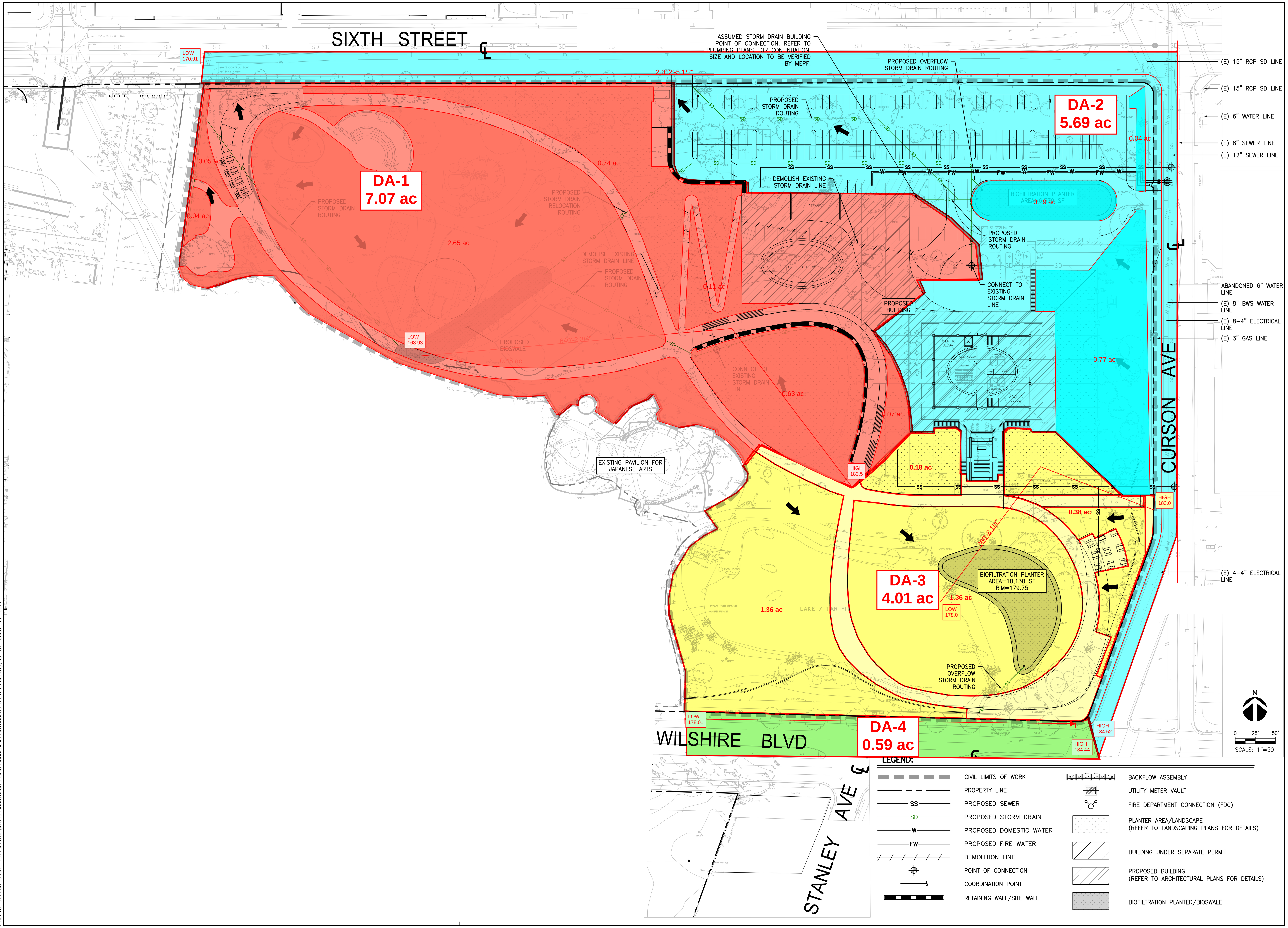
SIXTH STREET
WILSHIRE BLVD
CURSON AVE
STANLEY AVE
DA-1
7.07 ac
DA-2
5.69 ac
DA-3
4.01 ac
DA-4
0.59 ac
2.65 ac
0.74 ac
0.05 ac
0.04 ac
0.11 ac
0.63 ac
0.07 ac
0.19 ac
0.04 ac
0.77 ac
0.18 ac
0.38 ac
1.36 ac
1.36 ac
LOW 170.91
LOW 168.93
LOW 178.0
LOW 178.01
HIGH 183.5
HIGH 183.0
HIGH 184.52
HIGH 184.44
ASSUMED STORM DRAIN BUILDING POINT OF CONNECTION. REFER TO PLUMBING PLANS FOR CONTINUATION. SIZE AND LOCATION TO BE VERIFIED BY MEPF.
PROPOSED OVERFLOW STORM DRAIN ROUTING
PROPOSED STORM DRAIN ROUTING
DEMOLISH EXISTING STORM DRAIN LINE
PROPOSED STORM DRAIN RELOCATION ROUTING
CONNECT TO EXISTING STORM DRAIN LINE
PROPOSED BIOSWALE
PROPOSED BUILDING
EXISTING PAVILION FOR JAPANESE ARTS
BIOFILTRATION PLANTER AREA=10,130 SF RIM=179.75
LAKE / TAR PIT
(E) 15" RCP SD LINE
(E) 15" RCP SD LINE
(E) 6" WATER LINE
(E) 8" SEWER LINE
(E) 12" SEWER LINE
ABANDONED 6" WATER LINE
(E) 8" BWS WATER LINE
(E) 8-4" ELECTRICAL LINE
(E) 3" GAS LINE
(E) 4-4" ELECTRICAL LINE
SCALE: 1"=50'
0 25' 50'
N
LEGEND:
CIVIL LIMITS OF WORK
PROPERTY LINE
PROPOSED SEWER
PROPOSED STORM DRAIN
PROPOSED DOMESTIC WATER
PROPOSED FIRE WATER
DEMOLITION LINE
POINT OF CONNECTION
COORDINATION POINT
RETAINING WALL/SITE WALL
BACKFLOW ASSEMBLY
UTILITY METER VAULT
FIRE DEPARTMENT CONNECTION (FDC)
PLANTER AREA/LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
BUILDING UNDER SEPARATE PERMIT
PROPOSED BUILDING (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
BIOFILTRATION PLANTER/BIOSWALE

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DATE	△	ISSUED FOR

DATE	06.14.2023
PROJECT NUMBER	1900236
DESIGNED BY	JB
DRAWN BY	TA
CHECKED BY	KS
SCALE	AS SPECIFIED

KEY MAP

PROJECT DESCRIPTION
LA BREA TAR PITS DESIGN MASTER PLAN

5801 WILSHIRE BOULEVARD
LOS ANGELES, CA 90036

DRAWING TITLE
PROPOSED HYDROLOGY EXHIBIT

SHEET NUMBER (EXHIBIT NUMBER)
EXHB-02

SIXTH STREET

WILSHIRE BLVD

CURSON AVE

STANLEY AVE

ASSUMED STORM DRAIN BUILDING POINT OF CONNECTION. REFER TO PLUMBING PLANS FOR CONTINUATION. SIZE AND LOCATION TO BE VERIFIED BY MEPF.

PROPOSED OVERFLOW STORM DRAIN ROUTING

2.012'-5 1/2"

0.14 ac

PROPOSED STORM DRAIN ROUTING

DA-2
6.01 ac

0.16 ac

(E) 15" RCP SD LINE

(E) 15" RCP SD LINE

(E) 6" WATER LINE

(E) 8" SEWER LINE

(E) 12" SEWER LINE

LOW
170.91

0.05 ac

0.04 ac

PROPOSED STORM DRAIN ROUTING

0.44 ac

PROPOSED STORM DRAIN RELOCATION ROUTING

DEMOLISH EXISTING STORM DRAIN LINE

0.15 ac

PROPOSED STORM DRAIN ROUTING

2.65 ac

DA-1
6.75 ac

DEMOLISH EXISTING STORM DRAIN LINE

PROPOSED STORM DRAIN ROUTING

0.07 ac

CONNECT TO EXISTING STORM DRAIN LINE

PROPOSED BUILDING

ABANDONED 6" WATER LINE

(E) 8" BWS WATER LINE

(E) 8–4" ELECTRICAL LINE

(E) 3" GAS LINE

LOW
168.93

PROPOSED BIOSWALE

640'-2 3/4"

0.43 ac

CONNECT EXISTING STORM DRAIN LINE

0.63 ac

0.07 ac

0.7 ac

EXISTING PAVILION FOR JAPANESE ARTS

HIGH
183.5

0.18 ac

HIGH
183.0

0.38 ac

300'-9 1/4"

DA-3
4.01 ac

BIOFILTRATION PLANTER
AREA=10,130 SF
RIM=179.75

(E) 4–4" ELECTRICAL LINE

1.36 ac

LAKE / TAR PIT

1.36 ac

LOW
178.0

PROPOSED OVERFLOW STORM DRAIN ROUTING

LOW
178.01

DA-4
0.59 ac

HIGH
184.52

HIGH
184.44

N

0 25' 50'

SCALE: 1"=50'

- CIVIL LIMITS OF WORK
- PROPERTY LINE
- SS — PROPOSED SEWER
- SD — PROPOSED STORM DRAIN
- W — PROPOSED DOMESTIC WATER
- FW — PROPOSED FIRE WATER
- DEMOLITION LINE
- POINT OF CONNECTION
- COORDINATION POINT
- RETAINING WALL/SITE WALL
- BACKFLOW ASSEMBLY
- UTILITY METER VAULT
- FIRE DEPARTMENT CONNECTION (FDC)
- PLANTER AREA/LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- BUILDING UNDER SEPARATE PERMIT
- PROPOSED BUILDING (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
- BIOFILTRATION PLANTER/BIOSWALE

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KEY MAP

PROJECT DESCRIPTION

LA BREA TAR PITS DESIGN MASTER PLAN

5801 WILSHIRE BOULEVARD
LOS ANGELES, CA 90036

DRAWING TITLE

ALTERNATIVE 4
HYDROLOGY EXHIBIT

SHEET NUMBER (EXHIBIT NUMBER)

EXHB-03

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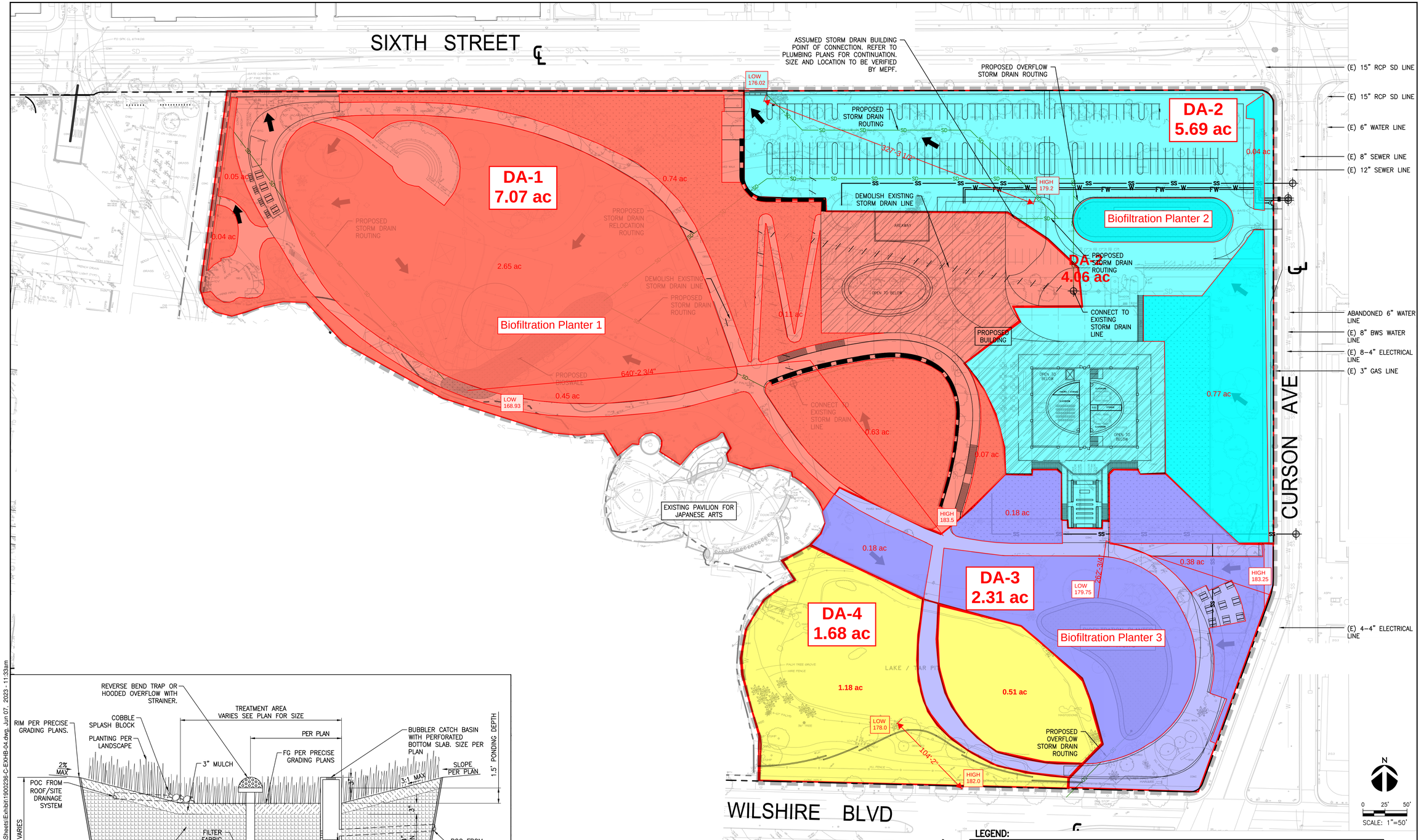

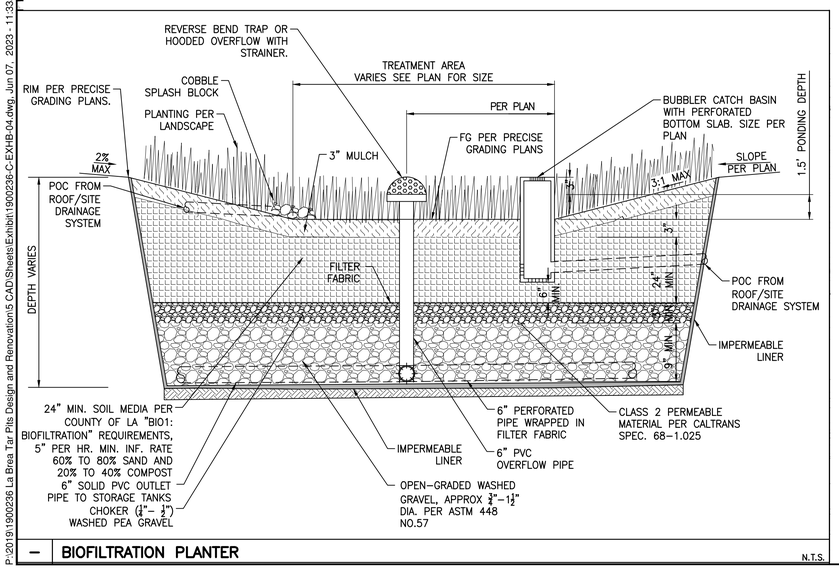

– BIOFILTRATION PLANTER

N.T.S.

LEGEND:

- CIVIL LIMITS OF WORK
- PROPERTY LINE
- SS — PROPOSED SEWER
- SD — PROPOSED STORM DRAIN
- W — PROPOSED DOMESTIC WATER
- FW — PROPOSED FIRE WATER
- DEMOLITION LINE
- POINT OF CONNECTION
- COORDINATION POINT
- RETAINING WALL/SITE WALL
- BACKFLOW ASSEMBLY
- UTILITY METER VAULT
- FIRE DEPARTMENT CONNECTION (FDC)
- PLANTER AREA/LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- BUILDING UNDER SEPARATE PERMIT
- PROPOSED BUILDING (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
- BIOFILTRATION PLANTER/BIOSWALE

kpff
700 South Flower Street
Suite 2100
Los Angeles, CA 90017
O: 213.418.0201
F: 213.266.5294
www.kpff.com

CONSULTANTS

STAMP

REVISIONS

DATE	△	ISSUED FOR

DATE	06.14.2023
PROJECT NUMBER	1900236
DESIGNED BY	JB
DRAWN BY	TA
CHECKED BY	KS
SCALE	AS SPECIFIED

KEY MAP

PROJECT DESCRIPTION

LA BREA TAR PITS DESIGN MASTER PLAN

5801 WILSHIRE BOULEVARD
LOS ANGELES, CA 90036

DRAWING TITLE

LOW IMPACT DEVELOPMENT (LID) EXHIBIT

SHEET NUMBER (EXHIBIT NUMBER)

EXHB-04

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SIXTH STREET

WILSHIRE BLVD

CURSON AVE

STANLEY AVE

ASSUMED STORM DRAIN BUILDING POINT OF CONNECTION. REFER TO PLUMBING PLANS FOR CONTINUATION. SIZE AND LOCATION TO BE VERIFIED BY MEPF.

PROPOSED OVERFLOW STORM DRAIN ROUTING

(E) 15" RCP SD LINE

(E) 15" RCP SD LINE

(E) 6" WATER LINE

(E) 8" SEWER LINE

(E) 12" SEWER LINE

ABANDONED 6" WATER LINE

(E) 8" BWS WATER LINE

(E) 8–4" ELECTRICAL LINE

(E) 3" GAS LINE

(E) 4–4" ELECTRICAL LINE

DA-1
6.75 ac

DA-2
6.01 ac -2
4.37 ac

DA-3
2.31 ac

DA-4
1.68 ac

Biofiltration Planter 1

Biofiltration Planter 2

Biofiltration Planter 3

0.14 ac

0.16 ac

0.05 ac

0.04 ac

2.65 ac

0.44 ac

0.07 ac

0.15 ac

0.63 ac

0.07 ac

0.7 ac

0.18 ac

0.18 ac

0.38 ac

1.18 ac

0.51 ac

LOW 176.0

HIGH 181.67

LOW 168.93

HIGH 183.5

LOW 179.75

HIGH 182.25

LOW 178.0

HIGH 182.0

760'-9 3/4"

640'-2 3/4"

262'-3 1/4"

104'-2"

PROPOSED STORM DRAIN ROUTING

PROPOSED STORM DRAIN RELOCATION ROUTING

DEMOLISH EXISTING STORM DRAIN LINE

PROPOSED STORM DRAIN ROUTING

CONNECT TO EXISTING STORM DRAIN LINE

PROPOSED BUILDING

PROPOSED BIOSWALE

CONNECT TO EXISTING STORM DRAIN LINE

EXISTING PAVILION FOR JAPANESE ARTS

PROPOSED OVERFLOW STORM DRAIN ROUTING

LAKE / TAR PIT

N

0 25' 50'

SCALE: 1"=50'

LEGEND:

- CIVIL LIMITS OF WORK
- PROPERTY LINE
- SS — PROPOSED SEWER
- SD — PROPOSED STORM DRAIN
- W — PROPOSED DOMESTIC WATER
- FW — PROPOSED FIRE WATER
- DEMOLITION LINE
- POINT OF CONNECTION
- COORDINATION POINT
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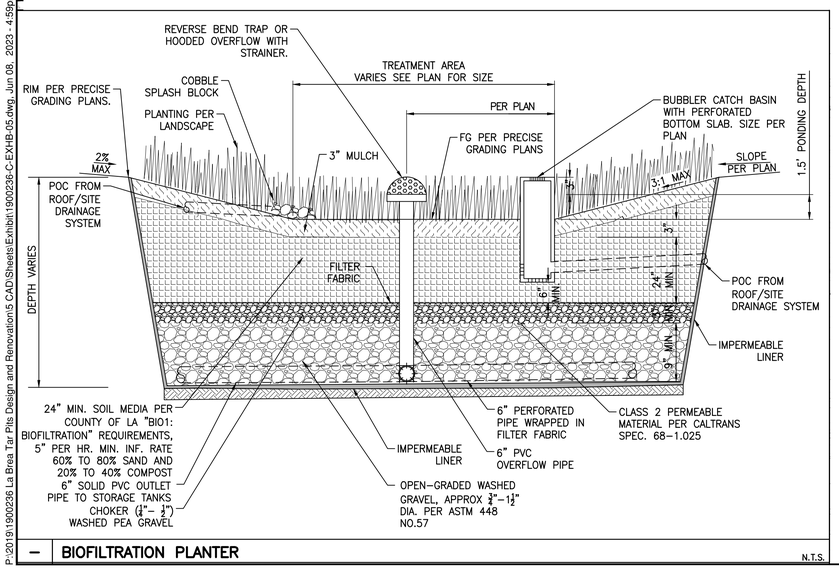
- PLANTER AREA/LANDSCAPE (REFER TO LANDSCAPING PLANS FOR DETAILS)
- BUILDING UNDER SEPARATE PERMIT
- PROPOSED BUILDING (REFER TO ARCHITECTURAL PLANS FOR DETAILS)
- BIOFILTRATION PLANTER/BIOSWALE



– BIOFILTRATION PLANTER

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CONSULTANTS

STAMP

REVISIONS

DATE	△	ISSUED FOR

DATE	06.14.2023
PROJECT NUMBER	1900236
DESIGNED BY	JB
DRAWN BY	TA
CHECKED BY	KS
SCALE	AS SPECIFIED

KEY MAP

PROJECT DESCRIPTION

LA BREA TAR PITS DESIGN MASTER PLAN

5801 WILSHIRE BOULEVARD
LOS ANGELES, CA 90036

DRAWING TITLE

ALTERNATIVE 4 LOW IMPACT DEVELOPMENT (LID) EXHIBIT

SHEET NUMBER (EXHIBIT NUMBER)

EXHB-05

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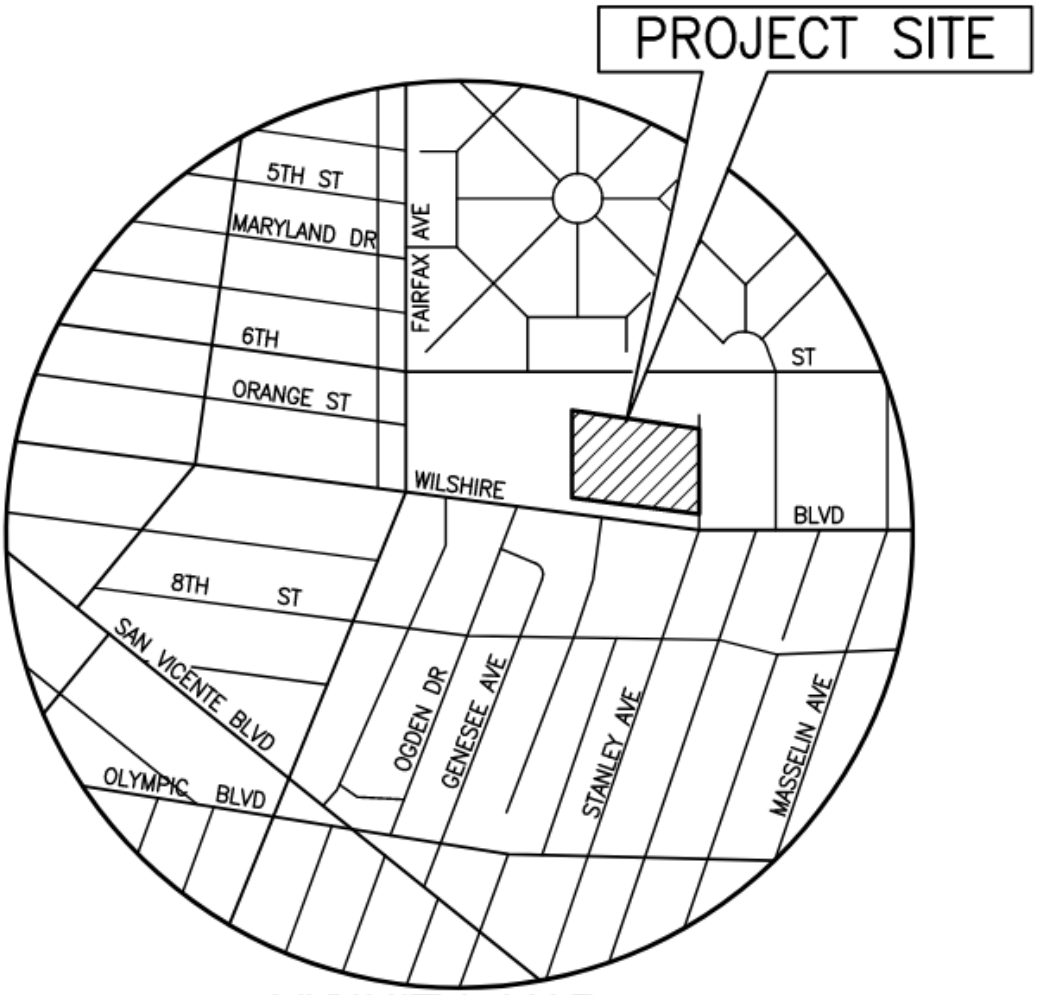
Appendices

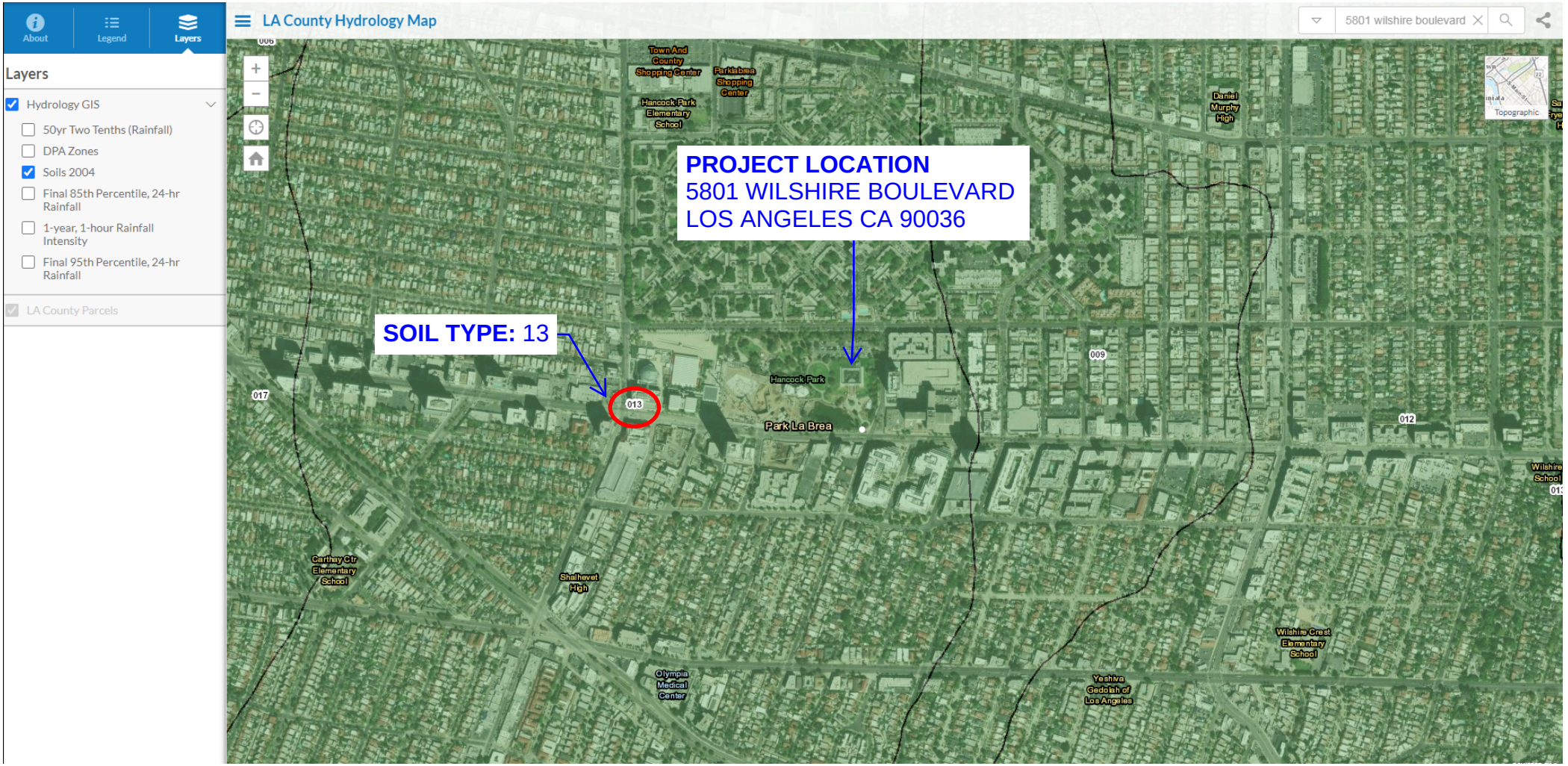
Appendix A
Vicinity Map and Rainfall Depth

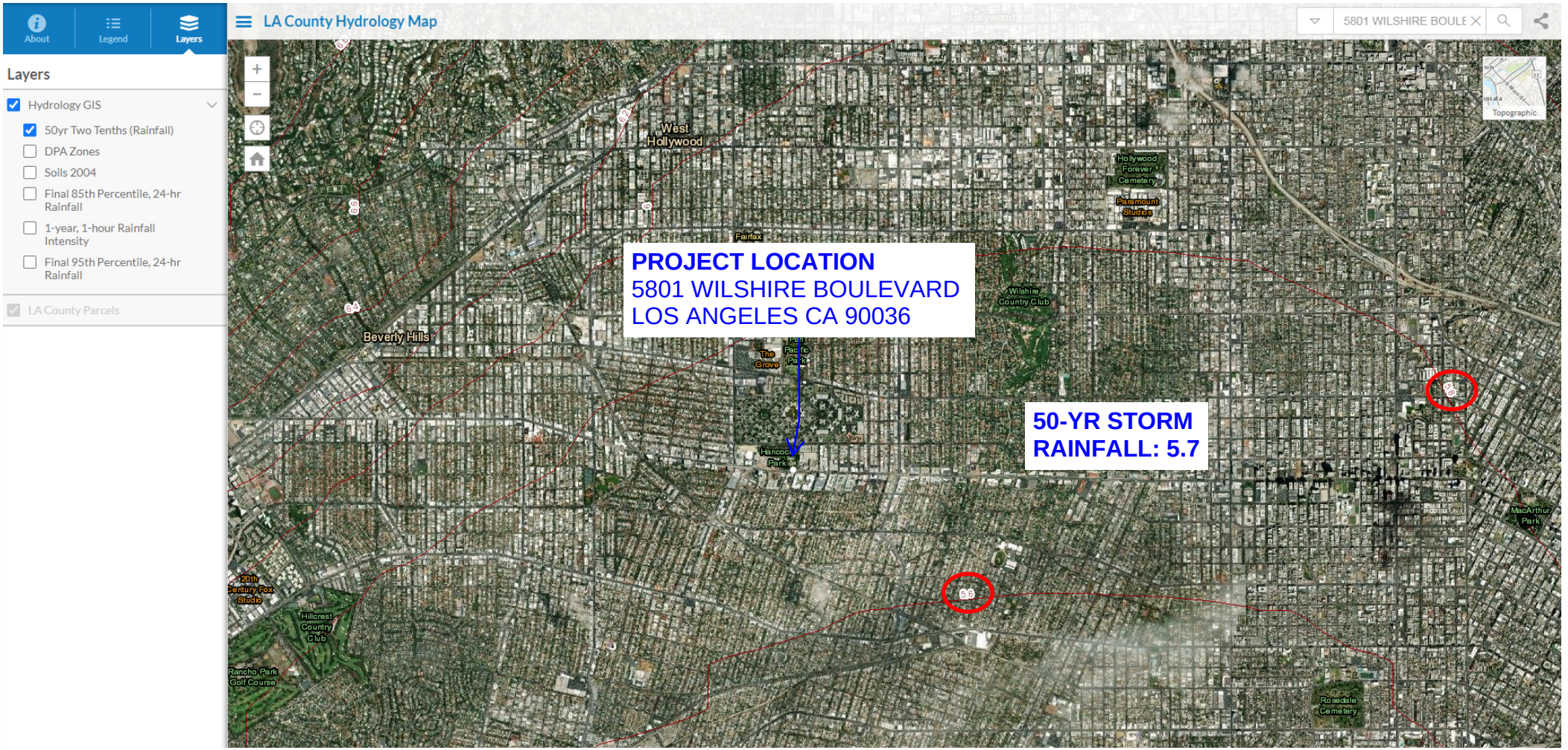


VICINITY MAP

NOT TO SCALE

THOMAS GUIDE **[LOS ANGELES]** EDITION
PAGE: **633** GRIDS: **B2 C2 C3**


About
Legend
Layers
LA County Hydrology Map
5801 wilshire boulevard
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
PROJECT LOCATION
5801 WILSHIRE BOULEVARD
LOS ANGELES CA 90036
SOIL TYPE: 13
013
017
009
012
Hancock Park
Park La Brea
Town And Country Shopping Center
Parklabrea Shopping Center
Hancock Park Elementary School
Daniel Murphy High
Topographic
Carthay Ctr Elementary School
Shalhevet High
Olympia Medical Center
Wilshire Crest Elementary School
Yeshiva Gedolah of Los Angeles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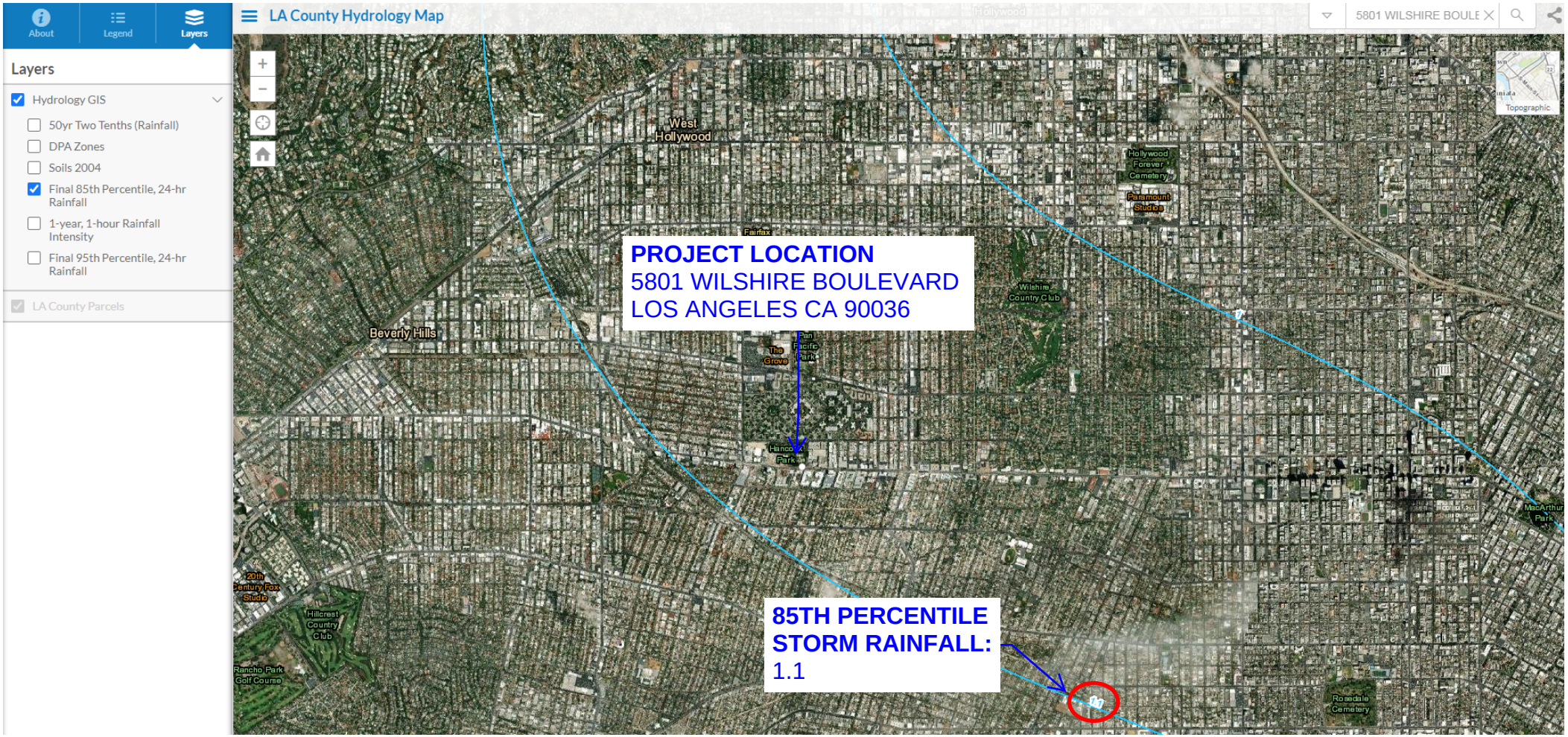
Layers
LA County Hydrology Map
5801 WILSHIRE BOULE
Layers
Hydrology GIS
50yr Two Tenths (Rainfall)
DPA Zones
Soils 2004
Final 85th Percentile, 24-hr Rainfall
1-year, 1-hour Rainfall Intensity
Final 95th Percentile, 24-hr Rainfall
LA County Parcels
Topographic
West Hollywood
Hollywood Forever Cemetery
Paramount Studios
Fairfax
Wilshire Country Club
Beverly Hills
The Grove
Hancock Park
MacArthur Park
20th Century Fox Studio
Hillcrest Country Club
Rancho Park Golf Course
Rosedale Cemetery
PROJECT LOCATION
5801 WILSHIRE BOULEVARD
LOS ANGELES CA 90036
50-YR STORM
RAINFALL: 5.7


About
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Soils 2004
Final 85th Percentile, 24-hr Rainfall
1-year, 1-hour Rainfall Intensity
Final 95th Percentile, 24-hr Rainfall
LA County Parcels
Topographic
West Hollywood
Hollywood Forever Cemetery
Paramount Studios
Fairfax
Wilshire Country Club
Beverly Hills
The Grove
Pan Pacific Park
Hancock Park
20th Century Fox Studio
Hillcrest Country Club
Rancho Park Golf Course
Rosedale Cemetery
PROJECT LOCATION
5801 WILSHIRE BOULEVARD
LOS ANGELES CA 90036
85TH PERCENTILE STORM RAINFALL:
1.1

Appendix B
LID Calculations

PROPOSED LID

Peak Flow Hydrologic Analysis

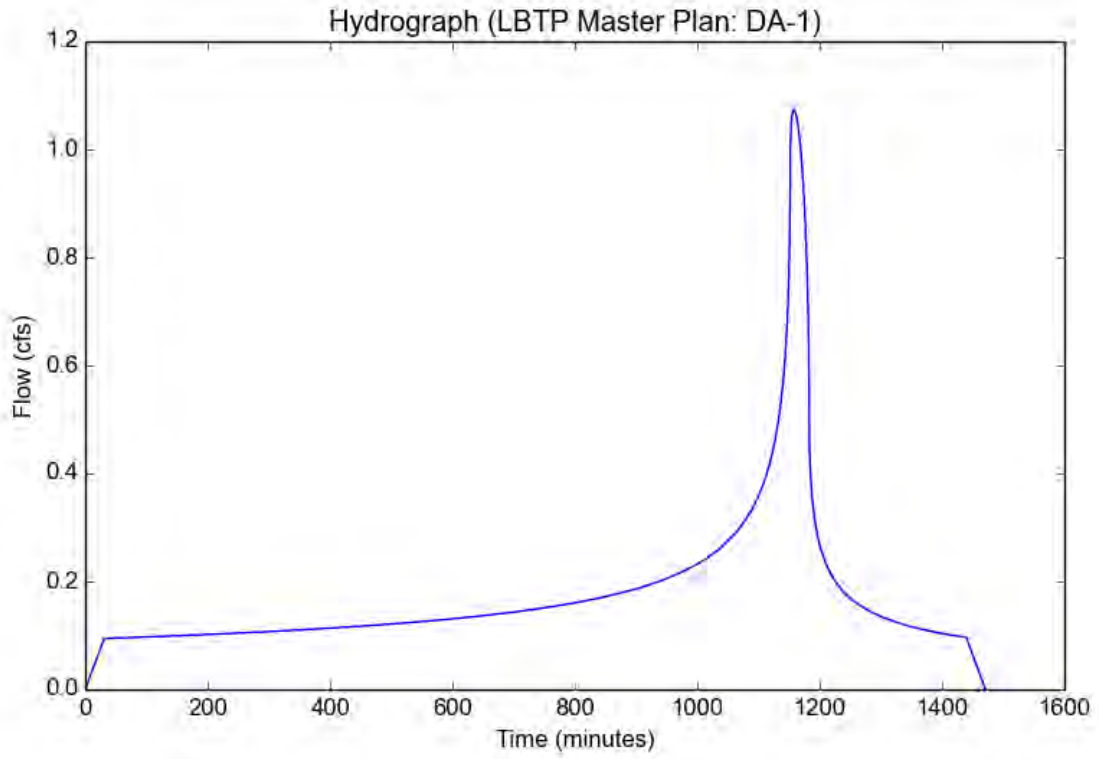
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan
Subarea ID	DA-1
Area (ac)	7.07
Flow Path Length (ft)	640.23
Flow Path Slope (vft/hft)	0.022757447
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.329561528
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.4176
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.3636
Time of Concentration (min)	31.0
Clear Peak Flow Rate (cfs)	1.0737
Burned Peak Flow Rate (cfs)	1.0737
24-Hr Clear Runoff Volume (ac-ft)	0.3506
24-Hr Clear Runoff Volume (cu-ft)	15271.9274



PROPOSED LID

Peak Flow Hydrologic Analysis

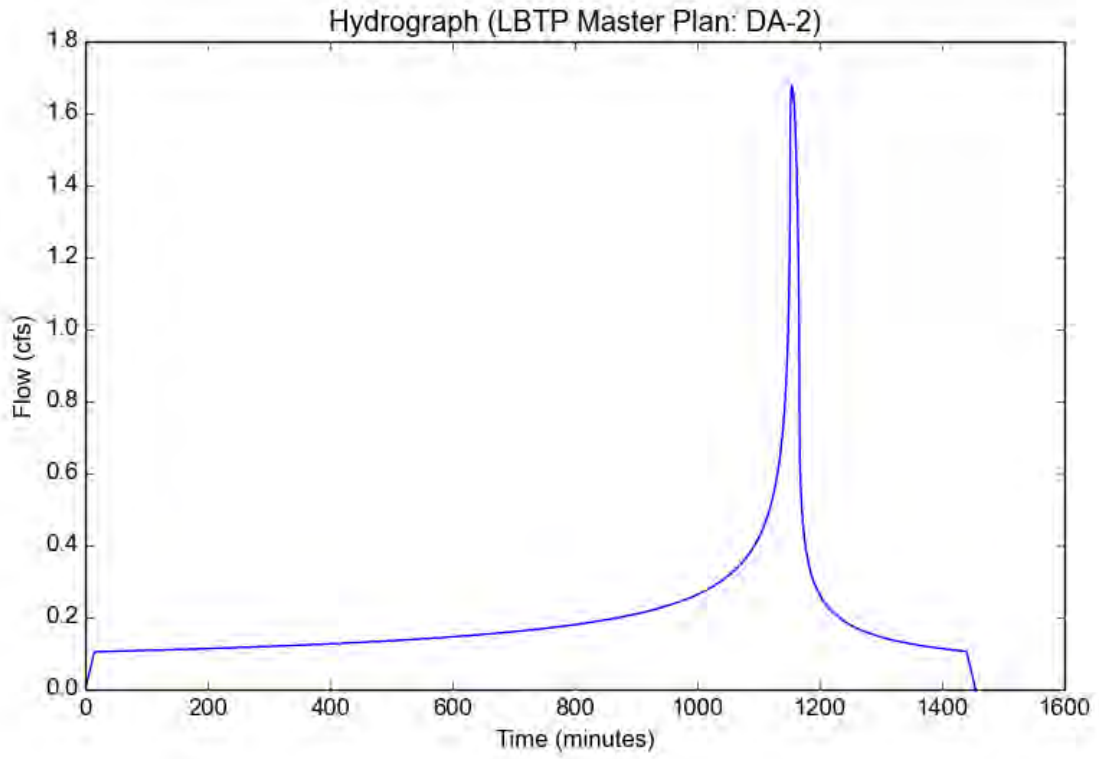
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan
Subarea ID	DA-2
Area (ac)	4.06
Flow Path Length (ft)	327.29
Flow Path Slope (vft/hft)	0.009716154
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.753694581
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.5874
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.703
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	1.6765
Burned Peak Flow Rate (cfs)	1.6765
24-Hr Clear Runoff Volume (ac-ft)	0.3892
24-Hr Clear Runoff Volume (cu-ft)	16952.8082



PROPOSED LID

Peak Flow Hydrologic Analysis

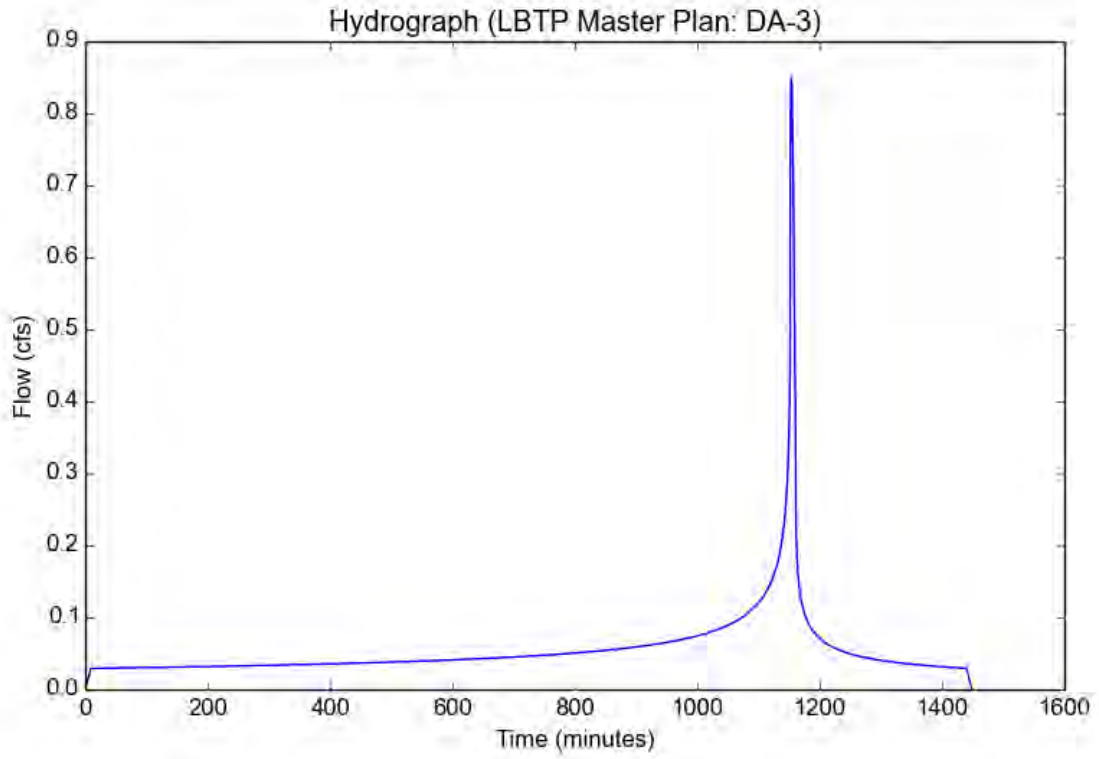
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan
Subarea ID	DA-3
Area (ac)	2.3
Flow Path Length (ft)	262.06
Flow Path Slope (vft/hft)	0.263
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.308695652
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.7468
Undeveloped Runoff Coefficient (Cu)	0.3129
Developed Runoff Coefficient (Cd)	0.4941
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	0.8487
Burned Peak Flow Rate (cfs)	0.8487
24-Hr Clear Runoff Volume (ac-ft)	0.1106
24-Hr Clear Runoff Volume (cu-ft)	4816.9533



PROPOSED LID

Peak Flow Hydrologic Analysis

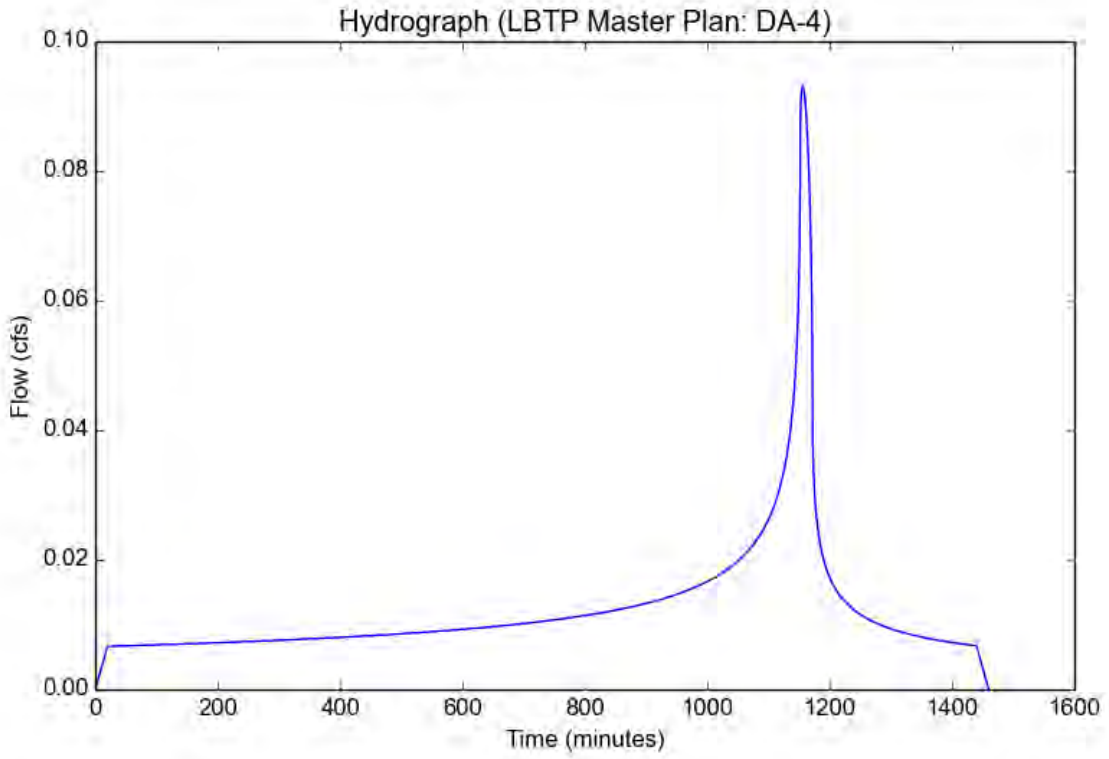
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan
Subarea ID	DA-4
Area (ac)	1.68
Flow Path Length (ft)	104.167
Flow Path Slope (vft/hft)	0.038399877
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.01
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.5131
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.108
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	0.0931
Burned Peak Flow Rate (cfs)	0.0931
24-Hr Clear Runoff Volume (ac-ft)	0.0247
24-Hr Clear Runoff Volume (cu-ft)	1077.7591



PROPOSED LID

Biofiltration Planter 1	DA-1		
[1]	85th Percentile Rainfall Depth (in)		1.10
[2]	Design Rainfall Depth (in)	[1] * 1.5	1.65
[3]	Clear Peak Flow Rate (cfs)	From Hydrocalc (Qpm)	1.07
[4]	24-Hr Clear Runoff Volume (cu-ft)	From Hydrocalc (=1.5 SWQDv)	15,272
[5]	$K_{sat,media}$ (in/hr)		5
[6]	FS		2
[7]	$K_{sat,design}$ (in/hr)	[5] / [6]	2.5
[8]	Proposed Planter Area (sf)		6,495
[9]	Proposed Planter Flow Rate (cfs)	[7]/12 in*[8]/60min*1/60sec	0.376
[10]	Proposed Total Storage Volume Required (cu-ft)	Use Hydrocalc CSV file to calculate area under hydrograph and above Planter Flow Rate	1,463
[11]	Proposed Additional Storage Volume Required (cu-ft)		0
[12]	d_{p_max}, Max. Ponding Depth (ft)		1
[13]	Proposed d_p, Calculated Ponding Depth (ft)	Use Hydrocalc CSV file to calculate peak depth. Roughly = [10]/[8]	0.23
[14]	Drawdown Time (hr)	[13]*12 in/ft /[7]	1.08
[15]	**A_{min} (sq. ft) (minimum area required)**	Iterate [8] until [13] = [12]	**4,038**

PROPOSED LID

Biofiltration Planter 2	DA-2		
[1]	85th Percentile Rainfall Depth (in)		1.10
[2]	Design Rainfall Depth (in)	[1] * 1.5	1.65
[3]	Clear Peak Flow Rate (cfs)	From Hydrocalc (Qpm)	1.68
[4]	24-Hr Clear Runoff Volume (cu-ft)	From Hydrocalc (=1.5 SWQDv)	16,953
[5]	$K_{sat,media}$ (in/hr)		5
[6]	FS		2
[7]	$K_{sat,design}$ (in/hr)	[5] / [6]	2.5
[8]	Proposed Planter Area (sf)		6,379
[9]	Proposed Planter Flow Rate (cfs)	[7]/12 in*[8]/60min*1/60sec	0.369
[10]	Proposed Total Storage Volume Required (cu-ft)	Use Hydrocalc CSV file to calculate area under hydrograph and above Planter Flow Rate	1,903
[11]	Proposed Additional Storage Volume Required (cu-ft)		0
[12]	d_{p_max}, Max. Ponding Depth (ft)		1
[13]	Proposed d_p, Calculated Ponding Depth (ft)	Use Hydrocalc CSV file to calculate peak depth. Roughly = [10]/[8]	0.30
[14]	Drawdown Time (hr)	[13]*12 in/ft /[7]	1.43
[15]	**A_{min} (sq. ft) (minimum area required)**	Iterate [8] until [13] = [12]	**3,619**

PROPOSED LID

Biofiltration Planter 3	DA-3		
[1]	85th Percentile Rainfall Depth (in)		1.10
[2]	Design Rainfall Depth (in)	[1] * 1.5	1.65
[3]	Clear Peak Flow Rate (cfs)	From Hydrocalc (Qpm)	0.85
[4]	24-Hr Clear Runoff Volume (cu-ft)	From Hydrocalc (=1.5 SWQDv)	4,817
[5]	$K_{sat,media}$ (in/hr)		5
[6]	FS		2
[7]	$K_{sat,design}$ (in/hr)	[5] /[6]	2.5
[8]	Proposed Planter Area (sf)		10,130
[9]	Proposed Planter Flow Rate (cfs)	[7]/12 in*[8]/60min*1/60sec	0.586
[10]	Proposed Total Storage Volume Required (cu-ft)	Use Hydrocalc CSV file to calculate area under hydrograph and above Planter Flow Rate	69
[11]	Proposed Additional Storage Volume Required (cu-ft)		0
[12]	d_{p_max}, Max. Ponding Depth (ft)		1
[13]	Proposed d_p, Calculated Ponding Depth (ft)	Use Hydrocalc CSV file to calculate peak depth. Roughly = [10]/[8]	0.01
[14]	Drawdown Time (hr)	[13]*12 in/ft /[7]	0.03
[15]	**A_{min} (sq. ft) (minimum area required)**	Iterate [8] until [13] = [12]	**1,048**

Appendix C
Alternate 4 LID Calculations

ALTERNATE 4 LID

Peak Flow Hydrologic Analysis

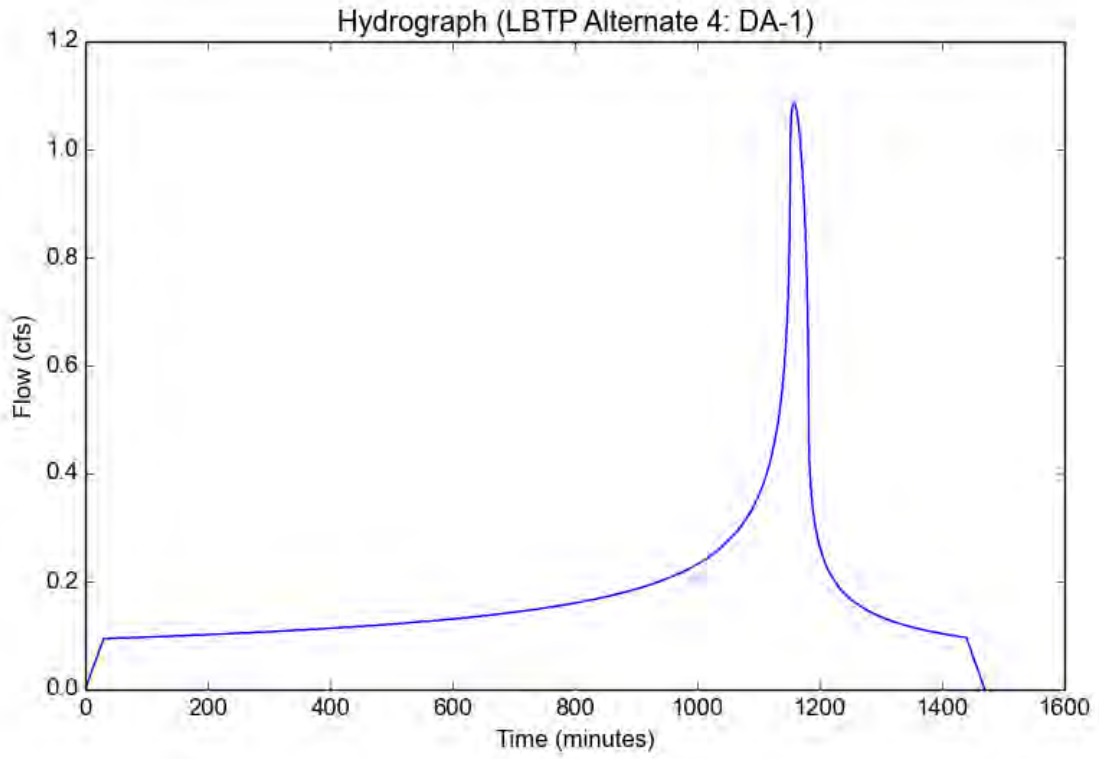
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4
Subarea ID	DA-1
Area (ac)	6.75
Flow Path Length (ft)	640.23
Flow Path Slope (vft/hft)	0.022757447
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.34962963
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.4241
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.3797
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	1.0869
Burned Peak Flow Rate (cfs)	1.0869
24-Hr Clear Runoff Volume (ac-ft)	0.3495
24-Hr Clear Runoff Volume (cu-ft)	15224.3948



ALTERNATE 4 LID

Peak Flow Hydrologic Analysis

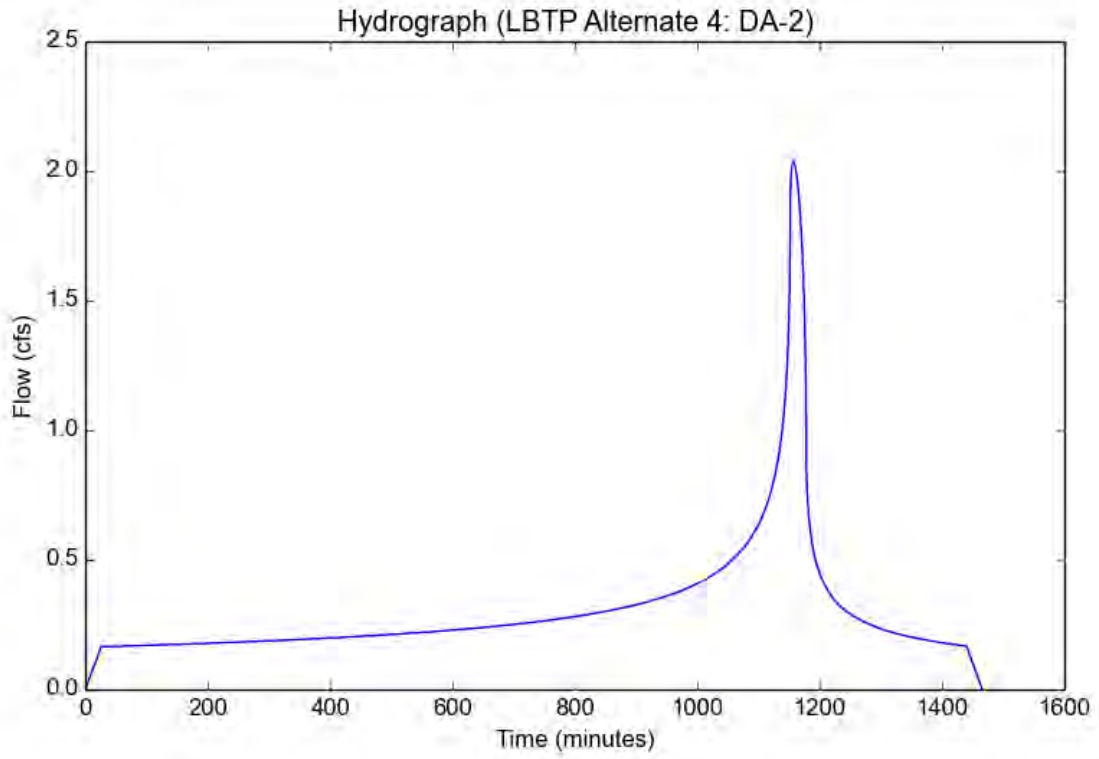
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4
Subarea ID	DA-2
Area (ac)	6.01
Flow Path Length (ft)	760.81
Flow Path Slope (vft/hft)	0.007452583
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.808652246
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.4536
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.7469
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	2.0362
Burned Peak Flow Rate (cfs)	2.0362
24-Hr Clear Runoff Volume (ac-ft)	0.6121
24-Hr Clear Runoff Volume (cu-ft)	26664.8893



ALTERNATE 4 LID

Peak Flow Hydrologic Analysis

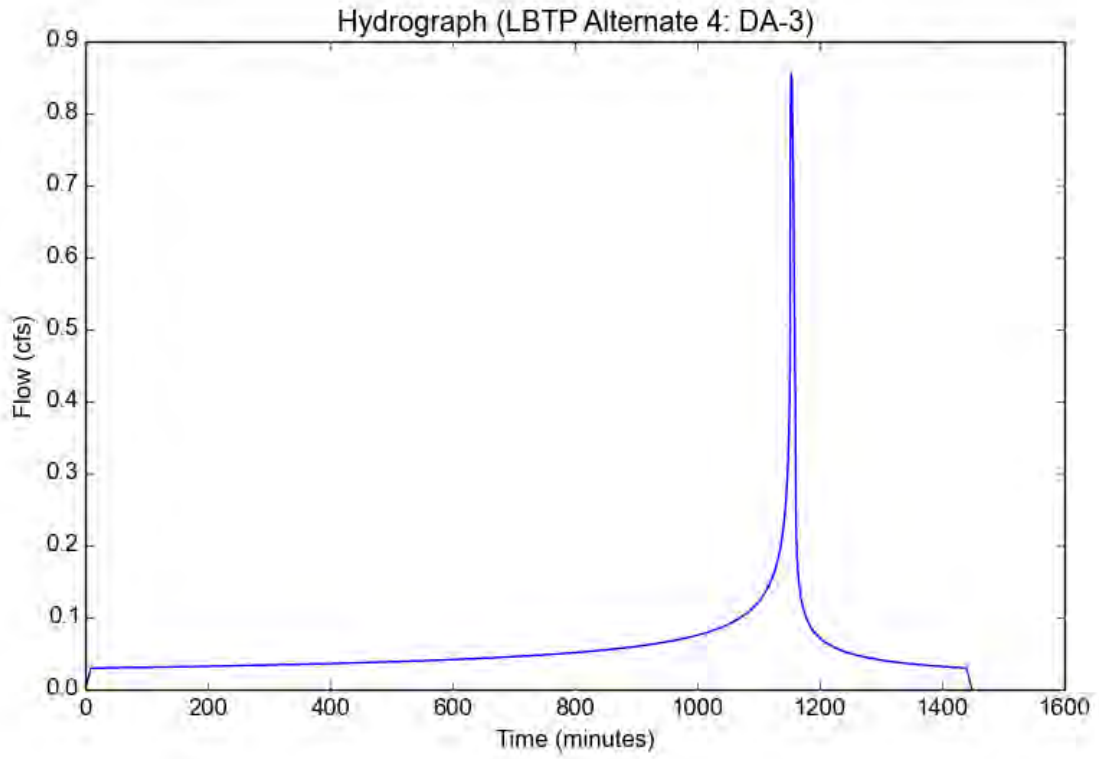
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4
Subarea ID	DA-3
Area (ac)	2.31
Flow Path Length (ft)	262.06
Flow Path Slope (vft/hft)	0.263
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.311688312
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.7468
Undeveloped Runoff Coefficient (Cu)	0.3129
Developed Runoff Coefficient (Cd)	0.4959
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	0.8555
Burned Peak Flow Rate (cfs)	0.8555
24-Hr Clear Runoff Volume (ac-ft)	0.1118
24-Hr Clear Runoff Volume (cu-ft)	4870.4134



ALTERNATE 4 LID

Peak Flow Hydrologic Analysis

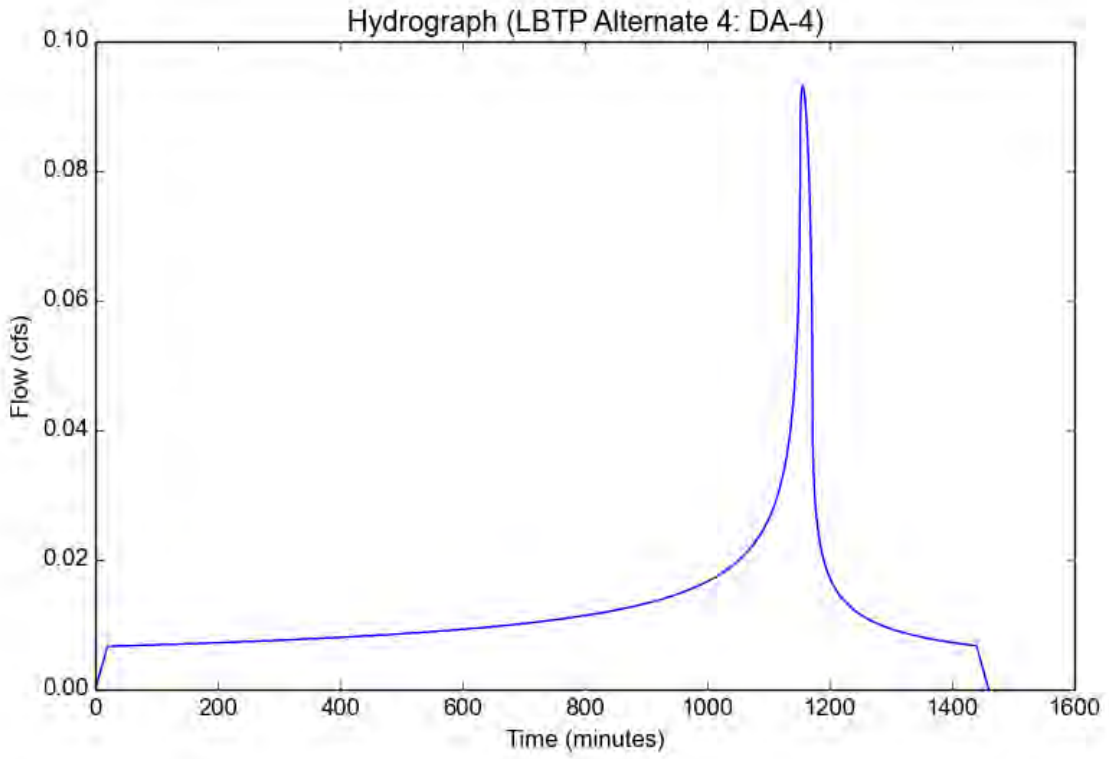
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4
Subarea ID	DA-4
Area (ac)	1.68
Flow Path Length (ft)	104.167
Flow Path Slope (vft/hft)	0.038399877
85th Percentile Rainfall Depth (in)	1.65
Percent Impervious	0.01
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.65
Peak Intensity (in/hr)	0.5131
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.108
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	0.0931
Burned Peak Flow Rate (cfs)	0.0931
24-Hr Clear Runoff Volume (ac-ft)	0.0247
24-Hr Clear Runoff Volume (cu-ft)	1077.7591



ALTERNATE 4 LID

Biofiltration Planter 1	DA-1		
[1]	85th Percentile Rainfall Depth (in)		1.10
[2]	Design Rainfall Depth (in)	[1] * 1.5	1.65
[3]	Clear Peak Flow Rate (cfs)	From Hydrocalc (Qpm)	1.09
[4]	24-Hr Clear Runoff Volume (cu-ft)	From Hydrocalc (=1.5 SWQDv)	15,224
[5]	$K_{sat,media}$ (in/hr)		5
[6]	FS		2
[7]	$K_{sat,design}$ (in/hr)	[5] / [6]	2.5
[8]	Proposed Planter Area (sf)		6,495
[9]	Proposed Planter Flow Rate (cfs)	[7]/12 in*[8]/60min*1/60sec	0.376
[10]	Proposed Total Storage Volume Required (cu-ft)	Use Hydrocalc CSV file to calculate area under hydrograph and above Planter Flow Rate	1,455
[11]	Proposed Additional Storage Volume Required (cu-ft)		0
[12]	d_{p_max}, Max. Ponding Depth (ft)		1
[13]	Proposed d_p, Calculated Ponding Depth (ft)	Use Hydrocalc CSV file to calculate peak depth. Roughly = [10]/[8]	0.22
[14]	Drawdown Time (hr)	[13]*12 in/ft /[7]	1.08
[15]	**A_{min} (sq. ft) (minimum area required)**	Iterate [8] until [13] = [12]	**3,248**

ALTERNATE 4 LID

Biofiltration Planter 2	DA-2		
[1]	85th Percentile Rainfall Depth (in)		1.10
[2]	Design Rainfall Depth (in)	[1] * 1.5	1.65
[3]	Clear Peak Flow Rate (cfs)	From Hydrocalc (Qpm)	2.04
[4]	24-Hr Clear Runoff Volume (cu-ft)	From Hydrocalc (=1.5 SWQDv)	26,665
[5]	$K_{sat,media}$ (in/hr)		5
[6]	FS		2
[7]	$K_{sat,design}$ (in/hr)	[5] / [6]	2.5
[8]	Proposed Planter Area (sf)		6,580
[9]	Proposed Planter Flow Rate (cfs)	[7]/12 in*[8]/60min*1/60sec	0.381
[10]	Proposed Total Storage Volume Required (cu-ft)	Use Hydrocalc CSV file to calculate area under hydrograph and above Planter Flow Rate	4,825
[11]	Proposed Additional Storage Volume Required (cu-ft)		0
[12]	d_{p_max}, Max. Ponding Depth (ft)		1
[13]	Proposed d_p, Calculated Ponding Depth (ft)	Use Hydrocalc CSV file to calculate peak depth. Roughly = [10]/[8]	0.73
[14]	Drawdown Time (hr)	[13]*12 in/ft /[7]	3.52
[15]	**A_{min} (sq. ft) (minimum area required)**	Iterate [8] until [13] = [12]	**5,689**

ALTERNATE 4 LID

Biofiltration Planter 3	DA-3		
[1]	85th Percentile Rainfall Depth (in)		1.10
[2]	Design Rainfall Depth (in)	[1] * 1.5	1.65
[3]	Clear Peak Flow Rate (cfs)	From Hydrocalc (Qpm)	0.86
[4]	24-Hr Clear Runoff Volume (cu-ft)	From Hydrocalc (=1.5 SWQDv)	4,870
[5]	$K_{sat,media}$ (in/hr)		5
[6]	FS		2
[7]	$K_{sat,design}$ (in/hr)	[5] /[6]	2.5
[8]	Proposed Planter Area (sf)		10,130
[9]	Proposed Planter Flow Rate (cfs)	[7]/12 in*[8]/60min*1/60sec	0.586
[10]	Proposed Total Storage Volume Required (cu-ft)	Use Hydrocalc CSV file to calculate area under hydrograph and above Planter Flow Rate	72
[11]	Proposed Additional Storage Volume Required (cu-ft)		0
[12]	d_{p_max}, Max. Ponding Depth (ft)		1
[13]	Proposed d_p, Calculated Ponding Depth (ft)	Use Hydrocalc CSV file to calculate peak depth. Roughly = [10]/[8]	0.01
[14]	Drawdown Time (hr)	[13]*12 in/ft /[7]	0.03
[15]	**A_{min} (sq. ft) (minimum area required)**	Iterate [8] until [13] = [12]	**1,060**

Appendix D
Existing Hydrology Calculations

EXISTING HYDROLOGY

Peak Flow Hydrologic Analysis

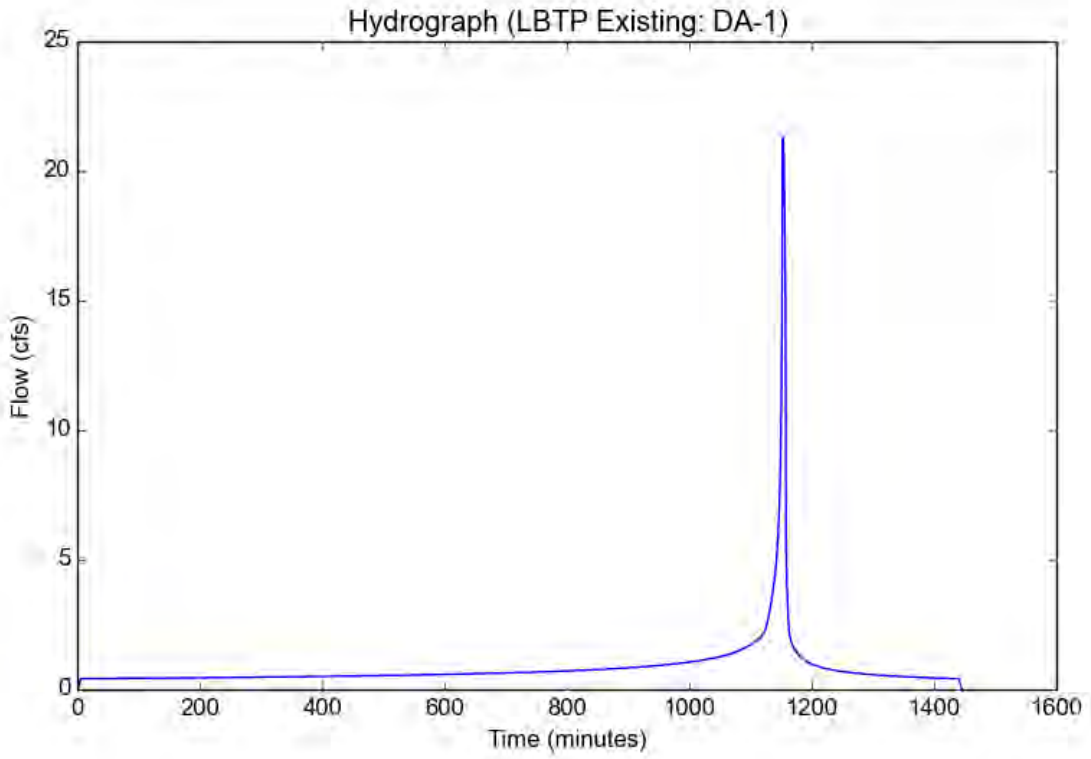
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Existing/Hydrocalc/Hydrocalc Output_LBTP Existing Report.p
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Existing
Subarea ID	DA-1
Area (ac)	8.59
Flow Path Length (ft)	531.1
Flow Path Slope (vft/hft)	0.039389945
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.41443539
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.7407
Undeveloped Runoff Coefficient (Cu)	0.9082
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	6.0
Clear Peak Flow Rate (cfs)	21.1882
Burned Peak Flow Rate (cfs)	21.1882
24-Hr Clear Runoff Volume (ac-ft)	1.6778
24-Hr Clear Runoff Volume (cu-ft)	73086.5755



EXISTING HYDROLOGY

Peak Flow Hydrologic Analysis

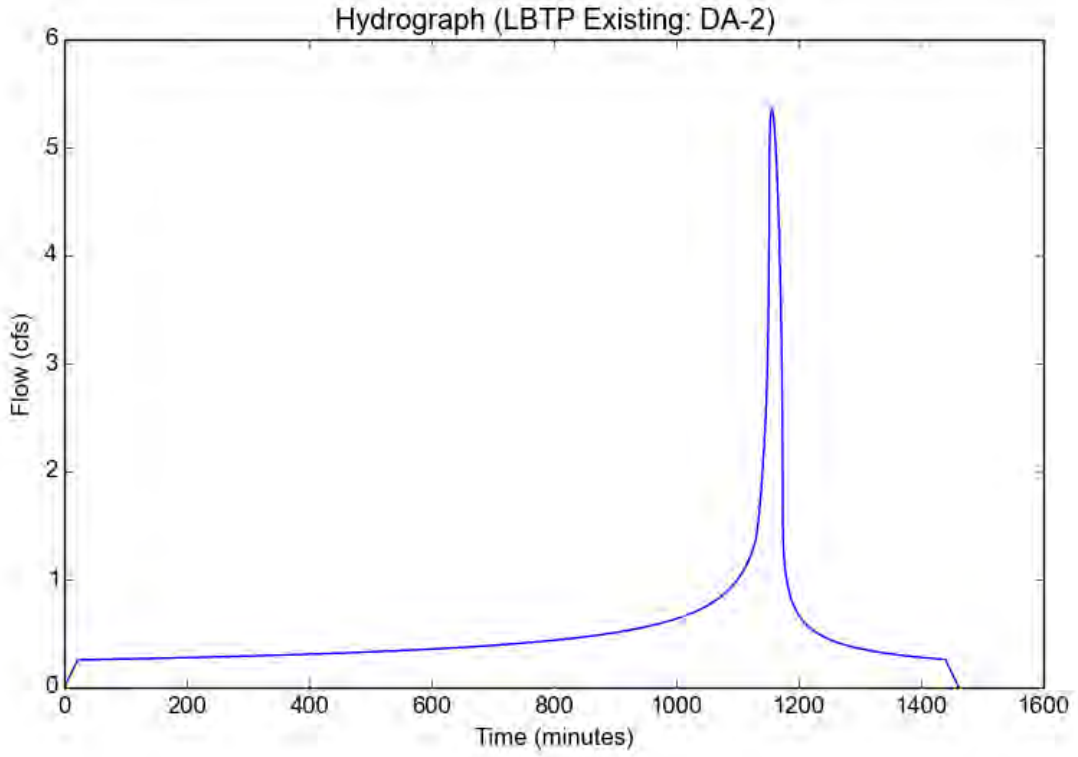
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Existing/Hydrocalc/Hydrocalc Output_LBTP Existing Report.p
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Existing
Subarea ID	DA-2
Area (ac)	4.51
Flow Path Length (ft)	2002.9167
Flow Path Slope (vft/hft)	0.00679509
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.509977827
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	1.4882
Undeveloped Runoff Coefficient (Cu)	0.6924
Developed Runoff Coefficient (Cd)	0.7983
Time of Concentration (min)	22.0
Clear Peak Flow Rate (cfs)	5.3578
Burned Peak Flow Rate (cfs)	5.3578
24-Hr Clear Runoff Volume (ac-ft)	1.0061
24-Hr Clear Runoff Volume (cu-ft)	43826.3335



EXISTING HYDROLOGY

Peak Flow Hydrologic Analysis

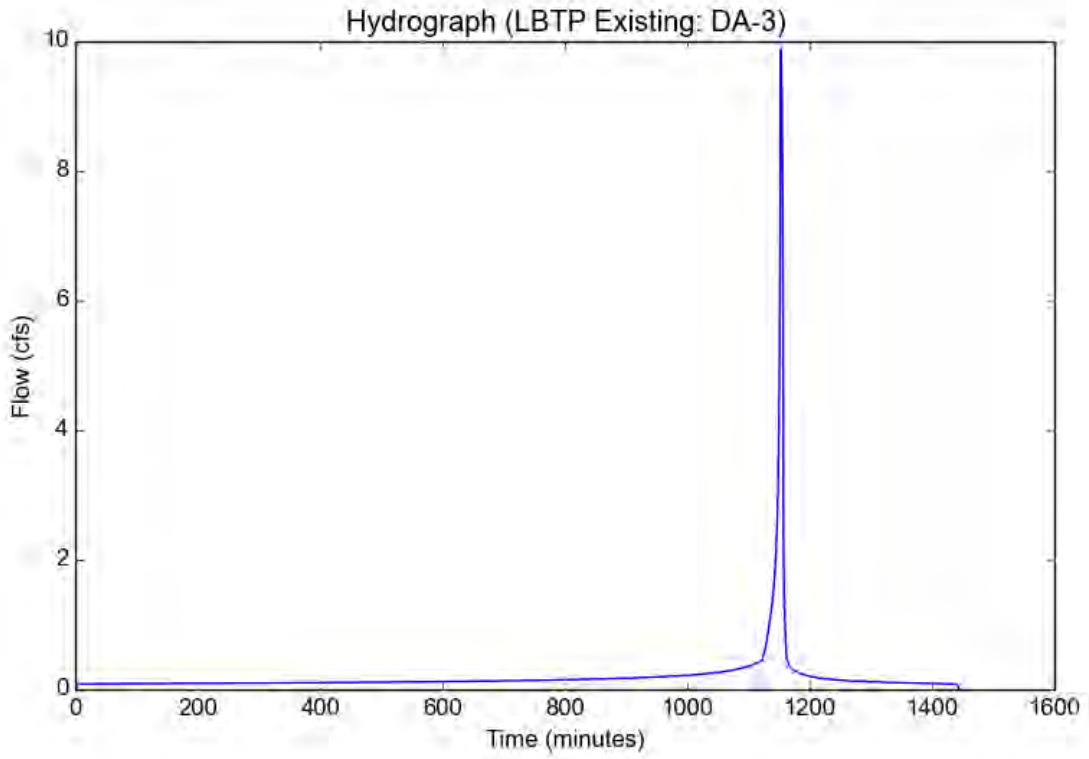
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Existing/Hydrocalc/Hydrocalc Output_LBTP Existing Report.p
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Existing
Subarea ID	DA-3
Area (ac)	3.59
Flow Path Length (ft)	291.167
Flow Path Slope (vft/hft)	0.065254648
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.142061281
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.9859
Undeveloped Runoff Coefficient (Cu)	0.9258
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	9.6474
Burned Peak Flow Rate (cfs)	9.6474
24-Hr Clear Runoff Volume (ac-ft)	0.4057
24-Hr Clear Runoff Volume (cu-ft)	17673.4429



EXISTING HYDROLOGY

Peak Flow Hydrologic Analysis

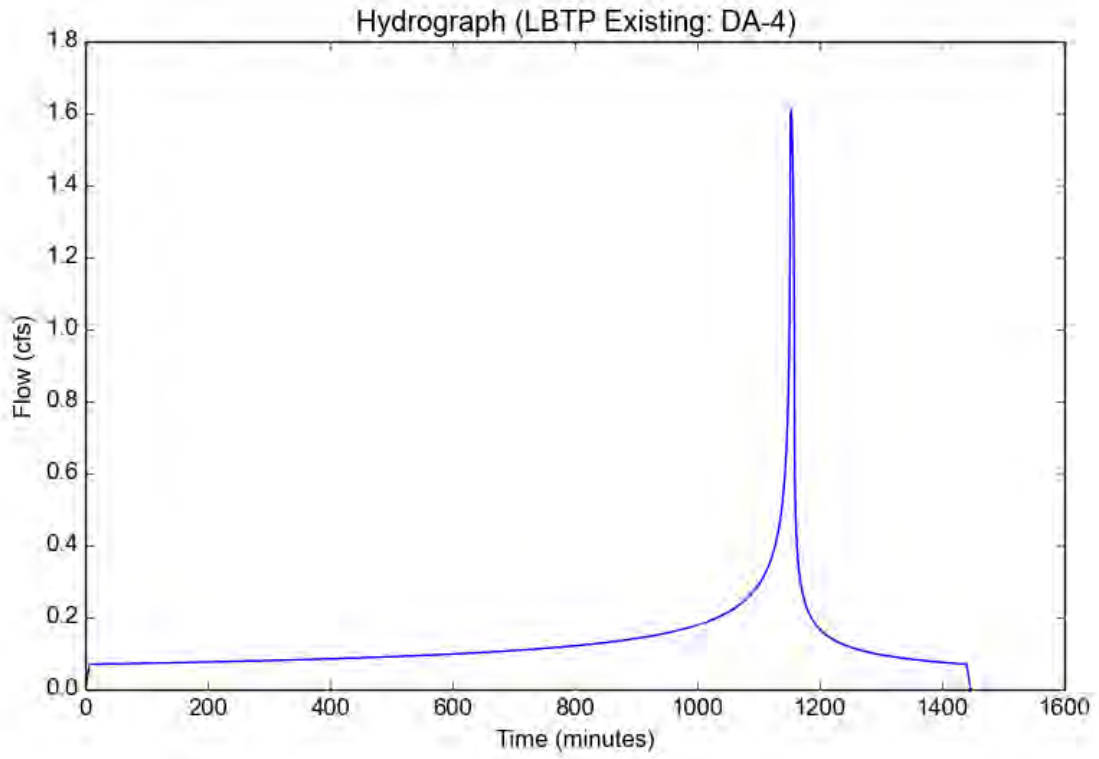
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Existing/Hydrocalc/Hydrocalc Output_LBTP Existing Report.p
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Existing
Subarea ID	DA-4
Area (ac)	0.7
Flow Path Length (ft)	526.14
Flow Path Slope (vft/hft)	0.014463831
50-yr Rainfall Depth (in)	5.7
Percent Impervious	1.0
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.5491
Undeveloped Runoff Coefficient (Cu)	0.8944
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	1.606
Burned Peak Flow Rate (cfs)	1.606
24-Hr Clear Runoff Volume (ac-ft)	0.2606
24-Hr Clear Runoff Volume (cu-ft)	11350.4398



Appendix E
Proposed Hydrology Calculations

PROPOSED HYDROLOGY

Peak Flow Hydrologic Analysis

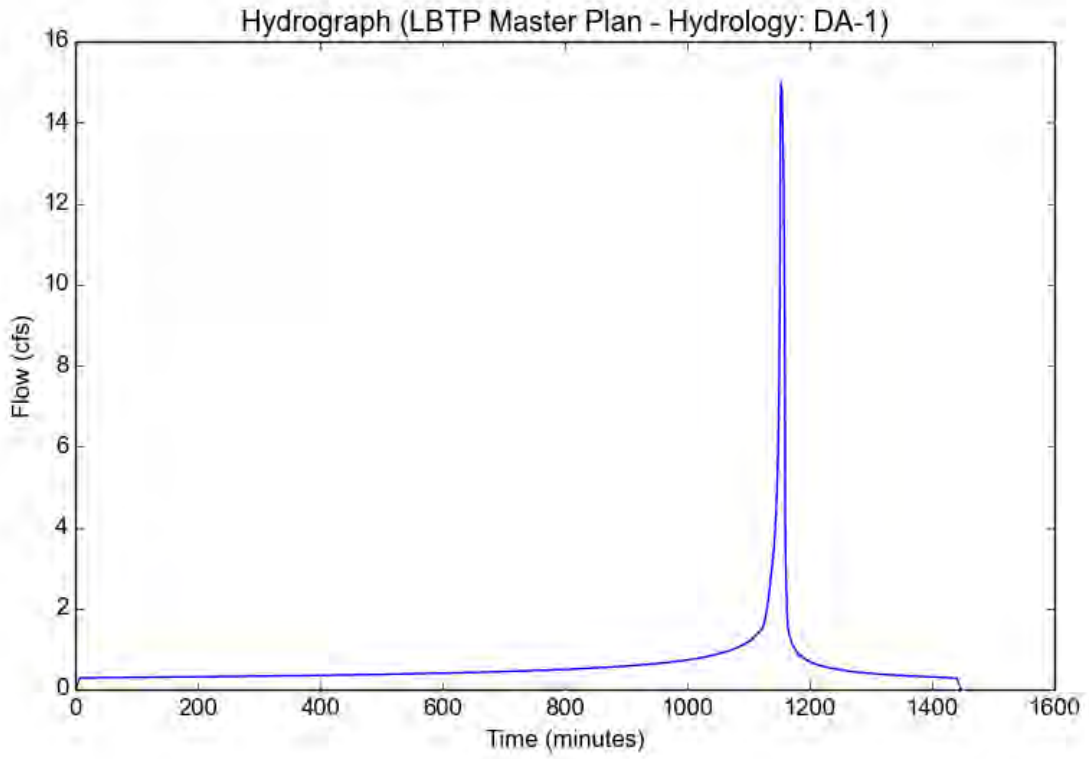
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan - Hydrology
Subarea ID	DA-1
Area (ac)	7.07
Flow Path Length (ft)	640.23
Flow Path Slope (vft/hft)	0.022757447
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.329561528
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.3941
Undeveloped Runoff Coefficient (Cu)	0.877
Developed Runoff Coefficient (Cd)	0.8846
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	14.9724
Burned Peak Flow Rate (cfs)	14.9724
24-Hr Clear Runoff Volume (ac-ft)	1.1993
24-Hr Clear Runoff Volume (cu-ft)	52243.5266



PROPOSED HYDROLOGY

Peak Flow Hydrologic Analysis

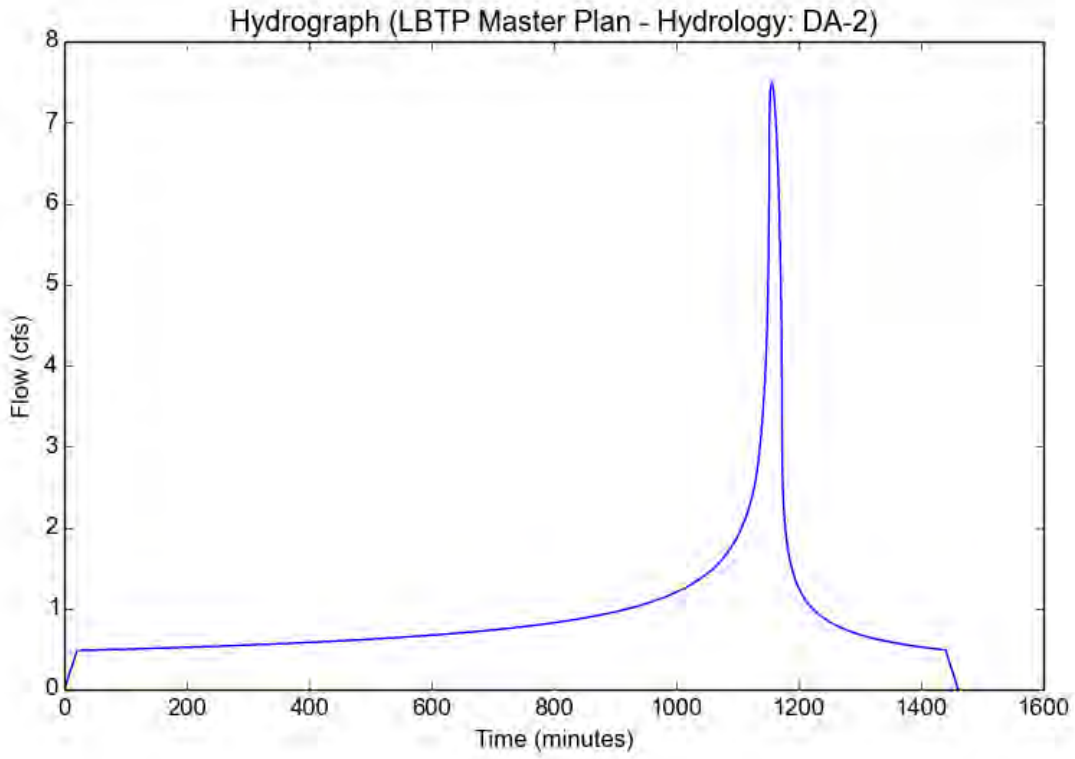
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan - Hydrology
Subarea ID	DA-2
Area (ac)	5.69
Flow Path Length (ft)	2012.46
Flow Path Slope (vft/hft)	0.006762867
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.824253076
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	1.5211
Undeveloped Runoff Coefficient (Cu)	0.7034
Developed Runoff Coefficient (Cd)	0.8654
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	7.4902
Burned Peak Flow Rate (cfs)	7.4902
24-Hr Clear Runoff Volume (ac-ft)	1.8139
24-Hr Clear Runoff Volume (cu-ft)	79014.93



PROPOSED HYDROLOGY

Peak Flow Hydrologic Analysis

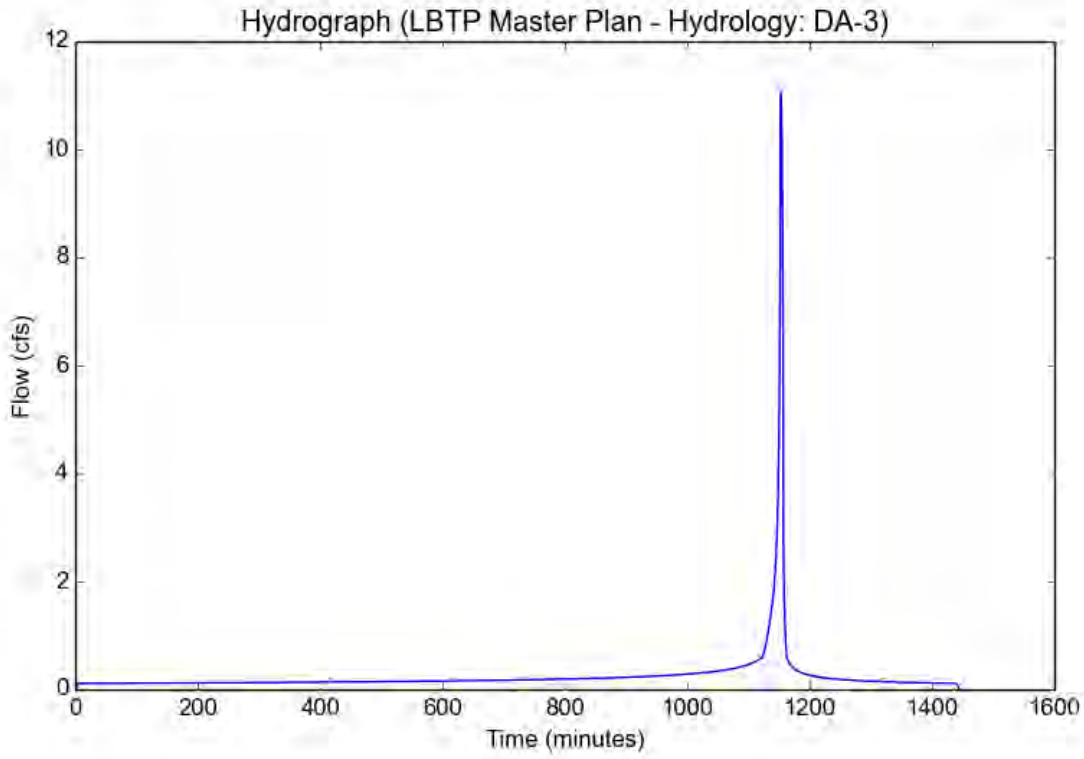
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan - Hydrology
Subarea ID	DA-3
Area (ac)	4.01
Flow Path Length (ft)	360.69
Flow Path Slope (vft/hft)	0.263
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.184538653
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.9859
Undeveloped Runoff Coefficient (Cu)	0.9258
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	10.776
Burned Peak Flow Rate (cfs)	10.776
24-Hr Clear Runoff Volume (ac-ft)	0.5047
24-Hr Clear Runoff Volume (cu-ft)	21982.9789



PROPOSED HYDROLOGY

Peak Flow Hydrologic Analysis

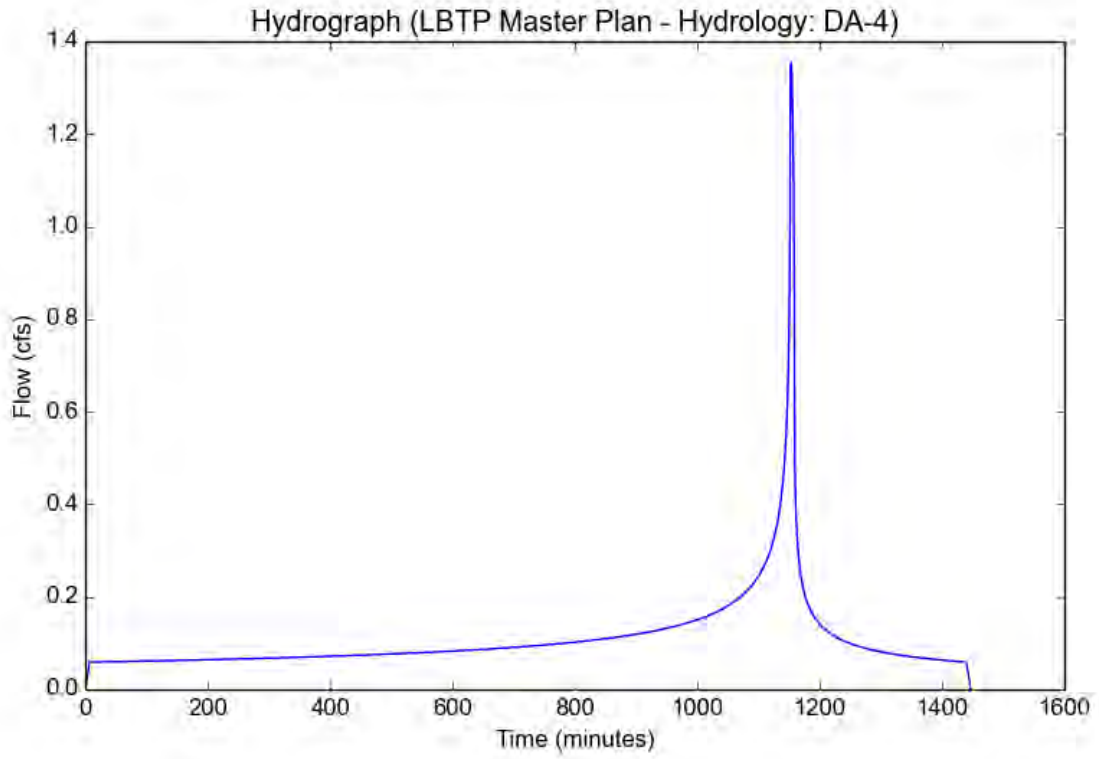
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Master Plan/Hydrocalc/Hydrocalc Output LBTP M
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Master Plan - Hydrology
Subarea ID	DA-4
Area (ac)	0.59
Flow Path Length (ft)	487.33
Flow Path Slope (vft/hft)	0.013194345
50-yr Rainfall Depth (in)	5.7
Percent Impervious	1.0
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.5491
Undeveloped Runoff Coefficient (Cu)	0.8944
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	1.3536
Burned Peak Flow Rate (cfs)	1.3536
24-Hr Clear Runoff Volume (ac-ft)	0.2196
24-Hr Clear Runoff Volume (cu-ft)	9566.7992



Appendix F

Alternate 4 Proposed Hydrology Calculations

ALTERNATE 4 HYDROLOGY

Peak Flow Hydrologic Analysis

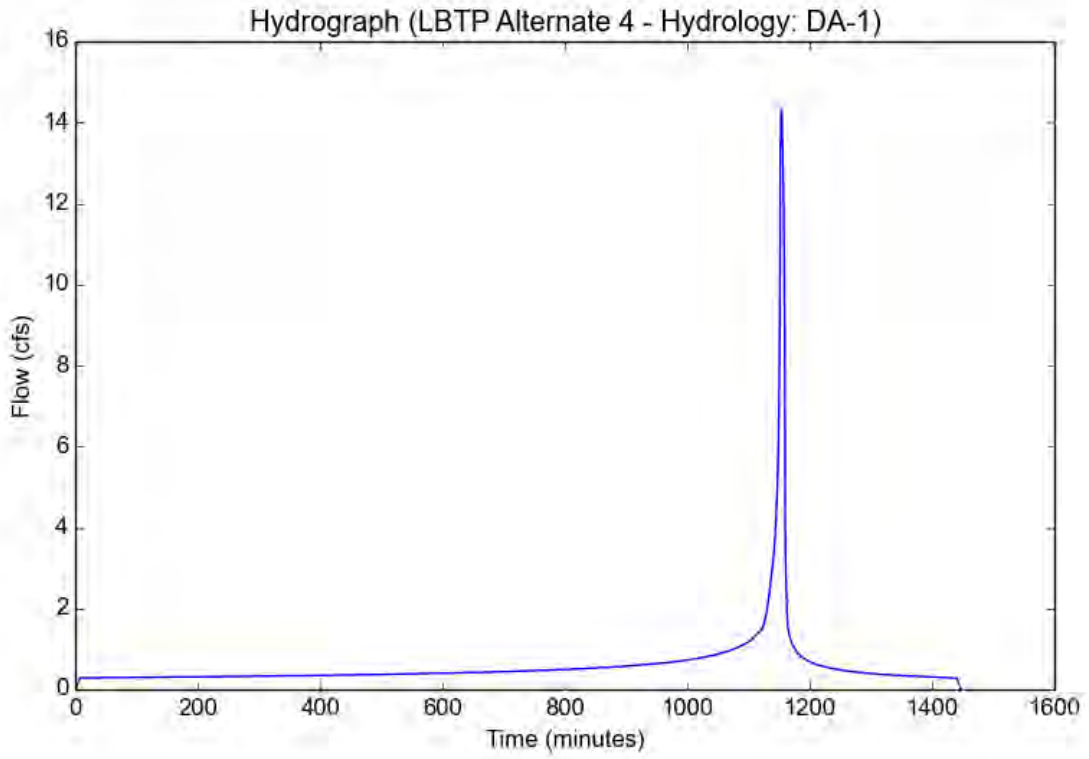
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4 - Hydrology
Subarea ID	DA-1
Area (ac)	6.75
Flow Path Length (ft)	640.23
Flow Path Slope (vft/hft)	0.022757447
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.34962963
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.3941
Undeveloped Runoff Coefficient (Cu)	0.877
Developed Runoff Coefficient (Cd)	0.885
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	14.3022
Burned Peak Flow Rate (cfs)	14.3022
24-Hr Clear Runoff Volume (ac-ft)	1.186
24-Hr Clear Runoff Volume (cu-ft)	51662.0481



ALTERNATE 4 HYDROLOGY

Peak Flow Hydrologic Analysis

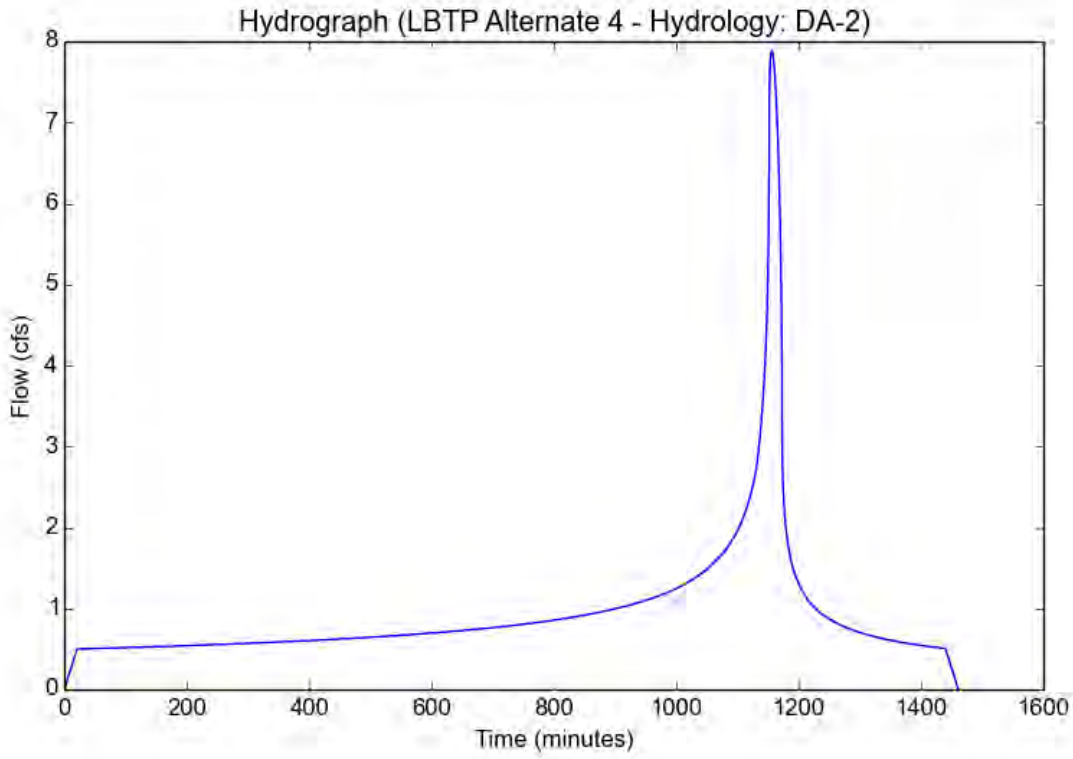
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4 - Hydrology
Subarea ID	DA-2
Area (ac)	6.01
Flow Path Length (ft)	2012.46
Flow Path Slope (vft/hft)	0.006762867
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.808652246
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	1.5211
Undeveloped Runoff Coefficient (Cu)	0.7034
Developed Runoff Coefficient (Cd)	0.8624
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	7.8834
Burned Peak Flow Rate (cfs)	7.8834
24-Hr Clear Runoff Volume (ac-ft)	1.8874
24-Hr Clear Runoff Volume (cu-ft)	82216.4698



ALTERNATE 4 HYDROLOGY

Peak Flow Hydrologic Analysis

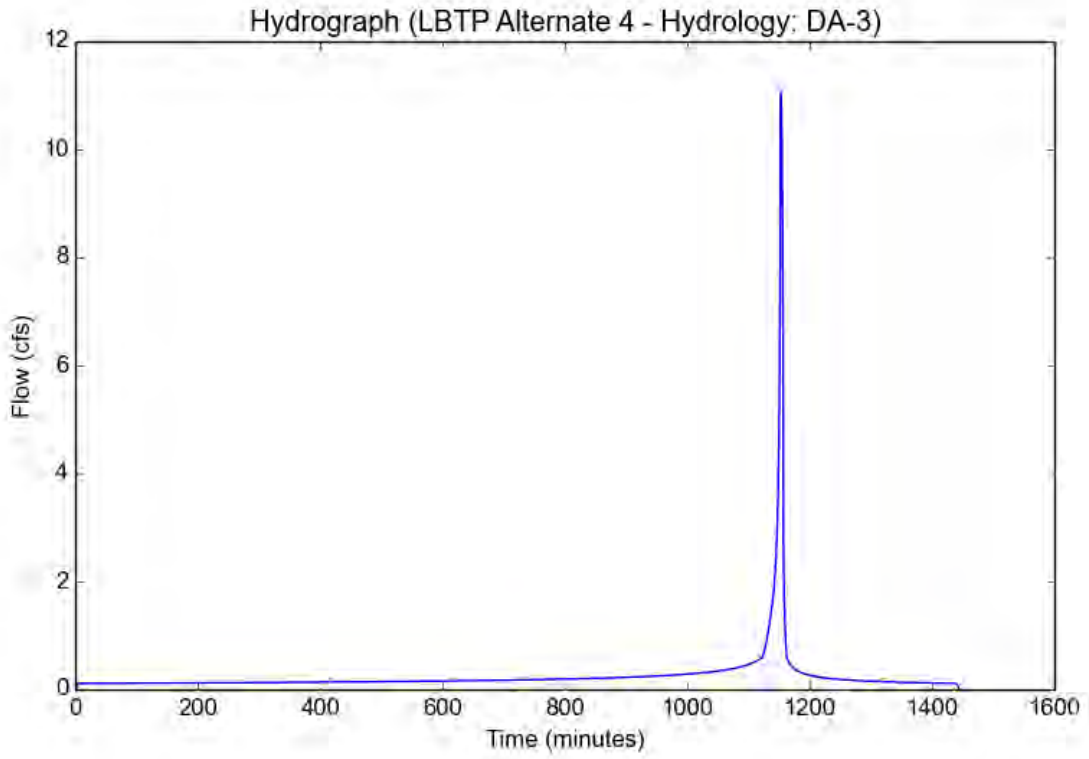
File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4 - Hydrology
Subarea ID	DA-3
Area (ac)	4.01
Flow Path Length (ft)	360.69
Flow Path Slope (vft/hft)	0.263
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.184538653
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.9859
Undeveloped Runoff Coefficient (Cu)	0.9258
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	10.776
Burned Peak Flow Rate (cfs)	10.776
24-Hr Clear Runoff Volume (ac-ft)	0.5047
24-Hr Clear Runoff Volume (cu-ft)	21982.9789



ALTERNATE 4 HYDROLOGY

Peak Flow Hydrologic Analysis

File location: P:/2019/1900236 La Brea Tar Pits Design and Renovation/2 ENGR/Hydrology/Proposed_Alternative 4/Hydrocalc/Hydrocalc Output LBTP A
Version: HydroCalc 1.0.2

Input Parameters

Project Name	LBTP Alternate 4 - Hydrology
Subarea ID	DA-4
Area (ac)	0.59
Flow Path Length (ft)	487.33
Flow Path Slope (vft/hft)	0.013194345
50-yr Rainfall Depth (in)	5.7
Percent Impervious	1.0
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.5491
Undeveloped Runoff Coefficient (Cu)	0.8944
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	1.3536
Burned Peak Flow Rate (cfs)	1.3536
24-Hr Clear Runoff Volume (ac-ft)	0.2196
24-Hr Clear Runoff Volume (cu-ft)	9566.7992