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PRELIMINARY STANDARD URBAN STORMWATER MITIGATION PLAN

Irwindale International Outlet Center
Irwindale, California

Submitted to:

Irwindale Outlet Partners
c/o Lindom Company
202 South Lake Avenue, Suite 200
Pasadena, CA, 91101

Submitted by:

JR Miller & Associates, Inc.
2700 Saturn Street
Brea, CA 92821

June 20, 2014
Revised November 10, 2014
Revised November 25, 2014

JR Miller & Associates, Inc.

Paul J. Hacunda, PE
Principal Civil Engineer

Contents

1 NARRATIVE EXPLANATION OF PROJECT

1.1 Existing Local Drainage Conditions

The majority of the property (Drainage Area 1) drains from southeast to northwest discharging into a curb inlet near the most westerly driveway. At this point the inlet connects into a City storm drainage system via a pipeline. The race track in-field (Drainage Area 2) drains to an inlet which is connected to a pipeline that discharges into an existing pump station near the northwest corner of the site. Drainage Area 3 drains to the southwest corner of the site to an inlet which is piped to the pump station. The pump station discharges the runoff onto the westerly driveway. The runoff then flows northerly in the driveway discharging out onto Live Oak Avenue.

Table 1: Existing Sub-Area Profiles

Sub-Area	Area (acres)	Description
1	42.3	Encompasses the eastern portion of the project site and includes parking areas north of the existing race track in-field. Drains from southwest to northeast to curb inlet near the western-most driveway located on Live Oak Avenue.
2	12.2	Encompasses the race track in-field. Stormwater drains to an existing inlet and is transported to an existing pump station near the northeast corner of the project site.
3	8.8	Encompasses the western portion of the project site. Stormwater drains to the southwest corner of the project site and is transported to an existing pump station on site. The pump station discharges the stormwater onto the westerly driveway and ultimately discharges out onto Live Oak Avenue.

1.2 Proposed Drainage Conditions

Table 2: Post-Development Sub-Area Profiles

Sub-Area	Area (acres)	Description
1	24.4	Encompasses the south half of the outlet center buildings, truck docks, employee parking and walkways of the outlet center and the west parking field. The runoff drains to a proposed storm drainage system that flows to an existing pump station and is pumped into a proposed infiltration trench along the northerly project boundary.
2	16.7	Encompasses the northwest quarter of the outlet center buildings and the northwest parking field. The runoff drains through a filter strip and into a proposed infiltration trench along the northerly project boundary.
3	22.2	Encompasses the northeast quarter of the outlet center buildings and the northeast and east parking fields. The runoff is collected in a drainage system and pumped into a proposed infiltration trench along the northerly project boundary.

Table 3: Existing and Post-Development Pervious Conditions

Site Condition	Pervious surfaces (acres)	Impervious surfaces (acres)	Percentage Pervious	Percentage Impervious
Existing	3.0	63.3	4.7	95.3
Post-Development	6.6	63.3	10.4	89.6

Table 4: Project Site Runoff Flow Comparison

Storm Event	Flow Discharge (cubic foot per second)		
	Existing	Post- development	Change in flow
2-year/24-hour	43.9	37.8	-6.1
10-year/24-hour	94.9	75.7	-19.2
100-year/24-hour	171.4	132.7	-38.7

2 DESIGN OF THE TREATMENT SYSTEMS

2.1 Proposed Pre-Treatment Trains

It is proposed to collect the storm water runoff from the building roofs and parking lots and treat the run-off in media-filter devices. The particular treatment train consists of installing BioClean® catch basin filters at each catch basin (see Appendix B for product "cut-sheets"). Curb inlets, if utilized, will have BioClean® filters and curb guard installed. If roof drains are connected directly into the storm drain system, roof drain filters will be installed on the roof leaders. A trench drain will be constructed across the most westerly driveway intercepting flows and directing the run-off into a drainage collection line. BioClean® trench drain filters will be installed into the trench drains.

2.2 Discussion of an Infiltration System

An infiltration system was considered, but as the existing property is constructed over an old landfill this BMP is not feasible. Infiltration will increase the possibility of settlement so as a BMP infiltration is not practical in this case.

2.3 Discussion of a Rainwater Harvesting System (RWH)

Any RWH system at this site would need to be designed in accordance with the LA County Department of Public Health's policy concerning the, "Approval and Use of Cisterns for Rainfall/Run-off Capture and Distribution" (Policy 515.07). This policy allows the re-use of storm

water run-off solely for landscape irrigation purposes and in only an underground drip or bubbler system. An analysis was made on an industrial project in the City of Los Angeles by JRMA utilizing rainfall data from 2010 to determine how a proposed RWH system might have performed during those storm events. The results indicated that it was impossible to use all the captured run-off prior to a subsequent storm event, usually anticipated within one week time of the last rainfall event.

It was determined in that case that the fiscal burden of the proposed BMP was substantially greater than the Treatment Control BMP alternative and did not achieve a substantially greater improvement in storm water quality. JRMA believes the same conditions would present themselves with the design of the International Outlet Center, thus this system was eliminated from consideration.

2.4 Discussion of the Treatment Control BMP System

It is proposed to install three (3) Perk Filter™ Media Filter Devices as manufactured by KriStar Enterprises, Inc. The Perk Filter™ is a storm water filtration device used to reduce pollutants loading. The filter captures and retains sediment, oils, metals and other targeted constituents. A train of BMPs will be provided on this project.

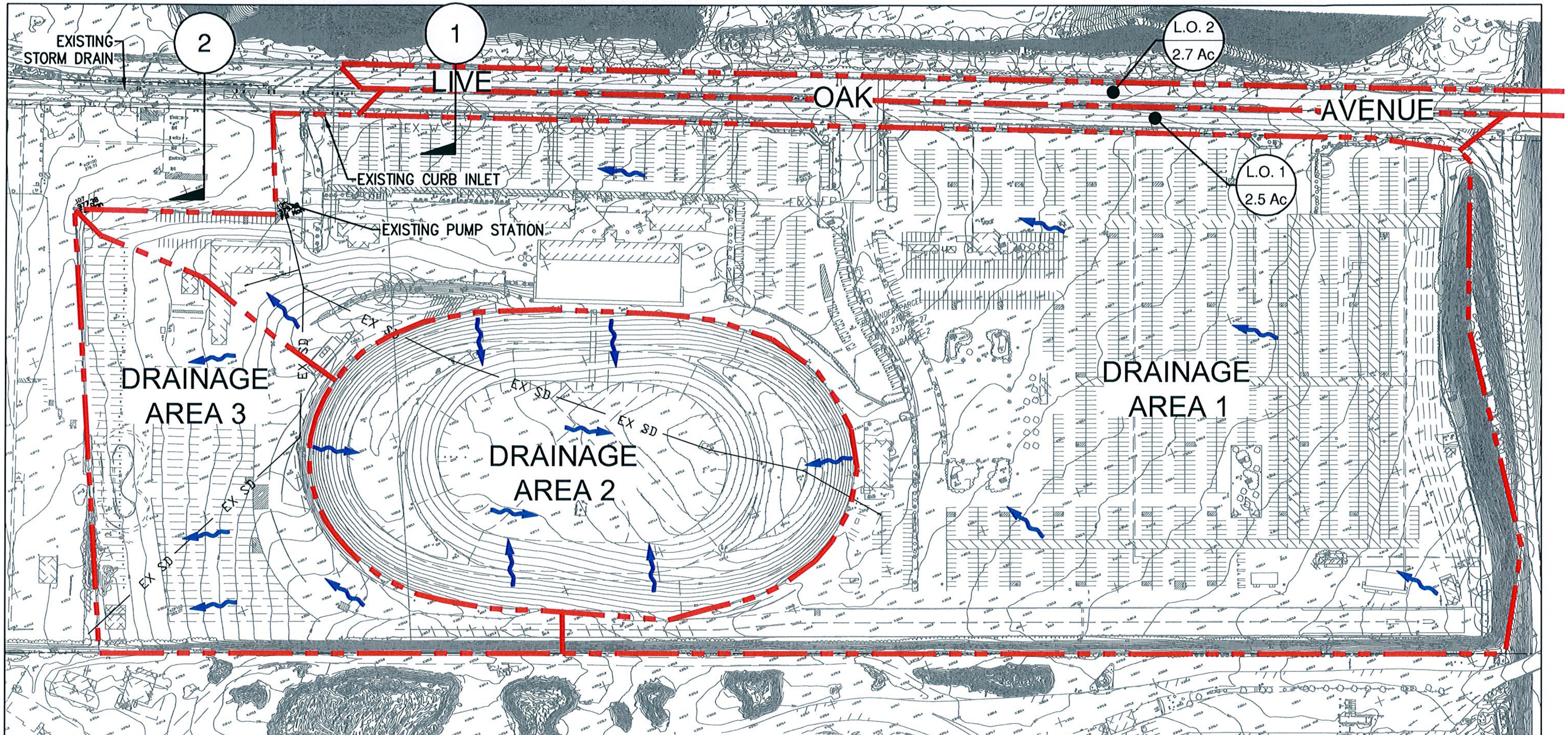
The flow rates for the selected BMPs were calculated using LA County's HydroCalc program. For the purposes of this study a rainfall amount of 0.75-inches was used in the calculations. The runoff calculations are contained in Appendix A.

The run-off from Area 1 will be collected in a series of catch basins, collected into a storm drain pipe and directed to Collector Pipe, Lateral "D" located in Live Oak Avenue. A Perk Filter™ Media Filter Device and by-pass will be constructed on the line prior to connection to the public storm drain system.

The run-off from Area 2 will sheet flow to a series of catch basins, collected into a storm drain pipe and connected to Connector Pipe A-19 located in Live Oak Avenue. A Perk Filter™ Media Filter Device and by-pass will be constructed on the line prior to connection to the public storm drain system.

The run-off from Area 3 will be collected in a series of catch basin and pipelines, collected into a storm drain pipe and connected into the back of an existing catch basin (CB A-21), located in Live Oak Avenue. A Perk Filter™ Media Filter Device and by-pass will be constructed on the line prior to connection to the public storm drain system.

\\BSERVER\JOBS\4501-5000\4638 LINDOM COMPANY RETAIL OUTLET\JRMA DRAWINGS\1-PRELIMINARY\JRMA CIVIL\CIVIL EXHIBITS\SUSMP\4638_ FIGURE 1 - EXISTING DRAINAGE PATTERN.DWG PLOTTED: 2014/11/26



SCALE: 1"=200'

0 200' 400'

JRM &A

ARCHITECTS
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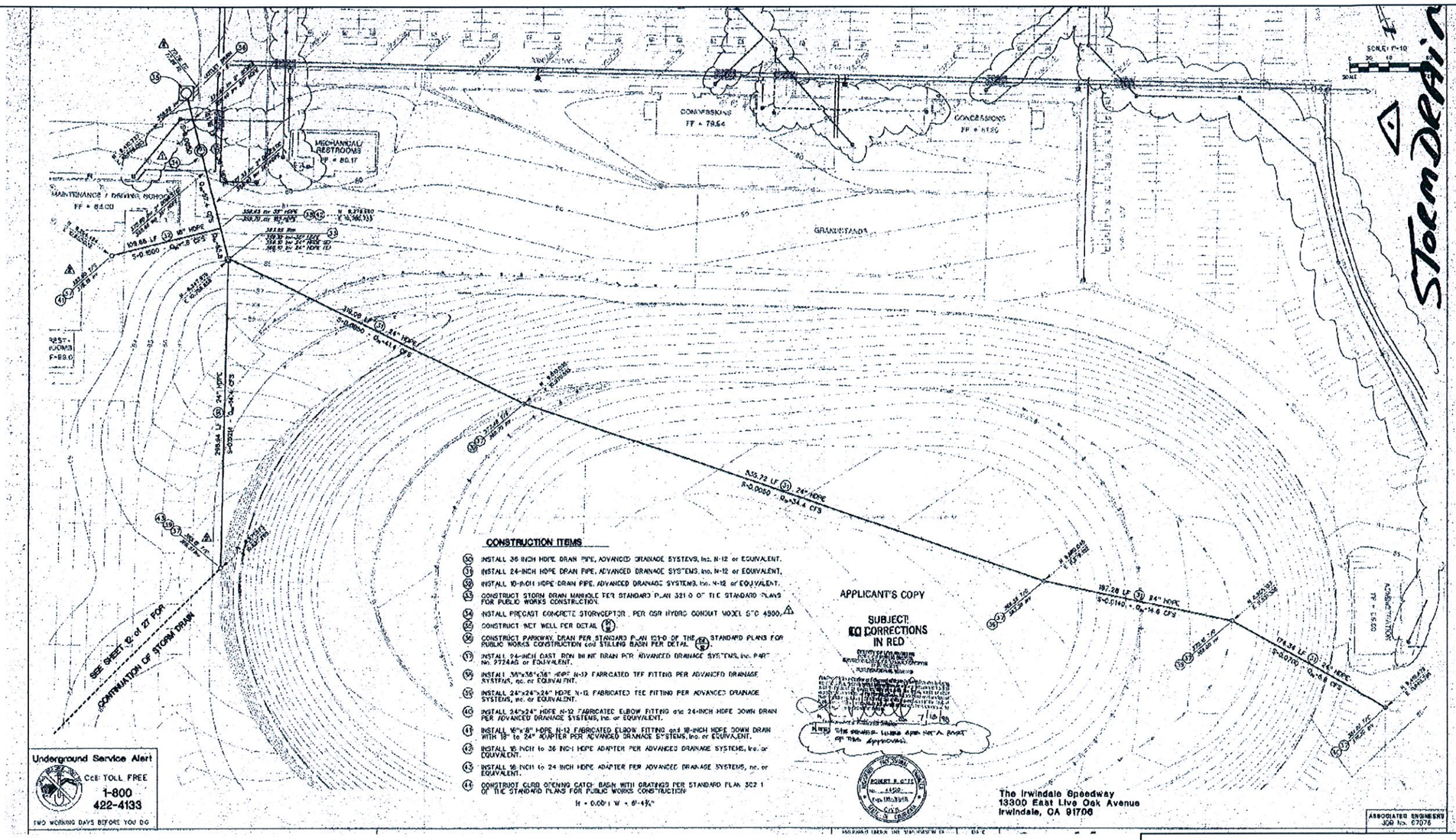
PLANNERS

J.R. Miller & Associates
2700 Saturn St
Brea, CA 92821
tel.714.524.1870
fax.714.524.1875
www.jrma.com

EXISTING DRAINAGE PATTERN

FIGURE 1



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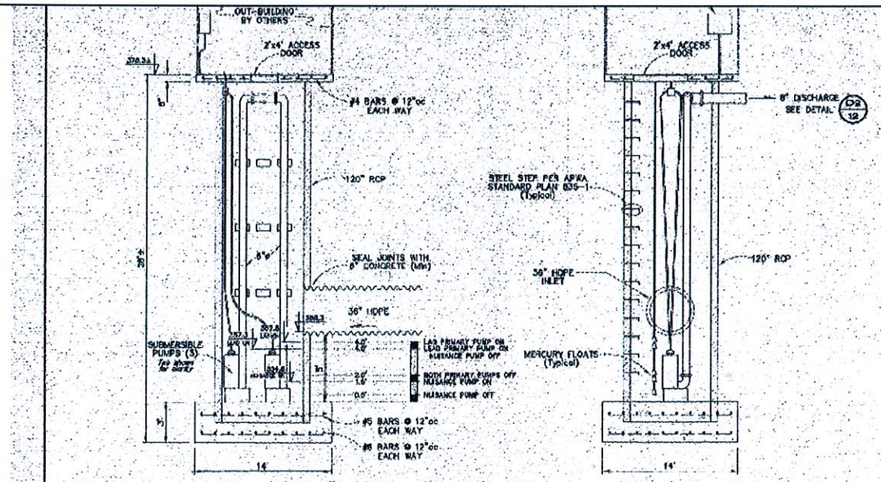
EXISTING DRAINAGE SYSTEM

FIGURE 2



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EXISTING PUMP STATION

FIGURE 3

EXISTING STORM DRAIN

LIVE OAK AVENUE

1
24.4 Ac

2
16.7 Ac

3
22.2 Ac

MEDIA FILTER

MEDIA FILTER

MEDIA FILTER

LIMIT OF LANDFILL

LIMIT OF LANDFILL

LIMIT OF LANDFILL

DETAIL A

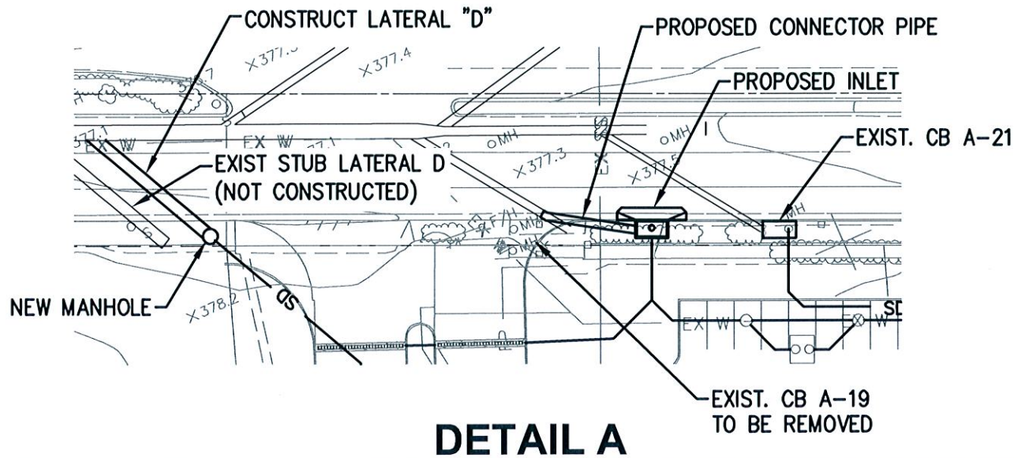
DRAINAGE AREA 1

DRAINAGE AREA 2

DRAINAGE AREA 3

SD

LIMIT OF LANDFILL



DETAIL A

SCALE: 1"=200'

0 200' 400'

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PROPOSED DRAINAGE PATTERN

FIGURE 4

Appendix A

VOLUME AND FLOW RATE CALCULATIONS

Peak Flow Hydrologic Analysis

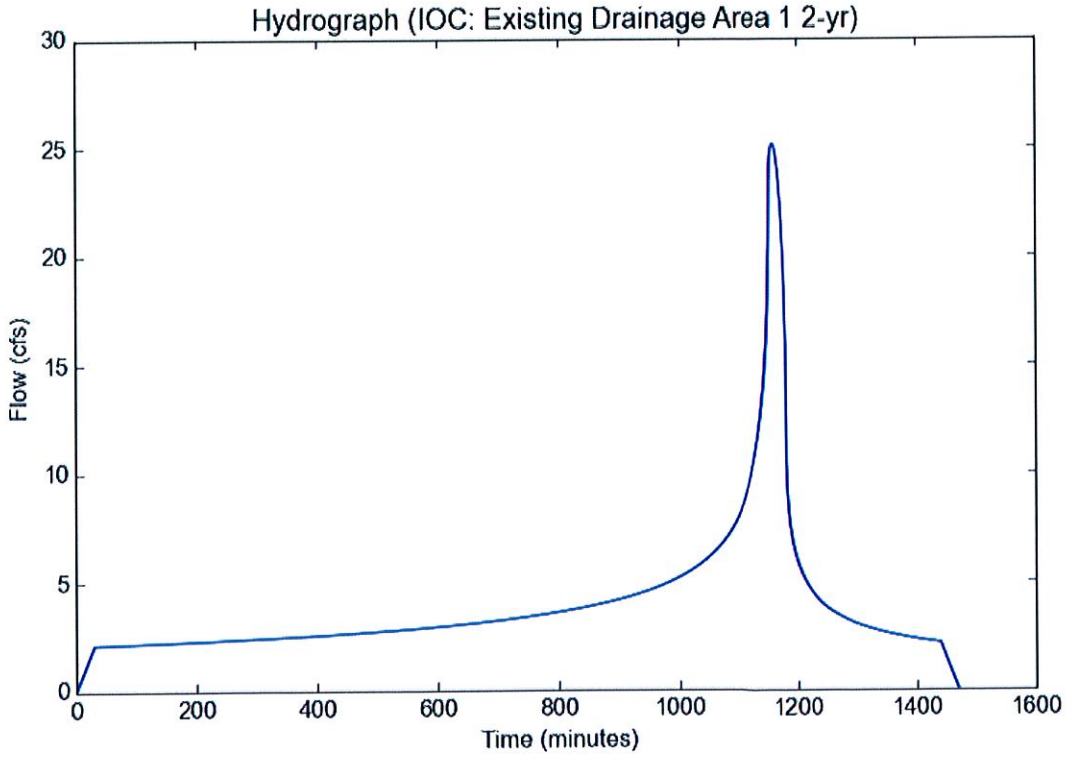
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 1 2-yr
Area (ac)	42.3
Flow Path Length (ft)	2570.0
Flow Path Slope (vft/hft)	0.0074
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.5929
Peak Intensity (in/hr)	0.6664
Undeveloped Runoff Coefficient (Cu)	0.7029
Developed Runoff Coefficient (Cd)	0.8901
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	25.0934
Burned Peak Flow Rate (cfs)	25.0934
24-Hr Clear Runoff Volume (ac-ft)	7.8403
24-Hr Clear Runoff Volume (cu-ft)	341522.8045



Peak Flow Hydrologic Analysis

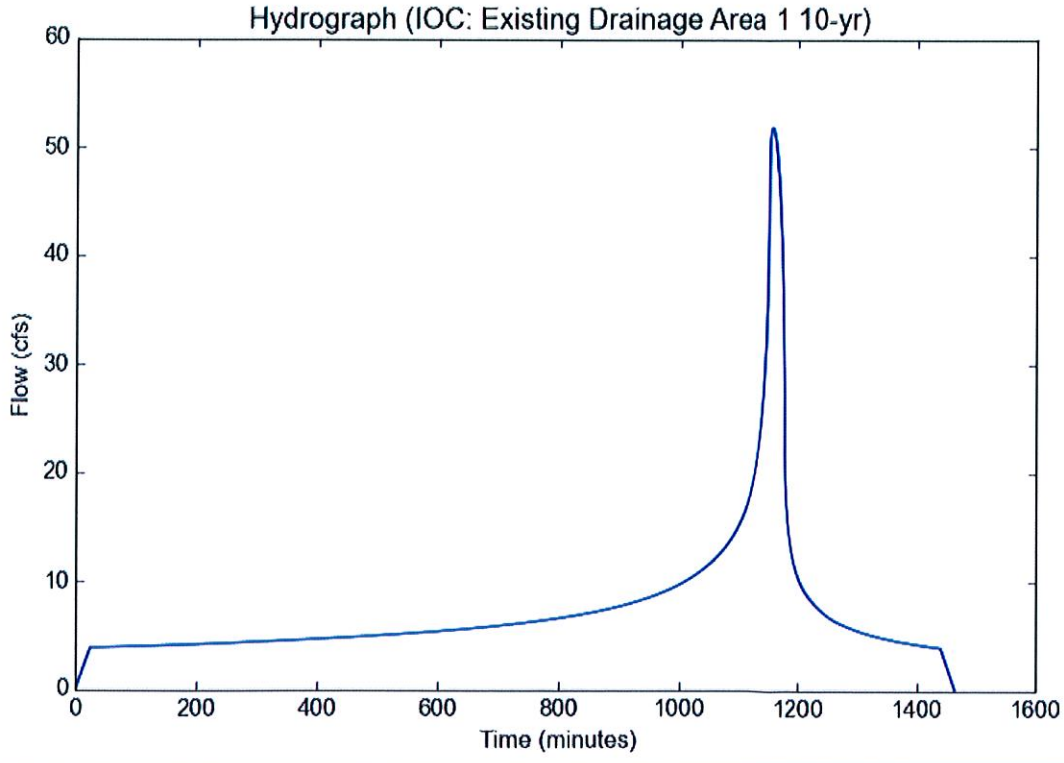
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 1 10-yr
Area (ac)	42.3
Flow Path Length (ft)	2570.0
Flow Path Slope (vft/hft)	0.0074
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	1.3655
Undeveloped Runoff Coefficient (Cu)	0.8484
Developed Runoff Coefficient (Cd)	0.8974
Time of Concentration (min)	24.0
Clear Peak Flow Rate (cfs)	51.8357
Burned Peak Flow Rate (cfs)	51.8357
24-Hr Clear Runoff Volume (ac-ft)	14.5506
24-Hr Clear Runoff Volume (cu-ft)	633822.3408



Peak Flow Hydrologic Analysis

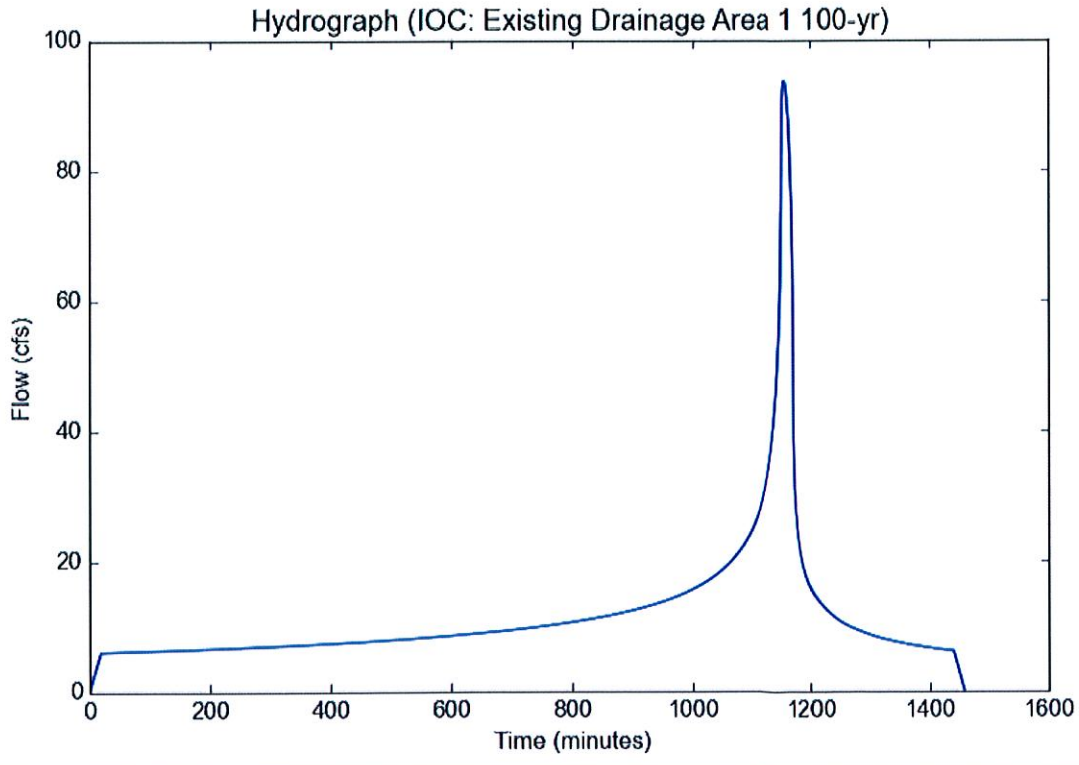
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 1 100-yr
Area (ac)	42.3
Flow Path Length (ft)	2570.0
Flow Path Slope (vft/hft)	0.0074
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.5174
Peak Intensity (in/hr)	2.4565
Undeveloped Runoff Coefficient (Cu)	0.9149
Developed Runoff Coefficient (Cd)	0.9007
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	93.5944
Burned Peak Flow Rate (cfs)	93.5944
24-Hr Clear Runoff Volume (ac-ft)	23.0423
24-Hr Clear Runoff Volume (cu-ft)	1003721.3294



Peak Flow Hydrologic Analysis

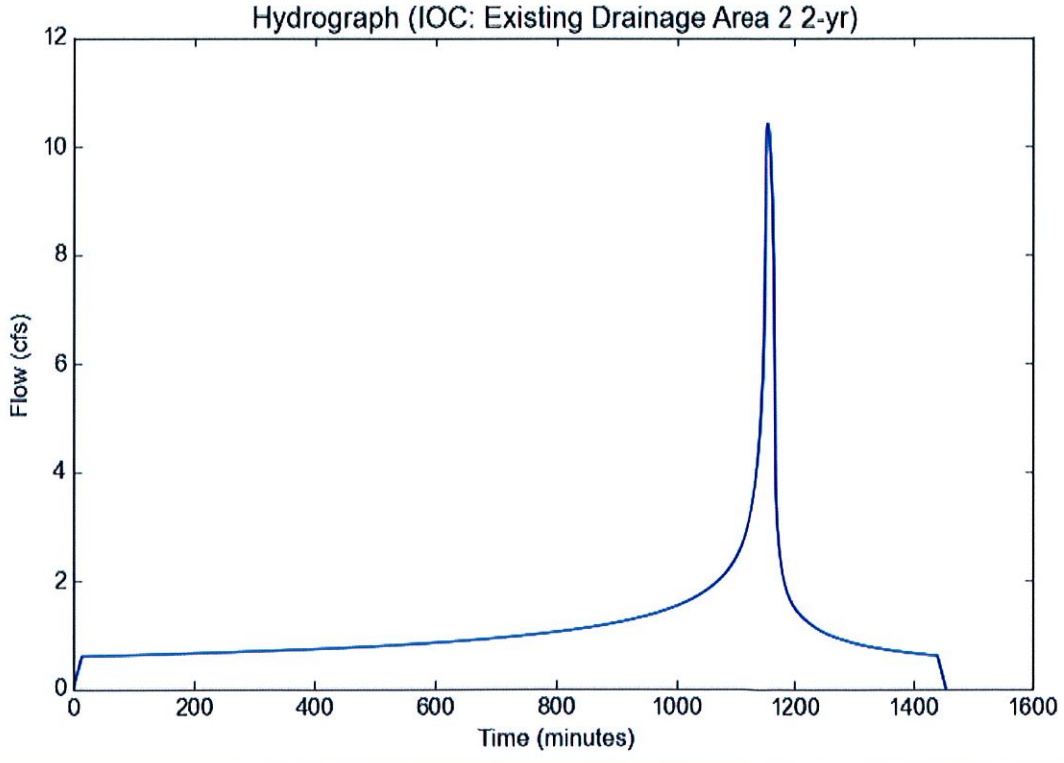
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 2 2-yr
Area (ac)	12.2
Flow Path Length (ft)	759.0
Flow Path Slope (vft/hft)	0.0224
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.5929
Peak Intensity (in/hr)	0.9535
Undeveloped Runoff Coefficient (Cu)	0.7919
Developed Runoff Coefficient (Cd)	0.8946
Time of Concentration (min)	14.0
Clear Peak Flow Rate (cfs)	10.4066
Burned Peak Flow Rate (cfs)	10.4066
24-Hr Clear Runoff Volume (ac-ft)	2.2615
24-Hr Clear Runoff Volume (cu-ft)	98509.5935



Peak Flow Hydrologic Analysis

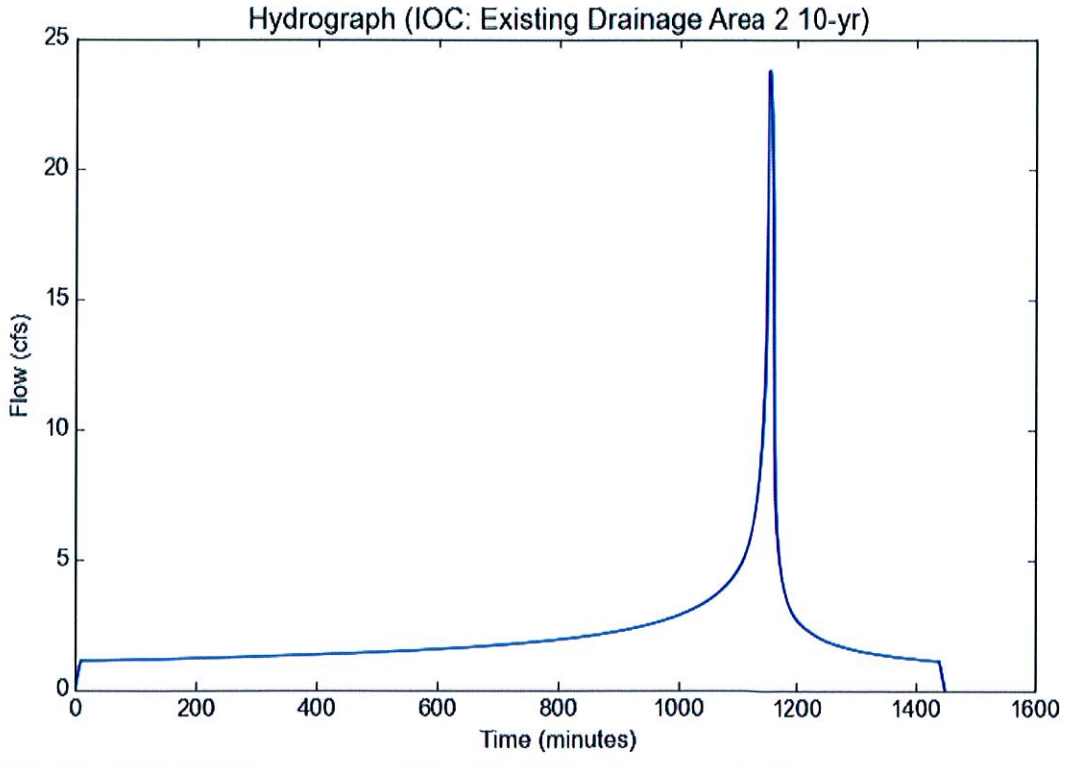
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 2 10-yr
Area (ac)	12.2
Flow Path Length (ft)	759.0
Flow Path Slope (vft/hft)	0.0224
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	2.1652
Undeveloped Runoff Coefficient (Cu)	0.9047
Developed Runoff Coefficient (Cd)	0.9002
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	23.7801
Burned Peak Flow Rate (cfs)	23.7801
24-Hr Clear Runoff Volume (ac-ft)	4.1967
24-Hr Clear Runoff Volume (cu-ft)	182810.4166



Peak Flow Hydrologic Analysis

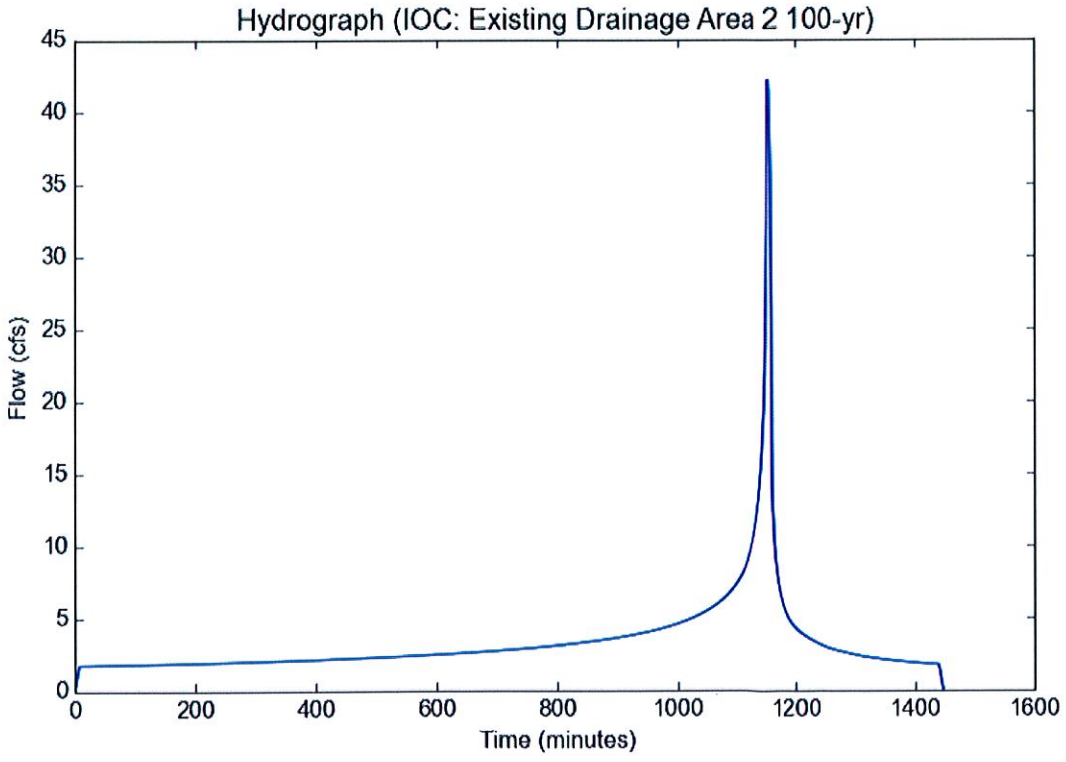
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Dr
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 2 100-yr
Area (ac)	12.2
Flow Path Length (ft)	759.0
Flow Path Slope (vft/hft)	0.0224
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.5174
Peak Intensity (in/hr)	3.829
Undeveloped Runoff Coefficient (Cu)	0.9489
Developed Runoff Coefficient (Cd)	0.9024
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	42.1571
Burned Peak Flow Rate (cfs)	42.1571
24-Hr Clear Runoff Volume (ac-ft)	6.6458
24-Hr Clear Runoff Volume (cu-ft)	289493.0529



Peak Flow Hydrologic Analysis

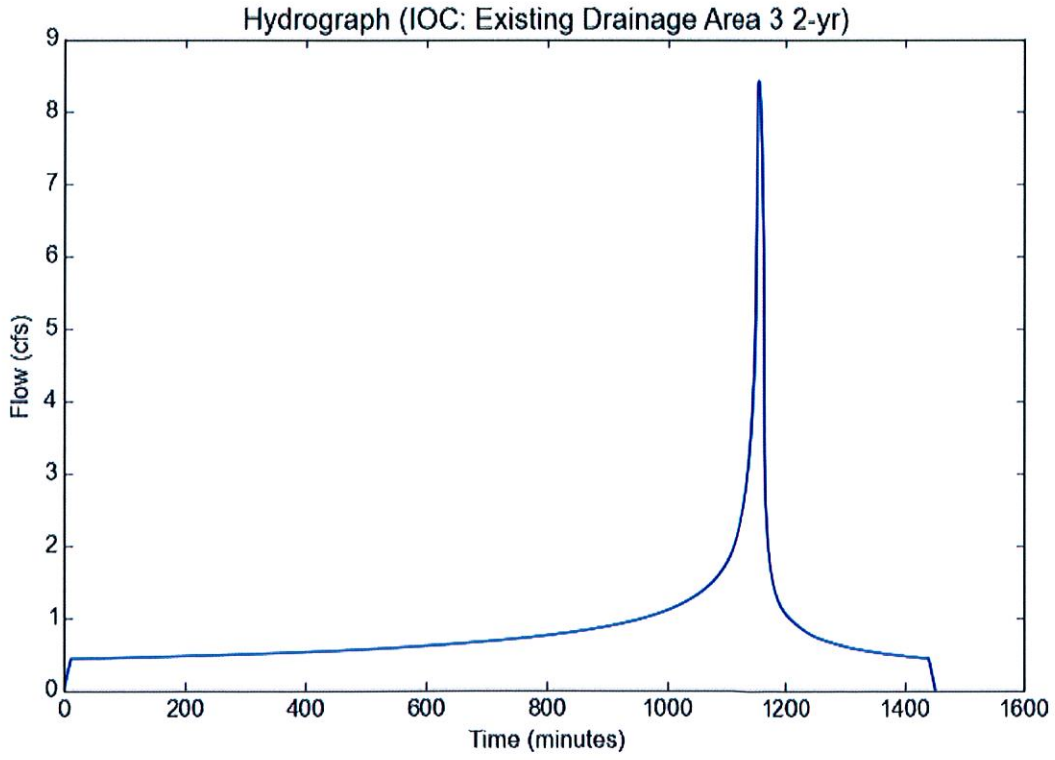
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 3 2-yr
Area (ac)	8.8
Flow Path Length (ft)	490.0
Flow Path Slope (vft/hft)	0.0183
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.5929
Peak Intensity (in/hr)	1.0679
Undeveloped Runoff Coefficient (Cu)	0.8108
Developed Runoff Coefficient (Cd)	0.8955
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	8.4162
Burned Peak Flow Rate (cfs)	8.4162
24-Hr Clear Runoff Volume (ac-ft)	1.6312
24-Hr Clear Runoff Volume (cu-ft)	71056.7817



Peak Flow Hydrologic Analysis

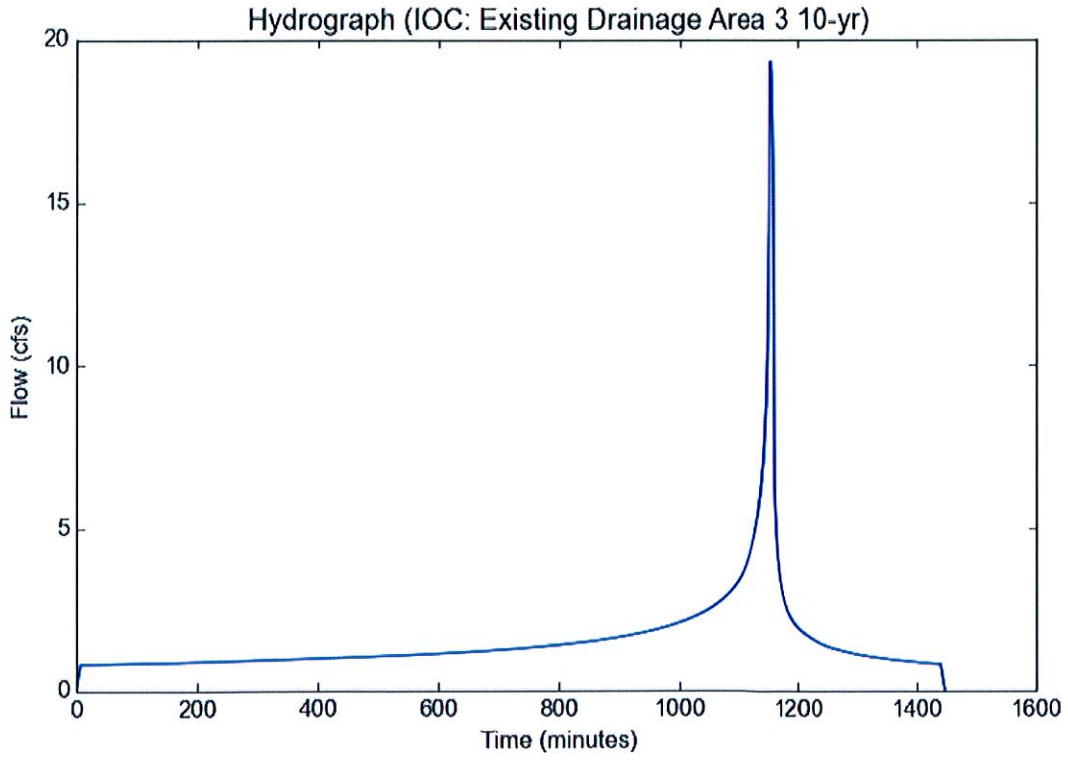
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 3 10-yr
Area (ac)	8.8
Flow Path Length (ft)	490.0
Flow Path Slope (vft/hft)	0.0183
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	2.4367
Undeveloped Runoff Coefficient (Cu)	0.9142
Developed Runoff Coefficient (Cd)	0.9007
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	19.3136
Burned Peak Flow Rate (cfs)	19.3136
24-Hr Clear Runoff Volume (ac-ft)	3.0272
24-Hr Clear Runoff Volume (cu-ft)	131863.1715



Peak Flow Hydrologic Analysis

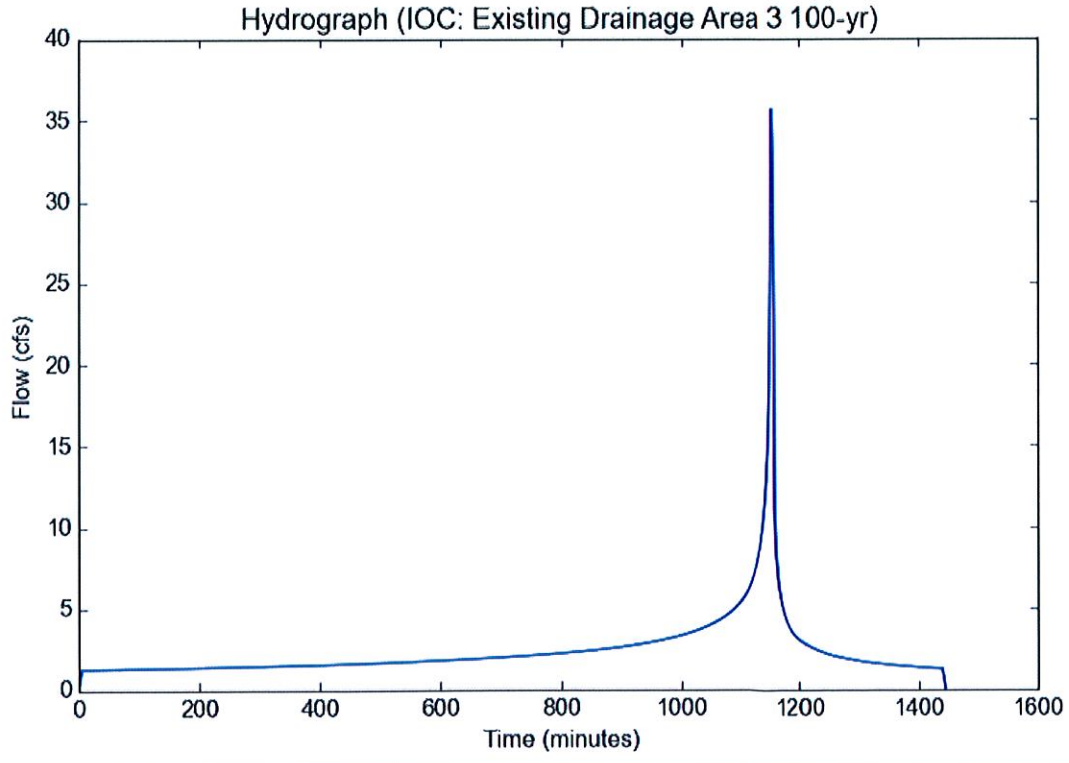
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Existing Di
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Existing Drainage Area 3 100-yr
Area (ac)	8.8
Flow Path Length (ft)	490.0
Flow Path Slope (vft/hft)	0.0183
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.5174
Peak Intensity (in/hr)	4.4851
Undeveloped Runoff Coefficient (Cu)	0.9573
Developed Runoff Coefficient (Cd)	0.9029
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	35.6351
Burned Peak Flow Rate (cfs)	35.6351
24-Hr Clear Runoff Volume (ac-ft)	4.7937
24-Hr Clear Runoff Volume (cu-ft)	208815.1212



Peak Flow Hydrologic Analysis

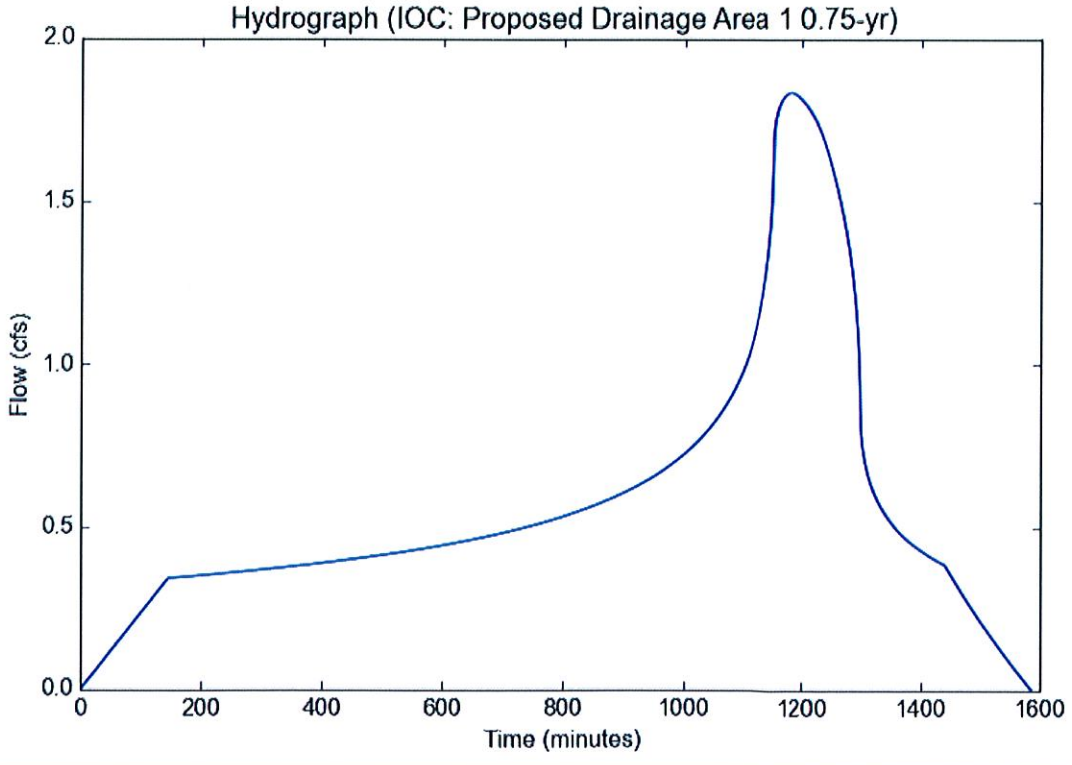
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 1 0.75-yr
Area (ac)	24.4
Flow Path Length (ft)	3235.0
Flow Path Slope (vft/hft)	0.0012
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.0916
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	146.0
Clear Peak Flow Rate (cfs)	1.8333
Burned Peak Flow Rate (cfs)	1.8333
24-Hr Clear Runoff Volume (ac-ft)	1.2405
24-Hr Clear Runoff Volume (cu-ft)	54037.4916



Peak Flow Hydrologic Analysis

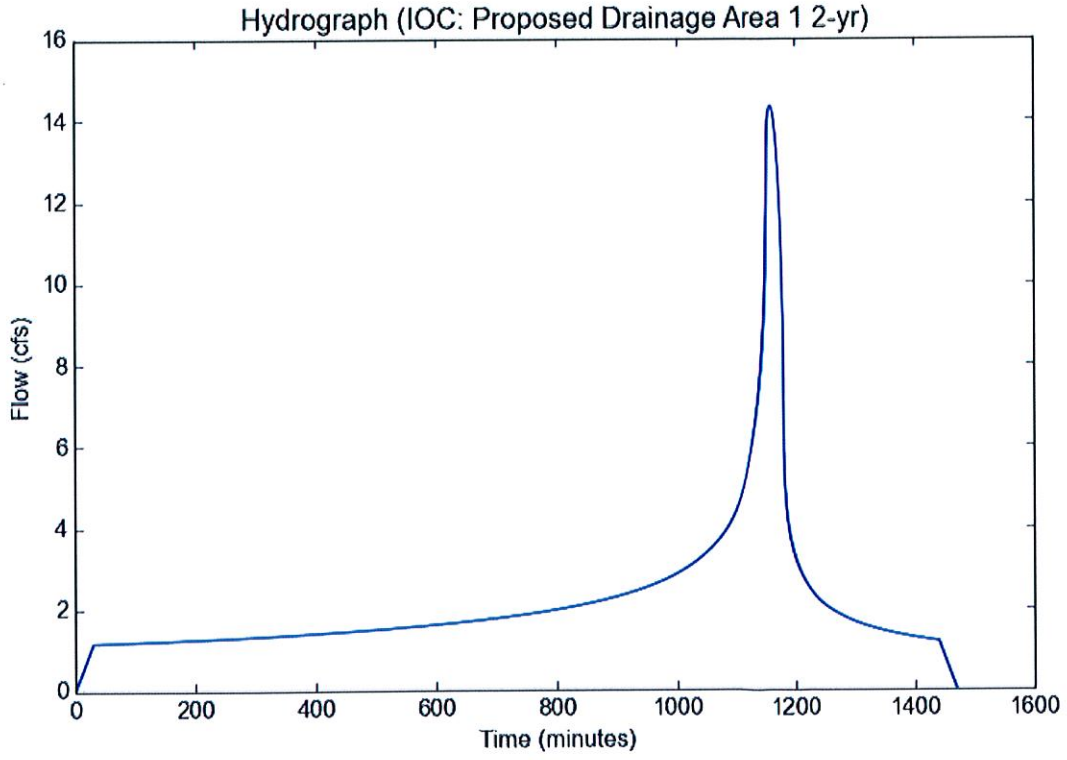
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 1 2-yr
Area (ac)	24.4
Flow Path Length (ft)	3235.0
Flow Path Slope (vft/hft)	0.0012
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.5929
Peak Intensity (in/hr)	0.6664
Undeveloped Runoff Coefficient (Cu)	0.7029
Developed Runoff Coefficient (Cd)	0.8803
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	14.3145
Burned Peak Flow Rate (cfs)	14.3145
24-Hr Clear Runoff Volume (ac-ft)	4.3392
24-Hr Clear Runoff Volume (cu-ft)	189016.0122



Peak Flow Hydrologic Analysis

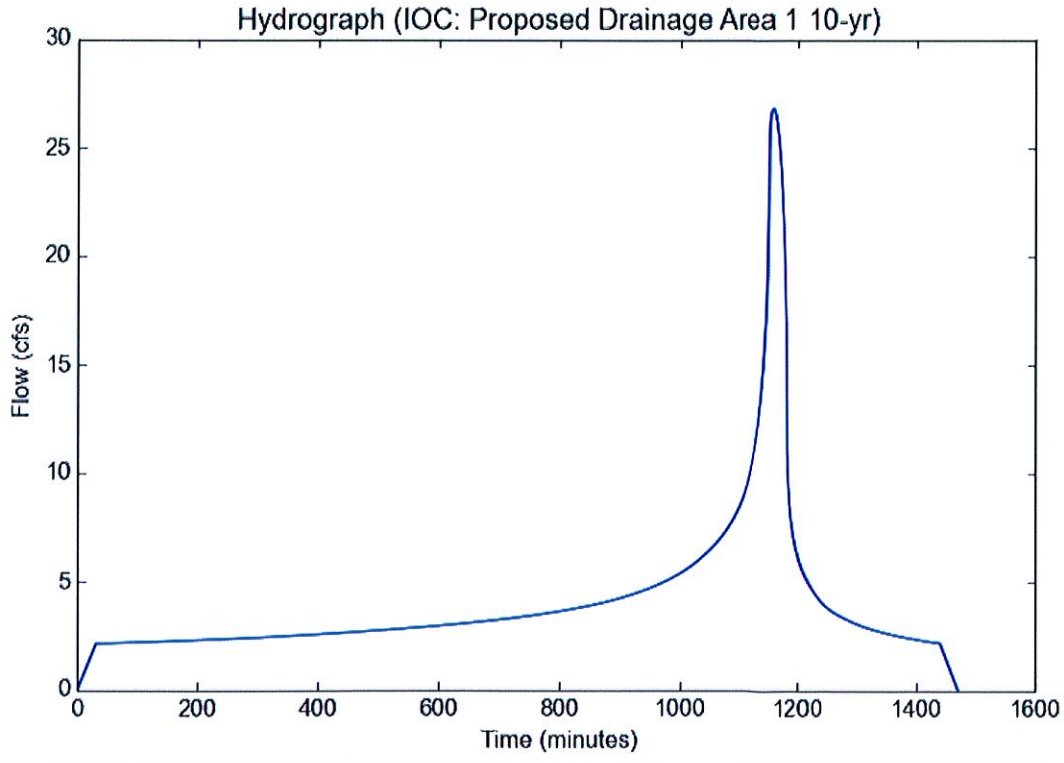
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 1 10-yr
Area (ac)	24.4
Flow Path Length (ft)	3235.0
Flow Path Slope (vft/hft)	0.0012
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	1.2295
Undeveloped Runoff Coefficient (Cu)	0.8312
Developed Runoff Coefficient (Cd)	0.8931
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	26.7945
Burned Peak Flow Rate (cfs)	26.7945
24-Hr Clear Runoff Volume (ac-ft)	8.1042
24-Hr Clear Runoff Volume (cu-ft)	353019.9857



Peak Flow Hydrologic Analysis

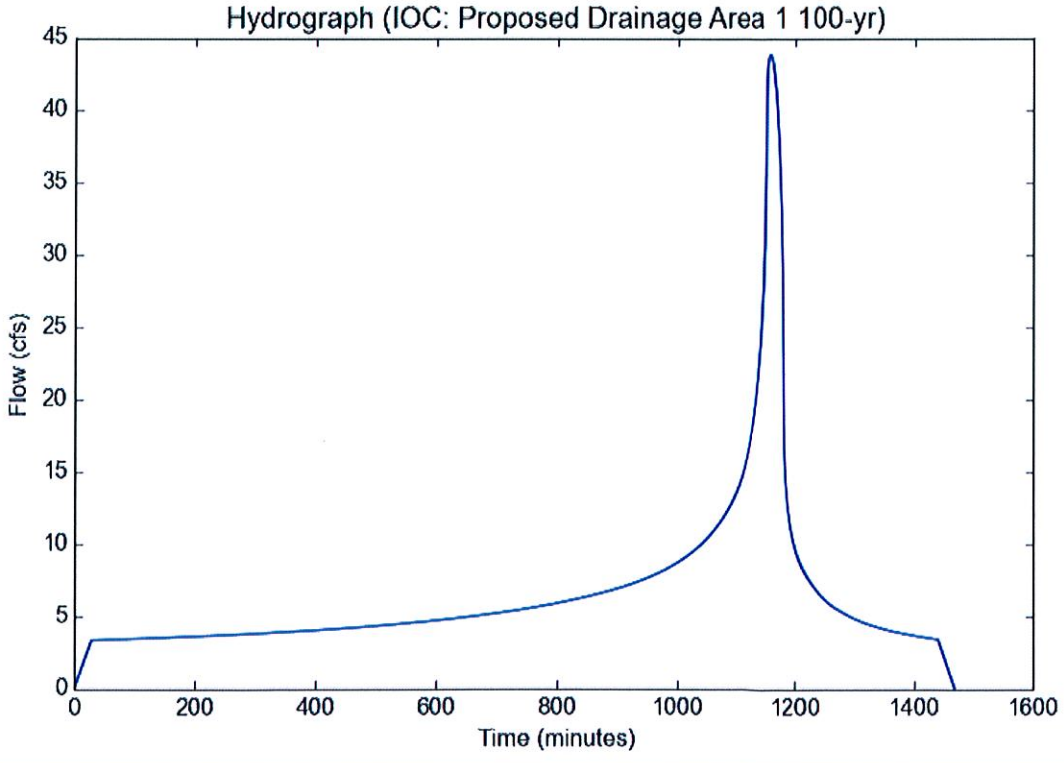
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 1 100-yr
Area (ac)	24.4
Flow Path Length (ft)	3235.0
Flow Path Slope (vft/hft)	0.0012
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.5174
Peak Intensity (in/hr)	1.9958
Undeveloped Runoff Coefficient (Cu)	0.8986
Developed Runoff Coefficient (Cd)	0.8999
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	43.8216
Burned Peak Flow Rate (cfs)	43.8216
24-Hr Clear Runoff Volume (ac-ft)	12.9398
24-Hr Clear Runoff Volume (cu-ft)	563659.8452



Peak Flow Hydrologic Analysis

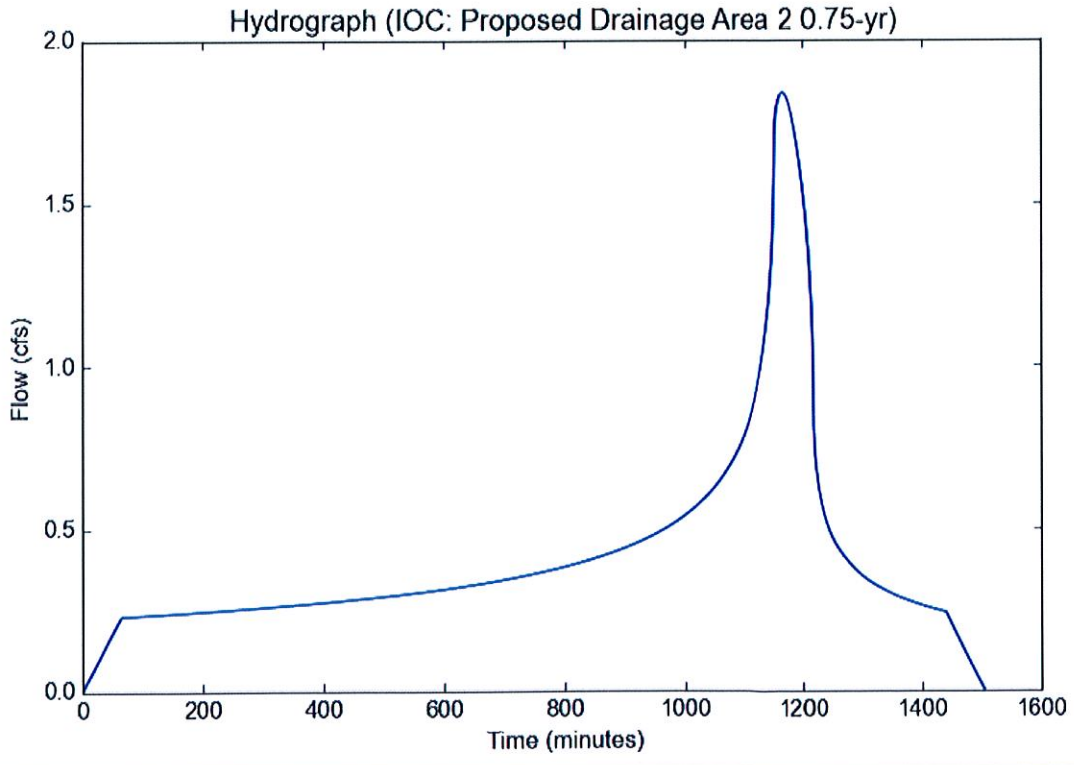
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 2 0.75-yr
Area (ac)	16.7
Flow Path Length (ft)	1268.0
Flow Path Slope (vft/hft)	0.0039
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.134
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	65.0
Clear Peak Flow Rate (cfs)	1.8354
Burned Peak Flow Rate (cfs)	1.8354
24-Hr Clear Runoff Volume (ac-ft)	0.8488
24-Hr Clear Runoff Volume (cu-ft)	36975.8394



Peak Flow Hydrologic Analysis

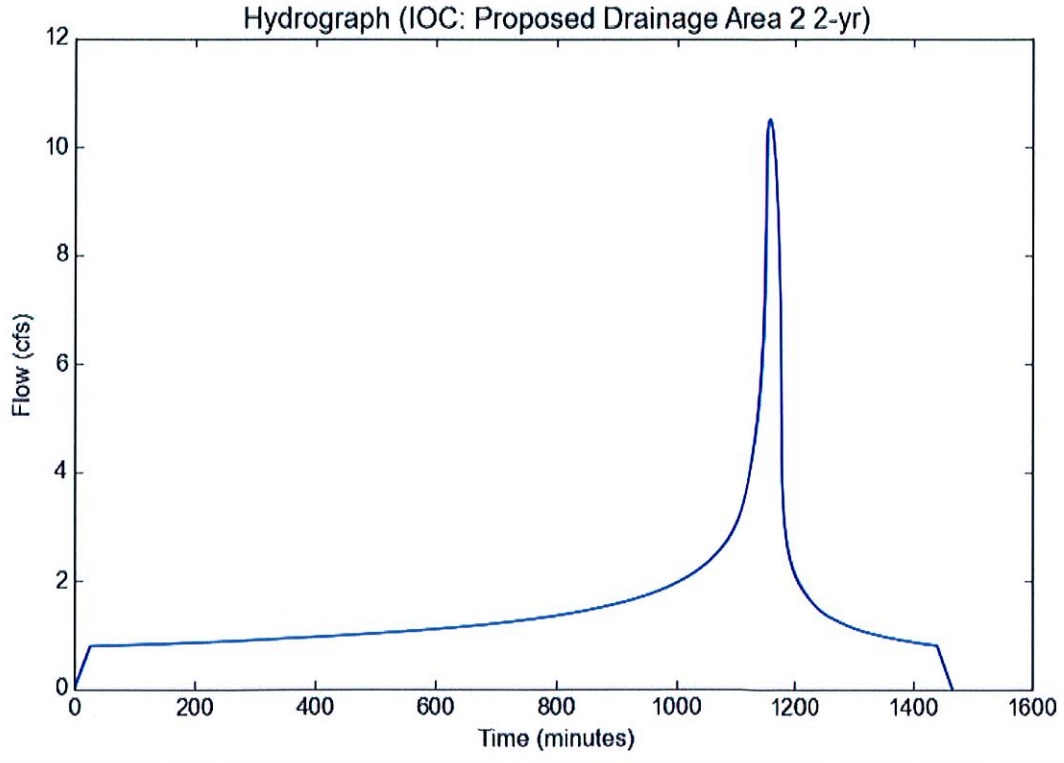
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 2 2-yr
Area (ac)	16.7
Flow Path Length (ft)	1268.0
Flow Path Slope (vft/hft)	0.0039
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.5929
Peak Intensity (in/hr)	0.7128
Undeveloped Runoff Coefficient (Cu)	0.7219
Developed Runoff Coefficient (Cd)	0.8822
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	10.5014
Burned Peak Flow Rate (cfs)	10.5014
24-Hr Clear Runoff Volume (ac-ft)	2.97
24-Hr Clear Runoff Volume (cu-ft)	129372.8395



Peak Flow Hydrologic Analysis

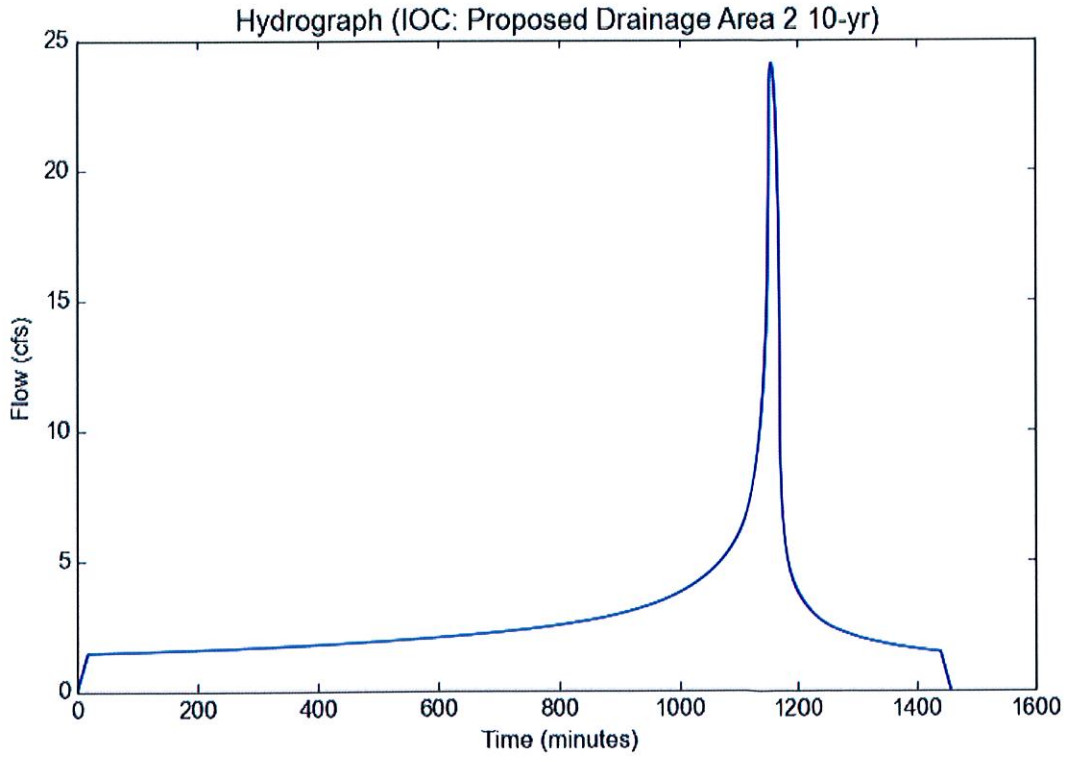
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 2 10-yr
Area (ac)	16.7
Flow Path Length (ft)	1268.0
Flow Path Slope (vft/hft)	0.0039
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	1.6058
Undeveloped Runoff Coefficient (Cu)	0.8725
Developed Runoff Coefficient (Cd)	0.8972
Time of Concentration (min)	17.0
Clear Peak Flow Rate (cfs)	24.0608
Burned Peak Flow Rate (cfs)	24.0608
24-Hr Clear Runoff Volume (ac-ft)	5.5471
24-Hr Clear Runoff Volume (cu-ft)	241632.413



Peak Flow Hydrologic Analysis

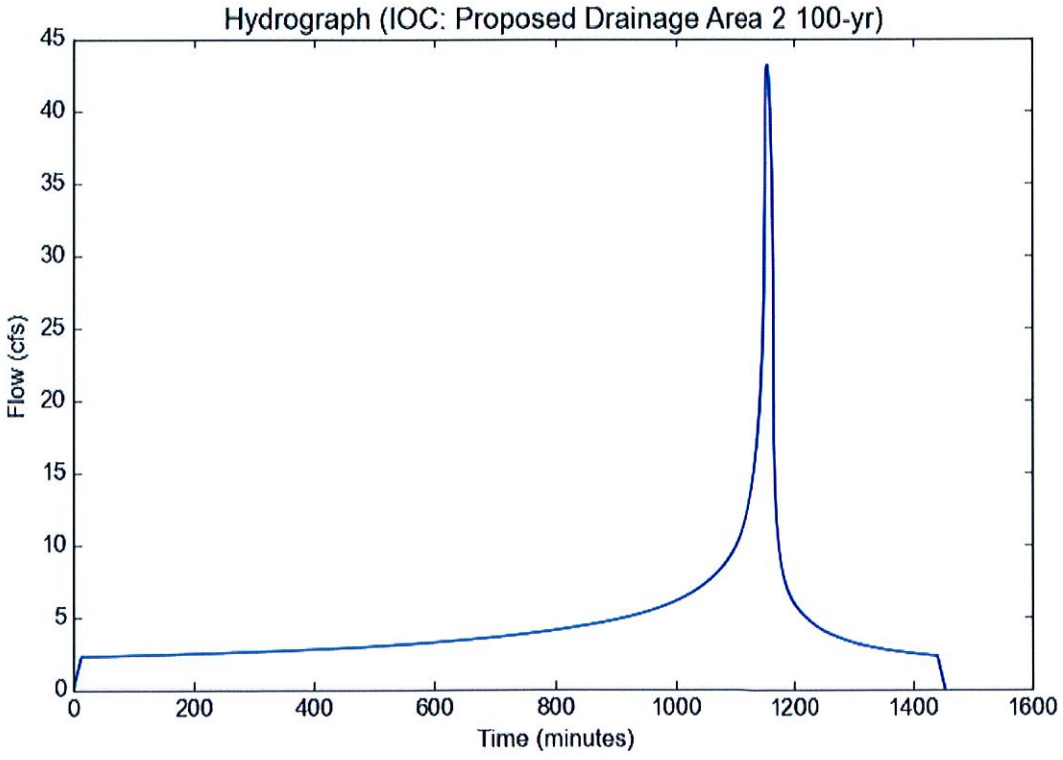
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 2 100-yr
Area (ac)	16.7
Flow Path Length (ft)	1268.0
Flow Path Slope (vft/hft)	0.0039
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.5174
Peak Intensity (in/hr)	2.8624
Undeveloped Runoff Coefficient (Cu)	0.9291
Developed Runoff Coefficient (Cd)	0.9029
Time of Concentration (min)	13.0
Clear Peak Flow Rate (cfs)	43.1611
Burned Peak Flow Rate (cfs)	43.1611
24-Hr Clear Runoff Volume (ac-ft)	8.8565
24-Hr Clear Runoff Volume (cu-ft)	385788.482



Peak Flow Hydrologic Analysis

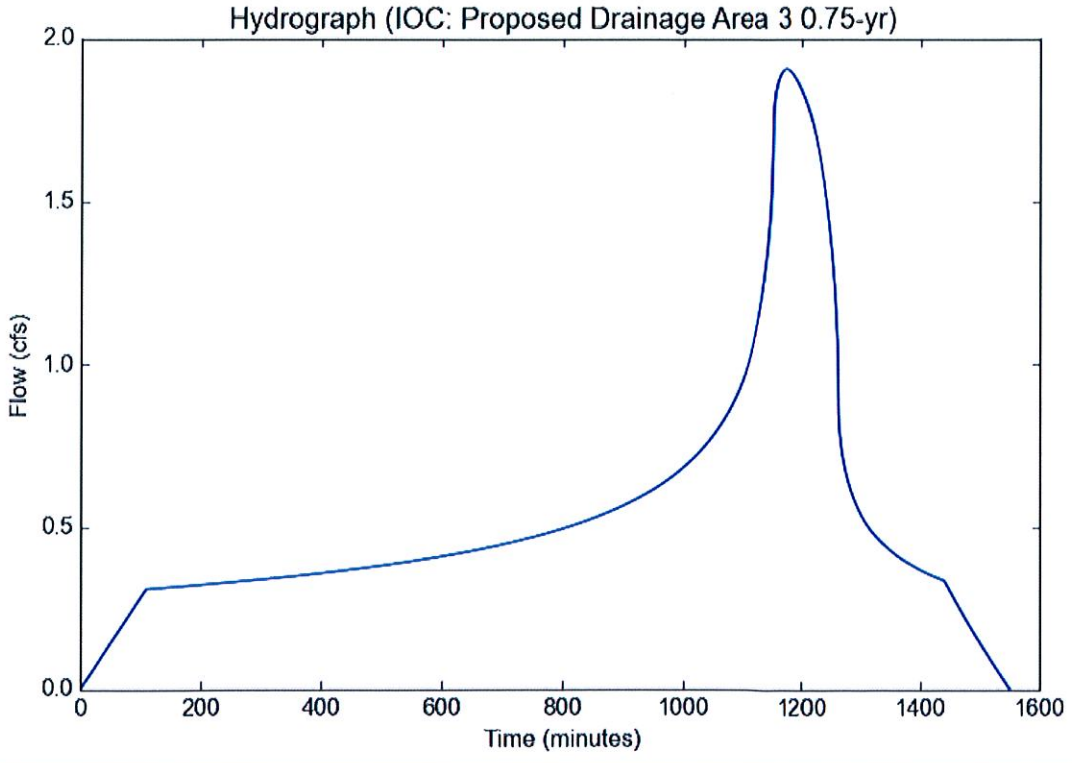
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 3 0.75-yr
Area (ac)	22.2
Flow Path Length (ft)	2215.0
Flow Path Slope (vft/hft)	0.0015
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1047
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.82
Time of Concentration (min)	110.0
Clear Peak Flow Rate (cfs)	1.9054
Burned Peak Flow Rate (cfs)	1.9054
24-Hr Clear Runoff Volume (ac-ft)	1.1285
24-Hr Clear Runoff Volume (cu-ft)	49158.8042



Peak Flow Hydrologic Analysis

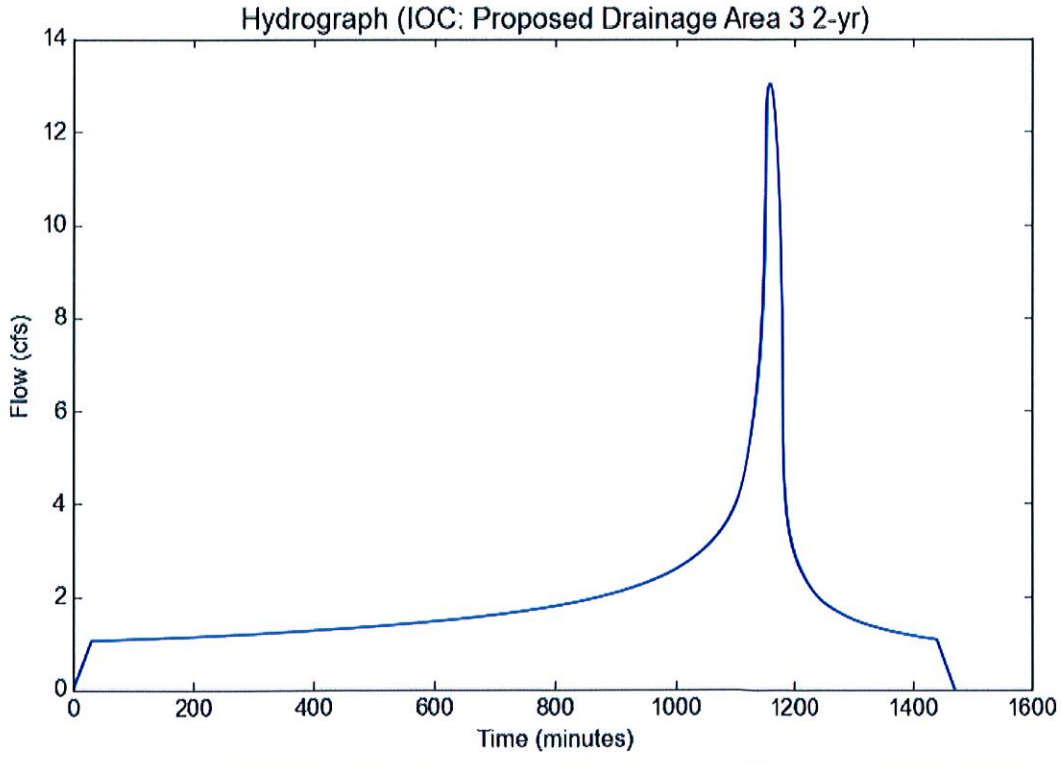
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 3 2-yr
Area (ac)	22.2
Flow Path Length (ft)	2215.0
Flow Path Slope (vft/hft)	0.0015
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	2-yr
Fire Factor	0
LID	False

Output Results

Modeled (2-yr) Rainfall Depth (in)	2.5929
Peak Intensity (in/hr)	0.6664
Undeveloped Runoff Coefficient (Cu)	0.7029
Developed Runoff Coefficient (Cd)	0.8803
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	13.0238
Burned Peak Flow Rate (cfs)	13.0238
24-Hr Clear Runoff Volume (ac-ft)	3.948
24-Hr Clear Runoff Volume (cu-ft)	171973.5849



Peak Flow Hydrologic Analysis

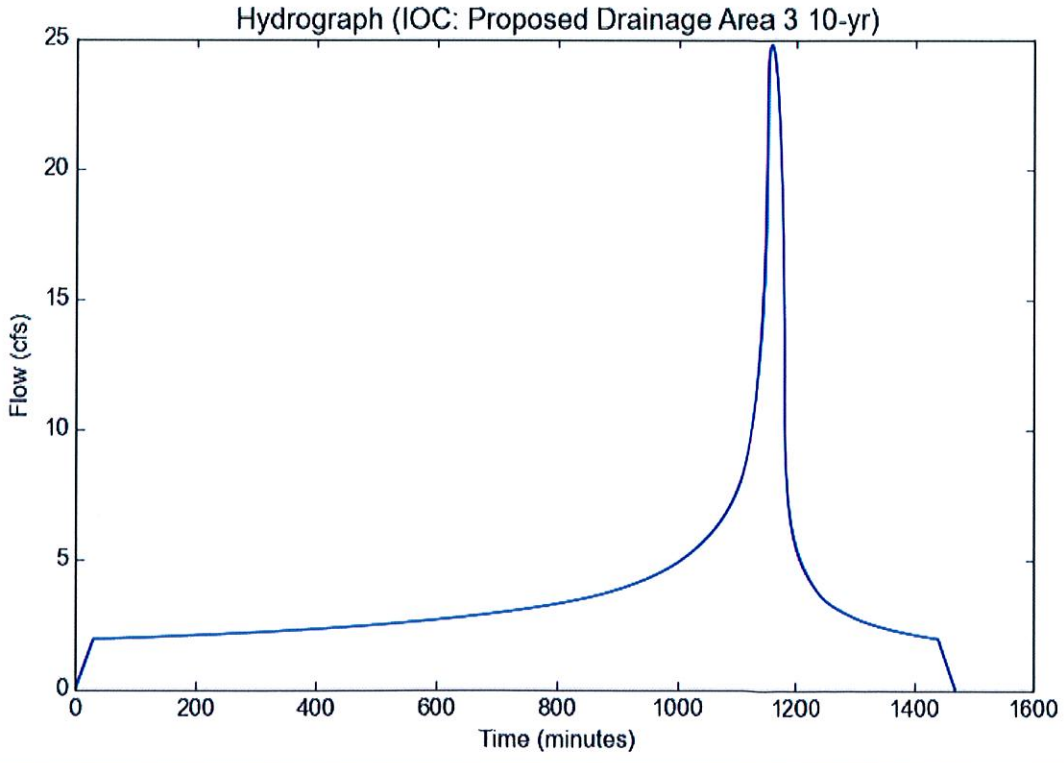
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 3 10-yr
Area (ac)	22.2
Flow Path Length (ft)	2215.0
Flow Path Slope (vft/hft)	0.0015
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	10-yr
Fire Factor	0
LID	False

Output Results

Modeled (10-yr) Rainfall Depth (in)	4.7838
Peak Intensity (in/hr)	1.2493
Undeveloped Runoff Coefficient (Cu)	0.8337
Developed Runoff Coefficient (Cd)	0.8934
Time of Concentration (min)	29.0
Clear Peak Flow Rate (cfs)	24.7771
Burned Peak Flow Rate (cfs)	24.7771
24-Hr Clear Runoff Volume (ac-ft)	7.3735
24-Hr Clear Runoff Volume (cu-ft)	321190.8869



Peak Flow Hydrologic Analysis

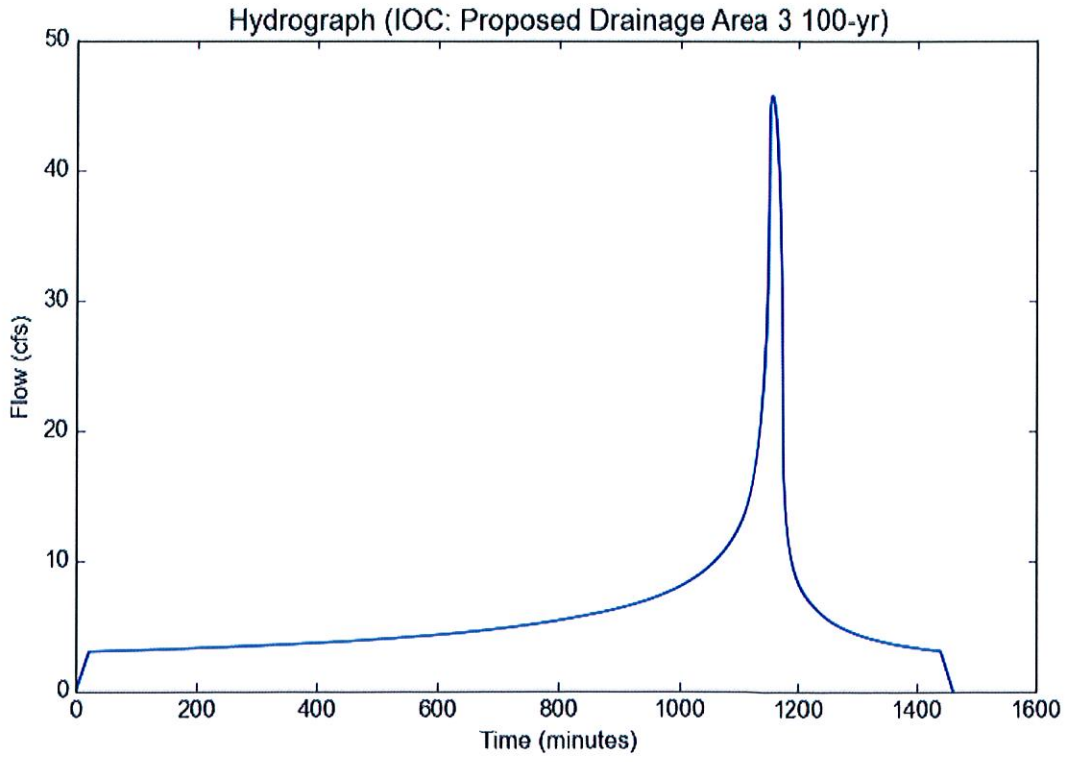
File location: //bserver/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/SUSMP or WQMP/Hydrocalc/IOC - Proposed
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Proposed Drainage Area 3 100-yr
Area (ac)	22.2
Flow Path Length (ft)	2215.0
Flow Path Slope (vft/hft)	0.0015
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	7.5174
Peak Intensity (in/hr)	2.2848
Undeveloped Runoff Coefficient (Cu)	0.9089
Developed Runoff Coefficient (Cd)	0.9009
Time of Concentration (min)	21.0
Clear Peak Flow Rate (cfs)	45.6947
Burned Peak Flow Rate (cfs)	45.6947
24-Hr Clear Runoff Volume (ac-ft)	11.7731
24-Hr Clear Runoff Volume (cu-ft)	512837.8607

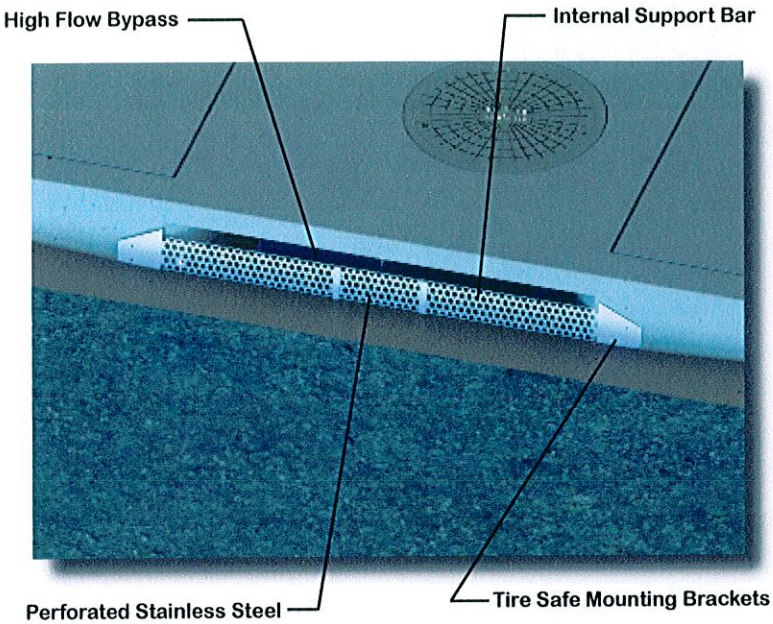


Appendix B

PRODUCT CUT SHEETS

CURB GUARD

STORMWATER INLET TRASH PROTECTOR

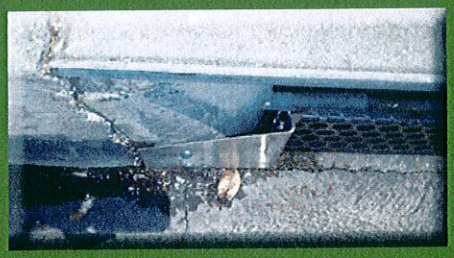


First Line Defense for Inlets

- Structural BMP That Prevents Debris & Litter from Entering the Storm Drain
  - Retrofits Any Existing Basin
  - Allows Nuisance & High Flows to Pass Through
  - Easy to Remove
  - Tire & Street Sweeping Truck Safe Design

100% Stainless Steel Construction

Recessed Design



The Bio Clean Curb Guard has a unique recessed design that sets the device back into the opening a few inches for better flow. The flat mounting bracket is flush with the curb making it tire safe and ideal for street sweeping operations.

High Effectiveness

The Curb Guard can be constructed using various sized perforations to meet state and local requirements. By providing 100% coverage of the basin opening during low flows the Curb Guard can assist your city or county with Trash TMDL compliance.

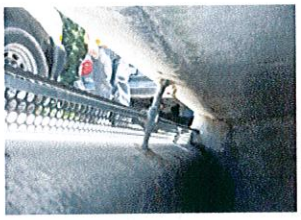
Applications

- Streets
- Parking Lots
- Culvert Drains
- Recycling Facilities
- Industrial

SIZES

MODEL	LENGTH	*FLOW RATE
BC-CG-4	4'	1.53 cfs
BC-CG-6	6'	2.29 cfs
BC-CG-7	7'	2.68 cfs
BC-CG-10	10'	3.82 cfs
BC-CG-12	12'	4.59 cfs

NOTE: Available in Any Length and Various Heights
*Flow Rate based on manufacturer recommended 50% clogging factor



Easy to Install

Bio Clean Environmental Services, Inc.
2972 San Luis Rey Rd
Oceanside, CA 92058

BIO CLEAN ENVIRONMENTAL SERVICES, INC

Proven Stormwater Treatment Technology

www.BioCleanEnvironmental.com
P 760-433-7640
F 760-433-3179

Grate Inlet Filter (GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Overview

The Bio Clean Grate Inlet Filter (GISB) for catch basins has been keeping property owners in compliance since 1994. Preferred by public agencies and backed with a 5 year unlimited warranty, this easy to install filter has been chosen because of its durability and easy maintenance.

Constructed of UV coated marine grade fiberglass and high grade stainless steel, it is built to last longer than any other filter brand. The multi-stage filtration provides three different sieve size filtration screens to optimize filtration and water flow. The filter is equipped with a hydrocarbon media boom and deflector shield protected bypass to eliminate scouring.

The filter is designed for grated inlets of any size and depth. Each filter can be custom built to meet specific project needs. Screen size and media type can be modified to remove specific pollutants.

Advantages

- 5 Year Warranty
- Custom Sizes Available
- Fits in Shallow Catch Basins
- No Nets or Geofabrics
- 15+ User Life
- No Replacement Costs as Found with Fabric Filters
- Meets **LEED** Requirements

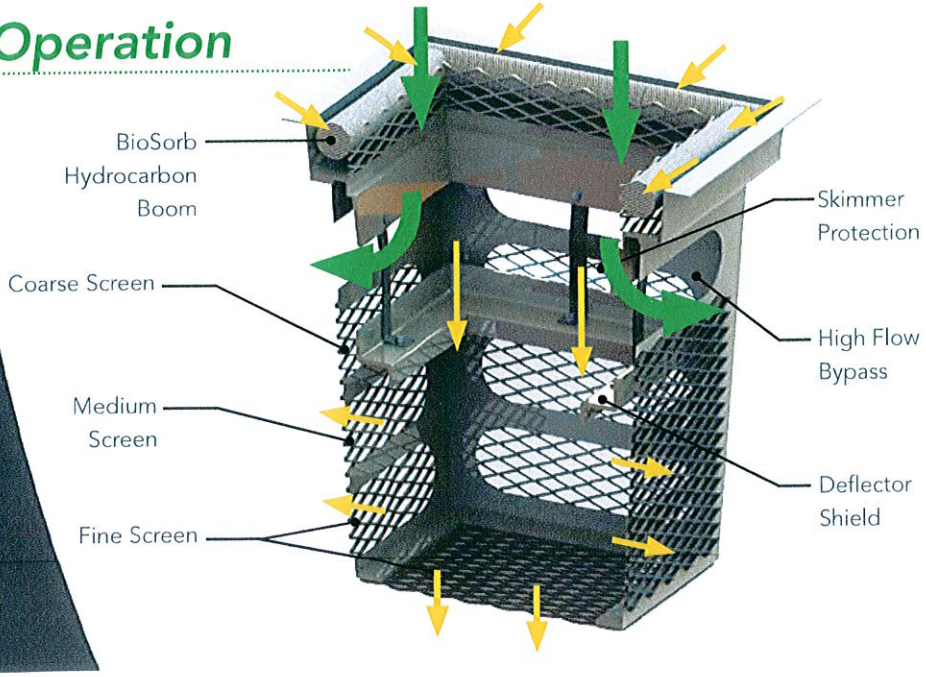
Performance

- 74%-86% Removal of TSS
- 54% Removal of Oils & Grease
- 57%-71% Removal of Phosphorus
- 56%-60% Removal of Nitrogen

Specifications

Model #	Treatment Flow (CFS)	Bypass Flow (CFS)
BC-GISB-12-12-12	0.5	0.5
BC-GISB-18-18-18	0.8	0.8
BC-GISB-24-24-24	3.7	4.4
BC-GISB-36-36-24	5.8	13.4
BC-GISB-48-48-18	6.6	13.3

Operation



www.BioCleanEnvironmental.com

Grate Inlet Filter (GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

Media Filter

The Bio Clean Grate Inlet Media Filter (GISB-MF) is an advanced level filtration device designed with a multi-layered media filter for increased removal efficiencies.

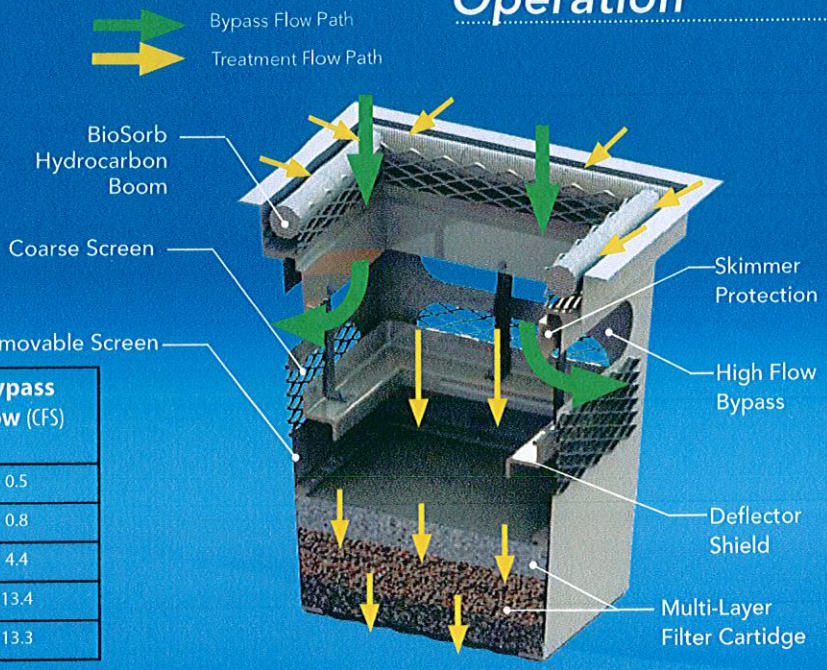
Performance

- 85% Removal of Fine TSS
- 69% Removal of Dissolved Phosphorus
- 95% Removal of Copper
- 87% Removal of Lead
- 95% Removal of Zinc
- 90% to 95% Removal of Oils & Grease
- 68% Removal of Fecal Coliform (bacteria)

Specifications

Model #	Media Treatment Flow (CFS)	Screen Treatment Flow (CFS)	Bypass Flow (CFS)
BC-GISB-MF-12-12-12	0.007	0.2	0.5
BC-GISB-MF-18-18-18	0.02	0.5	0.8
BC-GISB-MF-24-24-24	0.04	0.9	4.4
BC-GISB-MF-36-36-24	0.17	1.8	13.4
BC-GISB-MF-48-48-18	0.35	2.4	13.3

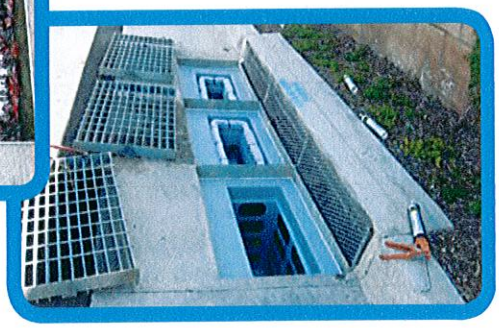
Operation



Application

Enhanced with Media to Meet Removal Requirements

- Parking Lots
- Roadways
- Bioswale Bypass Structures



Perfect for Retrofit Applications

Approvals

County of Orange

Meets Full Capture Requirements

Installation & Maintenance

See our website for installation & maintenance manuals at www.BioCleanEnvironmental.com

2972 San Luis Rey Rd
Oceanside, CA 92058
p 760.433.7640 f 760.433.3176
www.BioCleanEnvironmental.com

BIO CLEAN

Downspout Filter

PROVEN STORMWATER TREATMENT TECHNOLOGY

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Overview

The Bio Clean Downspout Filter is the industry's leading solution for treatment of roof runoff. This technology is used to treat commercial and industrial roof tops along with highrise buildings, parking structures and residential buildings.

Available in 3 sizes, this filter can easily adapt to downspouts 2" to 12" in diameter. The filter comes standard with rubber boots that allow for easy installation to the downspout.

Proven since 2003, the Bio Clean Downspout Filter has been used on hundreds of installations throughout the United States. All internal components are constructed of stainless steel.

The sleek inline design allows the filter to be used in tight spaces. Approved by the IAPMO, this filter can meet all your needs.

www.BioCleanEnvironmental.com

Advantages

- 10 Year Warranty
- No Nets or Geofabrics
- Sleek Inline Design
- High Treatment Flow Rate
- High Bypass Flow Rate
- Low Cost

Performance

- 93% Removal of TSS
- 87% Removal of Hydrocarbons
- Effective at Removing Metals, Nutrients and Bacteria (Media Type)

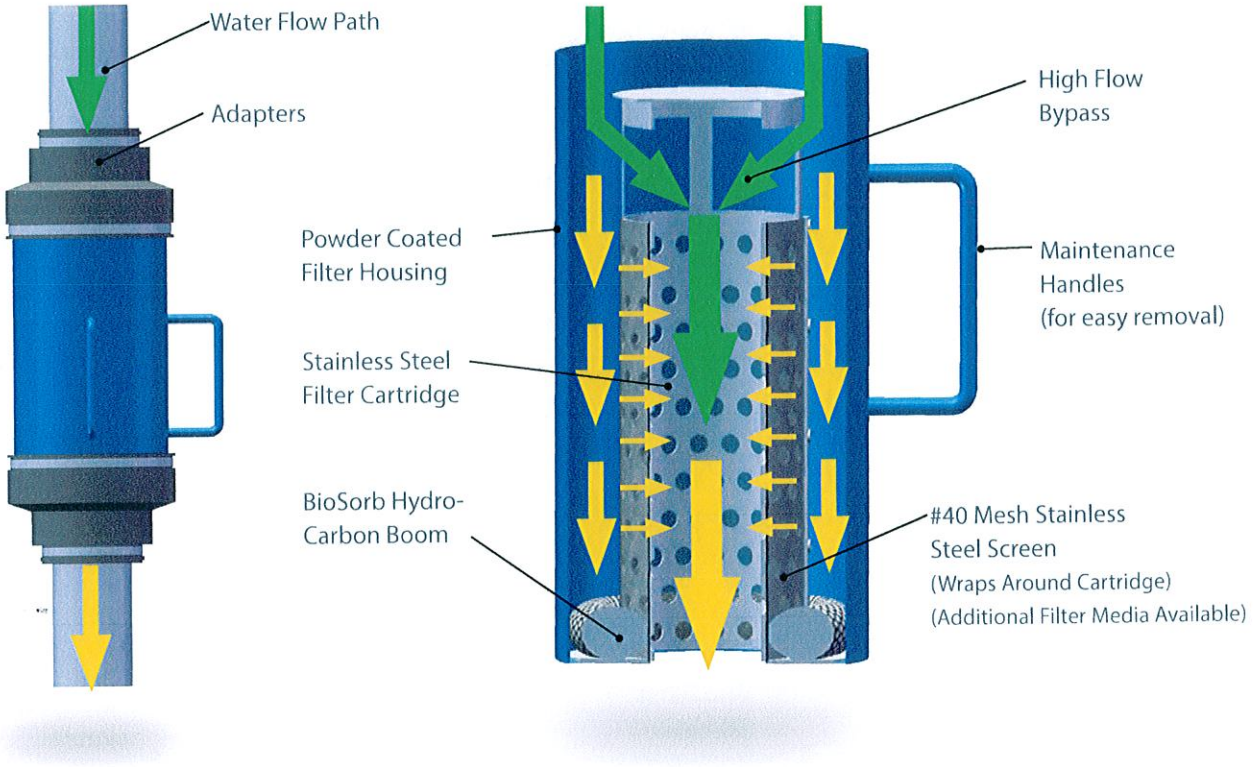
Specifications

Model #	Inlet ID (dia., in.)	Filter OD (dia., in.)	Storage Cap. (cu. ft.)	Filtered Flow (gpm)	Bypass Flow (gpm)
BC-DF4	4	6.625	0.9	249	566
BC-DF6	6	8.625	0.21	509	1006
BC-DF8	8	8.625	0.21	509	1006
BC-DF10	10	12.75	0.77	1145	2264
BC-DF12	12	12.75	0.77	1145	2264

Downspout Filter

PROVEN STORMWATER TREATMENT TECHNOLOGY

Operation



Application

Easily Adapts to Square or Rectangle Downspouts

- Commercial
- Residentail
- Parking Structures
- Mixed Use

Fits Inline with Iron, Steel or Plastic Pipe

Approvals

IAPMO Testing & Approval Listing

Installation & Maintenance

See our Website for Installation & Maintenance Manuals at www.BioCleanEnvironmental.com

2972 San Luis Rey Rd
Oceanside, CA 92058
p 760.433.7640 f 760.433.3176
www.BioCleanEnvironmental.com

BIO CLEAN

Round Curb Inlet Filter (R-GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

Overview

The Bio Clean Round Curb Inlet Filter (R-GISB) is a favorite amongst cities and municipalities nationwide. Many agencies have chosen this system as their standard due to its quick cleaning time and large storage capacity.

Its patented 'Shelf System' allows cleaning to be done in less than 15 minutes, and its larger storage capacity of 3.85 cubic feet allows for maximized cleaning intervals and minimized attention required by maintenance crews.

The modularized design of the 'Shelf System' for curb inlets makes it adaptable to any size or type catch basin.

Its multi-stage filtration screens allow this device to meet "full trash capture" requirements by removing 100% of trash & debris 5 mm and greater. Made of marine grade fiberglass and high grade stainless steel these filters come in standard and custom designs.

This filtration system addresses a wide array of pollutants including trash & debris, sediments, TSS, nutrients, metals, and hydrocarbons.

Includes the Patented 'Shelf System'

Higher Storage Capacity & 15 Minute Service Time

Advantages

- 8 Year Warranty
- Works in Any Size Catch Basin
- No Nets or Geofabrics
- 15+ Year User Life
- Meets **LEED** Requirements
- Patented Shelf System
- Fiberglass Construction

Performance

- 74%-86% Removal of TSS
- 54% Removal of Oils & Grease
- 57%-71% Removal of Phosphorus
- 56%-60% Removal of Nitrogen

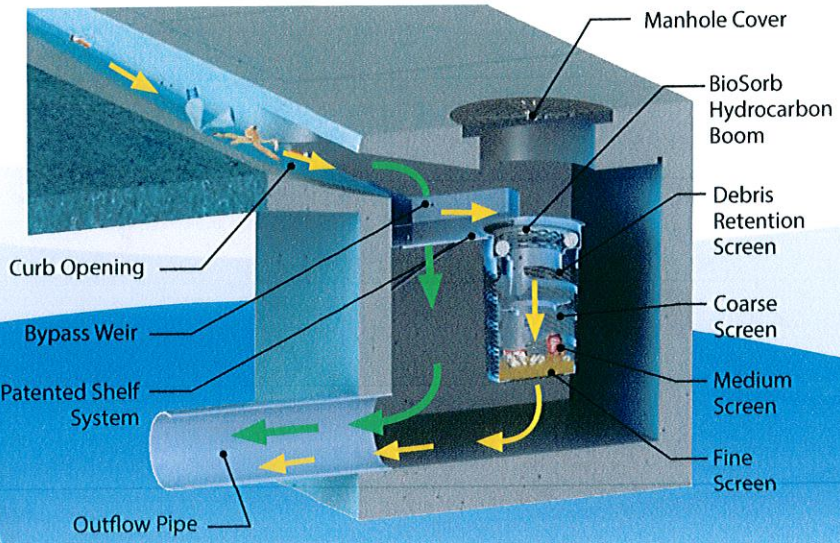
Specifications

Model #	Treatment Flow (CFS)	Bypass Flow (CFS)
BC-RGISB-22-24	2.4	Unlimited

Operation

Bypass Flow Path

Treatment Flow Path



www.BioCleanEnvironmental.com

Round Curb Inlet Filter (R-GISB)

PROVEN STORMWATER TREATMENT TECHNOLOGY

Media Filter

The Bio Clean Round Curb Inlet Media Filter (RGISB-MF) is an advanced level filtration device designed with a multi-layered media filter for increased removal efficiencies.

Performance

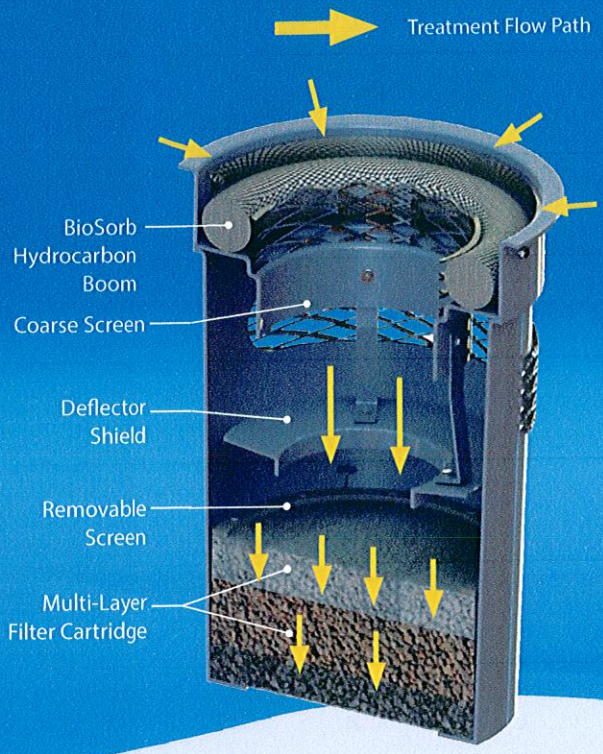
- 85% Removal of Fine TSS
- 69% Removal of Dissolved Phosphorus
- 95% Removal of Copper
- 87% Removal of Lead
- 95% Removal of Zinc
- 90% to 95% Removal of Oils & Grease
- 68% Removal of Fecal Coliform (bacteria)

Specifications

Model #	Media Treatment Flow (CFS)	Screen Treatment Flow (CFS)	Bypass Flow (CFS)
BC-RGISB-MF-22-24	0.12	2	Unlimited

Higher Flow Rate Models Available

Operation



Installation & Maintenance

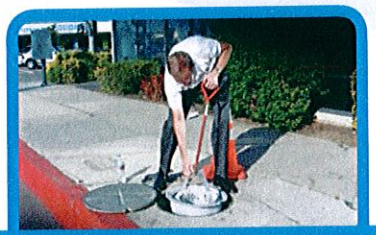
Cleaned Without Catch Basin Entry ✓

Cleaned Easily With Vac Truck ✓

15 Minute Service Time ✓

Application

- Parking Lots
- Roadways



Easily Removed without Entry into Basin

Always Positioned Under Manhole Opening

Approvals

City and County of Honolulu

County of San Diego

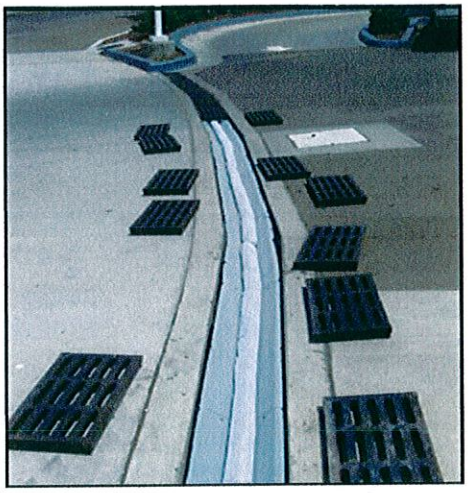
County of Orange

Meets Full Capture Requirements

2972 San Luis Rey Rd
Oceanside, CA 92058
p 760.433.7640 f 760.433.3176
www.BioCleanEnvironmental.com

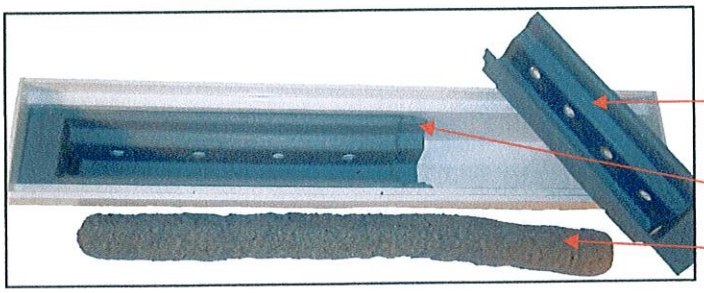
BIO CLEAN

Trench Drain Filter



- Bio Clean Trench Drain Filter is especially designed for high levels of hydrocarbon, oils and grease. It will also capture trash, litter, sediments and organics. The medium is both absorbent and absorbent attracting hydrocarbon to the polymer service for adsorption.

- For use in Standard Trench Drains
- Ideal for Gas Stations and Maintenance Yards
- Captures Hydrocarbon (Oil and Grease)
- Easy Maintenance and Replacement of Hydrocarbon Booms
- Also Captures Trash and Litter
- Treats Entire Flow
- Manufactured from Marine Grade Fiberglass with UV Protection
- Available in 4 Foot Sections
- The Flow Rate is 0.064cfs per foot. For Instance, a 10 foot long trench filter will flow 0.64cfs.



- Marine Grade High Durability UV Protected Fiberglass
- Custom Manufactured for Exact Fit
- Hydrocarbon Boom

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

P O Box 869, Oceanside, CA 92049
(760) 433-7640 • Fax (760) 433-3176
www.biocleanenvironmental.net

"The Stormwater Standard"

HYDROLOGY REPORT

Stormwater Hydrology Report
International Outlet Center
Irwindale, CA

JRM & A

ARCHITECTS
ENGINEERS
PLANNERS

Date: 11/24/2014

Paul J. Hacunda, PE No. 41627

TABLE OF CONTENTS

SECTION 1 INTRODUCTION/PROJECT DESCRIPTION

1.1 INTRODUCTION

This study has been prepared to accompany an EIR for the Irwindale International Outlet Center (IOC) to be located at the site of the existing Irwindale Speedway (Speedway).

1.2 EXISTING CONDITIONS

The majority of the property (Drainage Area 1) drains from southwest to northeast discharging into a curb inlet near the most westerly driveway. At this point the inlet connects into a City storm drainage system via a pipeline. The race track in-field (Drainage Area 2) drains to an inlet which is connected to a pipeline that discharges into an existing pump station near the northwest corner of the site. Drainage Area 3 drains to the southwest corner of the site to an inlet which is piped to the pump station. The pump station discharges the runoff onto the westerly driveway. The runoff then flows north in the driveway discharging out onto Live Oak Avenue.

Live Oak Avenue is a very flat roadway with a longitudinal slope of 0.5% or less in locations downstream of the Raceway. This condition provides very little carrying capacity for storm water runoff in the roadway. Additionally, the runoff from the pump station discharged to Live Oak Avenue is downstream of the large curb inlets located on Live Oak Avenue, thus all the discharge from the pump station proceeds down the street to the west causing flooded conditions on the road.

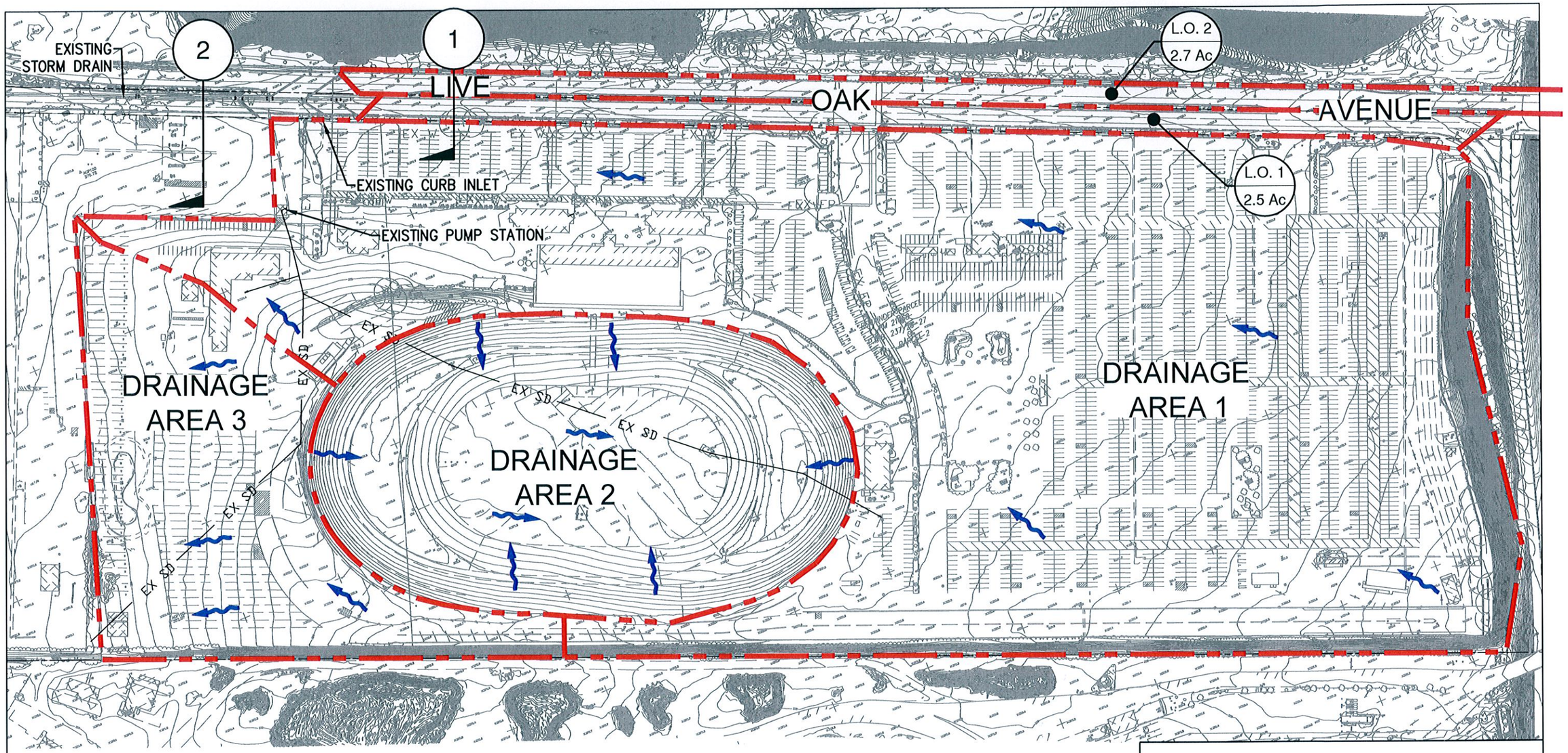
1.3 DESCRIPTION OF PROPOSED PROJECT

It is proposed to collect the on-site, storm water runoff in catch basins and/or inlets and connect the proposed discharge points from the IOC directly into the existing storm drainage system in Live Oak. This method will alleviate the existing flooding conditions on Live Oak Avenue due to the storm water runoff discharge from the Speedway.

There are three locations that are suitable for connections into the existing storm drainage system. One location is at the westerly driveway into the Speedway which will be improved as part of the IOC Project. The existing plans depict a proposed 48-inch RCP that was not constructed but was sealed with brick and mortar at the junction structure. It is proposed to excavate and recover the 48-inch diameter pipe and extend it to the right-of-way. At that point a private 36-inch onsite pipe will be constructed to carry the runoff flows from Proposed Drainage Area 1. The existing pump station will be removed as it will no longer be required due to the proposed grading of the IOC project.

The existing curb inlet at the east side of the Raceway's west driveway will be relocated easterly due to the wider driveway proposed by the IOC at this location. Proposed Drainage Area 2 will be collected by inlets and connected to the new curb inlet.

Proposed Drainage Area 3 will be collected by a system of inlets and piped to a connection with the existing curb inlet located approximately 100-feet to the east of the westerly driveway.



SCALE: 1"=200'

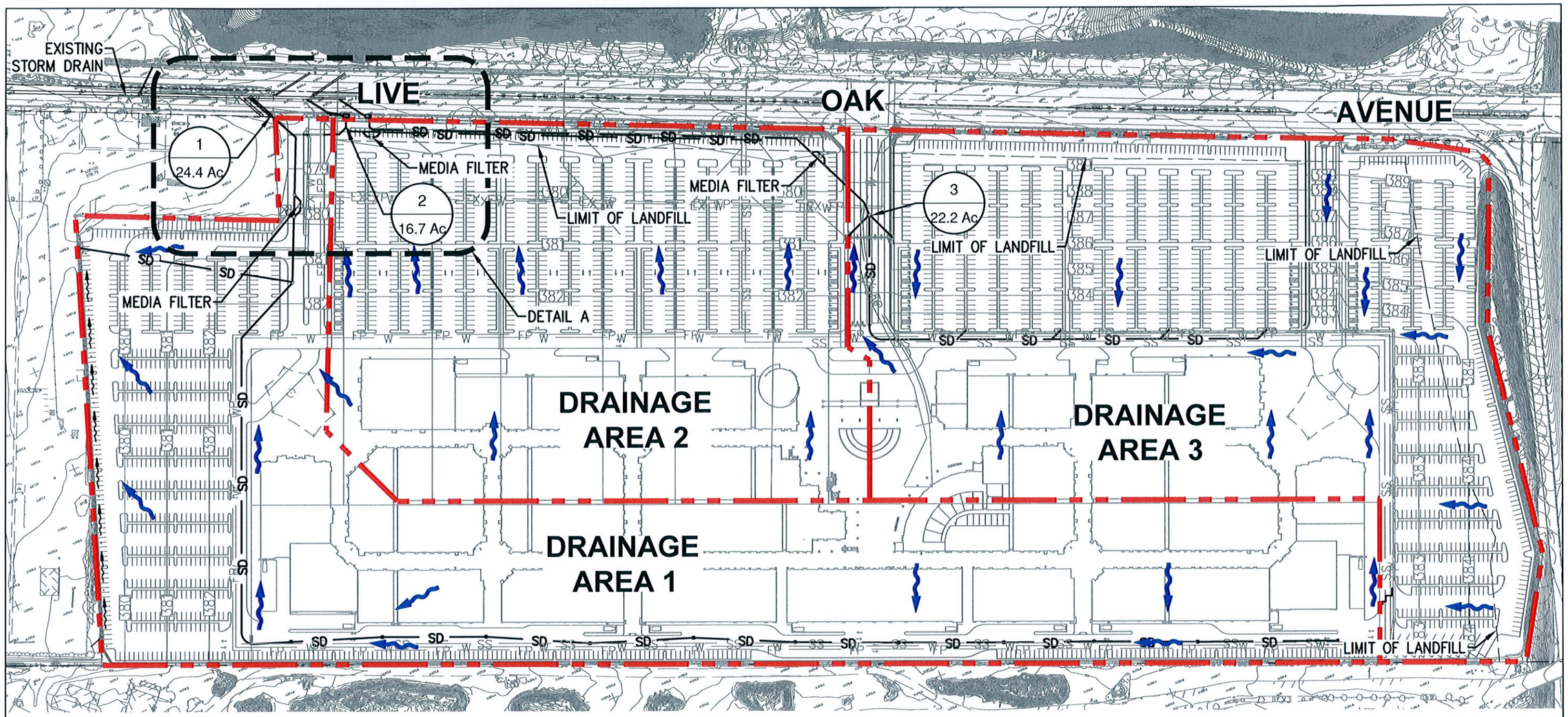
0 200' 400'

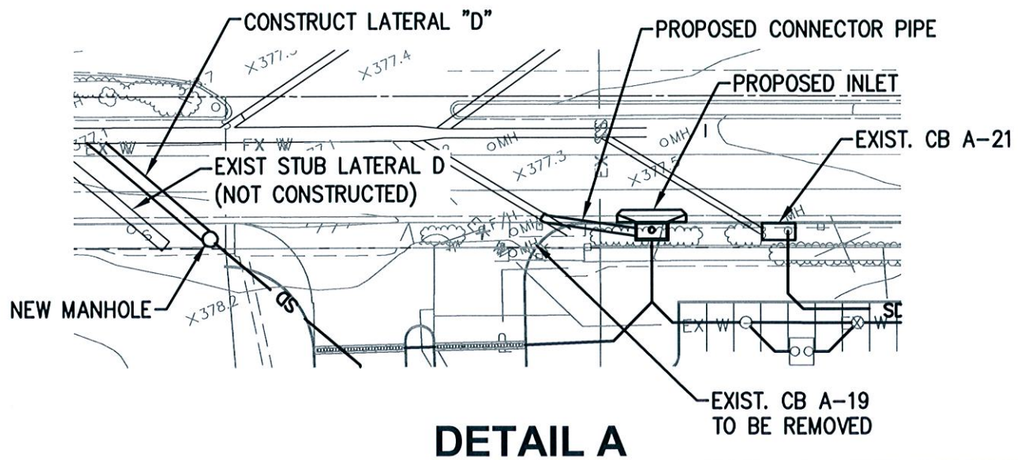
JRM & A
ARCHITECTS
ENGINEERS
PLANNERS

J.R. Miller & Associates
2700 Saturn St
Brea, CA 92821
tel.714.524.1870
fax.714.524.1875
www.jrma.com

EXISTING HYDROLOGY MAP

FIGURE 1





DETAIL A

SCALE: 1"=200'

0 200' 400'

ARCHITECTS
ENGINEERS
PLANNERS

J.R. Miller & Associates
2700 Saturn St
Brea, CA 92821
tel.714.524.1870
fax.714.524.1875
www.jrma.com

PROPOSED HYDROLOGY MAP

FIGURE 2

Figure 2: Proposed Hydrology Map

SECTION 2 HYDRAULIC ANALYSIS OF EXISTING PIPE

2.1 EXISTING DRAINAGE PIPE

A WSPG analysis of the existing storm drainage pipe in Live Oak Avenue was conducted to determine whether the existing pipe has capacity for the IOC Project. Hydraulic information was taken from plans entitled, "City of Irwindale & Irwindale Redevelopment Agency, Department of Public Works, Plans for the Construction, of Storm Drain MTD #1595, in E. Live Oak and Arrow Highway", prepared by Hall & Forman and revised by Corry Engineering dated 1/31/02, and revised 12/17/07 and 6/13/08.

The WSPG analysis began at Station 47+34 where the Arrow Highway Drain (Line B) joins the Live Oak Avenue Drain (Line A). The water surface elevation at Manhole 322-1 is elevation 1436.1, according to the Hydraulic Element Table on sheet 13 of the construction plans. Using flow rates developed by JRMA and flow rates from the hydraulic elements table a water surface profile was computed and plotted on the existing plans (see Appendix B). The analysis substantiates the premise that the storm drain has capacity to accept the Q_{25} year storm event from the IOC Project.

The tabular results of the WSPG analysis are contained in Appendix B.

SECTION 3 PEAK RUNOFF ANALYSIS

3.1 CRITERIA

All drainage facilities in developed areas must meet the Urban Flood level of protection as stated in the LA County Hydrology Manual. The Urban Flood is runoff from a 25-year frequency design storm falling on a saturated watershed.

Street flow due to the urban flood may not exceed the private property line elevation. However, runoff can be conveyed in drains under the street and on the street surface. Urban Flood runoff is allowed to flow in the street to the point where the flow reaches the street capacity at the property line. Depth analysis is to be started at the upstream end of the watershed. The flow should split to allow conveyance in the street and in a drain below the street when flows exceed the street capacity. Drains must at least carry flow from the 10-year frequency storm.

In this case because the one-half street capacity is only 36-cfs, it has been proposed to intercept all the run-off from the IOC and discharge into the existing storm drain that has been designed to carry the flow from a 25-year frequency storm event.

3.2 ANALYSIS

HydroCalc is a software program developed by LA County to replace the tc-calculator program. It is in beta testing presently. HydroCalc was utilized to determine the time of concentration and Q_{25} peak flow rates (see Appendix A). The rates were then adjusted to the longest time of

concentration (30-minutes, Area 1) by using the Intensity at 30-minutes (1.512 in/hr) and the rational formula Q=CIA.

The peak flow rates for the relevant Drainage Areas are summarized below:

Area	Q_{25}
1	33.1 cfs
2	31.5 cfs
3	30.2 cfs

Live Oak Avenue Q_{25} street flows discharging into CB A-20 and CB A-21 are 4.55-cfs and 4.2-cfs respectively. Using the nomograph in the LA County Hydraulics Manual the depth of flow in the street at the curb inlets is approximately 0.37-feet or 4.5-inches (see Appendix C).

Inlet Capacity was determined using the nomograghs on pages D-10A&B for the curb opening basin capacities. The street slope at the inlets is approximately 0.70%. Both inlets are 28-feet wide. The capacity of these inlets is approximately 29-cfs (see Appendix D).

SECTION 4 SUMMARY & CONCLUSIONS

This report provides the analyses necessary to conclude that the existing storm drainage system in Live Oak Avenue has sufficient capacity to receive the flows from a 25-year frequency storm event. By intercepting the on-site flows and directing the storm flow discharges directly into the existing storm drainage system, the street flows on Live Oak Avenue can be easily contained within the Urban Flood criteria established by the LA County Hydrology Manual. During a 25-year frequency storm event the depth in the street approaching the existing inlets will be approximately 4.5-inches deep, or one lane will be inundated and one lane will be clear of flooding. The existing inlets are capable of intercepting all the runoff from a 25-year event.

SECTION 5 REFERENCES

Los Angeles County Flood Control District, Design Manual, Hydraulic, March 1982

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

SECTION 6 APPENDICES

6.1 APPENDIX A: HydroCalc Q25 Peak Flow Hydrologic Analysis Calculations

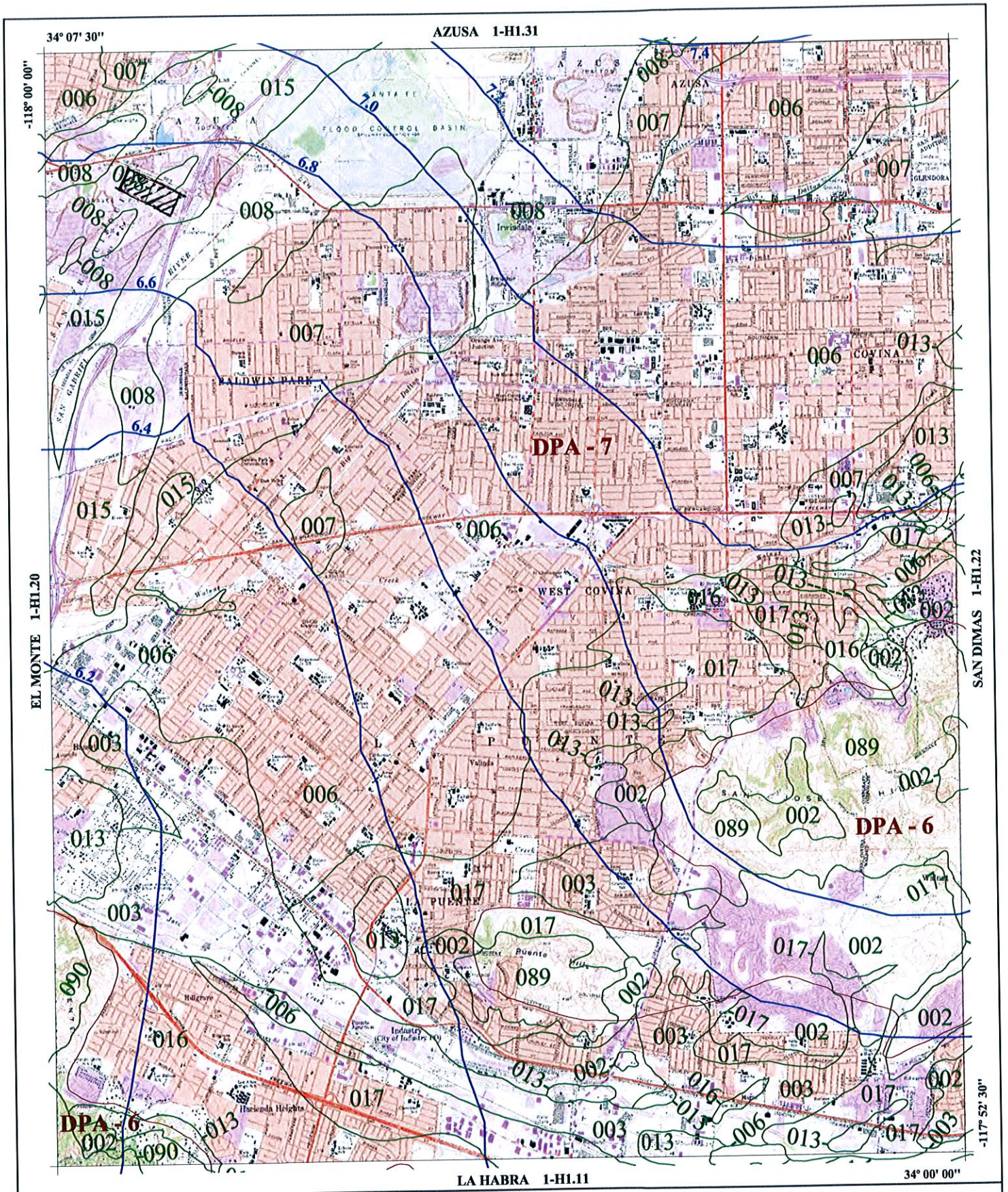
6.2 APPENDIX B: WSPG of Line "A" MTD #1595 Live Oak Avenue

6.3 APPENDIX C: Street Capacity Calculation

6.4 APPENDIX D: Curb Inlet Capacity Calculations

APPENDIX A

HydroCalc Calculations



016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

N W E S

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

BALDWIN PARK
50-YEAR 24-HOUR ISOHYET

1-H1.21

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Peak Flow Hydrologic Analysis

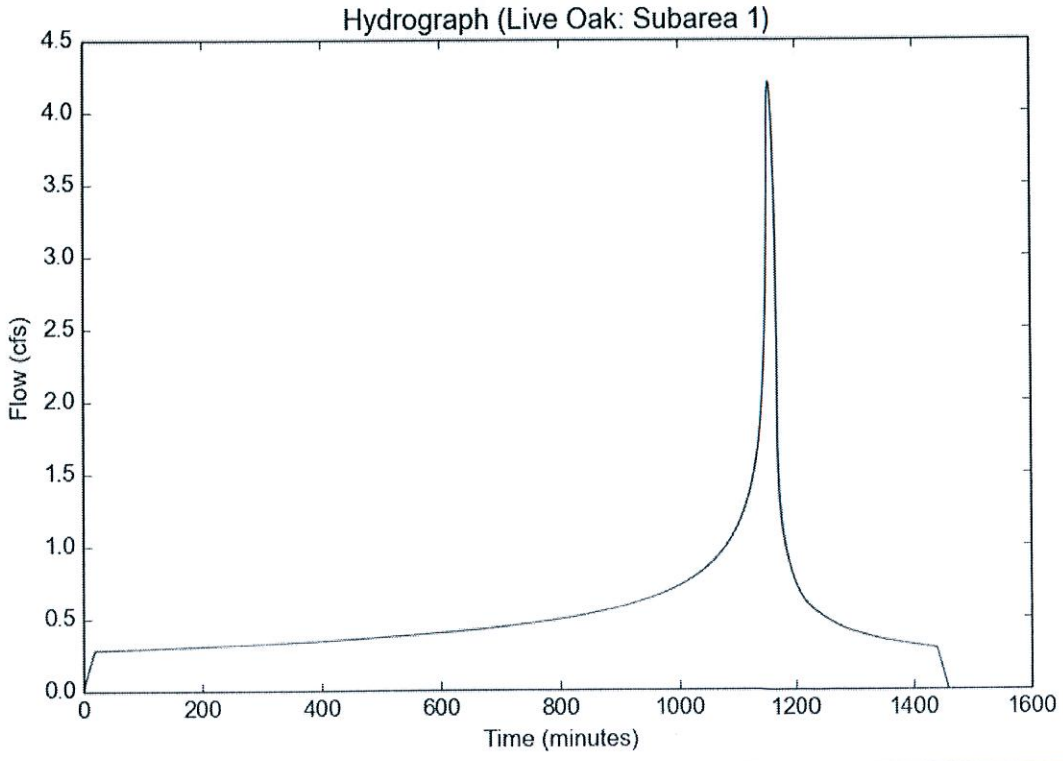
File location: //BSERVER/JRMA Corporate Directory/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/Hydrology/Live (
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	Live Oak
Subarea ID	Subarea 1
Area (ac)	2.5
Flow Path Length (ft)	2195.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	2
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.8826
Peak Intensity (in/hr)	1.874
Undeveloped Runoff Coefficient (Cu)	0.8283
Developed Runoff Coefficient (Cd)	0.8964
Time of Concentration (min)	19.0
Clear Peak Flow Rate (cfs)	4.1997
Burned Peak Flow Rate (cfs)	4.1997
24-Hr Clear Runoff Volume (ac-ft)	1.0636
24-Hr Clear Runoff Volume (cu-ft)	46329.3725



Peak Flow Hydrologic Analysis

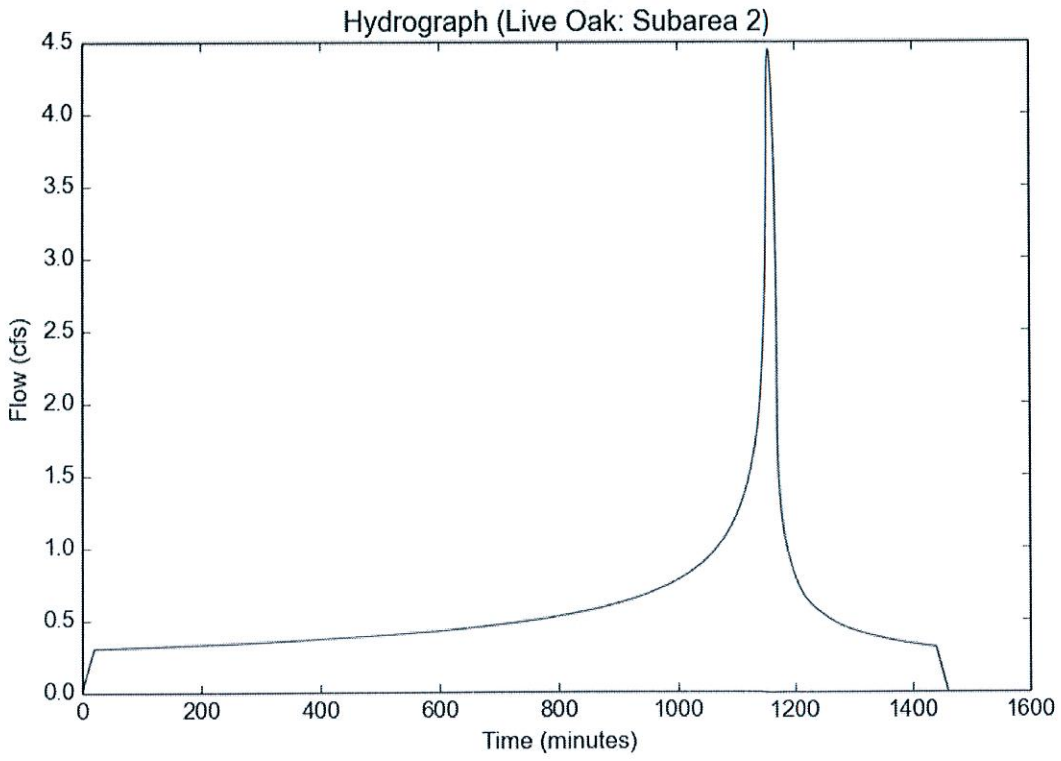
File location: //BSERVER/JRMA Corporate Directory/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/Hydrology/Live (
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	Live Oak
Subarea ID	Subarea 2
Area (ac)	2.7
Flow Path Length (ft)	2420.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.95
Soil Type	8
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.8826
Peak Intensity (in/hr)	1.8294
Undeveloped Runoff Coefficient (Cu)	0.8875
Developed Runoff Coefficient (Cd)	0.8994
Time of Concentration (min)	20.0
Clear Peak Flow Rate (cfs)	4.4423
Burned Peak Flow Rate (cfs)	4.4423
24-Hr Clear Runoff Volume (ac-ft)	1.1456
24-Hr Clear Runoff Volume (cu-ft)	49902.1105



Peak Flow Hydrologic Analysis

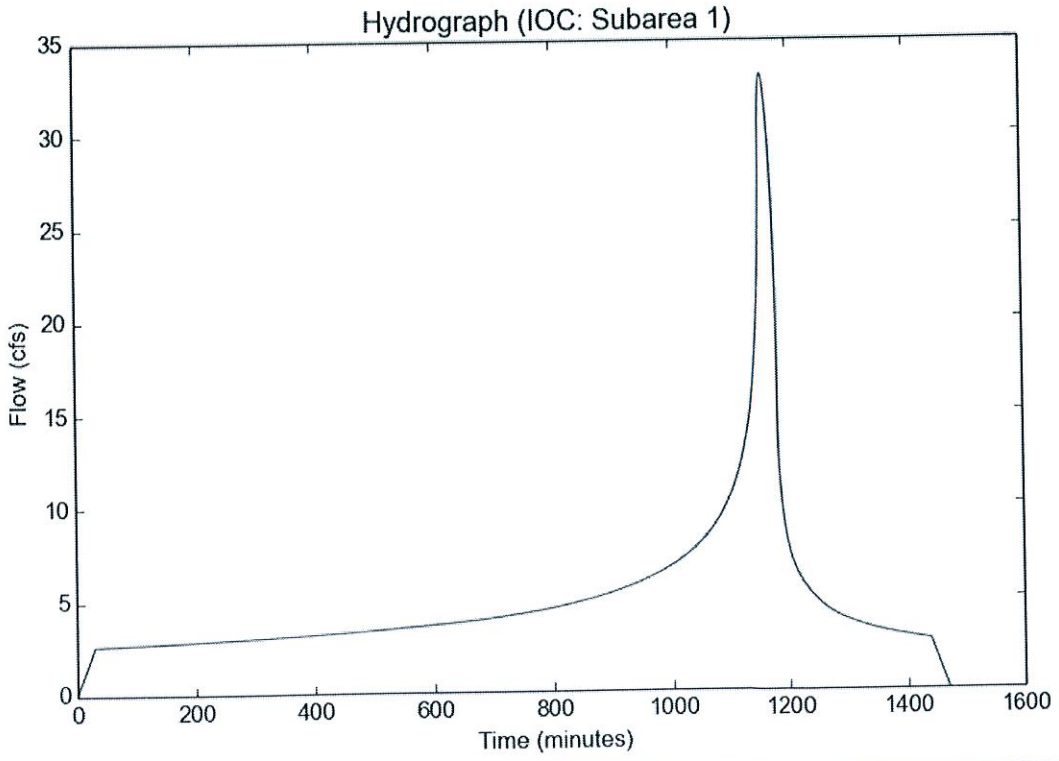
File location: //BSERVER/JRMA Corporate Directory/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/Hydrology/On-si
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Subarea 1
Area (ac)	24.4
Flow Path Length (ft)	3235.0
Flow Path Slope (vft/hft)	0.0012
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.8826
Peak Intensity (in/hr)	1.512
Undeveloped Runoff Coefficient (Cu)	0.8662
Developed Runoff Coefficient (Cd)	0.8966
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	33.078
Burned Peak Flow Rate (cfs)	33.078
24-Hr Clear Runoff Volume (ac-ft)	10.0291
24-Hr Clear Runoff Volume (cu-ft)	436869.0229



Peak Flow Hydrologic Analysis

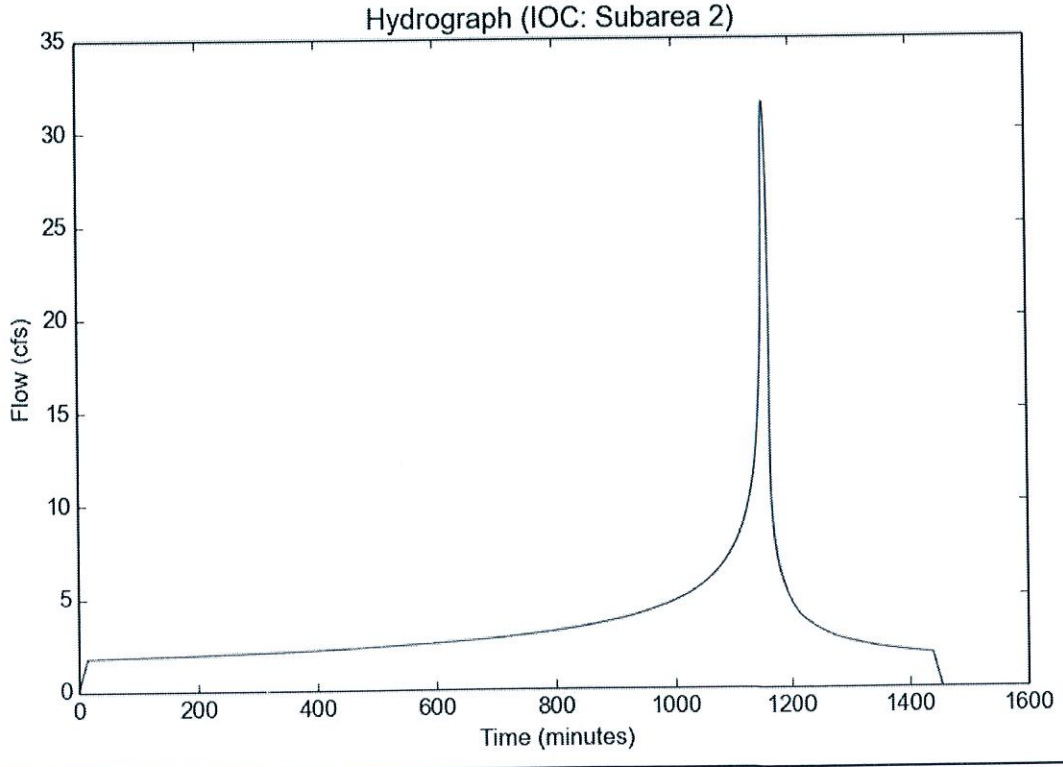
File location: //BSERVER/JRMA Corporate Directory/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/Hydrology/On-si
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Subarea 2
Area (ac)	16.7
Flow Path Length (ft)	1268.0
Flow Path Slope (vft/hft)	0.0039
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.8826
Peak Intensity (in/hr)	2.0942
Undeveloped Runoff Coefficient (Cu)	0.9022
Developed Runoff Coefficient (Cd)	0.9002
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	31.484
Burned Peak Flow Rate (cfs)	31.484
24-Hr Clear Runoff Volume (ac-ft)	6.8645
24-Hr Clear Runoff Volume (cu-ft)	299016.2823



Peak Flow Hydrologic Analysis

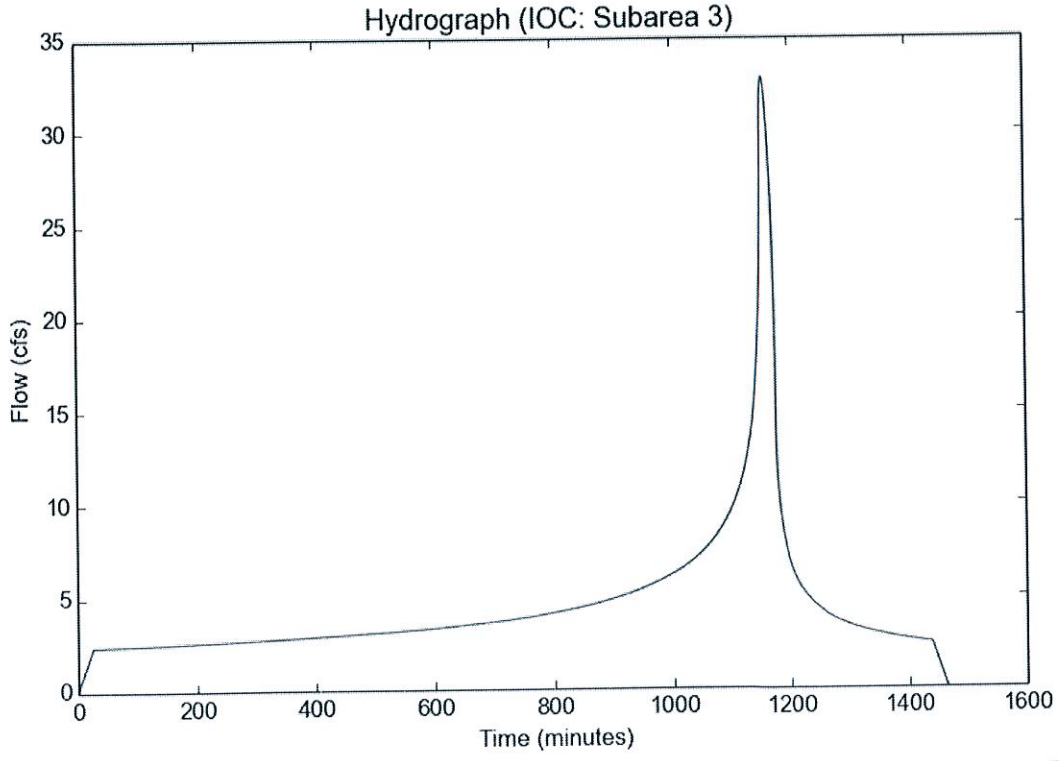
File location: //BSERVER/JRMA Corporate Directory/Jobs/4501-5000/4638 Lindom Company Retail Outlet/Civil Engineering/Reports/Hydrology/On-si
Version: HydroCalc 0.2.0-beta

Input Parameters

Project Name	IOC
Subarea ID	Subarea 3
Area (ac)	22.2
Flow Path Length (ft)	2215.0
Flow Path Slope (vft/hft)	0.0015
50-yr Rainfall Depth (in)	6.7
Percent Impervious	0.9
Soil Type	8
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.8826
Peak Intensity (in/hr)	1.6472
Undeveloped Runoff Coefficient (Cu)	0.8753
Developed Runoff Coefficient (Cd)	0.8975
Time of Concentration (min)	25.0
Clear Peak Flow Rate (cfs)	32.8214
Burned Peak Flow Rate (cfs)	32.8214
24-Hr Clear Runoff Volume (ac-ft)	9.125
24-Hr Clear Runoff Volume (cu-ft)	397482.9507



APPENDIX B

WSPG Analysis

International Outlet Center
On-site Discharges to Pipe

Drainage Area Designation	c	Intensity	Area (Acres)	Q (cfs)	t_c (min)
IOC-1	0.9	1.512	24.4	33.2	30
IOC-2	0.9	1.512	16.7	22.7	30
IOC-3	0.9	1.512	22.2	30.2	30
LO-1	0.95	1.512	2.5	3.6	30
LO-2	0.95	1.512	2.7	3.9	30

EXST 12" VCP SEWER
40.0' N OF CL
EXST C&G
EXST R/W

307 308 323 CB A-17
W = 28', V = ~~4.5'~~ ~~5.0'~~ 4.5'

CONNECTOR PIPE A-17
306 58' - 24" RCP
Q_{25} = 5.6 CFS

23'

319

℄ STORM DRAIN LINE 'A'

N66°44'14"W

53+00 54+00 99.01 CFS 55+00 93.41 CFS 56+00

153'

329

MH 320
SD STA 54+85.00

EXST R/W
EXST C&G
EXST 8" GAS
25.0' S OF CL
EXST 12" SO CAL WA
33.0' S OF CL

315 SEAL WITH 8" BRICK AND MORTAR
MAX. 5' FROM MAIN LINE

SEWER MAIN

56+80.11 LINE 'A' =
10+00.00 LINE 'D'

100.00' 50.00' 15' 50.00'

332 TS
SD STA 56+80.11

315 SEAL WITH 8" BRICK AND MORTAR
MAX. 5' FROM MAIN LINE
N36°44'14"W

315 327 LATERAL LINE 'D'
57' - 48" RCP
(SEE PROFILE HEREON)

CONNECTOR PIPE A-18
316 87' - 30" RCP

57+00 60.31 CFS

8" GAS

332 TS
SD STA 57+41.00

302 MH
SD STA 58+14.67

CONNECTOR PIPE A-19S
306 5' - 24" RCP

321 J.S.
SD STA 58+03.80

0 CFS

60.31 CFS 58+00

CONNECTOR PIPE A-20
83' - 36" RCP 318

CB A-20
W = 28', V = ~~5.5'~~ 11.25
307 308 323

315
8'
71'
R/W

3.8 CFS
STREET FLOW
(JRMA)

M.H.
325

℄ M.H. INT. 302
STA. 58+68.00

3.9 CFS
33.81 CFS

59+00 0.01 CFS
GAS

306 CONNECTOR PIPE "A-21"
(SEE PROFILE HEREON)

329

33.8 CFS

Q_{25} = 3.6 CFS
STREET FLOW
(JRMA)

WATER LINE

340

Q_{25} = 22.7 CFS

CB A-19
W = ~~28'~~ 24', V = ~~5.0'~~ ~~7.0'~~ 8.5'
307 308 323

EXIST. A.C. PARKING

CONNECTOR PIPE A-19
~~46'~~ 38' - 30" RCP 316

CB A-19S
340 341
W = 24', V = 5' (NOT TO
BE MAINTAINED BY LACFCD)
CONSTR. I.D. CASE B, H = 4"
PER STD. 313-1

C.B. A-21
W = 28'
V = 7.5'
307 308 32

Q_{25} = 30.2 CFS

342 CONSTRUCT 36" STOR
STUB (1500-D)

341 CONSTRUCT
OPENINGS C.B. PER A
B = 2-6" PER DE
AND INSTALL TRASH
GUARD SYSTEM WITH
THE OPENINGS BY KR
GUARD MODEL FG-TD
APPROVED EQUAL. (
MAINTAINED BY LACF

REGISTERED PROFESSIONAL ENGINEER
SAMIR M. KHOURY
No. 30567
Exp. 3-31-10
CIVIL
STATE OF CALIFORNIA

40 0 40 80
GRAPHIC SCALE: 1"=40'

REVISIONS CONTINUED — APPV'D
INCREASE C.B. A-16 "V" DEPTH

NOTE "A"
CONNECTOR PIPE A-19S
NOT MAINTAINED BY LA CO.

LIVE OAK AVENUE

3 Samir M. Khoury 6/16/09
2 Samir M. Khoury 8/19/08
1 Samir M. Khoury 12/21/07

BENCHMARK

2637 BENCH MARK ELEV. = 353.870
GWALL CF BRIDGE NO 964 @ SE COR PECK RD & LIVE OAK ST 48 FT S &
KD (67-76 1995), NGVD 29 DATUM

PREPARED UNDER THE SUPERVISION OF:
JON E. BOURGEOIS RCE No. 30242 EXP. 3/31/04

DRAWN BY	JKC
CHECKED	VN
RECOMMENDED	
APPROVED	KWOK TAM, P.E. PUBLIC WORKS DIRECTOR/CITY ENGINEER

DATE 1/31/12
DATE: 2/19/2002

PLANS PREPARED BY:
Hall & Foreman, Inc.
Civil Engineering • Planning • Surveying • Public Works
203 N. Golden Circle Dr., Ste. 300 • Santa Ana, CA 92705-4010 • (714)664-0570

REGISTERED PROFESSIONAL ENGINEER
JON E. BOURGEOIS
No. 30242
Exp. 3/31/04
CIVIL
STATE OF CALIFORNIA

CITY O
STORM DRAIN PLAN &
ARROW HIGHWAY
STORM DRAIN
IRWINDALE

WSPG Flows

Q_{25} = ~~166~~ CFS * 84.7

Q_{25} = ~~155~~ CFS * 79.1

Q_{25} = ~~83~~ CFS * ~~42.4~~ 79.1

Q_{25} = ~~62~~ CFS * ~~31.6~~ 68.3

Q_{25} = 21.6 CFS

PER REVISED L.A. COUNTY HYDROLOGY MANUAL

EXST SURFACE OVER STORM DRAIN ℄

℄ MH 320-1 STA: 54+85.00

322-1 ~~320-1~~ ℄ MH STA: 58+14.67

Q_{25} = 21.6 CFS

EXIST. SURFACE OVER STORM DRAIN ℄

TC

375

370

365

46'

3 - SACK SLURRY BKFILL

EX. 4" EDISON

EX. VERISON

EX. 6" SEWER EL. 369.15

HGL

366.60 HGL

366.42 HGL

367.50 HGL

366.74 HGL

366.43 HGL

366.73 HGL

367.34 HGL

371.66 HGL

367.10 HGL

8" GAS ℄

HGL*

EL. 364.46 24" RCP (N)

EL. 364.25 48" RCP (S)

EL. 365.24 30" RCP (PLUGGED) (N)

EL. 364.45 36" RCP STA. 58+83.38 (N)

EL. 364.01 48" RCP STA. 58+83.38

EL. 365.24 36" RCP

24" RCP/EL 366.8 S = 0.005

S = 0.005

S = 20.0745

51' - 24" RCP 1500 - D

EL. 365.24 36" RCP

S=0.0040

EL. 363.78

EL. 363.72

EL. 362.46

EL. 362.96

EL. 363.97

EL. 364.24

S=0.0040

S=0.0040

EL. 365.07

STA 10 + 05.00 EL. 366.20

STA. 10 + 56.00 EL. 370.00

CONNECTOR PIPE "A-21"

STA. 58 + 66.00

STA. 58 + 76.00 EL. 365.44

STA. 58 + 84.00 EL. 365.48

END OF PIPE PLUG W/8" BRICK & MORTAR

STA: 54+82.67

STA: 54+87.33

STA: 56+77.50

STA: 56+92.00

STA: 57+40.25

STA: 57+50.75

STA: 58+08.00

STA: 58+17.00

150' - 66" RCP 1500-D

191' - 60" RCP 1500-D

14.50' TS 340-1

49'-60" RCP 1500-D

10.50' TS 340-1

57'-60" RCP 1500-D

49'-36" RCP 1500-D

8'

36" RCP 1500 - D

LINE "A"

SCALE
HORIZ. 1"=40'
VERT. 1"=4'

53+00 54+00 55+00 56+00 57+00 58+00 59 + 00

WSPG PROFILE

```
************************************
Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 1.3          06/09/2010
XP Software         www.xpsoftware.com
************************************

INPUT FILE
************************************
C:\XPS\wspg2010\Samples\Irwindale IOC data.wsx
Computed  11/25/14  12:33:26

TITLE INFORMATION
************************************
 Irwindale IOC Storm Drain in Live Oak

WARNING SUMMARY
************************************
 WARNING 25: Link type element Link7 has different invert elevation than its upstream node.
 WARNING 36: D/S processing stopped in junction Node3 because critical momentum is greater than maximum momentum.
 WARNING 36: D/S processing stopped in junction Node4 because critical momentum is greater than maximum momentum.
 WARNING 36: D/S processing stopped in junction Node5 because critical momentum is greater than maximum momentum.
 WARNING 36: D/S processing stopped in junction Node6 because critical momentum is greater than maximum momentum.

RESULTS
************************************


============================================================
   Main Line
============================================================
```

Composite Profile:

ELEMENT NAME	TYPE	STATION	INVERT ELEV	GROUND ELEV	W.S. ELEV	DEPTH	Q	VELOC.	VELOC. HEAD	ENERGY GRADE LN	SUPER ELEV	CRITICAL DEPTH	FROUDE NUMBER	SLOPE	NORMAL DEPTH	CROSS SECTION
###																
"Node9"	Outlet	0.00	360.75	373.00	363.526	2.776	107.82	8.97	1.25	364.77	0.000	2.875	0.000	0.00000	0.000	Pipe
	"i.p."	147.55	361.34	373.59	364.115	2.776	107.82	8.97	1.25	365.36	0.000	2.875	1.069	0.00400	2.776	Pipe
	"i.p."	211.90	361.60	373.85	364.352	2.755	107.82	9.06	1.27	365.62	0.000	2.875	1.085	0.00400	2.776	Pipe
	"i.p."	281.57	361.87	374.12	364.529	2.654	107.82	9.50	1.40	365.93	0.000	2.875	1.165	0.00400	2.776	Pipe
	"i.p."	326.40	362.05	374.30	364.612	2.558	107.82	9.96	1.54	366.15	0.000	2.875	1.250	0.00400	2.776	Pipe
	"i.p."	363.84	362.20	374.45	364.670	2.466	107.82	10.45	1.69	366.36	0.000	2.875	1.340	0.00400	2.776	Pipe
	"i.p."	397.28	362.34	374.59	364.715	2.378	107.82	10.96	1.86	366.58	0.000	2.875	1.437	0.00400	2.776	Pipe
"Link8"	Reach	428.00	362.46	374.00	364.754	2.294	107.82	11.49	2.05	366.80	0.000	2.875	1.540	0.00400	2.776	Pipe
"Link7"	Transition	433.00	362.46	375.00	364.936	2.476	107.82	11.12	1.92	366.86	0.000	2.961	1.406	0.00000	0.000	Pipe
"Node7"	Junction	438.00	362.96	374.50	365.816	2.856	102.22	8.82	1.21	367.02	0.000	2.879	0.000	0.10000	0.000	Pipe
	"i.p."	621.49	363.69	375.23	366.546	2.856	102.22	8.82	1.21	367.75	0.000	2.879	1.016	0.00398	2.856	Pipe
"Link6"	Reach	629.00	363.72	375.00	366.598	2.878	102.22	8.74	1.19	367.78	0.000	2.879	1.001	0.00398	2.856	Pipe
"Node6"	Junction	643.50	363.72	375.00	367.775	4.055	69.12	4.05	0.25	368.03	0.000	2.346	0.000	0.00000	0.000	Pipe
	"i.p."	690.34	363.93	375.21	367.785	3.860	69.12	4.25	0.28	368.07	0.000	2.346	0.380	0.00439	2.201	Pipe
"Link5"	Reach	700.50	363.97	375.00	367.787	3.817	69.12	4.30	0.29	368.07	0.000	2.346	0.389	0.00439	2.201	Pipe
"Node5"	Junction	710.50	363.97	375.50	367.797	3.827	69.11	4.29	0.29	368.08	0.000	2.346	0.000	0.00000	0.000	Pipe
	"i.p."	747.69	364.15	375.68	367.800	3.654	69.11	4.50	0.31	368.11	0.000	2.346	0.426	0.00474	2.154	Pipe
"Link4"	Reach	767.50	364.24	375.50	367.800	3.560	69.11	4.62	0.33	368.13	0.000	2.346	0.448	0.00474	2.154	Pipe
"Node4"	Junction	772.50	364.24	375.50	368.050	3.810	37.61	2.34	0.09	368.13	0.000	1.709	0.000	0.00000	0.000	Pipe
"Link3"	Transition	781.50	365.07	375.50	367.732	2.662	37.61	5.67	0.50	368.23	0.000	1.995	0.535	0.09222	0.000	Pipe
"Node3"	Junction	790.50	365.07	375.50	367.976	2.906	33.81	4.83	0.36	368.34	0.000	1.888	0.000	0.00000	0.000	Pipe
"Link2"	Reach	839.50	365.24	376.00	368.077	2.837	33.81	4.89	0.37	368.45	0.000	1.888	0.381	0.00347	2.145	Pipe
"Node2"	Junction	848.50	365.24	376.00	368.458	3.218	0.01	0.00	0.00	368.46	0.000	0.030	0.000	0.00000	0.000	Pipe
	"i.p."	855.77	365.46	376.22	368.458	3.000	0.01	0.00	0.00	368.46	0.000	0.030	0.000	0.03000	0.023	Pipe
"Link1"	Reach	856.50	365.48	376.00	368.458	2.978	0.01	0.00	0.00	368.46	0.000	0.030	0.000	0.03000	0.023	Pipe
"Node1"	Headwrk	856.50	365.48	376.00	368.458	2.978	0.01	0.00	0.00	368.46	0.000	0.030	0.000	0.00000	0.000	Pipe

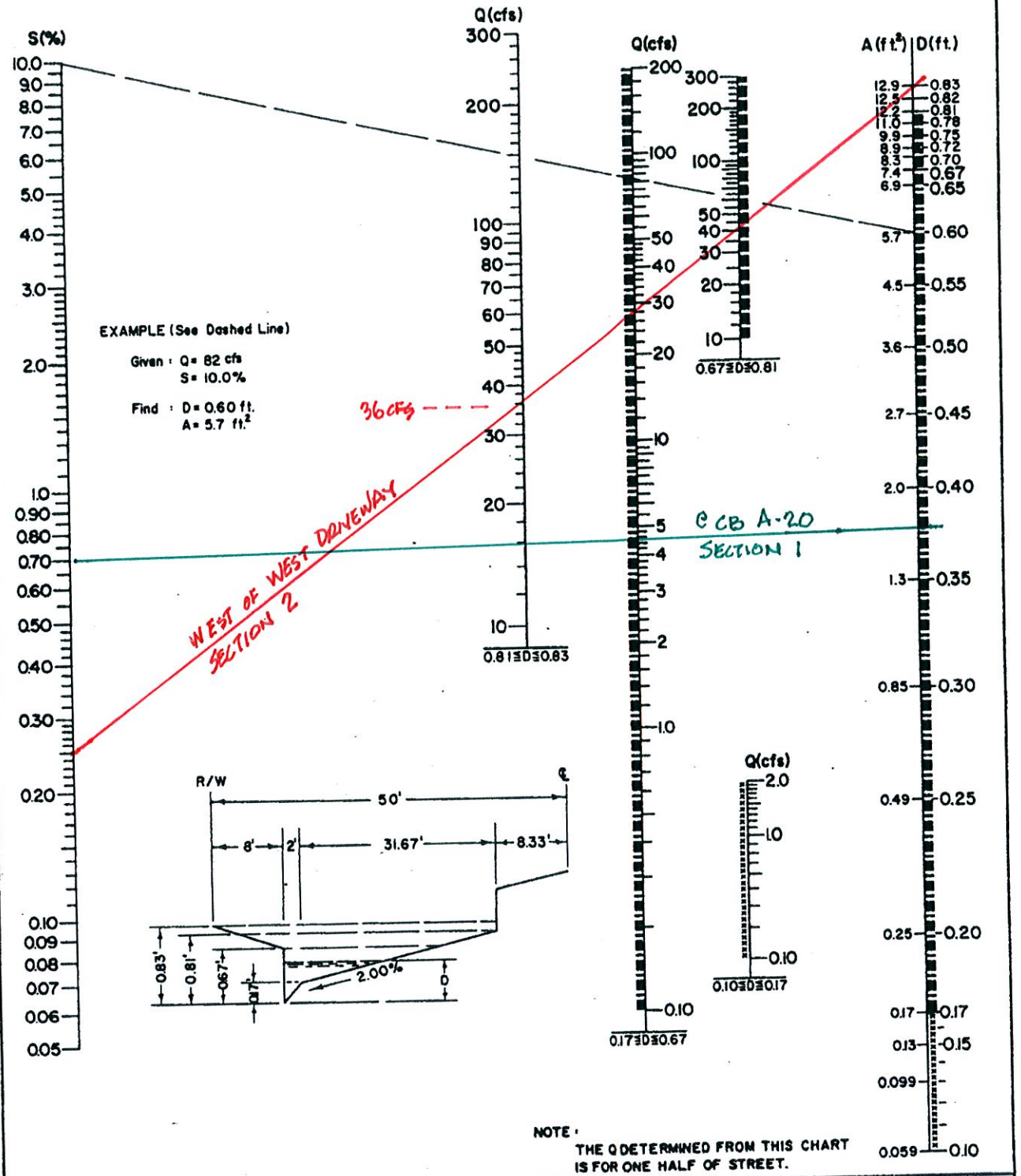
*) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
   i.p. = intermediate point processing results for reaches

APPENDIX C

Street Capacity Calculation

APPENDIX D

Inlet Capacity Calculation



NOTE :
THE Q DETERMINED FROM THIS CHART IS FOR ONE HALF OF STREET.

DESIGNED BY G.B. 8-64
CHECKED BY J.J.M. 8-64

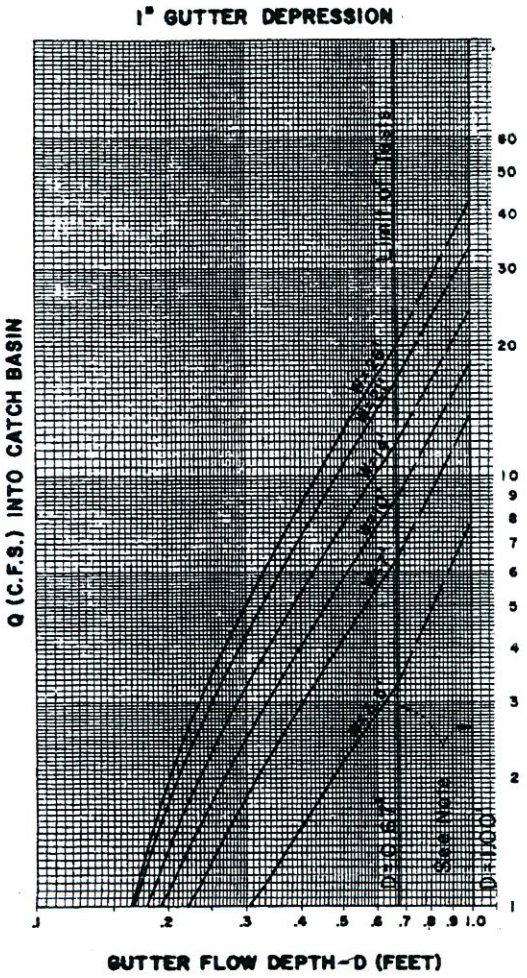
LOS ANGELES COUNTY ROAD DEPARTMENT

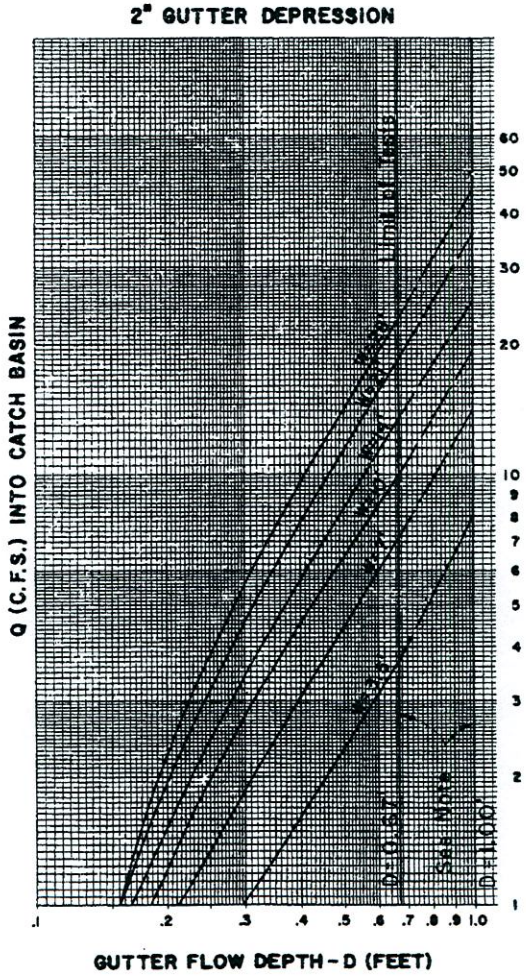
STREET FLOW
MAJOR HWY. - Chart 5 of 5

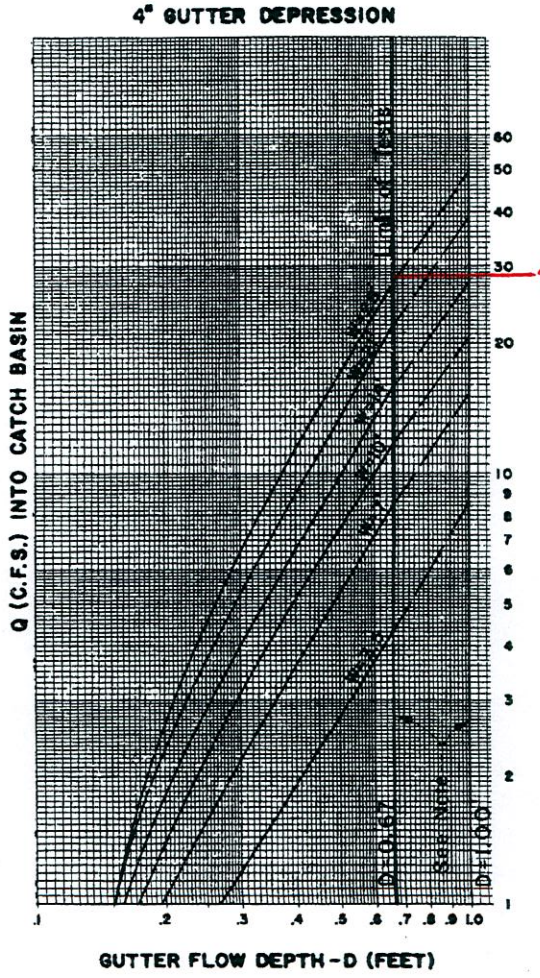
REFERENCE SHEET

APPENDIX D

Inlet Capacity Calculation







NOTE: Curves between D=0.67' and 1.0' are not from model test data and will be revised in the future when additional model test data are available.

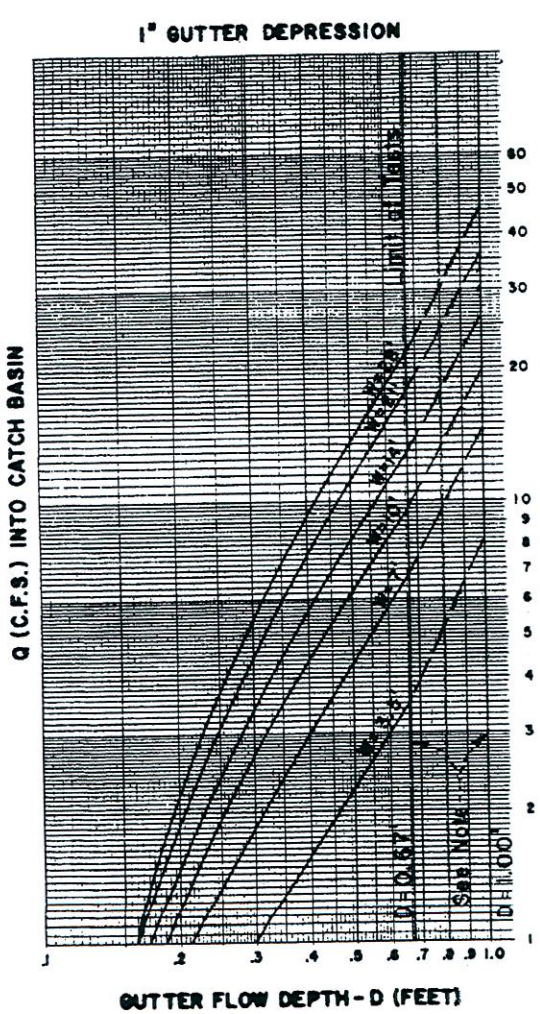
CURB OPENING CATCH BASIN CAPACITIES

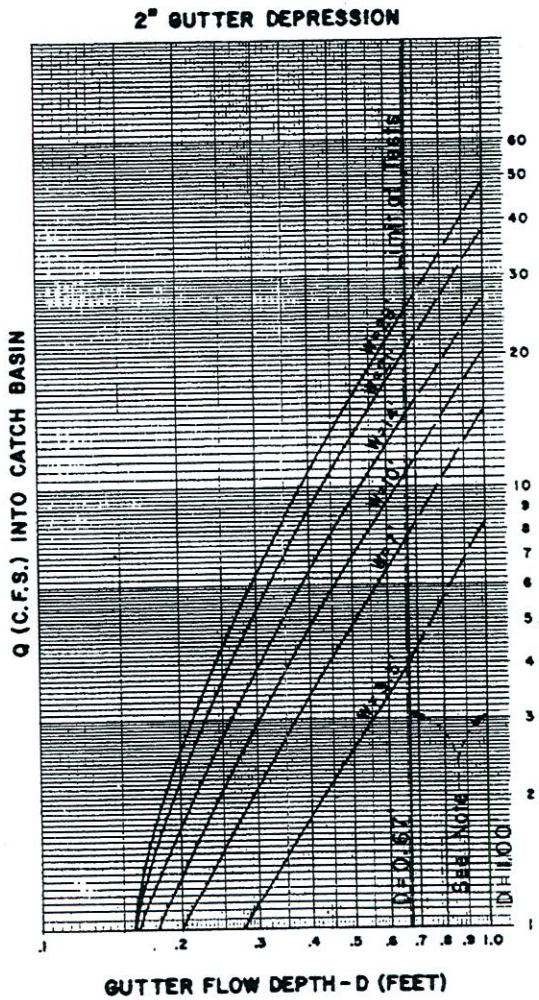
STREET SLOPE = .005

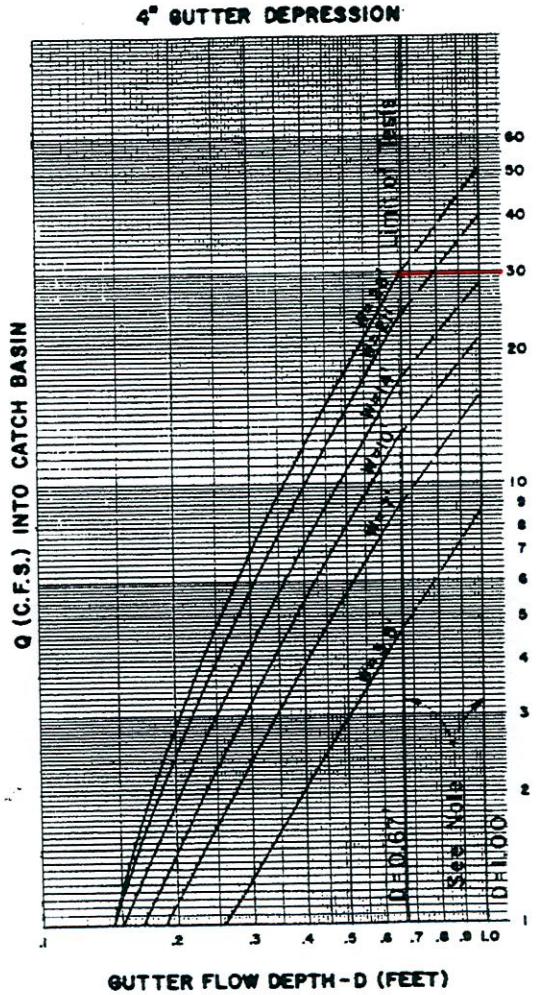
Rev. 6-12-84

D-10A

Los Angeles County Flood Control District







NOTE: Curves between D=0.67' and 1.0' are not from model test data and will be revised in the future when additional model test data are available.

CURB OPENING CATCH BASIN CAPACITIES

STREET SLOPE = .01

D-108