May 16, 2023

Re: **Submittal #3 - Supplement** (Re: Development Engineering comments)
DB22-0004 Boeckman Road Building W5

To: City of Wilsonville
Planning Division – Cindy Luxhoj AICP
29799 SW Town Center Loop East
Wilsonville, OR 97070

From: Bob Wells
Lance Mueller & Associates / Architects
130 Lakeside Ave. S., #250
Seattle, WA 98122

Dear Cindy,

Thank you for sharing Amy Pepper's comments of 5/5/23 as the Development Engineering Manager. Below are our item-by-item responses to the comments. Amy's comments are in blue and italics followed by our responses.

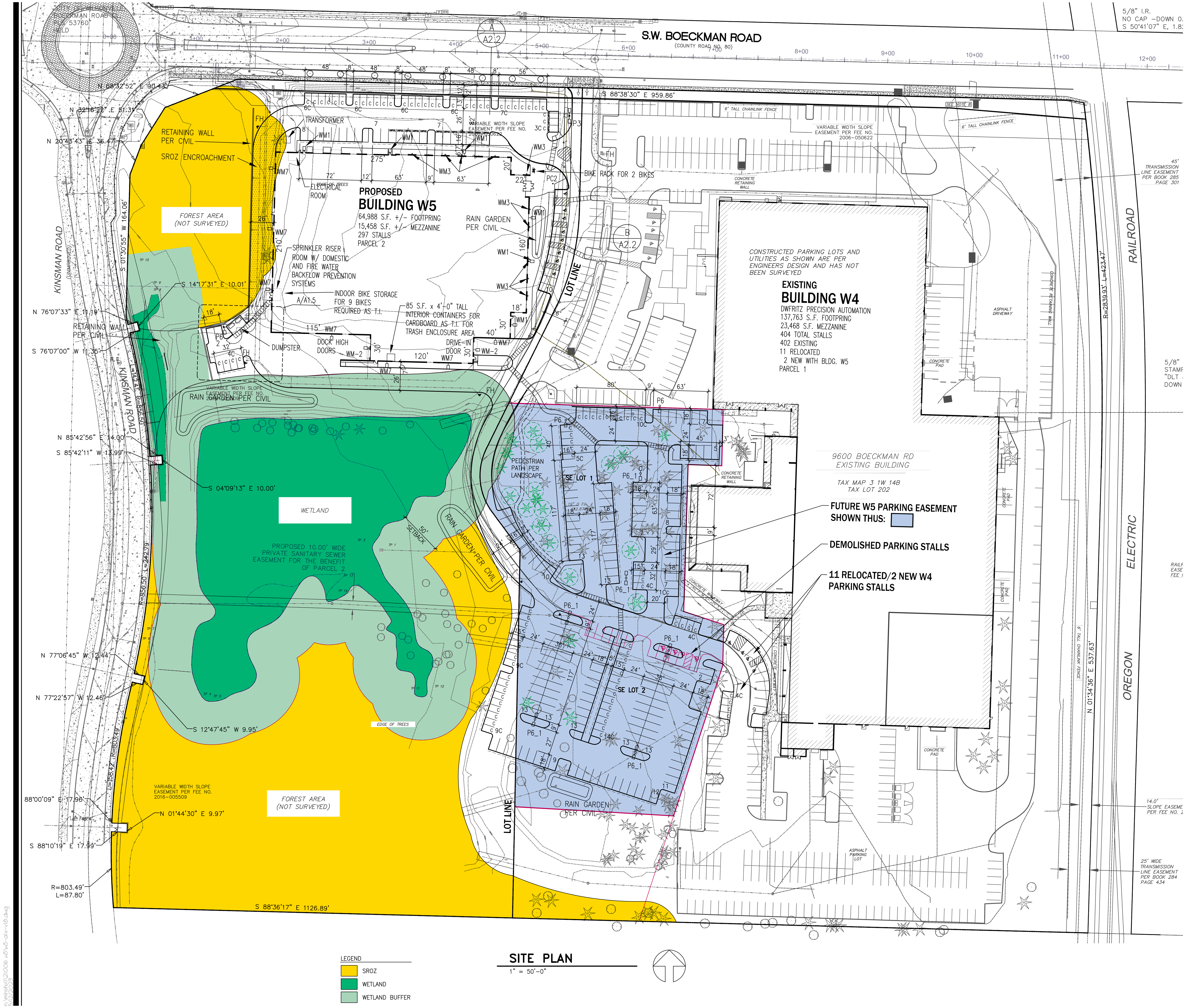
Sincerely,

Bob Wells
Lance Mueller & Associates / Architects
130 Lakeside Ave. S., #250
Seattle, WA 98122

Development Engineering Comments

- *The response letter acknowledges issues with the Stormwater sizing, but no new Storm Report is provided. An updated Stormwater Report is required. Without an updated Stormwater Report its difficult to confirm that the facilities are adequately sized.* See our updated Stormwater Report that addresses the concern, dated 05/15/23.
- *The fire water system is still shown as private. All hydrants must be on a public water main that needs to be located within a 15' exclusive water line easement. The main needs to be looped. It appears from the drawings provided that the looping will need to be separate from the system for W4 as it was constructed as a private system. This can be a condition of approval or they can fix it now, as there are impacts to other utilities.* The attached drawing revises the fire water system to public with a loop and suggests the easement limits, see Civil drawing C1.30, revised 05/15/23. In addition, Architectural Site Plan drawing A1.0 clarifies the domestic & fire water backflow prevention systems are located inside the building at the fire Sprinkler room.
- *The trash enclosure must be hydraulically isolated and covered. It appears from the plans that the enclosure does not have a cover. This can be addressed with a condition of approval as well.* A roof over the trash enclosure is added to the detail drawing, see Architectural drawing A1.2, revised 5/9/23.

End


S.W. BOECKMAN ROAD
(COUNTY ROAD NO. 80)
KINSMAN ROAD
RAILROAD
OREGON ELECTRIC
PROPOSED
BUILDING W5
64,988 S.F. +/- FOOTPRING
15,458 S.F. +/- MEZZANINE
297 STALLS
PARCEL 2
EXISTING
BUILDING W4
DWFRITZ PRECISION AUTOMATION
137,763 S.F. FOOTPRING
23,468 S.F. MEZZANINE
404 TOTAL STALLS
402 EXISTING
11 RELOCATED
2 NEW WITH BLDG. W5
PARCEL 1
CONSTRUCTED PARKING LOTS AND UTILITIES AS SHOWN ARE PER ENGINEERS DESIGN AND HAS NOT BEEN SURVEYED
9600 BOECKMAN RD
EXISTING BUILDING
TAX MAP 3 1W 14B
TAX LOT 202
FUTURE W5 PARKING EASEMENT SHOWN THUS:
DEMOLISHED PARKING STALLS
11 RELOCATED/2 NEW W4 PARKING STALLS
RETAINING WALL PER CIVIL
SROZ ENCROACHMENT
FOREST AREA (NOT SURVEYED)
WETLAND
PROPOSED 10.00' WIDE PRIVATE SANITARY SEWER EASEMENT FOR THE BENEFIT OF PARCEL 2
RAIN GARDEN PER CIVIL
SPRINKLER RISER ROOM W/ DOMESTIC AND FIRE WATER BACKFLOW PREVENTION SYSTEMS
INDOOR BIKE STORAGE FOR 9 BIKES REQUIRED AS T.I.
85 S.F. x 4'-0" TALL INTERIOR CONTAINERS FOR CARDBOARD AS T.I. FOR TRASH ENCLOSURE AREA
BIKE RACK FOR 2 BIKES
PEDESTRIAN PATH PER LANDSCAPE
SE LOT 1
SE LOT 2
LOT LINE
VARIABLE WIDTH SLOPE EASEMENT PER FEE NO. 2016-005509
S 88°36'17" E 1126.89'
S 88°38'30" E 959.86'
N 01°34'36" E 537.63'
LEGEND
SROZ
WETLAND
WETLAND BUFFER
SITE PLAN
1" = 50'-0"

BUILDING W5
99XX SW Boeckman Rd.
Wilsonville, OR 97070

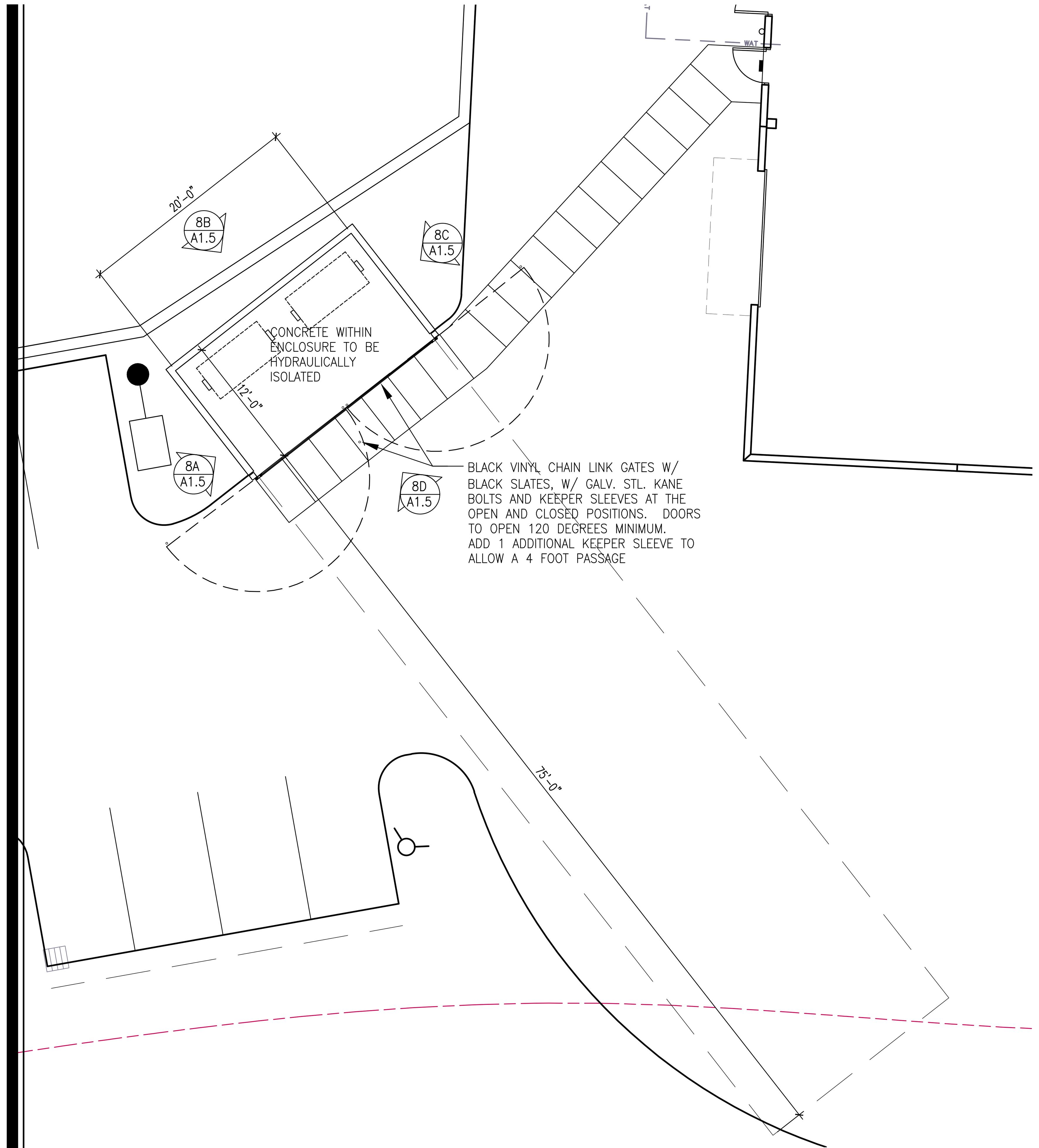
LANCE MUELLER & ASSOCIATES
ARCHITECTS AIA
130 LAKESIDE • SUITE 250 • SEATTLE, WA 98122 • (206) 325-2553

REGISTERED ARCHITECT
LANCE MUELLER
SEATTLE, WA
1491
STATE OF OREGON

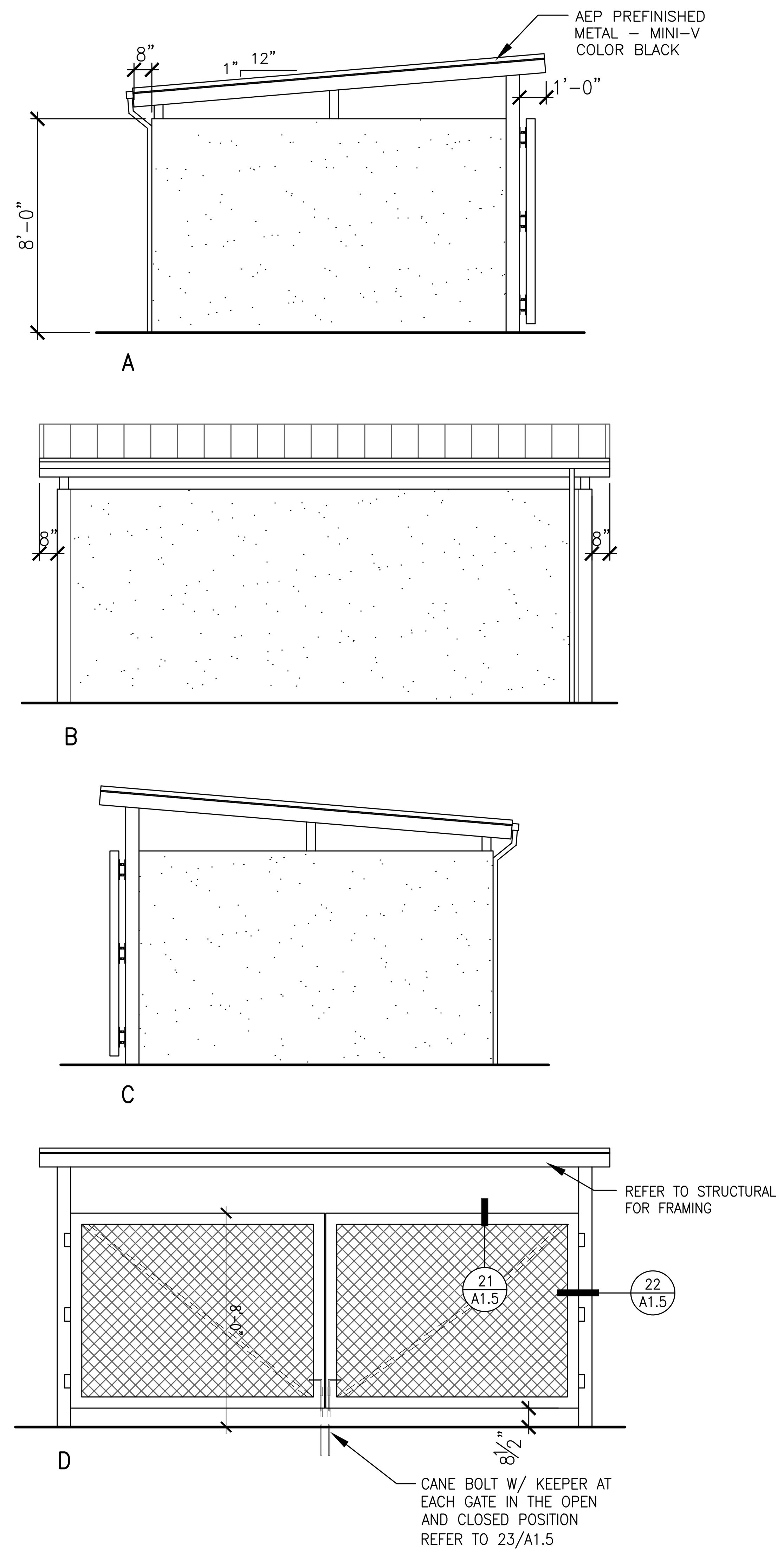
no.	revision	date
	LAND USE SUBMITTAL #3 - SUPPLEMENT	5-4-23
	LAND USE SUBMITTAL #3	11-11-22
	SITE DESIGN REVIEW RESUBMITTAL	7-8-22
	SITE DESIGN REVIEW	1-21-22

18003 job no.
EM drawn
BW checked
11-11-22 date

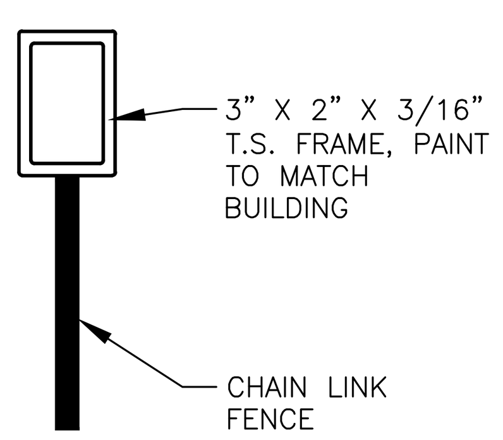
sheet
SITE PLAN
A1.0



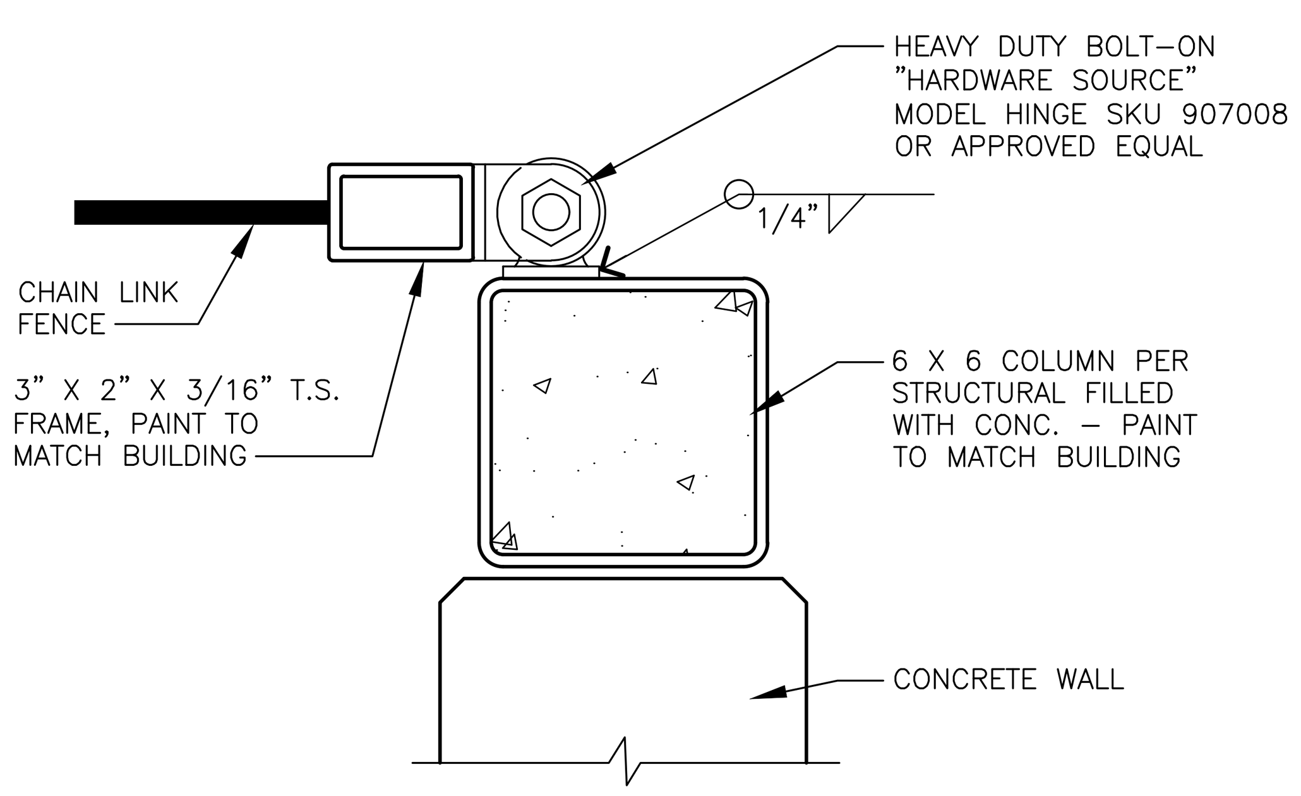
A **ENLARGED SITE PLAN**
SCALE: 1/8" = 1'-0"



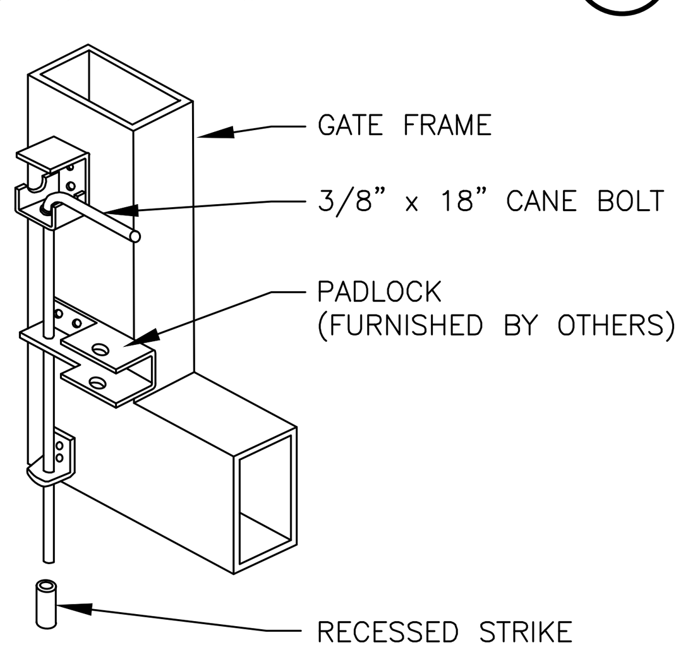
8 **DUMPSTER ENCLOSURE ELEVATIONS**
SCALE: 1/4" = 1'-0"



21 **DETAIL**
SCALE: 1" = 8"



22 **DETAIL**
SCALE: 1" = 8"



23 **DETAIL**
SCALE: 1" = 8"

no.	revision	date
	LAND USE SUBMITTAL #3 - SUPPLEMENT	5-4-23
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18003 job no.
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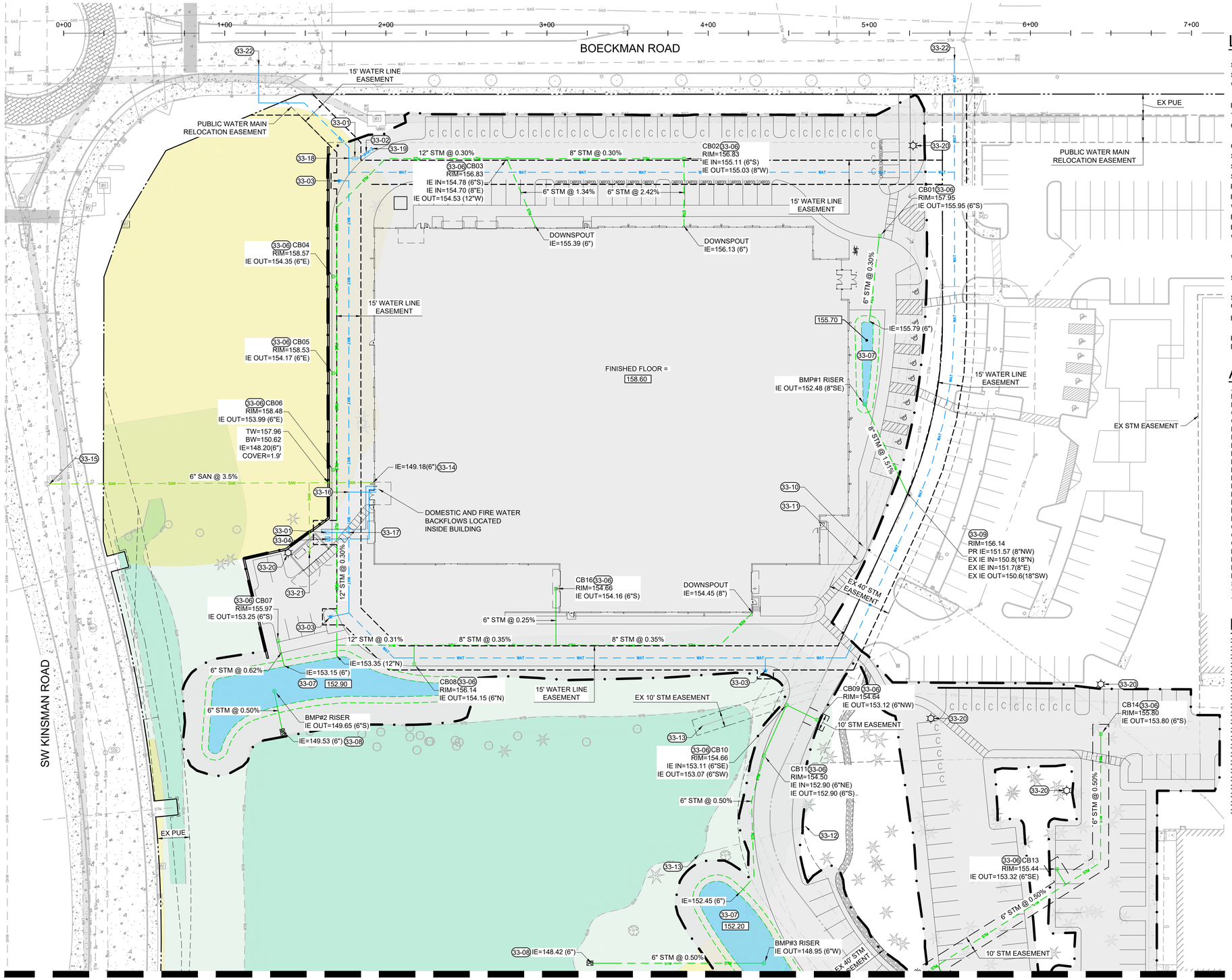
REGISTERED ARCHITECT · LANCE MUELLER · SEATTLE, WA. 1491 · STATE OF OREGON

BUILDING W5
99XX SW Boeckman Rd.
Wilsonville, OR 97070

LANCE MUELLER & ASSOCIATES
ARCHITECTS AIA
130 LAKESIDE • SUITE 250 • SEATTLE, WA 98122 • (206) 325-2553

ENLARGED PLANS AND DETAILS

sheet
A1.2



SEE SHEET C1.31

1 C1.30 UTILITY PLAN - NORTH

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

THE SURVEY INFORMATION SHOWN AS A BACKGROUND SCREEN ON THIS SHEET IS SHOWN FOR REFERENCE ONLY AND IS BASED ON A SURVEY BY: ANDY PARIS & ASSOCIATES, INC. DATE: 08/23/2022

LEGEND

	EXISTING	PROPOSED
STORM LINE	STM	STM
SANITARY LINE	SAN	SAN
WATER LINE	WAT	WAT
POWER LINE	PWR	
TELECOMMUNICATION LINE	TEL	
CATV LINE	TV	
CATCH BASIN		
STORM MANHOLE		
SANITARY MANHOLE		
SANITARY AREA DRAIN		
FIRE HYDRANT		
FIRE DEPARTMENT CONNECTION	FDC	
WATER METER		
BACKFLOW PREVENTER		
POST INDICATOR VALVE		
WATER VALVE	WAT	
WETLAND		
50' WETLAND BUFFER		
SIGNIFICANT RESOURCE OVERLAY ZONE (SROZ)		
PR STORMWATER AREA		
PROPOSED LIMITS OF DEVELOPMENT		

ABBREVIATIONS

AC	ASPHALT CONCRETE
BMP	BEST MANAGEMENT PRACTICE
BW	BOTTOM OF WALL
CB	CATCH BASIN
CO	CLEANOUT
DI	DUCTILE IRON
DW	DOMESTIC WATER
EX	EXISTING
FDC	FIRE DEPARTMENT CONNECTION
FF	FINISH FLOOR
FG	FINISHED GRADE ELEVATION
FH	FIRE HYDRANT
FW	FIRE WATER
IE	INVERT ELEVATION
MH	MANHOLE
MJ	MECHANICAL JOINT
NTS	NOT TO SCALE
OC	ON CENTER
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OSHA	OREGON STATE HEALTH AUTHORITY
PR	PROPOSED
RD	ROOF DRAIN
RIM	RIM ELEVATION
ROW	RIGHT OF WAY
SAN	SANITARY SEWER
TW	TOP OF WALL
TYP	TYPICAL

KEYNOTES

33-01	WATER METER
33-02	BACKFLOW PREVENTER
33-03	FIRE HYDRANT
33-04	FIRE DEPARTMENT CONNECTION
33-05	POST INDICATOR VALVE
33-06	CATCH BASIN
33-07	STORMWATER MANAGEMENT FACILITY, SEE 2/C1.31
33-08	STORM OUTFALL WITH RIP RAP PROTECTION
33-09	CONNECT TO EXISTING STORM MANHOLE
33-10	ADJUST EXISTING UTILITY BOXES TO GRADE AS REQUIRED
33-11	RELOCATE EXISTING SITE LIGHT
33-12	EXISTING STORM CULVERT
33-13	EXISTING STORM OUTFALL
33-14	SANITARY BUILDING CONNECTION
33-15	CONNECT TO EXISTING SANITARY MANHOLE
33-16	FIRE WATER CONNECTION
33-17	DOMESTIC WATER CONNECTION
33-18	IRRIGATION WATER CONNECTION
33-19	IRRIGATION STUB
33-20	SITE LIGHT
33-21	SANITARY AREA DRAIN
33-22	PUBLIC WATER MAIN CONNECTION

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SEATTLE, WA 98115

Project
W-5

9600 BOECKMAN ROAD
WILSONVILLE, OR 97070

REGISTERED PROFESSIONAL ENGINEER
91097
OREGON
JAN. 10, 2014
GREGORY I. MINO
EXPIRES: 12/31/24

REVISION SCHEDULE

Delta	Issued As	Issue Date

SHEET TITLE:
UTILITY PLAN - NORTH

DRAWN BY: BTC

CHECKED BY:GIM

SHEET:
C1.30

JOB NO. **2210115.00**

LAND USE SUBMITTAL #3 - SUPPLEMENT - 05/15/2023

MACKENZIE.

STORM DRAINAGE REPORT

Project
W-5
Planning DB No. _____

Applicant
Martin Development
Attn: Mac Martin
P.O. Box 15523
Seattle, WA 98115

Design Engineer
Mackenzie
Attn: Greg Mino
1515 SE Water Ave, #100
Portland, OR 97214
503.224.9560

Submitted
May 15, 2023

Mackenzie Project #
2210115.00

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Figures

Appendices

I. PROJECT DESCRIPTION

This report documents the stormwater management calculations and design approach carried out by Mackenzie to manage stormwater runoff for the W-5 project compliant with applicable code(s). The proposed W-5 project is located at the SE corner of the intersection of Boeckman Road and SW Kinsman Road in Wilsonville, Oregon (see Figure 1, Vicinity Map). According to City of Wilsonville GIS, the project site is approximately 23.86 acres when considered along with the existing W-4 development that resides on the easterly half of the property. The applicant is pursuing a subdivision to divide the property into two lots, apportioning the westerly 10.046 acres for this new development (referred to as the "project site" or "site" throughout the report). The overall site is currently addressed as 9600 Boeckman Road as Tax Lot 202 of Tax Map 3 1W 14B, and is zoned as Planned Development Industrial (PDI).

In pursuit of this project, the applicant (or their contractor(s)) is applying for the following permits: Development, Commercial Building, Mechanical, Plumbing, Clackamas County Electrical, Grading, Fire Alarm, Fire Sprinkler, DEQ 1200-C, and Type B/C Tree Removal permits. No right-of-way permits or environmental/regulatory permits are expected to be required at this time.

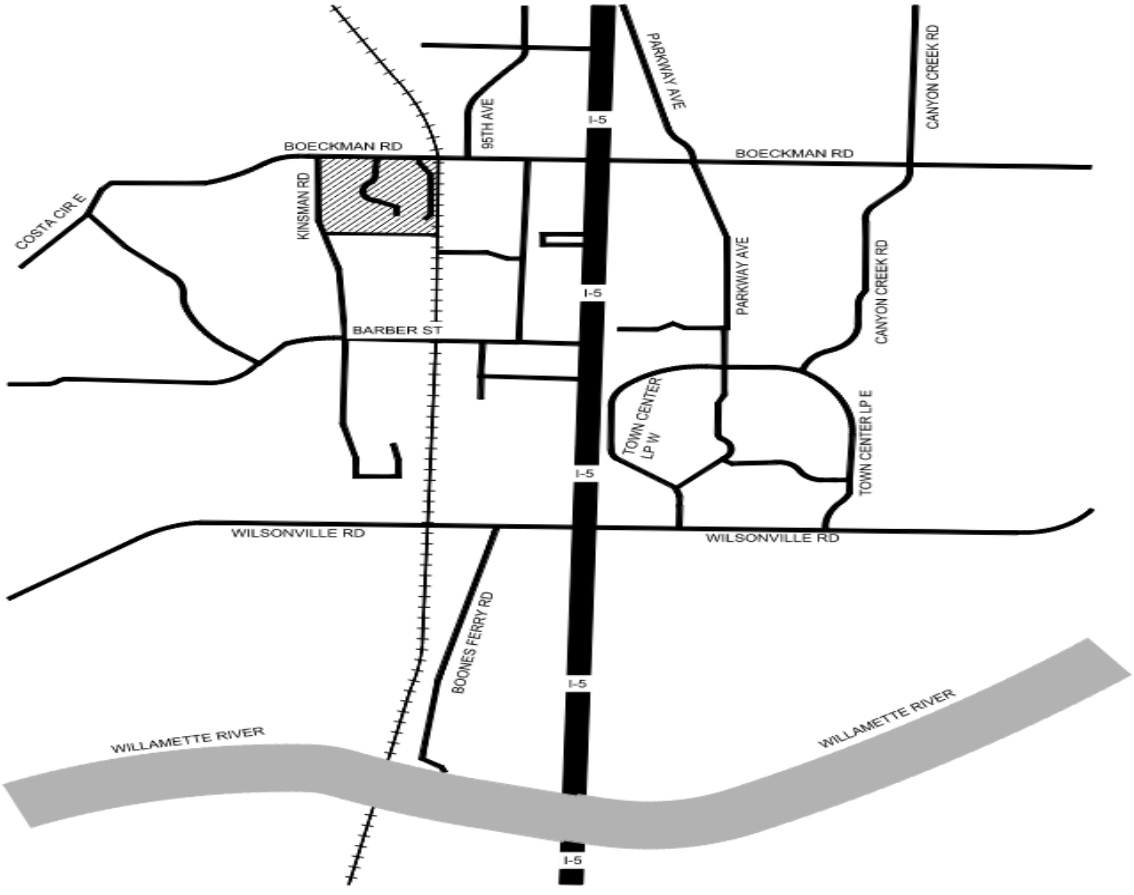


Figure 1: Vicinity Map

Existing Conditions

The existing site consists of a generally open grassy area bounded by the Significant Resource Overlay Zone (SROZ) in the NW corner and southerly portion of the site, Boeckman Road to the north, SW Kinsman Road to the west, and an existing private paved drive aisle to the east. The existing development known as W-4 resides on the easterly portion of the overall property. Figure 2 provides a simplified graphical depiction of the existing conditions.

Stormwater that falls on site generally either infiltrates into the grassy area or drains in a predominantly southerly direction over shallow sloped ground and into the larger SROZ/Wetlands prior to discharge to the public storm drain system. There are no identifiable upstream drainage basins to consider in design. Per City GIS, it appears that rainwater discharge from the project site ultimately outfalls to the Willamette River to the south.

SW Kinsman Road and Boeckman Road are fully improved roads with their own public drainage system.

Soil Conditions

Per the USDA Web Soil Survey, the existing soils on the portion of the site to be developed are almost entirely Aloha silt loam which are identified as Hydrologic Soil Group C/D for the purposes of relating to Technical Release 55 (TR-55) to assign the runoff curve number to be used in the hydrologic analysis of the existing conditions. Referring to Table 2-2a of TR-55 and designating the site as Open Space in Good Condition, the resulting curve number is between 74 and 80 – 76 will be used in the calculations.

Please see the Web Soil Survey Soils Map in Appendix C.

Hydrologic Analysis (Existing)

The hydrologic analysis of the existing conditions was performed using the Water Environment Services (WES) BMP Sizing Tool. For the purposes of hydrologic modeling, the WES BMP Sizing Tool models the historical vegetation which existed onsite prior to development. All subbasins are either defined as grass or forested. Please see the WES BMP Sizing Report, Appendix B, pages 62-63, for details on the hydrologic pre-developed conditions onsite.

Figure 2: Existing Conditions

II. DEVELOPED CONDITIONS

The proposed development consists of the construction of a 65,000 square foot (footprint) manufacturing building with an integral depressed truck dock, associated drive aisles and parking, an exterior trash enclosure, and associated utility services to the building and site. Although the site area (after subdivision) is 10.046 acres, the area to be developed is substantially less due to the SROZ/Wetland areas encumbering more than 50% of the southerly portion and the NW corner of the lot. The total site area being developed is 4.88 acres. Figure 3 provides a simplified graphical depiction of the developed conditions.

See the Drainage Management Area (DMA) Map in Appendix A that provides a breakdown of impervious and pervious areas within each DMA/subbasin.

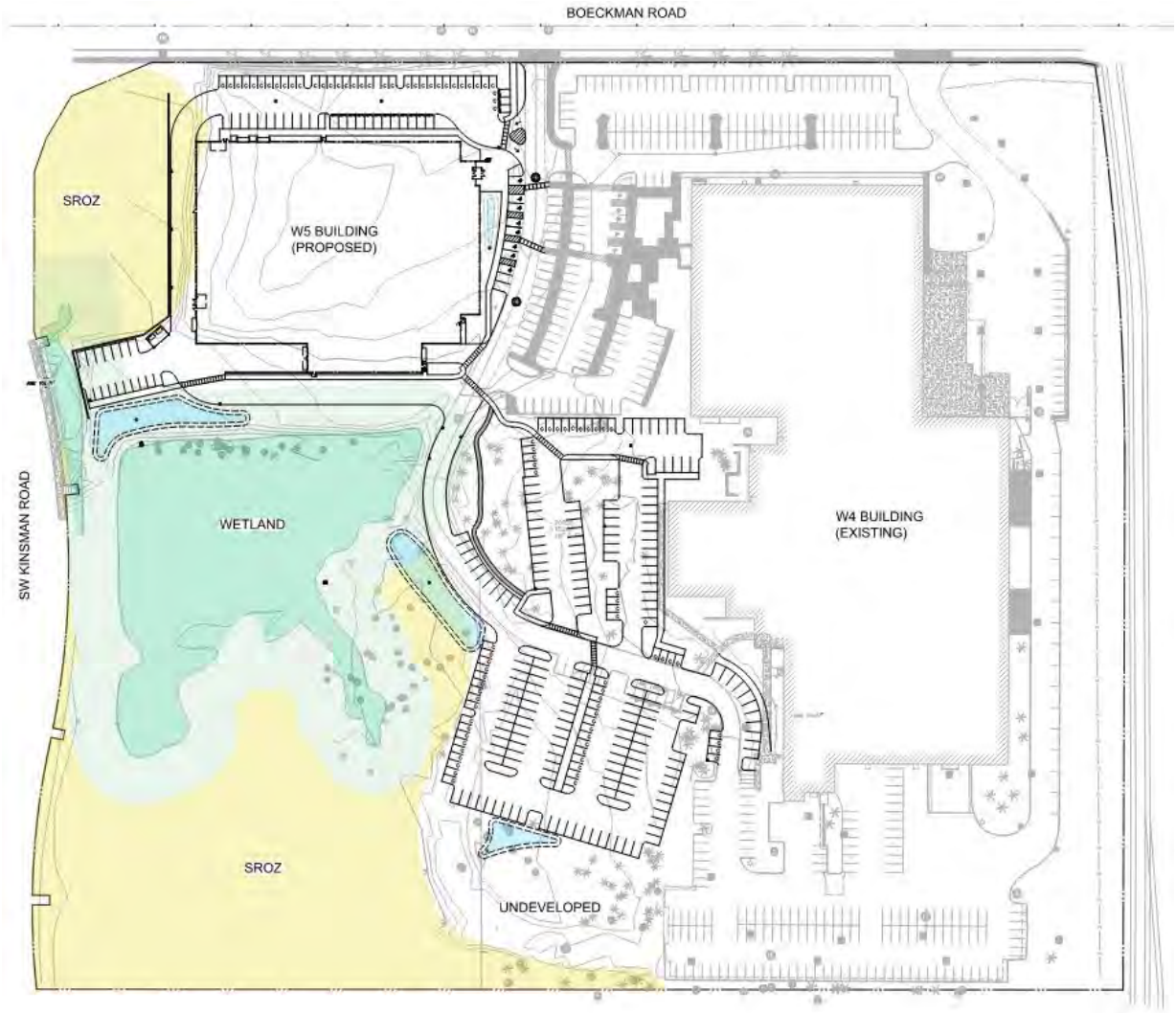


Figure 3: Developed Conditions

Water Quality Standard

Water quality facilities shall be designed to capture and treat 80% of the average annual runoff volume to the Maximum Extent Practicable (MEP) with the goal of 70% total suspended soils (TSS) removal. In this context, MEP means less effective treatment may not be substituted when it is practicable to provide more effective treatment. This treatment volume equates to a design storm of **1.0 inch over 24 hours**.

The BMP Sizing Tool addresses these water quality requirements to size stormwater management facilities.

Hydrodynamic separators, when used as a sole method of stormwater treatment, do not meet the MEP requirement for stormwater treatment effectiveness with regard to these stormwater standards.

Flow Control Standard

The duration of peak flow rates from post-development conditions shall be less than or equal to the duration of peak flow rates from pre-development conditions for all peak flows between **42% of the 2-year storm peak flow rate up to the 10-year peak flow rate**.

Hydrologic Analysis (Proposed)

Water Quality

In order to meet the goals of Low Impact Development, rain gardens have been selected as the proposed BMP to provide water quality treatment for this project. Although the project site has limited infiltration due to relatively high groundwater table (8' bgs) and low infiltration rates (0.1"/hr) , the BMP facilities are not proposed to be lined in order to promote any amount of infiltration that may still occur. The stormwater planters are dispersed throughout the site at strategic locations for capture of runoff, upon which underground piping collects the water and routes it to the SROZ/Wetland area for discharge.

Please refer to the DMA Map and WES BMP Sizing Report (Appendix A, pages 62-63) for facility sizes and impervious areas that are conveyed to each facility. Appendix B contains the Operations & Maintenance Manual for the proposed facilities.

Flow Control

As noted in the Water Quality section, rain gardens have been selected as the proposed BMP which will meet both treatment and flow control requirements.

Please refer to the Drainage Management Area (DMA) Map and WES BMP Sizing Report, Appendix A, pages 62-63, for further detail. Appendix B contains the Operations & Maintenance Manual for the proposed facilities.

Hydraulic Design Computations

The proposed underground storm drainage system for this project has been designed to collect and convey the runoff from a 25-year storm event per the City of Wilsonville 2015 Stormwater & Surface Water Design & Construction Standards. The peak flow has been calculated using the Santa Barbara Urban Hydrograph (SBUH) within the Storm & Sanitary Analysis (SSA) for Autodesk Civil3D software. The peak flow from the 25-year event over the project site has then been prorated on a cfs/sf basis into the various

drainage management areas (DMAs)/subbasins throughout the site. Underground piping has then been sized accordingly using SSA software. Please refer to the DMA Map and Profile Plots, pages 1-7, in Appendix A. In the occurrence of a storm event in excess of the design storm, adequate overland flow has been provided to prevent flooding of habitable structures.

Downstream Analysis

The existing drainage system downstream of the development has been analyzed to verify that it has the capacity to convey the 25-year design storm. The analysis is intended to extend downstream to a point in the drainage system where the proposed development site constitutes 10% or less of the total tributary drainage flow. However, the overall property containing the existing W-4 Building and proposed W-5 Building discharge to a major water body, being Coffee Lake Creek, just across Kinsman Road and as such, the analysis was terminated there.

City of Wilsonville GIS reveals that water is conveyed from the overall property to Coffee Lake Creek through three 18" culverts that run beneath SW Kinsman Road. Figure 4 is a snapshot of City of Wilsonville GIS, and it depicts the conveyance of the stormwater offsite into Coffee Lake Creek. Culverts 1-3 are hydraulically connected such that if stormwater backed up in the furthest downstream culvert (Culvert 3), then stormwater would be conveyed through Culverts 2 and 1 respectively.

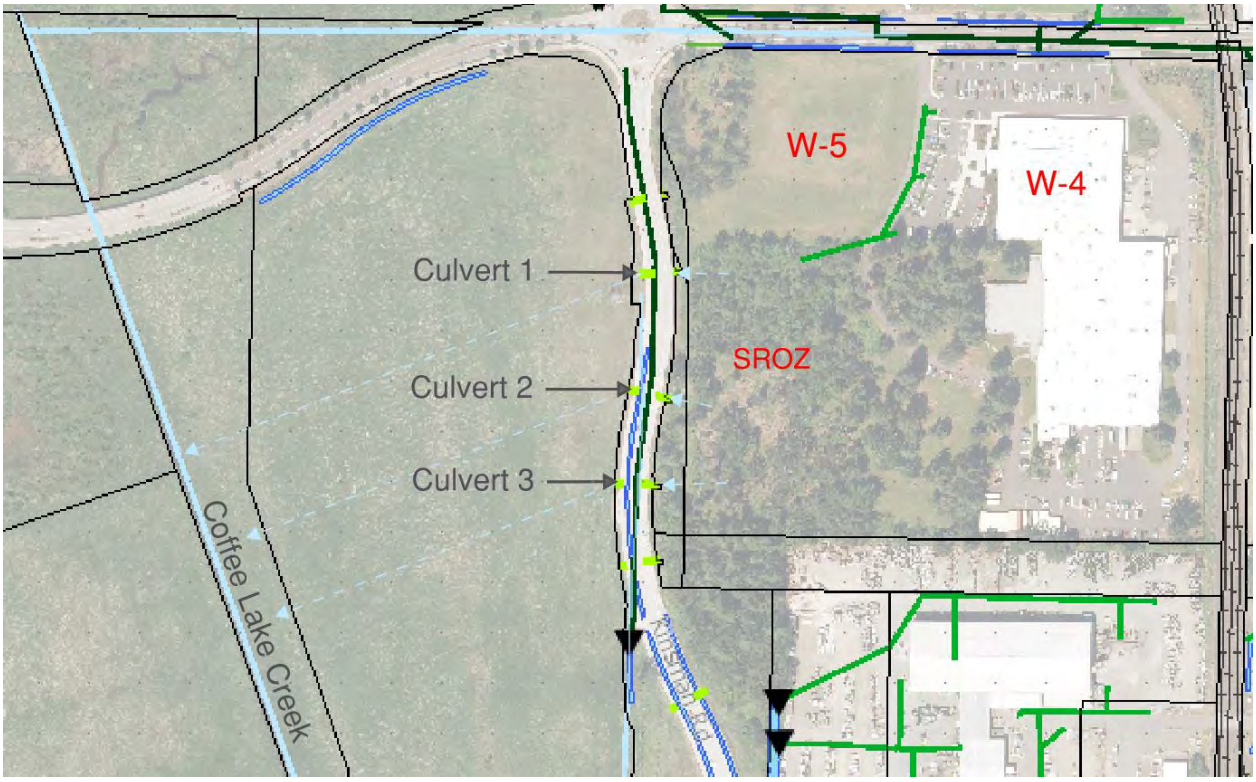


Figure 4: Downstream Analysis Study Area

Hyd. No. 1

Post Developed

Hydrograph type	= SBUH Runoff	Peak discharge	= 13.67 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.00 hrs
Time interval	= 2 min	Hyd. volume	= 236,391 cuft
Drainage area	= 23.860 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.70 min
Total precip.	= 3.90 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

* Composite (Area/CN) = [(4.280 x 98) + (0.760 x 76) + (6.910 x 76) + (10.120 x 98) + (1.790 x 76)] / 23.860

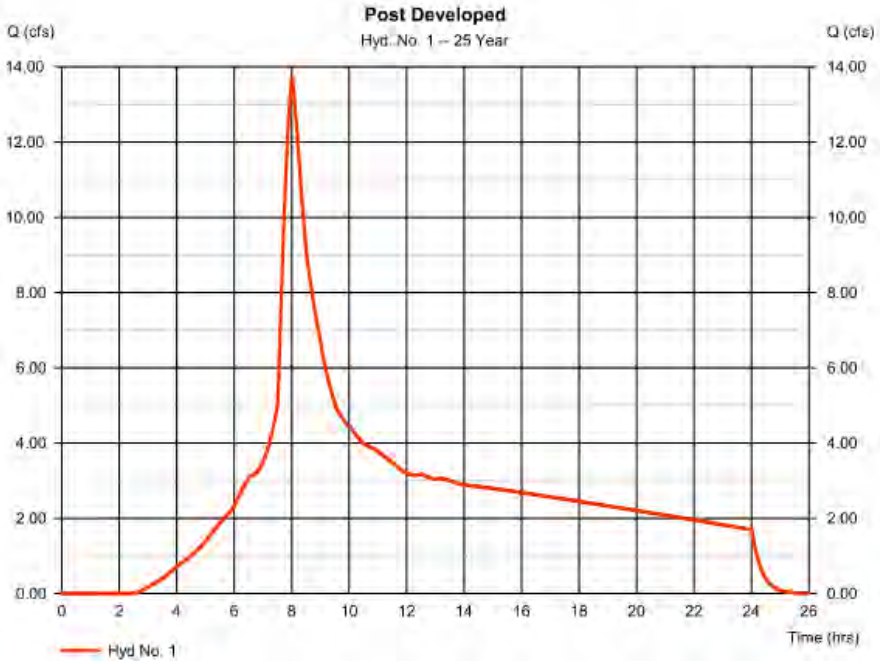


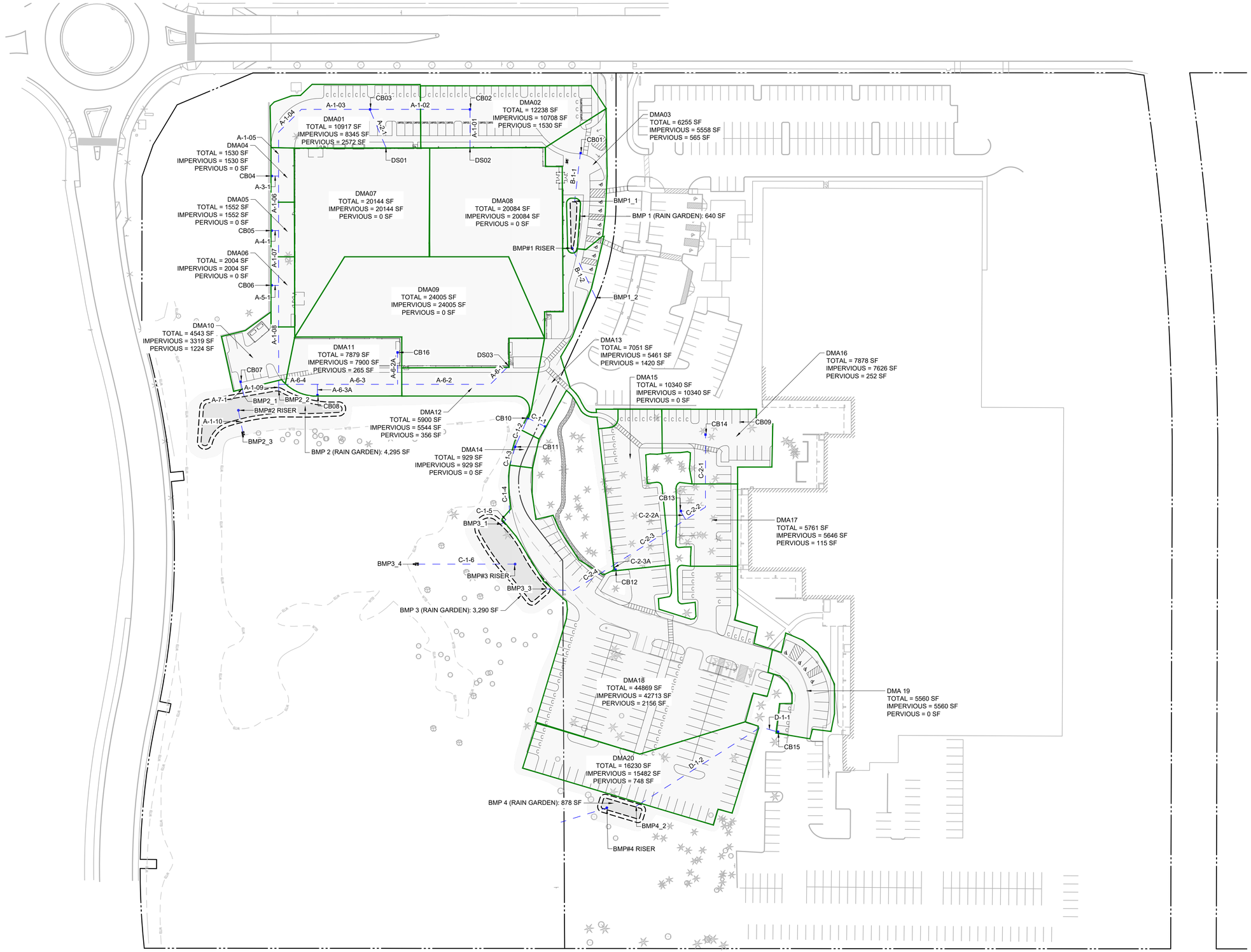
Figure 5: Post Developed Discharge Hydrograph

Runoff (cfs)	Slope(%)	Diameter (in)	Pipe Area (sf)	Hydraulic Radius^2/3	Capacity (cfs)	Velocity at Design Flow (fps)	Runoff/Capacity (ratio)
6.84	0.50	18	1.767	0.520	**7.40**	4.69	0.92
6.84	0.50	18	1.767	0.520	**7.40**	4.69	0.92

Figure 6: Culvert Downstream Conveyance Spreadsheet

Figure 5 illustrates the peak flow (13.67 cfs) for the 25-year storm from the overall property. Figure 6 lists the variables used in a Manning's calculations to determine capacity, and it is conclusive that two 18" culverts are sufficient to adequately convey the 25-year storm peak discharge from the overall property to Coffee Lake Creek.

APPENDIX A – HYDRAULIC DESIGN COMPUTATIONS AND DMA MAP



1 DRAINAGE MANAGEMENT AREA MAP

50 0 25 50 100 200

(IN FEET)
1 inch = **50** ft.

THE SURVEY INFORMATION SHOWN AS A BACKGROUND SCREEN ON THIS SHEET IS SHOWN FOR REFERENCE ONLY AND IS BASED ON A SURVEY BY: ANDY PARIS & ASSOCIATES, INC. DATE: 08/23/2022

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REVISION SCHEDULE

Delta	Issued As	Issue Date

SHEET TITLE:
DRAINAGE MANAGEMENT AREA MAP

DRAWN BY: BTC

CHECKED BY:GIM

SHEET:

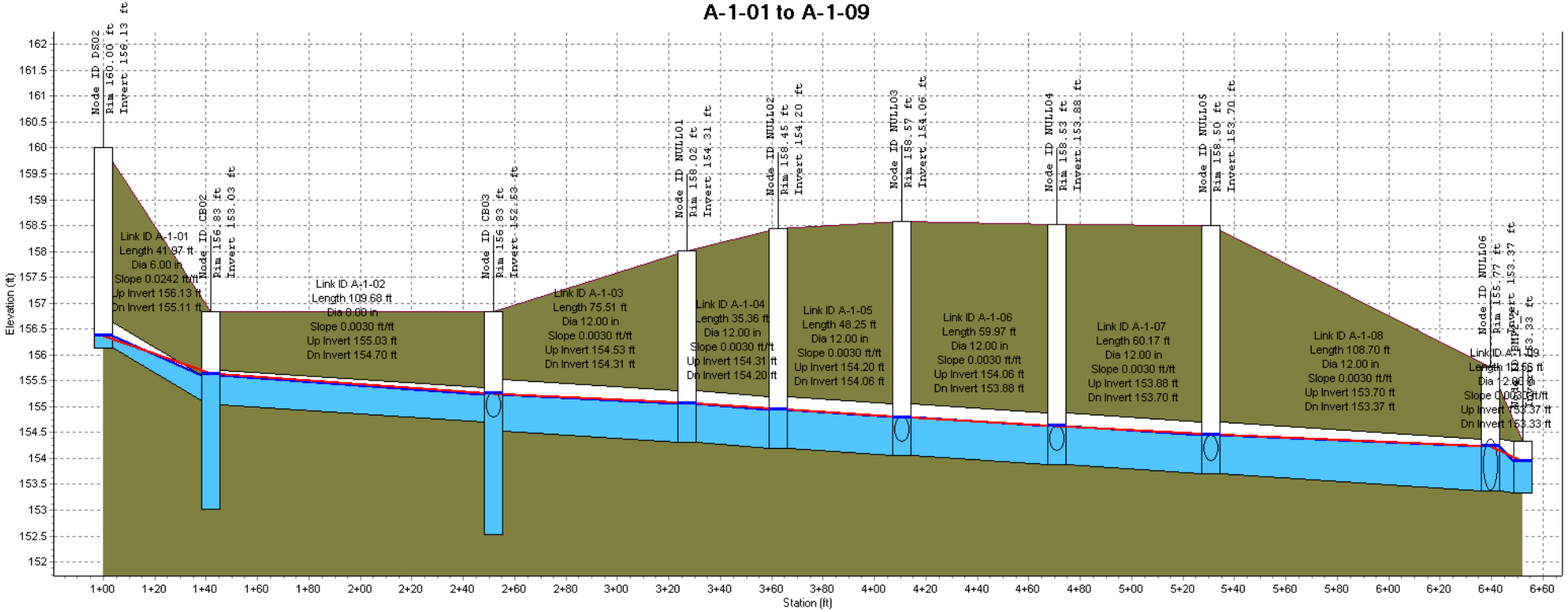
JOB NO. **2210115.00**

LAND USE SUBMITTAL - 10/XX/2022

221011500\DRAWINGS\CIVIL\EXHIBITS\115-DMA MAP.DWG VSN 10/18/22 17:28 1:50

Profile Plot

A-1-01 to A-1-09



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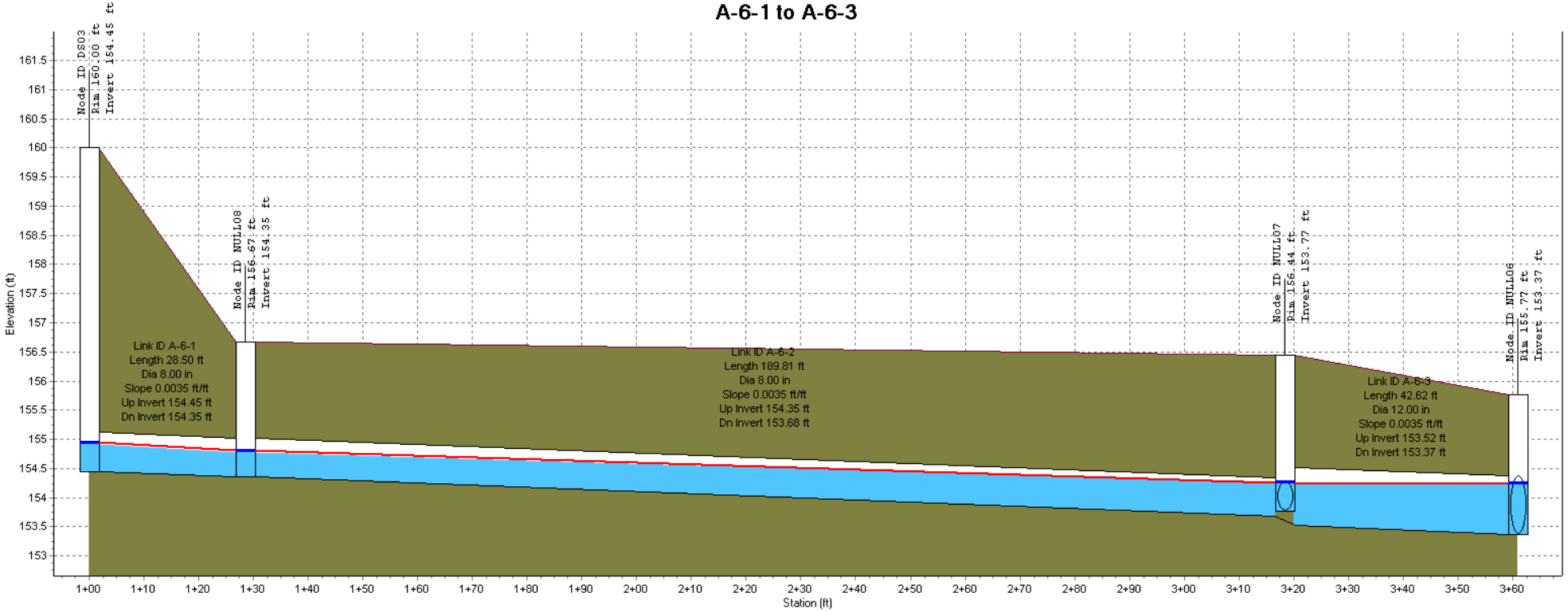
Rim (ft):	160.00	156.83	156.83	158.02	158.45	158.57	158.53	158.50	155.77	
Invert (ft):	156.13	153.03	152.53	154.31	154.20	154.06	153.88	153.70	153.37	153.33
Min Pipe Cover (ft):				2.71	3.25	3.51	3.65	3.80	1.40	
Max HGL (ft):	156.37	155.64	155.26	155.07	154.95	154.80	154.63	154.46	154.24	153.95

Link ID:	A-1-01	A-1-02	A-1-03	A-1-04	A-1-05	A-1-06	A-1-07	A-1-08	A-1-09
Length (ft):	41.97	109.68	75.51	35.36	48.25	59.97	60.17	108.70	12.56
Dia (in):	6.00	8.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Slope (ft/ft):	0.0242	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030
Up Invert (ft):	156.13	155.03	154.53	154.31	154.20	154.06	153.88	153.70	153.37
Dn Invert (ft):	155.11	154.70	154.31	154.20	154.06	153.88	153.70	153.37	153.33
Max Q (cfs):	0.43	0.68	1.31	1.31	1.30	1.33	1.36	1.41	2.09
Max Vel (ft/s):	2.75	2.10	2.13	2.08	2.13	2.16	2.19	2.05	3.34
Max Depth (ft):	0.37	0.58	0.74	0.75	0.74	0.75	0.76	0.82	0.74

Autodesk Storm and Sanitary Analysis

Profile Plot

A-6-1 to A-6-3



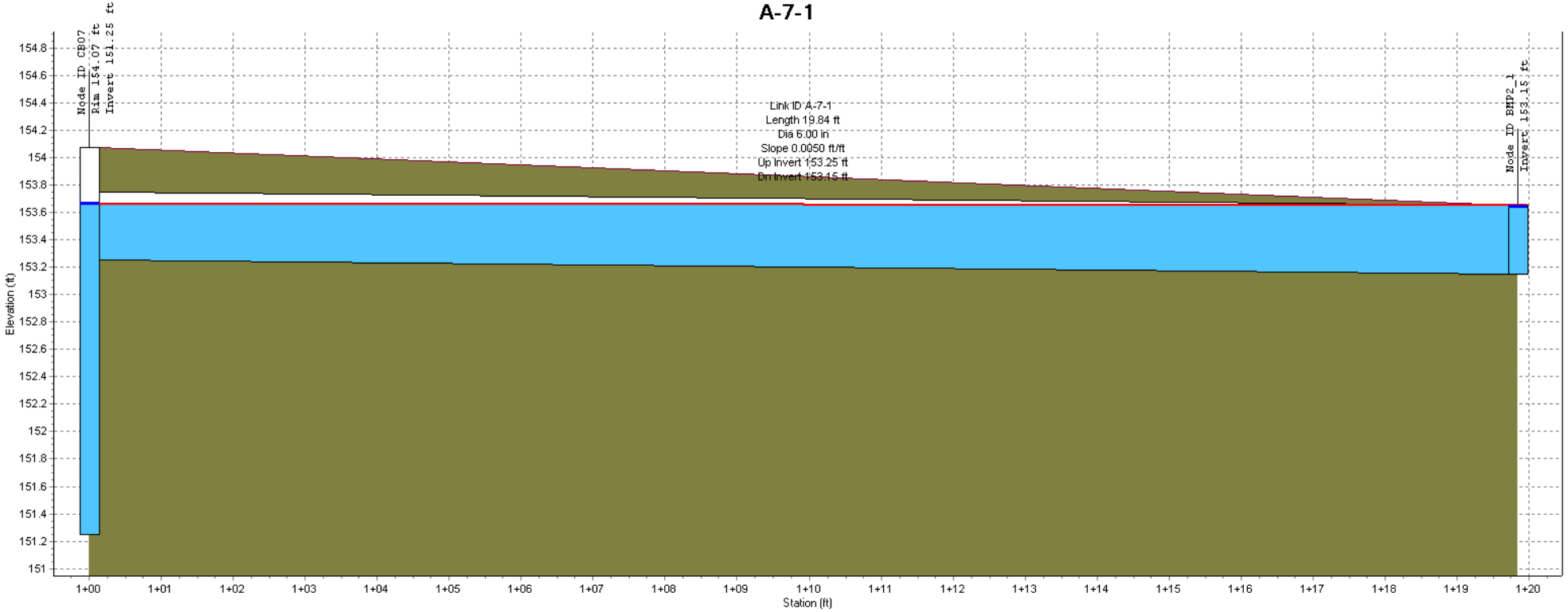
Node ID:	DS03	NULL08		NULL07	NULL06
Rim (ft):	160.00	156.67		156.44	155.77
Invert (ft):	154.45	154.35		153.77	153.37
Min Pipe Cover (ft):		1.65		1.92	1.40
Max HGL (ft):	154.95	154.81		154.26	154.24

Link ID:	A-6-1	A-6-2	A-6-3
Length (ft):	28.50	189.81	42.62
Dia (in):	8.00	8.00	12.00
Slope (ft/ft):	0.0035	0.0035	0.0035
Up Invert (ft):	154.45	154.35	153.52
Dn Invert (ft):	154.35	153.68	153.37
Max Q (cfs):	0.52	0.52	0.68
Max Vel (ft/s):	1.95	2.20	1.45
Max Depth (ft):	0.48	0.47	0.68

Autodesk Storm and Sanitary Analysis

Profile Plot

A-7-1



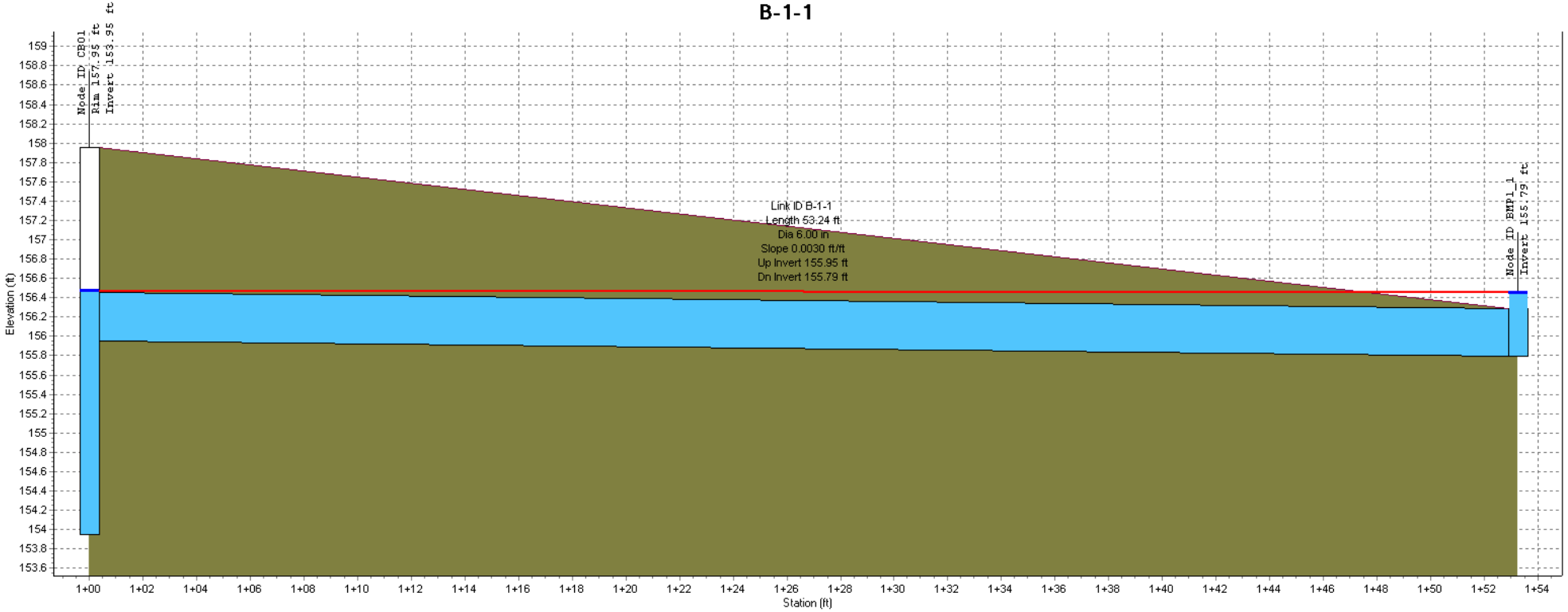
Node ID:	CB07		BMP2_1
Rim (ft):	154.07		
Invert (ft):	151.25		153.15
Min Pipe Cover (ft):			
Max HGL (ft):	153.67		153.65

Link ID:	A-7-1
Length (ft):	19.84
Dia (in):	6.00
Slope (ft/ft):	0.0050
Up Invert (ft):	153.25
Dn Invert (ft):	153.15
Max Q (cfs):	0.15
Max Vel (ft/s):	0.81
Max Depth (ft):	0.46

Autodesk Storm and Sanitary Analysis

Profile Plot

B-1-1

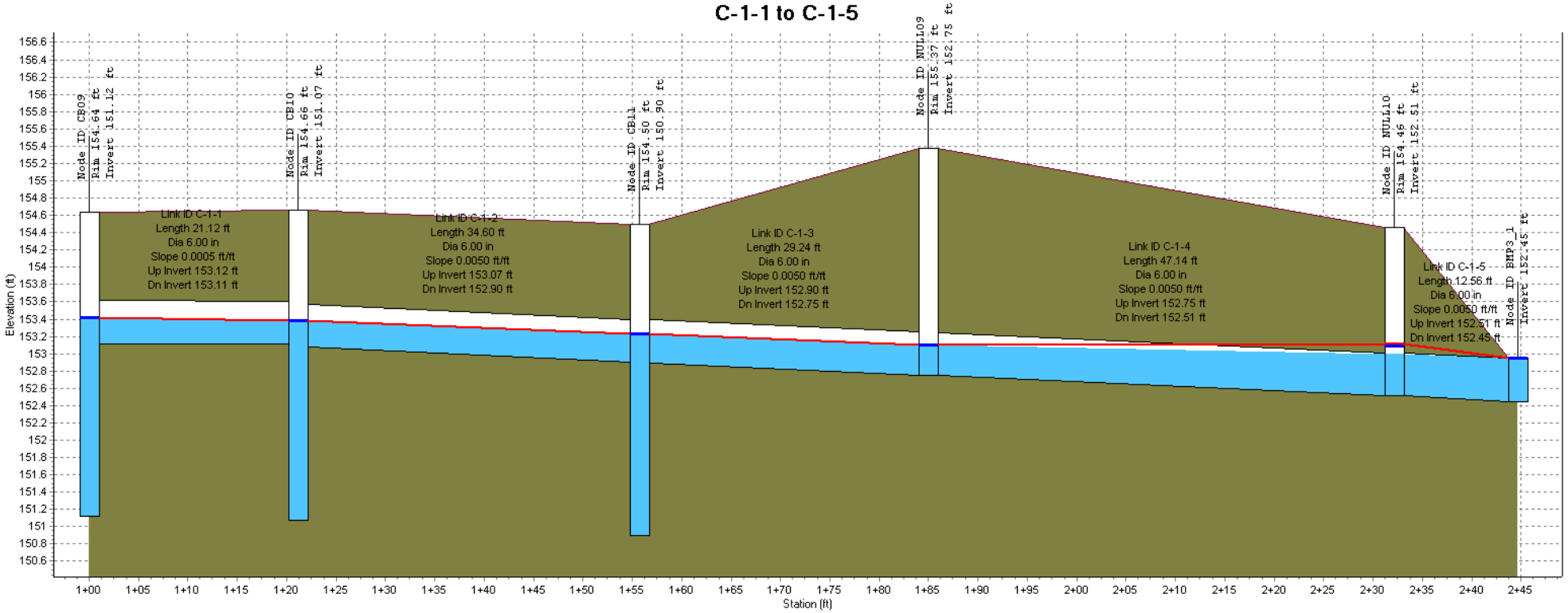


Node ID:	CB01	BMP1_1
Rim (ft):	157.95	
Invert (ft):	153.95	155.79
Min Pipe Cover (ft):		
Max HGL (ft):	156.48	156.45

Link ID:	B-1-1
Length (ft):	53.24
Dia (in):	6.00
Slope (ft/ft):	0.0030
Up Invert (ft):	155.95
Dn Invert (ft):	155.79
Max Q (cfs):	0.13
Max Vel (ft/s):	0.64
Max Depth (ft):	0.50

Profile Plot

C-1-1 to C-1-5



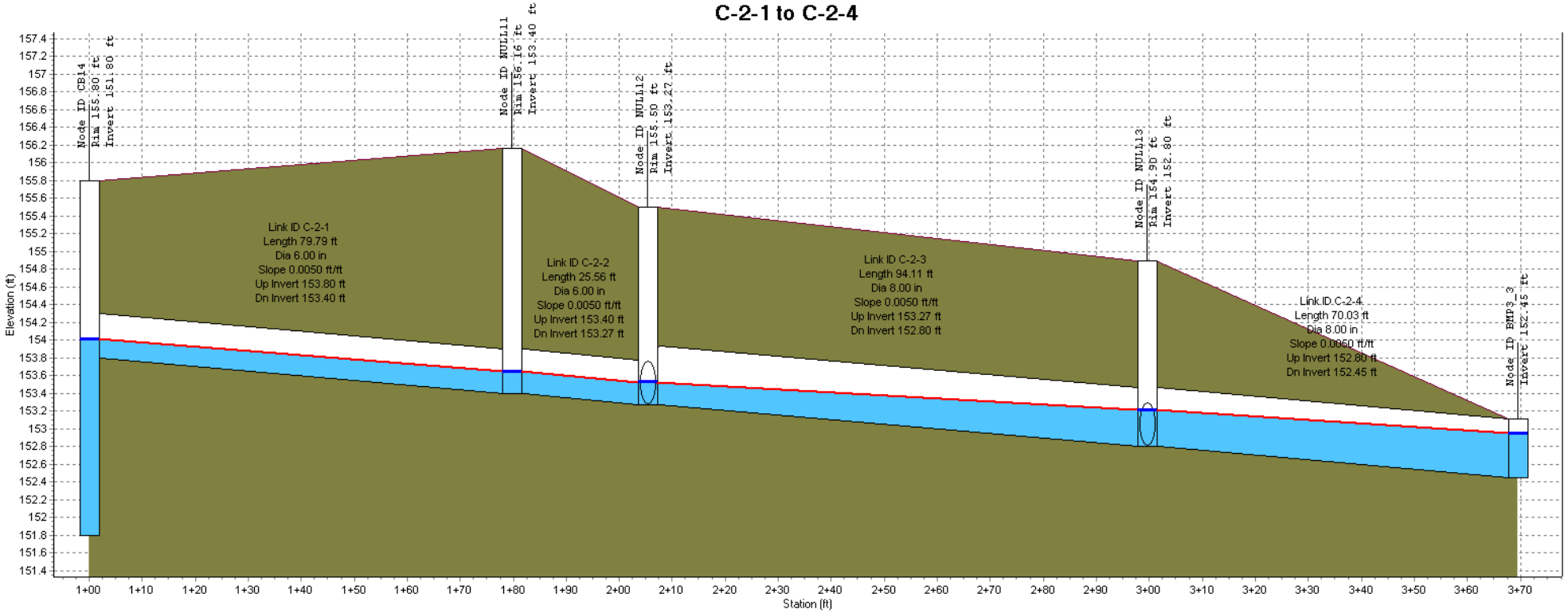
Node ID:	CB09	CB10	CB11	NULL09	NULL10	BMP3_1
Rim (ft):	154.64	154.66	154.50	155.37	154.46	
Invert (ft):	151.12	151.07	150.90	152.75	152.51	152.45
Min Pipe Cover (ft):				2.12	1.45	
Max HGL (ft):	153.42	153.38	153.23	153.10	153.11	152.95

Link ID:	C-1-1	C-1-2	C-1-3	C-1-4	C-1-5
Length (ft):	21.12	34.60	29.24	47.14	12.56
Dia (in):	6.00	6.00	6.00	6.00	6.00
Slope (ft/ft):	0.0005	0.0050	0.0050	0.0050	0.0050
Up Invert (ft):	153.12	153.07	152.90	152.75	152.51
Dn Invert (ft):	153.11	152.90	152.75	152.51	152.45
Max Q (cfs):	0.11	0.23	0.25	0.25	0.33
Max Vel (ft/s):	1.05	1.74	1.73	1.41	2.03
Max Depth (ft):	0.29	0.32	0.34	0.42	0.50

Autodesk Storm and Sanitary Analysis

Profile Plot

C-2-1 to C-2-4



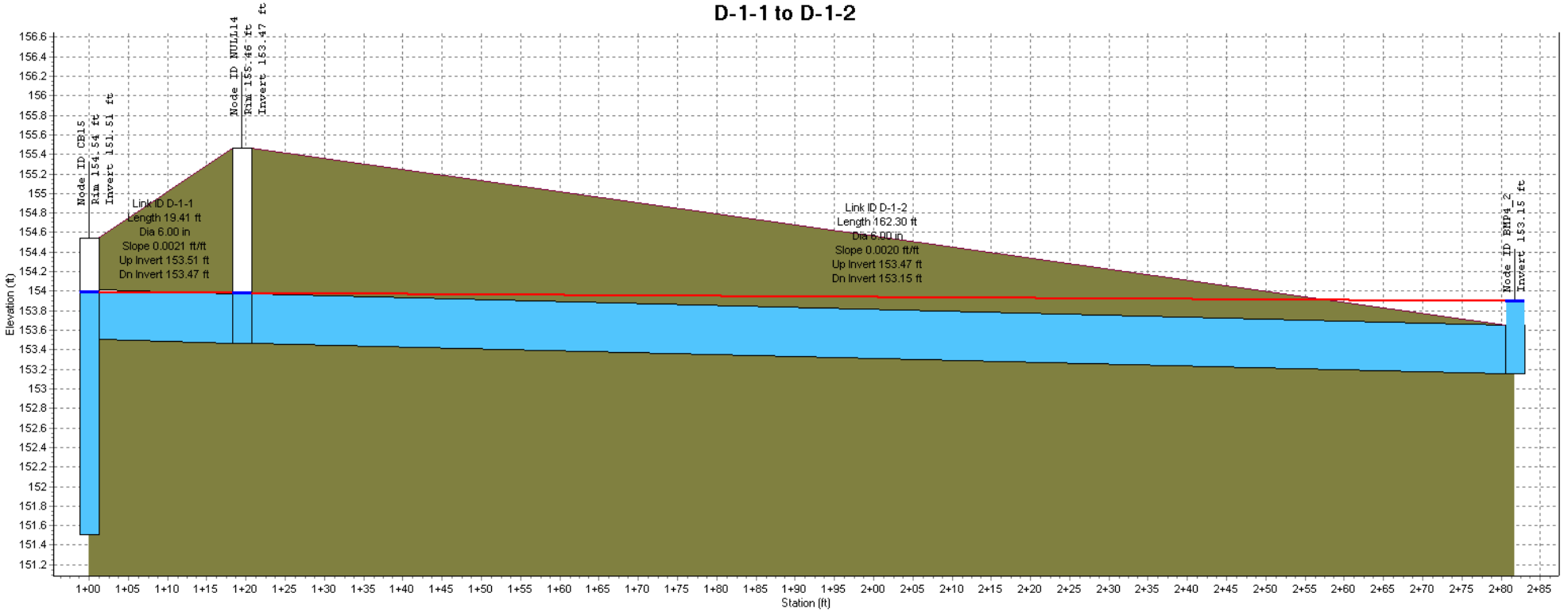
Node ID:	CB14	NULL11	NULL12	NULL13	BMP3_3
Rim (ft):	155.80	156.16	155.50	154.90	
Invert (ft):	151.80	153.40	153.27	152.80	152.45
Min Pipe Cover (ft):		2.26	1.56	1.43	
Max HGL (ft):	154.02	153.65	153.53	153.22	152.95

Link ID:	C-2-1	C-2-2	C-2-3	C-2-4
Length (ft):	79.79	25.56	94.11	70.03
Dia (in):	6.00	6.00	8.00	8.00
Slope (ft/ft):	0.0050	0.0050	0.0050	0.0050
Up Invert (ft):	153.80	153.40	153.27	152.80
Dn Invert (ft):	153.40	153.27	152.80	152.45
Max Q (cfs):	0.16	0.16	0.28	0.50
Max Vel (ft/s):	1.76	1.59	1.55	1.93
Max Depth (ft):	0.24	0.26	0.34	0.46

Autodesk Storm and Sanitary Analysis

Profile Plot

D-1-1 to D-1-2



Node ID:	CB15	NULL14	BMP4_2
Rim (ft):	154.54	155.46	
Invert (ft):	151.51	153.47	153.15
Min Pipe Cover (ft):		1.49	
Max HGL (ft):	153.99	153.98	153.90

Link ID:	D-1-1	D-1-2
Length (ft):	19.41	162.30
Dia (in):	6.00	6.00
Slope (ft/ft):	0.0021	0.0020
Up Invert (ft):	153.51	153.47
Dn Invert (ft):	153.47	153.15
Max Q (cfs):	0.17	0.16
Max Vel (ft/s):	2.75	1.09
Max Depth (ft):	0.49	0.50

Project Description

File Name 115-SSA.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Nov 23, 2021	00:00:00
End Analysis On	Nov 24, 2021	00:00:00
Start Reporting On	Nov 23, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	20
Nodes	48
Junctions	17
Outfalls	11
Flow Diversions	0
Inlets	20
Storage Nodes	0
Links	37
Channels	2
Pipes	35
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-025yr	Time Series	TS-025YR	Intensity	inches	Oregon	Clackamas	25	4.00	SCS Type IA 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Impervious Area	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ft²)	(%)			(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	DMA01	10917.01	76.00	98.00	76.00	3.99	3.27	0.82	0.20	0 00:05:00
2	DMA02	12238.01	87.00	98.00	76.00	3.99	3.49	0.98	0.24	0 00:05:00
3	DMA03	6123.01	91.00	98.00	76.00	3.99	3.57	0.50	0.13	0 00:05:00
4	DMA04	1530.00	100.00	98.00	76.00	3.99	3.76	0.13	0.03	0 00:05:00
5	DMA05	1552.00	100.00	98.00	76.00	3.99	3.76	0.13	0.03	0 00:05:00
6	DMA06	2004.02	100.00	98.00	76.00	3.99	3.76	0.17	0.04	0 00:05:00
7	DMA07	20144.02	100.00	98.00	76.00	3.99	3.76	1.74	0.44	0 00:05:00
8	DMA08	20083.99	100.00	98.00	76.00	3.99	3.76	1.73	0.43	0 00:05:00
9	DMA09	24005.00	100.00	98.00	76.00	3.99	3.76	2.07	0.52	0 00:05:00
10	DMA10	8343.00	85.00	98.00	76.00	3.99	3.44	0.66	0.15	0 00:11:12
11	DMA11	8165.02	97.00	98.00	76.00	3.99	3.70	0.69	0.17	0 00:05:00
12	DMA12	5899.98	94.00	98.00	76.00	3.99	3.63	0.49	0.12	0 00:05:00
13	DMA13	6881.00	79.00	98.00	76.00	3.99	3.32	0.52	0.11	0 00:17:06
14	DMA14	929.00	100.00	98.00	76.00	3.99	3.76	0.08	0.02	0 00:05:00
15	DMA15	10340.01	100.00	98.00	76.00	3.99	3.76	0.89	0.22	0 00:05:00
16	DMA16	7878.00	97.00	98.00	76.00	3.99	3.69	0.67	0.16	0 00:07:46
17	DMA17	5760.98	98.00	98.00	76.00	3.99	3.71	0.49	0.12	0 00:08:01
18	DMA18	44869.02	95.00	98.00	76.00	3.99	3.65	3.76	0.90	0 00:08:53
19	DMA19	5560.00	100.00	98.00	76.00	3.99	3.76	0.48	0.12	0 00:05:00
20	DMA20	16230.02	95.00	98.00	76.00	3.99	3.64	1.36	0.30	0 00:14:24

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	BMP#1 RISER	Junction	152.48	155.73	152.48	155.73	0.00	0.00	152.48	0.00	3.25	0 00:00	0.00	0.00
2	BMP#2 RISER	Junction	149.65	152.90	149.65	152.90	0.00	0.00	149.65	0.00	3.25	0 00:00	0.00	0.00
3	BMP#3 RISER	Junction	148.95	153.20	148.95	152.20	0.00	0.00	148.95	0.00	4.25	0 00:00	0.00	0.00
4	NULL01	Junction	154.31	158.02	154.31	155.38	0.00	1.31	155.07	0.00	2.95	0 00:00	0.00	0.00
5	NULL02	Junction	154.20	158.45	154.20	155.28	0.00	1.31	154.95	0.00	3.50	0 00:00	0.00	0.00
6	NULL03	Junction	154.06	158.57	154.06	155.13	0.00	1.34	154.80	0.00	3.77	0 00:00	0.00	0.00
7	NULL04	Junction	153.88	158.53	153.88	154.95	0.00	1.37	154.63	0.00	3.90	0 00:00	0.00	0.00
8	NULL05	Junction	153.70	158.50	153.70	154.77	0.00	1.41	154.46	0.00	4.04	0 00:00	0.00	0.00
9	NULL06	Junction	153.37	155.77	153.65	154.45	0.00	2.09	154.24	0.00	1.53	0 00:00	0.00	0.00
10	NULL07	Junction	153.77	156.44	153.55	154.91	0.00	0.69	154.26	0.00	2.18	0 00:00	0.00	0.00
11	NULL08	Junction	154.35	156.67	154.33	155.69	0.00	0.52	154.81	0.00	1.86	0 00:00	0.00	0.00
12	NULL09	Junction	152.75	155.37	152.75	153.29	0.00	0.25	153.10	0.00	2.27	0 00:00	0.00	0.00
13	NULL10	Junction	152.51	154.46	152.51	153.06	0.00	0.33	153.11	0.00	1.35	0 00:00	0.00	0.00
14	NULL11	Junction	153.40	156.16	153.40	153.94	0.00	0.16	153.65	0.00	2.51	0 00:00	0.00	0.00
15	NULL12	Junction	153.27	155.50	153.27	154.41	0.00	0.28	153.53	0.00	1.97	0 00:00	0.00	0.00
16	NULL13	Junction	152.80	154.90	152.80	153.93	0.00	0.50	153.22	0.00	1.68	0 00:00	0.00	0.00
17	NULL14	Junction	153.47	155.46	153.47	154.80	0.00	0.30	153.98	0.00	1.48	0 00:00	0.00	0.00
18	BMP1_1	Outfall	155.79					0.13	156.45					
19	BMP1_2	Outfall	151.57					0.00	151.57					
20	BMP2_1	Outfall	153.15					0.15	153.65					
21	BMP2_2	Outfall	153.33					2.09	153.95					
22	BMP2_3	Outfall	149.53					0.00	149.53					
23	BMP3_1	Outfall	152.45					0.33	152.95					
24	BMP3_2	Outfall	152.45					0.00	152.95					
25	BMP3_3	Outfall	152.45					0.50	152.95					
26	BMP3_4	Outfall	148.42					0.00	148.42					
27	BMP4_1	Outfall	153.40					0.01	153.90					
28	BMP4_2	Outfall	153.15					0.16	153.90					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	A-1-01	Pipe	DS02	CB02	41.97	156.13	154.94	2.8200	6.000	0.0130	0.43	0.94	0.46	2.83	0.37	0.74	0.00	Calculated
2	A-1-02	Pipe	CB02	CB03	109.68	154.86	154.53	0.3000	8.000	0.0130	0.68	0.66	1.02	1.94	0.67	1.00	16.00	SURCHARGED
3	A-1-03	Pipe	CB03	NULL01	75.51	154.53	154.31	0.3000	12.000	0.0130	1.31	1.95	0.67	2.13	0.74	0.74	0.00	Calculated
4	A-1-04	Pipe	NULL01	NULL02	35.36	154.31	154.20	0.3000	12.000	0.0130	1.31	1.95	0.67	2.09	0.75	0.75	0.00	Calculated
5	A-1-05	Pipe	NULL02	NULL03	48.25	154.20	154.06	0.3000	12.000	0.0130	1.30	1.95	0.67	2.12	0.74	0.74	0.00	Calculated
6	A-1-06	Pipe	NULL03	NULL04	59.97	154.06	153.88	0.3000	12.000	0.0130	1.33	1.95	0.68	2.16	0.75	0.75	0.00	Calculated
7	A-1-07	Pipe	NULL04	NULL05	60.17	153.88	153.70	0.3000	12.000	0.0130	1.36	1.95	0.70	2.18	0.76	0.76	0.00	Calculated
8	A-1-08	Pipe	NULL05	NULL06	108.70	153.70	153.37	0.3000	12.000	0.0130	1.41	1.95	0.72	2.05	0.82	0.82	0.00	Calculated
9	A-1-09	Pipe	NULL06	BMP2_2	12.56	153.37	153.33	0.3000	12.000	0.0130	2.09	1.95	1.07	3.34	0.74	0.74	0.00	> CAPACITY
10	A-1-10	Pipe	BMP#2 RISER	BMP2_3	24.86	149.65	149.53	0.5000	6.000	0.0130	0.00	0.40	0.00	0.00	0.00	0.00	0.00	Calculated
11	A-2-1	Pipe	DS01	CB03	45.40	155.39	154.78	1.3400	6.000	0.0130	0.44	0.65	0.67	2.94	0.39	0.78	0.00	Calculated
12	A-3-1	Pipe	CB04	NULL03	7.60	154.35	154.31	0.5000	6.000	0.0130	0.03	0.40	0.08	0.84	0.47	0.94	0.00	Calculated
13	A-4-1	Pipe	CB05	NULL04	7.60	154.17	154.13	0.5000	6.000	0.0130	0.03	0.40	0.08	0.84	0.48	0.96	0.00	Calculated
14	A-5-1	Pipe	CB06	NULL05	7.61	153.99	153.95	0.5000	6.000	0.0130	0.04	0.40	0.11	0.95	0.49	0.97	0.00	Calculated
15	A-6-1	Pipe	DS03	NULL08	28.50	154.45	154.35	0.3500	8.000	0.0130	0.52	0.72	0.72	1.95	0.48	0.71	0.00	Calculated
16	A-6-2	Pipe	NULL08	NULL07	189.81	154.35	153.68	0.3500	8.000	0.0130	0.52	0.67	0.78	2.20	0.47	0.70	0.00	Calculated
17	A-6-2A	Pipe	CB08	NULL07	11.86	154.15	153.77	3.2000	6.000	0.0130	0.17	1.00	0.17	1.97	0.31	0.63	0.00	Calculated
18	A-6-3	Pipe	NULL07	NULL06	42.62	153.52	153.37	0.3500	12.000	0.0130	0.68	3.45	0.20	1.46	0.68	0.68	0.00	Calculated
19	A-7-1	Pipe	CB07	BMP2_1	19.84	153.25	153.15	0.5000	6.000	0.0130	0.15	0.40	0.38	0.81	0.46	0.92	0.00	Calculated
20	B-1-1	Pipe	CB01	BMP1_1	53.24	155.95	155.79	0.3000	6.000	0.0130	0.13	0.31	0.41	0.64	0.50	1.00	1424.00	SURCHARGED
21	B-1-2	Pipe	BMP#1 RISER	BMP1_2	60.16	152.48	151.57	1.5100	8.000	0.0130	0.00	1.48	0.00	0.00	0.00	0.00	0.00	Calculated
22	C-1-1	Pipe	CB09	CB10	21.12	153.12	153.11	0.0500	6.000	0.0130	0.11	0.25	0.44	1.05	0.29	0.57	0.00	Calculated
23	C-1-2	Pipe	CB10	CB11	34.60	153.07	152.90	0.5000	6.000	0.0130	0.23	0.40	0.58	1.74	0.32	0.64	0.00	Calculated
24	C-1-3	Pipe	CB11	NULL09	29.24	152.90	152.75	0.5000	6.000	0.0130	0.25	0.40	0.63	1.73	0.34	0.69	0.00	Calculated
25	C-1-4	Pipe	NULL09	NULL10	47.14	152.75	152.51	0.5000	6.000	0.0130	0.25	0.39	0.63	1.41	0.42	0.84	0.00	Calculated
26	C-1-5	Pipe	NULL10	BMP3_1	12.56	152.51	152.45	0.5000	6.000	0.0130	0.33	0.40	0.84	2.03	0.50	1.00	0.00	SURCHARGED
27	C-1-6	Pipe	BMP#3 RISER	BMP3_4	106.93	148.95	148.42	0.5000	6.000	0.0130	0.00	0.40	0.00	0.00	0.00	0.00	0.00	Calculated
28	C-2-1	Pipe	CB14	NULL11	79.79	153.80	153.40	0.5000	6.000	0.0130	0.16	0.40	0.41	1.76	0.24	0.47	0.00	Calculated
29	C-2-2	Pipe	NULL11	NULL12	25.56	153.40	153.27	0.5000	6.000	0.0130	0.16	0.40	0.41	1.59	0.26	0.51	0.00	Calculated
30	C-2-2A	Pipe	CB13	NULL12	10.96	153.32	153.27	0.5000	6.000	0.0130	0.12	0.39	0.30	1.19	0.25	0.51	0.00	Calculated
31	C-2-3	Pipe	NULL12	NULL13	94.11	153.27	152.80	0.5000	8.000	0.0130	0.28	0.85	0.33	1.55	0.34	0.51	0.00	Calculated
32	C-2-3A	Pipe	CB12	NULL13	5.51	152.83	152.80	0.5000	6.000	0.0130	0.22	0.40	0.56	1.41	0.43	0.85	0.00	Calculated
33	C-2-4	Pipe	NULL13	BMP3_3	70.03	152.80	152.45	0.5000	8.000	0.0150	0.50	0.74	0.67	1.93	0.46	0.69	0.00	Calculated
34	D-1-1	Pipe	CB15	NULL14	19.41	153.51	153.47	0.2100	6.000	0.0130	0.17	0.25	0.67	2.75	0.49	0.98	0.00	Calculated
35	D-1-2	Pipe	NULL14	BMP4_2	162.30	153.47	153.15	0.2000	6.000	0.0130	0.16	0.25	0.65	1.09	0.50	1.00	15.00	SURCHARGED
36	BMP3_CURBBREAK	Channel	BMP3_CURBBREAK	BMP3_2	2.83	153.54	152.45	38.5200	12.000	0.0330	0.00	13.44	0.00	0.00	0.25	0.25	0.00	
37	BMP4_CURBBREAK	Channel	BMP4_CURBBREAK	BMP4_1	6.53	154.50	153.40	16.8500	12.000	0.0330	0.01	8.89	0.00	0.03	0.25	0.25	0.00	

Inlet Summary

SN	Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Initial Water Elevation (ft)	Ponded Area (ft²)	Peak Flow (cfs)	Peak Flow Intercepted by Inlet (cfs)	Peak Flow Bypassing Inlet (cfs)	Inlet Efficiency during Peak Flow (%)	Allowable Spread (ft)	Max Gutter Spread during Peak Flow (ft)	Max Gutter Water Elev. during Peak Flow (ft)
1	BMP3_CURBBREAK	FHWA HEC-22 GENERIC	N/A	On Sag	1	0.00	153.54	0.00	10.00	0.90	N/A	N/A	N/A	7.00	-1.60	153.76
2	BMP4_CURBBREAK	FHWA HEC-22 GENERIC	N/A	On Sag	1	0.00	154.51	0.00	10.00	0.30	N/A	N/A	N/A	7.00	3.67	154.83
3	CB01	FHWA HEC-22 GENERIC	N/A	On Sag	1	153.95	157.95	156.45	0.00	0.13	N/A	N/A	N/A	7.00	1.53	158.09
4	CB02	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.86	156.83	154.64	0.00	0.24	N/A	N/A	N/A	7.00	1.83	156.97
5	CB03	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.53	156.83	154.53	0.00	0.20	N/A	N/A	N/A	7.00	1.73	156.97
6	CB04	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.35	158.57	154.35	0.00	0.03	N/A	N/A	N/A	7.00	1.22	158.70
7	CB05	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.17	158.53	154.17	0.00	0.03	N/A	N/A	N/A	7.00	1.22	158.66
8	CB06	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.99	158.48	153.99	0.00	0.04	N/A	N/A	N/A	7.00	1.26	158.61
9	CB07	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.25	154.07	153.65	0.00	0.15	N/A	N/A	N/A	7.00	1.60	154.21
10	CB08	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.15	156.17	154.15	0.00	0.17	N/A	N/A	N/A	7.00	1.66	156.31
11	CB09	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.12	154.64	153.12	0.00	0.11	N/A	N/A	N/A	7.00	1.49	154.78
12	CB10	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.07	154.66	153.07	0.00	0.12	N/A	N/A	N/A	7.00	1.52	154.80
13	CB11	FHWA HEC-22 GENERIC	N/A	On Sag	1	150.90	154.50	152.95	0.00	0.02	N/A	N/A	N/A	7.00	1.16	154.63
14	CB12	FHWA HEC-22 GENERIC	N/A	On Sag	1	150.83	154.88	152.95	0.00	0.22	N/A	N/A	N/A	7.00	1.78	155.02
15	CB13	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.32	155.44	153.32	0.00	0.12	N/A	N/A	N/A	7.00	1.51	155.58
16	CB14	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.80	155.80	153.80	0.00	0.16	N/A	N/A	N/A	7.00	1.63	155.94
17	CB15	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.51	154.54	153.90	0.00	0.12	N/A	N/A	N/A	7.00	1.52	154.68
18	DS01	FHWA HEC-22 GENERIC	N/A	On Sag	1	155.39	160.00	155.39	0.00	0.44	N/A	N/A	N/A	7.00	2.22	160.15
19	DS02	FHWA HEC-22 GENERIC	N/A	On Sag	1	156.13	160.00	156.13	0.00	0.43	N/A	N/A	N/A	7.00	2.21	160.15
20	DS03	FHWA HEC-22 GENERIC	N/A	On Sag	1	154.45	160.00	154.45	0.00	0.52	N/A	N/A	N/A	7.00	2.37	160.15

Subbasin Hydrology

Subbasin : DMA01

Input Data

Area (ft²)	10917.01
Impervious Area (%)	76.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	10917.01		92.72

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

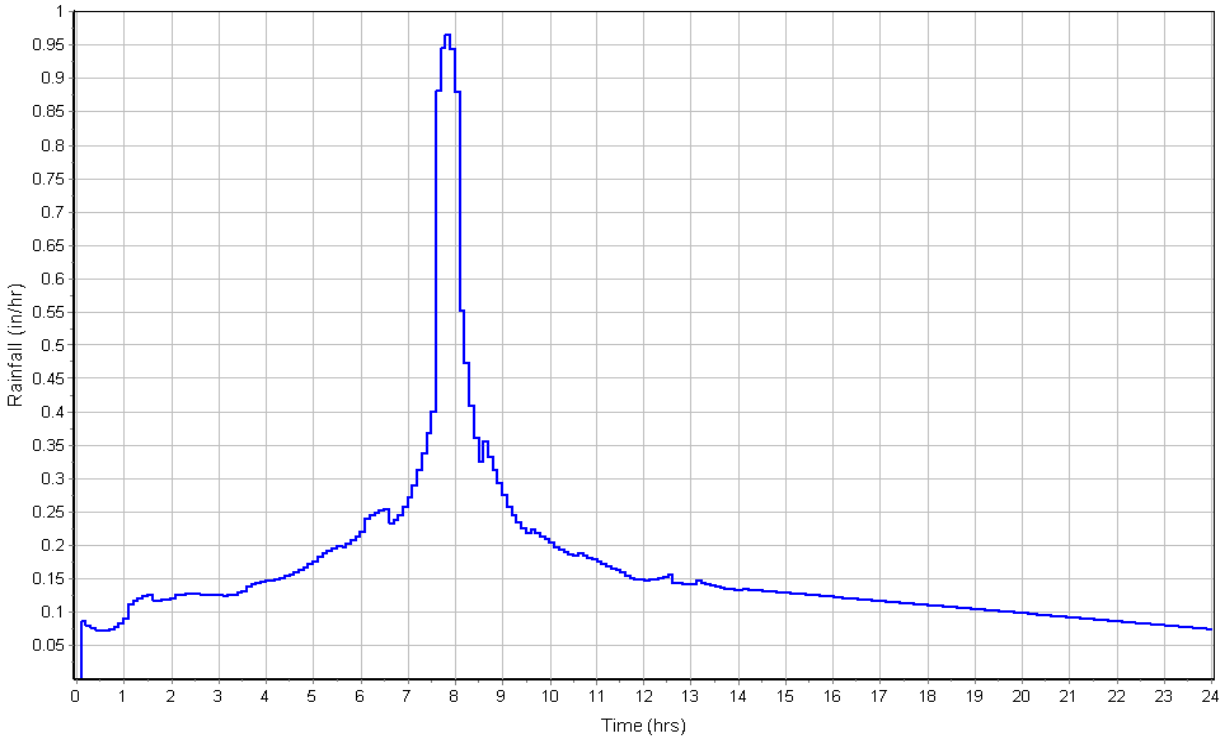
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

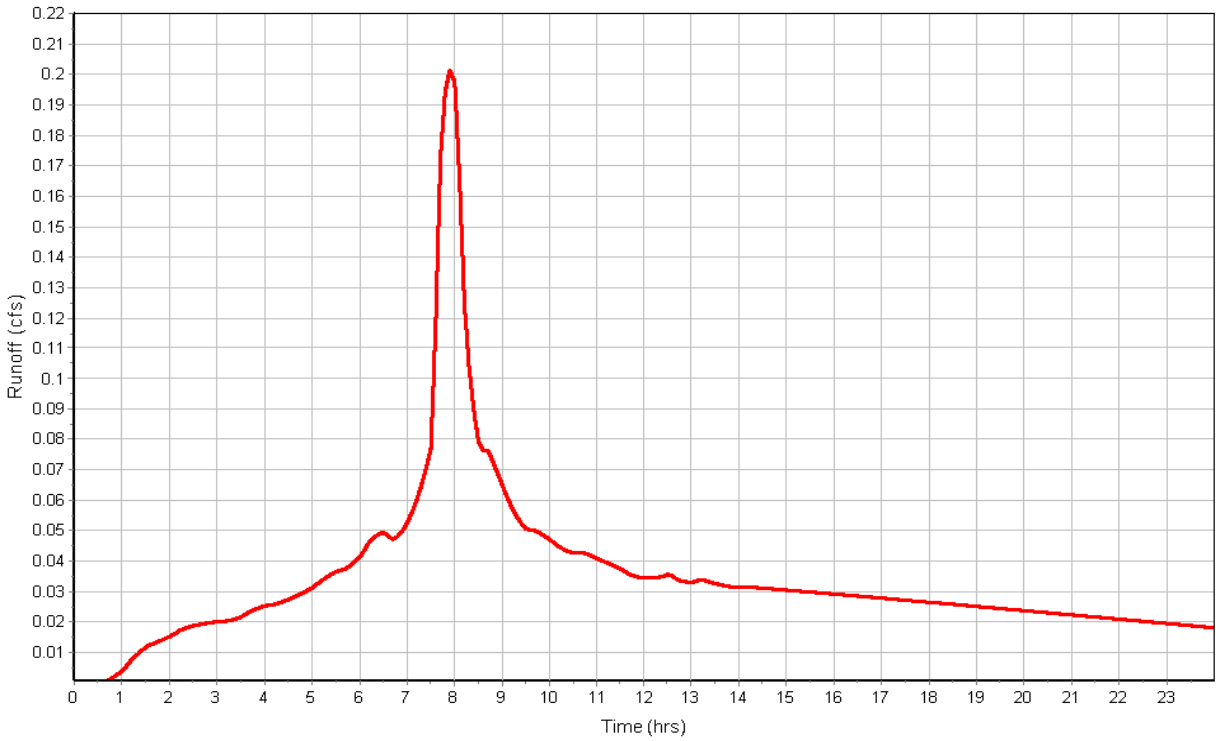
Total Rainfall (in)	3.99
Total Runoff (in)	3.27
Peak Runoff (cfs)	0.20
Weighted Curve Number	92.72
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA01

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA02

Input Data

Area (ft²)	12238.01
Impervious Area (%)	87.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	12238.01		95.14

Time of Concentration

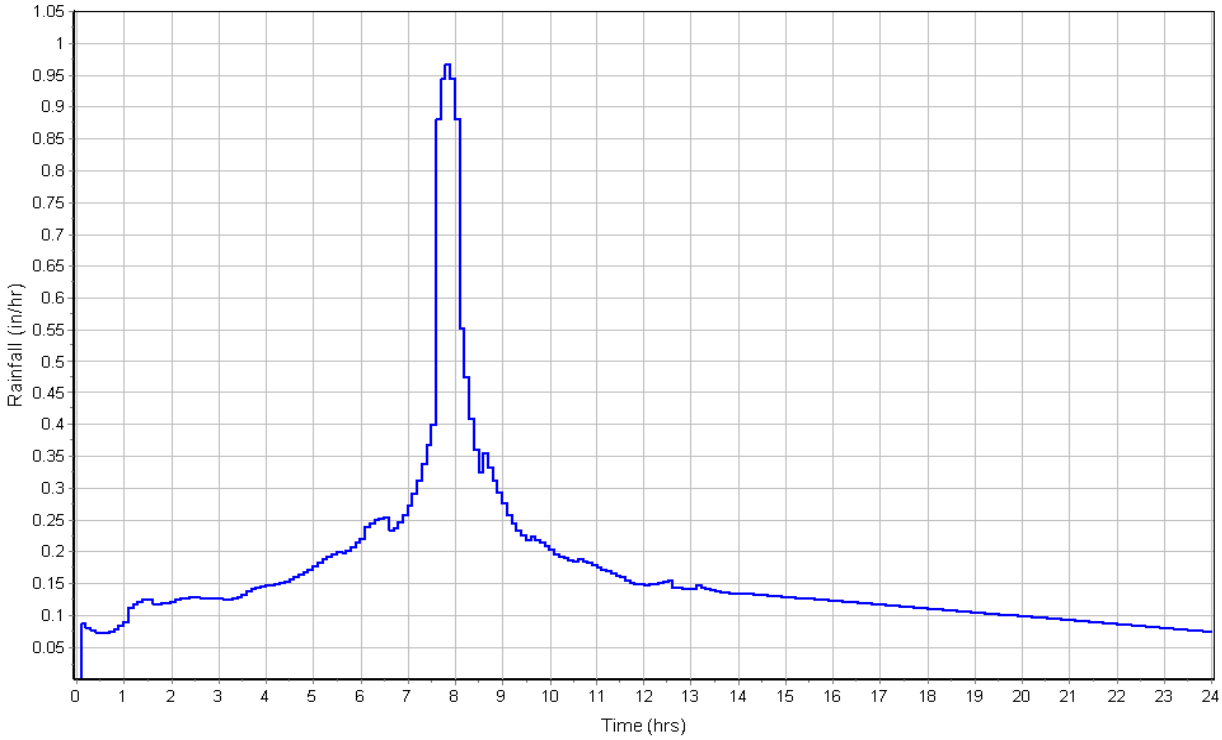
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

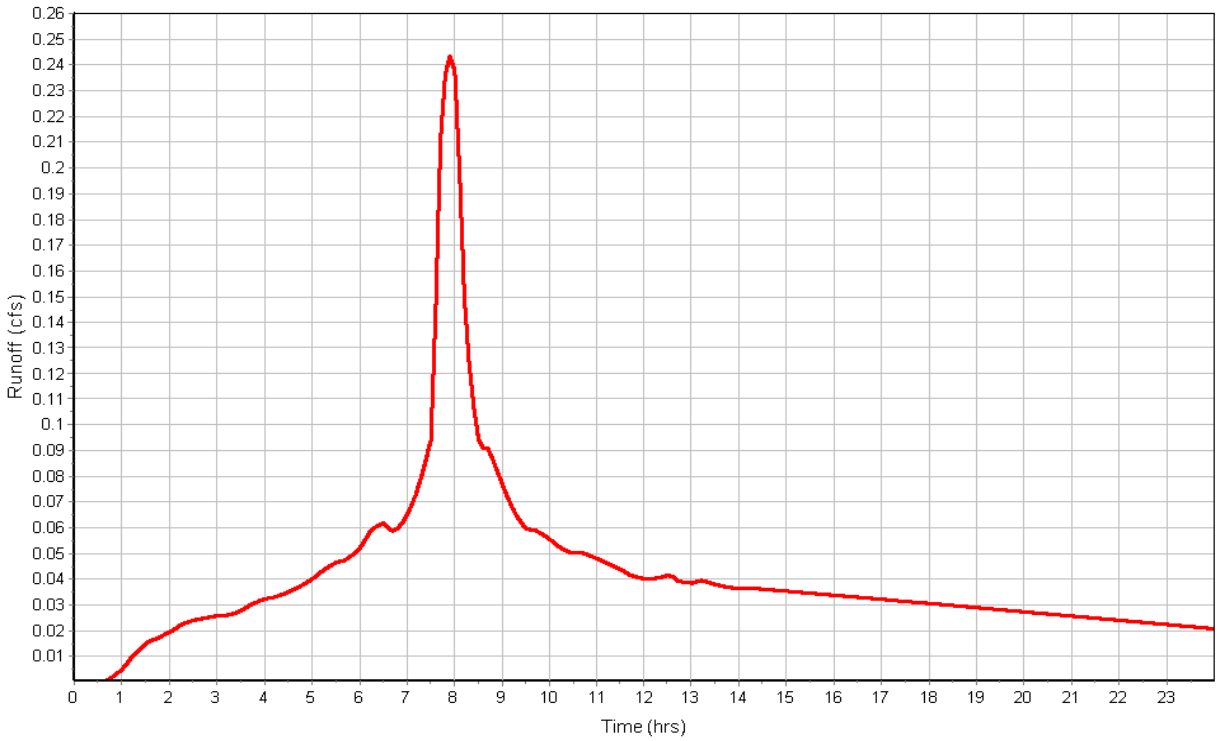
Total Rainfall (in)	3.99
Total Runoff (in)	3.49
Peak Runoff (cfs)	0.24
Weighted Curve Number	95.14
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA02

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA03

Input Data

Area (ft²)	6123.01
Impervious Area (%)	91.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	6123.01		96.02

Time of Concentration

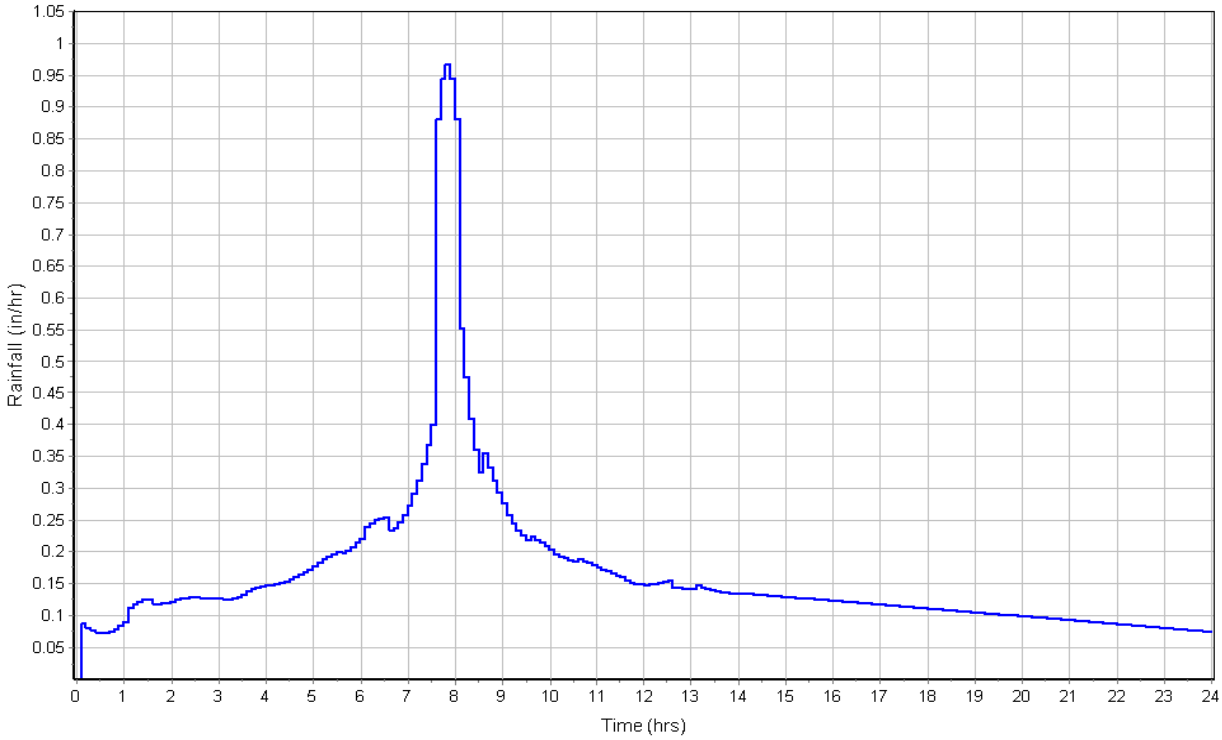
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

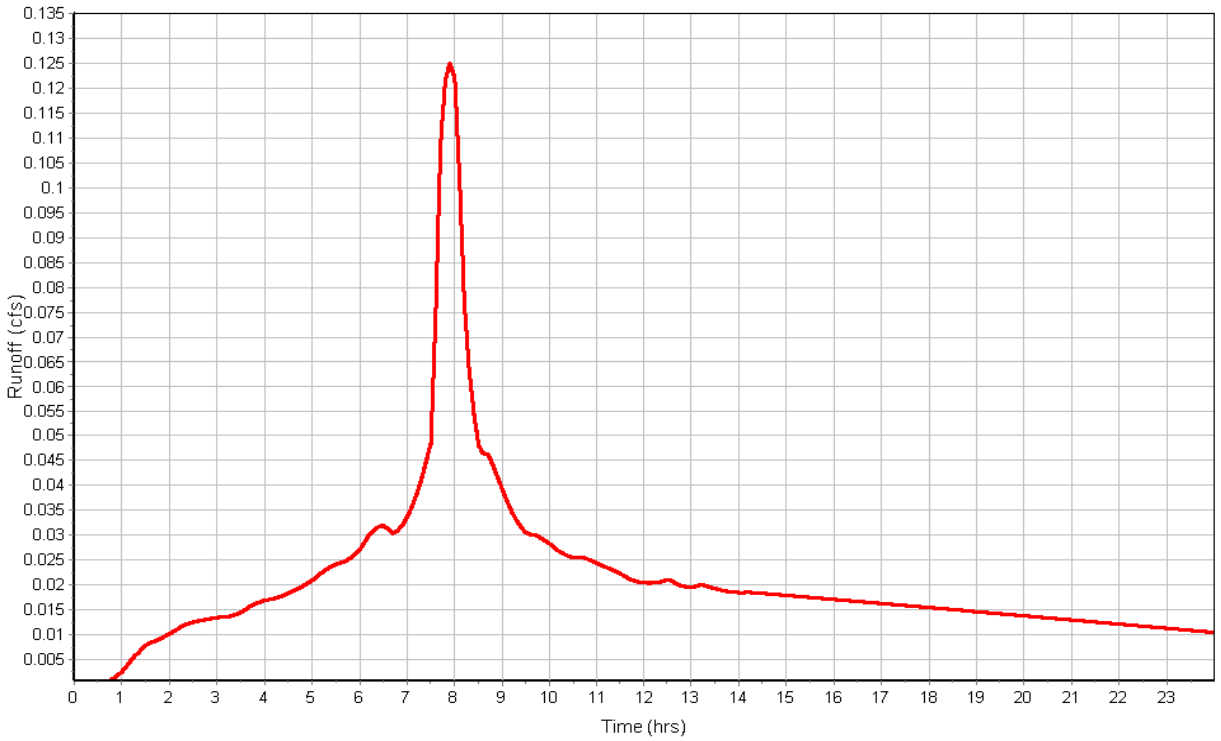
Total Rainfall (in)	3.99
Total Runoff (in)	3.57
Peak Runoff (cfs)	0.13
Weighted Curve Number	96.02
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA03

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA04

Input Data

Area (ft²)	1530.00
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	1530.00		98

Time of Concentration

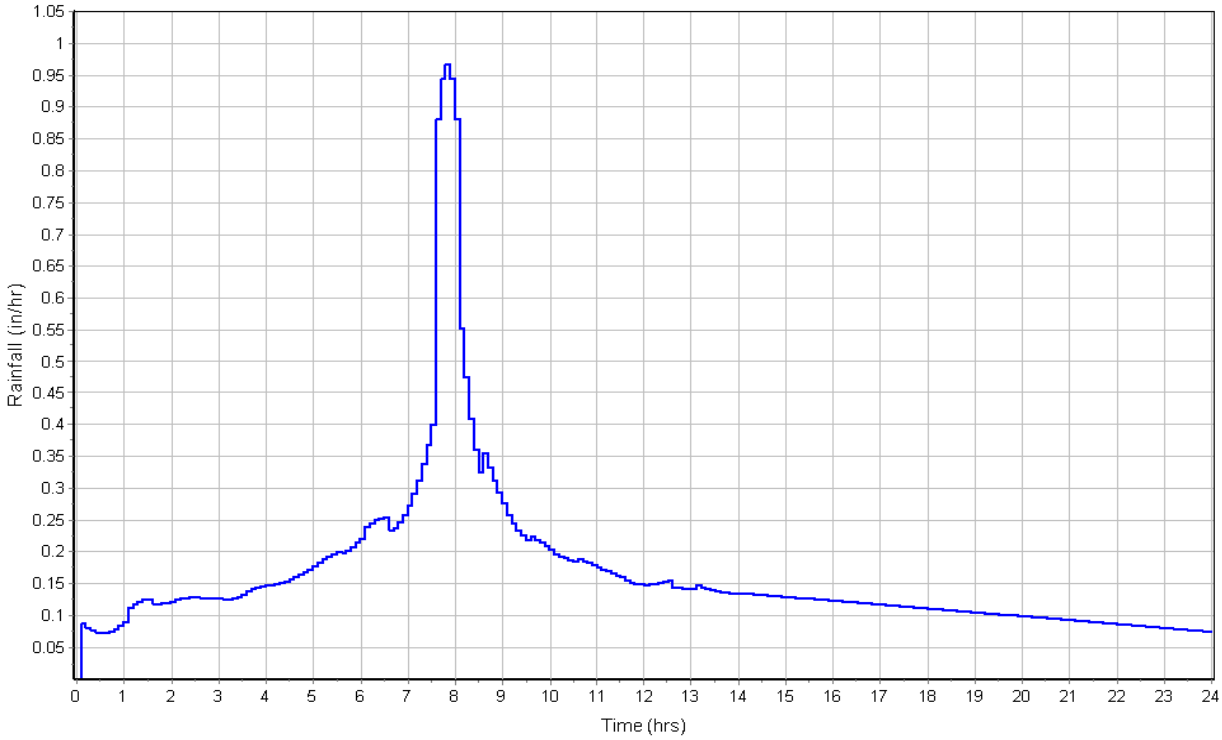
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

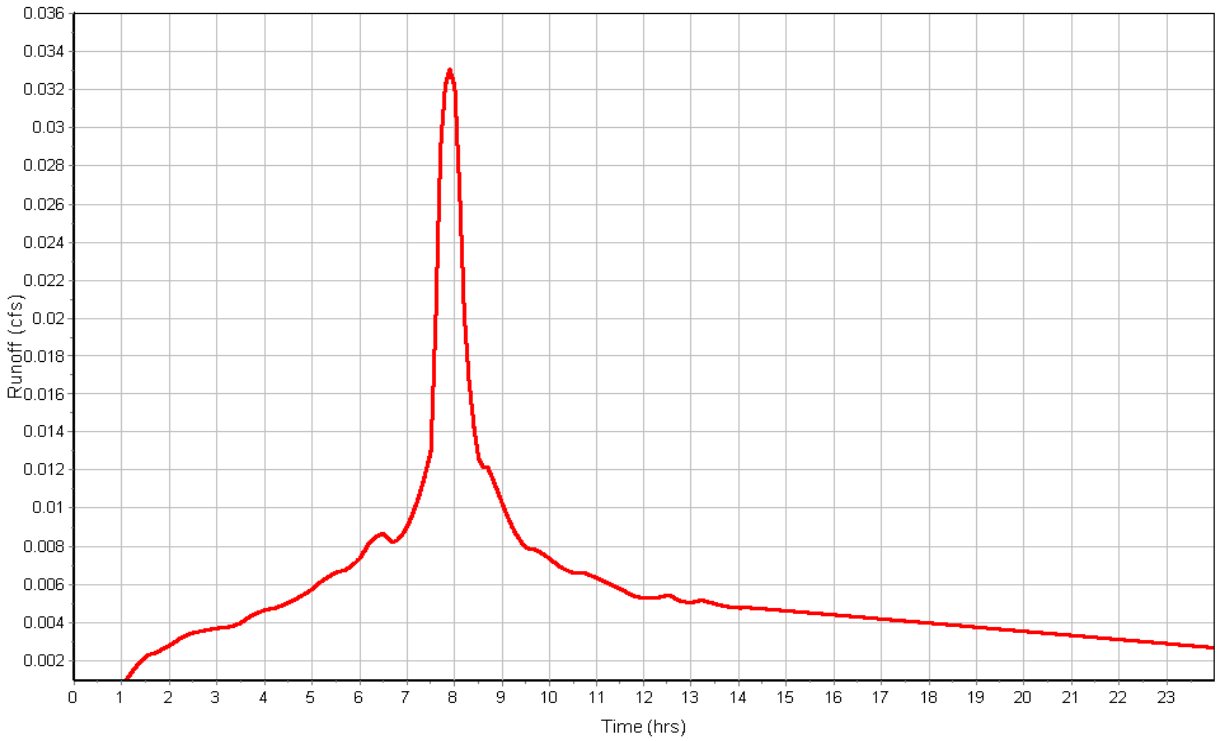
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.03
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA04

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA05

Input Data

Area (ft²)	1552.00
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	1552.00		98

Time of Concentration

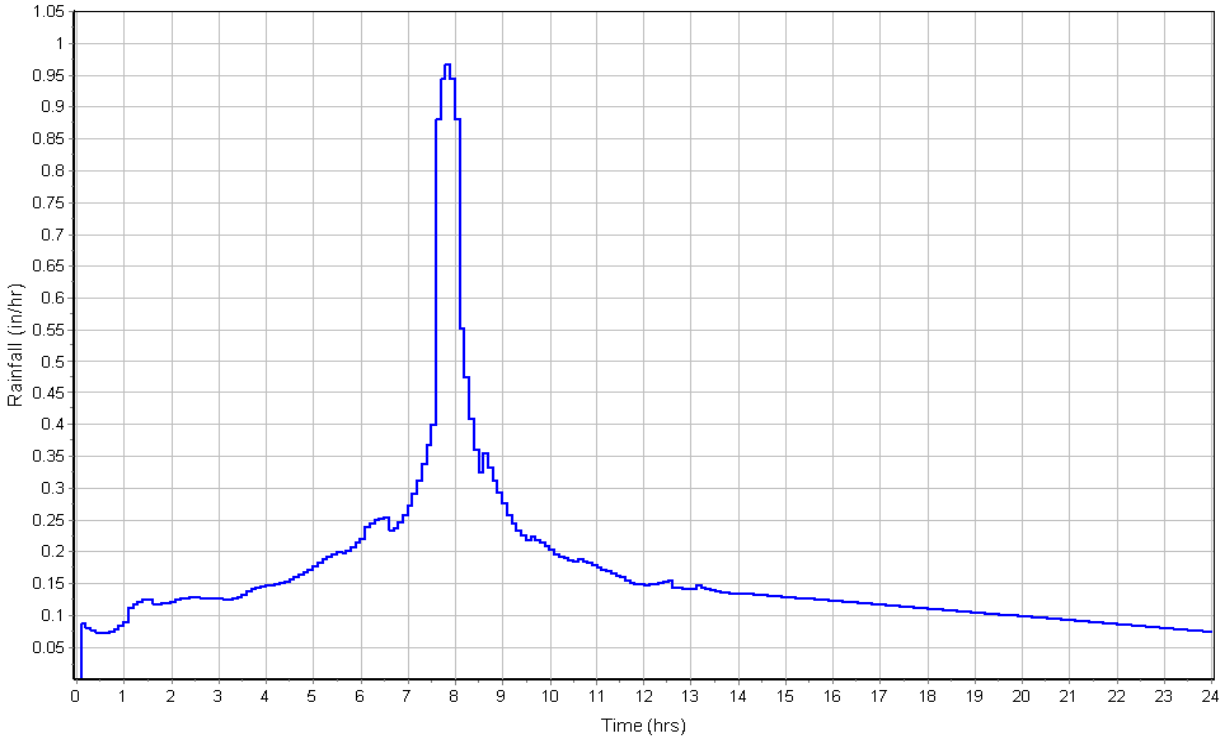
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

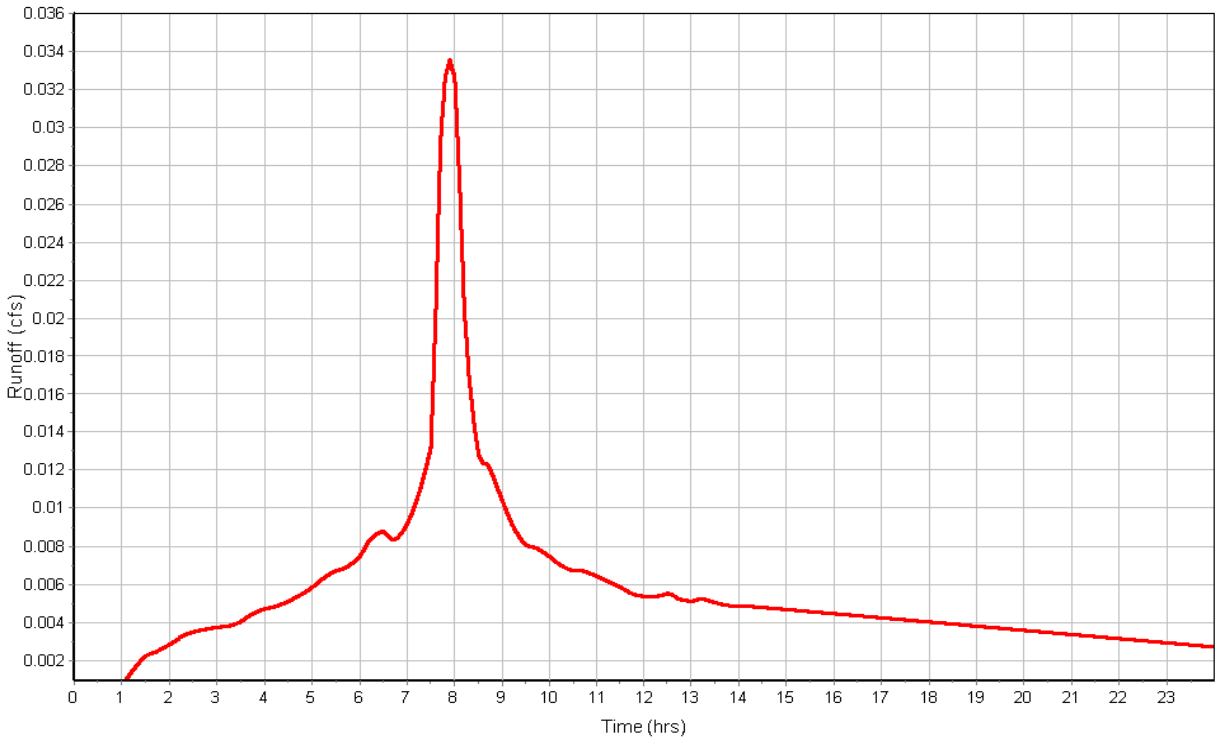
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.03
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA05

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA06

Input Data

Area (ft²)	2004.02
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	2004.02		98

Time of Concentration

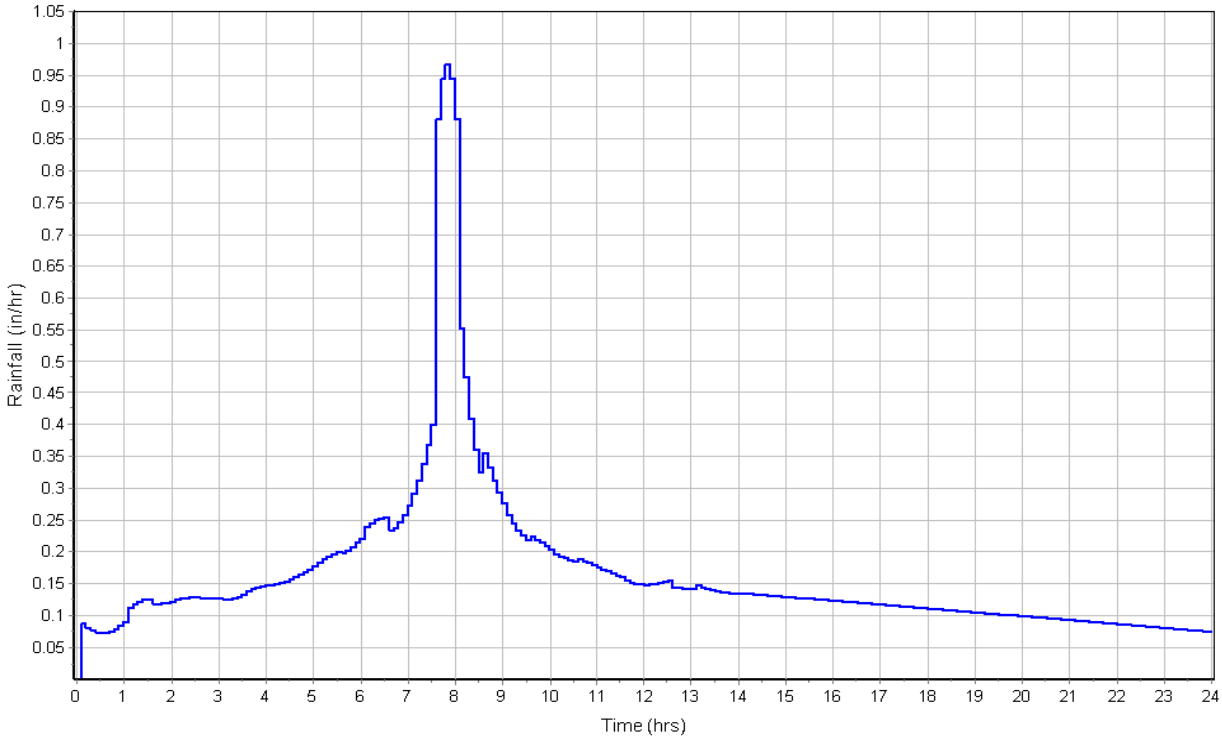
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

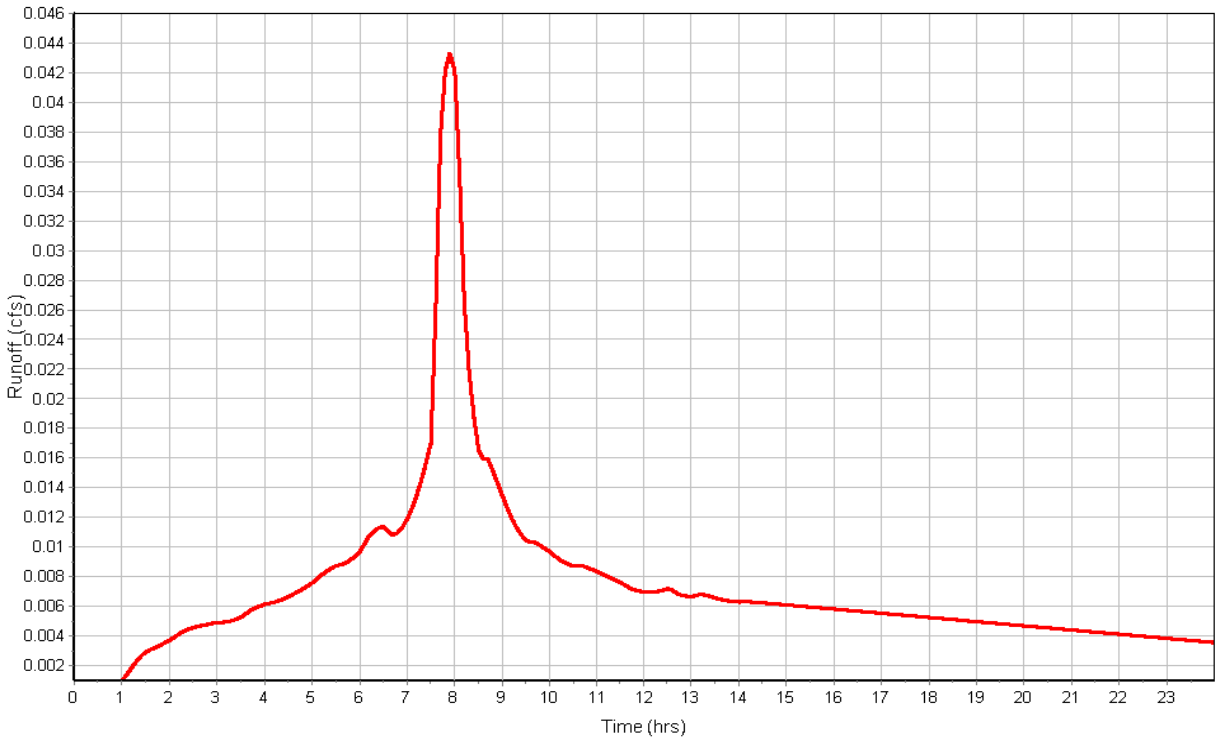
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.04
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA06

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA07

Input Data

Area (ft²)	20144.02
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	20144.02		98

Time of Concentration

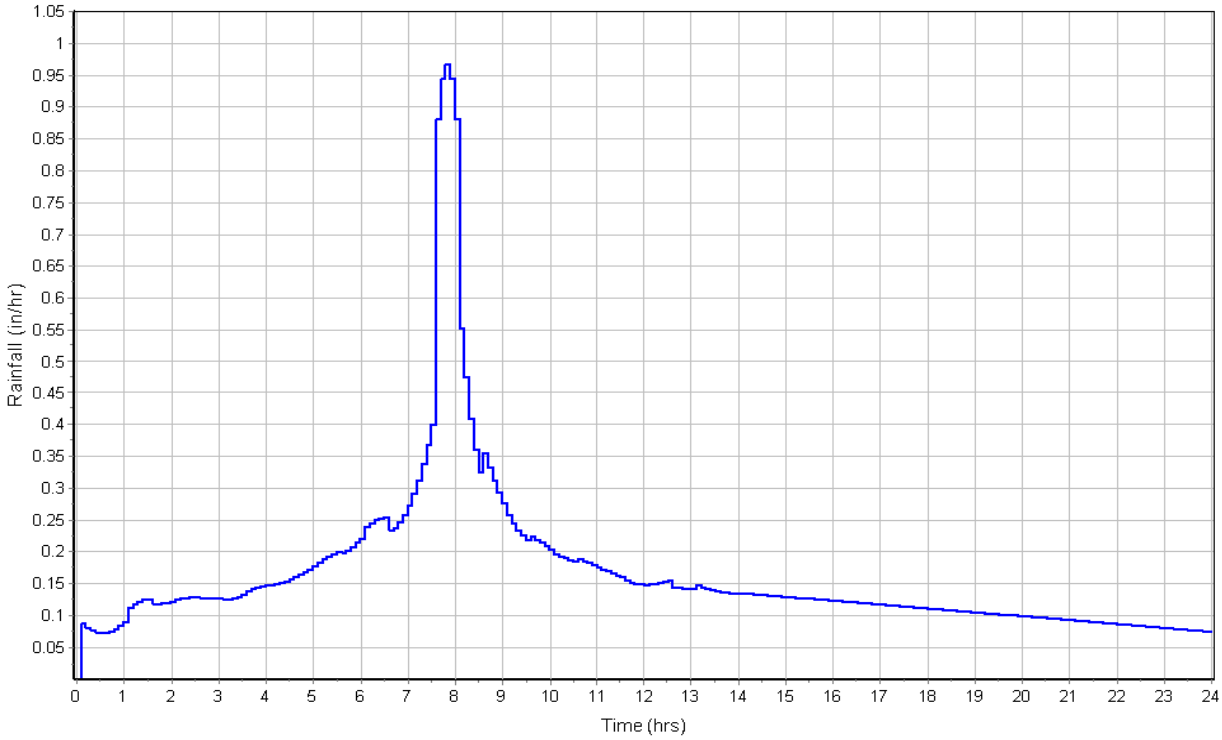
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

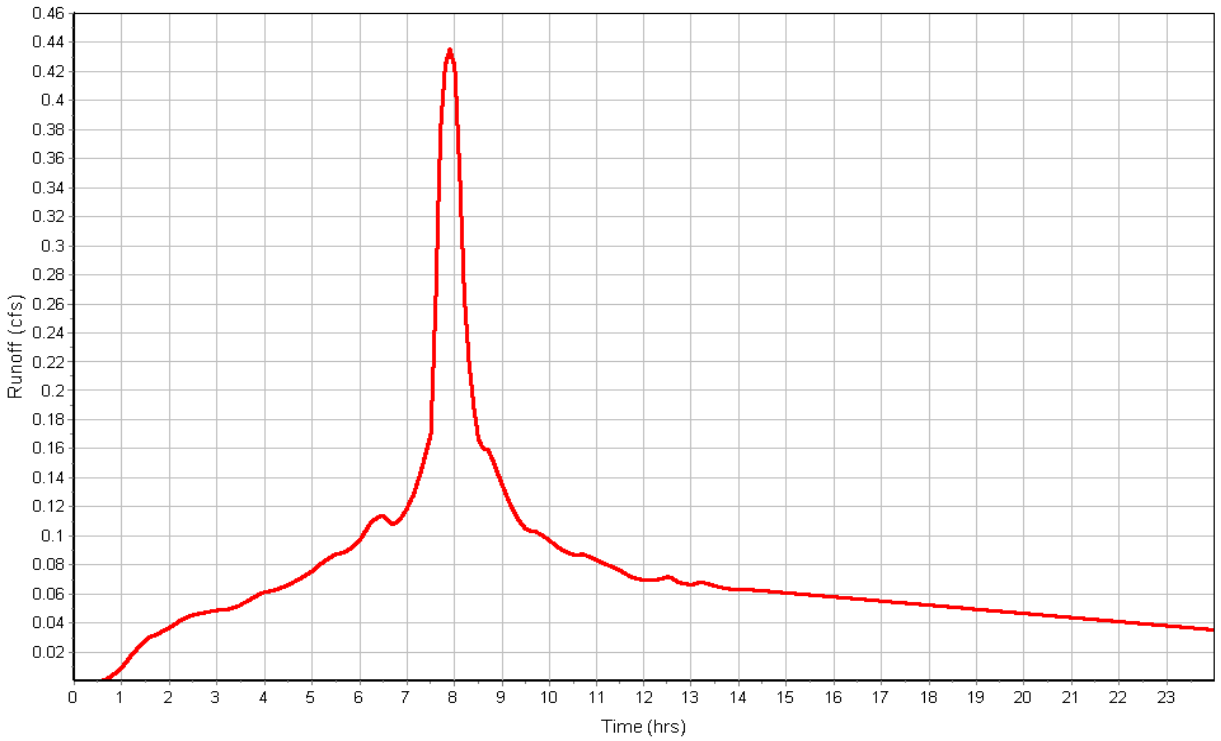
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.44
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA07

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA08

Input Data

Area (ft²)	20083.99
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	20083.99		98

Time of Concentration

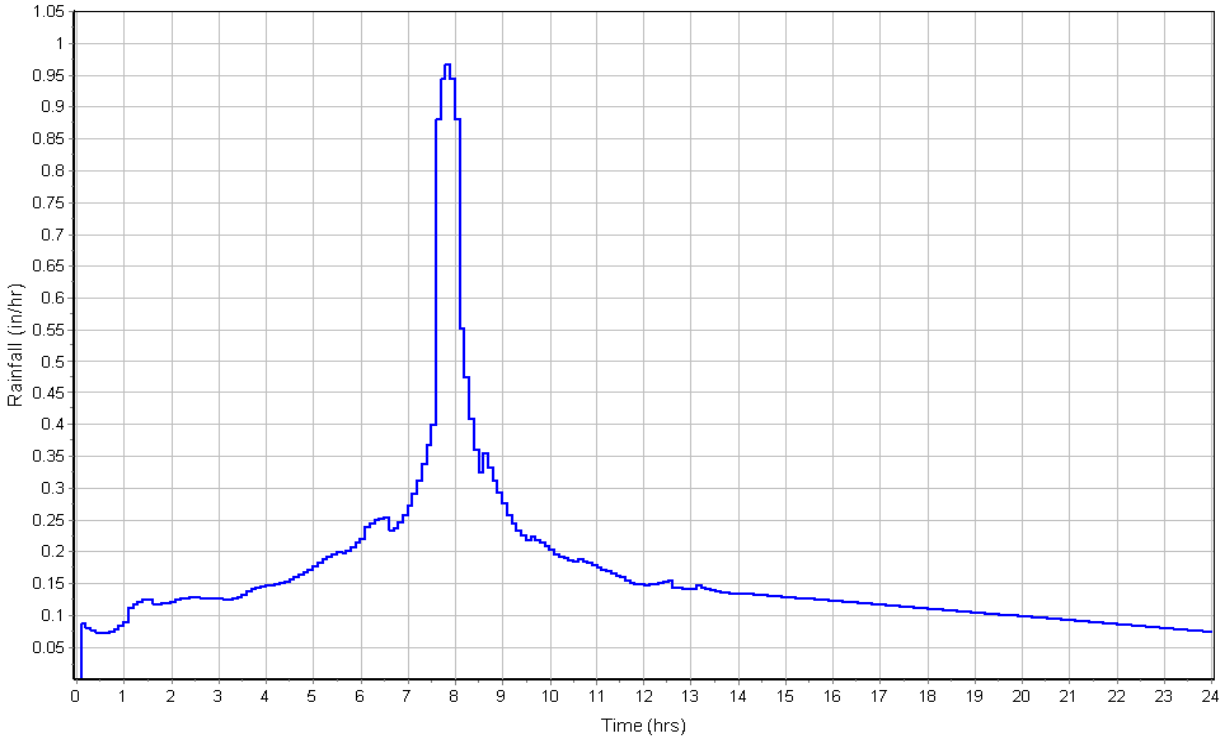
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

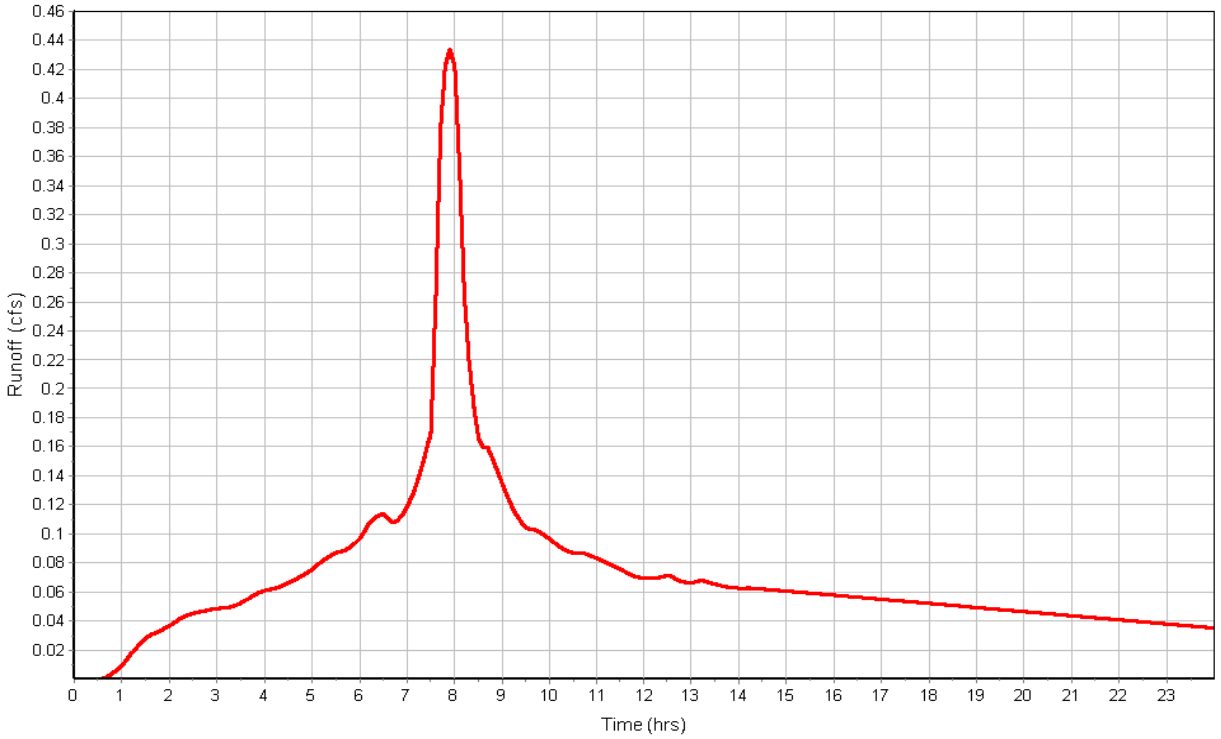
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.43
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA08

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA09

Input Data

Area (ft²)	24005.00
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	24005.00		98

Time of Concentration

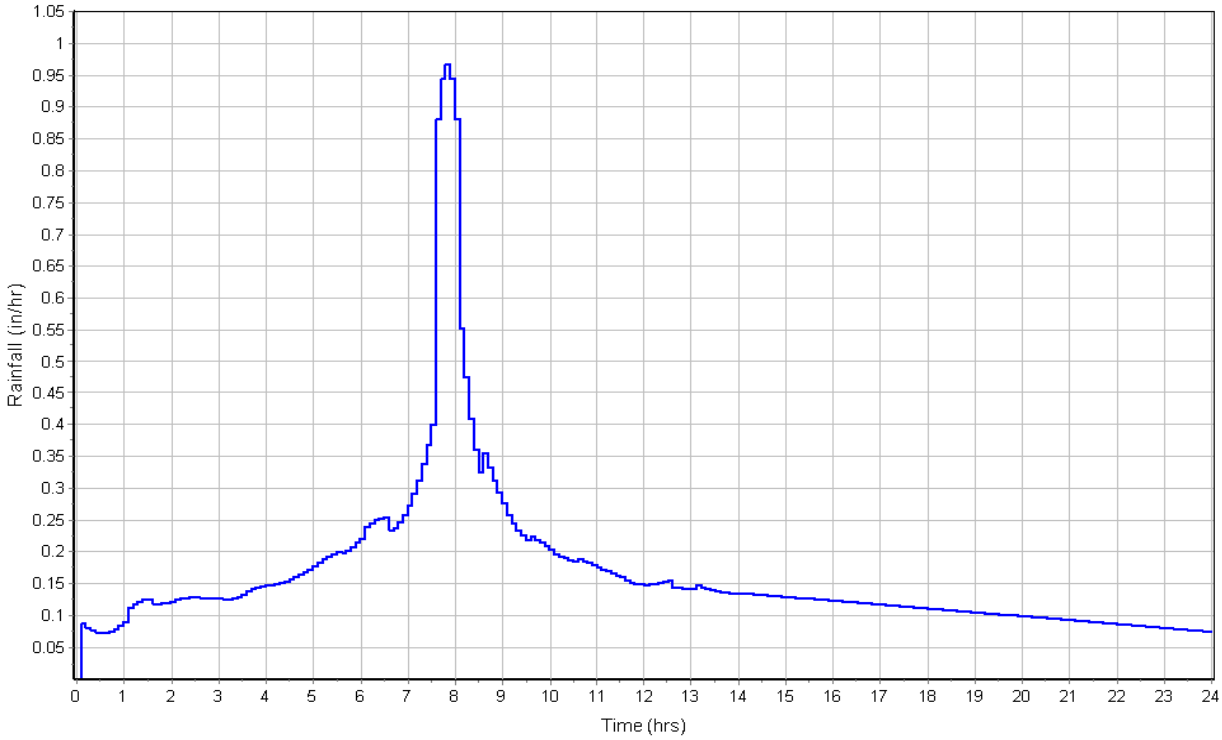
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

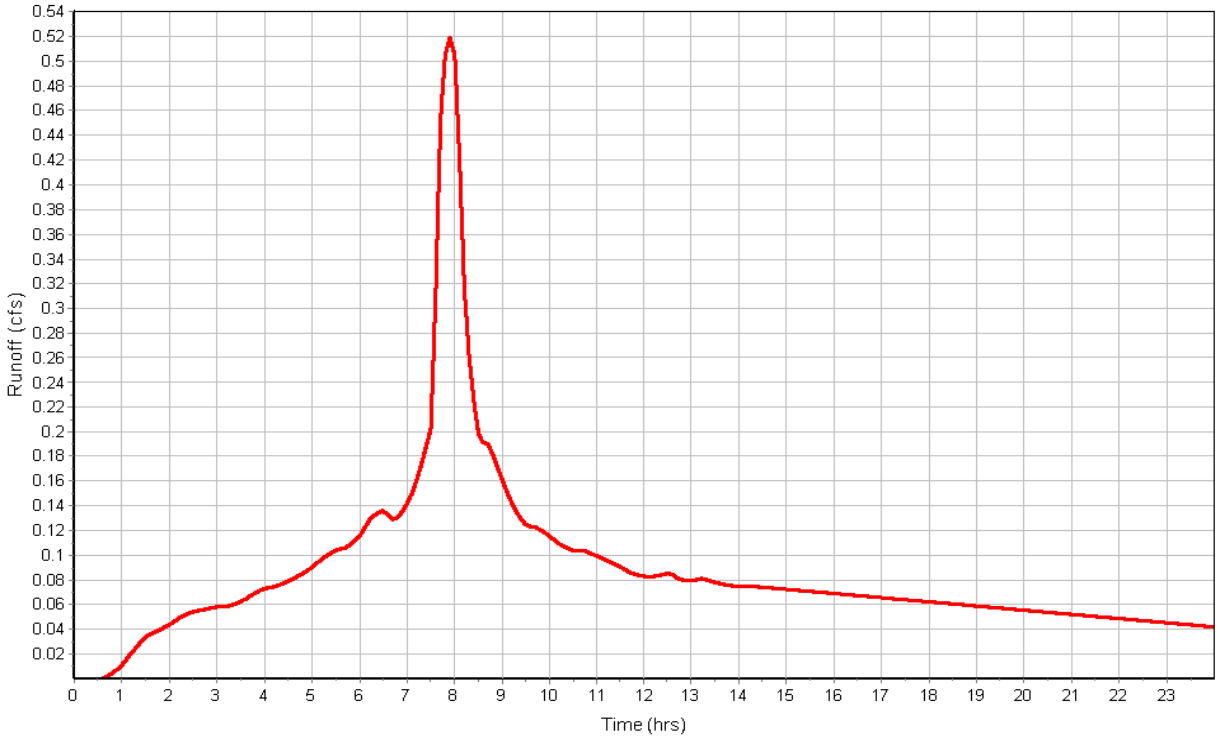
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.52
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA09

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA10

Input Data

Area (ft²) 8343.00
Impervious Area (%) 85.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 76.00
Rain Gage ID ..... Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	8343.00		94.7

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.01	0.00
Flow Length (ft) :	23.84	107.52	0.00
Slope (%) :	1	2	0.00
2 yr, 24 hr Rainfall (in) :	2.65	2.65	0.00
Velocity (ft/sec) :	0.04	1.37	0.00
Computed Flow Time (min) :	9.89	1.31	0.00

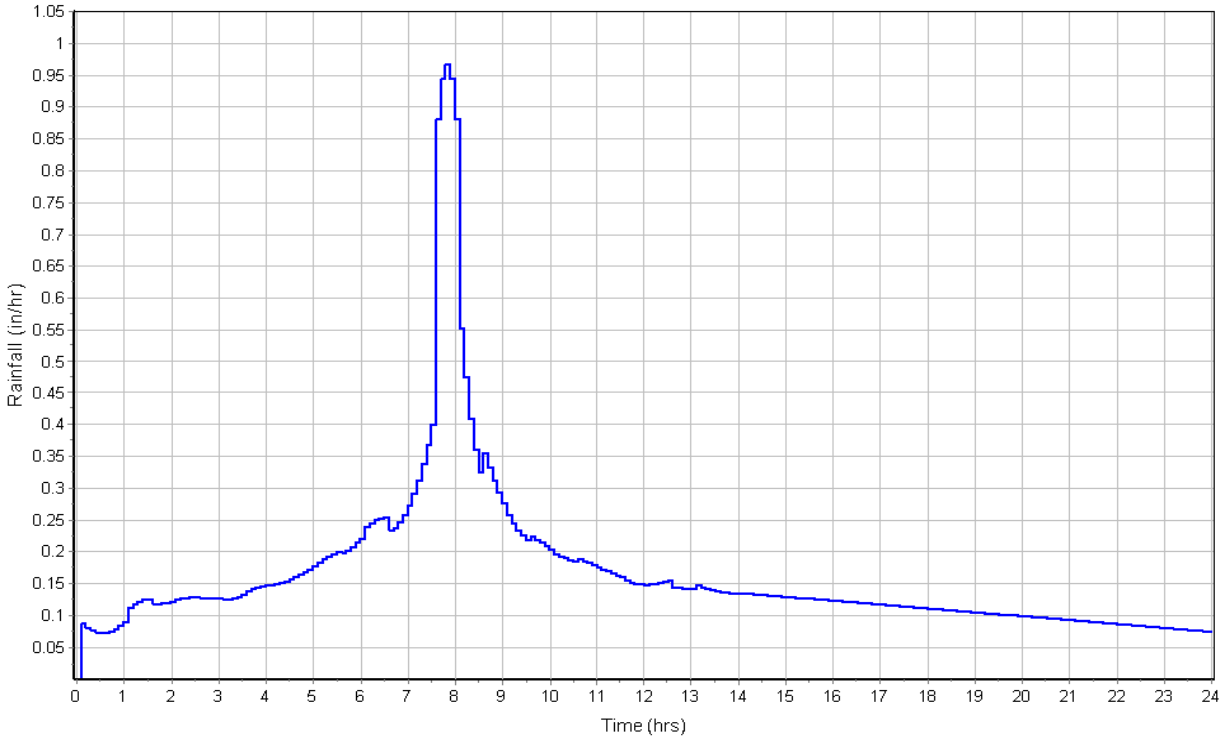
Total TOC (min) 11.20

Subbasin Runoff Results

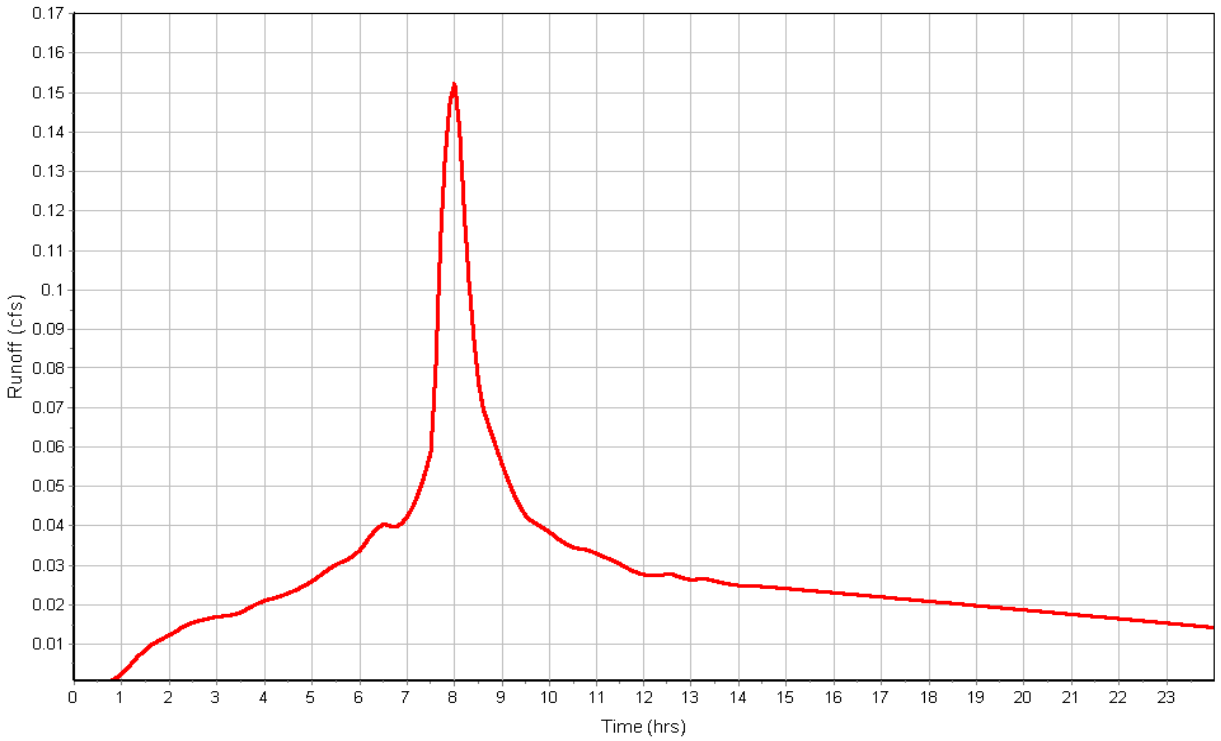
Total Rainfall (in) 3.99
Total Runoff (in) 3.44
Peak Runoff (cfs) 0.15
Weighted Curve Number 94.70
Time of Concentration (days hh:mm:ss) 0 00:11:12

Subbasin : DMA10

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA11

Input Data

Area (ft²) 8165.02
Impervious Area (%) 97.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 76.00
Rain Gage ID ..... Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	8165.02		97.34

Time of Concentration

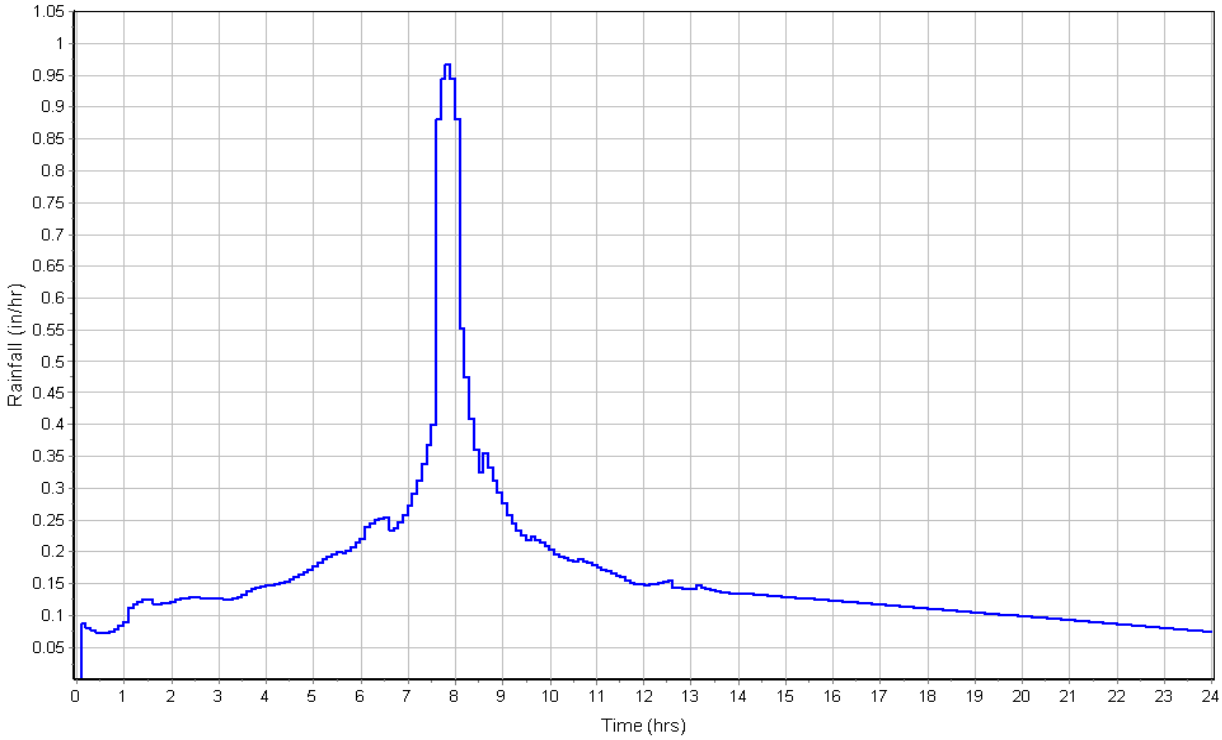
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

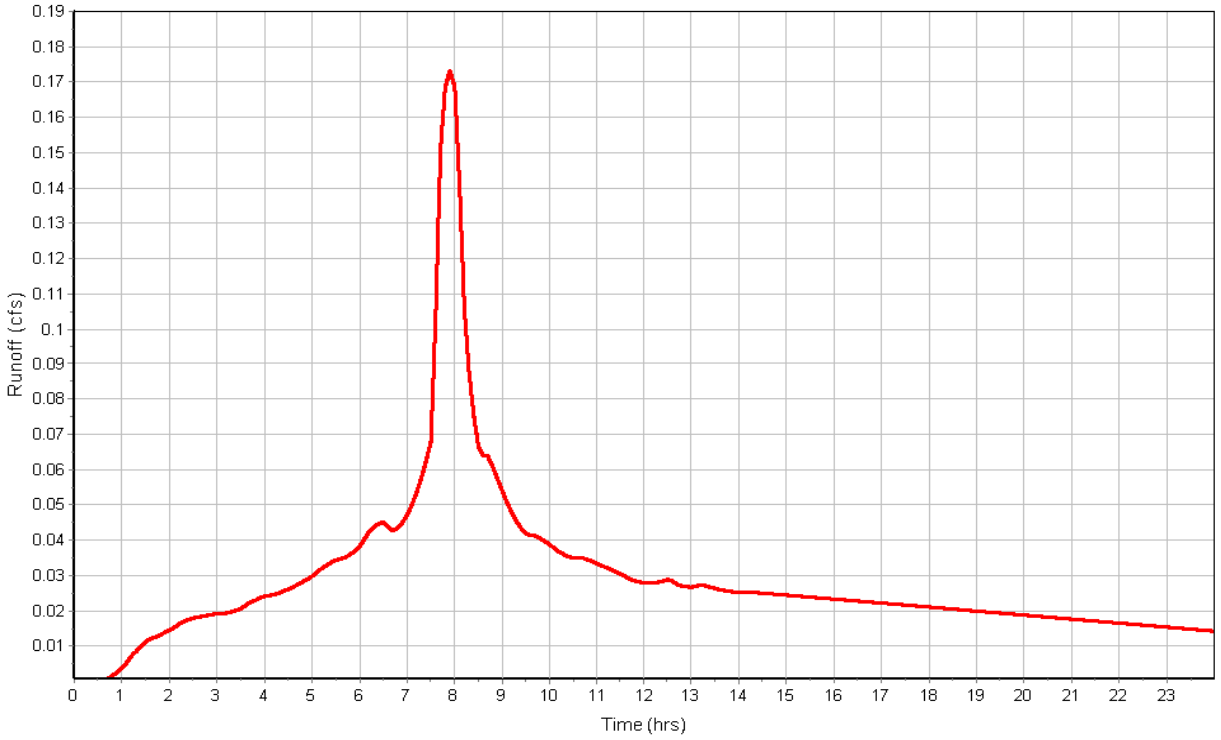
Total Rainfall (in) 3.99
Total Runoff (in) 3.70
Peak Runoff (cfs) 0.17
Weighted Curve Number 97.34
Time of Concentration (days hh:mm:ss) 0 00:05:00

Subbasin : DMA11

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA12

Input Data

Area (ft²)	5899.98
Impervious Area (%)	94.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	5899.98		96.68

Time of Concentration

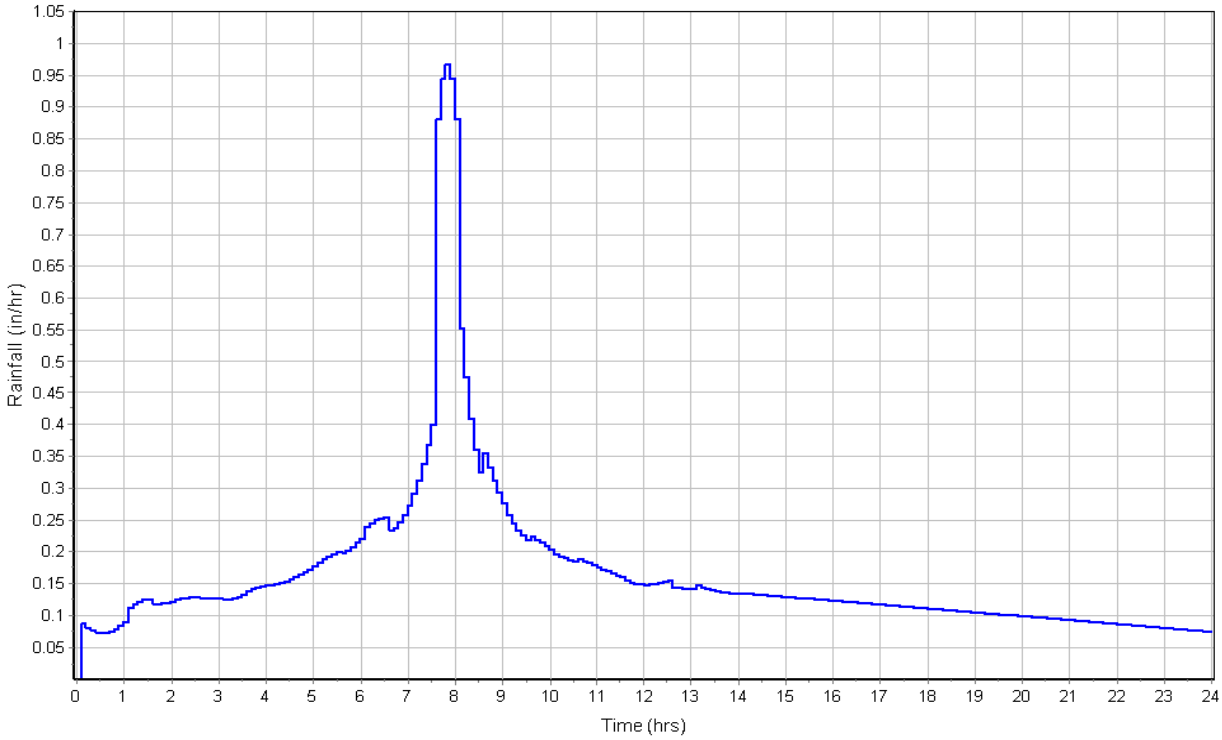
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

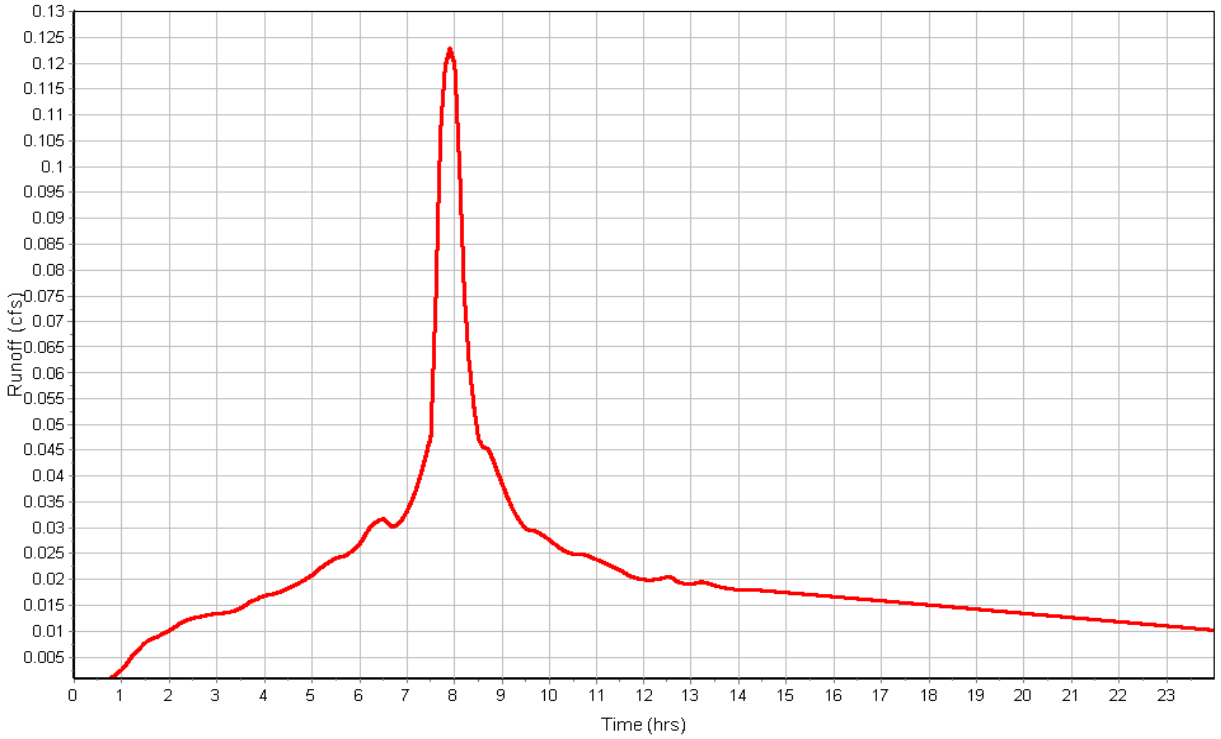
Total Rainfall (in)	3.99
Total Runoff (in)	3.63
Peak Runoff (cfs)	0.12
Weighted Curve Number	96.68
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA12

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA13

Input Data

Area (ft²)	6881.00
Impervious Area (%)	79.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	6881.00		93.38

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.01	0.00
Flow Length (ft) :	59.68	126.6	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.65	2.65	0.00
Velocity (ft/sec) :	0.06	1.42	0.00
Computed Flow Time (min) :	15.61	1.49	0.00

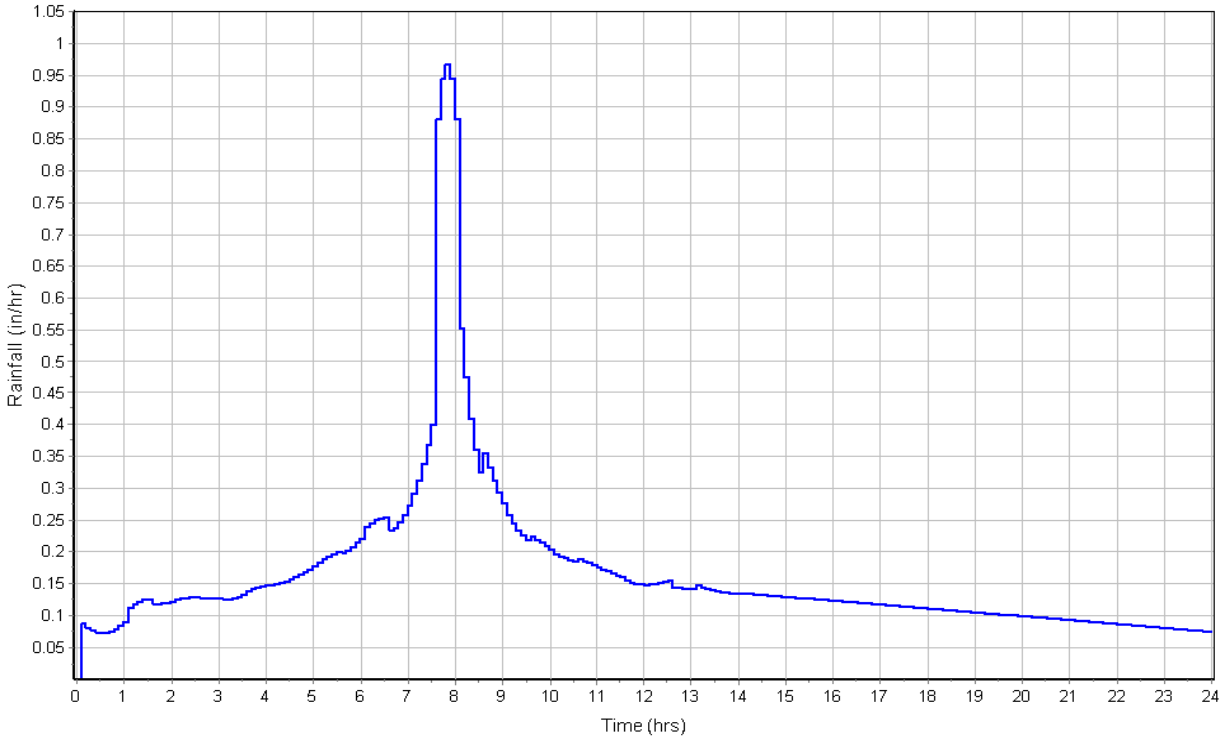
Total TOC (min) 17.10

Subbasin Runoff Results

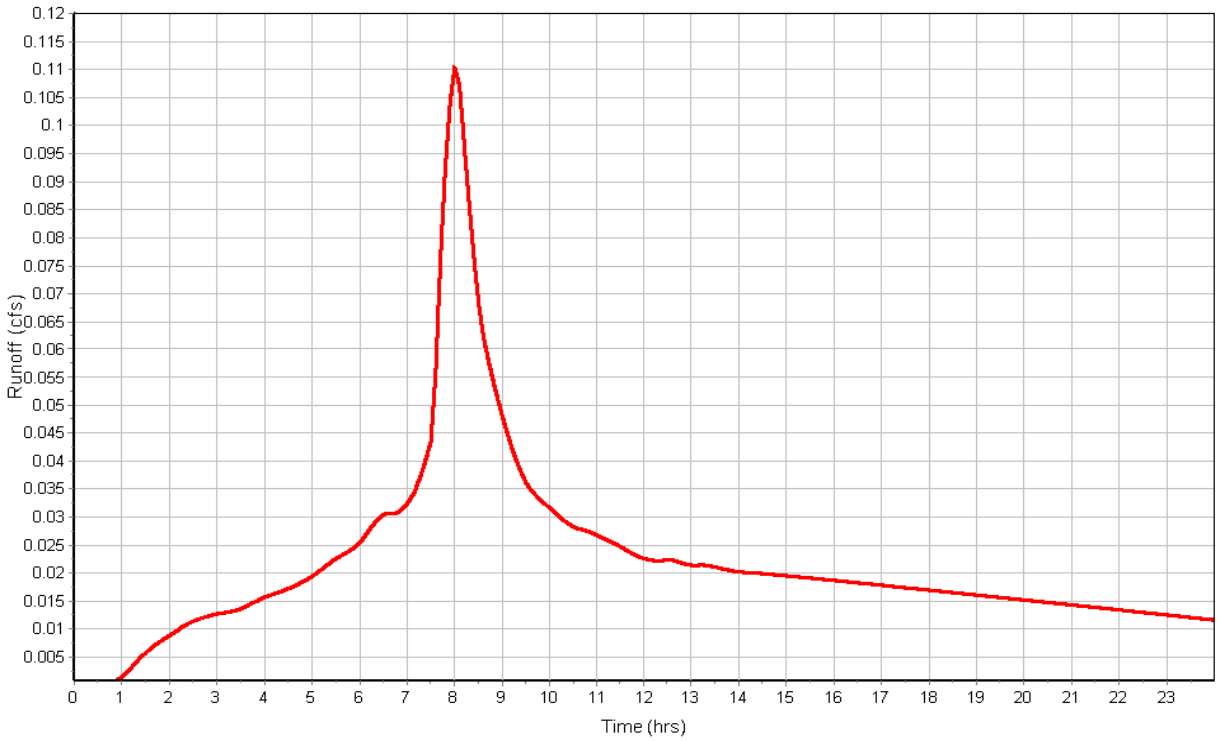
Total Rainfall (in)	3.99
Total Runoff (in)	3.32
Peak Runoff (cfs)	0.11
Weighted Curve Number	93.38
Time of Concentration (days hh:mm:ss)	0 00:17:06

Subbasin : DMA13

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA14

Input Data

Area (ft²)	929.00
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	929.00		98

Time of Concentration

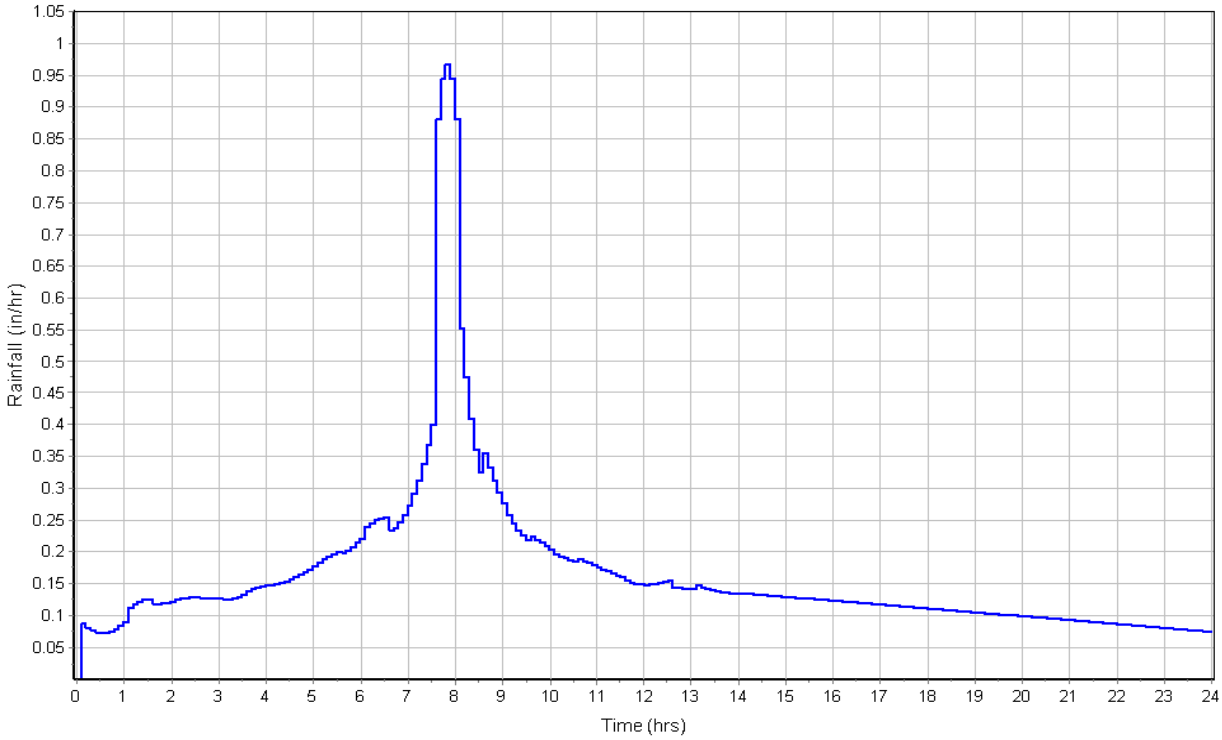
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

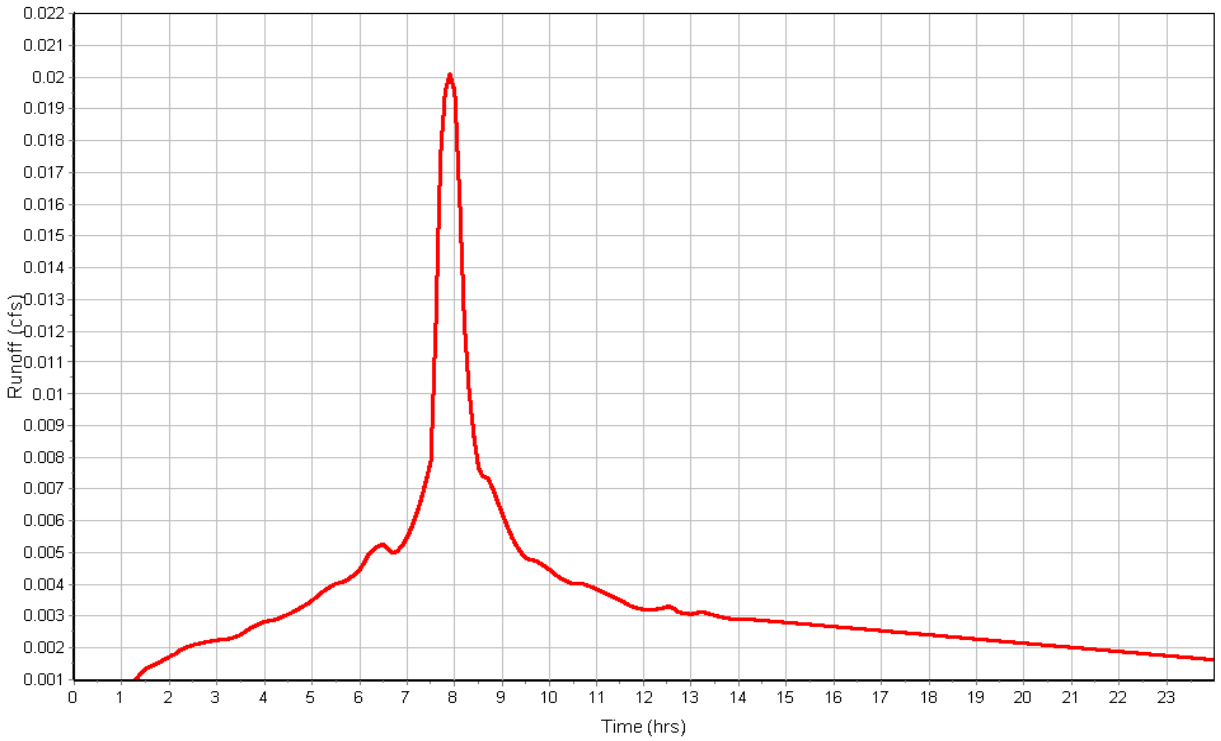
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.02
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA14

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA15

Input Data

Area (ft²)	10340.01
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	10340.01		98

Time of Concentration

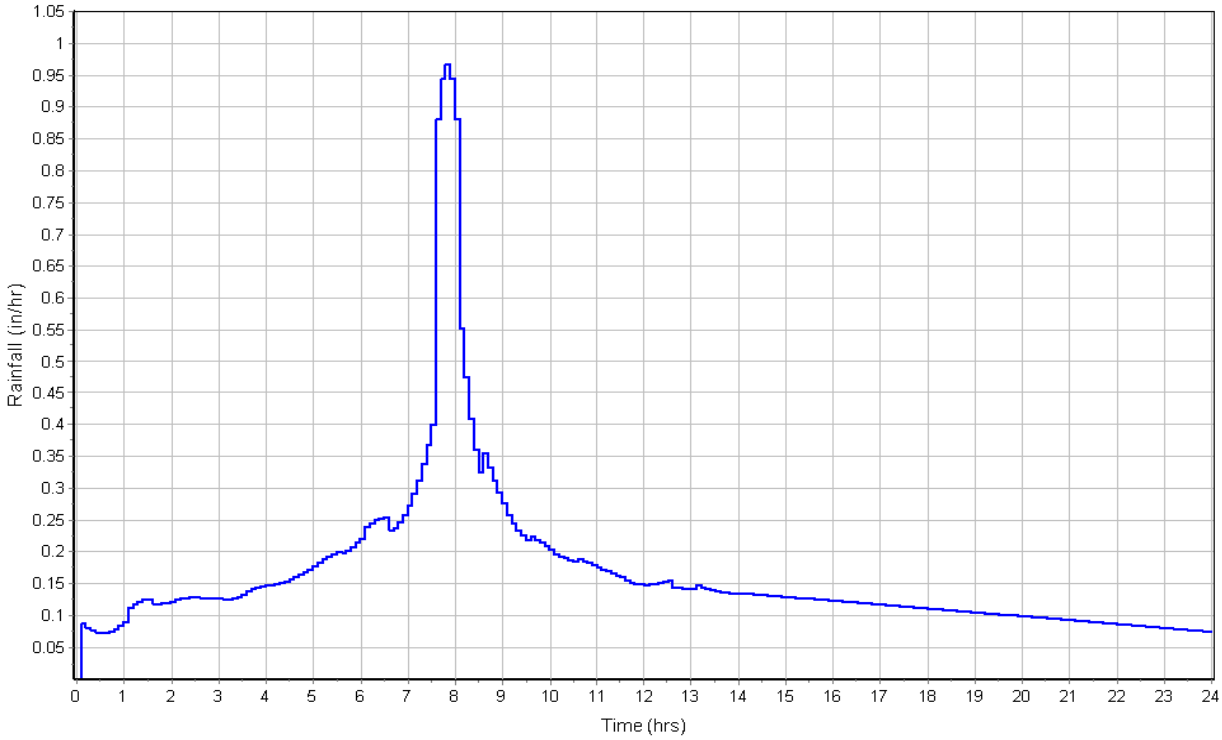
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

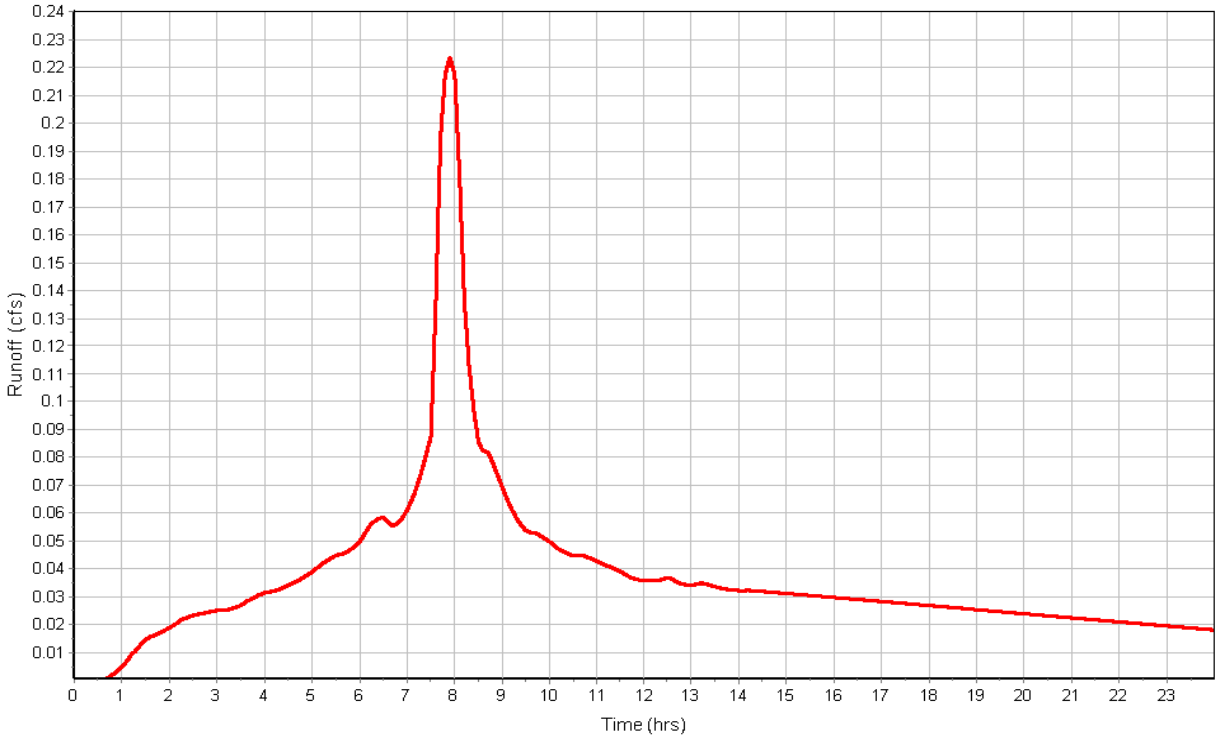
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.22
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA15

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA16

Input Data

Area (ft²)	7878.00
Impervious Area (%)	97.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	7878.00		97.34

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.01	0.00
Flow Length (ft) :	16.62	21.91	0.00
Slope (%) :	1	2	0.00
2 yr, 24 hr Rainfall (in) :	2.65	2.65	0.00
Velocity (ft/sec) :	0.04	1.00	0.00
Computed Flow Time (min) :	7.41	0.37	0.00

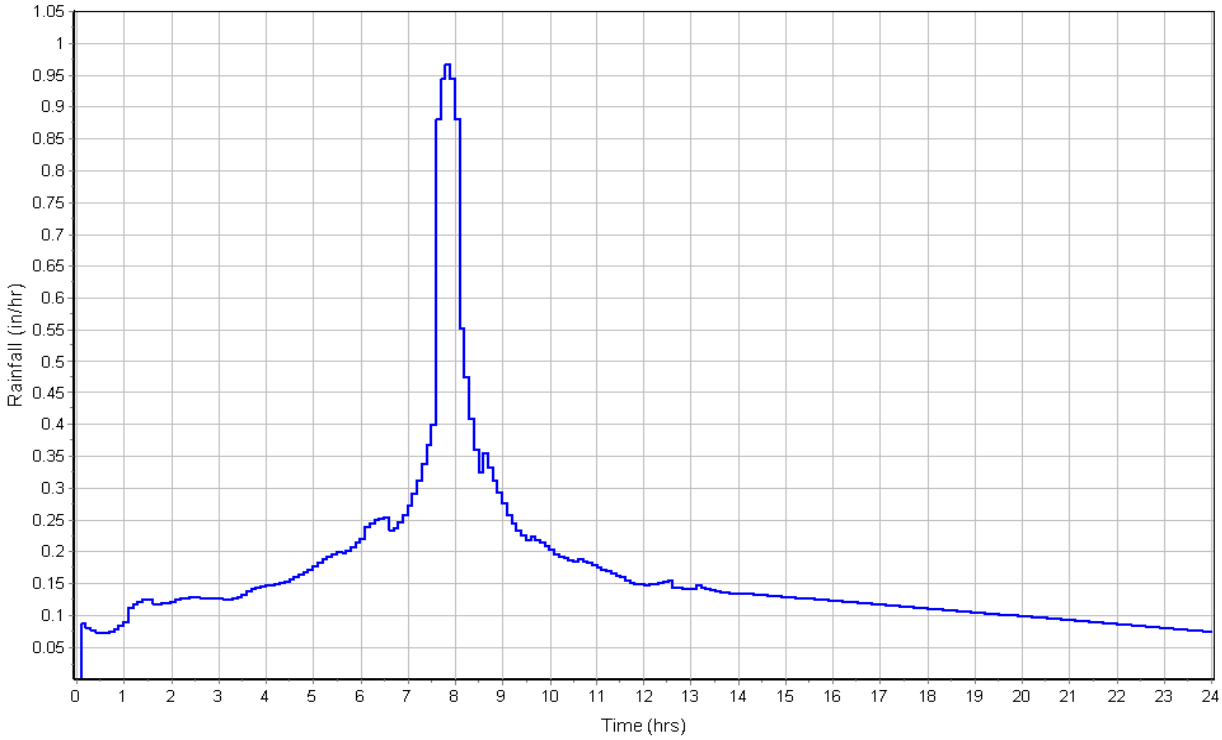
Total TOC (min) 7.78

Subbasin Runoff Results

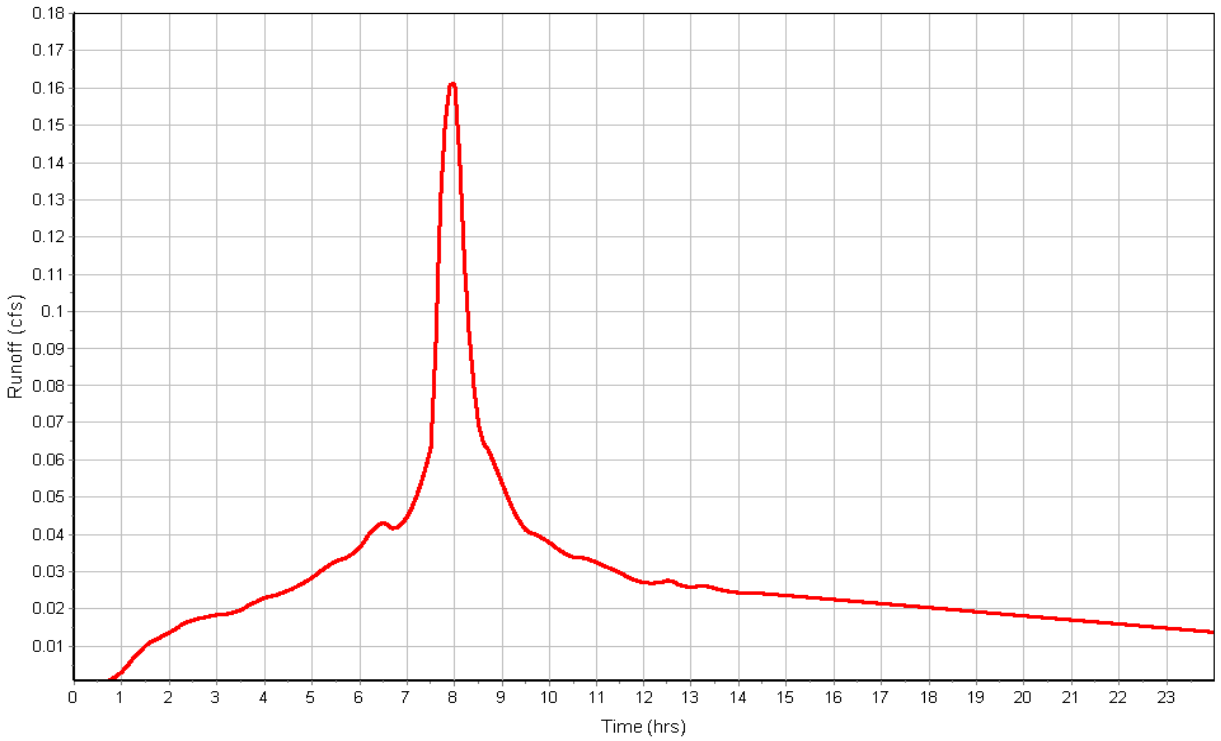
Total Rainfall (in)	3.99
Total Runoff (in)	3.69
Peak Runoff (cfs)	0.16
Weighted Curve Number	97.34
Time of Concentration (days hh:mm:ss)	0 00:07:47

Subbasin : DMA16

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA17

Input Data

Area (ft²) 5760.98
Impervious Area (%) 98.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 76.00
Rain Gage ID ..... Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	5760.98		97.56

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.01	0.00
Flow Length (ft) :	16.47	45.71	0.00
Slope (%) :	1	2	0.00
2 yr, 24 hr Rainfall (in) :	2.65	2.65	0.00
Velocity (ft/sec) :	0.04	1.16	0.00
Computed Flow Time (min) :	7.36	0.66	0.00

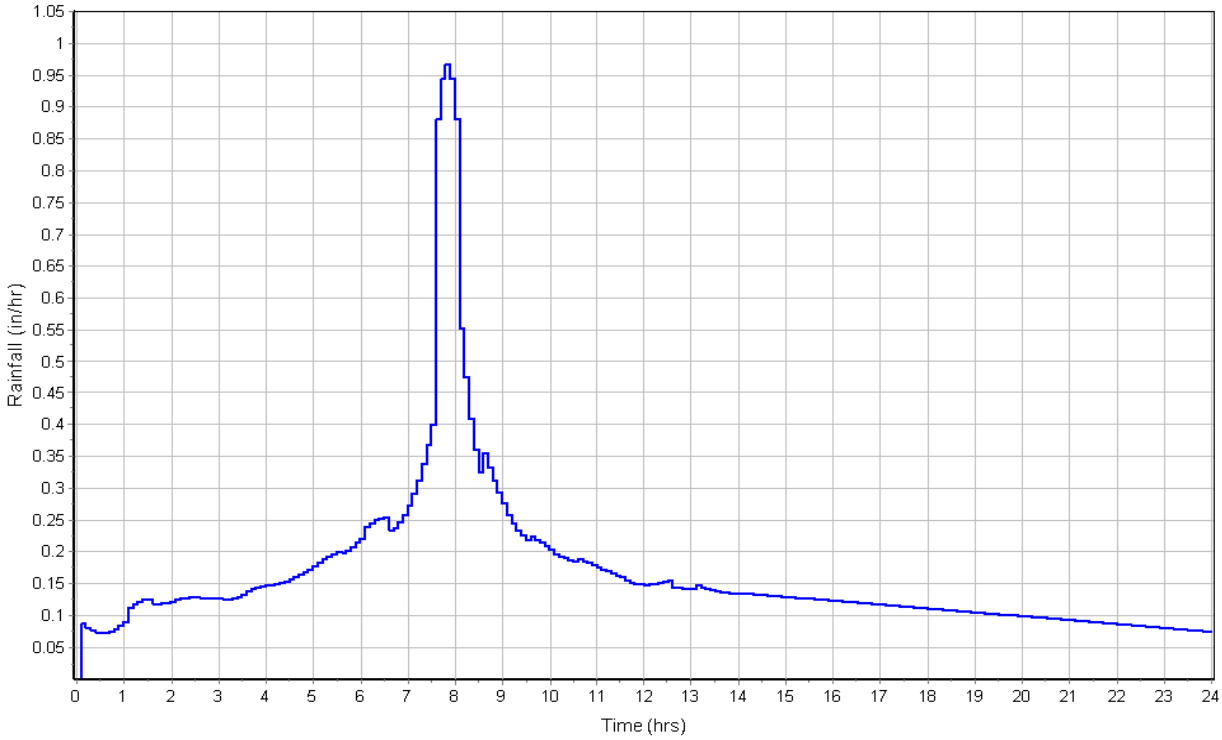
Total TOC (min) 8.02

Subbasin Runoff Results

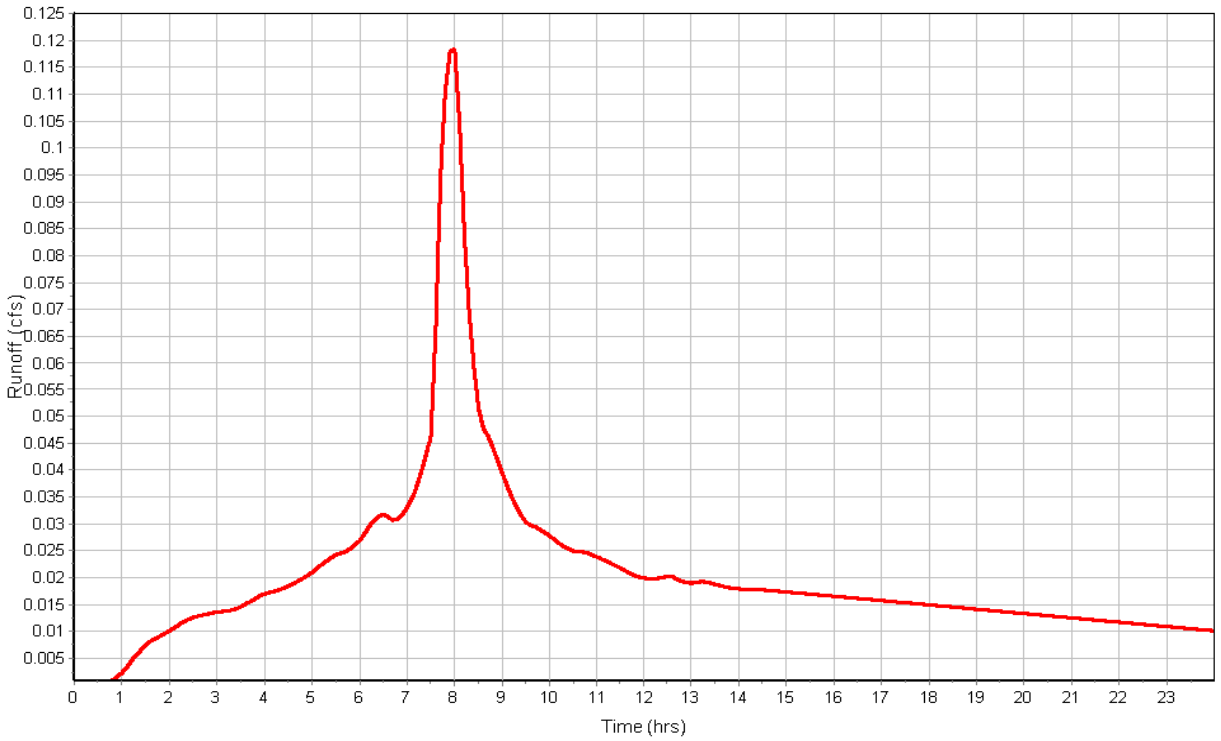
Total Rainfall (in) 3.99
Total Runoff (in) 3.71
Peak Runoff (cfs) 0.12
Weighted Curve Number 97.56
Time of Concentration (days hh:mm:ss) 0 00:08:01

Subbasin : DMA17

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA18

Input Data

Area (ft²)	44869.02
Impervious Area (%)	95.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	44869.02		96.9

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.01	0.00
Flow Length (ft) :	13.39	261.42	0.00
Slope (%) :	1	2	0.00
2 yr, 24 hr Rainfall (in) :	2.65	2.65	0.00
Velocity (ft/sec) :	0.04	1.64	0.00
Computed Flow Time (min) :	6.23	2.66	0.00

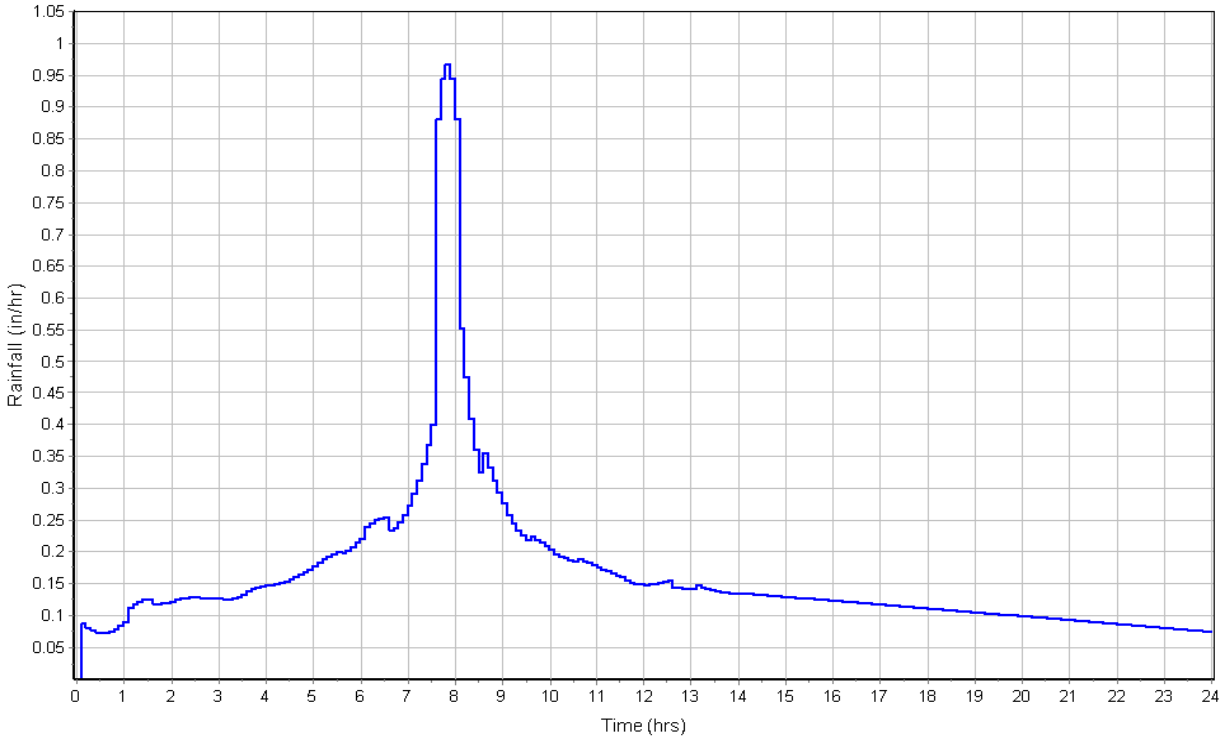
Total TOC (min) 8.89

Subbasin Runoff Results

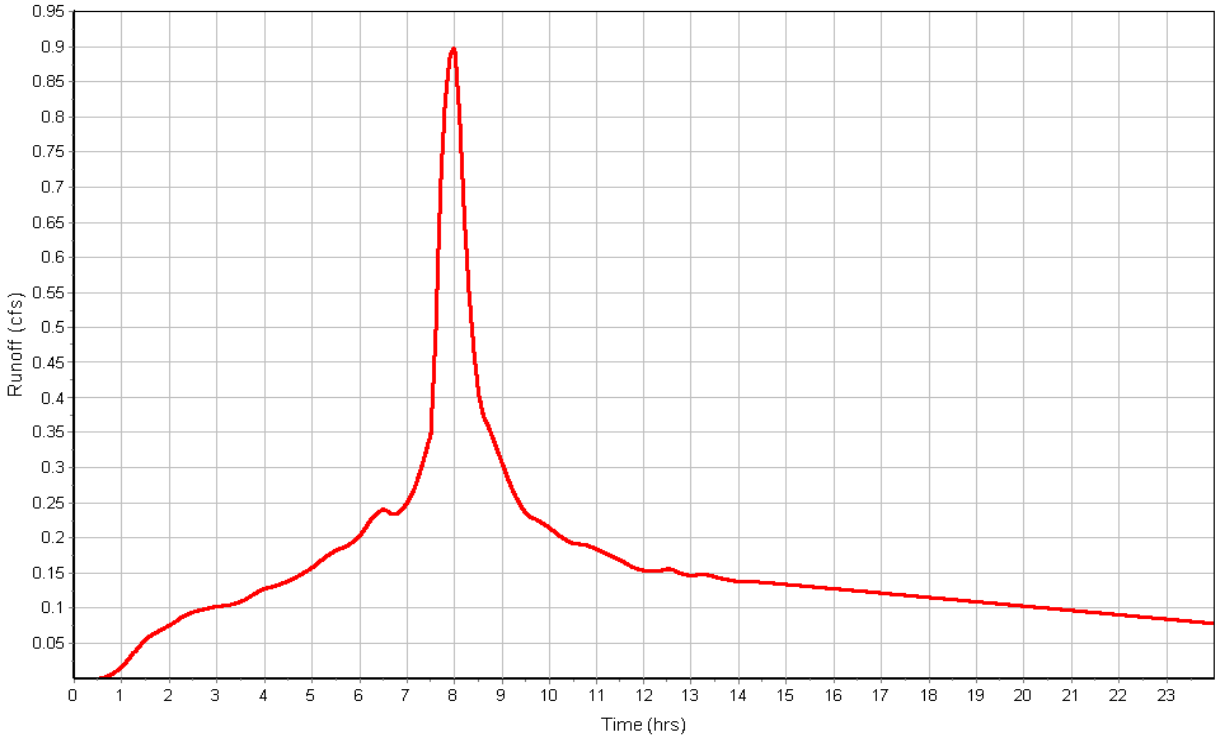
Total Rainfall (in)	3.99
Total Runoff (in)	3.65
Peak Runoff (cfs)	0.90
Weighted Curve Number	96.90
Time of Concentration (days hh:mm:ss)	0 00:08:53

Subbasin : DMA18

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA19

Input Data

Area (ft²)	5560.00
Impervious Area (%)	100.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	5560.00		98

Time of Concentration

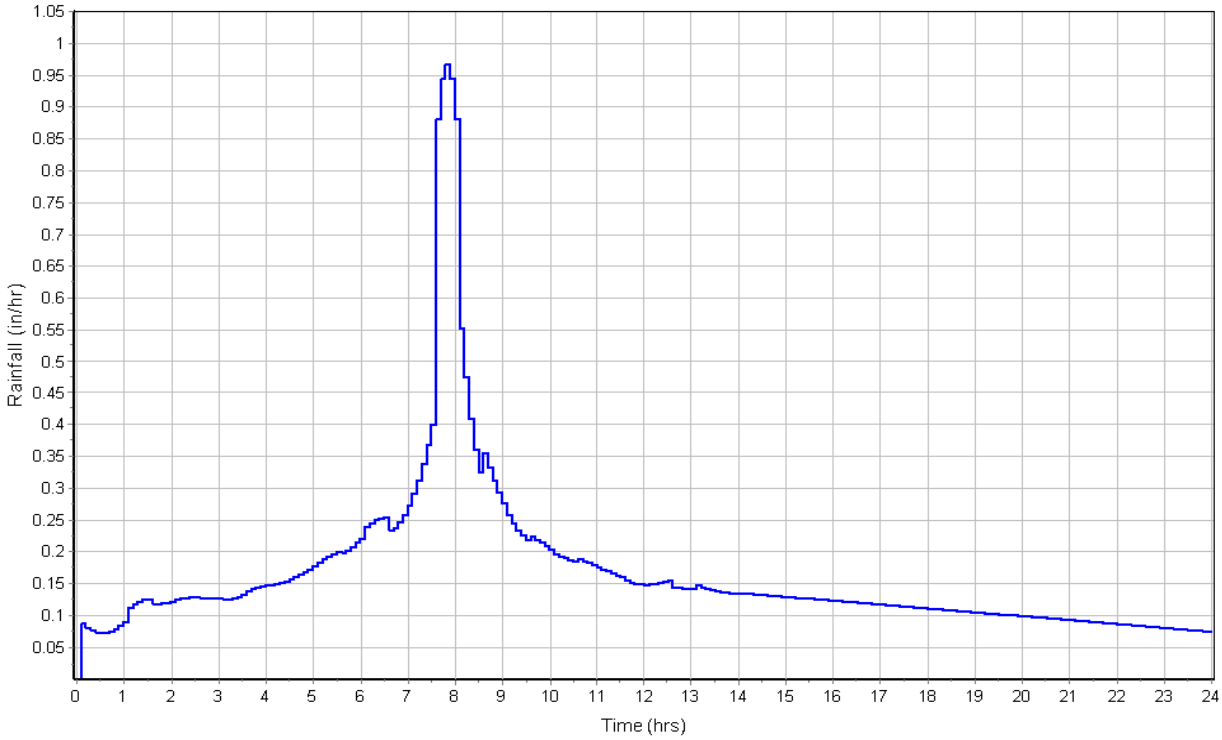
User-Defined TOC override (minutes): 5

Subbasin Runoff Results

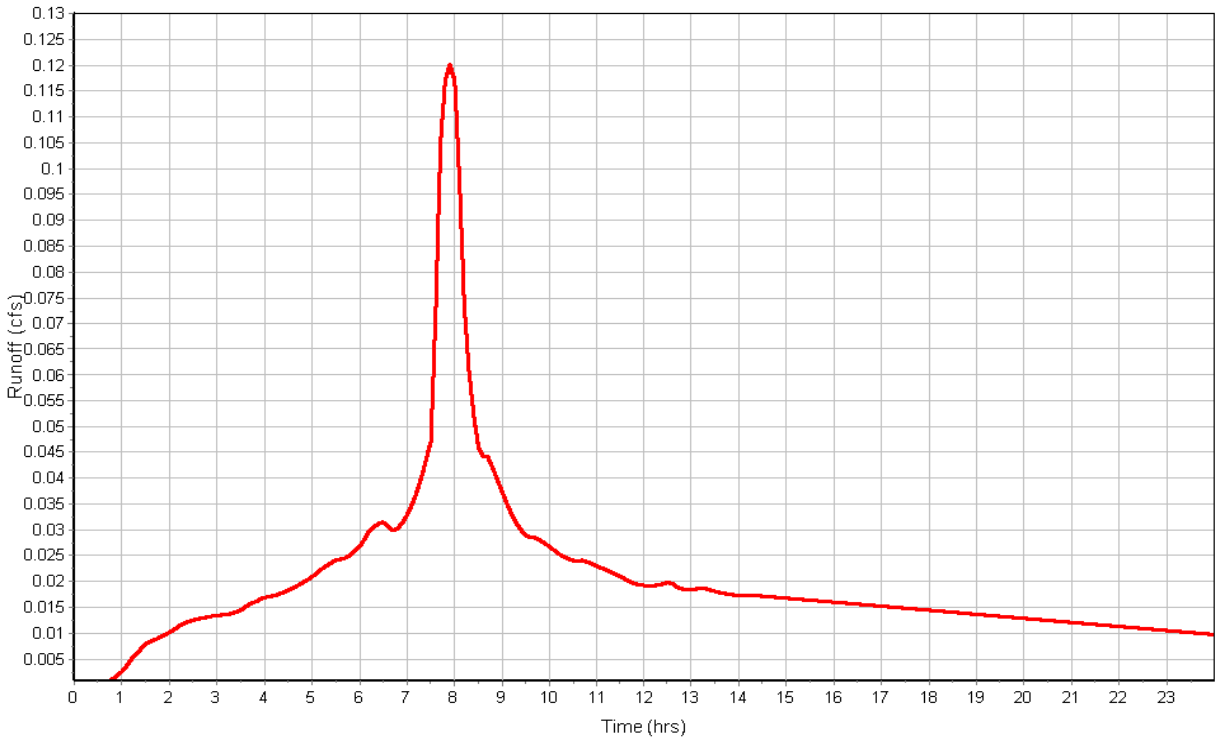
Total Rainfall (in)	3.99
Total Runoff (in)	3.76
Peak Runoff (cfs)	0.12
Weighted Curve Number	98.00
Time of Concentration (days hh:mm:ss)	0 00:05:00

Subbasin : DMA19

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DMA20

Input Data

Area (ft²)	16230.02
Impervious Area (%)	95.00
Impervious Area Curve Number	98.00
Pervious Area Curve Number	76.00
Rain Gage ID	Rain Gage-025yr

Composite Curve Number

Soil/Surface Description	Area (ft²)	Soil Group	Curve Number
Composite Area & Weighted CN	16230.02		96.9

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.01	0.00
Flow Length (ft) :	34.47	88.38	0.00
Slope (%) :	1	2	0.00
2 yr, 24 hr Rainfall (in) :	2.65	2.65	0.00
Velocity (ft/sec) :	0.04	1.32	0.00
Computed Flow Time (min) :	13.28	1.12	0.00

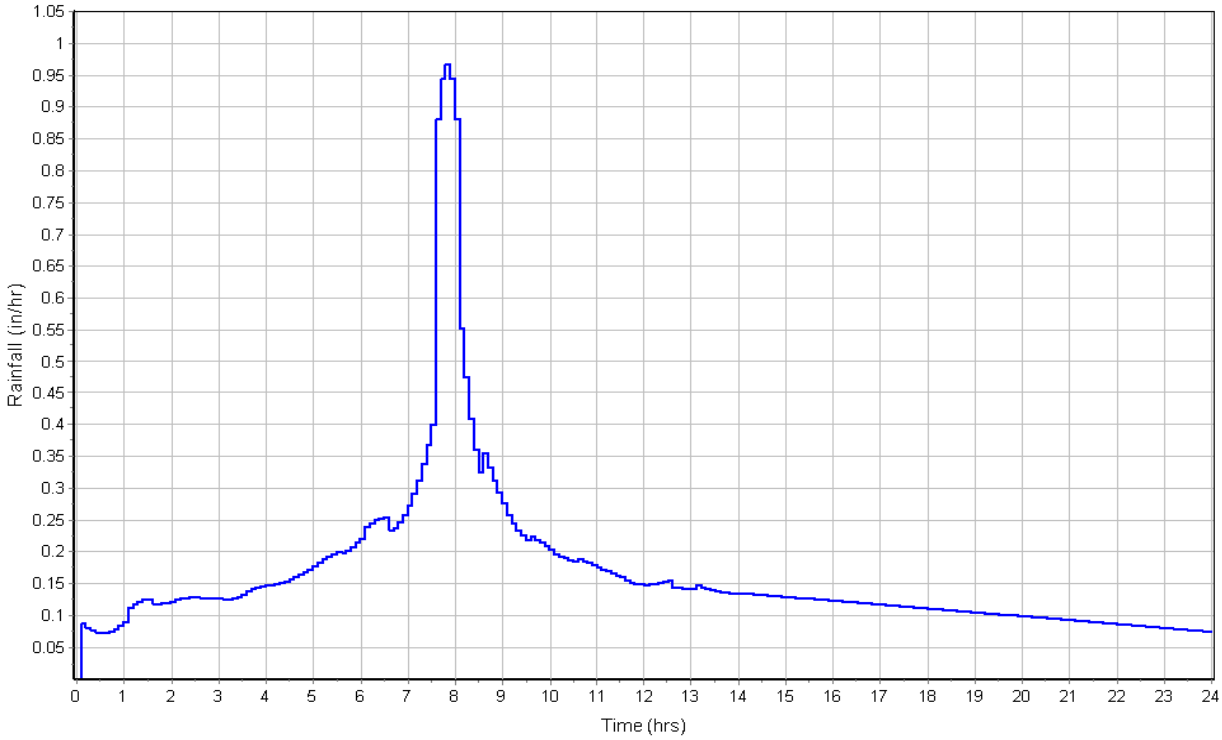
Total TOC (min) 14.40

Subbasin Runoff Results

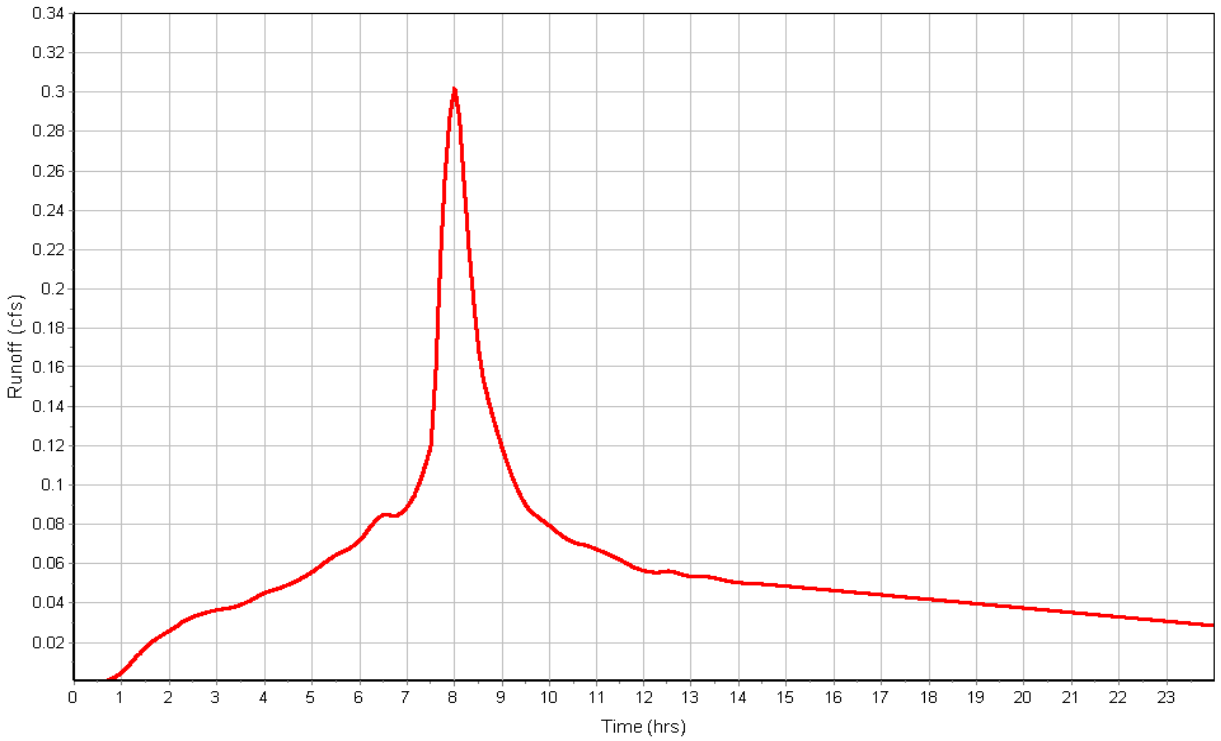
Total Rainfall (in)	3.99
Total Runoff (in)	3.64
Peak Runoff (cfs)	0.30
Weighted Curve Number	96.90
Time of Concentration (days hh:mm:ss)	0 00:14:24

Subbasin : DMA20

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	BMP#1 RISER	152.48	155.73	3.25	152.48	0.00	155.73	0.00	0.00	31.00
2	BMP#2 RISER	149.65	152.90	3.25	149.65	0.00	152.90	0.00	0.00	33.00
3	BMP#3 RISER	148.95	153.20	4.25	148.95	0.00	152.20	-1.00	0.00	45.00
4	NULL01	154.31	158.02	3.71	154.31	0.00	155.38	-2.64	0.00	32.55
5	NULL02	154.20	158.45	4.25	154.20	0.00	155.28	-3.17	0.00	38.99
6	NULL03	154.06	158.57	4.51	154.06	0.00	155.13	-3.44	0.00	42.16
7	NULL04	153.88	158.53	4.65	153.88	0.00	154.95	-3.58	0.00	43.84
8	NULL05	153.70	158.50	4.80	153.70	0.00	154.77	-3.73	0.00	45.65
9	NULL06	153.37	155.77	2.40	153.65	0.28	154.45	-1.32	0.00	16.80
10	NULL07	153.77	156.44	2.67	153.55	-0.22	154.91	-1.53	0.00	23.04
11	NULL08	154.35	156.67	2.32	154.33	-0.02	155.69	-0.98	0.00	19.84
12	NULL09	152.75	155.37	2.62	152.75	0.00	153.29	-2.08	0.00	25.44
13	NULL10	152.51	154.46	1.95	152.51	0.00	153.06	-1.40	0.00	17.37
14	NULL11	153.40	156.16	2.76	153.40	0.00	153.94	-2.22	0.00	27.12
15	NULL12	153.27	155.50	2.23	153.27	0.00	154.41	-1.09	0.00	18.75
16	NULL13	152.80	154.90	2.10	152.80	0.00	153.93	-0.97	0.00	17.20
17	NULL14	153.47	155.46	1.99	153.47	0.00	154.80	-0.67	0.00	17.88

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	BMP#1 RISER	0.00	0.00	152.48	0.00	0.00	3.25	152.48	0.00	0 00:00	0 00:00	0.00	0.00
2	BMP#2 RISER	0.00	0.00	149.65	0.00	0.00	3.25	149.65	0.00	0 00:00	0 00:00	0.00	0.00
3	BMP#3 RISER	0.00	0.00	148.95	0.00	0.00	4.25	148.95	0.00	0 00:00	0 00:00	0.00	0.00
4	NULL01	1.31	0.00	155.07	0.76	0.00	2.95	154.55	0.24	0 07:56	0 00:00	0.00	0.00
5	NULL02	1.31	0.00	154.95	0.75	0.00	3.50	154.44	0.24	0 07:57	0 00:00	0.00	0.00
6	NULL03	1.34	0.00	154.80	0.74	0.00	3.77	154.30	0.24	0 07:58	0 00:00	0.00	0.00
7	NULL04	1.37	0.00	154.63	0.75	0.00	3.90	154.12	0.24	0 07:58	0 00:00	0.00	0.00
8	NULL05	1.41	0.00	154.46	0.76	0.00	4.04	153.93	0.23	0 07:59	0 00:00	0.00	0.00
9	NULL06	2.09	0.00	154.24	0.87	0.00	1.53	153.73	0.36	0 07:59	0 00:00	0.00	0.00
10	NULL07	0.69	0.00	154.26	0.49	0.00	2.18	153.90	0.13	0 07:59	0 00:00	0.00	0.00
11	NULL08	0.52	0.00	154.81	0.46	0.00	1.86	154.52	0.17	0 07:49	0 00:00	0.00	0.00
12	NULL09	0.25	0.00	153.10	0.35	0.00	2.27	152.96	0.21	0 08:01	0 00:00	0.00	0.00
13	NULL10	0.33	0.00	153.11	0.60	0.00	1.35	152.95	0.44	0 00:01	0 00:00	0.00	0.00
14	NULL11	0.16	0.00	153.65	0.25	0.00	2.51	153.49	0.09	0 08:00	0 00:00	0.00	0.00
15	NULL12	0.28	0.00	153.53	0.26	0.00	1.97	153.38	0.11	0 08:00	0 00:00	0.00	0.00
16	NULL13	0.50	0.00	153.22	0.42	0.00	1.68	152.98	0.18	0 07:57	0 00:00	0.00	0.00
17	NULL14	0.30	0.00	153.98	0.51	0.00	1.48	153.90	0.43	0 07:54	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	BMP3_CURBBREAK	2.83	153.54	153.54	152.45	0.00	1.09	38.5200	Rectangular	1.000	1.000	0.0330	0.5000	0.5000	0.0000	0.00	No
2	BMP4_CURBBREAK	6.53	154.50	154.50	153.40	0.00	1.10	16.8500	Rectangular	1.000	1.000	0.0330	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	BMP3_CURBBREAK	0.00	0 00:00	13.44	0.00	0.00		0.25	0.25	0.00		
2	BMP4_CURBBREAK	0.01	0 08:21	8.89	0.00	0.03	3.63	0.25	0.25	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	A-1-01	41.97	156.13	0.00	154.94	2.08	1.19	2.8200	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	A-1-02	109.68	154.86	2.00	154.53	2.00	0.33	0.3000	CIRCULAR	8.040	8.040	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	A-1-03	75.51	154.53	2.00	154.31	0.00	0.23	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
4	A-1-04	35.36	154.31	0.00	154.20	0.00	0.11	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	A-1-05	48.25	154.20	0.00	154.06	0.00	0.14	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	A-1-06	59.97	154.06	0.00	153.88	0.00	0.18	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	A-1-07	60.17	153.88	0.00	153.70	0.00	0.18	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	A-1-08	108.70	153.70	0.00	153.37	0.00	0.33	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	A-1-09	12.56	153.37	0.00	153.33	0.00	0.04	0.3000	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	A-1-10	24.86	149.65	0.00	149.53	0.00	0.12	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
11	A-2-1	45.40	155.39	0.00	154.78	2.25	0.61	1.3400	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	A-3-1	7.60	154.35	2.00	154.31	0.25	0.04	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	A-4-1	7.60	154.17	2.00	154.13	0.25	0.04	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	A-5-1	7.61	153.99	2.00	153.95	0.25	0.04	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	A-6-1	28.50	154.45	0.00	154.35	0.00	0.10	0.3500	CIRCULAR	8.040	8.040	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	A-6-2	189.81	154.35	0.00	153.68	-0.09	0.67	0.3500	CIRCULAR	8.040	8.040	0.0130	0.5000	0.5000	0.0000	0.00	No	1
17	A-6-2A	11.86	154.15	2.00	153.77	0.00	0.38	3.2000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
18	A-6-3	42.62	153.52	-0.25	153.37	0.00	0.15	0.3500	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
19	A-7-1	19.84	153.25	2.00	153.15	0.00	0.10	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
20	B-1-1	53.24	155.95	2.00	155.79	0.00	0.16	0.3000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
21	B-1-2	60.16	152.48	0.00	151.57	0.00	0.91	1.5100	CIRCULAR	8.040	8.040	0.0130	0.5000	0.5000	0.0000	0.00	No	1
22	C-1-1	21.12	153.12	2.00	153.11	2.04	0.01	0.0500	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
23	C-1-2	34.60	153.07	2.00	152.90	2.00	0.17	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
24	C-1-3	29.24	152.90	2.00	152.75	0.00	0.15	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
25	C-1-4	47.14	152.75	0.00	152.51	0.00	0.24	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
26	C-1-5	12.56	152.51	0.00	152.45	0.00	0.06	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
27	C-1-6	106.93	148.95	0.00	148.42	0.00	0.53	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
28	C-2-1	79.79	153.80	2.00	153.40	0.00	0.40	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
29	C-2-2	25.56	153.40	0.00	153.27	0.00	0.13	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
30	C-2-2A	10.96	153.32	2.00	153.27	0.00	0.05	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
31	C-2-3	94.11	153.27	0.00	152.80	0.00	0.47	0.5000	CIRCULAR	8.040	8.040	0.0130	0.5000	0.5000	0.0000	0.00	No	1
32	C-2-3A	5.51	152.83	2.00	152.80	0.00	0.03	0.5000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
33	C-2-4	70.03	152.80	0.00	152.45	0.00	0.35	0.5000	CIRCULAR	8.040	8.040	0.0150	0.5000	0.5000	0.0000	0.00	No	1
34	D-1-1	19.41	153.51	2.00	153.47	0.00	0.04	0.2100	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
35	D-1-2	162.30	153.47	0.00	153.15	0.00	0.32	0.2000	CIRCULAR	6.000	6.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	A-1-01	0.43	0 07:54	0.94	0.46	2.83	0.25	0.37	0.74	0.00		Calculated
2	A-1-02	0.68	0 07:54	0.66	1.02	1.94	0.94	0.67	1.00	16.00		SURCHARGED
3	A-1-03	1.31	0 07:54	1.95	0.67	2.13	0.59	0.74	0.74	0.00		Calculated
4	A-1-04	1.31	0 07:55	1.95	0.67	2.09	0.28	0.75	0.75	0.00		Calculated
5	A-1-05	1.30	0 07:55	1.95	0.67	2.12	0.38	0.74	0.74	0.00		Calculated
6	A-1-06	1.33	0 07:57	1.95	0.68	2.16	0.46	0.75	0.75	0.00		Calculated
7	A-1-07	1.36	0 07:58	1.95	0.70	2.18	0.46	0.76	0.76	0.00		Calculated
8	A-1-08	1.41	0 07:59	1.95	0.72	2.05	0.88	0.82	0.82	0.00		Calculated
9	A-1-09	2.09	0 07:59	1.95	1.07	3.34	0.06	0.74	0.74	0.00		> CAPACITY
10	A-1-10	0.00	0 00:00	0.40	0.00	0.00		0.00	0.00	0.00		Calculated
11	A-2-1	0.44	0 07:54	0.65	0.67	2.94	0.26	0.39	0.78	0.00		Calculated
12	A-3-1	0.03	0 08:03	0.40	0.08	0.84	0.15	0.47	0.94	0.00		Calculated
13	A-4-1	0.03	0 07:59	0.40	0.08	0.84	0.15	0.48	0.96	0.00		Calculated
14	A-5-1	0.04	0 07:59	0.40	0.11	0.95	0.13	0.49	0.97	0.00		Calculated
15	A-6-1	0.52	0 07:54	0.72	0.72	1.95	0.24	0.48	0.71	0.00		Calculated
16	A-6-2	0.52	0 07:55	0.67	0.78	2.20	1.44	0.47	0.70	0.00		Calculated
17	A-6-2A	0.17	0 07:54	1.00	0.17	1.97	0.10	0.31	0.63	0.00		Calculated
18	A-6-3	0.68	0 07:56	3.45	0.20	1.46	0.49	0.68	0.68	0.00		Calculated
19	A-7-1	0.15	0 08:00	0.40	0.38	0.81	0.41	0.46	0.92	0.00		Calculated
20	B-1-1	0.13	0 07:54	0.31	0.41	0.64	1.39	0.50	1.00	1424.00		SURCHARGED
21	B-1-2	0.00	0 00:00	1.48	0.00	0.00		0.00	0.00	0.00		Calculated
22	C-1-1	0.11	0 08:01	0.25	0.44	1.05	0.34	0.29	0.57	0.00		Calculated
23	C-1-2	0.23	0 08:00	0.40	0.58	1.74	0.33	0.32	0.64	0.00		Calculated
24	C-1-3	0.25	0 08:00	0.40	0.63	1.73	0.28	0.34	0.69	0.00		Calculated
25	C-1-4	0.25	0 08:01	0.39	0.63	1.41	0.56	0.42	0.84	0.00		Calculated
26	C-1-5	0.33	0 00:01	0.40	0.84	2.03	0.10	0.50	1.00	0.00		SURCHARGED
27	C-1-6	0.00	0 00:00	0.40	0.00	0.00		0.00	0.00	0.00		Calculated
28	C-2-1	0.16	0 08:00	0.40	0.41	1.76	0.76	0.24	0.47	0.00		Calculated
29	C-2-2	0.16	0 08:00	0.40	0.41	1.59	0.27	0.26	0.51	0.00		Calculated
30	C-2-2A	0.12	0 08:00	0.39	0.30	1.19	0.15	0.25	0.51	0.00		Calculated
31	C-2-3	0.28	0 08:00	0.85	0.33	1.55	1.01	0.34	0.51	0.00		Calculated
32	C-2-3A	0.22	0 07:54	0.40	0.56	1.41	0.07	0.43	0.85	0.00		Calculated
33	C-2-4	0.50	0 07:57	0.74	0.67	1.93	0.60	0.46	0.69	0.00		Calculated
34	D-1-1	0.17	0 00:00	0.25	0.67	2.75	0.12	0.49	0.98	0.00		Calculated
35	D-1-2	0.16	0 00:01	0.25	0.65	1.09	2.48	0.50	1.00	15.00		SURCHARGED

Inlet Input

SN	Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft²)	Grate Clogging Factor (%)
1	BMP3_CURBBREAK	FHWA HEC-22 GENERIC	N/A	On Sag	1	0.00	153.54	153.54	0.00	0.00	10.00	0.00
2	BMP4_CURBBREAK	FHWA HEC-22 GENERIC	N/A	On Sag	1	0.00	154.51	154.51	0.00	0.00	10.00	0.00
3	CB01	FHWA HEC-22 GENERIC	N/A	On Sag	1	153.95	157.95	4.00	156.45	2.50	0.00	0.00
4	CB02	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.86	156.83	3.97	154.64	1.78	0.00	0.00
5	CB03	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.53	156.83	4.30	154.53	2.00	0.00	0.00
6	CB04	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.35	158.57	6.22	154.35	2.00	0.00	0.00
7	CB05	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.17	158.53	6.36	154.17	2.00	0.00	0.00
8	CB06	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.99	158.48	6.49	153.99	2.00	0.00	0.00
9	CB07	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.25	154.07	2.82	153.65	2.40	0.00	0.00
10	CB08	FHWA HEC-22 GENERIC	N/A	On Sag	1	152.15	156.17	4.02	154.15	2.00	0.00	0.00
11	CB09	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.12	154.64	3.52	153.12	2.00	0.00	0.00
12	CB10	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.07	154.66	3.59	153.07	2.00	0.00	0.00
13	CB11	FHWA HEC-22 GENERIC	N/A	On Sag	1	150.90	154.50	3.60	152.95	2.05	0.00	0.00
14	CB12	FHWA HEC-22 GENERIC	N/A	On Sag	1	150.83	154.88	4.05	152.95	2.12	0.00	0.00
15	CB13	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.32	155.44	4.12	153.32	2.00	0.00	0.00
16	CB14	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.80	155.80	4.00	153.80	2.00	0.00	0.00
17	CB15	FHWA HEC-22 GENERIC	N/A	On Sag	1	151.51	154.54	3.03	153.90	2.39	0.00	0.00
18	DS01	FHWA HEC-22 GENERIC	N/A	On Sag	1	155.39	160.00	4.61	155.39	0.00	0.00	0.00
19	DS02	FHWA HEC-22 GENERIC	N/A	On Sag	1	156.13	160.00	3.87	156.13	0.00	0.00	0.00
20	DS03	FHWA HEC-22 GENERIC	N/A	On Sag	1	154.45	160.00	5.55	154.45	0.00	0.00	0.00

Roadway & Gutter Input

SN	Element ID	Roadway Longitudinal Slope (ft/ft)	Roadway Cross Slope (ft/ft)	Roadway Manning's Roughness	Gutter Cross Slope (ft/ft)	Gutter Width (ft)	Gutter Depression (in)	Allowable Spread (ft)
1	BMP3_CURBBREAK	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
2	BMP4_CURBBREAK	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
3	CB01	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
4	CB02	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
5	CB03	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
6	CB04	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
7	CB05	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
8	CB06	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
9	CB07	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
10	CB08	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
11	CB09	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
12	CB10	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
13	CB11	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
14	CB12	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
15	CB13	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
16	CB14	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
17	CB15	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
18	DS01	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
19	DS02	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
20	DS03	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00

Inlet Results

SN	Element ID	Peak Flow (cfs)	Peak Lateral Inflow (cfs)	Peak Flow Intercepted by Inlet (cfs)	Peak Flow Bypassing Inlet (cfs)	Inlet Efficiency during Peak Flow (%)	Max Gutter Spread during Peak Flow (ft)	Max Gutter Water Elev. during Peak Flow (ft)	Max Gutter Water Depth during Peak Flow (ft)	Time of Max Depth Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	BMP3_CURBBREAK	0.90	0.90	N/A	N/A	N/A	-1.60	153.76	0.22	0 05:47	3.23	1093.00
2	BMP4_CURBBREAK	0.30	0.30	N/A	N/A	N/A	3.67	154.83	0.32	0 08:21	0.69	939.00
3	CB01	0.13	0.13	N/A	N/A	N/A	1.53	158.09	0.14	0 07:54	0.00	0.00
4	CB02	0.24	0.24	N/A	N/A	N/A	1.83	156.97	0.14	0 07:54	0.00	0.00
5	CB03	0.20	0.20	N/A	N/A	N/A	1.73	156.97	0.14	0 07:55	0.00	0.00
6	CB04	0.03	0.03	N/A	N/A	N/A	1.22	158.70	0.13	0 07:58	0.00	0.00
7	CB05	0.03	0.03	N/A	N/A	N/A	1.22	158.66	0.13	0 07:59	0.00	0.00
8	CB06	0.04	0.04	N/A	N/A	N/A	1.26	158.61	0.13	0 07:59	0.00	0.00
9	CB07	0.15	0.15	N/A	N/A	N/A	1.60	154.21	0.14	0 08:00	0.00	0.00
10	CB08	0.17	0.17	N/A	N/A	N/A	1.66	156.31	0.14	0 07:54	0.00	0.00
11	CB09	0.11	0.11	N/A	N/A	N/A	1.49	154.78	0.14	0 08:00	0.00	0.00
12	CB10	0.12	0.12	N/A	N/A	N/A	1.52	154.80	0.14	0 08:00	0.00	0.00
13	CB11	0.02	0.02	N/A	N/A	N/A	1.16	154.63	0.13	0 08:00	0.00	0.00
14	CB12	0.22	0.22	N/A	N/A	N/A	1.78	155.02	0.14	0 07:57	0.00	0.00
15	CB13	0.12	0.12	N/A	N/A	N/A	1.51	155.58	0.14	0 08:00	0.00	0.00
16	CB14	0.16	0.16	N/A	N/A	N/A	1.63	155.94	0.14	0 07:54	0.00	0.00
17	CB15	0.12	0.12	N/A	N/A	N/A	1.52	154.68	0.14	0 07:54	0.00	0.00
18	DS01	0.44	0.44	N/A	N/A	N/A	2.22	160.15	0.15	0 07:48	0.00	0.00
19	DS02	0.43	0.43	N/A	N/A	N/A	2.21	160.15	0.15	0 07:54	0.00	0.00
20	DS03	0.52	0.52	N/A	N/A	N/A	2.37	160.15	0.15	0 07:54	0.00	0.00

APPENDIX B –
OPERATIONS AND
MAINTENANCE MANUAL

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	W5
Project Type	Industrial
Location	9600 Boeckman Road
Stormwater Management Area	219453
Project Applicant	W5, LLC (c/o Mac Martin)
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
DMA 01 - Impervious	8,345	Grass	ConventionalConcrete	D	BMP 2
DMA 01 - Pervious	2,572	Grass	LandscapeDsoil	D	BMP 2
DMA 02 - Impervious	10,708	Grass	ConventionalConcrete	D	BMP 2
DMA 02 - Pervious	1,530	Grass	LandscapeDsoil	D	BMP 2
DMA 03 - Impervious	5,558	Forested	ConventionalConcrete	D	BMP 1
DMA 03 - Pervious	565	Forested	LandscapeDsoil	D	BMP 1
DMA 04 - Impervious	1,530	Forested	ConventionalConcrete	D	BMP 2
DMA 05 - Impervious	1,552	Grass	ConventionalConcrete	D	BMP 2
DMA 06 - Impervious	2,004	Grass	ConventionalConcrete	D	BMP 2
DMA 07 - Roof	20,144	Grass	Roofs	D	BMP 2
DMA 08 - Roof	20,084	Grass	Roofs	D	BMP 2
DMA 09 - Roof	24,005	Grass	Roofs	D	BMP 2
DMA 10 - Impervious	7,119	Grass	ConventionalConcrete	D	BMP 2
DMA 10 - Pervious	1,224	Grass	LandscapeDsoil	D	BMP 2
DMA 11 - Impervious	7,900	Grass	ConventionalConcrete	D	BMP 2

DMA 11 - Pervious	265	Grass	LandscapeDsoil	D	BMP 2
DMA 12 - Impervious	5,544	Grass	ConventionalConcrete	D	BMP 3
DMA 12 - Pervious	356	Grass	LandscapeDsoil	D	BMP 3
DMA 13 - Impervious	5,461	Grass	ConventionalConcrete	D	BMP 3
DMA 13 - Pervious	1,420	Grass	LandscapeDsoil	D	BMP 3
DMA 14 - Impervious	929	Grass	ConventionalConcrete	D	BMP 3
DMA 15 - Impervious	10,340	Grass	ConventionalConcrete	D	BMP 3
DMA 16 - Impervious	7,626	Grass	ConventionalConcrete	D	BMP 3
DMA 16 - Pervious	252	Grass	LandscapeDsoil	D	BMP 3
DMA 17 - Impervious	5,646	Grass	ConventionalConcrete	D	BMP 3
DMA 17 - Pervious	115	Grass	LandscapeDsoil	D	BMP 3
DMA 18 - Impervious	42,713	Grass	ConventionalConcrete	D	BMP 3
DMA 18 - Pervious	2,156	Grass	LandscapeDsoil	D	BMP 3
DMA 19 - Impervious	5,560	Grass	ConventionalConcrete	D	BMP 4
DMA 20 - Impervious	15,482	Grass	ConventionalConcrete	D	BMP 4
DMA 20 - Pervious	748	Grass	LandscapeDsoil	D	BMP 4

LID Facility Sizing Details

LID ID	Design Criteria	BMP Type	Facility Soil Type	Minimum Area (sq-ft)	Planned Areas (sq-ft)	Orifice Diameter (in)
BMP 2	FlowControlAndTreatment	Rain Garden - Filtration	D1	4,292.2	4,300.0	3.3
BMP 3	FlowControlAndTreatment	Rain Garden - Filtration	D1	3,250.7	3,290.0	2.9
BMP 4	FlowControlAndTreatment	Rain Garden - Filtration	D1	862.6	878.0	1.5
BMP 1	FlowControlAndTreatment	Rain Garden - Filtration	D1	238.1	640.0	0.8

Pond Sizing Details

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Stormwater Operations & Maintenance Manual

For:

Building W-5
Wilsonville, Oregon

December 2021

Prepared by:

Mackenzie
1515 SE Water Avenue
Suite 100
Portland, OR 97214
2210115.00

TABLE OF CONTENTS

ATTACHMENTS

I. GENERAL- SITE DESCRIPTION, ASSUMPTIONS AND GENEREAL SYSTEM DESCRIPTION

This plan was developed to provide a basis for maintenance of stormwater facilities for the W-5 Building project located in Wilsonville, Oregon. The W-5 project includes the construction of a 65,000 square foot (footprint) manufacturing building with an integral depressed truck dock, associated drive aisles and parking, an exterior trash enclosure, and associated utility services to the building and site..

Runoff from the site sheets flows to various standard catch basins and is conveyed to four rain garden stormwater systems onsite.

This Operations and Maintenance Plan generally provides maintenance requirements of the stormwater collection and treatment system. Best Management Practices (BMPs) related to maintenance of the facilities shall include regular maintenance and upkeep of the parking and landscape areas.

II. GENERAL MAINTENANCE AND FACILITY-SPECIFIC MAINTENANCE REQUIREMENTS

The W-5 Facilities Manager shall be responsible for regular inspections and maintenance of the storm drainage system and related facilities. Inspections shall include observations of the landscaping, parking areas, catch basin grates and basins for debris, loose soil or sediment that may enter the system. Inspection of the collection system includes observation of the catch basins, and conveyance lines. General maintenance requirements of those facilities include removal of sediment and debris, repair of damaged components and general maintenance of mechanical systems.

Facility-specific maintenance requirements shall also be the responsibility of the W-5 Facilities Manager. Inspections shall include documentation of observations and maintenance or repairs of each of the drainage system facilities. This would include:

- Landscape areas
- Parking areas
- Catch basins
- Cleanouts
- Conveyance pipes
- Treatment devices
- Detention elements

Operations and Maintenance Contact

W-5 – Facilities Manager

Mac Martin
206.399.6676
macmartinis@gmail.com

III. GENERAL MAINTENANCE ACTIVITIES

Maintenance of stormwater system components is the key to a successful stormwater plan. Most stormwater systems can fail in the first few years due to lack of adequate maintenance. The following guidelines will be used for general maintenance of the stormwater system.

1. Dry sweeping of the parking area to reduce accumulation of sediments and debris in the catch basins will be conducted regularly. Clogging the catch basin with sediments will result in its failure.

2. Quarterly visual inspection of the catch basins for debris and obstructions. All catch basins or other structures shall be kept clear of sediment, debris or other obstructions that may affect the flow or treatment of stormwater.

3. Visually inspect the rain gardens after all major storm events for evidence of system problems. Look for ponded water, debris, erosion, or any other signs of system problems.

4. Annually inspect the spill kit to ensure all supplies are available and have not deteriorated or expired (Note: each tenant shall have a separate spill kit or access to a shared spill kit). Check with city staff to stay aware of newly available products or spill containment procedures. Become familiar with the spill control plan (included with this O&M Plan) and ensure that at least one employee during each work shift is familiar with the plan (always have someone on-site who is aware of the spill containment kit and procedures).

5. Biannually or quarterly inspect the catch basin sumps. Sediments need to be removed along with any oils before the deposits reach one foot in depth and before the outlet is obstructed. Materials removed from the catch basin inlet shall be disposed of in accordance with applicable state law. Records of debris disposal shall be kept on file at the main office in accordance with the state law and shall be available for review by regulating agencies.

IV. SITE PLAN SHOWING LOCATION OF FACILITY COMPONENTS

The attached O&M Facility Map shows the general location of the facility components. The site utility "As-built" drawings should be consulted for further information regarding facility locations, sizes or details.

V. INSPECTION PROGRAM – PERFORMANCE MEASURES FOR MAINTENANCE ACTIVITIES

Objective

The objective of this manual is to help the property owner to maintain the storm sewer system for W-5 so it can continue to operate as designed.

Requirements

Conduct inspections with the as-built plans in hand. Inspect the facility on a quarterly basis for the first 3 years from construction, and a minimum or semi-annually thereafter. Additional inspections will be necessary after long dry periods, large storms or spills. Immediately remove spilled material, taking the appropriate safety and disposal precautions.

Keep inspection records to track the progressive development of the system over time. The inspection records shall include:

1. Sediment condition and depth in sumps
2. Water elevation/observations (sheen, smell, etc.)
3. Conditions of the inlet and outlet pipes, and remaining storage capacity
4. Unscheduled maintenance needs
5. Components that do not meet performance criteria and require immediate maintenance
6. Common problem areas, solutions, and general observations
7. Aesthetic conditions

Collection System

The collection system consists of underground pipes and catch basins.

Catch Basins

The catch basins are metal basins with steel grates. The catch basins have a trapped outlet and sump and need to be inspected and maintained (if necessary) on a quarterly basis and following major storm events. Maintenance includes inspection of the structure itself and removal of any oils, debris or sediment as described in the maintenance table. Check to see if sediment has built up on the bottom of the catch basin by measuring down from the outlet pipe. If it is less than 12-inches then the catch basin needs to be cleaned out.

Storm Sewer Pipes

The storm sewer pipes are plastic with associated fittings. The pipes need to be inspected and cleaned quarterly (if necessary) following major storm events. Cleanouts and manholes are provided for access to the pipe system. The pipes need to be inspected for sediment buildup and cleaned out, if necessary, using a vactor truck so that sediment is removed.

Rain Gardens

Refer to attached City of Wilsonville 2012 Manual for the Operation & Maintenance of Privately Owned Stormwater Facilities.

Maintenance Schedule

Summer: Make structural repairs; clean gutters and downspouts; remove any build-up of weeds or organic debris.

Fall: Replant exposed soil and replace dead plants. Remove sediment and plant debris.

Winter: Clear gutters and downspouts.

Spring: Remove sediment and plant debris. Replant exposed soil and replace dead plants.

All season: Weed as necessary.

Maintenance Record

All facility operators are required to keep an inspection and maintenance log. Record date, description, and contractor (if applicable) for all repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access

Maintain ingress/egress per design standards.

Vector (Mosquitoes and Rats)

Facilities must not harbor mosquito larvae or rodents. Record the time/date, weather, and site conditions when vector activity is observed. Record when vector abatement started and ended.

VI. O&M INSPECTION SCHEDULE

- Quarterly inspection of the catch basins and drainage system for accumulation of sediments or oils
- Annual inspection of the emergency spill kit to ensure that all supplies are available and have not deteriorated or expired
- Quarterly inspection of the swale for proper landscape maintenance, removal of trash or sediment and repair of erosion
- Materials removed from the catch basin or pipes shall be disposed of in accordance with state law

Employee and Public Education

Employees will be trained upon hiring and thereafter annually, when new requirements are published or when there are any changes to the system equipment. Employee training will include:

- Reading this Stormwater Management Plan
- Familiarity of all components and locations for materials indicated in the SWMP
- Spill response and Personal Protective Equipment (PPE)
- Documentation requirements

VII. MAINTENANCE EQUIPMENT

Hand tools or other specialized equipment may be necessary to maintain the facilities. Suggested maintenance equipment is listed in the Inspection Checklist. The Facility Manager shall be responsible to maintain on-site, or be able to make available, all required equipment.

Suggested Maintenance Equipment and Materials

- Push broom
- Rake
- Shovel
- Spill kit
- Manhole lid puller
- General landscape tools (weed cutters, pruning clippers, leak rake, etc.)
- Vactor Truck

VIII. SEDIMENT STORAGE, TESTING, AND DISPOSAL

Maintenance of the storm drainage facilities (manholes and catch basins) may include removal of oils, sediments or debris that requires specialized testing or disposal. All removed oils, sediments or other debris shall be disposed of in accordance with applicable regulations. The Facility Manager shall be responsible to retain a qualified company to dispose of this material or otherwise comply with the applicable regulations. The Facility Manager should contact the City of Wilsonville Public Works to verify current regulations or requirements. Local companies providing testing, storage and disposal services:

Clearwater Environmental Services in Wilsonville: (503) 582-1951
River City Environmental in Portland: (503) 252-6144
Bravo Environmental in NW Portland: (503) 261-9800

IX. EMERGENCY CONTACTS

Emergency Contacts

Mac Martin
206.399.6676
macmartinis@gmail.com

Maintenance Responsibilities

The Facility Manager shall be responsible to inspect, maintain or otherwise repair the stormwater facilities. Regular inspections shall occur, and documentation of the inspections, maintenance or repairs kept on-site for a minimum of three years from the date of the activity.

X. SPILL PREVENTION AND CONTROL PLAN

Spill prevention is an important factor in the successful operation of a stormwater management system. All employees will be trained to this plan so that they are certain of the location of materials, who to notify in case of a spill, and how to initially contain the spill of hazardous materials. Employees shall never dump water materials into the stormwater collection/treatment system. Employees shall be observant of other potential contamination occurrences. All employees will review the following page regarding detailed spill response steps.

This data will be posted in an accessible area.

WHAT TO DO IN CASE OF A SPILL

1. The spill kit is located at the stand up shelter near the site entry
2. Get the spill kit (and spill kit instructions when provided)
    a. If possible, determine visually what type of fluids have been spilled
    b. Put on gloves and glasses or any other necessary Personal Protective Equipment (PPE)
    c. Get the absorbent material provided in the kit and drain block cover (pig)
    d. Place the absorbent material in the path of the spill
    e. Remove any debris from the vicinity of the catch basin inlets in the parking lot
    f. Unroll the drain blocker, and place is snugly over the catch basin inlet
    g. Verify the cover has full contact with the rim of the catch basin inlet
    h. Use snakes, pillow or pigs to completely contain the areas
    i. If the spill cannot be contained locally, shut off the storm drain pumps so any spilled material does not leave the site
3. Notify the following personnel immediately:

City of Wilsonville Public Works:	(503) 682-4092
After Hours:	(866) 252-3614
Department of Environmental Quality:	(800) 452-0311
	(800) 452-4011
	(503) 229-5263

Note: Only dry cleanup methods may be employed to clean up spills (i.e. no use of water to wash spilled materials from pavement will be conducted).

XI. ADDITIONAL MAINTENANCE REQUIREMENTS FOR INITIAL ESTABLISHMENT PERIOD

Initial maintenance of landscape vegetation may require additional attention to ensure that landscaping, groundcover and erosion control measures are established or maintained as intended. Proper landscaping and groundcover are an important feature of a successful storm drainage system.

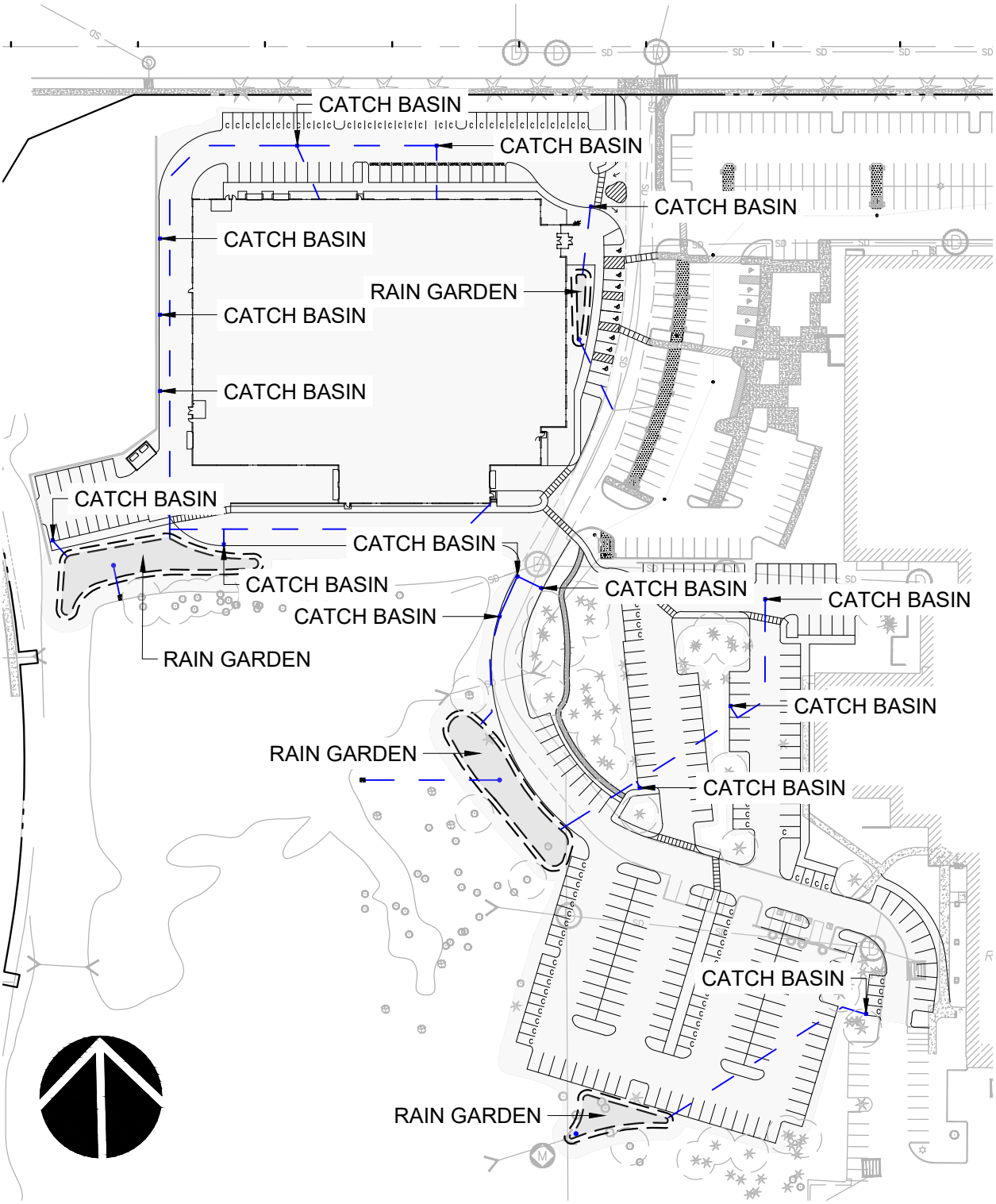
1. During the initial 3-year establishment period, remove undesired vegetation using minimal (or preferably no) use of toxic herbicides and pesticides at least 3 times a year. Replace plants that die during this period.

2. Irrigate as necessary to establish site landscaping

3. Replenish mulch at least annually. Make sure that all exposed soil is covered with mulch or other groundcover

4. Do not use excessive fertilizers, herbicides or pesticides for vegetation maintenance

5. Use replacement plants that conform to the initial planting list



MARTIN DEVELOPMENT
W-5
12/2/2021

O&M FACILITY MAP
2210115.00

City of Wilsonville
Annual Stormwater Facility Inspection and Maintenance Report

Name of Development:
Location/Site Address:
Contact Name:
Telephone:
Email:
Mailing Address (if different from Site Address):

Facilities to be Maintained:

	Catch Basin(s)		
	Pretreatment Manhole(s)		
____	Flow Control Manhole(s)		
____	Detention Pond(s)	# of inlets	
____		# of outlets	
____	Rain Garden(s)	# of inlets	
____		#of outlets	____
	Stormwater Planter(s)	# of inlets	____
____		# of outlets	____
	Vegetated Swale(s)	# of inlets	____
____		# of outlets	____
	All Other Facilities as Described on Plans:		____
____			____
			____

Inspection Date:
Describe Inspection, Maintenance, Repair, or Replanting Activities (attach invoices for work performed)**:**

Owner or Representative Signature Date

CITY OF WILSONVILLE • COMMUNITY DEVELOPMENT
Phone 503-682-4960
Fax 503-682-7025
29799 SW Town Center Loop East
Wilsonville, OR 97070
www.ci.wilsonville.or.us
info@ci.wilsonville.or.us

The Owner(s) or Owner's designee shall be responsible for annually conducting inspections and performing maintenance on the above stormwater management facilities annually, in conformance with Section 301.13.00, "Operation and Maintenance Requirements," of the City of Wilsonville Public Works Standards. This requirement pertains to all Stormwater Facilities, including but not limited to: catch basins, pipes, treatment manholes, manholes, trash racks, vegetated swales, and detention ponds.

<u>For vegetated stormwater facilities, particular attention will be given to:</u>

- Examine inlets, outlets, and curb cuts for sediment buildup. Remove sediment as necessary to maintain flow into and out of facility.
- Inspect facility for erosion, gullies, and slope slippage. Repair if present.
- Check for evidence of ponding or slow draining soil media. If necessary, remove and clean or replace the clogged soil media.
- Remove weeds manually.
- Ensure that all plants are healthy. Replace all dead or dying plants with approved plantings.
- Remove trash and excess debris.
- Ensure overflow covers are in place.

<u>For structural facilities and components, particular attention will be given to:</u>

- Remove sediment at least once a year or when basin is half full of sediment.
- Remove trash, oils, and debris.
- Ensure facility is structurally sound by repairing or replacing cracked, loose, askew, or damaged pipes.
- Access covers, trash racks, and metal grates shall be kept free of trash and debris, closed, and in good working order.
- Maintain filter cartridges and other proprietary systems according to manufacturer's recommendations.

Spring 	Summer	Fall 	Winter 
Remove sediment Remove trash Remove weeds Fix erosion **Plant** **Prune grasses** Check irrigation	Remove sediment Remove trash Remove weeds Fix erosion Check irrigation Water plants **Structural repairs**	Remove sediment Remove trash Remove weeds Fix erosion **Plant** Drain irrigation **Structural repairs**	Remove sediment Remove trash Fix erosion **Prune trees & shrubs**

City of Wilsonville

A Manual for the Operation & Maintenance of Privately Owned Stormwater Facilities

March 2012

Working together...

towards a common goal...

clean waters and healthy rivers.

City of Wilsonville
Natural Resources Program
(503) 682-4960
www.ci.wilsonville.or.us

TABLE OF CONTENT

CARING FOR YOUR STORMWATER FACILITY

THANK YOU

As the owner of a stormwater management facility, you are making a meaningful contribution to the health of Wilsonville's streams, wetlands and the Willamette River. This handbook will help you maintain your facility to make sure it performs the work it is designed to accomplish.

WHAT ARE STORMWATER FACILITIES?

Stormwater facilities are any combination of landscape and structural features that slow, filter, or infiltrate (absorb) runoff on your property after a rainfall. Types of facilities include vegetated systems (planters, swales, ponds, created wetlands, etc.), and structural systems (ecoroofs, porous pavement and manufactured facilities). Piping, inlets and catch basins are also important components that need adequate maintenance to assure facility function. All of these serve a common purpose: controlling the quality and quantity of stormwater runoff from your site to help safeguard our valuable water resources.

PROPERTY OWNER RESPONSIBILITIES

Federal, state and local agencies created management regulations and guidelines so as to improve stormwater quality and protect watersheds, rivers, streams and drinking water resources. The City of Wilsonville has a Stormwater Maintenance and Access Easement that includes the following requirements:

- Annual maintenance on storm drainage facilities in conformance with City of Wilsonville's Public Works Standards. For more information go to: www.ci.wilsonville.or.us/Index.aspx?page=127 Go to Important Links at the bottom of the page and click on Public Works Construction Standards 2006 (section 301.6.00 Operations and Maintenance Req.)
- Removal of debris, leaves and sediment from manholes, detention outlet structures, and catch basins.
- Disposal of all oils, sediment and debris in an approved dumpsite.
- Replacement of all dead or dying plants in ponds and swales. Maintenance of original plantings.
- Removal of trash from ditches, swales, catch basins, or any stormwater conveyance.

The steps we take today will greatly influence Wilsonville's environmental health and quality of life for years to come. Individual actions can make a big difference. Thank you for the significant part you and your stormwater management facility are playing.

* For information or questions about your facility, call the Natural Resources Program at (503) 682-4960

YOUR CONNECTION TO WILSONVILLE'S STREAMS AND THE WILLAMETTE RIVER

THE PROBLEM WITH STORMWATER RUNOFF

When it rains, the stormwater runs off impervious surfaces (such as roofs and paved areas) instead of soaking into the ground.

Conventional stormwater management directs runoff into drains and pipes that carry it offsite and eventually discharge it into a local stream. This approach has a number of harmful effects:

- Impervious areas generate large volumes of runoff relatively quickly. The increased volume and speed of the runoff can cause flooding and erosion and damage natural habitat.
- The runoff picks up a variety of pollutants including oil, pesticides, metals, chemicals, and sediment that negatively impact water quality and fish habitat.
- During warm weather, the runoff absorbs heat from impervious surfaces. This increases the temperature of the receiving waters, with negative impacts on fish and other aquatic life.
- Less water is able to infiltrate into the ground. This reduces groundwater recharge, which reduces summer flows in streams.

For information on the City's stormwater permitting requirements please visit:

www.ci.wilsonville.or.us/Index.aspx?page=693

A BETTER WAY TO FLOW

The City of Wilsonville is actively pursuing a variety of measures to reduce stormwater impacts. One important approach is to manage stormwater on the property where it originates. This is commonly referred to as Low Impact Development. It includes the use of vegetated swales, pervious concrete, rain gardens, eco-roofs, etc. Onsite stormwater management uses processes that mimic nature. Onsite facilities allow runoff to soak into the ground, help filter out pollutants, and slow the flow rate of runoff leaving your site. This significantly reduces the volume and pollution levels in stormwater leaving your property and ending up in local streams and the Willamette River.

WHAT ELSE IS THE CITY DOING?

Onsite management, through the use of Low Impact Development, is just one component of a comprehensive citywide program to limit stormwater runoff impacts. Here are some other steps the City is taking:

- The City requires onsite stormwater management for new construction and redevelopment on public and private property.
- Adhering to and updating the procedures outlined in the Stormwater Master Plan.
- Natural areas, especially riparian areas adjacent to rivers and streams, help filter out pollution, control erosion, and provide shade, food, and habitat for fish and wildlife. The City uses a variety of measures to preserve these critical areas including development and land use zoning requirements and enhancement and restoration efforts.
- In partnership with numerous other organizations, the City provides education and technical assistance aimed at reducing stormwater impacts and promoting watershed health.

INSPECTING AND MAINTAINING YOUR FACILITY

PROTECTING YOUR RESOURCES

It is essential to maintain your facility so it functions as intended and limits off-site environmental impacts. You are required to inspect your facility at a minimum of once a year to determine maintenance needs. Routine inspection and maintenance can help keep overall maintenance costs low by detecting problems early and avoiding large repair or replacement costs. This section identifies general guidelines on what to look for and how to maintain your facility. It also notes non-routine maintenance that may require professional assistance. **If you are unsure of what type of facility you have, call the City of Wilsonville's Natural Resources Program at (503) 682-4960.**

LEGAL REQUIREMENTS: OPERATIONS AND MAINTENANCE PLAN

As a property owner, you are legally required to follow all of the maintenance tasks and schedules outlined in your recorded maintenance and access easement. An Annual Inspection and Maintenance Report must be submitted to the City of Wilsonville no later than May 1 each year (see sample form on page 7). Pictures included with the report are very helpful. Include copies of invoices of work performed by contractors. While inspecting your facility, please keep in mind that it will be necessary for you to refer to your landscape plan in order to maintain your facility as it was originally designed.

INSPECTION SCHEDULE: HOW OFTEN

It is recommended that you inspect your facility at least::

- Quarterly for the first two years
- Once a year there after, and
- Within 48 hours of major rainfall events (more than one inch of rain over a 24-hour period).

SAMPLE REPORTING FORM

Stormwater Annual Inspection and Maintenance Report

- The owner(s) or owner's designee shall be responsible for having inspections conducted and maintenance performed on the above private stormwater facilities annually, in conformance with Section 301.6.00, "Operation and Maintenance," of the City of Wilsonville Public Works Standards. All oils, sediment and debris will be removed and deposited in an approved waste disposal site. Any damaged equipment will be repaired promptly.
- Particular attention will be given to sedimentation and pollution control manholes, and stormwater facility inlet and outlet structures. All debris shall be removed to assure proper functioning.
- The grates of all catch basins shall be kept free of debris and leaves.
- The stormwater facility outlet structure(s) shall be checked to assure that sediment accumulation has not encroached on the required stormwater facility volume. Sediment shall be removed as necessary to maintain that required volume.
- The outlet control manhole shall be inspected to assure that all parts are intact and the orifice is free of any debris that could cause malfunction.
- Inspect all stormwater facilities for survival and viability of plantings. Replace all dead or dying plants with in-kind plantings, and remove sediments and debris. **Maintain all original landscaping in swales, ponds, etc.**
- This includes all stormwater facilities including but not limited to: catch basins, pipes, treatment manholes, manholes, trash racks, and structural controls.

The above inspection and maintenance activities shall be documented annually by sending a signed original letter format report of what was completed to the City of Wilsonville at the mailing address below. **The Annual Inspection and Maintenance Report must be submitted no later than May 1 each year.**

City of Wilsonville
Stormwater Management Coordinator
29799 SW Town Center Loop
Wilsonville, OR 97070
(Stormwater Facilities Maintenance Plan Exhibit B Stormwater Maintenance and Access Easement)

_____
Name of Development

Contact _____
Telephone _____
Mailing Address _____

Location
Tax Lot _____
Street Address _____

Facilities to be maintained
_____ Trapped catch basin(s) (number of each)
_____ Pollution control manhole(s) (number of each)
_____ Outlet control manhole(s) (number of each)
_____ Detention pond(s); ____ tank(s) (number of each)
_____ WQ pond(s) swales; ____ MH(s); ____ vault(s); ____
All other facilities as described on plans _____

Inspection Date _____

Describe inspection, maintenance, repair or replanting _____

_____

_____

_____

_____

_____

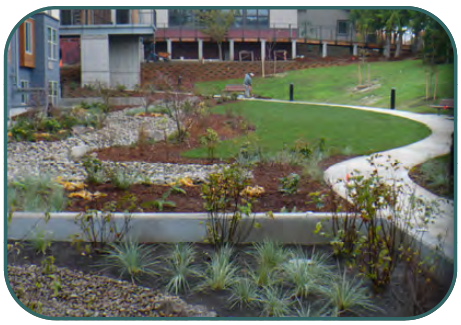
(Attach invoices for work performed) (Continue above on additional sheet if needed)

Owner, Owners or their Representative Signature _____

Date _____

SEDIMENT REMOVAL AND DISPOSAL

FACILITIES AND SYSTEM COMPONENTS THIS APPLIES TO



Vegetated Facilities: ecoroofs, infiltration basins, planters, ponds, swales, trees, vegetated filters, and created wetlands.

Structural Facilities: catch basins, curb cuts, inlets, manufactured facilities, piping, sedimentation manholes, and vaults.

Pervious Pavement: porous concrete or asphalt, permeable pavers.

IMPACT ON FACILITY PERFORMANCE

The purpose of a stormwater treatment facility is to remove pollutants, including suspended solids, by capturing sediment. Sediment can include dirt, leaves, and litter. These materials can restrict or clog the facility. Timely removal of sediment will improve infiltration rates, water quality, and help prevent clogging and flooding.

WHAT TO LOOK FOR

Check the depth of accumulated sediments. Sediment markers can be placed in the facility to help identify depths. Remove sediment when:

Vegetated Facilities:

- Sediment is 4" deep,
- Sediment depth is damaging or killing vegetation, or
- Sediment is preventing the facility from draining within a 24-48 hour period.

Structural Facilities:

- At least once a year, or
- When the basin is half full of sediment.

Pervious Pavement:

- Sediment is preventing the facility from draining in 24 hours.

WHAT TO DO

Often sediment can be removed by hand. Large facilities and underground facilities will need to be cleaned with heavy equipment by trained professionals.

- Remove sediment during dry months when it is easier to remove, weighs less, and creates fewer secondary environmental impacts (such as wet sediment running off the site).

NOTE: It is illegal to hose sediments through your system.

Doing it yourself

Vegetated Facilities:

- Use rakes and shovels to dig out accumulated sediment.
- Avoid damage to existing vegetation.
- If sediment is deep, plants may need to be removed in order to excavate sediment.
- Reseed and mulch disturbed areas to prevent erosion.
- Excavate sand or gravel and clean or replace.

Doing it yourself (continued)

Structural Facilities, Dispersion Trenches and Pervious Pavement:

- Catch Basins: Clean debris off the grate and bars. Lift the grate and use a bucket to remove water and a shovel to dig out sediment.
- Curb cuts, piping and other conveyance facilities: Use a shovel, router, air hose or other dry method to clear sediment and debris.
- Dispersion Trenches: Excavate sand or gravel and clean or replace.
- Pervious Pavement: Remove accumulated sediment from the surface with a dry broom, vacuum system, or other hand tools.

Hiring Professionals

Cleaning certain facilities will require professional assistance.

- Underground facilities such as manholes, and manufactured facilities must be cleaned by a vactor truck. Do not enter these facilities. They are defined by the Oregon Occupational Safety and Health Division as confined spaces and require proper certification to enter.
- Certain components such as collection basins, piping or pervious pavement systems may require vacuuming with a vactor truck or street sweeping equipment.

DISPOSAL

When deciding how to dispose of sediment, you need to consider the types of activities and pollutants on site. Sediment from commercial or industrial sites is usually not considered hazardous waste. However, as the generator of this waste you are responsible for deciding how to properly manage the removed solids.

Contaminated Water and Sediment

Catch basins and stormwater facilities in areas used for chemical or hazardous waste storage, material handling or equipment maintenance may collect the chemicals used in these activities from spills or via stormwater runoff. If you observe an oily sheen, odors, discoloration, or other signs of pollution, hire a professional laboratory or sampling firm to assess whether the material needs specialized hauling, treatment or disposal to comply with Oregon State Department of Environmental Quality (DEQ) rules. If you need assistance deciding whether the solids should be managed as hazardous waste, contact DEQ.

Non-Contaminated Water and Sediment

If the pollutant load is non-hazardous, water may be spread across vegetation onsite. Let the solids dry out, then properly dispose of them. Temporary erosion control measures may be needed to contain the material onsite. Dry materials may be reused elsewhere on your site, may be eligible for reuse by others, or can be disposed of at a designated solid waste facility.

REDUCING SEDIMENT ACCUMULATION AND POLLUTION IN YOUR FACILITY

- Minimize outside sources of sediment, such as eroding soil upstream of your facility.
- Sweep paved areas on your property regularly.
- Make sure chemical and waste storage areas are not exposed to rainfall and stormwater runoff.
- Don't let water from washing vehicles or equipment drain to your stormwater facility.

RESOURCES

City of Wilsonville Public Works Standards: www.ci.wilsonville.or.us/Index.aspx?page=127
Go to *Important Links* at the bottom of the page and click on *Public Works Construction Standards 2006* (section 301.6.00 Operations and Maintenance Req.)

Environmental Protection Agency: www.cfpub.epa.gov/npdes/home.cfm?program_id=6

Department of Environmental Quality: www.oregon.gov/DEQ

Private Maintenance Companies (listed below are just a few examples of companies that provide maintenance services, more companies are available)

- Clearwater Environmental Services in Wilsonville (503) 582-1951
- River City Environmental in Portland (503) 252-6144
- Bravo Environmental NW in Portland (503) 261-9800

Stormwater runoff has substantial impacts on the water quality and habitat that fish depend on. By reducing those impacts, we are taking direct action on behalf of threatened species as well as other fish and wildlife that are under stress.

VEGETATION MANAGEMENT

FACILITIES THIS APPLIES TO

Vegetated Facilities: ecoroofs, infiltration basins, planters, ponds, swales, trees, vegetated filters, and created wetlands.

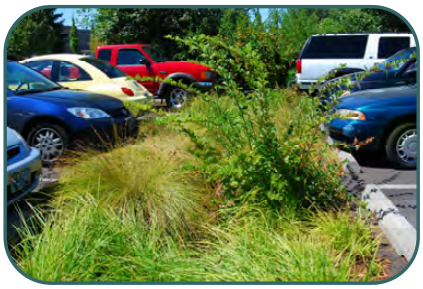
IMPORTANCE TO FACILITY PERFORMANCE

Plants play an important role in stormwater facilities. They absorb water, improve infiltration rates of soil, prevent erosion by stabilizing soil, cool water, and capture pollutants. Plants create habitat for birds and other wildlife and provide aesthetic value to a property. Proper maintenance of vegetation improves the appearance and performance of your facility. Your facility must be kept in accordance with the original landscape design.

WHAT TO LOOK FOR

When identifying maintenance needs it is helpful to have a copy of your landscape plan, this shows the plants you are required to have in your facility. Facilities should be checked for maintenance needs quarterly for the first two years and once a year after that.

Facility needs maintenance when:



- Areas of soil are bare.
- Vegetation is buried by sediment.
- Vegetation appears unhealthy or has died.
- Nuisance and invasive plants are present.
- Vegetation is compromising the facility's structure by blocking inlets or outlets, or roots are intruding into a component of the facility.
- Dropped leaves and other debris are contributing to sediment accumulation or are blocking inlets or outlets.

WHAT TO DO

Maintenance activities can easily be incorporated into existing site landscape maintenance contracts. Vegetation can be maintained with a formal or more natural appearance depending on your preference.

General Maintenance

- Remove dropped leaves, dead plants, and grass and other plant clippings. Plant debris adds nutrient pollution as it breaks down, and can clog facility piping and reduce infiltration.
- Avoid using fertilizers, herbicides, or pesticides in the facility. These products add to the pollution problems the facilities are designed to remedy.
- Use mulch to inhibit weed growth, retain moisture, and add nutrients. Replenish when needed. Ensure mulch does not inhibit water flow.
- Irrigate all new plantings as needed for the first two years.

Caring for wanted vegetation

Facility owners are responsible for maintaining healthy vegetation and must replace any plants that have died or been removed.

- You are required to maintain vegetation to the density approved on your landscape plans or specified in the City's Public Works Standards.
- Replant with vegetation approved for use in the original planting plan or from the recommended plant list in the City's Public Works Standards.

Caring for wanted vegetation (continued)

- Plant in late fall or early spring so plant roots can establish during the cool, rainy seasons, before summer.
- Amend and aerate compacted soils before replanting by adding compost to increase nutrients and enhance soil texture.
- If plants are not surviving, determine the reason for the plant die-off. Survivability may be improved by planting vegetation better suited for the site conditions or by irrigating more. You may need to test planting bed soils for pH, moisture, and other factors such as nutrient levels, soil structure, and organic matter content.

Mowing

- Grassy facilities are designed for routine mowing. Mow at least twice a year.
- Grass should be mowed to keep it 4" to 9" tall. Grass that is at least 4" tall captures more pollutants and is hardier. Do not allow grass to become a fire hazard.

Nuisance and unwanted vegetation

- Remove nuisance and invasive vegetation, such as Himalayan blackberry, English ivy and reed canarygrass, before it goes to seed in the spring. Do additional weeding in the fall. A list of nuisance plants can be found in the Portland Plant List (see below).
- Immediately remove vegetation that is clogging or impeding flow into the facility.
- Remove potentially large and deep-rooted trees or bushes when they might impede the flow path or compromise facility structures.
- Provide ground cover on any dirt exposed by vegetation removal.

Wildlife

Vegetated facilities create habitat, especially for birds. The Migratory Bird Treaty Act protects all native bird species. Birds and other animals will generally adjust to human activity. However, there are simple measures that should be taken to avoid disturbance:

- Avoid maintenance during bird nesting season from early March to late July. Prune and mow during late summer. Many baby birds will spend some time on the ground after leaving a nest.
- Walk the site before you do maintenance. Look for nests, burrows and animals in the facility. Reroute around animal areas by at least a few yards.

RESOURCES

Clackamas County Resources:

Clackamas County Soil and Water Conservation District: www.conservationdistrict.org

Plant Identification:

Native Plant Society: www.npsoregon.org

Master Gardeners: www.extension.oregonstate.edu/mg

Native Plant Nurseries:

Native Plant Nursery: www.plantnative.org

EROSION, BANK FAILURE, CHANNEL FORMATION

FACILITIES THIS APPLIES TO

Vegetated Facilities: ecoroofs, infiltration basins, planters, ponds, swales, trees, vegetated filters, and created wetlands.

IMPORTANCE TO FACILITY PERFORMANCE

Stormwater flowing through a facility can cause erosion. Erosion can increase sediment build up, clog outlets, reduce water quality benefits, add to pollution and cause facility components to fail. Eroded channels create an easy path for water to travel down reducing the ability of the facility to filter pollutants and infiltrate water.

WHAT TO LOOK FOR

Any area with erosion more than two inches deep needs maintenance. Signs of erosion and common locations:

- The formation of flow restricting channels in the bottom of the facility, around inlet pipes and curb cuts, or at overflows.
- Undercutting, scouring, and slumping along banks or berms.
- Channels and undercutting through check dams. (check dams are small berms built across a facility to slow water and create small areas of ponding).

WHAT TO DO

- Fill the eroded area with soil, compact it lightly, and cover with mulch, compost, seed, sod, or other erosion prevention materials.
- Plant banks with deep or heavily rooted plants to permanently stabilize soil.
- Install or repair structures designed to dissipate energy and spread flow, such as splash blocks on downspouts, or riprap around inlet pipes and curb cuts. See the City's Public Works Standards for requirements.
- If erosion continues to be a problem, consult a professional to determine the cause and a solution.
- Replant in accordance with the landscape plan.

STRUCTURAL DEFICIENCIES

FACILITIES THIS APPLIES TO

Most stormwater facilities have some structural components. Some facilities such as vaults, drywells, and sediment manholes are completely structural. In vegetated facilities, structural components often control how water enters, travels through, or exits a facility. Common structural components include:

- Inflow and outflow pipes, curb cuts, and trenches.
- Valves, orifices, trash racks, and pipes.
- Concrete, metal, and plastic structures and components such as curbs, retaining walls, and manholes.
- Manufactured devices such as filter cartridges.
- Earthworks such as embankments, check dams, dikes, berms and side slopes.
- Riprap and other flow spreading elements.
- Access roads, gates and signs.

IMPORTANCE TO FACILITY PERFORMANCE

These elements need to be in good working order to route flows into a facility and for the facility to function properly.

WHAT TO LOOK FOR

Look at the general condition of these elements. Do they need repair or replacement? Are they still properly aligned? Look for:

- cracks, scratches, dents, rust, or other conditions of wear.
- loose fittings, broken or missing components.
- insufficient oil/grease for moving parts.
- appropriate gravel cover or bedding to support the structures.
- misaligned parts or other impediments to the component's ability to still pass flow.

MAINTENANCE

- Immediately repair or replace any major damage to prevent catastrophic failure. This includes any structural component that is cracked, loose or askew. You may need to consult a professional engineer or hire a trained contractor to design and perform any repairs. Refer to page 10 for a list of resources.
- Minor damage such as dents, or rust spots may not need immediate replacement but should be monitored.
- Maintain access to the facility by keeping the access route open and structurally sound, fence gates and vault lids oiled and locks functioning. Access must be available in an emergency.

PONDING WATER

FACILITIES THIS APPLIES TO

Vegetated Facilities: dry ponds, infiltration basins, planters, rain gardens, sand filters, swales, created wetlands, and vegetated filter strips.

Structural Facilities: manufactured facilities and pervious pavement.

NOTE: Some facilities are specifically designed to always hold water such as: wet ponds, spill control manholes, and sedimentation manholes.

IMPORTANCE TO FACILITY PERFORMANCE

Most facilities are designed to drain in a certain amount of time. This varies from 2 to 48 hours depending on the type of facility. This time is stated in the Operations and Maintenance plan for the type of facility. Ponding water is usually a sign that the facility's outlet is clogged or it is not infiltrating properly.

WHAT TO LOOK FOR

- clogging of overflows or outlets with debris, trash or other obstructions.
- fine sediments filtering into the soil or other filtration media (like sand or gravel) that can prevent proper infiltration.
- water that has remained ponded for more than 48 hours.

MAINTENANCE

- For surface facilities, first try raking the top few inches of soil to break up clogged sections and restore water flow.
- Clean out overflows and outlets with hand tools, if possible. Difficult or hard to access blockages may require a professional contractor.
- Identify sources of sediment and debris to prevent them from entering the facility. Simple actions like sweeping a parking lot regularly can keep sediment out of facilities.
- Make sure the facility has enough vegetation. Vegetation absorbs water and roots help keep soil loose so it can infiltrate water.

For more thorough instructions on removing sediment, see the "Sediment Removal and Disposal" section of this handbook. Sediment accumulated in stormwater facilities may be considered hazardous waste and must be handled and disposed of properly.

If ponding still occurs, contact a landscape architect, professional engineer or trained contractor for more assistance.

PESTS


Nutria photo by NDomer

FACILITIES THIS APPLIES TO

All types of stormwater facilities

IMPORTANCE TO FACILITY PERFORMANCE

Mosquitoes can breed in ponded or other stagnant water. Vegetated areas can be attractive habitat for rats, nutria, beaver, and a variety of birds and amphibians. While some species are desirable, others can be public health or nuisance concerns. In particular, mosquitoes and rats can breed quickly and cause a public health hazard if not removed. The presence of pests does not necessarily impact the ability of your facility to treat and manage stormwater but may indicate maintenance needs, such as lack of proper infiltration.

WHAT TO LOOK FOR

- Check for mosquito larvae in any system with open, slow, or non-moving waters - especially during warmer weather. Larvae look like tiny wiggling sticks floating perpendicular to the water's surface.
- Look for nutria, rat, and other animal droppings year round. Also check for structural indicators such as beaver dams and rodent holes and burrows.

WHAT TO DO

Mosquitos

- The best way to avoid breeding mosquitoes is to prevent ponding water. Mosquitoes need standing water to lay their eggs, and for their larvae and pupae to develop. Most stormwater facilities are designed to drain in at least 48 hours. If your facility is not draining properly see the "Ponding Water" and "Sediment Removal and Disposal" sections of this handbook.
- As a temporary control for mosquitoes, the county or other licensed professionals can apply pesticides to kill mosquito larvae in the water or adult insects in the air.

Rats

Rats need shelter, food and water to survive.

- Remove plant debris that may provide shelter for rats from the facility.
- Remove fruits and nuts that fall to the ground.
- Fill in burrows.
- Trap and remove individual animals.

Other Wildlife Other non-native and invasive animal species may take up residence in your facility. Contact the Oregon Department of Fish and Wildlife (ODFW) to help identify these species and suggest removal processes. Permits from ODFW are required to capture and relocate native wildlife. Some common non-native species are:

- Opossum
- Eastern gray squirrel
- Nutria
- Bullfrog
- Fox squirrel
- Eastern cottontail
- Egyptian goose
- Red-eared slider turtle
- Snapping turtle

PEST RESOURCES

Rats and mosquitoes:

Clackamas County Vector Control (includes Washington County)
www.clackamas.us\vector
(503) 655-8394

Other pest issues:
Look in yellow pages or on the internet under "Pest Control"

Other Wildlife:
Oregon Department of Fish and Wildlife
www.dfw.state.or.us/wildlife/
(503) 947-6000 or (800) 720-6339

POLLUTION YOU CAN SEE OR SMELL

FACILITIES THIS APPLIES TO

All types of stormwater facilities.

IMPORTANCE TO FACILITY PERFORMANCE

Stormwater facilities often collect a variety of trash and debris. Trash and debris, especially floating debris, can clog pipes or treatment media. It can also cause odors through decay or by collecting spilled or dumped materials.

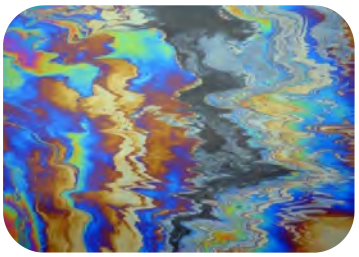
Stormwater facilities are designed to help prevent pollutants from entering rivers and streams. Any visible water quality pollutants may wash out of the facility spreading the pollution problem.

WHAT TO LOOK FOR

- Check monthly for Trash and debris.

Any unusual or unpleasant smells from sources such as:

- Natural plant decay.
- Dying plants trapped under sediment.
- A spill or a leak (e.g., gasoline or sewage).



Visible pollution such as:

- Sheens
- Turbid (cloudy) water
- Discoloration, or
- Other pollutants on the surface of the water.

Pollution You Can See And Smell (continued)

WHAT TO DO

- Regularly remove trash and plant debris.
- Remove accumulated sediment (see "Sediment Removal and Disposal" in this manual).
- Make sure inlets and outlets are not clogged.
- Identify the source of trash, debris or pollutant, such as a spill, leak, or illicit discharge.
- If there is evidence of a spill or leak, contact a professional laboratory or sampling firm to assess whether the material needs specialized removal, treatment, and disposal. Use trained professional staff for any cleanup and remediation.

SAFETY

In addition to keeping the facility in good working order, maintenance should also strive to meet safety and aesthetic goals that benefit the community and protect your site workers. Consider establishing maintenance triggers and practices that respond to the following issues below. Keep in mind the safety of both the employees who maintain your facility and the general public.

WHAT TO LOOK FOR

Site Conditions

Conditions, such as steep slopes, slick surfaces, and vegetation debris, can create a falling hazard to employees and visitors.

Public Safety

Some stormwater facilities, such as ponds and created wetlands, can be "attractive nuisances" attracting undesirable activity, vandalism, or use that could be harmful to public safety. Consider the safety features now in place at your facility.

WHAT TO DO

- Use barrier plantings or fencing to bar entry into the facility area.
- Install road bollards, lighting, and signage to discourage illegal dumping.
- Avoid maintaining facilities in wet weather to reduce the risk of injuries from slipping. Always make sure that appropriate safety gear (e.g., harness, gloves, face shields, safety line) is used.
- For underground facilities, avoid entering anything defined as a confined space. Vaults, deep ponds, manufactured facilities or manholes are examples of confined spaces. These areas require special permits, training and entry techniques. Some can be inspected and cleaned from above without entering. Always use caution when working with underground facilities. You are legally required to meet Oregon Occupational Safety and Health Division (OR-OSHA) requirements for such activities.

RESOURCES

Confined space entry:

OR-OSHA (confined space entry requirements)
www.orosha.org/subjects/confined_spaces.html
(503) 229-5910

PAYING FOR MAINTENANCE

Specific maintenance costs depend on the characteristics of the facility, the site, and the area draining to the facility. The general rule of thumb is that annual maintenance costs will be 5 to 10% of the facility's total capital cost. Routine, scheduled maintenance can help keep overall costs down by addressing problems before they require major attention. Contact your stormwater system manufacturer for information about your system.

FINANCING MAINTENANCE

You need to determine how you will finance your maintenance needs. A facility maintenance fund is recommended for both capital maintenance procedures (e.g., facility replacement and non-routine maintenance, such as sediment removal, facility component repair or replacement, major replanting, or safety structure construction) and operating maintenance procedures (routine activities such as facility inspection, debris removal, and vegetation management). For homeowner associations, this could be a portion of homeowner fees or a specific assessment.

HOW MUCH TO SAVE

- An average 5 to 10% per year of the facility's capital cost for annual routine maintenance.
- A percentage of the non-routine maintenance costs per year (i.e. for sediment removal, vegetation replacement) based on the needed frequency. For example, if the facility is designed to need mechanical sediment removal every five years, 20% of the total cost should be put aside each year.
- An additional 3 to 5% of the facility's capital cost per year for eventual facility replacement (based on the facility's life expectancy). Most of these facilities have a life expectancy of 25 to 50 years.

VEGETATED FACILITIES

- Most required routine maintenance (excluding major repair and replacement) is estimated to have an annual cost of $200 to $600 dollars per acre of facility, above current landscape maintenance costs. Costs can vary depending on the types and level of maintenance practices used.
- The cost and intensity of maintenance activities are usually higher during the two-year plant establishment period. During this time, plants will need additional watering and plants that die will need to be replaced.

WHERE TO GET MORE ASSISTANCE

City of Wilsonville Natural Resources Program
www.ci.wilsonville.or.us/Index.aspx?page=91
(503) 682-4960

City of Wilsonville Public Works Standards:
www.ci.wilsonville.or.us/Index.aspx?page=127 Go to *Important Links* at the bottom of the page and click on *Public Works Construction Standards 2006* (section 301.6.00 Operations and Maintenance Req.)
(503) 682-4092

HIRING CONTRACTORS

Professional maintenance services phone book/internet references:

Vegetation Management:

- "Landscape Contractors"

Sediment Removal and Disposal:

- "Sewage," or
- "Waste Disposal"

Facility Alterations:

- "Landscape Architects" or
- "Engineers - Civil"

Manufactured Facilities:

- Find the specific manufacturer

CONFINED SPACE ENTRY

Oregon Occupational Safety and Health Division (OR-OSHA):
www.orosha.org/subjects/confined_spaces.html
(503) 229-5910

PEST RESOURCES

Rats and mosquitoes:

Clackamas County Vector Control (includes Washington County)
www.clackamas.us\vector
(503) 655-8394

Other pest issues:
Look in yellow pages or on the internet under "Pest Control"

Other Wildlife:
Oregon Department of Fish and Wildlife
www.dfw.state.or.us/wildlife/
(503) 947-6000 or (800) 720-6339

Portland Audubon Wildlife Care Center
Help with injured animals and animal identification questions:
www.audubonportland.org
(503) 292-0304

The Audubon Wildlife Care Center is the oldest and busiest wildlife rehabilitation facility in Oregon. Each year they treat over 3,000 wild animals for release back to the wild and respond to more than 15,000 wildlife related inquiries.

VEGETATION

Clackamas County Resources:

Clackamas County Soil and Water Conservation District:
www.conservationdistrict.org

Plant Identification:

Native Plant Society:
www.npsoregon.org

Master Gardeners:
www.extension.oregonstate.edu/mg

Native Plant Nurseries:

Native Plant Nursery:
www.plantnative.org

City of Wilsonville

29799 SW Town Center Loop E

Phone: 503-682-4960
Fax: 503-682-7025

www.ci.wilsonville.or.us

This brochure was prepared by the City of Wilsonville's Natural Resources Program staff.
March 2012
NOTE: A considerable amount of information was obtained from the City of Portland's Stormwater Management Facilities Operations and Maintenance for Private Property Owners guide.

OTHER WAYS TO PROTECT OUR STREAMS AND THE WILLAMETTE RIVER

In Your Home or Business

- Use nontoxic cleaners.
- Properly dispose of hazardous materials.
- Conserve energy: switch to compact fluorescent bulbs, turn down the heat, do the laundry with cold water, purchase energy-efficient appliances.
- Use water wisely: fix leaks, use low-flow showerheads, use only the water you need.

In Your Yard

- Plant native vegetation.
- Consider planting perennials versus annuals.
- Sweep instead of hose.
- Cover bare soil with mulch or plants.
- Compost yard debris.
- Disconnect downspouts (where appropriate).
- Use drip irrigation.

In and Out of Your Car

- Properly maintain vehicles.
- Wash vehicles where water is recycled.
- Drive less: use transit, bike, walk, or carpool.
- Recycle motor oil.
- Clean up spills or leaks.

In Your Community

- Volunteer for tree planting, cleanup, stream restoration, or invasive plant species removal projects.
- Report spills and illegal dumping (call 503-823-7180).
- Don't litter, and pick up litter when you see it.
- Pick up pet waste and put it in the garbage or toilet.

In Parks and Natural Areas

- Stay on designated hiking trails and biking areas.
- Keep dogs on leashes and away from the streambanks and water. Pick up pet

THANK YOU

for helping keep Wilsonville clean, healthy and sustainable and for stewarding this beautiful place that we all share.

Printed on recycled paper.

APPENDIX C – WEB SOIL SURVEY SOILS MAP

Map Scale: 1:2,660 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 18, Oct 27, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 1, 2019—Sep 12, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1A	Aloha silt loam, 0 to 3 percent slopes	C/D	13.2	48.2%
3	Amity silt loam	C/D	5.7	21.0%
25	Cove silty clay loam	D	2.6	9.4%
91A	Woodburn silt loam, 0 to 3 percent slopes	C	4.3	15.7%
91B	Woodburn silt loam, 3 to 8 percent slopes	C	1.6	5.8%
Totals for Area of Interest			**27.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

May 31, 2023

Re: **Submittal #3b - Supplement** (Re: Tree Assessment Updates)
DB22-0004 Boeckman Road Building W5

To: City of Wilsonville
Planning Division – Cindy Luxhoj AICP
29799 SW Town Center Loop East
Wilsonville, OR 97070

From: Bob Wells
Lance Mueller & Associates / Architects
130 Lakeside Ave. S., #250
Seattle, WA 98122

Dear Cindy,

This is in response to your 5/24/23 email request for a table summarizing the existing trees saved versus removed. Attached is revised sheets TR-1 and TR-2, revision 2, dated 5/30/23, which now includes the summary in the lower right of both sheets.

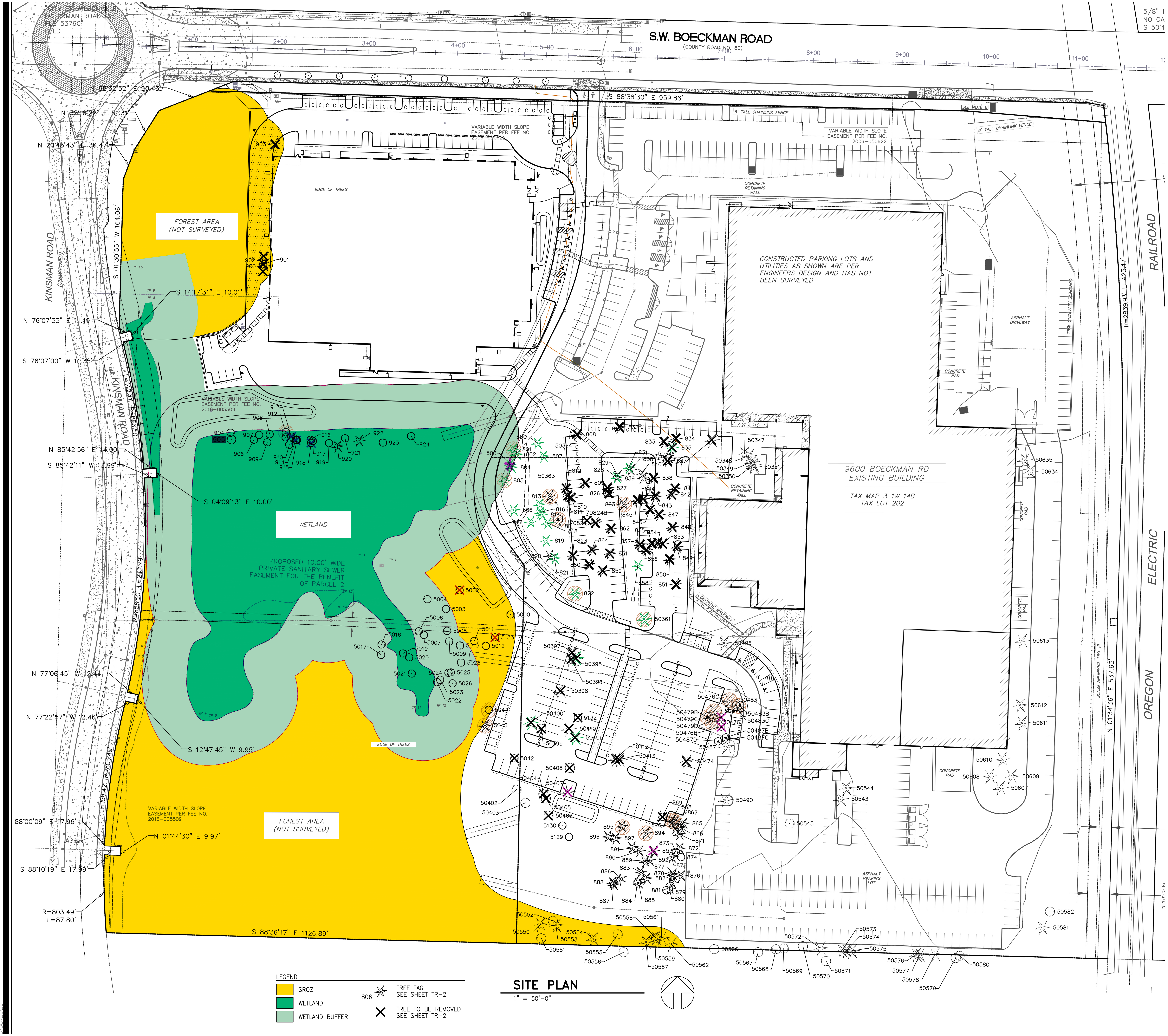
The submitted Tree Assessment Report is specific on condition with recommendations for each individual tree, but lacks a table with the overall summary total. Unfortunately, we could not get guidance in this effort from the arborist, who has closed his office for health reasons and is not available. So, the Architects created the requested summary based upon the arborist's Tree Assessment and the paving/grading plans. We used our judgement to make a few TR-1/TR-2 revisions when appropriate. For example:

1. We removed three trees from the count because the tree table labeled them "no tree". We'll get a more accurate count this way. (This is why the Tree Assessment lists approximately 176 trees, but our TR-1/2 totals list 173).
2. The arborist lists 93 trees retained in his text, but we don't have access to how he arrived at his count. Our TR-1 total lists 101 retained, which is our best estimate based on the arborist's description of the tree and the paving/grading plans.
3. At your request, we identify on the plan the retained "situational" trees that we are hoping to preserve with aeriation (aka, Retain B on table). We add specific language to the table regarding this, which is addition to the Tree Assessment Report.
4. For a few retained trees we revised the designation to receive aeriation when it appeared to have fill over portions of the roots. This seemed prudent for the best outcome.
5. Trees in the wetland or SROZ are not removed, even if they are in very poor condition or labeled "stumps".

The Tree Assessment Report is not revised. Consider the revised drawings TR-1 and TR-2 as updated summaries of the Tree Assessment Report.

Sincerely,

Bob Wells
Lance Mueller & Associates / Architects
130 Lakeside Ave. S., #250
Seattle, WA 98122


S.W. BOECKMAN ROAD
(COUNTY ROAD NO. 80)
KINSMAN ROAD
RAILROAD
OREGON
ELECTRIC
FOREST AREA (NOT SURVEYED)
WETLAND
PROPOSED 10.00' WIDE PRIVATE SANITARY SEWER EASEMENT FOR THE BENEFIT OF PARCEL 2
VARIABLE WIDTH SLOPE EASEMENT PER FEE NO. 2016-005509
VARIABLE WIDTH SLOPE EASEMENT PER FEE NO. 2006-050622
CONSTRUCTED PARKING LOTS AND UTILITIES AS SHOWN ARE PER ENGINEERS DESIGN AND HAS NOT BEEN SURVEYED
9600 BOECKMAN RD EXISTING BUILDING
TAX MAP 3 1W 14B TAX LOT 202
6' TALL CHAINLINK FENCE
CONCRETE RETAINING WALL
CONCRETE PAD
ASPHALT DRIVEWAY
ASPHALT PARKING LOT
EDGE OF TREES
S 88°38'30" E 959.86'
S 88°36'17" E 1126.89'
N 01°34'36" E 537.63'
LEGEND
SROZ
WETLAND
WETLAND BUFFER
806 TREE TAG SEE SHEET TR-2
TREE TO BE REMOVED SEE SHEET TR-2
SITE PLAN
1" = 50'-0"

TREE ASSESSMENT TOTALS

	TOTAL TREES – 173 (TREES 6612, 50363 AND 50364 ARE NOT COUNTED, NO TREE ON SITE)
X	TREES TO GET REMOVED – 72 TREES
A	TREES TO BE SAVED WITHOUT AN AERATION SYSTEM – 80
B	TREES TO BE SAVED WITH AN AERATION SYSTEM – 21 THESE "SITUATIONAL" TREES ARE IDENTIFIED AS LIKELY TO BE RETAINED, AND INSTALLATION OF AN AERATION SYSTEM OVER THE ROOTS, BEFORE FILL IS PLACED, IS PLANNED TO ASSIST WITH LONG-TERM SURVIVAL. THE TREES WILL BE RE-EVALUATED AT THE TIME OF SITE CLEARING TO ASSESS SUITABILITY FOR PRESERVATION AND WILL BE MONITORED DURING CONSTRUCTION TO MINIMIZE ROOT ZONE IMPACTS. IF, AS A RESULT OF CONSTRUCTION, ONE OR MORE OF THE TREES IS DETERMINED TO BE NO LONGER SUSTAINABLE, PER A CONDITION OF APPROVAL, THE APPLICANT MAY SEEK WRITTEN AUTHORIZATION FROM THE CITY FOR REMOVAL AND APPROPRIATE MITIGATION.

no.	revision	date
2	TREE ASSESSMENT SUPPLEMENT	5-30-23
1	SAVE TREES 5000 AND 50403	11-11-22
	SITE DESIGN REVIEW RESUBMITTAL	7-8-22

18003 job no.
EM drawn
BW checked
11-10-22 date

REGISTERED ARCHITECT · LANCE MUELLER · SEATTLE, WA. · 1491 · STATE OF OREGON

BUILDING W5
99XX SW Boeckman Rd.
Wilsonville, OR 97070

LANCE MUELLER & ASSOCIATES
ARCHITECTS AIA
130 LAKESIDE • SUITE 250 • SEATTLE, WA 98122 • (206) 325-2553

TREE REMOVAL PLAN

sheet TR-1

9600 Boeckman Rd Tree Assessment

	Tag No.	Dia. Inches	Species	Est Ht x Crown Width(ft)	Health	Condition	Comments	Retain A or B
	800	48	Ponderosa Pine	100+ x 37	Fair	Moderate & non-correctable defects	Partial lower crown due to crowding with a full upper crown. Co-dominant stems at 70'. Average annual twig growth.	A
	801	17	Ponderosa Pine	60 x 30	Poor	Moderate & non-correctable defects	Partial 1/3 very thin crown due to crowding. Below average annual twig growth. May improve with care.	B
	802	20	Ponderosa Pine	70 x 25	Fair	Moderate & non-correctable defects	Partial 3/4 crown due to crowding. Co-dominant stems at 50'. Average annual twig growth and moderate amount of large to medium deadwood in crown to remove.	A
X	803	22	Ponderosa Pine	15 x 0	DEAD	DEAD	Dead 15' tall stump/snag has bark sloughing off and several holes from woodpeckers. DEAD STUMP, REMOVE.	
	804	12	Ponderosa Pine	50 x 12	Good	Few & minor or correctable defects	Nearly full asymetric crown with average to above average annual twig growth.	A
	805	15	Ponderosa Pine	50 x 15	Fair	Moderate & non-correctable defects	Partial 1/2 crown due to crowding and below average annual twig growth.	B
	806	36	Ponderosa Pine	100+ x 42	Good	Moderate & non-correctable defects	Partial 1/3 crown due to crowding and average annual twig growth.	A
	807	32	Ponderosa Pine	100+ x 30	Fair	Moderate & non-correctable defects	Partial 3/4 crown due to crowding and average annual twig growth.	A
X	808	30	Douglas Fir	100+ x 46	Good	Few & minor or correctable defects	Full crown with good annual twig growth.	
X	809	27	Douglas Fir	100+ x 35	Poor	Moderate & non-correctable defects	Partial 2/3 crown due to crowding. Codominant stems at 30'. Large deadwood in lower crown should be removed if tree is retained. Below average annual twig growth.	
X	810	19	Douglas Fir	100+ x 25	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with below average annual twig growth.	
X	811	34	Douglas Fir	100+ x 40	Fair	Moderate & non-correctable defects	Partial 1/2 crown due to crowding and below average annual twig growth.	
X	812	29	Douglas Fir	90 x 25	Poor	Major defects or problems	Very thin partial crown, top broken out at 90' with very poor annual twig growth.	
	813	22	Douglas Fir	80 x 22	Poor	Major defects or problems	Partial 1/2 crown due to crowding and below average annual twig growth. Top broken out at 80'.	B
	814	11	Douglas Fir	35 x15	Poor	Major defects or problems	Partial very thin 1/8 crown due to crowding. Top 12' to 15' dead with very poor annual twig growth. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	A
	815	24	Ponderosa Pine	100+ x 18	Fair	Moderate & non-correctable defects	Full narrow asymetric crown with broken out top. Below average annual twig growth.	A
	816	17	Ponderosa Pine	90 x 10	Poor	Major defects or problems	Very small, 5% to 8% live crown ratio, with below average annual twig growth.	A
	817	34	Ponderosa Pine	100+ x 25	Good	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with good annual twig growth.	A
	818	25	Ponderosa Pine	100+ x 18	Good	Moderate & non-correctable defects	Partial 7/8 asymetrical crown due to crowding with good annual twig growth.	A
	818 B	20	Douglas Fir	100+ x 30	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average annual twig growth. Light amount of medium deadwood to remove if retaining.	B
	819	36	Ponderosa Pine	100+ x 30	Good	Moderate & non-correctable defects	Partial 2/3 crown due to crowding. Good annual twig growth.	A
	820	24	Douglas Fir	80 x 20	Fair	Moderate & non-correctable defects	Subdominant tree with partial 1/3 crown due to crowding. Below average annual twig growth.	A
	821	36	Ponderosa Pine	100+ x 25	Good	Moderate & non-correctable defects	Partial lower crown and full upper crown due to crowding. Good annual twig growth.	A
	822	36	Ponderosa Pine	100+ x 35	Good	Few & minor or correctable defects	Full asymetric crown with good annual twig growth. Nice specimen.	B
X	823	25	Douglas Fir	90 x 30	Very Poor	Major defects or problems	Very thin partial 1/2 crown due to crowding with very poor annual twig growth indicates declining health. May improve with care.	
X	826	30	Douglas Fir	100+ x 40	Fair	Moderate & non-correctable defects	Partial 2/3 asymetric crown due to crowding with below average annual twig growth. Large amount of medium to large deadwood in lower crown to be removed if retaining.	
X	827	15	Douglas Fir	75 x 28	Fair	Moderate & non-correctable defects	Subdominant tree with thin partial 1/3 crown due to crowding. Below average annual twig growth. Some medium to fine deadwood in lower crown.	
	828	36	Ponderosa Pine	100+ x 33	Good	Few & minor or correctable defects	Nearly full asymetric crown with average to above average annual twig growth. Large amount of medium to large deadwood in lower crown to remove if retaining.	A
	829	17	Douglas Fir	90 x 30	Fair	Moderate & non-correctable defects	Subdominant tree with partial 2/3 crown due to crowding and below average annual twig growth. Some medium deadwood in lower crown to remove if retaining.	A
	830	17	Douglas Fir	90 x 22	Fair	Moderate & non-correctable defects	Top broken out at 90' with partial 2/3 crown due to crowding. Below average annual twig growth.	A
	831	36	Ponderosa Pine	100+ x 38	Fair	Moderate & non-correctable defects	Below average annual twig growth. Some fine deadwood at branch tips indicates declining health which may improve with care.	A
X	832	30	Douglas Fir	90 x 50	Excellent	Moderate & non-correctable defects	Top broken out at 90' with full symetrical crown and good annual twig growth. Some medium to large deadwood in lower crown to remove if retaining.	
X	833	30	Douglas Fir	80 x 30	Poor	Major defects or problems	Fungal fruiting bodies (conks) on trunk indicate presence of internal decay. Top splits into crooked top at 45'. Tree leans southwest at 15° to 20° with partial 2/3 crown due to crowding. Below average annual twig growth. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	
X	834	30	Douglas Fir	75 x 38	Fair	Moderate & non-correctable defects	Subdominant tree with top broken out. Partial 3/4 crown due to crowding with below average annual twig growth.	
X	835	41	Ponderosa Pine	100+ x 50	Good	Moderate & non-correctable defects	Partial 2/3 lower crown due to crowding with full asymetric upper crown. Average annual twig growth with some medium to fine deadwood in crown to remove if retaining.	
X	837	33	Douglas Fir	100+ x 37	Good	Moderate & non-correctable defects	Partial lower crown with full asymetric upper crown due to crowding. Average annual twig growth. Some large, medium and fine deadwood to remove if retaining.	
X	838	14	Douglas Fir	55 x 25	Very Poor	Major defects or problems	Fungal fruiting bodies (conks) on trunk indicate presence of internal decay. Partial 1/3 crown due to crowding. Below average annual twig growth and trunk has long swoop. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	
	839	18	Douglas Fir	90 x 18	Poor	Moderate & non-correctable defects	Subdominant tree with top broken out. Thin partial 1/3 crown due to crowding with very poor annual twig growth. POOR SPECIMEN, MARGINAL FOR RETENTION.	A
	840	23	Douglas Fir	100+ x 25	Fair	Moderate & non-correctable defects	Thin partial lower and full upper crown with below average annual twig growth.	A
X	841	18	Douglas Fir	90 x 40	Fair	Moderate & non-correctable defects	Thin partial 1/3 crown due to crowding. Below average annual twig growth.	
X	842	24	Douglas Fir	100+ x 40	Fair	Moderate & non-correctable defects	Partial 1/2 crown due to crowding and average annual twig growth. Large amount of medium to large deadwood in lower crown to remove if retaining.	
X	843	30	Douglas Fir	100+ x 45	Fair	Moderate & non-correctable defects	Nearly full asymetric crown with below average annual twig growth. Large amount of large deadwood on west side of lower crown to remove if retaining.	
X	844	16	Douglas Fir	60 x 28	Poor	Major defects or problems	Subdominant tree with top broken out at 60', thin crown and below average annual twig growth.	
X	845	12	Douglas Fir	80 x 25	Poor	Major defects or problems	Top broken out at 80', partial 3/4 crown due to crowding. Below average annual twig growth.	B
X	846	21	Douglas Fir	100+ x 30	Fair	Moderate & non-correctable defects	Partial 1/8 & 1/4 crown due to crowding. Below average annual twigh growth with some medium to large deadwood to remove if retaining.	
X	847	20	Douglas Fir	90 x 30	Fair	Moderate & non-correctable defects	Partial 1/2 crown due to crowding with below average annual twig growth. Some medium to fine deadwood in crown.	
X	848	24	Douglas Fir	100+ x 40	Fair	Moderate & non-correctable defects	Partial 3/8 crown due to crowding with average annual twig growth. Some medium deadwood on west side of lower crown to remove if retaining.	
X	849	30	Douglas Fir	100+ x 42	Good	Moderate & non-correctable defects	Partial 1/2 lower and full asymetric upper crown with average annual twig growth. Large amount of large deadwood on northwest side of lower crown to remove if retaining.	
X	850	30	Douglas Fir	100+ x 40	Good	Moderate & non-correctable defects	Partial 1/2 lower and full asymetric upper crown with average annual twig growth. Large amount of large deadwood on north side of lower crown to remove if retaining.	
X	851	45	Douglas Fir	100+ x 42	Good	Few & minor or correctable defects	Full crown with average annual twig growth. Two stems at 55'. Prune to improve structure if retaining.	
X	853	8	Douglas Fir	65 x 12	Poor	Major defects or problems	Subdominant tree with thin partial 1/4 crown due to crowding. Below average annual twig growth. POOR SPECIMEN MARGINAL FOR PRESERVATION.	
X	854	16	Douglas Fir	100+ x 16	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with below average annual twig growth.	
X	855	22	Douglas Fir	100+ x 35	Fair	Moderate & non-correctable defects	Partial 1/8 & 1/8 lower crown with a nearly full upper crown. Below average annual twig growth.	
X	856	22	Douglas Fir	90 x 18	Poor	Moderate & non-correctable defects	Very thin partial 1/4 crown due to crowding with below average annual twig growth. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	
X	857	29	Douglas Fir	100+ x 30	Fair	Moderate & non-correctable defects	Partial 1/3 lower and full upper crown with well below average annual twig growth.	
	858	35	Ponderosa Pine	100+ x 25	Good	Moderate & non-correctable defects	Partial 1/2 lower with full upper crown. Average annual twig growth with some deadwood in lower crown to be removed if retaining.	A
X	859	40	Douglas Fir	100+ x 50	Good	Moderate & non-correctable defects	2 stems at 3' with a partial 3/4 crown due to crowding. Below average annual twig growth. Some deadwood in lower crown to remove if retaining.	
X	860	26	Douglas Fir	100+ x 18	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with below average annual twig growth. Some medium to fine deadwood to remove if retaining.	
X	861	24	Douglas Fir	100+ x 32	Fair	Moderate & non-correctable defects	Thin partial 1/4 crown due to crowding with below average annual twig growth.	
X	862	27	Douglas Fir	100+ x 35	Fair	Few & minor or correctable defects	Full asymetric crown due to crowding with below average annual twig growth.	
	863	17	Douglas Fir	100+ x 30	Fair	Moderate & non-correctable defects	Partial 1/3 lower and full upper crown. Below average annual twig growth.	B
X	864	14	Douglas Fir	95 x 14	Fair	Moderate & non-correctable defects	Partial 1/4 lower with full upper crown due to crowding. Below average annual twig growth.	
	865	22	Douglas Fir	100+ x 25	Good	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average annual twig growth. Moderate amount of medium to fine deadwood to remove if retaining.	A ~~B~~
	866	11	Douglas Fir	100+ x 20	Poor	Moderate & non-correctable defects	Partial 1/8 very narrow crown due to crowding with poor annual twig growth and a light amount of deadwood. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	A
	867	11	Douglas Fir	55 x 16	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with average annual twig growth. Some medium deadwood to remove if retaining.	B

9600 Boeckman Rd Tree Assessment

	Tag No.	Dia. Inches	Species	Est Ht x Crown Width(ft)	Health	Condition	Comments	Retain A or B
	868	26	Douglas Fir	100+ x 45	Fair	Moderate & non-correctable defects	Partial 1/3 lower and nearly full upper crown with average annual twig growth. Moderate amount of medium to large deadwood to remove if retaining.	B
X	869	13	Pacific Madrone	35 x 30	Good	Moderate & non-correctable defects	Wound on south side at 3'. Asymetrical crown with good leaf size and annual twig growth. Some structural issues could be improved with pruning.	
	870	24	Douglas Fir	100+ x 30	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with below average annual twig growth. Some medium deadwood to remove if retaining.	A
	871	28	Douglas Fir	100+ x 50	Good	Moderate & non-correctable defects	Partial 1/4 lower and full upper crown due to crowding. Average annual twig growth wth a large amount of medium to large deadwood to remove if retaining.	A
	872	12	Douglas Fir	70 x 25	Fair	Moderate & non-correctable defects	Subdominant tree with partial 1/4 crown due to crowding. Average annual twig growth. Light amount of medium to fine deadwood in crown.	A
	873	24	Oregon White Oak	85 x 30	Good	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with good annual twig growth and average leaf size. Some fine deadwood in upper crown suggests some insect or health issue that should be further investigated if it is retained.	A
	874	17	Oregon White Oak	85 x 30	Good	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average annual twig growth and average leaf size. Some large deadwood to remove if retaining.	A
	875	14	Douglas Fir	70 x 25	Fair	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with average annual twig growth. Light amount of medium deadwood to remove if retaining.	A
	876	30	Douglas Fir	100+ x 50	Good	Moderate & non-correctable defects	Partial 1/2 lower and full upper crown due to crowding with average annual twig growth. Some light deadwood in crown.	A
	877	22	Douglas Fir	100+ x 37	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with poor annual twig growth. Some medium deadwood to remove if retaining.	A
	878	10	Douglas Fir	70 x 16	Fair	Moderate & non-correctable defects	Subdominant tree with partial 1/3 crown due to crowding. Below average annual twig growth with some light deadwood in lower crown.	A
	879	13	Douglas Fir	85 x 16	Poor	Major defects or problems	Partial 1/2 very thin crown due to crowding with poor annual twig growth. Some light deadwood. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	A
	880	24	Douglas Fir	100+ x 28	Fair	Moderate & non-correctable defects	Partial 1/8 lower and 1/2 partial upper crown due to crowding. Average annual twig growth with some medium deadwood to remove if retaining.	A
	881	24	Oregon White Oak	85 x 43	Good	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with good annual twig growth and leaf size. 2 stems at 6.5.' Crown is off center and heavy to south. Prune to balance and improve structure.	A
	882	13	Douglas Fir	50 x 25	Poor	Moderate & non-correctable defects	Partial 3/4 crown due to crowding with very poor annual twig growth and with a moderate amountd of medium to fine deadwood. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	A
	883	23	Douglas Fir	100 x 16	DYING	DYING	Nearly dead. Top 40' is dead. Dying tree is a POTENTIAL HAZARD, DO NOT PRESERVE.	A
	884	23	Oregon White Oak	70 x 38	Fair	Moderate & non-correctable defects	Partial 1/2 crown due to crowding with average leaf size and annual twig growth. 2 stems at 6' and some medium deadwood to remove if retaining. Prune to improve structure.	A
	885	17	Douglas Fir	80 x 20	Poor	Major defects or problems	Weak connection at base and partial 1/4 crown due to crowding. Poor annual twig growth and some medium deadwood in crown. POOR SPECIMEN, DO NOT PRESERVE.	A
	886	24	Douglas Fir	95 x 25	Poor	Major defects or problems	Thin partial 2/3 crown due to crowding with poor annual twig growth. Clearly declining health with med to large deadwood in mid crown. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	A
	887	17	Douglas Fir	85 x 25	Poor	HAZARD REMOVE	Partial 1/2 crown due to crowding with major wound and exposed internal decay on south side from 0' to 6'. HAZARD REMOVE.	A
	888	17	Douglas Fir	75 x 25	Poor	Major defects or problems	Thin partial 1/3 crown due to crowding with very poor annual twig growth. Some medium to large deadwood in lower crown. Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
	889	17	Douglas Fir	80 x 25	Poor	Major defects or problems	Thin partial 1/4 crown due to crowding with very poor annual twig growth. Moderate amount of medium to fine deadwood throughout crown. Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
	890	21	Douglas Fir	100+ x 35	Poor	Major defects or problems	Small thin full crown due to crowding with poor annual twig growth. Large amount of large deadwood. Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
	891	21	Douglas Fir	100+ x 18	Poor	Major defects or problems	Small thin crown due to crowding with poor annual twig growth. Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
	892	21	Douglas Fir	85 x 25	Poor	Major defects or problems	Thin partial 1/3 crown due to crowding. Poor annual twig growth. Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
X	893	22	Douglas Fir	100+ x 25	Poor	Major defects or problems	Narrow thin nearly full crown with poor annual twig growth. Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	
	894	24	Douglas Fir	100+ x 35	Poor	Major defects or problems	Thin full crown with poor annual twig growth. Top is dying back and has fine deadwood throughout crown, Serious decline in health and condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	B
	895	22	Douglas Fir	100+ x 32	Fair	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with below average annual twig growth. Moderate amount of medium to large deadwood to remove if retaining.	B
	896	22	Douglas Fir	85 x 32	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average annual twig growth. Top is split with a dead side stem attached. Prune to remove deadwood and improve structure if retaining.	A
	897	27	Douglas Fir	100+ x 35	Poor	Major defects or problems	Thin full crown with dead top. Dying and serious decline in condition. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
X	900	13	Douglas Fir	65 x 20	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding. Below average annual twig growth.	
X	901	6	Scouler Willow	23 x 12	Very Poor	DYING HAZARD	Open wound exposes internal decay at 1' to 3'. Dead top and bark is sloughing off from 5' to top. DYING, HAZARD REMOVE.	
X	902	8	Douglas Fir	35 x 10	Fair	Major defects or problems	Subdominant tree with partial 1/8 crown due to crowding. Below average annual twig growth. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	
X	903	13	Douglas Fir	55 x 20-	Fair	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with below average annual twig growth.	
	904	14	Oregon Ash	45 x 21	Fair	Moderate & non-correctable defects	Nearly full narrow crown due to crowding. Top leans 15° to 25° to north. Average annual leaf size and twig growth. May require inspection and pruning to improve structure if retained.	A
	905	14	Oregon Ash	60 x 24	Good	Few & minor or correctable defects	Full upper and partial lower crown due to crowding. Good annual leaf size and twig growth.	A
	906	12	Oregon Ash	80 x 20	Good	Moderate & non-correctable defects	2 co-dominant stems at 30' with nearly full asymetric crown. Average annual leaf size and twig growth. Some medium size deadwood to be removed if area beneath it is developed.	A
	907	10	Oregon Ash	75 x 18	Fair	Moderate & non-correctable defects	2 co-dominant stems at 40' with partial, 2/3 crown due to crowding. Average annual leaf size and twig growth.	A
	908	15	Oregon Ash	70 x 30	Good	Moderate & non-correctable defects	Partial 2/3 crown due to crowding is off balance and heavy to north. Good annual leaf size and twig growth.	A
	909	11	Oregon Ash	75 x 20	Good	Few & minor or correctable defects	Nearly full narrow crown due to crowding. Good annual leaf size and twig growth.	A
	910	8	Oregon Ash	80 x 18	Good	Few & minor or correctable defects	Nearly full narrow crown due to crowding. Good annual leaf size and twig growth.	A
	911	8	Oregon Ash	80 x 15	Good	Few & minor or correctable defects	Nearly full narrow crown due to crowding. Good annual leaf size and twig growth.	A
	912	8	Oregon Ash	75 x 20	Fair	Moderate & non-correctable defects	Partial crown due to crowding with below average annual twig growth. Top broken out at 60' and may need pruning to improve structure.	B ~~X~~
X	913	11	Oregon Ash	20 x 5	Poor	Major defects or problems	Top broken out at 20' with a small amount of sucker growth from trunk. TREE DESTROYED, DO NOT PRESERVE.	~~X~~
X	914	7	Oregon Ash	28 x 2	Poor	Major defects or problems	Top broken out at 28' with a small amount of sucker growth from trunk. TREE DESTROYED, DO NOT PRESERVE.	~~X~~
	915	15	Oregon Ash	80 x 25	Fair	Few & minor or correctable defects	Nearly full asymetric crown with average annual leaf size and twig growth. Some stubs from ice storm broken branches.	A
	916	11	Oregon Ash	80 x 25	Good	Moderate & non-correctable defects	Partial crown due to crowding with good annual leaf size and twig growth. Off balance and heavy to north. Some stubs from ice storm broken branches.	A
	917	14	Oregon Ash	80 x 25	Good	Moderate & non-correctable defects	Partial crown due to crowding with good annual leaf size and twig growth. Off balance and heavy to north. Some stubs from ice storm broken branches.	A
X	918	5, 4	Common Hawthorne	30 x 20	Poor	Major defects or problems	Partial crown due to crowding. Off balance to west. INVASIVE SPECIES & POOR SPECIMEN, DO NOT PRESERVE.	~~X~~
	5000	15	Oregon White Oak	60 x 45	Good	Few & minor or correctable defects	Full crown with good annual leaf size and twig growth. Some medium to fine deadwood to remove.	A
X	5002	17	Douglas Fir	0 x 0	DEAD	DEAD	Broken off lower trunk. TAKEN DOWN & REMOVED.	~~B~~
	5003	48	Ponderosa Pine	100+ x 40	Good	Few & minor or correctable defects	Full crown with good annual twig growth. Some medium deadwood to remove.	A
	5011	9	Bird Cherry	50 x 15	Very Poor	Moderate & non-correctable defects	Partial very small crown due to crowding. Sapsucker damage has nearly girdled trunk. Large amount of deadwood. VERY POOR SPECIMEN, DO NOT PRESERVE.	A
	5012	13	Oregon White Oak	50 x 20	Fair	Moderate & non-correctable defects	Partial asymetric crown with below average annual twig growth and leaf size.	A
X	5042	27, 18	Oregon White Oak	85 x 75	Good	Moderate & non-correctable defects	2 stems at 30". Crown off balance to east with some medium and large deadwood to remove. Prune to balance and improve structure. Cable two stems together if retaining.	
	5043	48	Ponderosa Pine	100+ x 47	Good	Moderate & non-correctable defects	Full asymetric crown due to crowding with average annual twig growth. Some recently dead branches and some large deadwood throughout crown to remove if retaining.	B
	5044	14	Oregon Ash	90 x 37	Good	Moderate & non-correctable defects	Partial 3/4 crown due to crowding with good leaf size and annual twig growth. Some medium to fine deadwood throughout crown.	B
	5129	12	Oregon Ash	80 x 23	Fair	Moderate & non-correctable defects	Full asymetric crown with chlorotic leaves, below average leaf size and annual twig growth indicates current health problems. May improve with care.	A
	5130	14	Oregon Ash	80 x 40	Fair	Moderate & non-correctable defects	Full asymetric crown with below average leaf size and annual twig growth. Tree has some structural problems that can be improved with pruning.	A
X	5132	24	Oregon White Oak	0 X 0	DEAD	DEAD	15' stump lying on ground due to being toppled by winter ice storm.	
X	5133	23	Oregon White Oak	8 x 0	DEAD	DEAD	Trunk broken off at 8', only stump remains. REMOVE STUMP.	
X	6604	34	Douglas Fir	100+ x 45	Very Poor	Major defects or problems	Nearly full asymetric very thin crown with very poor annual twig growth. Tree in serious decline, likely due to saturated soil in wetland. Medium to fine deadwood throughout crown. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	
	~~6612~~		~~NO TREE~~			~~NO TREE~~	~~No tree at this location.~~	
X	6616	12	Oregon Ash	75 x 30	DYING	DYING HAZARD	Wounds extensive internal decay exposed from 0' to 7' across over 50% of circumference. DYING, HAZARD, REMOVE.	

9600 Boeckman Rd Tree Assessment

	Tag No.	Dia. Inches	Species	Est Ht x Crown Width(ft)	Health	Condition	Comments	Retain A or B
	6587	17	Oregon Ash	80 x 25	Fair	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with average annual leaf size and twig growth. Some large to medium deadwood to remove if area beneath it is improved.	A
	6597	11	Oregon White Oak	90 x 20	Fair	Moderate & non-correctable defects	Partial 1/8 & 1/8 crown due to crowding with average annual leaf size and twig growth.	A
X	50346	32	Douglas Fir	85 x 35	Very Poor	Dying Hazard	Thin partial 3/4 crown due to crowding with very poor annual twig growth. Top was broken out and remaining top is dying with large amount of deadwood throughout crown. Dying tree is a POTENTIAL HAZARD REMOVE.	
	50347	26	Douglas Fir	95 x 35	Good	Moderate & non-correctable defects	Partial lower and full upper crown due to crowding. Below average annual twig growth. Leans to northwest at 8° to 10°.	A
	50348	9	Douglas Fir	25 x 18	Fair	Moderate & non-correctable defects	Partial crown due to crowding with below average annual twig growth. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
	50349	34	Ponderosa Pine	100+ x 40	Good	Moderate & non-correctable defects	Partial lower and full upper crown with average annual twig growth. Top broken out and recently dead branches on north side indicates some potential health problem. May improve with care.	A
	50350	24	Douglas Fir	100+ x 40	Good	Moderate & non-correctable defects	Partial crown due to crowding with below average annual twig growth. Some medium to fine deadwood to remove if retaining.	A
	50351	35	Douglas Fir	100+ x 35	Fair	Moderate & non-correctable defects	Partial crown due to crowding with below average annual twig growth. Light amount of fine deadwood throughout crown.	A
	50361	41	Ponderosa Pine	100+ x 50	Good	Few & minor or correctable defects	Full crown with average annual twig growth. Moderate amount of medium to large deadwood to remove is retaining.	B
	~~50363~~	~~No Tree~~	~~NO TREE~~		~~NO TREE~~		~~No tree at this location.~~	
	~~50364~~	~~No Tree~~	~~NO TREE~~		~~NO TREE~~		~~No tree at this location.~~	
X	50395	36	Ponderosa Pine	100+ x 35	Good	Few & minor or correctable defects	Full crown with good annual twig growth. Some medium to large deadwood to remove if retaining.	
X	50396	19	Ponderosa Pine	75 x 20	Fair	Moderate & non-correctable defects	Partial 1/2 crown due to crowding with average annual twig growth. Some recently dead branches in crown.	
X	50397	19	Douglas Fir	75 x 30	Fair	Moderate & non-correctable defects	Subdominant tree with partial 2/3 crown due to crowding and good annual twig growth.	
X	50398	19	Douglas Fir	90 x 27	Fair	Few & minor or correctable defects	Full crown with below average annual twig growth.	
X	50399	21	Oregon White Oak	75 x 30	Good	Moderate & non-correctable defects	Full asymetric crown is off balance and heavy to south. Some large, medium to fine deadwood in crown. Prune to improve structure if retaining.	
X	50400	42	Ponderosa Pine	100+ x 45	Good	Few & minor or correctable defects	Full crown with average annual twig growth. Some medium to large deadwood to remove if retaining.	
	50402	15, 13	Oregon Ash	85 x 42	Good	Moderate & non-correctable defects	2 stems at 3', full asymetric crown is off balance to south. Some medium deadwood. Good leaf size and annual twig growth. Prune to improve structure and remove deadwood.	A
	50403	17	Oregon White Oak	80 x 35	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average leaf size and annual twig growth. Prune to improve structure and balance.	A
X	50404	17	Oregon White Oak	85 x 40	Good	Moderate & non-correctable defects	Full asymetric crown with average leaf size and annual twig growth. Some medium to large deadwood to remove if retaining.	
X	50405	12	Oregon Ash	70 x 27	Poor	HAZARD REMOVE	Large open wound that exposes internal decay from 0' to 3'. Partial crown due to crowding. Some large deadwood. Poor specimen and not sound due to decay. HAZARD REMOVE.	
X	50406	12, 9	Bird Cherry	65 x 30	Fair	Moderate & non-correctable defects	Full crown with 2 stems at ground. Thin crown, average size wilted leaves due drought and average annual twig growth. May improve with care.	
X	50407	24	Douglas Fir	100+ x 40	Fair	Moderate & non-correctable defects	Partial 1/2 lower crown and full upper crown. Average annual twig growth with large, medium and fine deadwood to remove if retaining.	
X	50408	15	Bigleaf Maple	60 x 40	Fair	Moderate & non-correctable defects	Full crown with dead top. Below average annual twig growth and average leaf size may be due to drought. Prune to remove deadwood.	
X	50409	32	Ponderosa Pine	100+ x 40	Good	Moderate & non-correctable defects	Partial 3/4 asymetric crown due to crowding with good annual twig growth. Some large, medium and fine deadwood to remove if retaining.	
X	50410	23	Douglas Fir	100+ x 42	Good	Moderate & non-correctable defects	Partial 7/8 asymetrical crown due to crowding with average annual twig growth. Some medium to fine deadwood.	
X	50412	15	Douglas Fir	100+ x 23	Fair	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with below average annual twig growth. Medium to fine deadwood to remove if retaining.	
X	50413	20	Douglas Fir	100+ x 30	Fair	Moderate & non-correctable defects	Partial 2/3 lower and full upper crown due to crowding with average annual twig growth. Some medium to fine deadwood to remove if retaining.	
X	50474	28	Douglas Fir	100+ x 35	Good	Few & minor or correctable defects	Full crown with below average annual twig growth. Moderate amount of medium to fine deadwood to remove if retaining.	
	50476	35	Douglas Fir	100+ x 45	Good	Few & minor or correctable defects	Partial 2/3 lower and nearly full upper crown with good annual twig growth. Moderate amount of large, medium and fine deadwood to remove if retaining.	B
X	50476 B	16	Douglas Fir	90 x 32	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with below average annual twig growth. Some medium to large deadwood to remove if retaining.	A
	50476 C	17	Douglas Fir	100 x 32	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with below average annual twig growth. Some medium to large deadwood to remove if retaining.	A
	50479	24	Douglas Fir	100+ x 35	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average annual twig growth. Moderate amount of medium to fine deadwood to remove if retaining.	B
	50479 B	11	Douglas Fir	60 x 16	Poor	Moderate & non-correctable defects	Subdomiant tree with partial 1/4 crown due to crowding with below average annual twig growth. Serious declining health with significant deadwood. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	B
	50479 C	7	Douglas Fir	50 x 12	Poor	Major defects or problems	Subdominant tree with 1/8 crown due to crowding with very poor annual twig growth. Seriously declining health with significant deadwood. POOR SPECIMEN, MARGINAL FOR PRESERVATION.	A
X	50479 D	6	Douglas Fir	35 x 0	DEAD	DEAD	DEAD TREE, REMOVE.	
	50483	25	Douglas Fir	100+ x 28	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with average annual twig growth. Moderate amount of medium to fine deadwood to remove if retaining.	B
	50483 B	25	Douglas Fir	100+ x 45	Good	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with below average annual twig growth. Moderate amount of medium to find deadwood to remove if retaining.	B
	50483 C	19	Douglas Fir	100+ x 28	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with below average annual twig growth. Some fine deadwood.	B
	50487	16	Douglas Fir	100+ x 25	Fair	Moderate & non-correctable defects	Partial 1/4 crown due to crowding with below average annual twig growth. Some fine deadwood.	A
	50487 B	18	Douglas Fir	100+ x 28	Fair	Moderate & non-correctable defects	Partial 1/3 crown due to crowding with below average annual twig growth. Some medium to large deadwood to remove if retaining.	A
	50487 C	7	Douglas Fir	25 x 10	Poor	Major defects or problems	Subdominant tree with 1/2 crown due to crowding and below average annual twig growth. Moderate amount of medium deadwood. POOR SPECIMEN MARGINAL FOR PRESERVATION.	A
	50487 D	22	Douglas Fir	100+ x 32	Fair	Moderate & non-correctable defects	Partial 2/3 crown due to crowding with below average annual twig growth. Moderate amount of medium to find deadwood to remove if retaining.	A
	50490	30	Douglas Fir	100+ x 40	Fair	Moderate & non-correctable defects	Full crown with below average annual twig growth. Moderate amount of medium to fine deadwood to remove if retaining.	A
	50496	41	Douglas Fir	100+ x 50	Good	Few & minor or correctable defects	Full crown with average annual twig growth. Some medium to large deadwood to remove if retaining.	A
X	70824	19	Douglas Fir	100+ x 35	Fair	Moderate & non-correctable defects	Partial 1/4 lower and full upper crown due to crowding. Below average annual twig growth with a moderate amount of medium to large deadwood to remove if retaining.	
X	70824 B	20	Douglas Fir	100+ x 35	Fair	Moderate & non-correctable defects	Partial 1/4 lower and full upper crown due to crowding. Below average annual twig growth with a moderate amount of medium to large deadwood to remove if retaining.	

Notes: Retain A = Retain without aeration, Retain B = Retain with aeration

TREE ASSESSMENT TOTALS

	TOTAL TREES – 173 (TREES 6612, 50363 AND 50364 ARE NOT COUNTED, NO TREE ON SITE)
X	TREES TO GET REMOVED – 72 TREES
A	TREES TO BE SAVED WITHOUT AN AERATION SYSTEM – 80
B	TREES TO BE SAVED WITH AN AERATION SYSTEM – 21 THESE "SITUATIONAL" TREES ARE IDENTIFIED AS LIKELY TO BE RETAINED, AND INSTALLATION OF AN AERATION SYSTEM OVER THE ROOTS, BEFORE FILL IS PLACED, IS PLANNED TO ASSIST WITH LONG–TERM SURVIVAL. THE TREES WILL BE RE–EVALUATED AT THE TIME OF SITE CLEARING TO ASSESS SUITABILITY FOR PRESERVATION AND WILL BE MONITORED DURING CONSTRUCTION TO MINIMIZE ROOT ZONE IMPACTS. IF, AS A RESULT OF CONSTRUCTION, ONE OR MORE OF THE TREES IS DETERMINED TO BE NO LONGER SUSTAINABLE, PER A CONDITION OF APPROVAL, THE APPLICANT MAY SEEK WRITTEN AUTHORIZATION FROM THE CITY FOR REMOVAL AND APPROPRIATE MITIGATION.

no.	revision	date
2	TREE ASSESSMENT SUPPLEMENT	5-30-23
1	SAVE TREES 5000 AND 50403	11-11-22
	SITE DESIGN REVIEW RESUBMITTAL	7-8-22

18003 job no.
EM drawn
BW checked
11-11-22 date

REGISTERED ARCHITECT — LANCE MUELLER — SEATTLE, WA. — 1491 — STATE OF OREGON

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TREE REPORT
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