Appendix F. Hydrology and Hydraulics Study

HYDROLOGY AND HYDRAULICS STUDY

Prepared By:
HARIYA LLC

10/10/2020 PROJECT NO. 2005

LOCATION:

3593 Multiview Drive
Los Angeles, California 90068

CLIENT: Gavin Brodin

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1. Description of Project Area

The subject property is located at 3593 Multiview Drive, in the City of Los Angeles, California. The property is currently vacant with the majority of the property covered in trees with a land area of 5.14 Acres. Adjacent sites to the west, south and east are single family residences. The proposed development will consist of single family residence with pool and pool house and an ADU structure to be used as a home office. Construction of two retaining walls on the property. The purpose of this hydrology/hydraulics study is to size the drainage structures associated with this development.

2. Hydrologic Analysis

a. Watershed Area:

The limits for the watershed area were determined from a topographic survey and a grading and drainage plan which was utilized as the base sheet for the hydrology maps. The subject property has a descending slope from Multiview Drive northerly towards various single family residences.

In the developed condition, the runoff from the impervious areas will be collected in catch basins and conveyed by storm drain pipes to the permavoid rainwater collection system to be used for irrigation in the proposed lawn area above. Emergency overflow will be directed to the existing storm drain pipe located on the subject property.

b. Hydrologic Parameters:

The hydrologic parameters were obtained from the Los Angeles County Department of Public Works Hydrology website. From this website it was determined that the soil type for the site is 002, and the 85th percentile and 50-year 24 hour isohyet values are 1.05" and 6.5" respectively.

c. Hydrologic Calculations:

The above referenced parameters and the HydroCalc program were utilized in determining the post-developed time of concentration and flow rate for the runoff which will be conveyed from the property. Additionally, the property was divided into smaller interior subareas in order to more accurately size the drainage devices. The flow for the interior subareas was determined by multiplying the subarea size by the discharge per acre determined from the TC Calculator results. Calculations are included in Appendix A.

3. Hydraulic Calculations

Hydraulic calculations were prepared to ensure the catch basins and pipes have adequate capacity to capture convey the 50-year flow to the street. Calculations are included in Appendix A.

4. Discussion

This hydrology and hydraulics was completed in order to correctly size the storm drain inlets and pipe size. The onsite drainage will be conveyed in a series of catch basins and drainage pipes and will gravity flow into the permavoid rainwater collection System.

Based on the above discussion, calculations, and above described improvements, it is the opinion of this office that development of the subject property as planned will not result in an adverse impact to the subject property, adjacent properties or to the existing storm drain system.

5. Limitations

This report is prepared for use by Gavin Brodin and its authorized agents and should not be considered transferable. Prior to the use by others, the subject site and this report should be reviewed by this office to determine if any additional work is required to update this report. It is the intent of this report to aid in the design and construction of the described project. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions contained in this report are not intended to imply total performance of the project. Furthermore, the opinions contained within this report are based on the referenced materials.

This report has been prepared in accordance with generally accepted engineering practices and makes no warranties, either expressed or implied, as to the professional opinions provided.

Should you have any questions, please don't hesitate to call.

Respectfully submitted,

Manoj B. Hariya
PE No. 74429

APPENDIX A
Hydrology and Hydraulic Calculations

Peak Flow Hydrologic Analysis

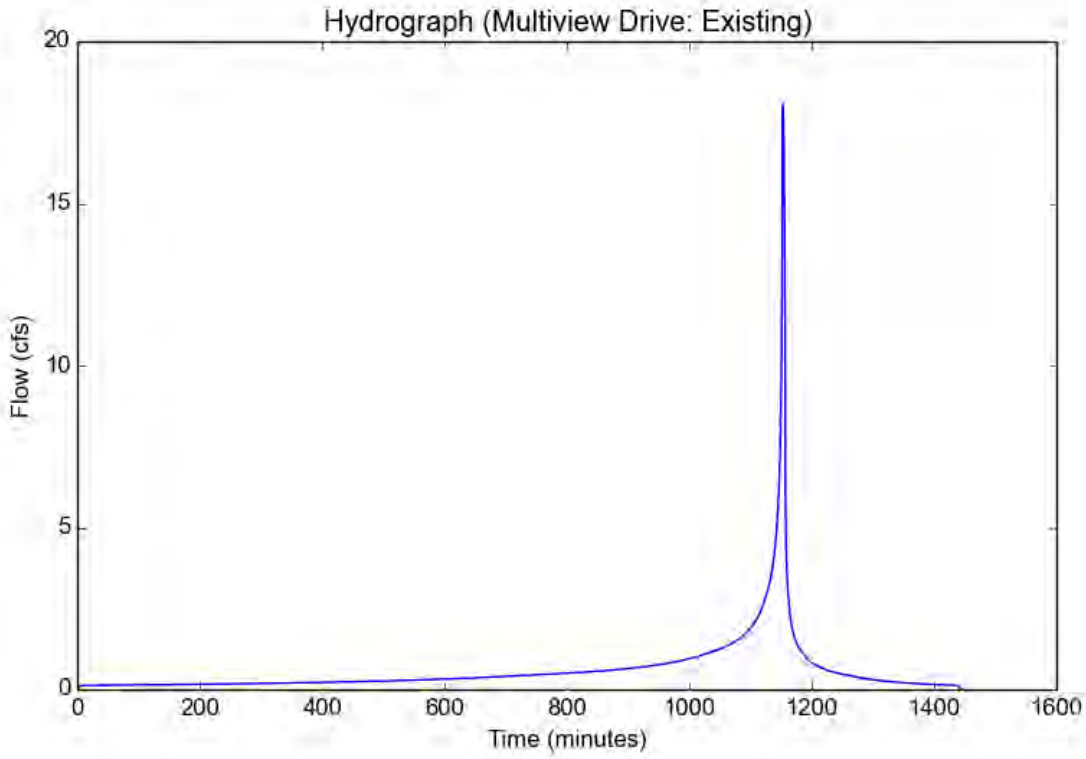
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/HYDROLOGY/HYDRO EXH
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Multiview Drive
Subarea ID	Existing
Area (ac)	5.14
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.01
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9049
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	17.94
Burned Peak Flow Rate (cfs)	17.94
24-Hr Clear Runoff Volume (ac-ft)	1.2108
24-Hr Clear Runoff Volume (cu-ft)	52742.4249



Peak Flow Hydrologic Analysis

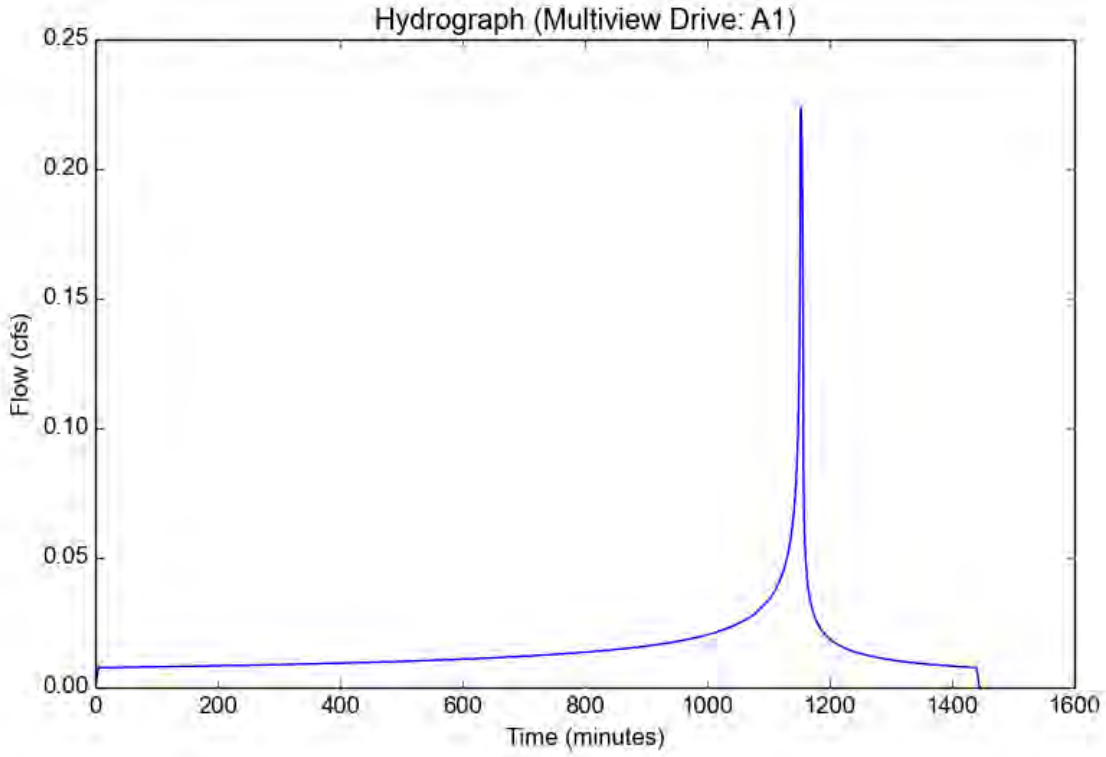
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/HYDROLOGY/HYDRO EXH
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Multiview Drive
Subarea ID	A1
Area (ac)	0.064
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.9
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9049
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.2234
Burned Peak Flow Rate (cfs)	0.2234
24-Hr Clear Runoff Volume (ac-ft)	0.0293
24-Hr Clear Runoff Volume (cu-ft)	1278.0298



Peak Flow Hydrologic Analysis

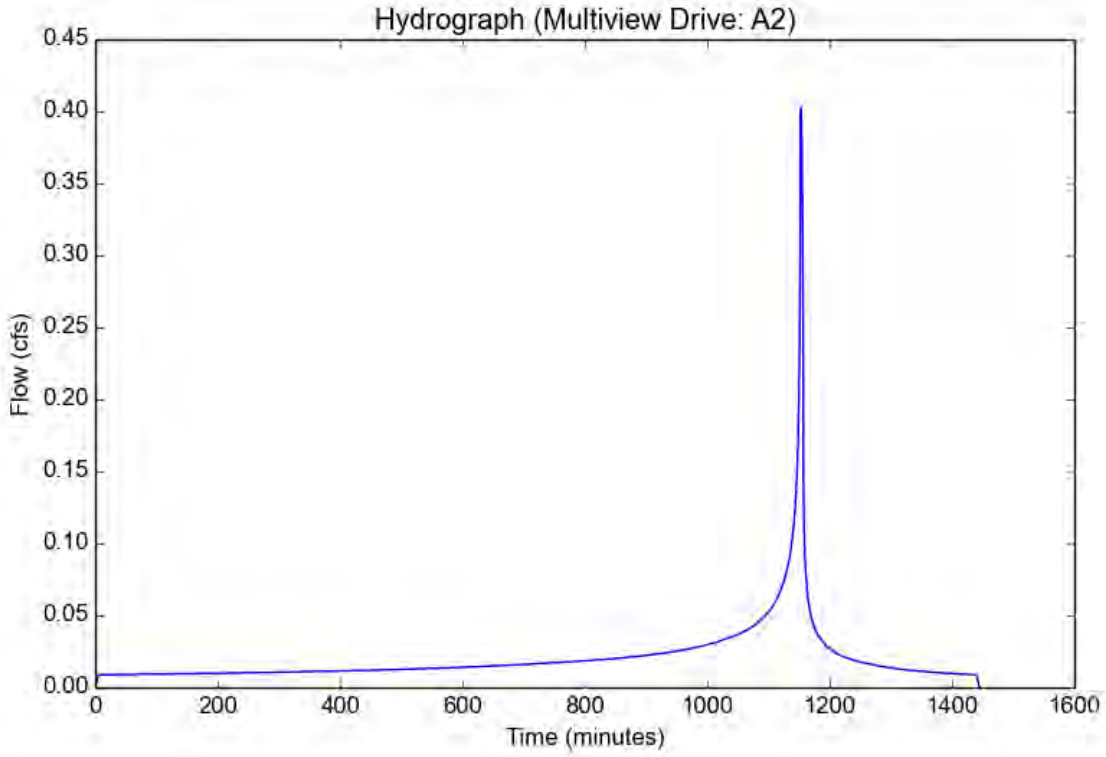
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/HYDROLOGY/HYDRO EXH
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Multiview Drive
Subarea ID	A2
Area (ac)	0.115
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.5
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9049
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.4014
Burned Peak Flow Rate (cfs)	0.4014
24-Hr Clear Runoff Volume (ac-ft)	0.0412
24-Hr Clear Runoff Volume (cu-ft)	1794.6957



Peak Flow Hydrologic Analysis

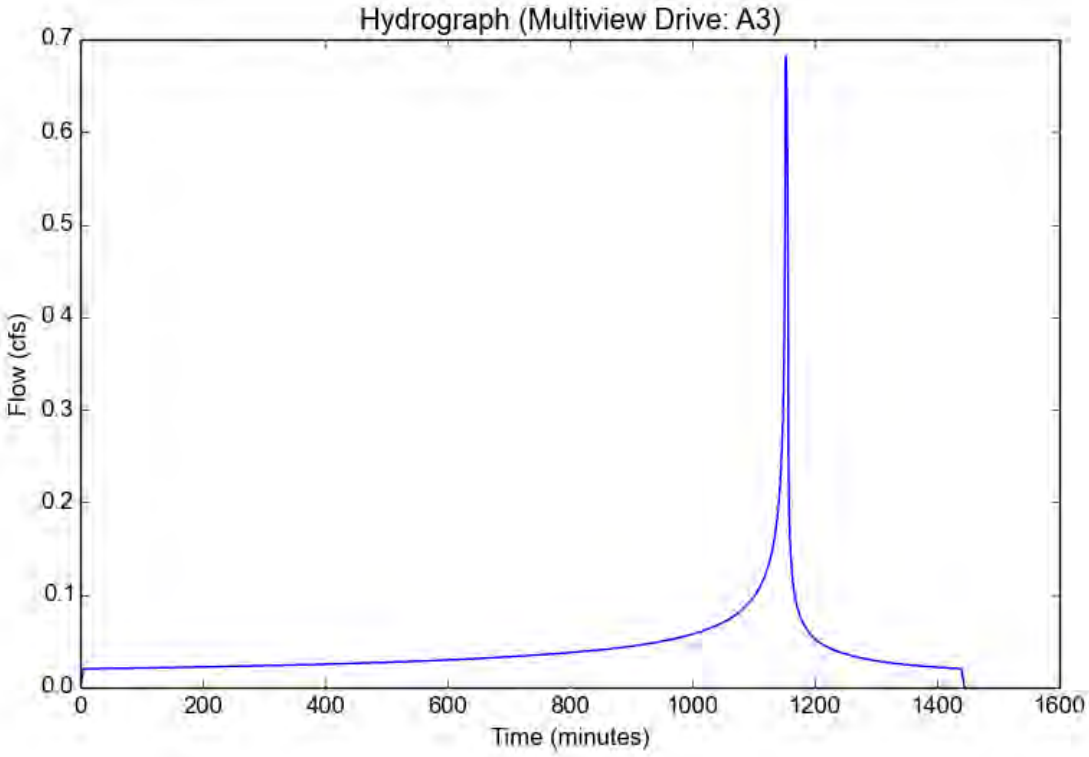
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/HYDROLOGY/HYDRO EXH
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Multiview Drive
Subarea ID	A3
Area (ac)	0.195
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.75
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9049
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.6806
Burned Peak Flow Rate (cfs)	0.6806
24-Hr Clear Runoff Volume (ac-ft)	0.0821
24-Hr Clear Runoff Volume (cu-ft)	3574.9405



Peak Flow Hydrologic Analysis

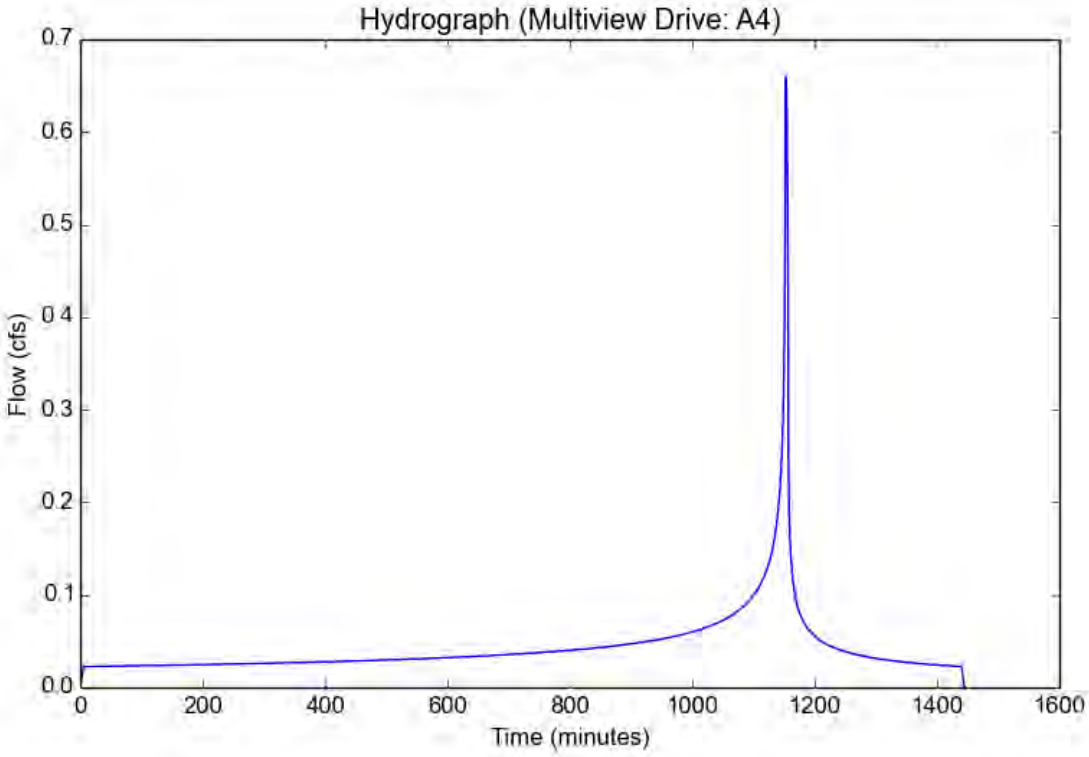
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/HYDROLOGY/HYDRO EXH
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Multiview Drive
Subarea ID	A4
Area (ac)	0.189
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.9
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9049
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.6597
Burned Peak Flow Rate (cfs)	0.6597
24-Hr Clear Runoff Volume (ac-ft)	0.0866
24-Hr Clear Runoff Volume (cu-ft)	3774.1817



Peak Flow Hydrologic Analysis

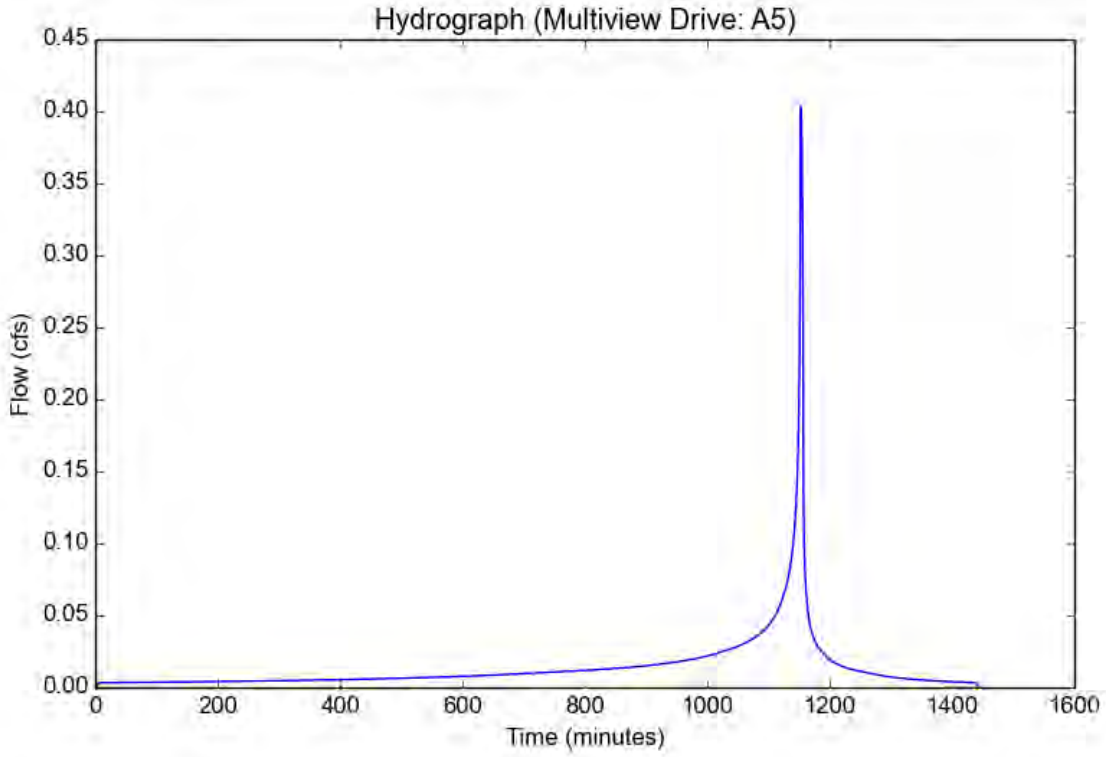
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/HYDROLOGY/HYDRO EXH
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Multiview Drive
Subarea ID	A5
Area (ac)	0.115
Flow Path Length (ft)	200.0
Flow Path Slope (vft/hft)	0.02
50-yr Rainfall Depth (in)	6.5
Percent Impervious	0.05
Soil Type	2
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	6.5
Peak Intensity (in/hr)	3.8781
Undeveloped Runoff Coefficient (Cu)	0.9049
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.4014
Burned Peak Flow Rate (cfs)	0.4014
24-Hr Clear Runoff Volume (ac-ft)	0.0282
24-Hr Clear Runoff Volume (cu-ft)	1230.2112



Existing Conditions

Job Location: 3593 Multiview drive
Los Angeles, CA 90068
Job Number: 2005

Drainage Area Name	Area (ac)	50-Year Discharge (cfs)
A1	5.14	17.94
Total	5.14	17.94

Developed Conditions

Job Location:	3593 Multiview Drive
	Los Angeles, CA 90068
Job Number:	2005

50-Year Discharge=	2.364	cfs
Total Site Area =	0.678	ac
50-Year Unit Discharge* =	3.49	cfs/ac

Drainage Area Name	Area (ac)	50-Year Discharge (cfs)
A1	0.064	0.223
A2	0.115	0.401
A3	0.195	0.680
A4	0.189	0.659
A5	0.115	0.401
Total	0.678	2.364

Grating Basin Sizing

Job Location: 3593 Multiview Drive
Los Angeles, CA 90068
Job Number: 2005
50-Year

Grating Basin subarea	Discharge (Q) (cfs)	# of basins	discharge per basin (cfs)	assumed max. head on grate (H) (ft)	calculated grate size opening (sq ft)	grate type	grate size	actual opening size (sq ft)
A1	0.223	1	0.22	0.1	0.29	Trench	6"	8.860
A2	0.401	2	0.20	0.1	0.26	Square	12"	0.353
A3	0.680	1	0.68	0.1	0.88	Trench	6"	11.070
A4	0.659	14	0.05	0.1	0.06	Round	6"	0.063
A5	0.401	3	0.13	0.1	0.17	Round	18"	0.260

FORMULA:

Q =A*.61*(2gh)^0.5
a = Q/(((2gh)^0.5)*.61)

CATCH BASIN SIZE:	4" Attrium Grate (Part No 75)	4" Area Drain (Part No 910B)	12" ATRIUM GRATE (Part No 1280)	6" AREA DRAIN Round (Part No 60)	9" Square (Part No. 980)	9" ATRIUM GRATE (Part No 981)	12"X12" (part 1210)	24"X24" (Part No 2411)
OPEN AREA (in^2)*	17	5.25	50.6	9.1	37.49	31.5	50.76	231.69
OPEN AREA (ft^2)	**0.118**	**0.036**	**0.351**	**0.063**	**0.260**	**0.219**	**0.353**	**1.609**

CATCH BASIN SIZE:	Dura Slope Trench Drain - Grate Part No. DS-231	NDS Micro Channel
OPEN AREA (in^2/FT)*	63.78	1.00
OPEN AREA (ft^2/FT)	**0.443**	**0.01**

*Open Area taken direclty from NDS catalog.
Half Open Area to be used to size all inlets (half clogged condition)

Determination of Required Pipe Size (50-Year)

Job Location: 3593 Multiview Drive
Los Angeles, CA 90068

Job Number: 2006

For Hancor HDPE pipe, Kprov from Hancor Water Management Drainage Handbook, table 3-1

Pipe Size (in)	Kprov
4	2.5
6	7.3
8	15.7
10	28.5
12	46.3
15	84.0
18	136.6
21	206.0
24	294.4
30	533.0
36	866.8

Equations:
Kreq = Q/((S)^0.5) Kreq=Krequired
Kprov=46.3d^(8/3) Kprov=Kprovided
Kprov must be greater than Kreq

contributing subareas	Q (cfs)	slope	Kreq	Pipe Size (in)	Kprov	Kreq/Kprov
A1	0.22	0.020	1.6	6	7.3	22%
A2	0.40	0.020	2.8	6	7.3	39%
A3	0.68	0.020	4.8	6	7.3	66%
A4	0.66	0.020	4.7	6	7.3	64%
A5	0.40	0.020	2.8	6	7.3	39%
A1+A2	0.62	0.020	4.4	6	7.3	60%

LID CALCULATIONS

Prepared By:

HARIYA LLC

DATE: 10/14/20 JOB NUMBER: 2005

SCOPE: LOW IMPACT DEVELOPMENT CALCULATIONS

LOCATION: 3593 MULTIVIEW DRIVE LOS ANGELES, CA 90068

CLIENT: GAVIN BRODIN

(LID) FOR: GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

Job # 2005

SUBAREA A1

Proposed Project Characteristicts

Area Total	0.17	Acres
Type of Development	SFR	Single Family Residential
Predominate Soil Type	2	
AI=% of Project Impervious	1.000	
Ap=% of Project Pervious	0.000	
% of Project Contributing undeveloped area	1	
AI	0.17	Acres
Ap	0.00	Acres
Au	0	Acres
Vm	605.88	Cubic Feet (from HydroCalc)

(LID) FOR: GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

Job # 2005

SUBAREA A2

Proposed Project Characteristicts

Area Total	0.09	Acres
Type of Development	SFR	Single Family Residential
Predominate Soil Type	2	
AI=% of Project Impervious	1	
Ap=% of Project Pervious	0	
% of Project Contributing undeveloped area	1	
AI	0.09	Acres
Ap	0.00	Acres
Au	0	Acres
Vm	320.76	Cubic Feet (from HydroCalc)
Qpm	0.05	CFS (from HydroCalc)

(LID) FOR: GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

Job # 2005

SUBAREA A3

Proposed Project Characteristicts

Area Total	0.14	Acres
Type of Development	SFR	Single Family Residential
Predominate Soil Type	2	
AI=% of Project Impervious	1	
Ap=% of Project Pervious	0	
% of Project Contributing undeveloped area	1	
AI	0.14	Acres
Ap	0.00	Acres
Au	0	Acres
Vm	498.96	Cubic Feet (from HydroCalc)
Qpm	0.07	CFS (from HydroCalc)

(LID) FOR: GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

Job # **2005**

Permavoid Calculations (all other developments)

subarea	total area draining to permavoid	% impervious	impervious area	volume required	Volume of permavoid provided	thickness of permavoid	area of permavoid required	area of permavoid provided
	(ac)		(sq ft)	(cu ft)	(cu ft)	(ft)	(ft)	(ft)
A1	0.170	100	7405	606	655	0.985	647	700
A2	0.090	100	3920	321	374	0.985	343	400
A3	0.140	100	6098	499	561	0.985	533	600
				Total:	**1591**		**1523**	**1700**

(LID) FOR: GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

Job # **2005**

ESTIMATED TOTAL WATER USAGE (ETWU)

hydrozone	plant water use type	plant factor (PF)	area (PA)	PF	Oct 1-Apr 30 7-month ET_7	Oct 1-Apr 30 7-month ETWU	total rainwater harvesting volume
			(sq ft)	(sq ft)	(in)	(gallons)	(gallons)
A1	medium	0.40		0	21.7	0	4,532
A2	medium	0.40		0	21.7	0	2,399
A3	medium	0.40		0	21.7	0	3,732

ETWU=Estimated total water use per year (gallons per year)

ET_7=7 month Reference Evapotranspiration (inches/year)

PF=Planter Factor=PAx0.4

0.62=Conversion Factor (to gallons per square foot)

ETWU=0.62*PF*ET_7

Peak Flow Hydrologic Analysis

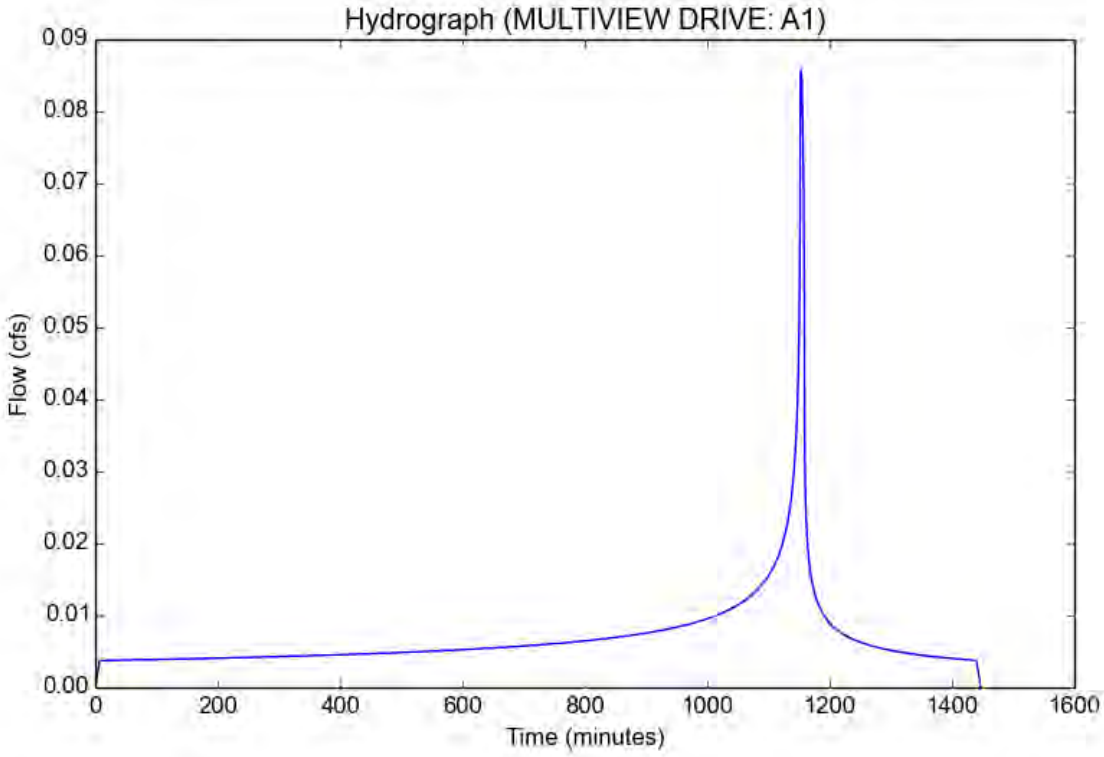
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/LID/A1 SUBAREA.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	MULTIVIEW DRIVE
Subarea ID	A1
Area (ac)	0.17
Flow Path Length (ft)	100.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.5603
Undeveloped Runoff Coefficient (Cu)	0.5892
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.0857
Burned Peak Flow Rate (cfs)	0.0857
24-Hr Clear Runoff Volume (ac-ft)	0.0139
24-Hr Clear Runoff Volume (cu-ft)	605.8804



Peak Flow Hydrologic Analysis

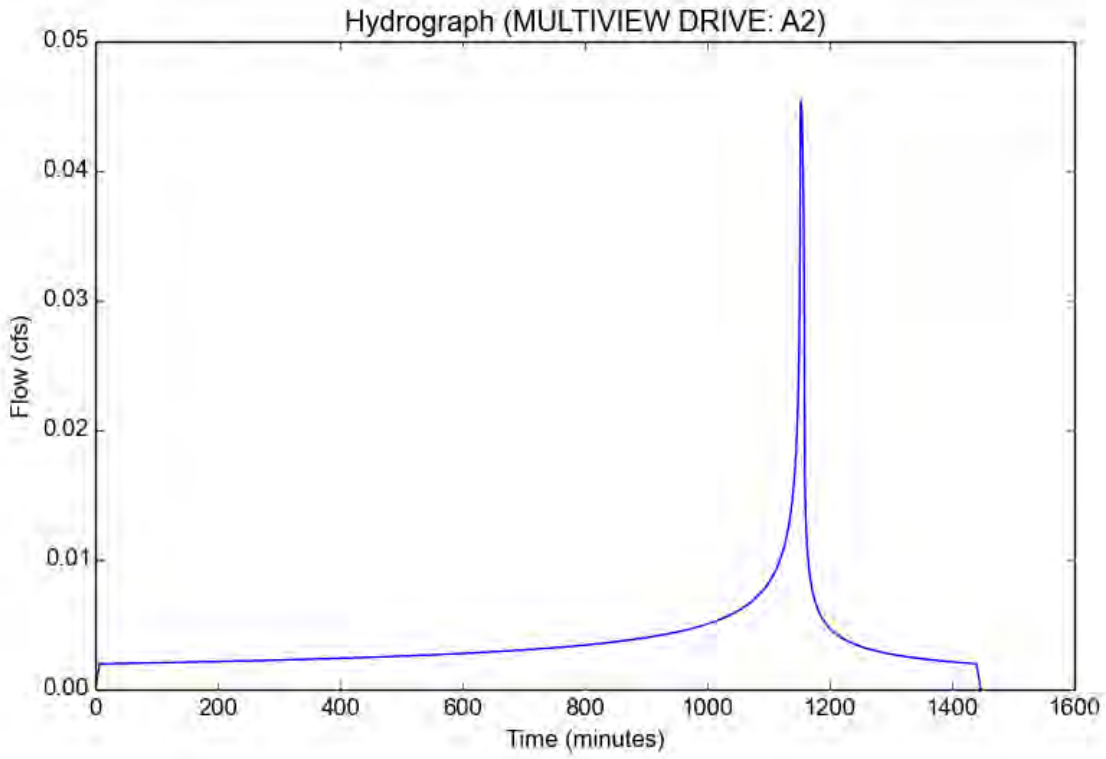
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/LID/A2 SUBAREA.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	MULTIVIEW DRIVE
Subarea ID	A2
Area (ac)	0.09
Flow Path Length (ft)	100.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.5603
Undeveloped Runoff Coefficient (Cu)	0.5892
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.0454
Burned Peak Flow Rate (cfs)	0.0454
24-Hr Clear Runoff Volume (ac-ft)	0.0074
24-Hr Clear Runoff Volume (cu-ft)	320.7602



Peak Flow Hydrologic Analysis

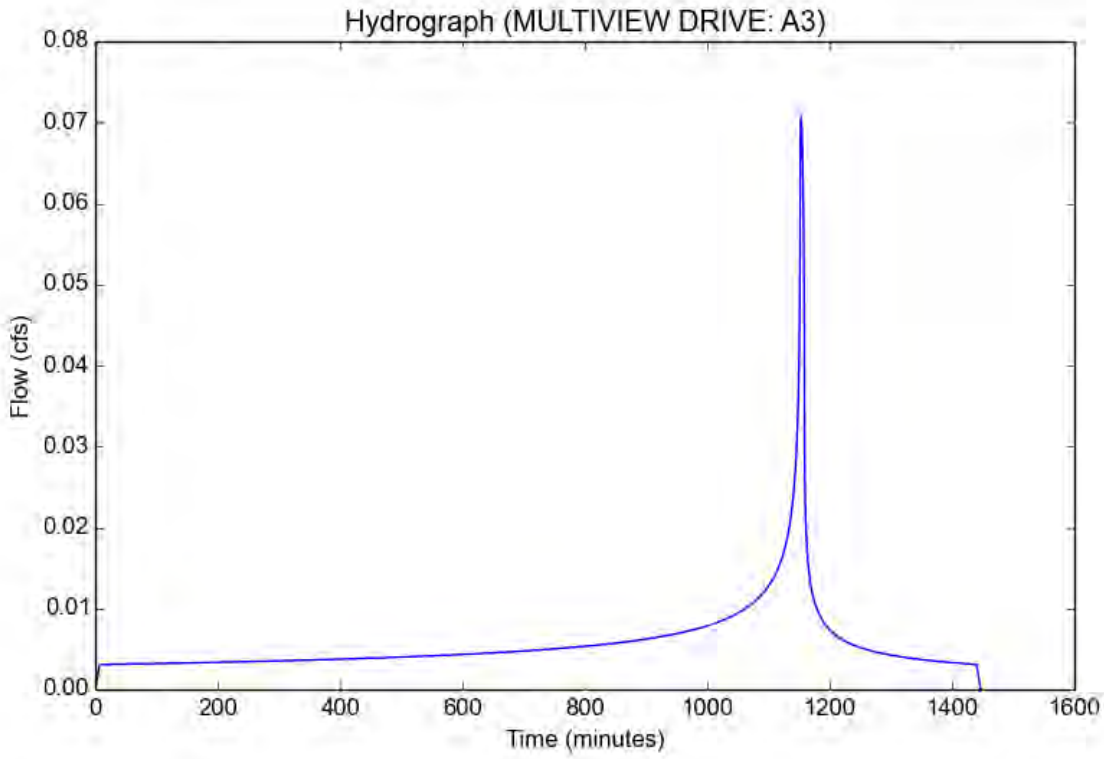
File location: D:/CAPTAIN CURT/CCOOK/AUTOCAD PROJECTS/CRC/GAVIN BRODIN/2005 MULTIVIEW DRIVE/CALCS/LID/A3 SUBAREA.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	MULTIVIEW DRIVE
Subarea ID	A3
Area (ac)	0.14
Flow Path Length (ft)	100.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	1.1
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.1
Peak Intensity (in/hr)	0.5603
Undeveloped Runoff Coefficient (Cu)	0.5892
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	0.0706
Burned Peak Flow Rate (cfs)	0.0706
24-Hr Clear Runoff Volume (ac-ft)	0.0115
24-Hr Clear Runoff Volume (cu-ft)	498.9603



APPENDIX B
Hydrology Maps

REPLAT OF A PORTION OF POR. OF LOT 1
OF THE PROPERTY OF THE LANKERSHIM RANCH
LAND AND WATER COMPANY
M.R. 66-84-85

MULTIVIEW DRIVE

A1

AREA=5.14 AC
% IMPERVIOUS=0%
Q_{50}=1.02 CFS

LEGEND

A — SUBAREA DESIGNATION

— — — SUBAREA BOUNDARY

HYDROLOGIC DATA

SOIL TYPE: 002
24-HR 50-YEAR RAIN FALL ISOHYET= 6.5

Existing Conditions

Job Location: 3593 Multiview drive
Los Angeles, CA 90068
Job Number: 2005

Drainage Area Name	Area (ac)	50-Year Discharge (cfs)
A1	5.14	1.02
Total	5.14	1.02

SCALE: 1"=20'
0 20 40 60

	REVISION DESCRIPTION	DATE
1	–	–

HARIYA LLC
26121 Wallack Place
Loma Linda, CA 92354
(909)499-8270

Manoj Hariya, RCE # 74429 Date

REGISTERED PROFESSIONAL ENGINEER
MANOJ RABULAL HARIYA
NO. 74429
CIVIL
STATE OF CALIFORNIA

DESIGNED ____ DRAWN ____ CHECKED ____
PROJ. ENG. ____ RECOMMENDED ____
REG. NO. ____ DATE ____ APPROVED ____

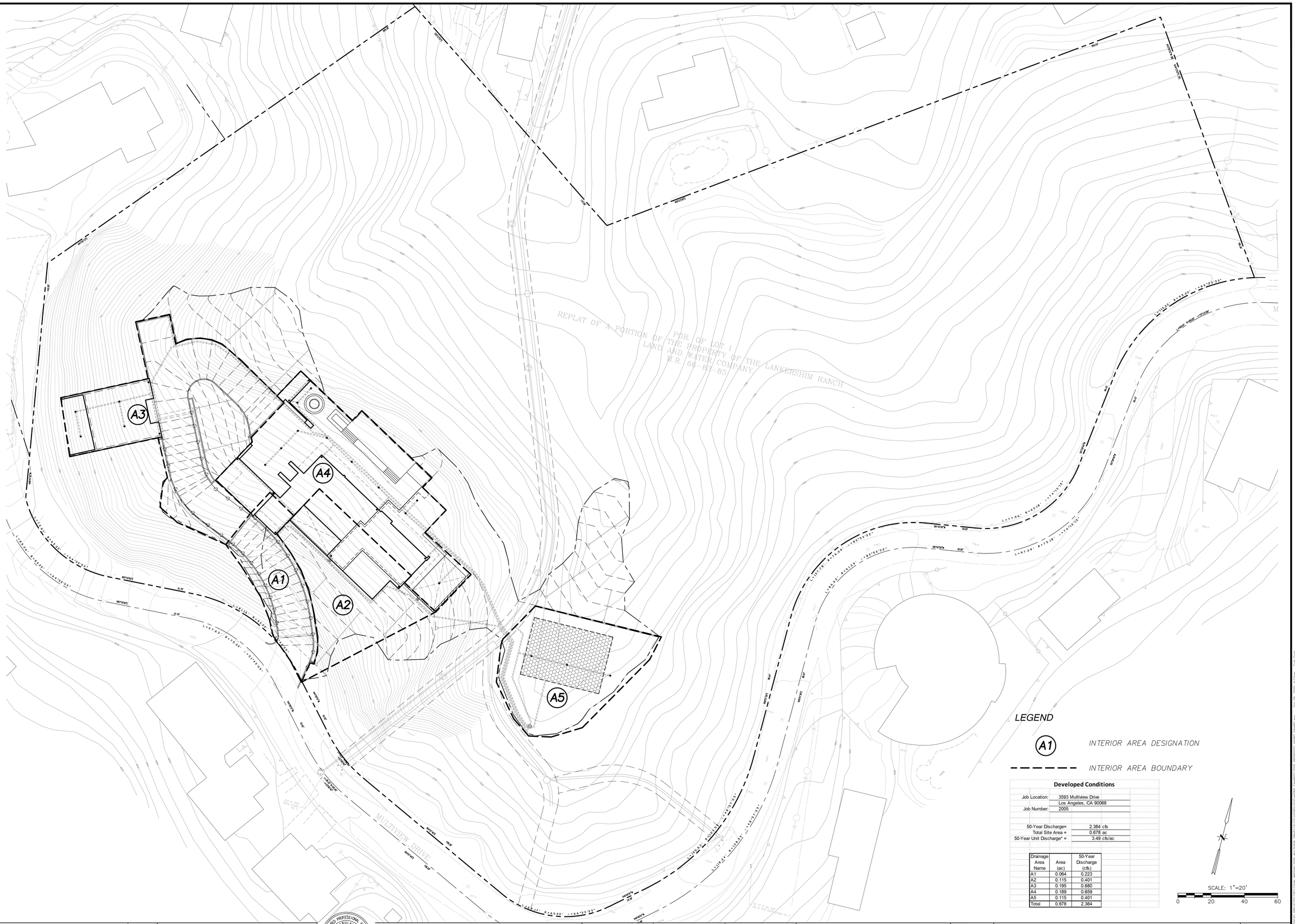
CITY OF LOS ANGELES

SPEC. NO.
PROJ. NO. 2005

EXISTING CONDITION HYDROLOGY MAP
GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

SHEET 1 OF 1
DRAWING NO.

Exported: C:\PROJECTS\2005 MULTIVIEW DRIVE\CAD\EXISTING 2005 MULTIVIEW DRIVE.DWG Dec 19, 2020 - 1:46pm Carl Cole



Developed Conditions

Job Location:	3593 Multiview Drive
	Los Angeles, CA 90068
Job Number:	2005
50-Year Discharge=	2.364 cfs
Total Site Area =	0.678 ac
50-Year Unit Discharge* =	3.49 cfs/ac

Drainage Area Name	Area (ac)	50-Year Discharge (cfs)
A1	0.064	0.223
A2	0.115	0.401
A3	0.195	0.680
A4	0.189	0.659
A5	0.115	0.401
Total	0.678	2.364

REVISION DESCRIPTION	DATE
1 –	–

HARIYA LLC
26121 Wallack Place
Loma Linda, CA 92354
(909)499-8270

Manoj Hariya, RCE # 74429 Date

REGISTERED PROFESSIONAL ENGINEER MANOJ BABULAL HARIYA NO. 74429 CIVIL STATE OF CALIFORNIA

DESIGNED | DRAWN | CHECKED
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DEVELOPED CONDITION HYDROLOGY MAP
GAVIN BRODIN
3593 MULTIVIEW DRIVE
LOS ANGELES, CA 90068

SHEET 1 OF 1
DRAWING NO.

D:\CAPTAIN_CONTOOLS\AUTOCAD PROJECTS\DRCS\GAVIN BRODIN\2005 MULTIVIEW DRIVE\CALCS\HYDROLOGY\HYDRO EXHIBITS\2005 PROPOSED HYDRO EXHIBIT.dwg Oct 09, 2020, 4:12pm Carl Cook