Preliminary Technical Information Report

La Center School District Middle School
La Center, WA

Prepared for:

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PBS Project No. 71282.000

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CERTIFICATE OF ENGINEER

La Center School District Middle School

Preliminary Technical Information Report

The technical information and data contained in this report was prepared under the direction and supervision of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Prepared by: Justin R. Maynard, P.E.

Reviewed by: Elissa Peters, P.E.

SECTION A PROJECT OVERVIEW

The Project is located south of NE Lockwood Creek Road on parcels recently annexed by the City of La Center, Washington. The subject site, as currently proposed, includes three tax parcels with no assigned address(es) (209118000, 209120000, and 209119000), covering approximately 19 acres.

Proposed improvements include a new Middle School serving approximately 450 students near NE Lockwood Creek Road, along with all required parking, recreational facilities (including a track and field), and access roads and trails throughout the site.

The site location and general topography is shown in Figure 1.

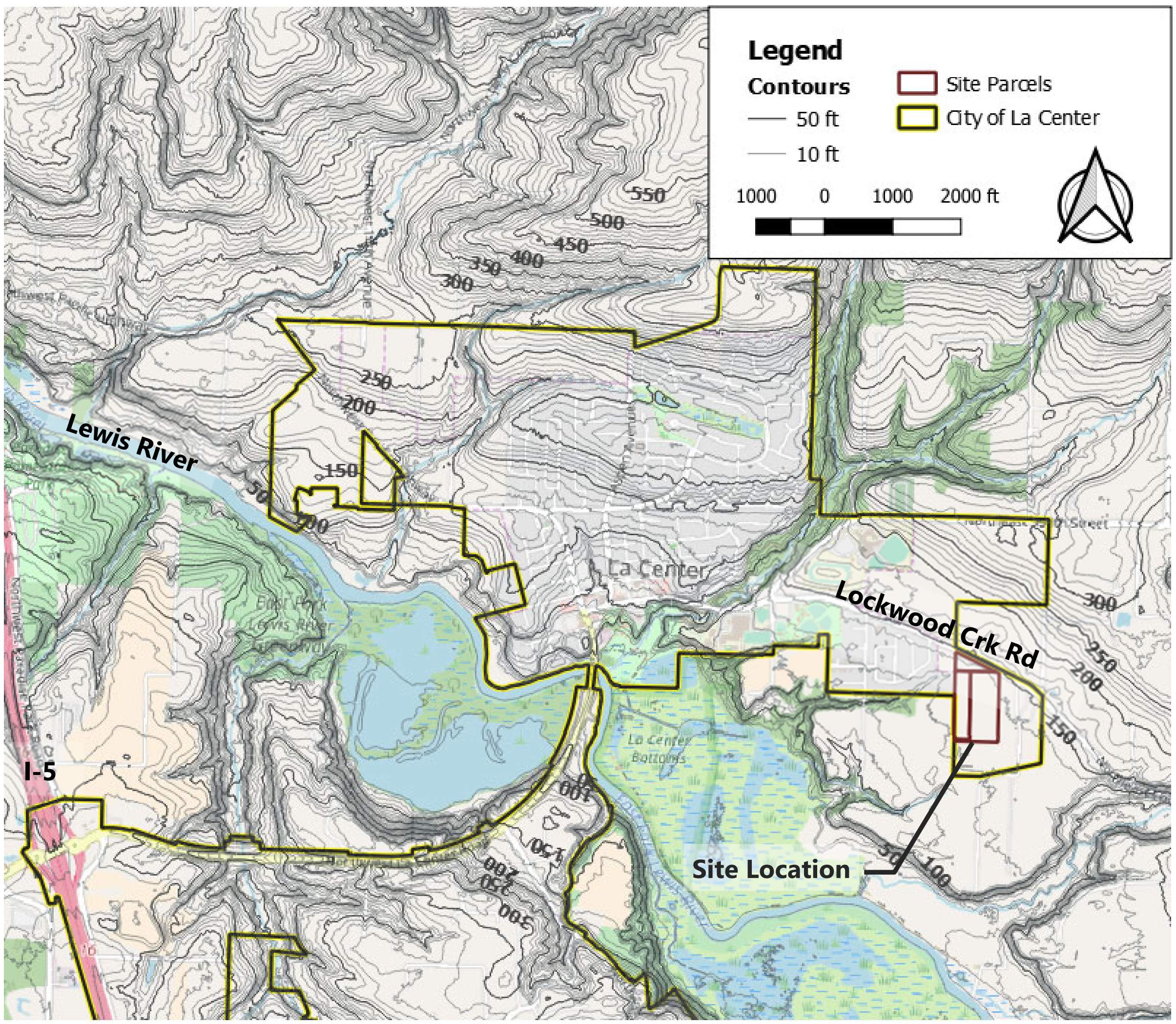


Figure 1: Project Site Vicinity Map

The site design has been developed around two large delineated wetland areas, which will not be impacted by construction activity. Three smaller wetlands have been identified on the northern, triangular parcel, two of which will require impact mitigation. Wetland buffer areas comprise approximately 3.9 acres of the site. Construction affects an overall area of approximately 10.35 acres on-site, 0.5 acre of frontage, and produces approximately 6.5 acres of new or replaced impervious surface. Existing site drainage is characterized by two outflows. Because drainage courses remain generally separate ¼ mile downstream of the two discharges, the drainage areas will be treated as separate threshold discharge areas (TDAs). Drainage on the north side of the site discharges west to a 12-inch pipe and to the adjacent overland flow course towards the stream west of the site (TDA #1). On the south side of the site, a separate wetland receives surface runoff and discharges to an unpaved access drive at the southwest corner of the site (TDA #2). Runoff from both discharge points is conveyed to Lewis River, approximately ½ mile downstream.

Though on-site tributary drainage areas of each discharge point will be altered, the development will largely keep existing drainage patterns in tact by utilizing detention ponds with controlled outflows in accordance with the Stormwater Management Manual for the Puget Sound Basin ("Stormwater Manual" - Washington Department of Ecology, 1992), which has been adopted by the City of La Center to govern stormwater management.

Bioretention facilities are proposed for water quality treatment, capturing runoff from pollution generating surfaces (the expanded frontage and parking lots) and all run-on to such surfaces from the surrounding site improvements (primarily landscaping and sidewalks). Pipe conveyance systems will carry runoff to detention ponds which will meet quantity control requirements, discharging to the existing pipe to the north and the existing wetland to the south.

A large drainage area north of NE Lockwood Creek Road is collected by roadside ditches that discharge through a 24-inch ductile iron culvert and an 8-inch CPP culvert onto the north end of the site and to the TDA #1 discharge point. Drainage through these two culverts will be conveyed through the site without entering pipe, detention, and/or bioretention facilities designed to manage runoff from site improvements. The proposed bypass culvert will maintain the same discharge point as existing conditions (the TDA #1 discharge).

This report addresses the collection, conveyance, water quality treatment, detention, and discharge of stormwater runoff for the Project

SECTION B APPROVAL CONDITIONS SUMMARY

Conditions of approval will be provided after the Type III Land Use application has been processed and City of La Center staff recommendations have been provided, and a public hearing takes place.

SECTION C DOWNSTREAM ANALYSIS

This project will assume undisturbed forest is the pre-development land use condition in the design of stormwater facilities. Therefore, no downstream analysis will be required per La Center Municipal Code (LCMC) Section 18.320.220 (2).(b) (Quantity Control – Hydrologic and Hydraulic Analysis).

SECTION D QUANTITY CONTROL ANALYSIS AND DESIGN

Infiltration has been ruled out as a feasible means of flow control due to the presence of high groundwater; therefore, the Project will utilize two detention facilities with flow control to meet discharge requirements.

D.1 Site Hydrology

Hydrologic calculations for development of quantity control and bypass facility design utilize site survey, GIS topography, geotechnical investigation, and site plans for curve number selection in accordance with the Stormwater Manual.

D.1.1 Site Soils Evaluation

A summary of Geotechnical site investigation is provided in Section G. According to Clark County's soil database, site soils are identified primarily as mildly sloped Gee Silt Loam (GeB) and Odne Silt Loam (OdB). In general, the site soils are categorized as Hydrologic Soil Group C and D for purposes of hydrologic and hydraulic modeling. This is due to the presence of high seasonal groundwater throughout the site. The off-site drainage to the site also includes some surface soils characterized as Hillsboro Silt Loam with varying steepness (HoA/HoB/HoC) and Gee Silt Loam with steeper slopes (GeD). For more detailed analysis of soil conditions, see the Project Geotechnical Report (Appendix G).

D.1.2 Drainage Basins (Off-Site)

The drainage area north of the site tributary to the two culverts across NE Lockwood Creek Road is shown in Figure 2.

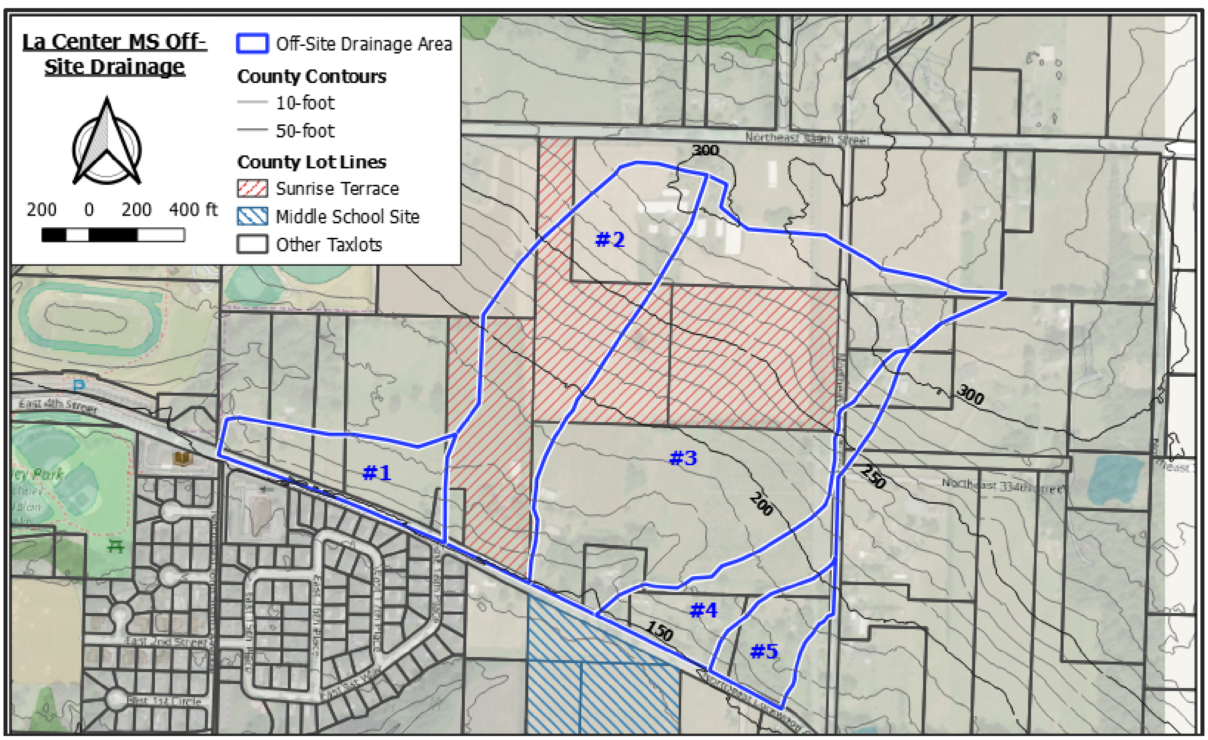


Figure 2: La Center Middle School Off-Site Drainage Area

This approximately 75-acre area drains to the ditch on the north side of NE Lockwood Creek Road, which conveys drainage to the 24-inch and 8-inch culverts that discharge to the Middle School Site. The modeled area consists of five subcatchments, delineated based on pre-development elevation data (representative of pre-settlement conditions).

The westernmost subcatchment (Subcatchment #1) consists mostly of vegetated hillside site with a small number of residential structures shedding into the ditch west of the Middle School. Subcatchments #2 and #3, the largest subareas, consist of single-family residential lots and the recently constructed Sunrise Terrace Subdivision, extending north from NE Lockwood Creek Road near East 18th Place, then east to NE 24th Avenue, including most of Parcel 209113000. Subcatchments #4 and #5 are smaller drainage areas shedding runoff from rural residential lots into the ditch near the northeast corner of the Middle School site.

While the recently developed subdivision includes a storm drain pipe network and detention basins that have most likely altered drainage patterns within off-site drainage areas, modeling of such systems is not available for this analysis. As such, this report assumes un-altered pre-development flow conditions were matched by the development in accordance with the LCMC and the 1992 Puget Sound Manual. Bypass systems have been designed based on these assumptions and are discussed in Section E.

D.1.3 Drainage Basins (On-Site)

Pre-development and post-development on-site drainage basins were delineated based on existing topographic contours and preliminary site grading plans. The site currently consists primarily grass pasture with a dense row of trees bordering the south property line. Except for existing roadway and wetland area, pre-developed conditions are modeled primarily as undisturbed forested land in accordance with the La Center Municipal Code (as shown in Table 1).

Table 1: Pre-Developed Land Cover Area (in Acres)

Land Cover	Curve Number	TDA #1	TDA #2
Lockwood Creek Rd	98	0.416	N/A
Undisturbed Forest	76	10.315	7.746
Wetland	100	0.184	0.567
Total Area		**10.915**	**8.313**

A developed condition area breakdown is provided in Table 2. Both Pre- and Post-Development drainage area figures are provided in Appendix B. While frontage improvements are not technically "on-site" areas, they will drain to pipe systems managing site improvement drainage. Therefore, NE Lockwood Creek Road is included in on-site analysis for the purposes of this study.

Table 2: Post-Developed Land Cover Area (in Acres)

Land Cover	Curve Number	TDA #1 (Northern Facility)	TDA #2 (Southern Facility)
Road/Sidewalk	98	0.713	N/A
Parking Lot/Sidewalk	98	1.212	0.911
Other Paved (Courtyard/Access Road/Track)	98	0.695	1.487
Building (Roof)	98	N/A	1.504
Bioretention/Landscape/Field	86	0.786	3.622
Gravel Road	96	N/A	0.132
Undisturbed	76	2.182	5.327
Wetland	100	0.092	0.567
Total Area		**5.680**	**13.549**

Hydrology for the drainage basins has been modeled using the Santa Barbara Urban Hydrograph method in HydroCAD software. The HydroCAD model also includes pipe system and detention pond hydraulics. Schematics of pre- and post-developed conditions, drainage sub-area parameters, and model results are provided in Appendix C.

D.2 Facility Sizing and Results

Detention basins are sized using HydroCAD to meet the requirements of the Stormwater Manual and City of La Center Municipal Code (LCMC) Section 18.320.220, such that the peak release rate for the two-, 10-, 25-, and 100-year design storms do not exceed the respective predevelopment discharge rates.

In accordance with the 1992 Puget Sound manual, the detention basins have been sized in the HydroCAD model, then adjusted by a volumetric correction factor. The post-development drainage area land cover is approximately 33% impervious, corresponding to a correction factor of about 23%, as shown in Figure 3. Detention facility sizes, post-adjustment, and parameters of the flow control outlet structures including invert elevation (IE) are summarized in Table 3.

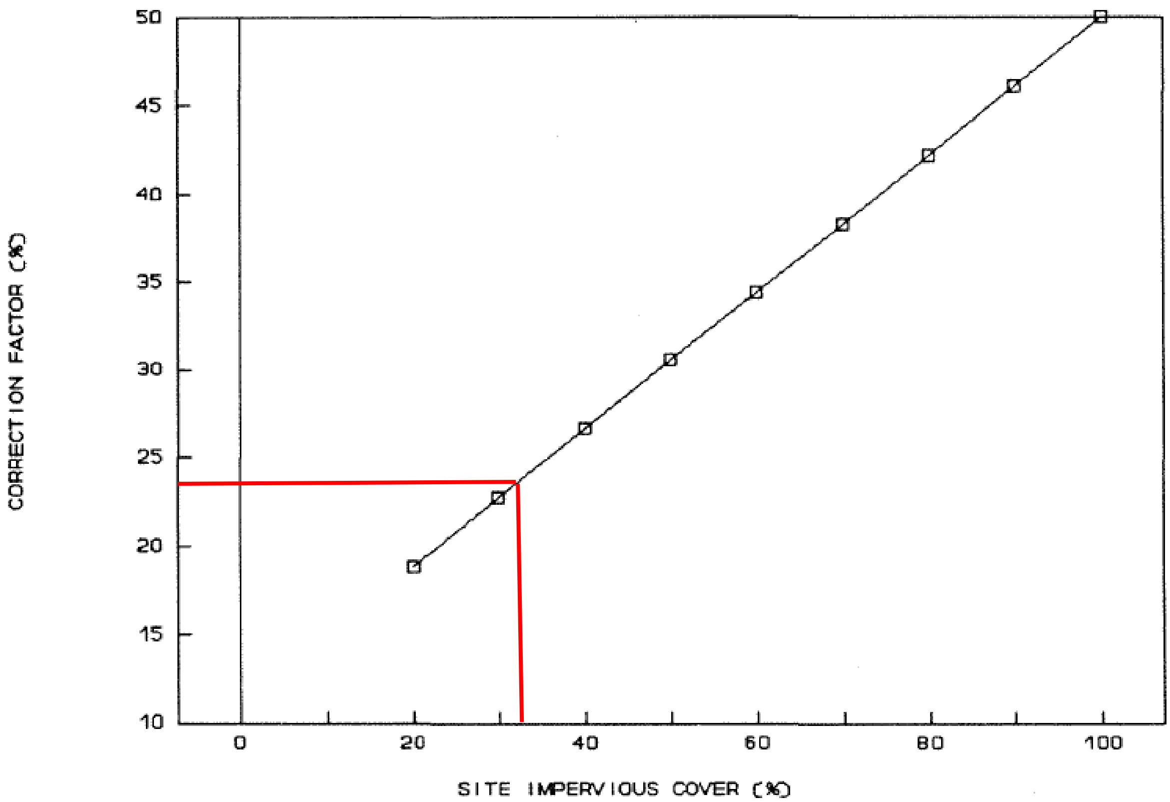


Figure 3: Puget Sound Manual Detention Volume Correction Factor.

Table 3: Detention Facility Design Parameters Based on Hydraulic Modeling

Parameter	TDA #1 Facility	TDA #2 Facility
Min. Detention Bottom Area & Elev.	2,170 sq ft IE 131.30	14,760 sq ft I.E. 131.50
Side Slopes	3H:1V	3H:1V
Outlet Riser	18-inch diam. Top Elev 133.00	18-inch diam. Top Elev 133.47
Rectangular Notch	0.40' H x 1.00' W	0.47' H x 1.10' W
Orifice(s)	2-inch @ 131.30 5-inch @ 131.80	2-inch @ 131.50 6-inch @ 132.00

Peak pre- and post-development flows for each event at the two modeled discharge points are provided in Table 4. These values do not include drainage from off-site areas north of Lockwood Creek Road, as these flows will remain unaltered and bypass site improvements.

Table 4: Peak Discharge in Cubic Feet per Second by TDA and Event

	Pre-Developed		Post-Developed	
Storm Event	**TDA #1**	**TDA #2**	**TDA #1**	**TDA #2**
2-yr	1.01	1.07	0.97	1.07
10-yr	2.35	2.34	1.99	1.92
25-yr	3.29	3.23	2.97	2.94
100-yr	4.48	4.34	4.06	4.32

Per LCMC 18.320.220.(3).(f), the modeled starting condition for each detention facility is equivalent to the water surface elevation from an immediately prior two-year event.

While facility outlets are designed to pass a 100-year event without overtopping the detention ponds' banks, emergency overflow weirs are provided as shown on the design plans to provide safe overflow in the event of outlet system blockages.

SECTION E CONVEYANCE SYSTEMS ANALYSIS AND DESIGN

Design of the project's conveyance system utilizes the same HydroCAD model discussed in Section D, fully integrating hydrology and detention hydraulics with pipe system modeling. Pipe system parameters in the model represent the preliminary design layout shown in Appendix D, with some laterals excluded from the model.

Model results provided in Appendix C indicate that in general, the on-site system operates in an open channel flow regime (i.e. the system is not pressurized) during a 100-year event, with minor surcharge near submerged outfalls not exceeding proposed rim elevations in the pipe system. Backwater effects are not expected to be significant throughout most of the system, with the exception of culverts from the ditch north of NE Lockwood Creek Road and in the bypass culvert under the west parking lot. The systems where backwater is expected are intended for bypass flows and will not have any adverse impact to the Project.

Initial conditions for the model are characterized by detention facility water elevations equivalent to an immediately prior two-year event.

E.1 Off-Site Bypass

A bypass structure has been designed that will convey flows entering the site from the north underneath the west parking lot and to the existing point of discharge from TDA #1. Hydraulic modeling includes the ditch on the north side of NE Lockwood Creek Road. Existing culverts are modeled as catch basin structures (structures without considerable storage), with consideration given to tailwater and inlet/outlet control. The existing conditions model also includes a 15-inch pipe and secondary overflow conveyed overland through the existing site, also modeled as a "Catch Basin" with multiple outlets and without significant storage.

Because no drainage report for the recently constructed subdivision is available, 100-year flow to the site from the existing ditch and culverts has been analyzed in HydroCAD assuming pre-settlement forested conditions draining through the ditch cross section (no culverts associated with the development). This is based on the assumption that the development has been designed and constructed in conformance with the requirements of the LCMC and 1992 Puget Sound Stormwater Manual. 100-year peak runoff from the off-site areas to the north is approximately 25.72 cfs. Of this flow, approximately 23.25 cfs is directed through the 24-inch ductile Iron pipe to the northwest corner of the site. The remainder flows through the 8-inch CPP and into the existing sloped wetland and buffer area.

The Project proposes a 42-linear foot extension of the existing 24-inch culvert drains to a ditch that routes flow to the wetland buffer and towards the proposed bypass system. The proposed 24-inch pipe extension will continue to convey approximately 23.3 cfs, while an extension of the existing 8-inch culvert will continue to convey about 2.4 cfs. On the west side of the buffer, bypass flows will enter a large, sloped field inlet, modeled in HydroCAD as a compound catch basin, calculating whether weir flow into the basin or pipe flow (inlet/outlet control) limits culvert discharge.

This system has been designed to pass flow from off-site and from the on-site wetland and buffer area between parking lots with less than one foot of ponding and maintains existing drainage patterns to the greatest extent practicable, directing flow to the existing riparian buffer, centered around a 12-inch pipe off-site to the west.

SECTION F WATER QUALITY DESIGN

Water quality design has been performed using the HydroCAD model and verified with the 2012 Western Washington Hydrology Model (WWHM) model. WWHM is a continuous hydrologic modeling software that provides an evaluation of the effectiveness of water treatment facilities in terms of total runoff volume treated.

The Project will include three bioretention facilities, treating runoff as follows:

1. NE Lockwood Creek Road Facility (treating frontage improvements)
2. West Parking Lot Facilities
3. East Parking Lot Facility

The bioretention areas will be sized for run-on from sidewalks, courtyard areas, and any pervious areas (landscaping and undisturbed vegetation) that will shed runoff to pollution generating surfaces. The proposed locations of the bioretention facilities are shown in Appendix D.

The northern bioretention facility collects runoff from frontage improvements. To prevent accumulation of flow in the street gutters, three catch basins are proposed along the frontage, spaced to each collect runoff approximately 250 linear feet of frontage. A pipe system will then carry runoff to the bioretention area south of the NE Lockwood Creek Road right of way.

West and east parking lot bioretention facilities are located within landscaped areas of each parking lot. The parking lots are graded such that runoff may shed overland and collect in the bioretention facilities. Treated runoff is then routed through underdrain pipes and into collection systems discharging to the project's detention facilities.

Pre-development conditions are considered historic pre-settlement, consisting entirely of forested land cover (SG4), while post-development conditions, taken from current Project drawings, are presented in Table 5. Areas modeled in WWHM represent only pollution-generating hard surfaces (PGHS) and those areas that contribute additional runoff to the bioretention areas treating runoff from PGHS.

Table 5. Modeled Post-Development Bioretention Drainage Area Breakdown

Cover	NE Lockwood Creek Road (sq ft)	West Parking Lot (sq ft)	East Parking Lot (sq ft)	Total Area (sq ft)	Modeled Soil Group
Lawn, Flat	--	4,730	7,200	11,930	SG4
Field, Flat	--	--	33,780	33,780	SG4
Roads, Flat*	**26,380**	**--**	**--**	**26,380**	**N/A**
Driveways, Flat*	**--**	**46,310**	**36,950**	**83,260**	**N/A**
Sidewalk, Flat	5,080	7,160	2,725	14,965	N/A

*PGHS (all other areas are non-pollution generating but contribute runoff to bioretention areas treating PGHS.

WWHM modeling indicates that a minimum of 94% of the entire runoff volume over a multi-decade period of record is treated by each of the facilities. This meets the general intent of the 1992 Stormwater Manual for treatment facility design. See Appendix C for WWHM modeling results. Facility sizing is summarized in Table 6.

Table 6: Bioretention Facility Design Parameters From HydroCAD and WWHM

Parameter	Lockwood Creek Road Facility	West Parking Lot Facility 1*	West Parking Lot Facility 2*	East Parking Lot Facility
Bioretention Bottom Area & Elev.	300 sq ft IE 145.00	280 sq ft IE 135.00	153 sq ft IE 135.00	450 sq ft IE 135.65
Side Slopes	3H:1V	3H:1V	3H:1V	3H:1V
Outlet Riser	24-in Beehive Top Elev 145.50	24-in Beehive Top Elev 135.50	24-in Beehive Top Elev 135.70	24-in Beehive Top Elev 136.15
Orifice(s)	6-inch Pipe 2.70-in Orifice IE 143.00	6-inch Pipe 1.56-in Orifices* IE 132.50	6-inch Pipe 1.56-in Orifices* IE 132.70	6-inch Pipe 6.00-in Orifice IE 132.65

* Each facility includes two areas with separate perforated drain pipes.

Bioretention facilities are not intended to serve as standalone quantity control facilities for the project. However, they do provide some ancillary storage benefit, and have been included in the HydroCAD model used to size the Project's two large detention facilities. The

WWHM model results provided with this report are only intended to indicate that quality requirements are met by the facilities for the project's pollution-generating drainage areas.

The west parking lot includes two separate facilities that in total meet the water quality requirement for the lot's drainage area. Values presented for the west parking lot facilities in Table 6 represent an aggregate area requirement for the bioretention area. Each facility consists of two ponding areas, connected by equalizing overflow pipes so the ponding areas can exchange flow freely and act as a single bioretention area. The two facilities each collect runoff from approximately half of the west parking lot area. In WWHM and HydroCAD, the areas are modeled as two Bioretention ponds with 2.20-inch diameter orifices. However, that modeled orifice area will be split equally amongst four separate underdrains, as shown in Table 6.

SECTION G SOILS EVALUATION

See Appendix A for soils map and Appendix F for the Project's Geotechnical Report and infiltration testing results. The Geotechnical report includes discussion regarding high groundwater conditions and recommends the removal of approximately 18 inches of top soil prior to placement of fill.

SECTION H SPECIAL REPORTS AND STUDIES

A wetland study has been performed for the site, indicating the presence of two large Category III wetlands on the large southern parcels, as well as three smaller, Category IV wetlands in the northern, triangular parcel. The location of wetlands is shown in Appendix D. Wetland studies are provided in Appendix E.

No other special reports or studies have been performed for the project, as the site does not lie within a floodplain or floodway.

SECTION I OTHER PERMITS

Permits for the proposed development include a Grading Permit, Building Permit, Environmental Permitting (SEPA), and Construction Stormwater Permit (NPDES). Investigation of the northern portion of the site has revealed two Category IV wetlands that will be directly impacted by site and frontage improvements. Wetland bank credits will be purchased to mitigate these impacts.

SECTION J GROUNDWATER MONITORING PROGRAM

Based on the results of geotechnical investigation, no groundwater monitoring program is proposed.

SECTION K MAINTENANCE AND OPERATIONS MANUAL

Operations and Maintenance procedures recommended for bioretention and detention facilities are provided in Appendix F

SECTION L REFERENCES

City of La Center. “La Center Municipal Code.” *Title 18 – Development Code*. Updated July 25, 2018.

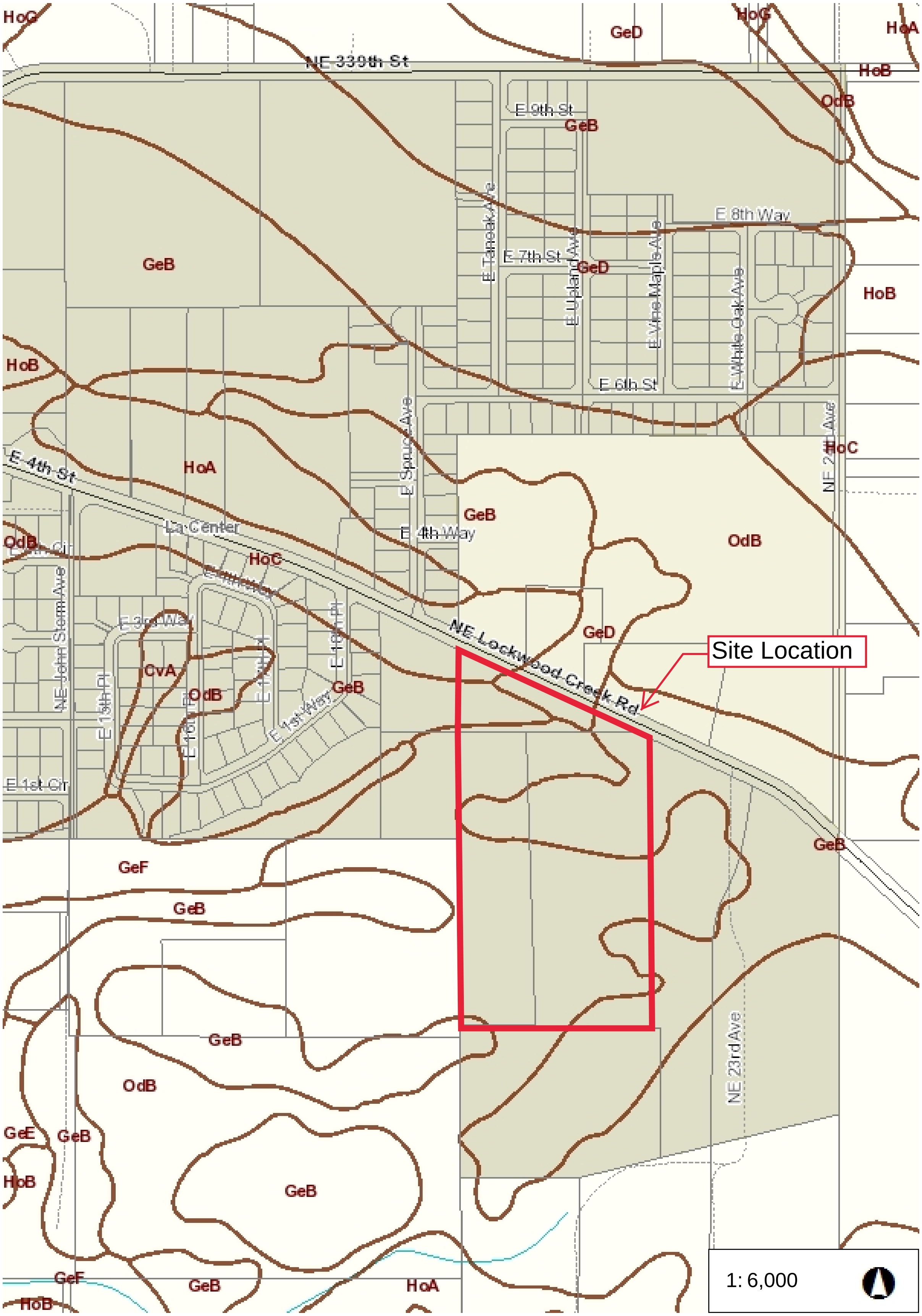
Washington State Department of Ecology – Water Quality Program. “2012 Stormwater Management Manual for Western Washington as Amended in December 2014 (The 2014 SWMMWW).” Publication Number 14-10-055. December 2014.

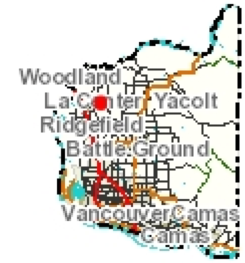
Washington State Department of Ecology – Water Quality Program. “Stormwater Management Manual for the Puget Sound Basin (The Technical Manual).” Publication 91-75. February 1992.

TECHNICAL APPENDICES

Appendix A
Soils Map

La Center Middle School Site Soils





Legend

- Taxlots
- Soil Type
- Cities Boundaries
- Urban Growth Boundaries

1: 6,000

Notes:

1,000.0 0 500.00 1,000.0 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Appendix B
Drainage Basin Maps

LA CENTER MIDDLE SCHOOL
EXISTING CONDITION

PBS Engineering and Environmental Inc.
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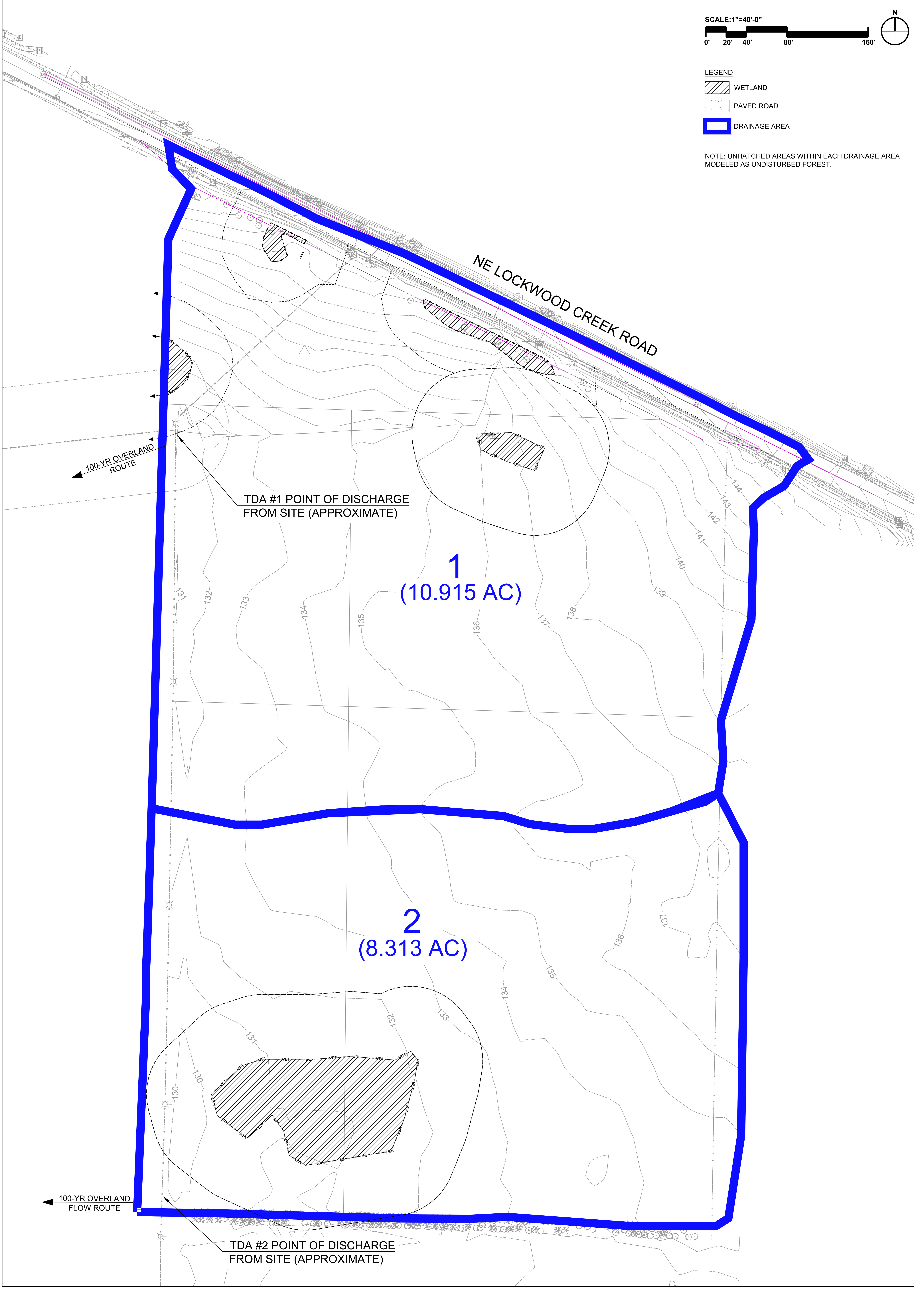


LA CENTER MIDDLE SCHOOL
PROPOSED CONDITION

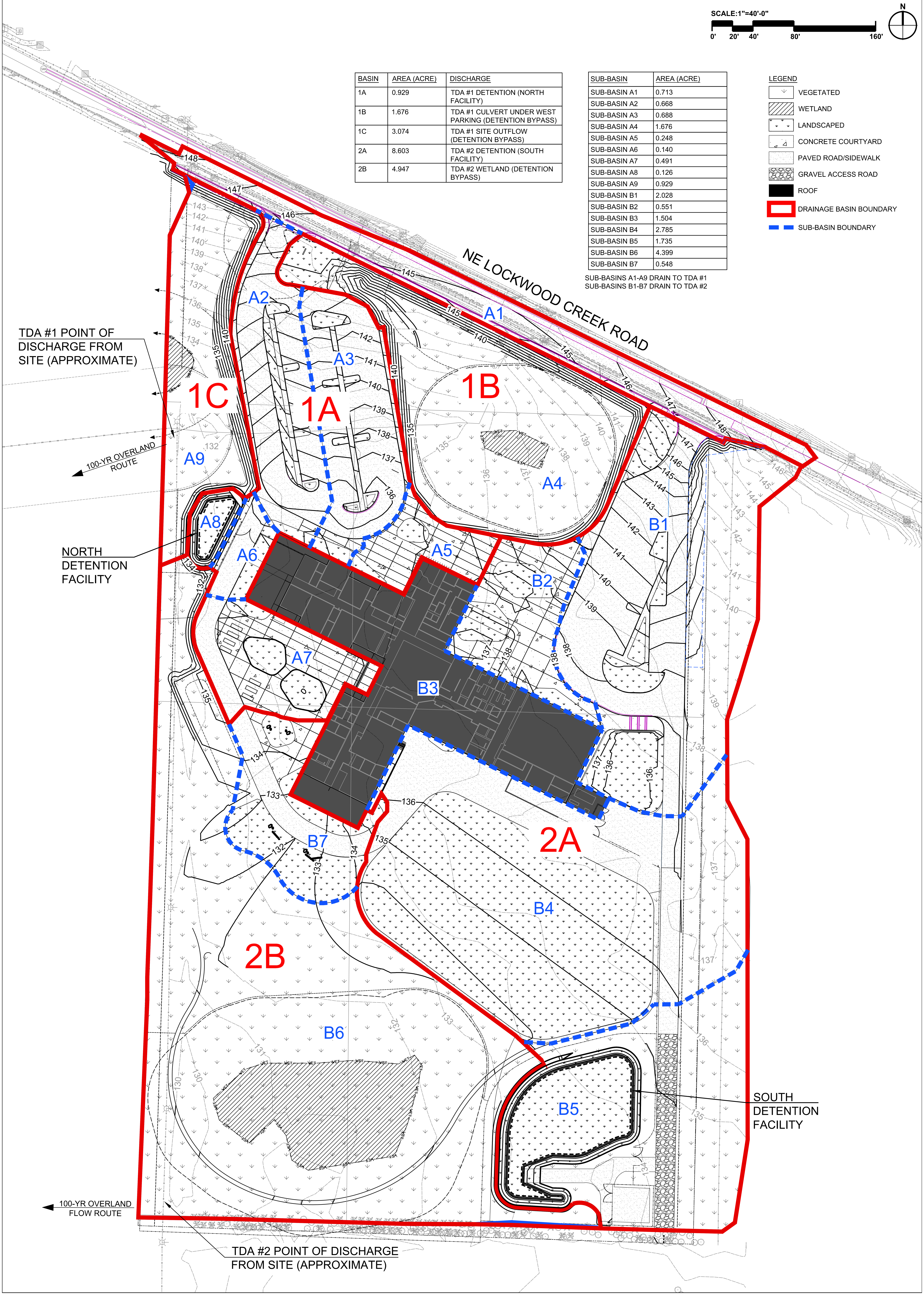
PBS
PBS Engineering and Environmental Inc.
415 W 6th Street, Suite 601
Vancouver, WA 98660
360.695.3488
pbsusa.com

BASIN	AREA (ACRE)	DISCHARGE
1A	0.929	TDA #1 DETENTION (NORTH FACILITY)
1B	1.676	TDA #1 CULVERT UNDER WEST PARKING (DETENTION BYPASS)
1C	3.074	TDA #1 SITE OUTFLOW (DETENTION BYPASS)
2A	8.603	TDA #2 DETENTION (SOUTH FACILITY)
2B	4.947	TDA #2 WETLAND (DETENTION BYPASS)

SUB-BASIN	AREA (ACRE)
SUB-BASIN A1	0.713
SUB-BASIN A2	0.668
SUB-BASIN A3	0.688
SUB-BASIN A4	1.676
SUB-BASIN A5	0.248
SUB-BASIN A6	0.140
SUB-BASIN A7	0.491
SUB-BASIN A8	0.126
SUB-BASIN A9	0.929
SUB-BASIN B1	2.028
SUB-BASIN B2	0.551
SUB-BASIN B3	1.504
SUB-BASIN B4	2.785
SUB-BASIN B5	1.735
SUB-BASIN B6	4.399
SUB-BASIN B7	0.548

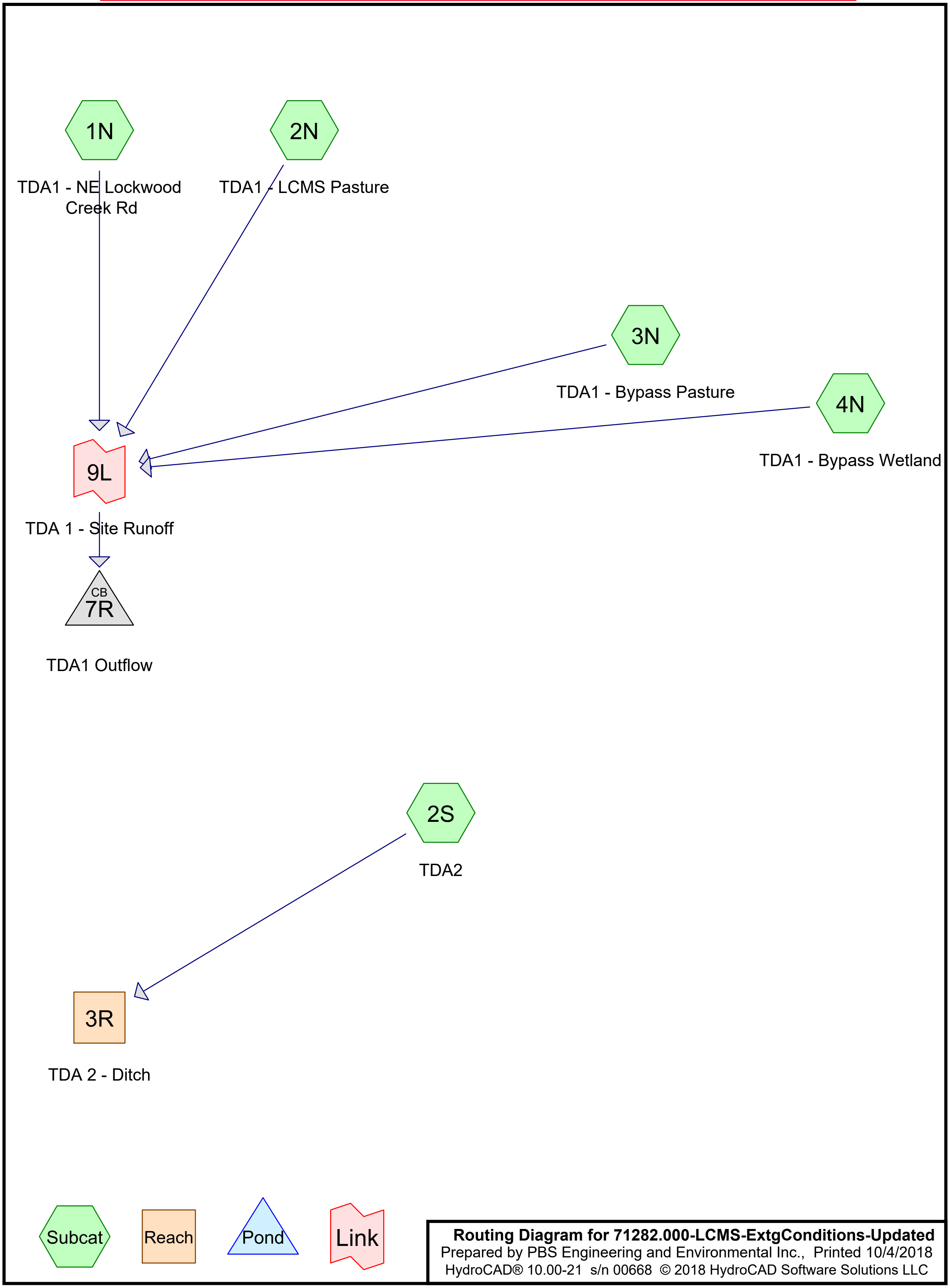
SUB-BASINS A1-A9 DRAIN TO TDA #1
SUB-BASINS B1-B7 DRAIN TO TDA #2

LEGEND
- VEGETATED
- WETLAND
- LANDSCAPED
- CONCRETE COURTYARD
- PAVED ROAD/SIDEWALK
- GRAVEL ACCESS ROAD
- ROOF
- DRAINAGE BASIN BOUNDARY
- SUB-BASIN BOUNDARY



Appendix C
Stormwater Modeling Results
(WWHM and HydroCAD)

HydroCAD Pre-Development On-Site Model



Routing Diagram for 71282.000-LCMS-ExtgConditions-Updated
Prepared by PBS Engineering and Environmental Inc., Printed 10/4/2018
HydroCAD® 10.00-21 s/n 00668 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
18.062	76	Existing Grass Cover (Undisturbed Forest) (2N, 2S, 3N)
0.416	98	Existing NE Lockwood Creek Rd (1N)
0.751	100	Wetland (2N, 2S, 4N)
19.229	**77**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
19.229	Other	1N, 2N, 2S, 3N, 4N
19.229		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subca Numb
0.000	0.000	0.000	0.000	18.062	18.062	Existing Grass Cover (Undisturbed Forest)	
0.000	0.000	0.000	0.000	0.416	0.416	Existing NE Lockwood Creek Rd	
0.000	0.000	0.000	0.000	0.751	0.751	Wetland	
0.000	**0.000**	**0.000**	**0.000**	**19.229**	**19.229**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	7R	126.99	120.35	247.0	0.0269	0.012	10.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1N: TDA1 - NE Lockwood Runoff Area=18,110 sf 100.00% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=0/98 Runoff=0.23 cfs 0.075 af

Subcatchment 2N: TDA1 - LCMS Pasture Runoff Area=389,185 sf 1.45% Impervious Runoff Depth>0.65"
Flow Length=1,000' Slope=0.0100 '/' Tc=23.8 min CN=76/100 Runoff=0.64 cfs 0.484 af

Subcatchment 2S: TDA2 Runoff Area=362,138 sf 6.82% Impervious Runoff Depth>0.75"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=76/100 Runoff=1.07 cfs 0.521 af

Subcatchment 3N: TDA1 - Bypass Pasture Runoff Area=65,790 sf 0.00% Impervious Runoff Depth>0.63"
Flow Length=570' Slope=0.0260 '/' Tc=8.4 min CN=76/0 Runoff=0.14 cfs 0.079 af

Subcatchment 4N: TDA1 - Bypass Wetland Runoff Area=2,373 sf 100.00% Impervious Runoff Depth>2.39"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=0/100 Runoff=0.03 cfs 0.011 af

Reach 3R: TDA 2 - Ditch Avg. Flow Depth=0.24' Max Vel=1.38 fps Inflow=1.07 cfs 0.521 af
n=0.022 L=31.0' S=0.0048 '/' Capacity=8.91 cfs Outflow=1.07 cfs 0.521 af

Pond 7R: TDA1 Outflow Peak Elev=127.56' Inflow=1.01 cfs 0.649 af
Primary=1.01 cfs 0.649 af Secondary=0.00 cfs 0.000 af Outflow=1.01 cfs 0.649 af

Link 9L: TDA 1 - Site Runoff Inflow=1.01 cfs 0.649 af
Primary=1.01 cfs 0.649 af

Total Runoff Area = 19.229 ac Runoff Volume = 1.170 af Average Runoff Depth = 0.73"
93.93% Pervious = 18.062 ac 6.07% Impervious = 1.167 ac

Summary for Subcatchment 1N: TDA1 - NE Lockwood Creek Rd

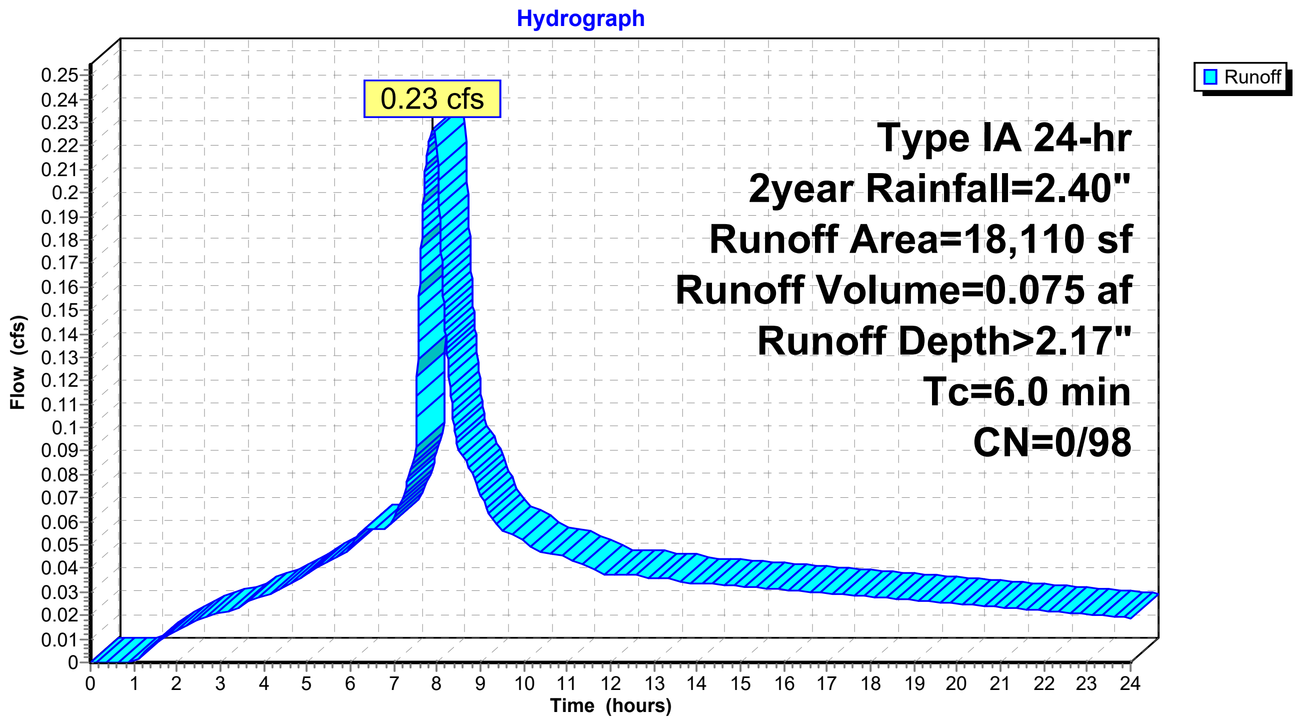
Runoff = 0.23 cfs @ 7.90 hrs, Volume= 0.075 af, Depth> 2.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (sf)	CN	Description
*	18,110	98	Existing NE Lockwood Creek Rd
	18,110	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min**

Subcatchment 1N: TDA1 - NE Lockwood Creek Rd



Summary for Subcatchment 2N: TDA1 - LCMS Pasture

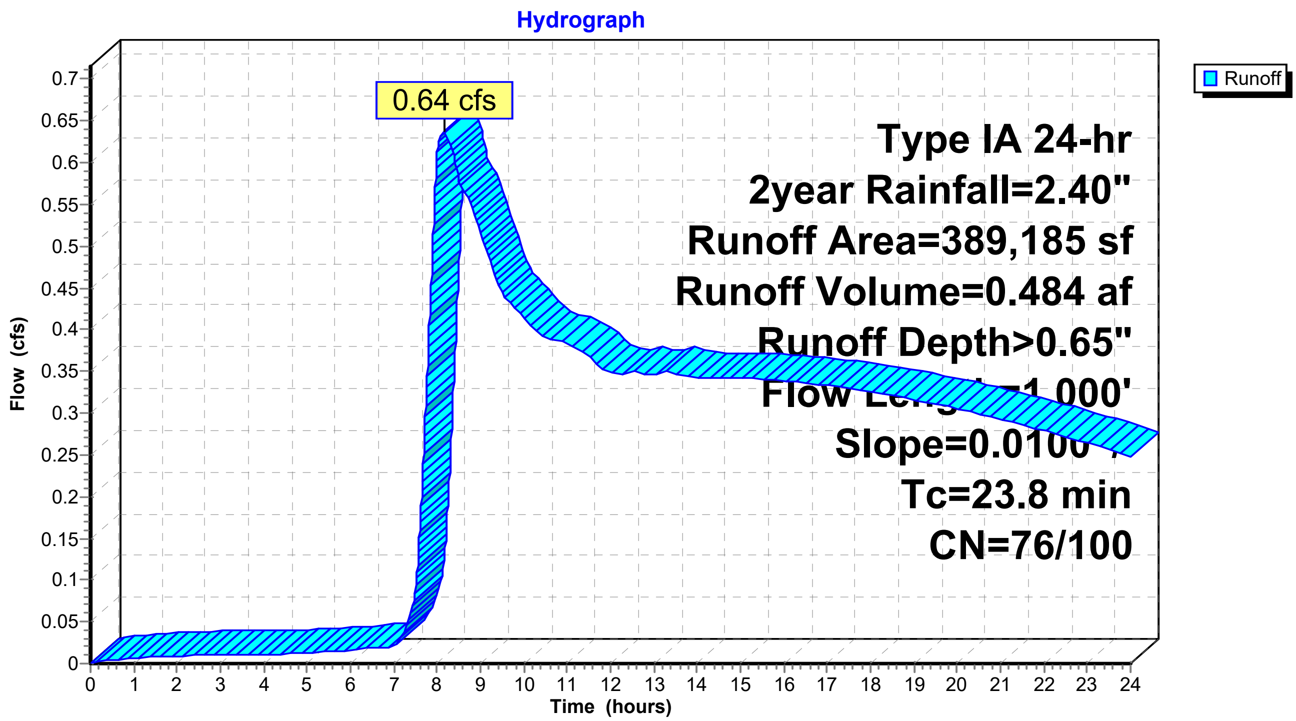
Runoff = 0.64 cfs @ 8.15 hrs, Volume= 0.484 af, Depth> 0.65"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (sf)	CN	Description
*	383,541	76	Existing Grass Cover (Undisturbed Forest)
*	5,644	100	Wetland
	389,185	76	Weighted Average
	383,541	76	98.55% Pervious Area
	5,644	100	1.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	1,000	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2N: TDA1 - LCMS Pasture



Summary for Subcatchment 2S: TDA2

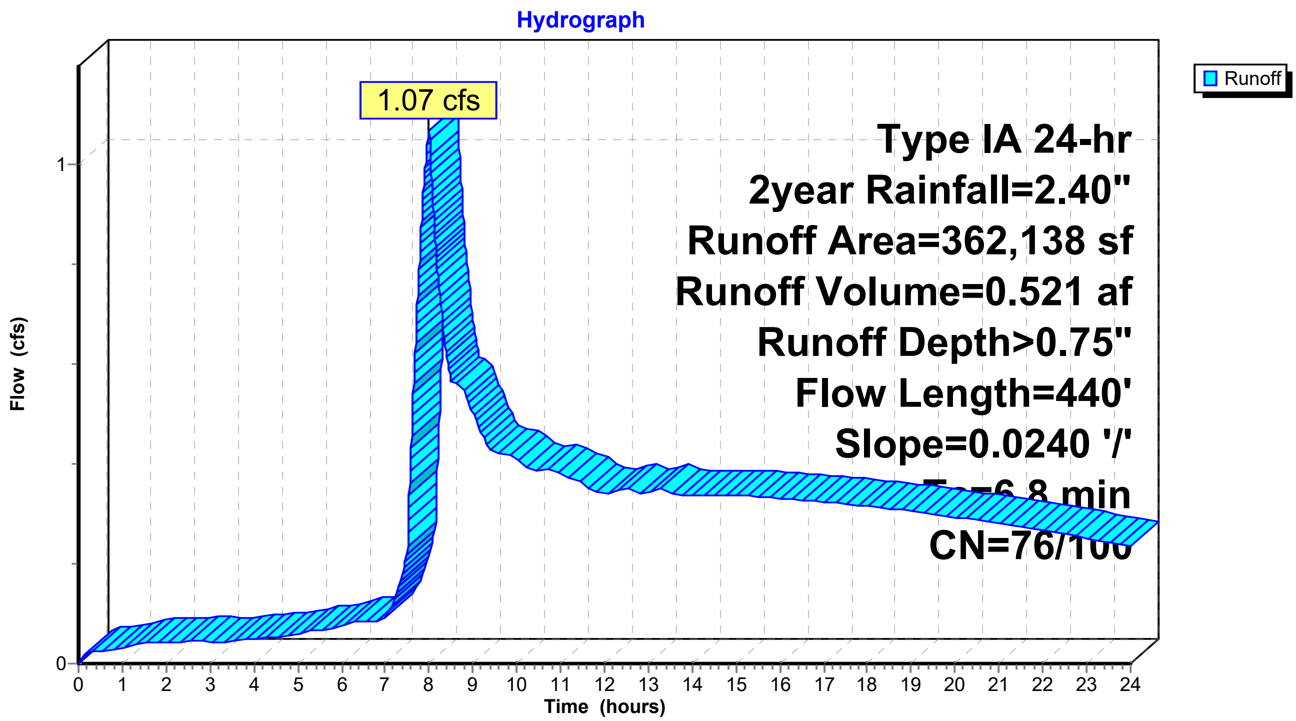
Runoff = 1.07 cfs @ 8.00 hrs, Volume= 0.521 af, Depth> 0.75"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (sf)	CN	Description
*	24,708	100	Wetland
*	337,430	76	Existing Grass Cover (Undisturbed Forest)
	362,138	78	Weighted Average
	337,430	76	93.18% Pervious Area
	24,708	100	6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2S: TDA2



Summary for Subcatchment 3N: TDA1 - Bypass Pasture

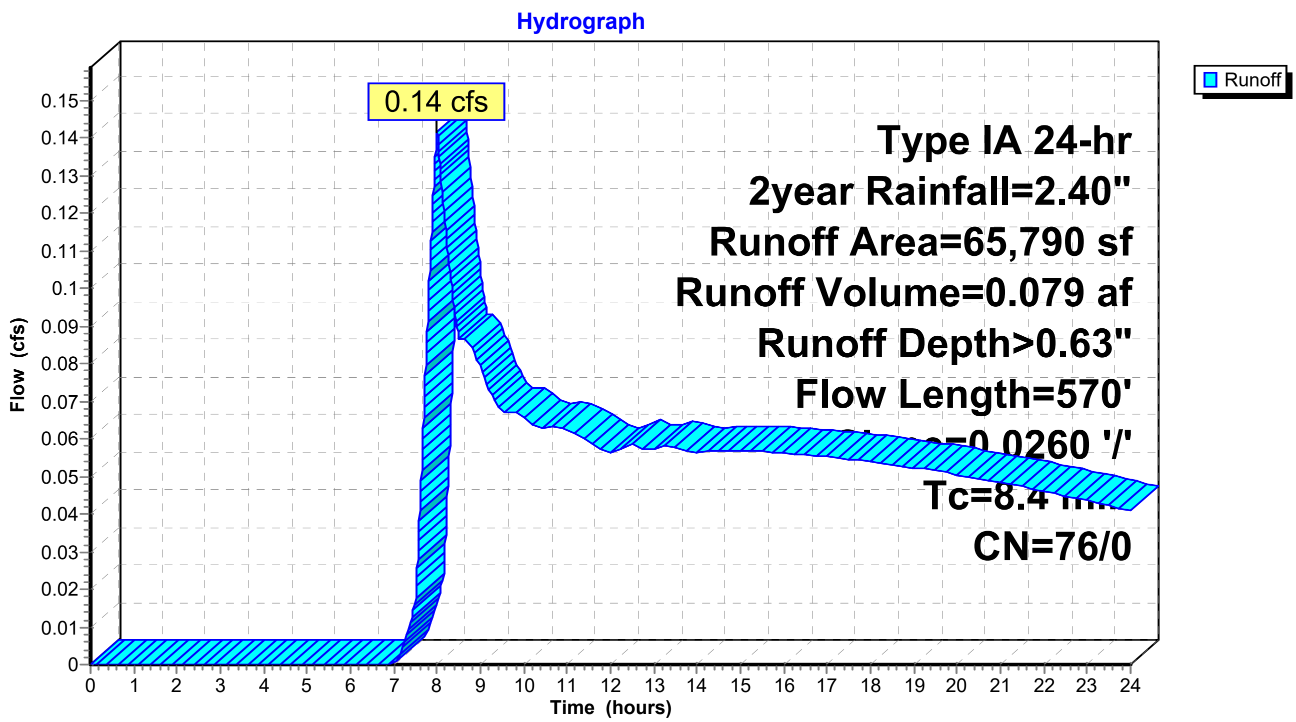
Runoff = 0.14 cfs @ 8.00 hrs, Volume= 0.079 af, Depth> 0.63"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (sf)	CN	Description
*	65,790	76	Existing Grass Cover (Undisturbed Forest)
	65,790	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	570	0.0260	1.13		**Shallow Concentrated Flow, Existing Ditch** Short Grass Pasture Kv= 7.0 fps

Subcatchment 3N: TDA1 - Bypass Pasture



Summary for Subcatchment 4N: TDA1 - Bypass Wetland

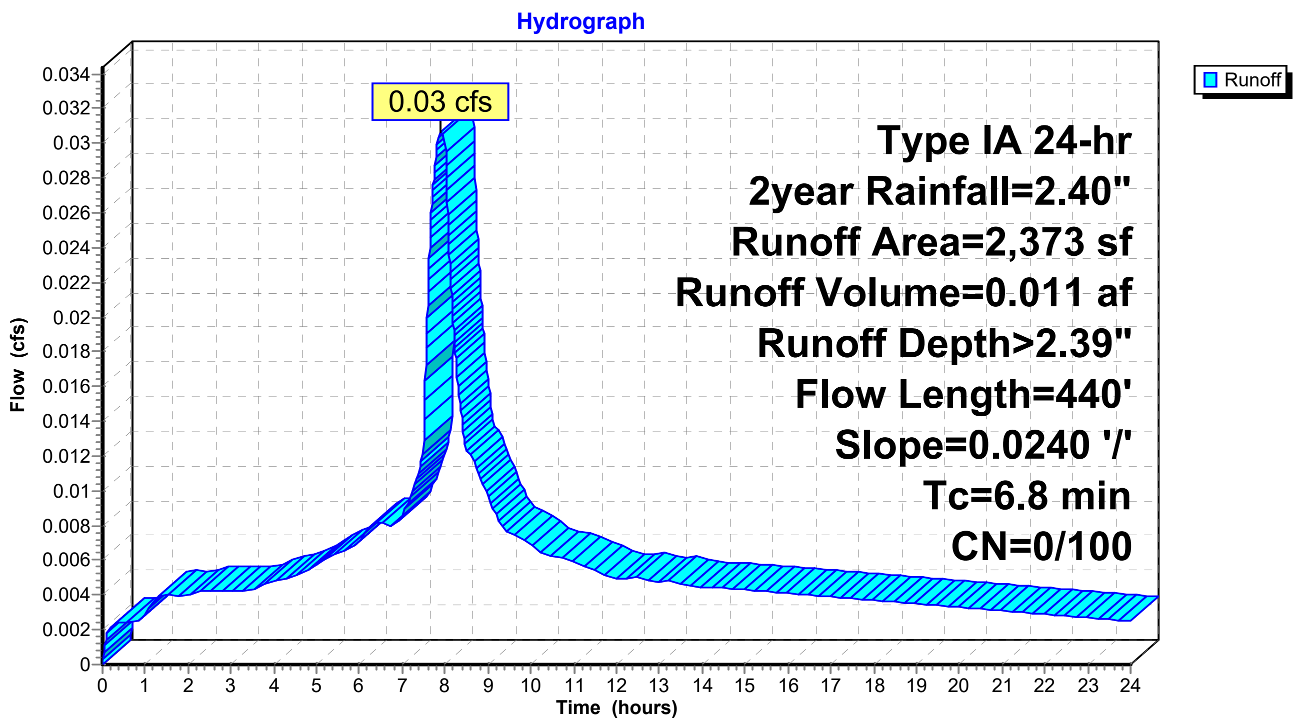
Runoff = 0.03 cfs @ 7.91 hrs, Volume= 0.011 af, Depth> 2.39"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (sf)	CN	Description
*	2,373	100	Wetland
	2,373	100	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 4N: TDA1 - Bypass Wetland



Summary for Reach 3R: TDA 2 - Ditch

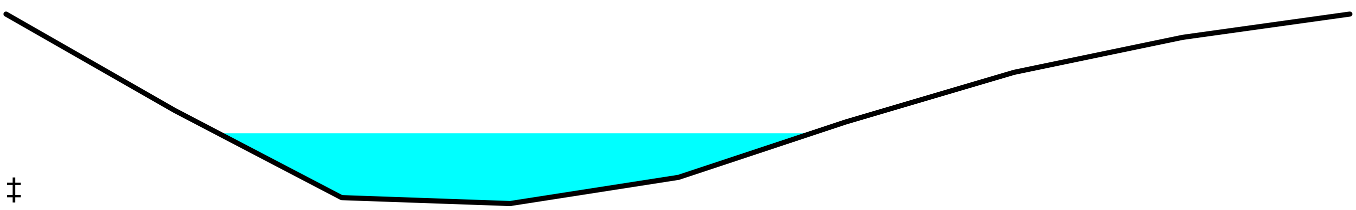
Custom Section pulled from 2017 SWWA Foothills LiDAR Elevation dataset.

Inflow Area = 8.314 ac, 6.82% Impervious, Inflow Depth > 0.75" for 2year event
Inflow = 1.07 cfs @ 8.00 hrs, Volume= 0.521 af
Outflow = 1.07 cfs @ 8.00 hrs, Volume= 0.521 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.38 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 0.6 min

Peak Storage= 24 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 0.65' Flow Area= 3.8 sf, Capacity= 8.91 cfs

Custom cross-section, Length= 31.0' Slope= 0.0048 '/'
Constant n= 0.022 Earth, clean & straight
Inlet Invert= 133.85', Outlet Invert= 133.70'

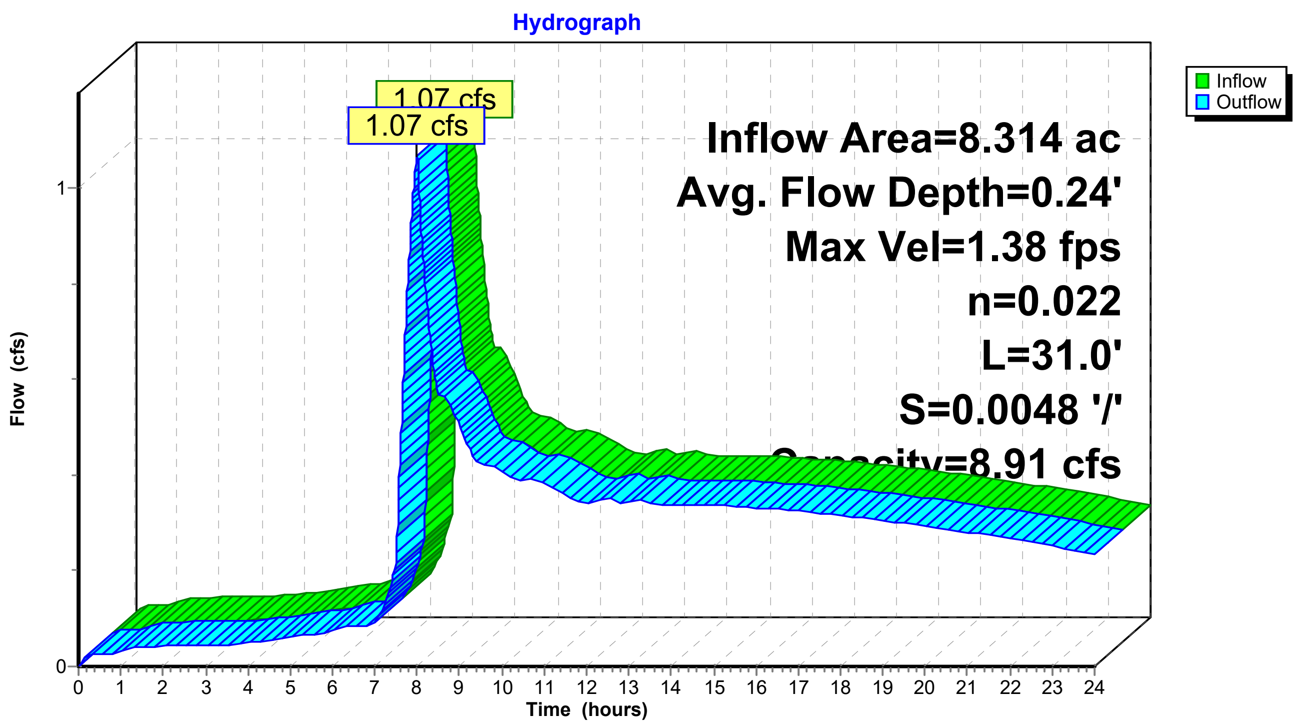


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	134.47	0.00
1.36	134.14	0.33
2.71	133.84	0.63
4.07	133.82	0.65
5.43	133.91	0.56
6.78	134.10	0.37
8.14	134.27	0.20
9.50	134.39	0.08
10.85	134.47	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.02	0.0	1.7	1	0.00
0.09	0.2	3.0	6	0.13
0.28	1.0	5.3	30	1.46
0.32	1.2	5.8	37	1.94
0.45	2.0	7.4	63	4.05
0.57	3.0	9.3	94	6.73
0.65	3.8	11.0	119	8.91

Reach 3R: TDA 2 - Ditch



Summary for Pond 7R: TDA1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 127.56' (Flood elevation advised)

Inflow Area = 10.915 ac, 5.50% Impervious, Inflow Depth > 0.71" for 2year event
Inflow = 1.01 cfs @ 8.01 hrs, Volume= 0.649 af
Outflow = 1.01 cfs @ 8.01 hrs, Volume= 0.649 af, Atten= 0%, Lag= 0.0 min
Primary = 1.01 cfs @ 8.01 hrs, Volume= 0.649 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

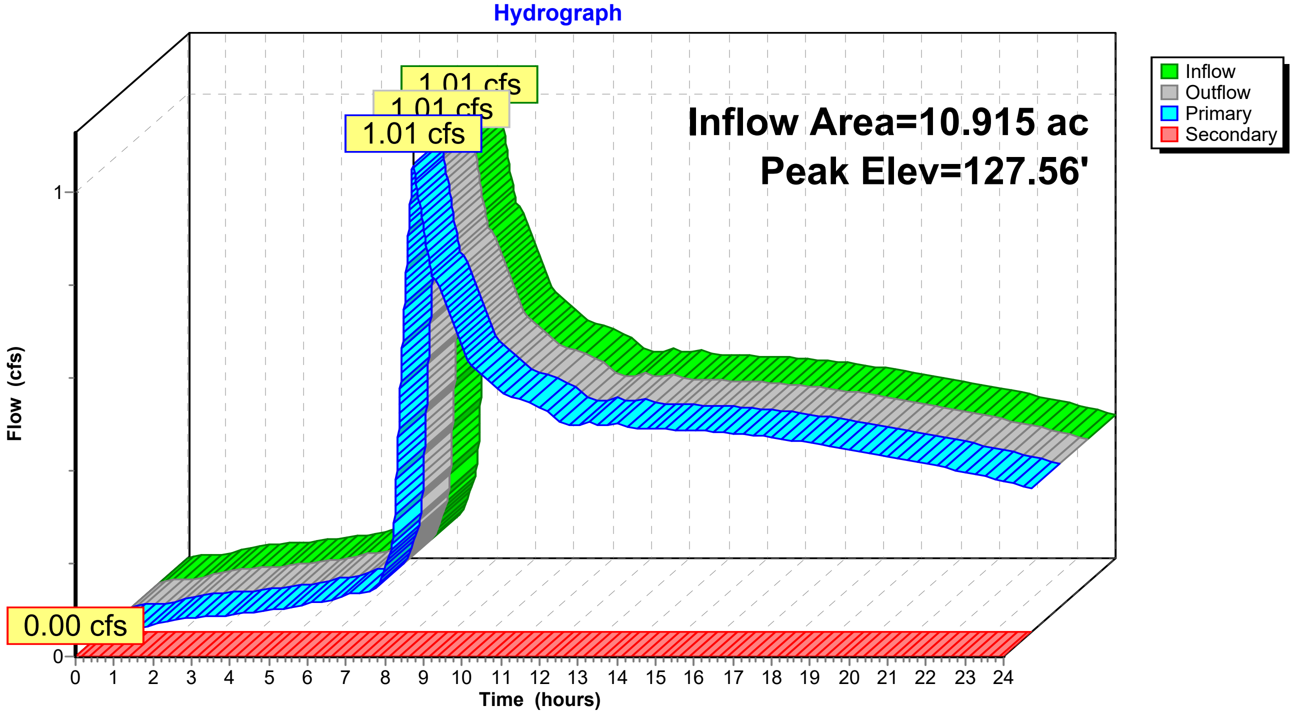
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.56' @ 8.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.01 cfs @ 8.01 hrs HW=127.56' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.01 cfs @ 2.56 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=126.99' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7R: TDA1 Outflow

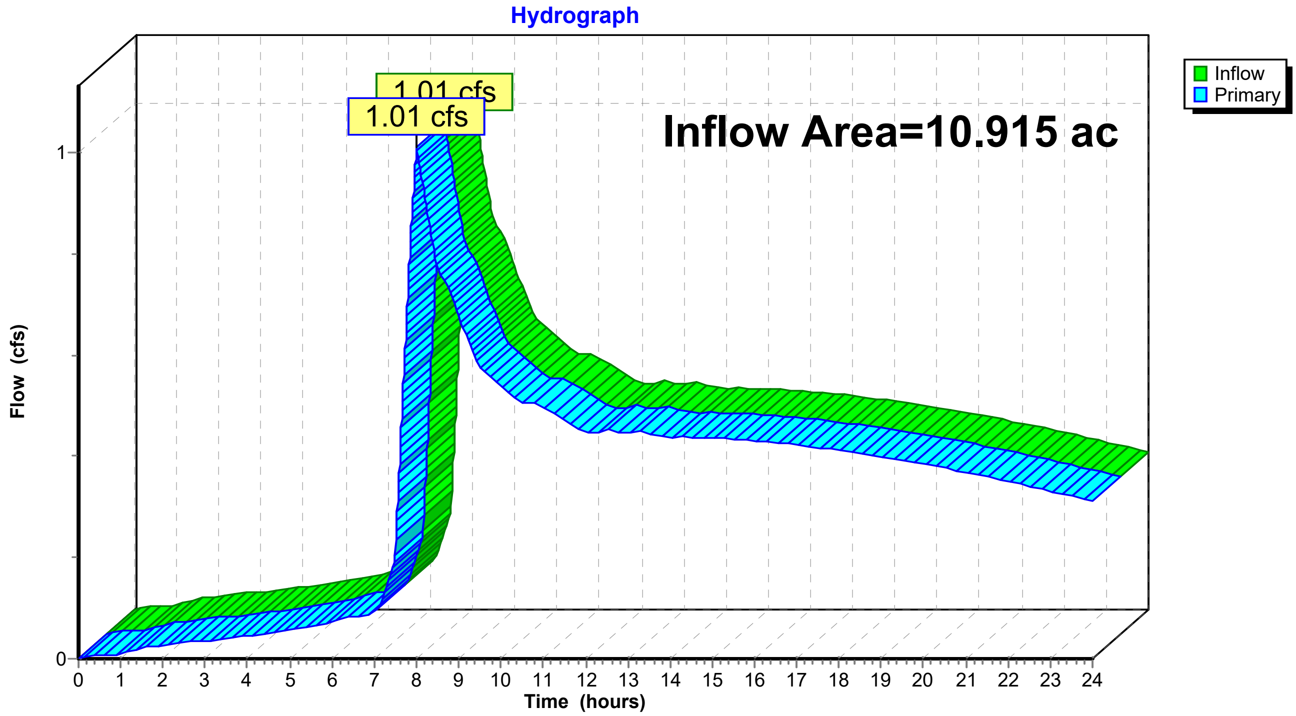


Summary for Link 9L: TDA 1 - Site Runoff

Inflow Area =	10.915 ac,	5.50% Impervious,	Inflow Depth > 0.71"	for 2year event
Inflow =	1.01 cfs @	8.01 hrs, Volume=	0.649 af	
Primary =	1.01 cfs @	8.01 hrs, Volume=	0.649 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 9L: TDA 1 - Site Runoff



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1N: TDA1 - NE Lockwood Runoff Area=18,110 sf 100.00% Impervious Runoff Depth>3.06"
Tc=6.0 min CN=0/98 Runoff=0.32 cfs 0.106 af

Subcatchment 2N: TDA1 - LCMS Pasture Runoff Area=389,185 sf 1.45% Impervious Runoff Depth>1.23"
Flow Length=1,000' Slope=0.0100 '/' Tc=23.8 min CN=76/100 Runoff=1.64 cfs 0.919 af

Subcatchment 2S: TDA2 Runoff Area=362,138 sf 6.82% Impervious Runoff Depth>1.36"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=76/100 Runoff=2.33 cfs 0.941 af

Subcatchment 3N: TDA1 - Bypass Pasture Runoff Area=65,790 sf 0.00% Impervious Runoff Depth>1.22"
Flow Length=570' Slope=0.0260 '/' Tc=8.4 min CN=76/0 Runoff=0.36 cfs 0.153 af

Subcatchment 4N: TDA1 - Bypass Wetland Runoff Area=2,373 sf 100.00% Impervious Runoff Depth>3.29"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=0/100 Runoff=0.04 cfs 0.015 af

Reach 3R: TDA 2 - Ditch Avg. Flow Depth=0.35' Max Vel=1.72 fps Inflow=2.33 cfs 0.941 af
n=0.022 L=31.0' S=0.0048 '/' Capacity=8.91 cfs Outflow=2.33 cfs 0.941 af

Pond 7R: TDA1 Outflow Peak Elev=127.88' Inflow=2.35 cfs 1.193 af
Primary=1.81 cfs 1.176 af Secondary=0.54 cfs 0.017 af Outflow=2.35 cfs 1.193 af

Link 9L: TDA 1 - Site Runoff Inflow=2.35 cfs 1.193 af
Primary=2.35 cfs 1.193 af

Total Runoff Area = 19.229 ac Runoff Volume = 2.134 af Average Runoff Depth = 1.33"
93.93% Pervious = 18.062 ac 6.07% Impervious = 1.167 ac

Summary for Subcatchment 1N: TDA1 - NE Lockwood Creek Rd

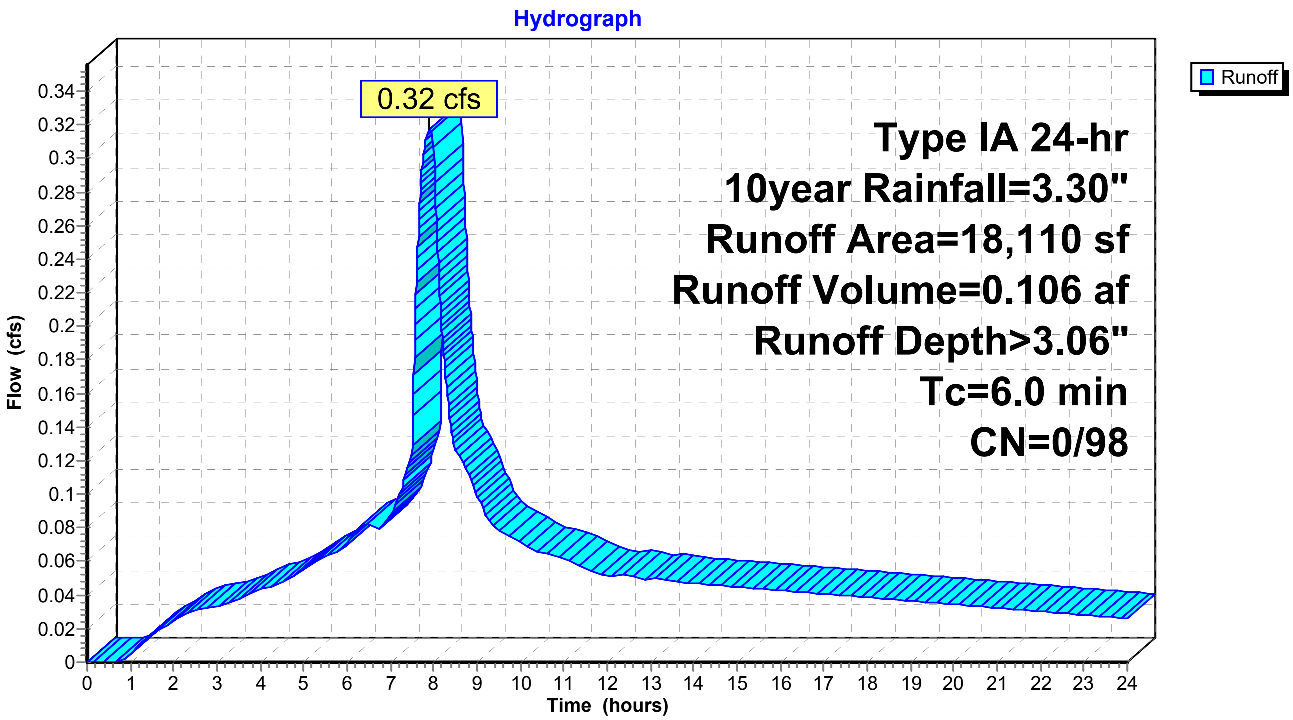
Runoff = 0.32 cfs @ 7.90 hrs, Volume= 0.106 af, Depth> 3.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10year Rainfall=3.30"

	Area (sf)	CN	Description
*	18,110	98	Existing NE Lockwood Creek Rd
	18,110	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min**

Subcatchment 1N: TDA1 - NE Lockwood Creek Rd



Summary for Subcatchment 2N: TDA1 - LCMS Pasture

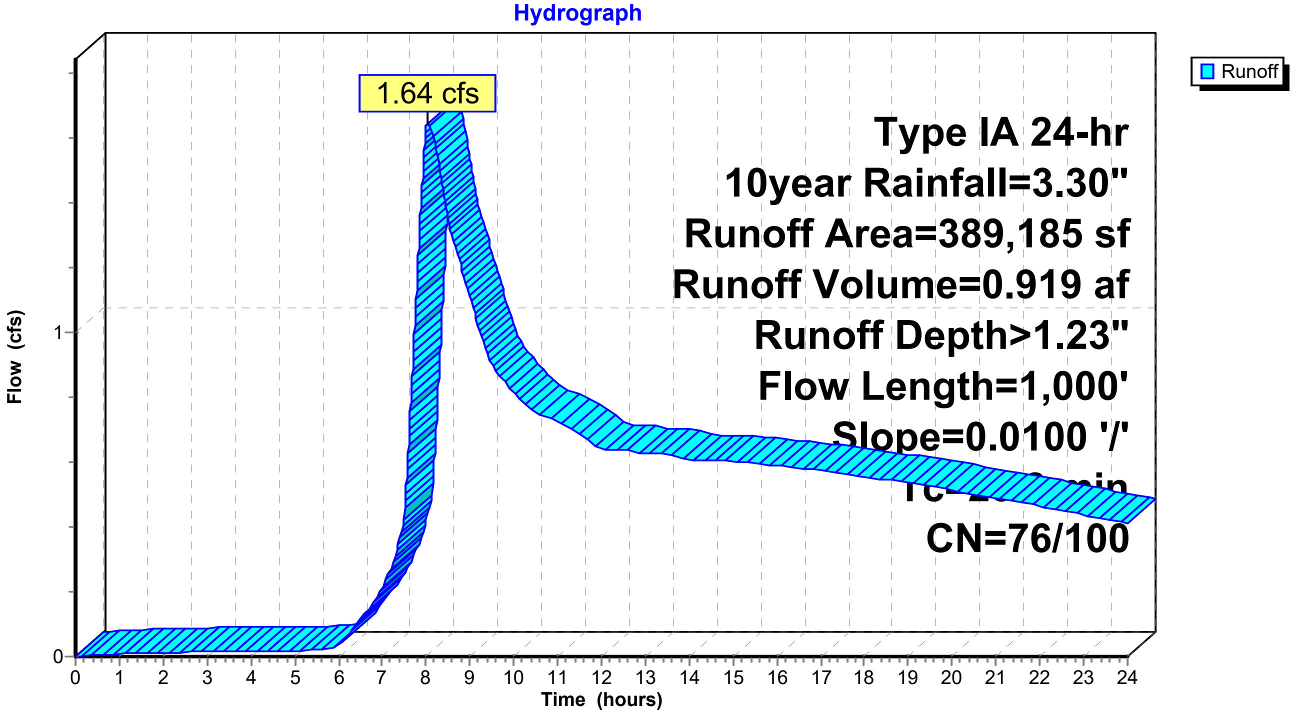
Runoff = 1.64 cfs @ 8.02 hrs, Volume= 0.919 af, Depth> 1.23"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10year Rainfall=3.30"

	Area (sf)	CN	Description
*	383,541	76	Existing Grass Cover (Undisturbed Forest)
*	5,644	100	Wetland
	389,185	76	Weighted Average
	383,541	76	98.55% Pervious Area
	5,644	100	1.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	1,000	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2N: TDA1 - LCMS Pasture



Summary for Subcatchment 2S: TDA2

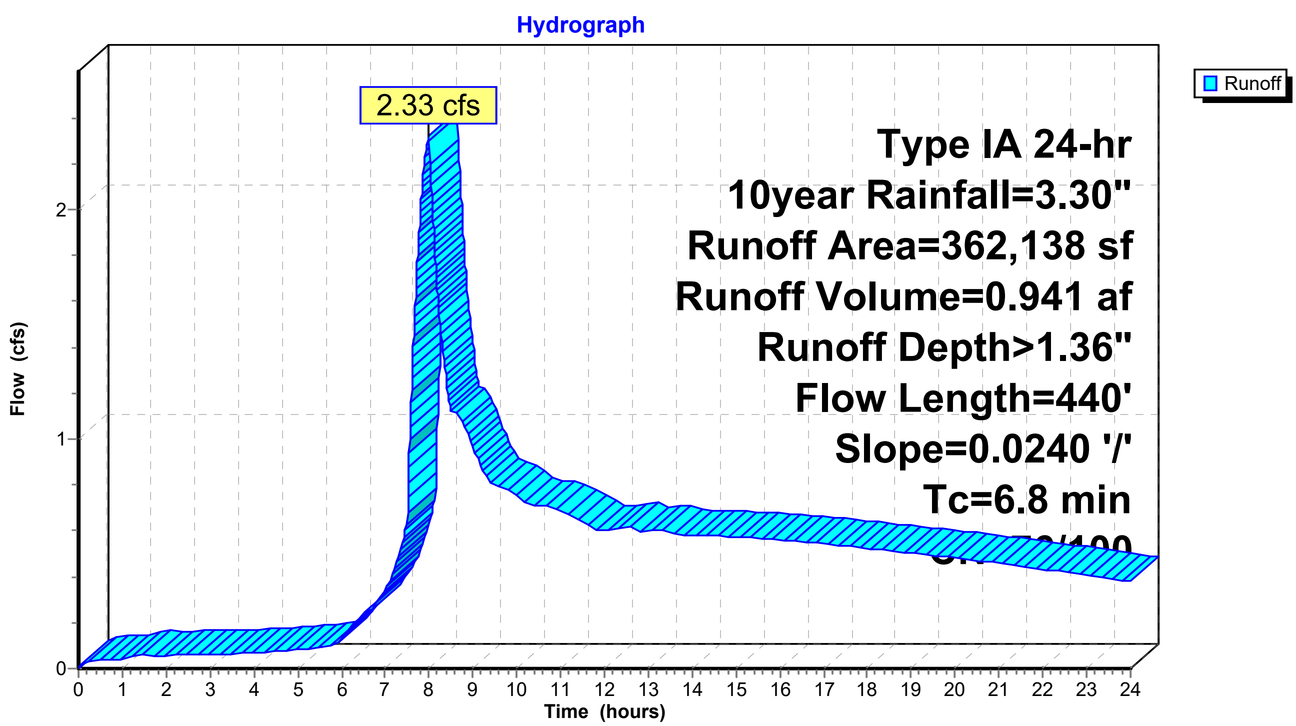
Runoff = 2.33 cfs @ 8.00 hrs, Volume= 0.941 af, Depth> 1.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10year Rainfall=3.30"

	Area (sf)	CN	Description
*	24,708	100	Wetland
*	337,430	76	Existing Grass Cover (Undisturbed Forest)
	362,138	78	Weighted Average
	337,430	76	93.18% Pervious Area
	24,708	100	6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2S: TDA2



Summary for Subcatchment 3N: TDA1 - Bypass Pasture

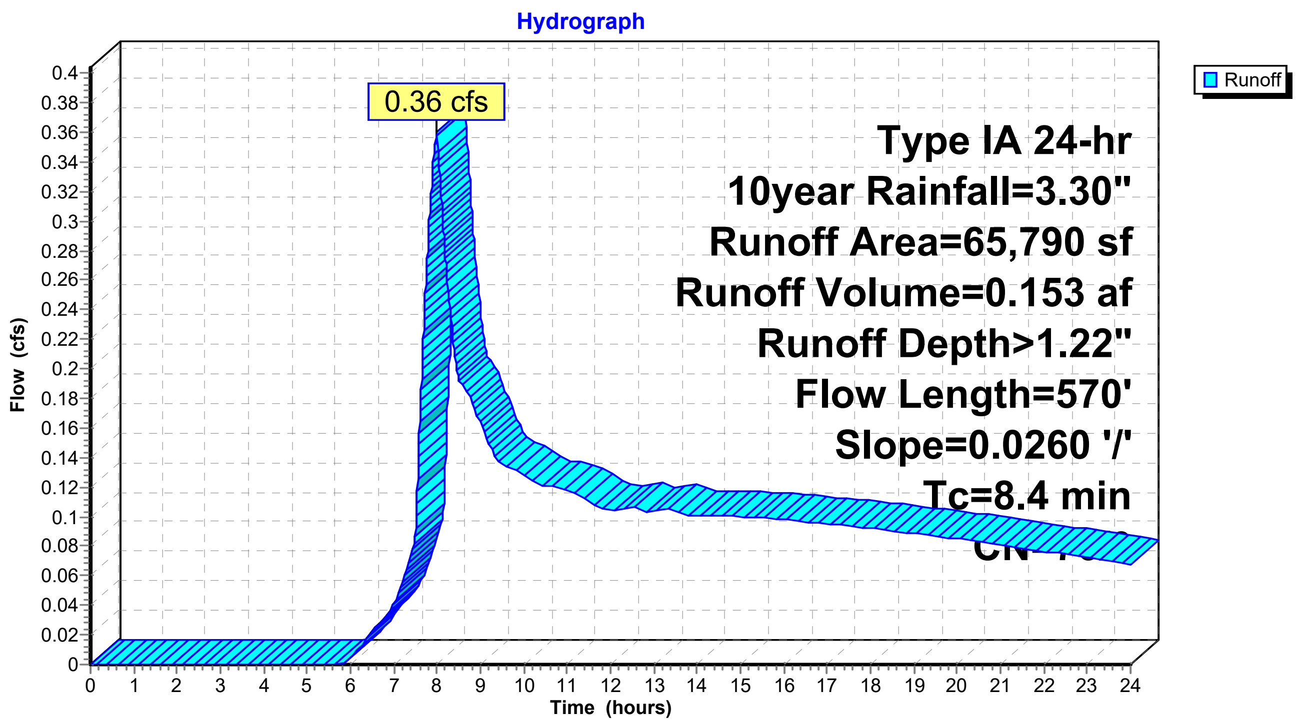
Runoff = 0.36 cfs @ 8.00 hrs, Volume= 0.153 af, Depth> 1.22"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10year Rainfall=3.30"

	Area (sf)	CN	Description
*	65,790	76	Existing Grass Cover (Undisturbed Forest)
	65,790	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	570	0.0260	1.13		**Shallow Concentrated Flow, Existing Ditch** Short Grass Pasture Kv= 7.0 fps

Subcatchment 3N: TDA1 - Bypass Pasture



Summary for Subcatchment 4N: TDA1 - Bypass Wetland

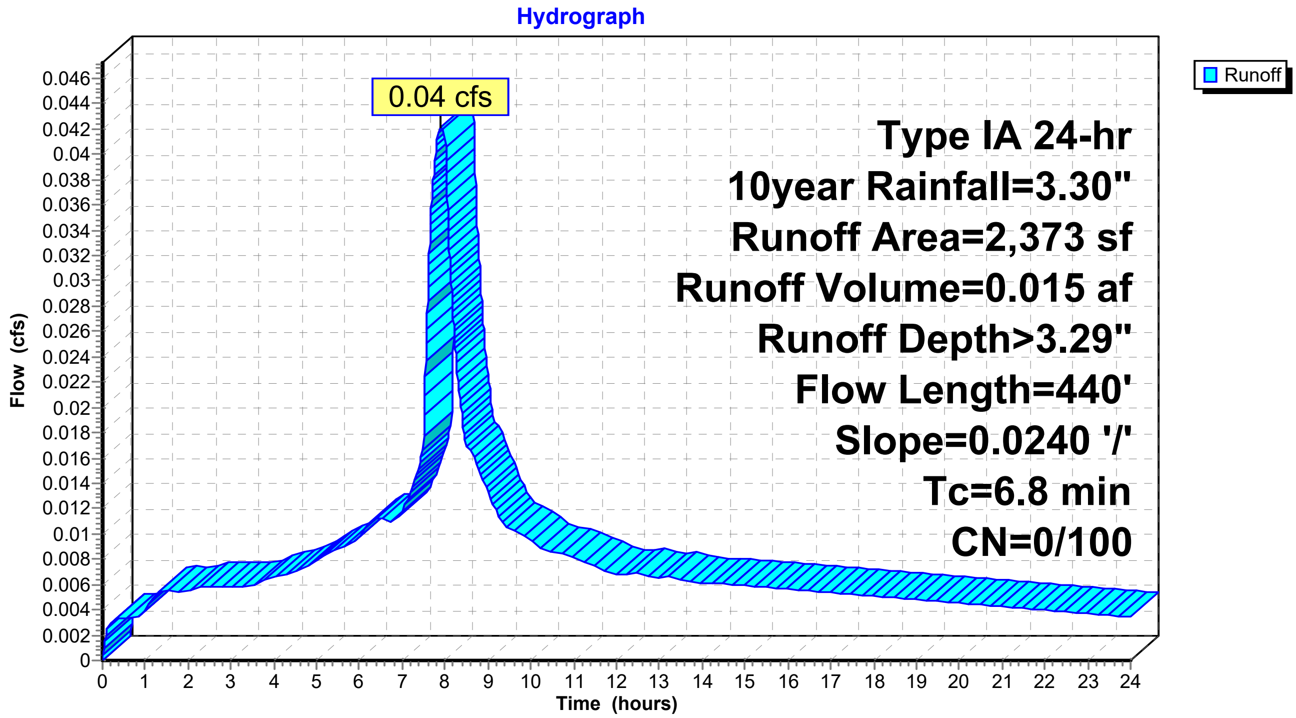
Runoff = 0.04 cfs @ 7.91 hrs, Volume= 0.015 af, Depth> 3.29"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10year Rainfall=3.30"

	Area (sf)	CN	Description
*	2,373	100	Wetland
	2,373	100	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 4N: TDA1 - Bypass Wetland



Summary for Reach 3R: TDA 2 - Ditch

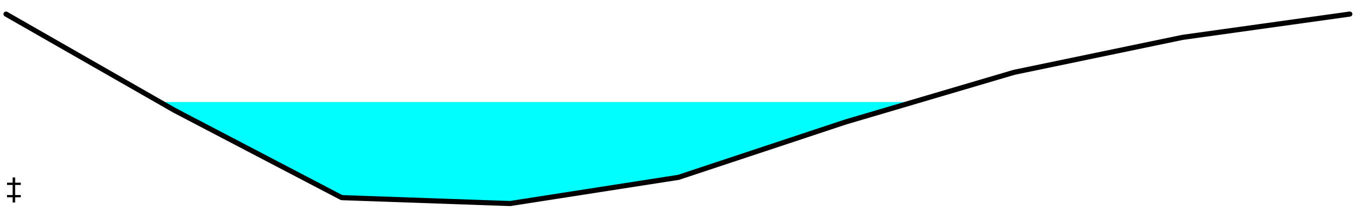
Custom Section pulled from 2017 SWWA Foothills LiDAR Elevation dataset.

Inflow Area = 8.314 ac, 6.82% Impervious, Inflow Depth > 1.36" for 10year event
Inflow = 2.33 cfs @ 8.00 hrs, Volume= 0.941 af
Outflow = 2.33 cfs @ 8.00 hrs, Volume= 0.941 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.72 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.01 fps, Avg. Travel Time= 0.5 min

Peak Storage= 42 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 0.65' Flow Area= 3.8 sf, Capacity= 8.91 cfs

Custom cross-section, Length= 31.0' Slope= 0.0048 '/'
Constant n= 0.022 Earth, clean & straight
Inlet Invert= 133.85', Outlet Invert= 133.70'

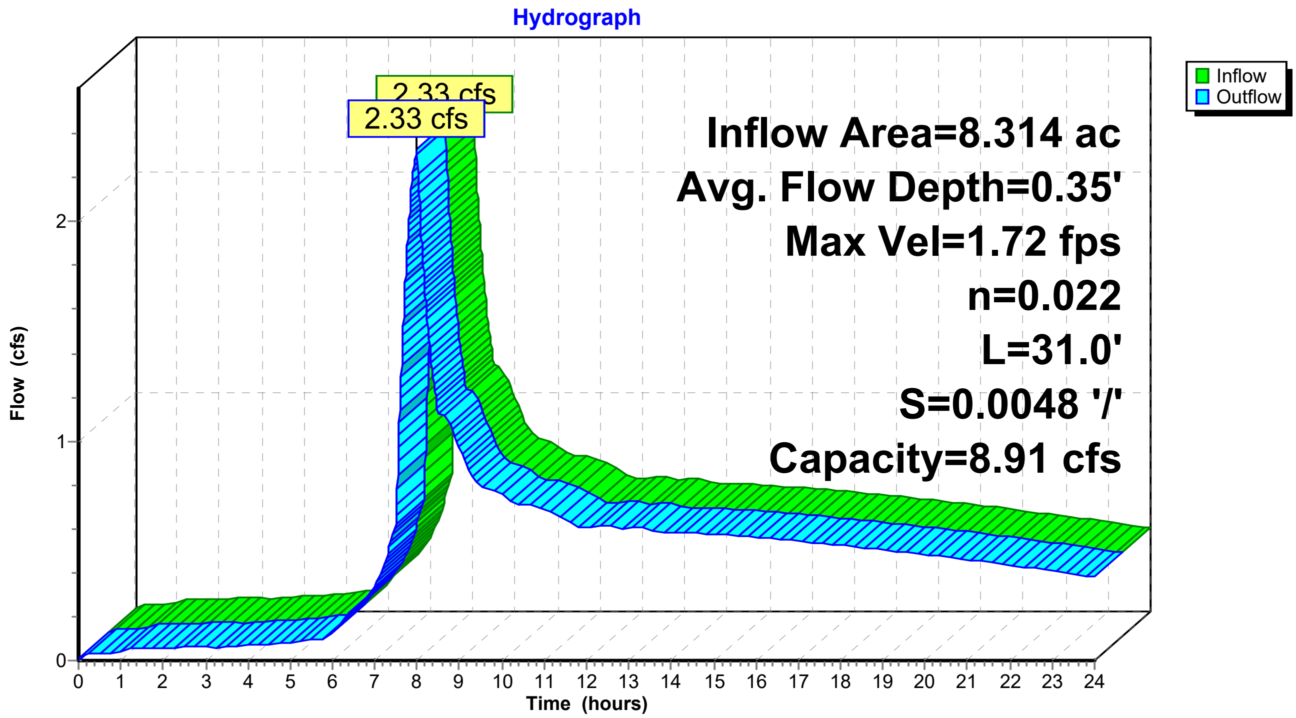


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	134.47	0.00
1.36	134.14	0.33
2.71	133.84	0.63
4.07	133.82	0.65
5.43	133.91	0.56
6.78	134.10	0.37
8.14	134.27	0.20
9.50	134.39	0.08
10.85	134.47	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.02	0.0	1.7	1	0.00
0.09	0.2	3.0	6	0.13
0.28	1.0	5.3	30	1.46
0.32	1.2	5.8	37	1.94
0.45	2.0	7.4	63	4.05
0.57	3.0	9.3	94	6.73
0.65	3.8	11.0	119	8.91

Reach 3R: TDA 2 - Ditch



Summary for Pond 7R: TDA1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 127.88' (Flood elevation advised)

Inflow Area =	10.915 ac,	5.50% Impervious, Inflow Depth > 1.31"	for 10year event	
Inflow =	2.35 cfs @	8.01 hrs, Volume=	1.193 af	
Outflow =	2.35 cfs @	8.01 hrs, Volume=	1.193 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.81 cfs @	8.01 hrs, Volume=	1.176 af	
Secondary =	0.54 cfs @	8.01 hrs, Volume=	0.017 af	

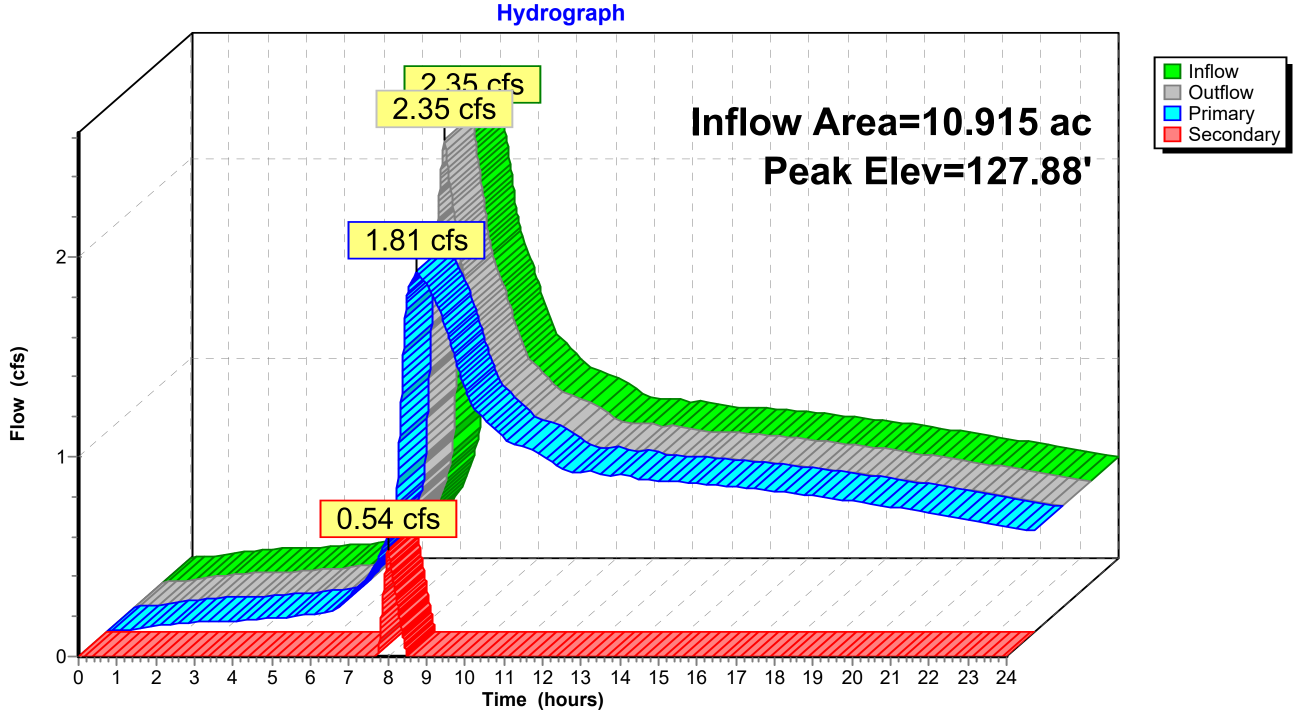
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.88' @ 8.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.81 cfs @ 8.01 hrs HW=127.88' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.81 cfs @ 3.31 fps)

Secondary OutFlow Max=0.54 cfs @ 8.01 hrs HW=127.88' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.54 cfs @ 0.66 fps)

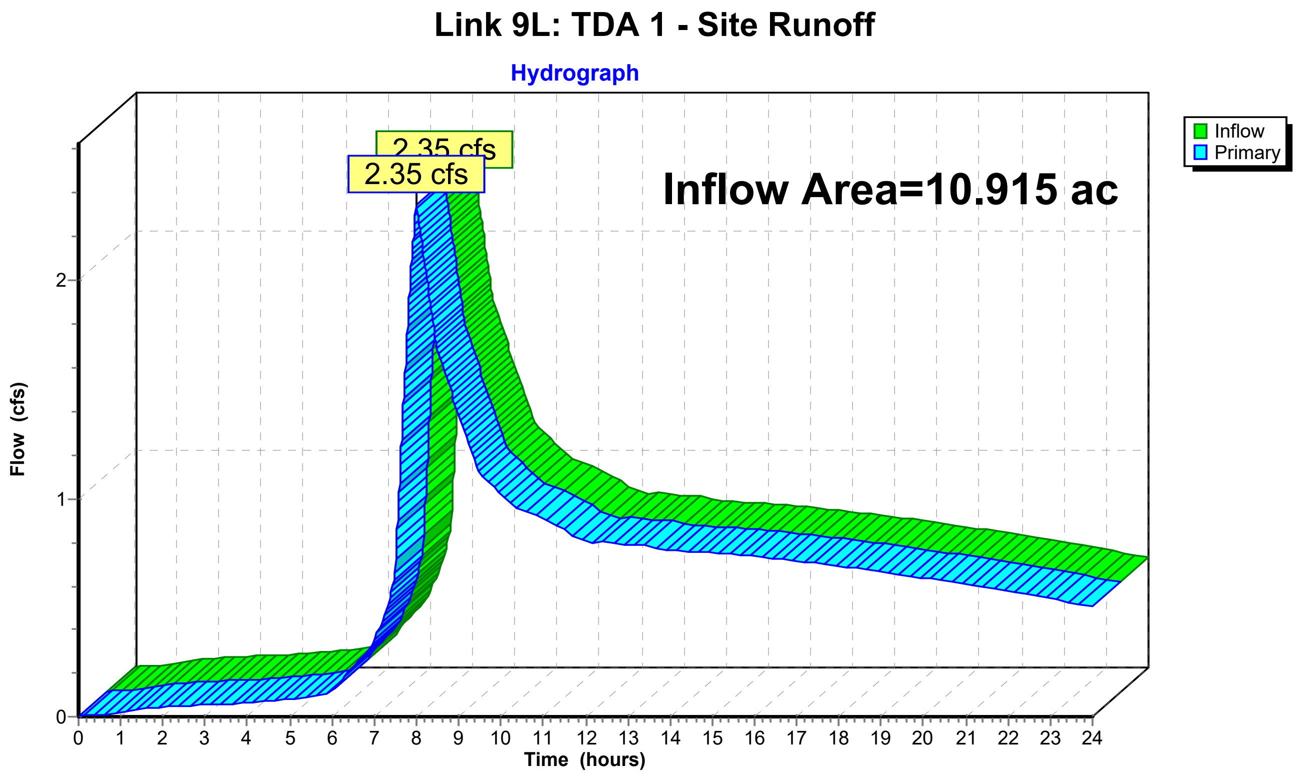
Pond 7R: TDA1 Outflow



Summary for Link 9L: TDA 1 - Site Runoff

Inflow Area = 10.915 ac, 5.50% Impervious, Inflow Depth > 1.31" for 10year event
Inflow = 2.35 cfs @ 8.01 hrs, Volume= 1.193 af
Primary = 2.35 cfs @ 8.01 hrs, Volume= 1.193 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1N: TDA1 - NE Lockwood Runoff Area=18,110 sf 100.00% Impervious Runoff Depth>3.61"
Tc=6.0 min CN=0/98 Runoff=0.37 cfs 0.125 af

Subcatchment 2N: TDA1 - LCMS Pasture Runoff Area=389,185 sf 1.45% Impervious Runoff Depth>1.63"
Flow Length=1,000' Slope=0.0100 '/' Tc=23.8 min CN=76/100 Runoff=2.37 cfs 1.217 af

Subcatchment 2S: TDA2 Runoff Area=362,138 sf 6.82% Impervious Runoff Depth>1.77"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=76/100 Runoff=3.20 cfs 1.226 af

Subcatchment 3N: TDA1 - Bypass Pasture Runoff Area=65,790 sf 0.00% Impervious Runoff Depth>1.62"
Flow Length=570' Slope=0.0260 '/' Tc=8.4 min CN=76/0 Runoff=0.51 cfs 0.203 af

Subcatchment 4N: TDA1 - Bypass Wetland Runoff Area=2,373 sf 100.00% Impervious Runoff Depth>3.84"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=0/100 Runoff=0.05 cfs 0.017 af

Reach 3R: TDA 2 - Ditch Avg. Flow Depth=0.40' Max Vel=1.87 fps Inflow=3.20 cfs 1.226 af
n=0.022 L=31.0' S=0.0048 '/' Capacity=8.91 cfs Outflow=3.20 cfs 1.226 af

Pond 7R: TDA1 Outflow Peak Elev=127.95' Inflow=3.29 cfs 1.563 af
Primary=1.93 cfs 1.487 af Secondary=1.35 cfs 0.076 af Outflow=3.29 cfs 1.563 af

Link 9L: TDA 1 - Site Runoff Inflow=3.29 cfs 1.563 af
Primary=3.29 cfs 1.563 af

Total Runoff Area = 19.229 ac Runoff Volume = 2.789 af Average Runoff Depth = 1.74"
93.93% Pervious = 18.062 ac 6.07% Impervious = 1.167 ac

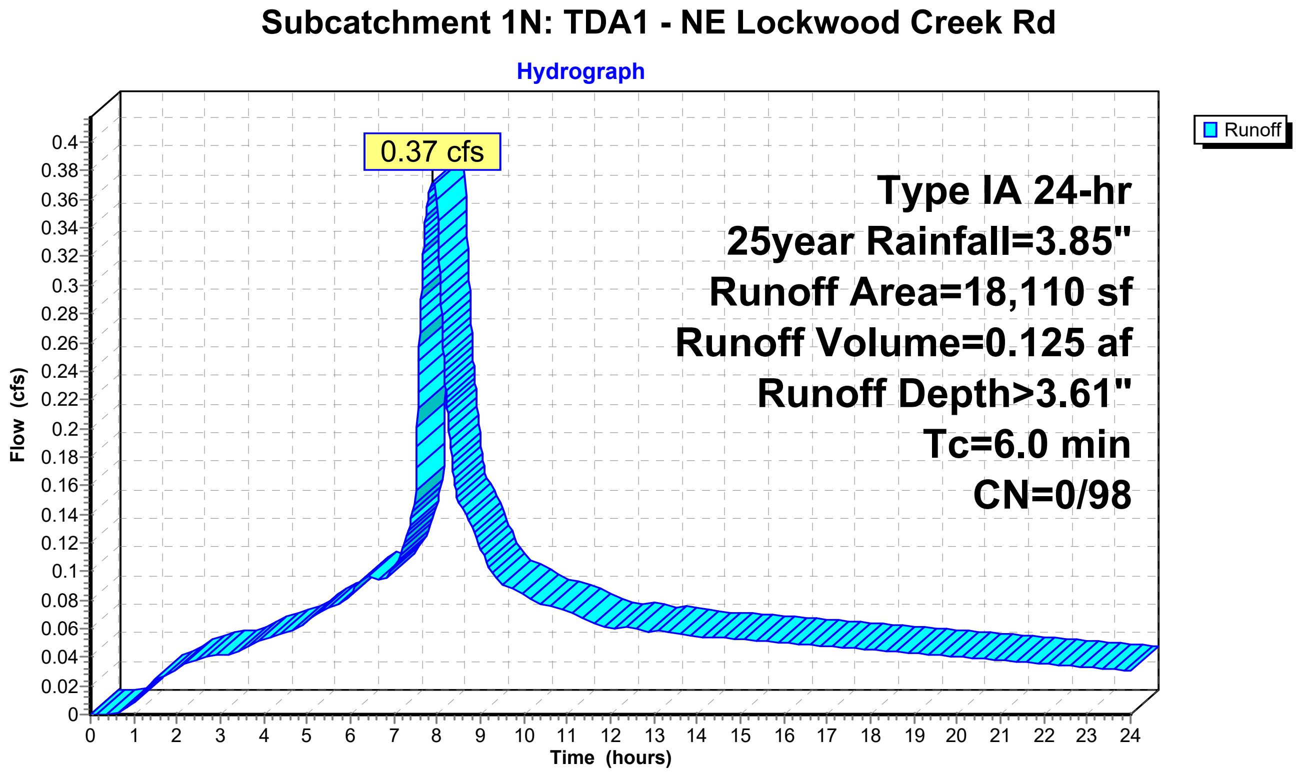
Summary for Subcatchment 1N: TDA1 - NE Lockwood Creek Rd

Runoff = 0.37 cfs @ 7.90 hrs, Volume= 0.125 af, Depth> 3.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25year Rainfall=3.85"

	Area (sf)	CN	Description
*	18,110	98	Existing NE Lockwood Creek Rd
	18,110	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min**



Summary for Subcatchment 2N: TDA1 - LCMS Pasture

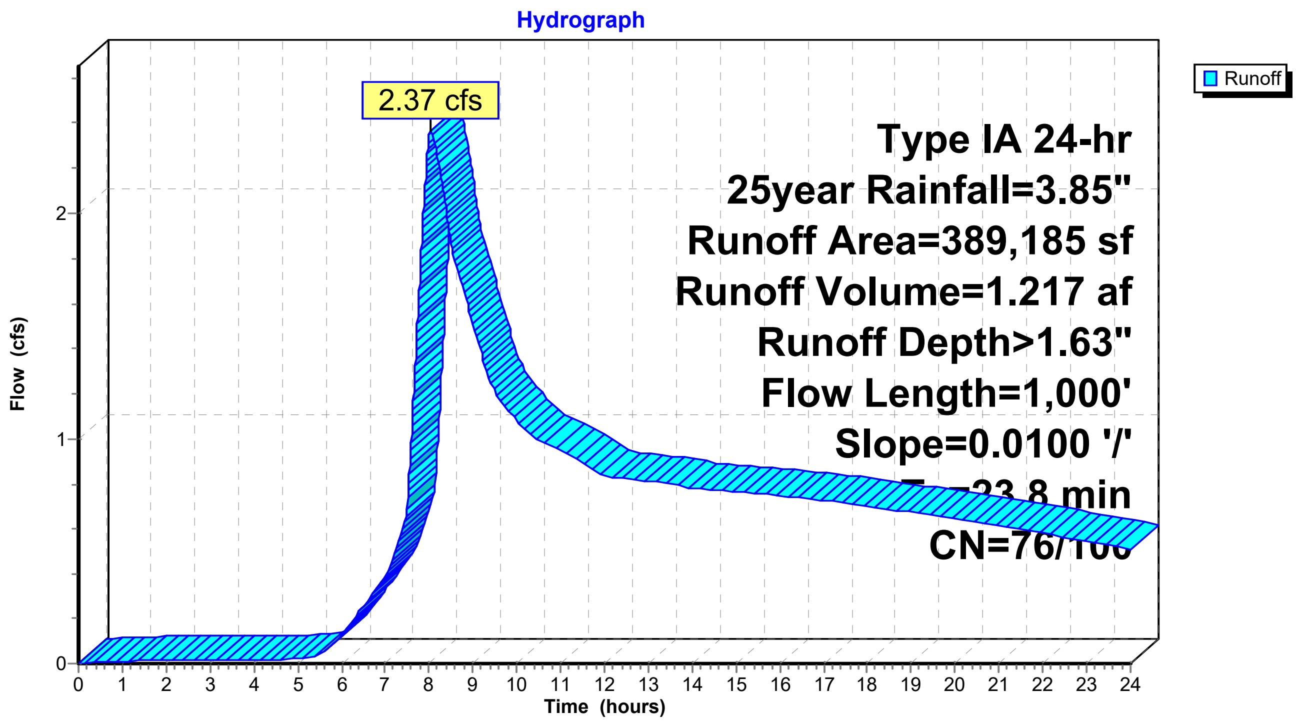
Runoff = 2.37 cfs @ 8.01 hrs, Volume= 1.217 af, Depth> 1.63"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25year Rainfall=3.85"

	Area (sf)	CN	Description
*	383,541	76	Existing Grass Cover (Undisturbed Forest)
*	5,644	100	Wetland
	389,185	76	Weighted Average
	383,541	76	98.55% Pervious Area
	5,644	100	1.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	1,000	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2N: TDA1 - LCMS Pasture



Summary for Subcatchment 2S: TDA2

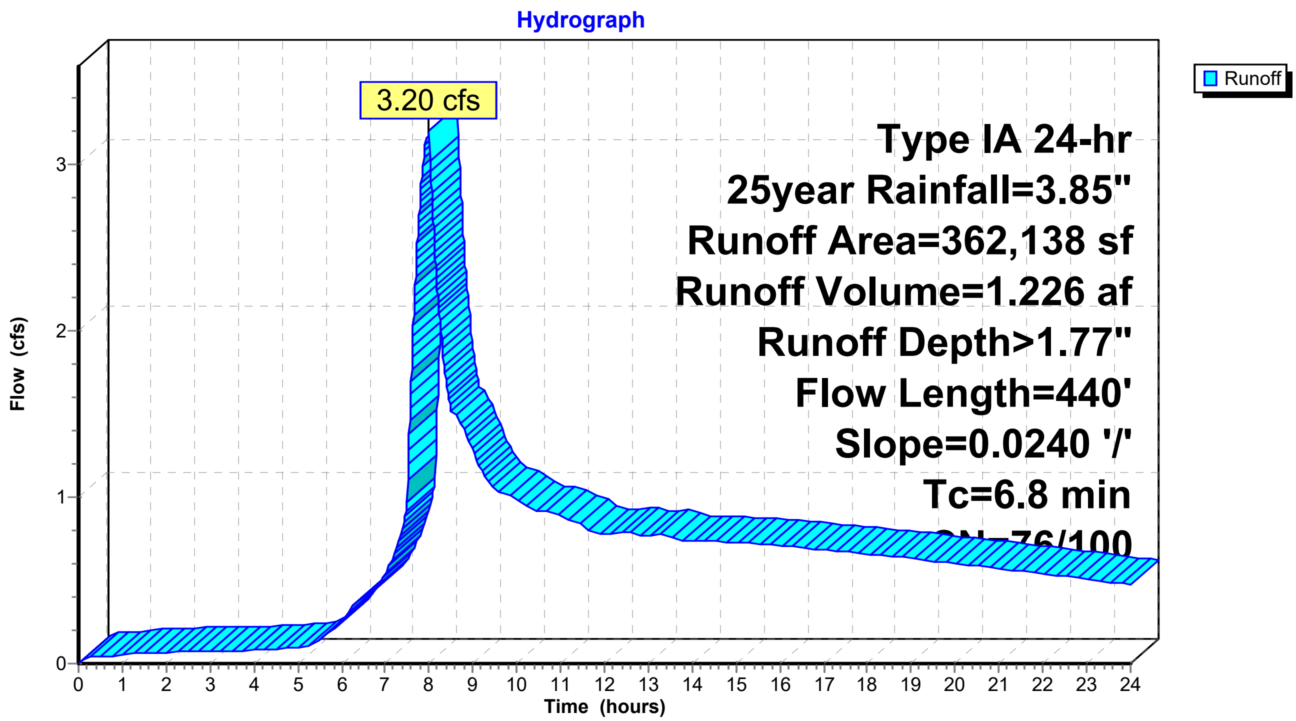
Runoff = 3.20 cfs @ 8.00 hrs, Volume= 1.226 af, Depth> 1.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25year Rainfall=3.85"

	Area (sf)	CN	Description
*	24,708	100	Wetland
*	337,430	76	Existing Grass Cover (Undisturbed Forest)
	362,138	78	Weighted Average
	337,430	76	93.18% Pervious Area
	24,708	100	6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2S: TDA2



Summary for Subcatchment 3N: TDA1 - Bypass Pasture

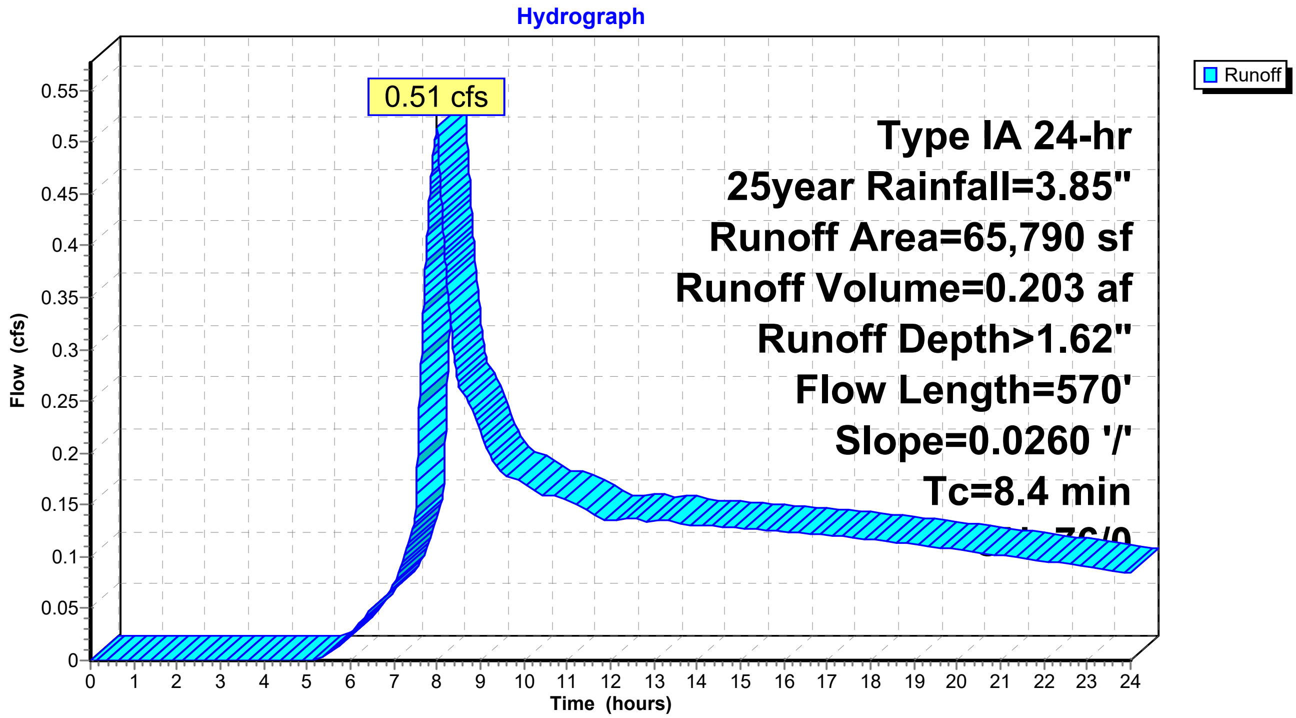
Runoff = 0.51 cfs @ 8.00 hrs, Volume= 0.203 af, Depth> 1.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25year Rainfall=3.85"

	Area (sf)	CN	Description
*	65,790	76	Existing Grass Cover (Undisturbed Forest)
	65,790	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	570	0.0260	1.13		**Shallow Concentrated Flow, Existing Ditch** Short Grass Pasture Kv= 7.0 fps

Subcatchment 3N: TDA1 - Bypass Pasture



Summary for Subcatchment 4N: TDA1 - Bypass Wetland

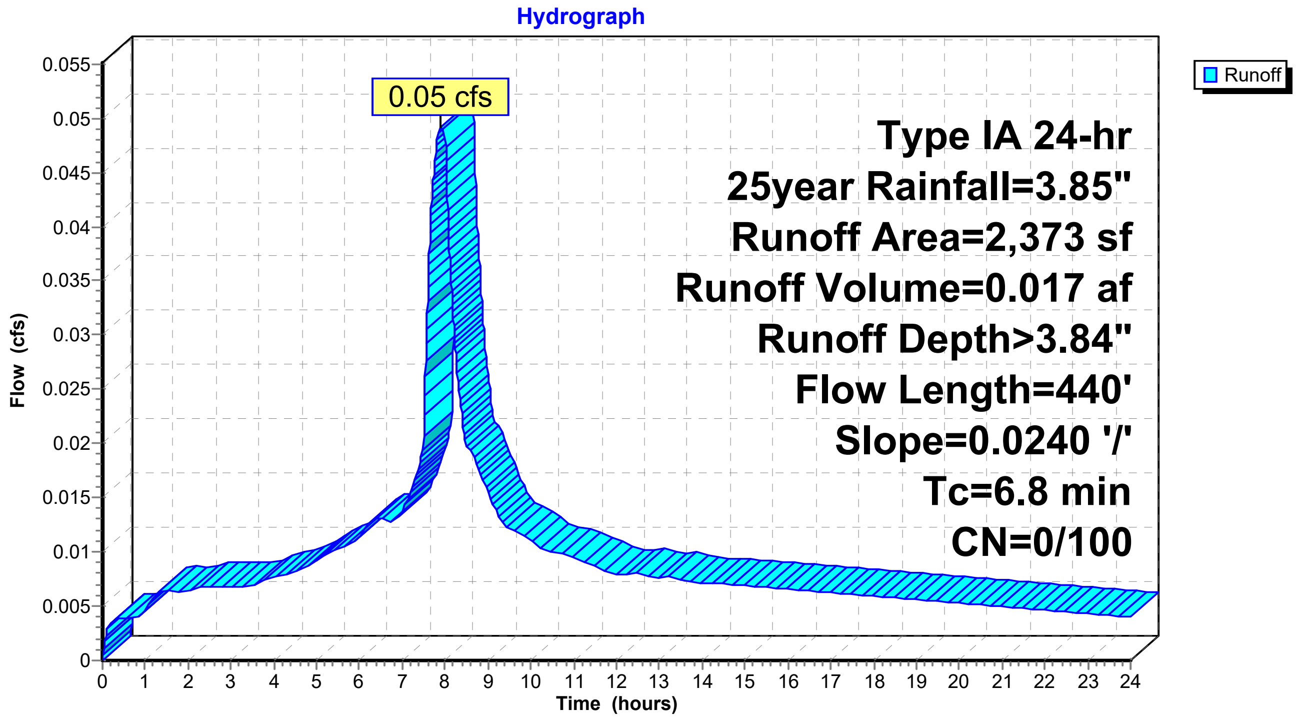
Runoff = 0.05 cfs @ 7.91 hrs, Volume= 0.017 af, Depth> 3.84"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25year Rainfall=3.85"

	Area (sf)	CN	Description
*	2,373	100	Wetland
	2,373	100	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 4N: TDA1 - Bypass Wetland



Summary for Reach 3R: TDA 2 - Ditch

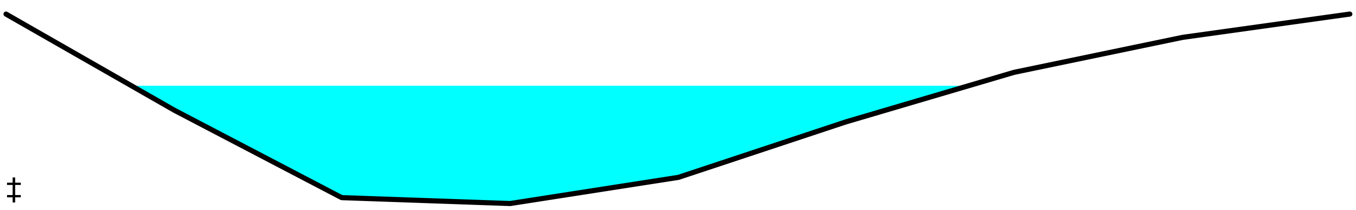
Custom Section pulled from 2017 SWWA Foothills LiDAR Elevation dataset.

Inflow Area = 8.314 ac, 6.82% Impervious, Inflow Depth > 1.77" for 25year event
Inflow = 3.20 cfs @ 8.00 hrs, Volume= 1.226 af
Outflow = 3.20 cfs @ 8.00 hrs, Volume= 1.226 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.87 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.09 fps, Avg. Travel Time= 0.5 min

Peak Storage= 53 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 0.65' Flow Area= 3.8 sf, Capacity= 8.91 cfs

Custom cross-section, Length= 31.0' Slope= 0.0048 '/'
Constant n= 0.022 Earth, clean & straight
Inlet Invert= 133.85', Outlet Invert= 133.70'

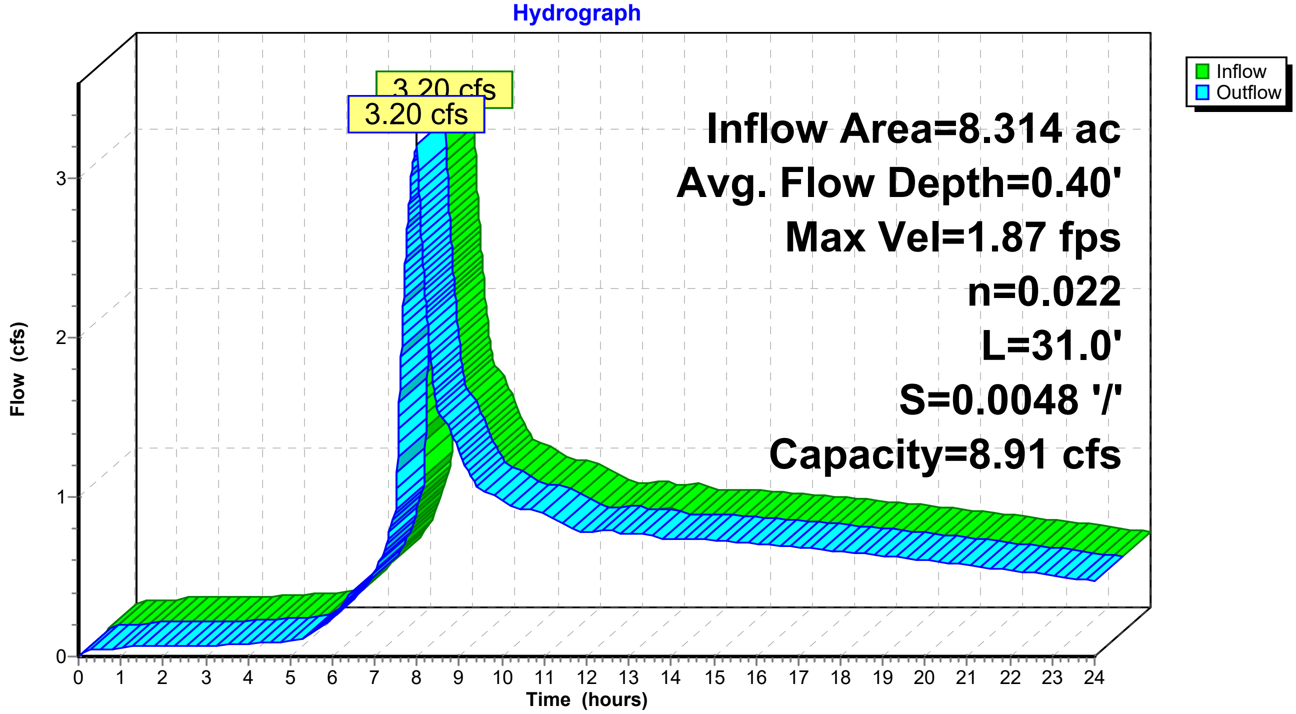


‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	134.47	0.00
1.36	134.14	0.33
2.71	133.84	0.63
4.07	133.82	0.65
5.43	133.91	0.56
6.78	134.10	0.37
8.14	134.27	0.20
9.50	134.39	0.08
10.85	134.47	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.02	0.0	1.7	1	0.00
0.09	0.2	3.0	6	0.13
0.28	1.0	5.3	30	1.46
0.32	1.2	5.8	37	1.94
0.45	2.0	7.4	63	4.05
0.57	3.0	9.3	94	6.73
0.65	3.8	11.0	119	8.91

Reach 3R: TDA 2 - Ditch



Summary for Pond 7R: TDA1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 127.95' (Flood elevation advised)

Inflow Area =	10.915 ac,	5.50% Impervious, Inflow Depth > 1.72"	for 25year event
Inflow =	3.29 cfs @	8.00 hrs, Volume=	1.563 af
Outflow =	3.29 cfs @	8.00 hrs, Volume=	1.563 af, Atten= 0%, Lag= 0.0 min
Primary =	1.93 cfs @	8.00 hrs, Volume=	1.487 af
Secondary =	1.35 cfs @	8.00 hrs, Volume=	0.076 af

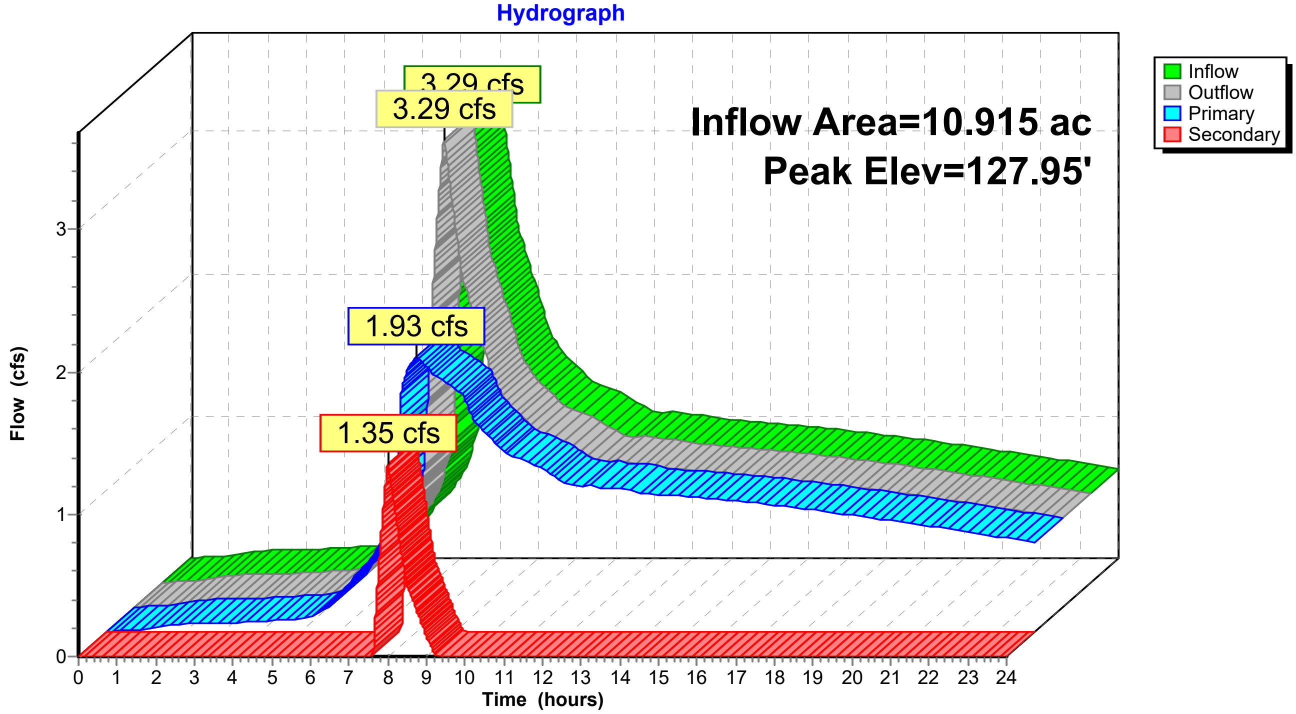
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.95' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.93 cfs @ 8.00 hrs HW=127.95' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.93 cfs @ 3.55 fps)

Secondary OutFlow Max=1.35 cfs @ 8.00 hrs HW=127.95' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.35 cfs @ 0.90 fps)

Pond 7R: TDA1 Outflow

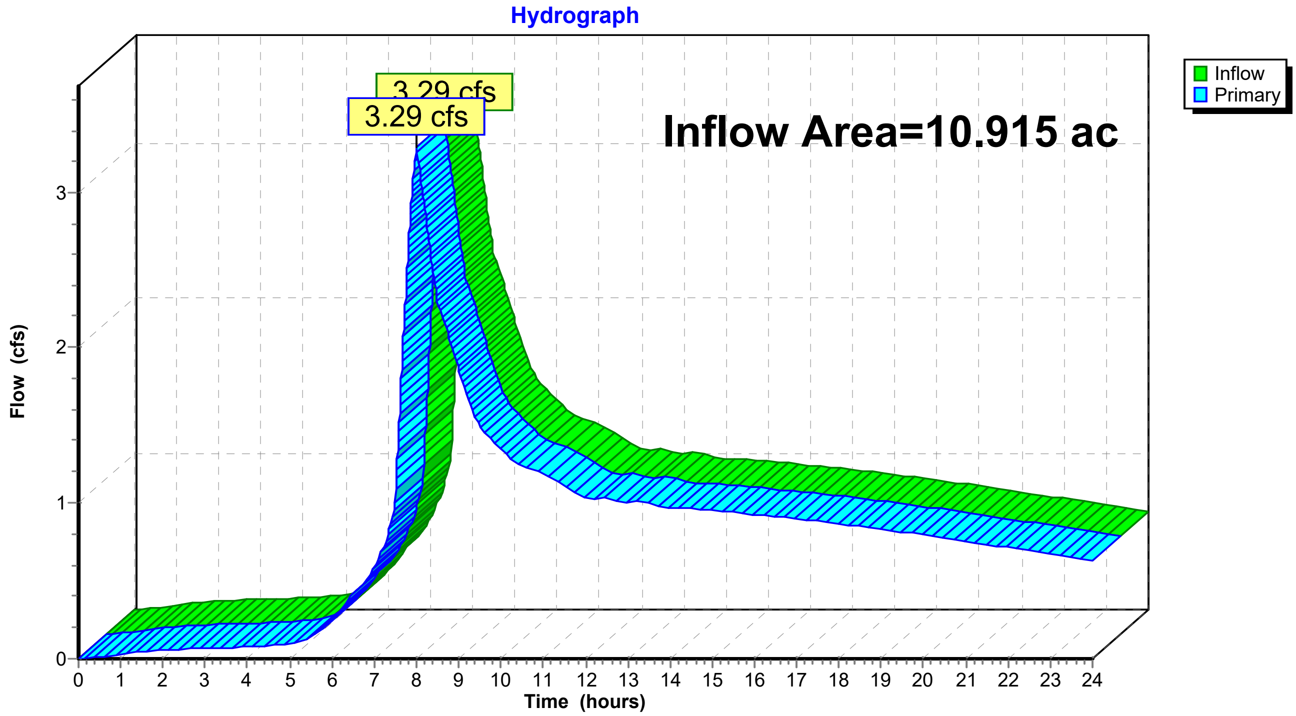


Summary for Link 9L: TDA 1 - Site Runoff

Inflow Area = 10.915 ac, 5.50% Impervious, Inflow Depth > 1.72" for 25year event
Inflow = 3.29 cfs @ 8.00 hrs, Volume= 1.563 af
Primary = 3.29 cfs @ 8.00 hrs, Volume= 1.563 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 9L: TDA 1 - Site Runoff



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1N: TDA1 - NE Lockwood Runoff Area=18,110 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=0/98 Runoff=0.44 cfs 0.147 af

Subcatchment 2N: TDA1 - LCMS Pasture Runoff Area=389,185 sf 1.45% Impervious Runoff Depth>2.14"
Flow Length=1,000' Slope=0.0100 '/' Tc=23.8 min CN=76/100 Runoff=3.30 cfs 1.591 af

Subcatchment 2S: TDA2 Runoff Area=362,138 sf 6.82% Impervious Runoff Depth>2.28"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=76/100 Runoff=4.30 cfs 1.582 af

Subcatchment 3N: TDA1 - Bypass Pasture Runoff Area=65,790 sf 0.00% Impervious Runoff Depth>2.12"
Flow Length=570' Slope=0.0260 '/' Tc=8.4 min CN=76/0 Runoff=0.71 cfs 0.267 af

Subcatchment 4N: TDA1 - Bypass Wetland Runoff Area=2,373 sf 100.00% Impervious Runoff Depth>4.49"
Flow Length=440' Slope=0.0240 '/' Tc=6.8 min CN=0/100 Runoff=0.06 cfs 0.020 af

Reach 3R: TDA 2 - Ditch Avg. Flow Depth=0.46' Max Vel=2.02 fps Inflow=4.30 cfs 1.582 af
n=0.022 L=31.0' S=0.0048 '/' Capacity=8.91 cfs Outflow=4.30 cfs 1.582 af

Pond 7R: TDA1 Outflow Peak Elev=128.02' Inflow=4.48 cfs 2.025 af
Primary=2.06 cfs 1.839 af Secondary=2.43 cfs 0.186 af Outflow=4.48 cfs 2.025 af

Link 9L: TDA 1 - Site Runoff Inflow=4.48 cfs 2.025 af
Primary=4.48 cfs 2.025 af

Total Runoff Area = 19.229 ac Runoff Volume = 3.608 af Average Runoff Depth = 2.25"
93.93% Pervious = 18.062 ac 6.07% Impervious = 1.167 ac

Summary for Subcatchment 1N: TDA1 - NE Lockwood Creek Rd

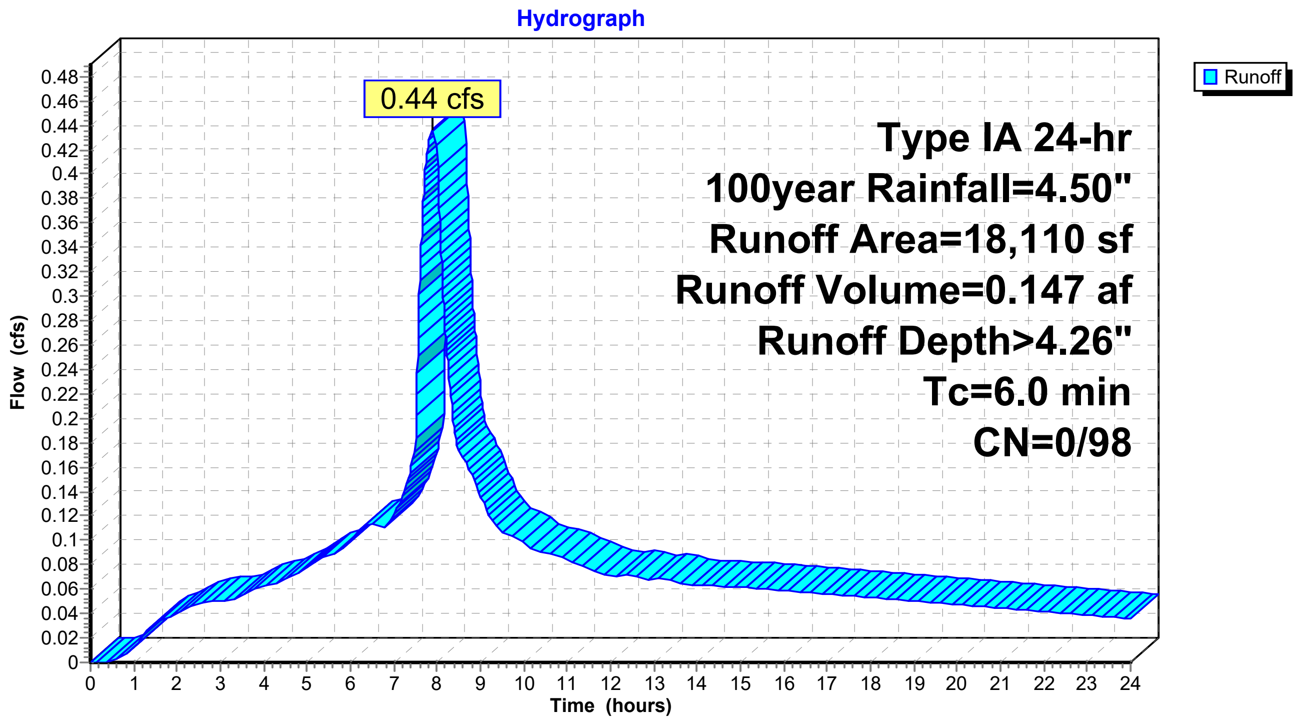
Runoff = 0.44 cfs @ 7.90 hrs, Volume= 0.147 af, Depth> 4.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (sf)	CN	Description
*	18,110	98	Existing NE Lockwood Creek Rd
	18,110	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min**

Subcatchment 1N: TDA1 - NE Lockwood Creek Rd



Summary for Subcatchment 2N: TDA1 - LCMS Pasture

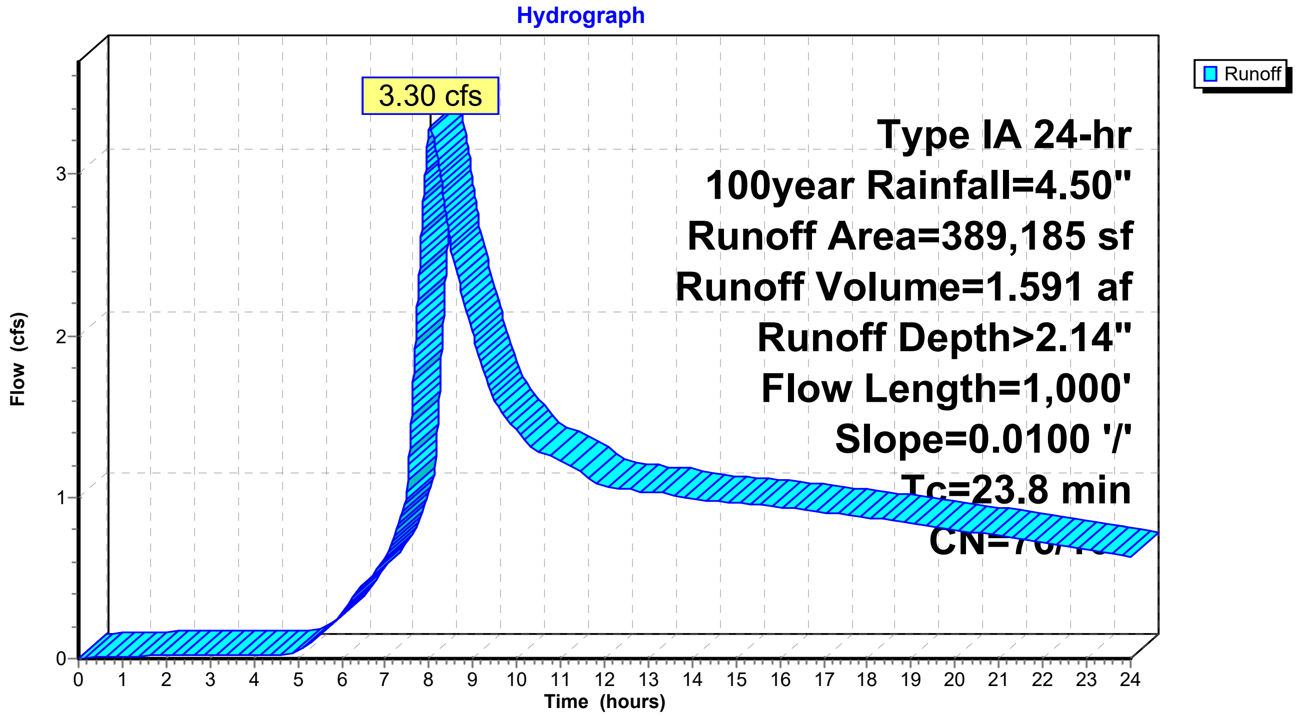
Runoff = 3.30 cfs @ 8.01 hrs, Volume= 1.591 af, Depth> 2.14"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (sf)	CN	Description
*	383,541	76	Existing Grass Cover (Undisturbed Forest)
*	5,644	100	Wetland
	389,185	76	Weighted Average
	383,541	76	98.55% Pervious Area
	5,644	100	1.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	1,000	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2N: TDA1 - LCMS Pasture



Summary for Subcatchment 2S: TDA2

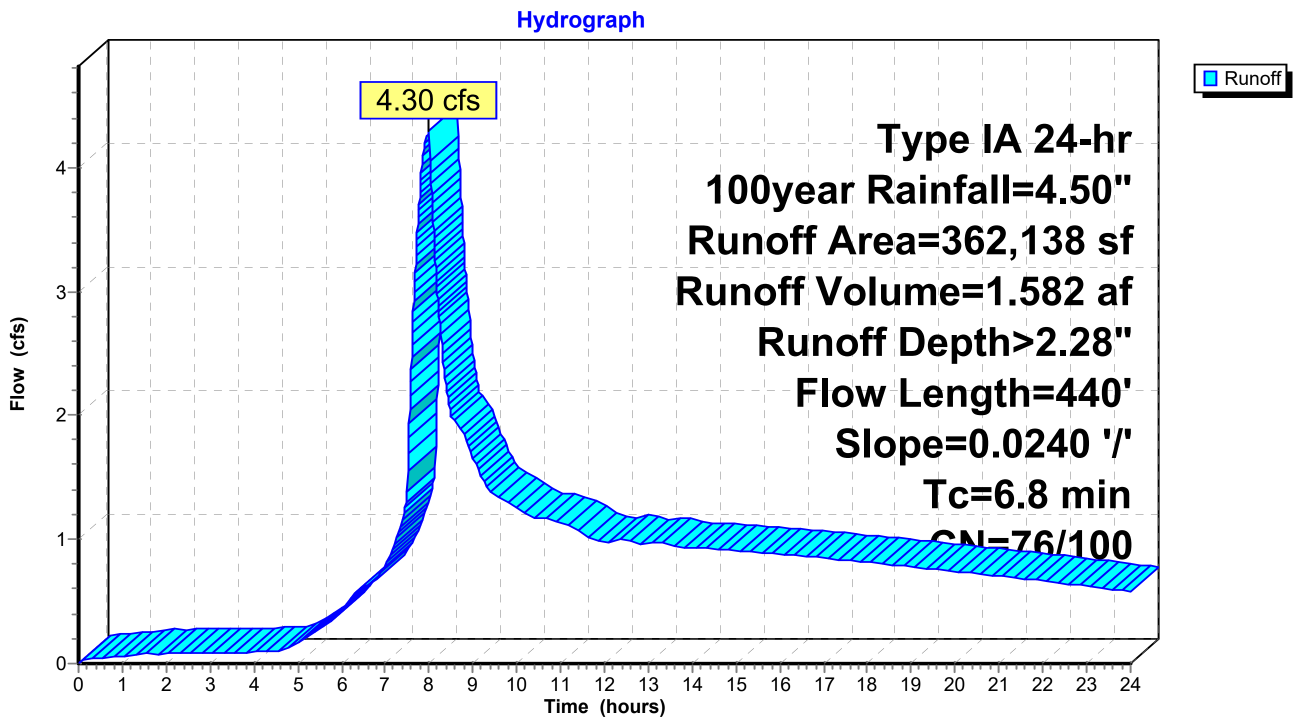
Runoff = 4.30 cfs @ 7.99 hrs, Volume= 1.582 af, Depth> 2.28"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (sf)	CN	Description
*	24,708	100	Wetland
*	337,430	76	Existing Grass Cover (Undisturbed Forest)
	362,138	78	Weighted Average
	337,430	76	93.18% Pervious Area
	24,708	100	6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment 2S: TDA2



Summary for Subcatchment 3N: TDA1 - Bypass Pasture

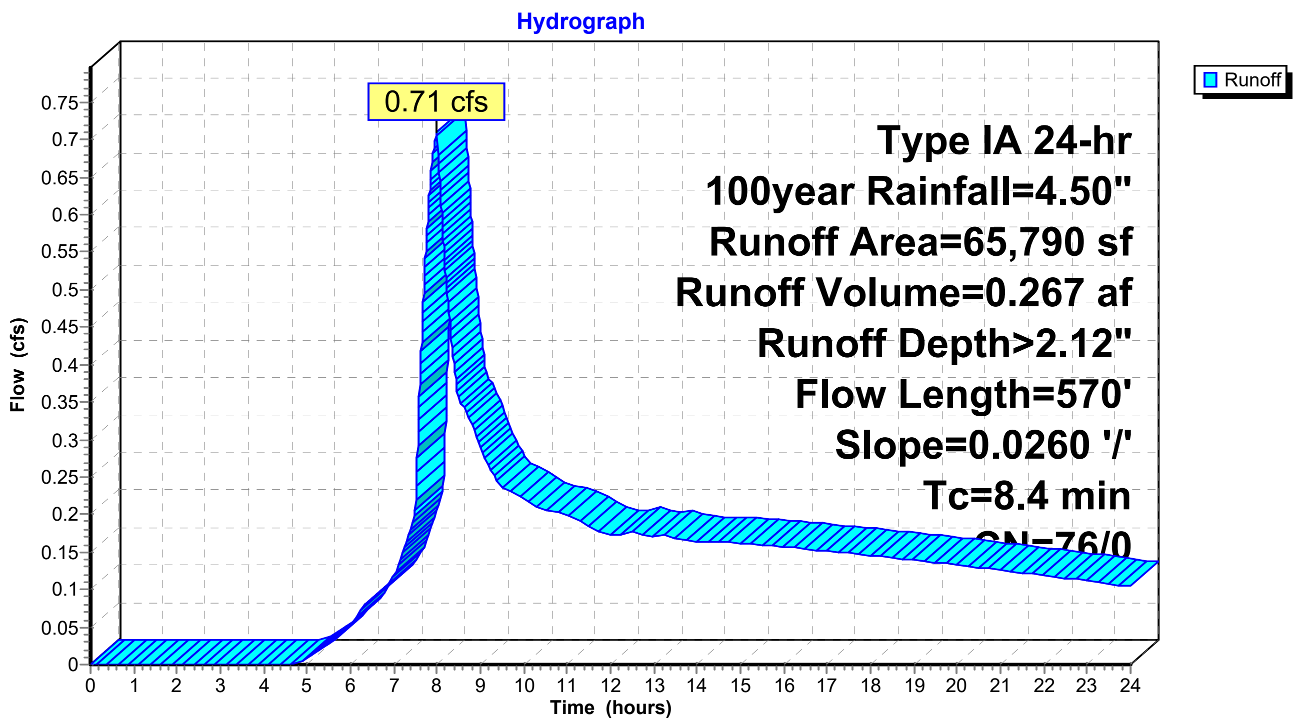
Runoff = 0.71 cfs @ 8.00 hrs, Volume= 0.267 af, Depth> 2.12"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (sf)	CN	Description
*	65,790	76	Existing Grass Cover (Undisturbed Forest)
	65,790	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	570	0.0260	1.13		**Shallow Concentrated Flow, Existing Ditch** Short Grass Pasture Kv= 7.0 fps

Subcatchment 3N: TDA1 - Bypass Pasture



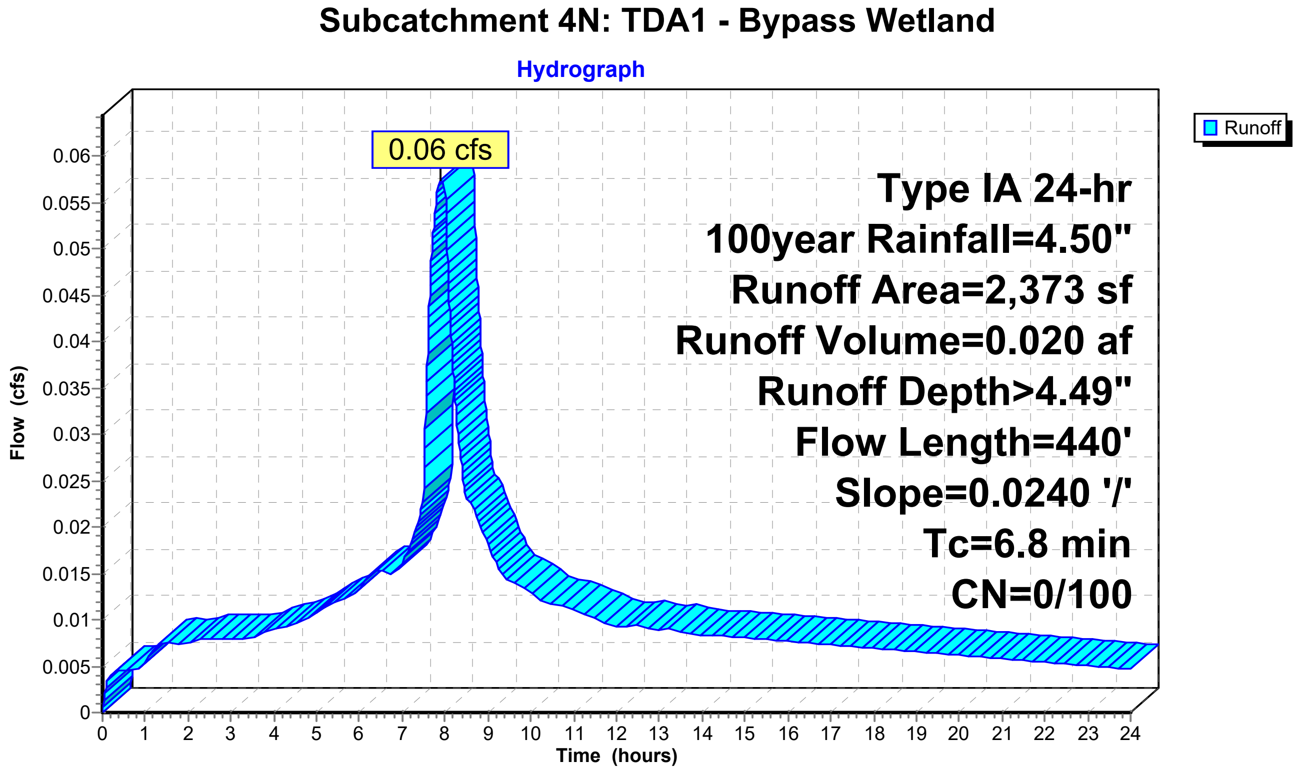
Summary for Subcatchment 4N: TDA1 - Bypass Wetland

Runoff = 0.06 cfs @ 7.91 hrs, Volume= 0.020 af, Depth> 4.49"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (sf)	CN	Description
*	2,373	100	Wetland
	2,373	100	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	440	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps



Summary for Reach 3R: TDA 2 - Ditch

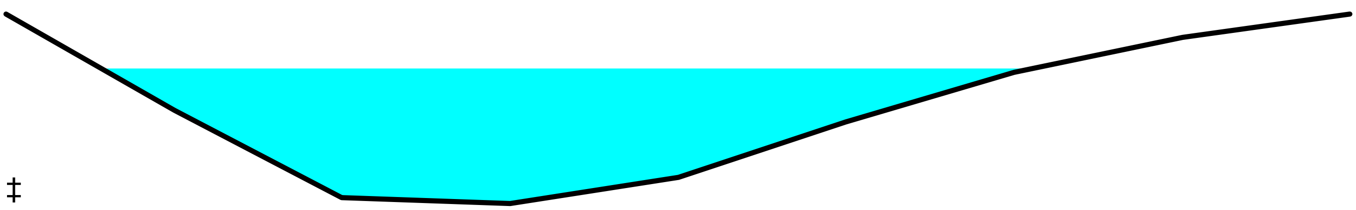
Custom Section pulled from 2017 SWWA Foothills LiDAR Elevation dataset.

Inflow Area = 8.314 ac, 6.82% Impervious, Inflow Depth > 2.28" for 100year event
Inflow = 4.30 cfs @ 7.99 hrs, Volume= 1.582 af
Outflow = 4.30 cfs @ 8.00 hrs, Volume= 1.582 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.02 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 0.4 min

Peak Storage= 66 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 0.65' Flow Area= 3.8 sf, Capacity= 8.91 cfs

Custom cross-section, Length= 31.0' Slope= 0.0048 '/'
Constant n= 0.022 Earth, clean & straight
Inlet Invert= 133.85', Outlet Invert= 133.70'



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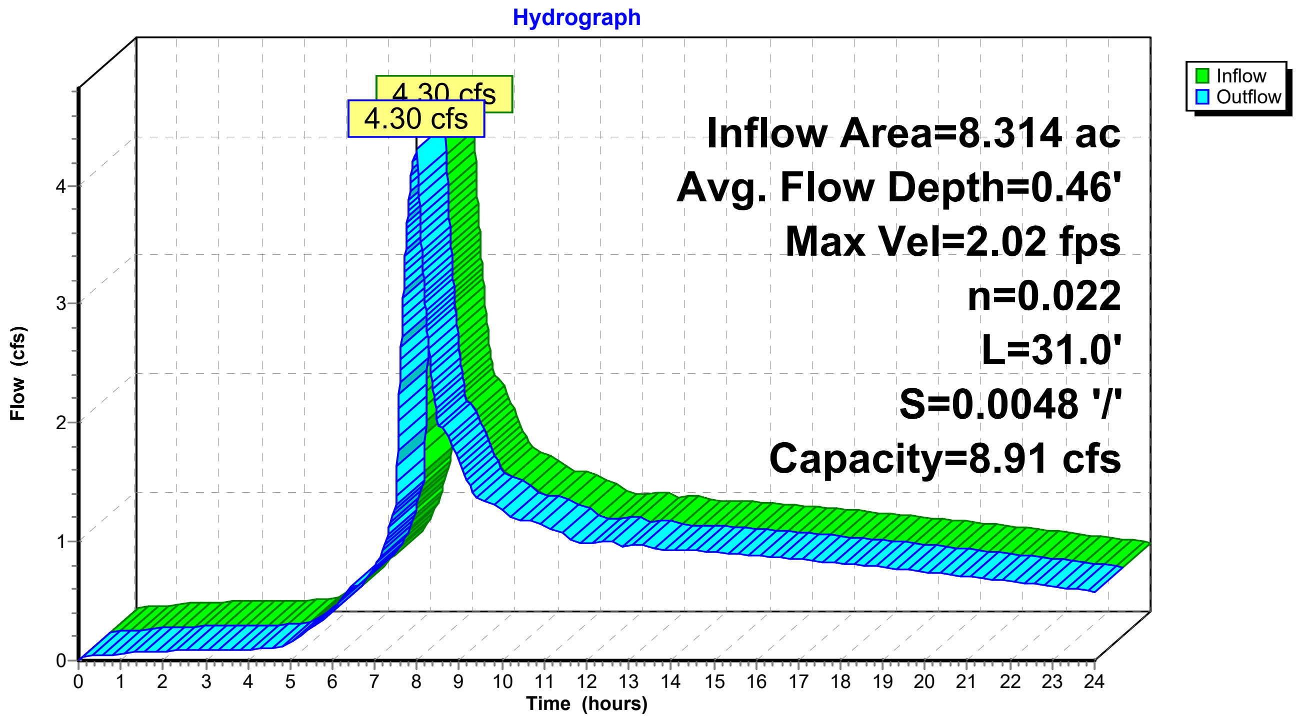
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	134.47	0.00
1.36	134.14	0.33
2.71	133.84	0.63
4.07	133.82	0.65
5.43	133.91	0.56
6.78	134.10	0.37
8.14	134.27	0.20
9.50	134.39	0.08
10.85	134.47	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.02	0.0	1.7	1	0.00
0.09	0.2	3.0	6	0.13
0.28	1.0	5.3	30	1.46
0.32	1.2	5.8	37	1.94
0.45	2.0	7.4	63	4.05
0.57	3.0	9.3	94	6.73
0.65	3.8	11.0	119	8.91

Reach 3R: TDA 2 - Ditch



Summary for Pond 7R: TDA1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 128.02' (Flood elevation advised)

Inflow Area = 10.915 ac, 5.50% Impervious, Inflow Depth > 2.23" for 100year event
Inflow = 4.48 cfs @ 8.00 hrs, Volume= 2.025 af
Outflow = 4.48 cfs @ 8.00 hrs, Volume= 2.025 af, Atten= 0%, Lag= 0.0 min
Primary = 2.06 cfs @ 8.00 hrs, Volume= 1.839 af
Secondary = 2.43 cfs @ 8.00 hrs, Volume= 0.186 af

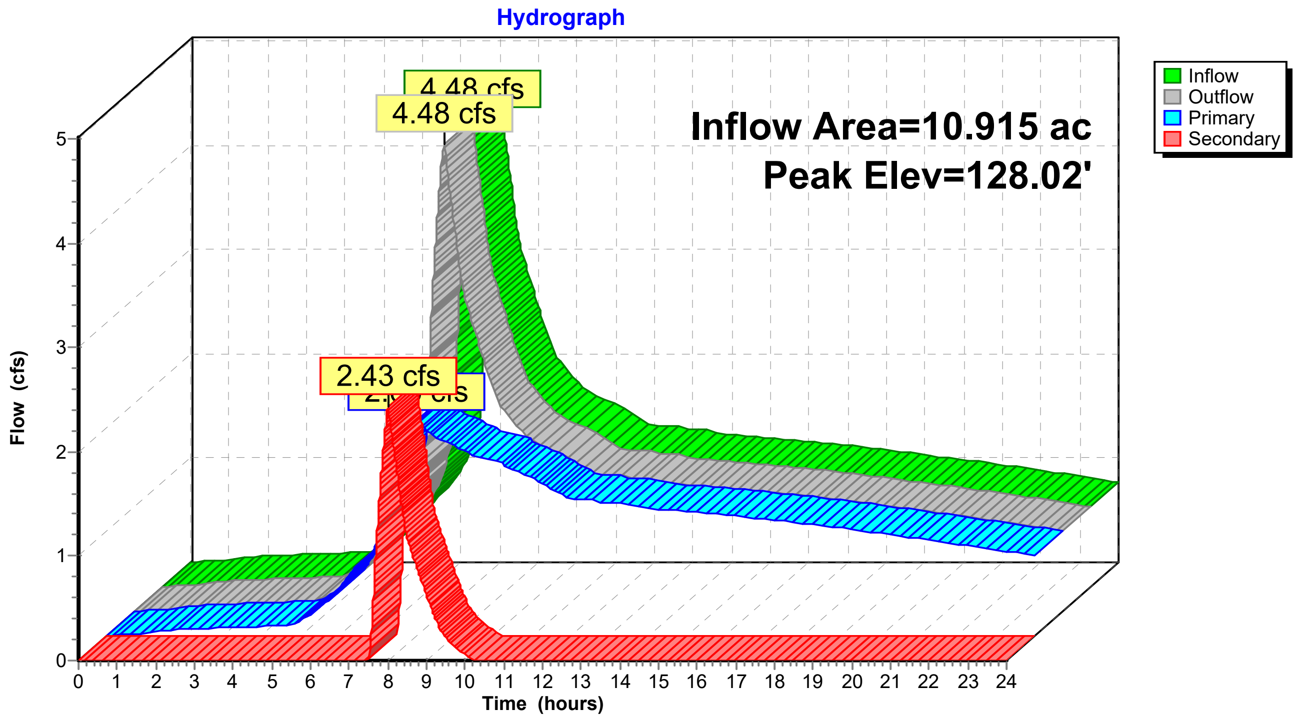
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.02' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.06 cfs @ 8.00 hrs HW=128.02' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 2.06 cfs @ 3.77 fps)

Secondary OutFlow Max=2.43 cfs @ 8.00 hrs HW=128.02' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.43 cfs @ 1.10 fps)

Pond 7R: TDA1 Outflow

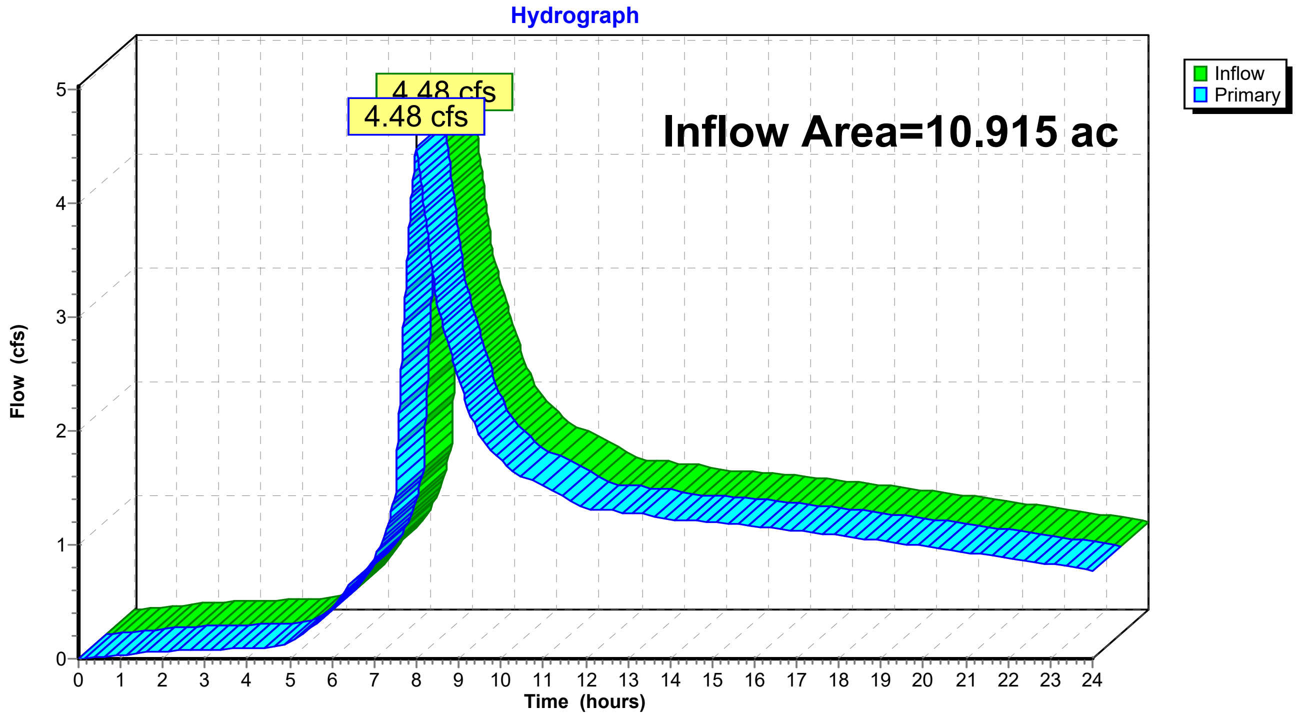


Summary for Link 9L: TDA 1 - Site Runoff

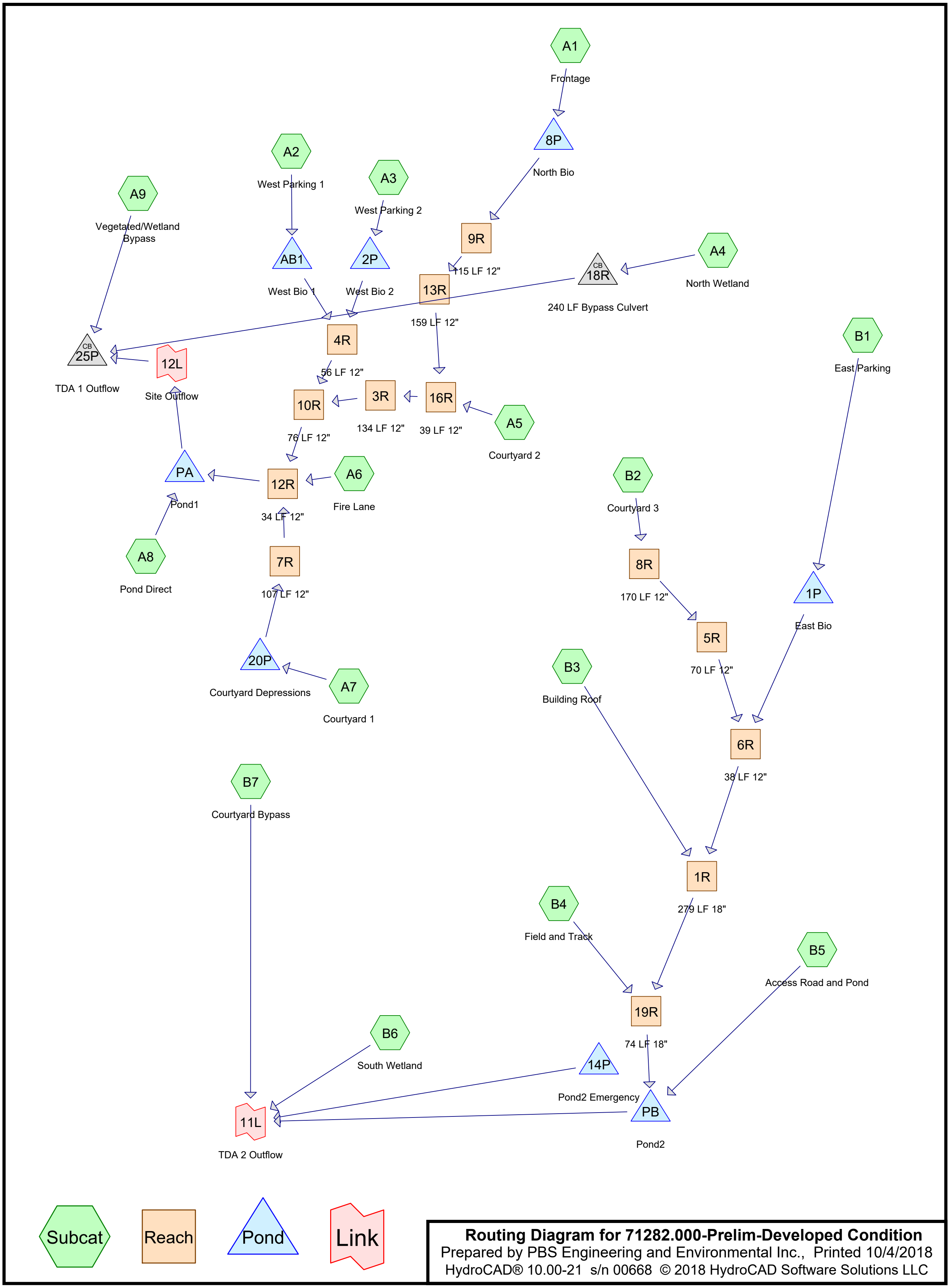
Inflow Area = 10.915 ac, 5.50% Impervious, Inflow Depth > 2.23" for 100year event
Inflow = 4.48 cfs @ 8.00 hrs, Volume= 2.025 af
Primary = 4.48 cfs @ 8.00 hrs, Volume= 2.025 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 9L: TDA 1 - Site Runoff



HydroCAD Post-Development On-Site Model



Routing Diagram for 71282.000-Prelim-Developed Condition
Prepared by PBS Engineering and Environmental Inc., Printed 10/4/2018
HydroCAD® 10.00-21 s/n 00668 © 2018 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.484	86	Bioretention/Landscape (A2, A3, B1)
0.670	86	Courtyard Landscaping (A5, A6, A7, B2, B4, B7)
0.994	98	Courtyard Pavement (A5, A7, B2, B7)
0.142	86	Disturbed Vegetated (B1)
1.633	86	Field (B4)
0.213	86	Fill Slope (A9)
0.320	98	Fire Lane (A6, A7, B7)
0.631	98	Fire Lane/Access Road (B4)
0.132	96	Gravel Road (B5)
0.118	86	Landscaping/Fill Slope (A4)
2.123	98	Parking Lot/Sidewalk (A2, A3, B1)
0.020	98	Paved Access Road (B5)
0.126	86	Pond Top Area (A8)
0.867	86	Pond/Landscaping (B5)
0.131	98	Pump Station/Access (B5)
0.713	98	Road/Sidewalk (A1)
1.504	98	Roofs, HSG D (B3)
0.153	86	Site Fill (B6)
0.086	98	Track (B4)
1.014	76	Undisturbed (B4, B5)
1.504	76	Undisturbed Buffer (A4)
4.991	76	Undisturbed Forest (A9, B1, B6)
0.659	100	Wetland (A4, A9, B6)
19.229	**87**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.504	HSG D	B3
17.725	Other	A1, A2, A3, A4, A5, A6, A7, A8, A9, B1, B2, B4, B5, B6, B7
19.229		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	0.484	0.484	Bioretention/Landscape	A2, A3, B1
0.000	0.000	0.000	0.000	0.670	0.670	Courtyard Landscaping	A5, A6, A7, B2, B4, B7
0.000	0.000	0.000	0.000	0.994	0.994	Courtyard Pavement	A5, A7, B2, B7
0.000	0.000	0.000	0.000	0.142	0.142	Disturbed Vegetated	B1
0.000	0.000	0.000	0.000	1.633	1.633	Field	B4
0.000	0.000	0.000	0.000	0.213	0.213	Fill Slope	A9
0.000	0.000	0.000	0.000	0.320	0.320	Fire Lane	A6, A7, B7
0.000	0.000	0.000	0.000	0.631	0.631	Fire Lane/Access Road	B4
0.000	0.000	0.000	0.000	0.132	0.132	Gravel Road	B5
0.000	0.000	0.000	0.000	0.118	0.118	Landscaping/Fill Slope	A4
0.000	0.000	0.000	0.000	2.123	2.123	Parking Lot/Sidewalk	A2, A3, B1
0.000	0.000	0.000	0.000	0.020	0.020	Paved Access Road	B5
0.000	0.000	0.000	0.000	0.126	0.126	Pond Top Area	A8
0.000	0.000	0.000	0.000	0.867	0.867	Pond/Landscaping	B5
0.000	0.000	0.000	0.000	0.131	0.131	Pump Station/Access	B5
0.000	0.000	0.000	0.000	0.713	0.713	Road/Sidewalk	A1
0.000	0.000	0.000	1.504	0.000	1.504	Roofs	B3
0.000	0.000	0.000	0.000	0.153	0.153	Site Fill	B6
0.000	0.000	0.000	0.000	0.086	0.086	Track	B4
0.000	0.000	0.000	0.000	1.014	1.014	Undisturbed	B4, B5
0.000	0.000	0.000	0.000	1.504	1.504	Undisturbed Buffer	A4
0.000	0.000	0.000	0.000	4.991	4.991	Undisturbed Forest	A9, B1, B6
0.000	0.000	0.000	0.000	0.659	0.659	Wetland	A4, A9, B6
0.000	**0.000**	**0.000**	**1.504**	**17.725**	**19.229**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1R	132.54	131.70	279.0	0.0030	0.012	18.0	0.0	0.0
2	3R	132.46	131.53	134.0	0.0069	0.012	12.0	0.0	0.0
3	4R	132.63	132.35	56.0	0.0050	0.012	12.0	0.0	0.0
4	5R	133.15	132.65	70.0	0.0071	0.012	12.0	0.0	0.0
5	6R	132.65	132.54	38.0	0.0029	0.012	12.0	0.0	0.0
6	7R	131.42	130.67	107.0	0.0070	0.012	12.0	0.0	0.0
7	8R	134.04	133.15	170.0	0.0052	0.012	12.0	0.0	0.0
8	9R	136.50	135.93	115.0	0.0050	0.012	12.0	0.0	0.0
9	10R	131.43	130.67	76.0	0.0100	0.012	12.0	0.0	0.0
10	12R	130.57	130.30	34.0	0.0079	0.012	12.0	0.0	0.0
11	13R	135.82	132.85	159.0	0.0187	0.012	12.0	0.0	0.0
12	16R	132.75	132.56	39.0	0.0049	0.012	12.0	0.0	0.0
13	19R	131.70	131.50	74.0	0.0027	0.012	18.0	0.0	0.0
14	18R	132.50	131.70	240.0	0.0033	0.012	36.0	0.0	0.0
15	25P	126.99	120.35	247.0	0.0269	0.012	10.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A1: Frontage Runoff Area=0.713 ac 100.00% Impervious Runoff Depth>2.17"
Tc=5.0 min CN=0/98 Runoff=0.39 cfs 0.129 af

Subcatchment A2: West Parking 1 Runoff Area=29,090 sf 85.39% Impervious Runoff Depth>2.02"
Tc=5.0 min CN=86/98 Runoff=0.34 cfs 0.112 af

Subcatchment A3: West Parking 2 Runoff Area=0.688 ac 93.31% Impervious Runoff Depth>2.10"
Tc=5.0 min CN=86/98 Runoff=0.37 cfs 0.120 af

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>0.73"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.22 cfs 0.102 af

Subcatchment A5: Courtyard 2 Runoff Area=0.248 ac 87.10% Impervious Runoff Depth>2.04"
Tc=5.0 min CN=86/98 Runoff=0.13 cfs 0.042 af

Subcatchment A6: Fire Lane Runoff Area=0.140 ac 53.57% Impervious Runoff Depth>1.67"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.03 cfs 0.019 af

Subcatchment A7: Courtyard 1 Runoff Area=0.491 ac 82.28% Impervious Runoff Depth>1.95"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.14 cfs 0.080 af

Subcatchment A8: Pond Direct Runoff Area=5,502 sf 0.00% Impervious Runoff Depth>1.16"
Tc=10.0 min CN=86/0 Runoff=0.03 cfs 0.012 af

Subcatchment A9: Vegetated/Wetland Runoff Area=40,486 sf 4.10% Impervious Runoff Depth>0.79"
Flow Length=240' Slope=0.0750 '/' Tc=14.0 min CN=78/100 Runoff=0.12 cfs 0.061 af

Subcatchment B1: East Parking Runoff Area=88,300 sf 44.93% Impervious Runoff Depth>1.42"
Tc=5.0 min CN=80/98 Runoff=0.67 cfs 0.241 af

Subcatchment B2: Courtyard 3 Runoff Area=24,008 sf 70.66% Impervious Runoff Depth>1.87"
Tc=5.0 min CN=86/98 Runoff=0.26 cfs 0.086 af

Subcatchment B3: Building Roof Runoff Area=65,510 sf 100.00% Impervious Runoff Depth>2.17"
Tc=0.0 min CN=0/98 Runoff=0.85 cfs 0.272 af

Subcatchment B4: Field and Track Runoff Area=121,328 sf 25.76% Impervious Runoff Depth>1.31"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=84/98 Runoff=0.55 cfs 0.303 af

Subcatchment B5: Access Road and Pond Runoff Area=75,574 sf 8.72% Impervious Runoff Depth>1.06"
Flow Length=260' Slope=0.0100 '/' Tc=33.5 min CN=83/98 Runoff=0.27 cfs 0.154 af

Subcatchment B6: South Wetland Runoff Area=191,628 sf 12.89% Impervious Runoff Depth>0.84"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=76/100 Runoff=0.42 cfs 0.309 af

Subcatchment B7: Courtyard Bypass Runoff Area=23,868 sf 41.91% Impervious Runoff Depth>1.58"
Flow Length=330' Slope=0.0100 '/' Tc=12.9 min CN=86/98 Runoff=0.19 cfs 0.072 af

Reach 1R: 279 LF 18" Avg. Flow Depth=0.54' Max Vel=3.01 fps Inflow=1.72 cfs 0.598 af
18.0" Round Pipe n=0.012 L=279.0' S=0.0030 '/' Capacity=6.24 cfs Outflow=1.72 cfs 0.597 af

Reach 3R: 134 LF 12" Avg. Flow Depth=0.24' Max Vel=2.78 fps Inflow=0.40 cfs 0.170 af
12.0" Round Pipe n=0.012 L=134.0' S=0.0069 '/' Capacity=3.22 cfs Outflow=0.40 cfs 0.170 af

Reach 4R: 56 LF 12" Avg. Flow Depth=0.30' Max Vel=2.72 fps Inflow=0.55 cfs 0.232 af
12.0" Round Pipe n=0.012 L=56.0' S=0.0050 '/' Capacity=2.73 cfs Outflow=0.55 cfs 0.232 af

Reach 5R: 70 LF 12" Avg. Flow Depth=0.19' Max Vel=2.48 fps Inflow=0.26 cfs 0.086 af
12.0" Round Pipe n=0.012 L=70.0' S=0.0071 '/' Capacity=3.26 cfs Outflow=0.26 cfs 0.086 af

Reach 6R: 38 LF 12" Avg. Flow Depth=0.46' Max Vel=2.56 fps Inflow=0.91 cfs 0.326 af
12.0" Round Pipe n=0.012 L=38.0' S=0.0029 '/' Capacity=2.08 cfs Outflow=0.91 cfs 0.326 af

Reach 7R: 107 LF 12" Avg. Flow Depth=0.14' Max Vel=2.04 fps Inflow=0.14 cfs 0.079 af
12.0" Round Pipe n=0.012 L=107.0' S=0.0070 '/' Capacity=3.23 cfs Outflow=0.14 cfs 0.079 af

Reach 8R: 170 LF 12" Avg. Flow Depth=0.21' Max Vel=2.22 fps Inflow=0.26 cfs 0.086 af
12.0" Round Pipe n=0.012 L=170.0' S=0.0052 '/' Capacity=2.79 cfs Outflow=0.26 cfs 0.086 af

Reach 9R: 115 LF 12" Avg. Flow Depth=0.22' Max Vel=2.23 fps Inflow=0.28 cfs 0.128 af
12.0" Round Pipe n=0.012 L=115.0' S=0.0050 '/' Capacity=2.72 cfs Outflow=0.28 cfs 0.128 af

Reach 10R: 76 LF 12" Avg. Flow Depth=0.34' Max Vel=4.06 fps Inflow=0.95 cfs 0.402 af
12.0" Round Pipe n=0.012 L=76.0' S=0.0100 '/' Capacity=3.86 cfs Outflow=0.95 cfs 0.402 af

Reach 12R: 34 LF 12" Avg. Flow Depth=0.38' Max Vel=3.83 fps Inflow=1.04 cfs 0.501 af
12.0" Round Pipe n=0.012 L=34.0' S=0.0079 '/' Capacity=3.44 cfs Outflow=1.04 cfs 0.501 af

Reach 13R: 159 LF 12" Avg. Flow Depth=0.16' Max Vel=3.56 fps Inflow=0.28 cfs 0.128 af
12.0" Round Pipe n=0.012 L=159.0' S=0.0187 '/' Capacity=5.28 cfs Outflow=0.28 cfs 0.128 af

Reach 16R: 39 LF 12" Avg. Flow Depth=0.26' Max Vel=2.46 fps Inflow=0.40 cfs 0.170 af
12.0" Round Pipe n=0.012 L=39.0' S=0.0049 '/' Capacity=2.69 cfs Outflow=0.40 cfs 0.170 af

Reach 19R: 74 LF 18" Avg. Flow Depth=0.64' Max Vel=3.11 fps Inflow=2.23 cfs 0.900 af
18.0" Round Pipe n=0.012 L=74.0' S=0.0027 '/' Capacity=5.92 cfs Outflow=2.23 cfs 0.900 af

Pond 1P: East Bio Peak Elev=133.60' Storage=0.004 af Inflow=0.67 cfs 0.241 af
Outflow=0.66 cfs 0.240 af

Pond 2P: West Bio 2 Peak Elev=135.54' Storage=0.005 af Inflow=0.37 cfs 0.120 af
Outflow=0.37 cfs 0.120 af

Pond 8P: North Bio Peak Elev=145.23' Storage=0.007 af Inflow=0.39 cfs 0.129 af
Outflow=0.28 cfs 0.128 af

Pond 14P: Pond2 Emergency Peak Elev=132.00' Storage=0.448 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=134.05' Inflow=0.22 cfs 0.102 af
Outflow=0.22 cfs 0.102 af

Pond 20P: Courtyard Depressions Peak Elev=134.52' Storage=0.006 af Inflow=0.14 cfs 0.080 af
Outflow=0.14 cfs 0.079 af

Pond 25P: TDA 1 Outflow Peak Elev=127.54' Inflow=0.97 cfs 0.646 af
Primary=0.97 cfs 0.646 af Secondary=0.00 cfs 0.000 af Outflow=0.97 cfs 0.646 af

Pond AB1: West Bio 1 Peak Elev=135.46' Storage=0.009 af Inflow=0.34 cfs 0.112 af
Outflow=0.20 cfs 0.112 af

Pond PA: Pond1 Peak Elev=132.73' Storage=0.070 af Inflow=1.07 cfs 0.513 af
Outflow=0.79 cfs 0.483 af

Pond PB: Pond2 Peak Elev=132.67' Storage=0.343 af Inflow=2.50 cfs 1.054 af
Outflow=0.72 cfs 0.803 af

Link 11L: TDA 2 Outflow Inflow=1.07 cfs 1.185 af
Primary=1.07 cfs 1.185 af

Link 12L: Site Outflow Inflow=0.79 cfs 0.483 af
Primary=0.79 cfs 0.483 af

Total Runoff Area = 19.229 ac Runoff Volume = 2.115 af Average Runoff Depth = 1.32"
62.65% Pervious = 12.047 ac 37.35% Impervious = 7.182 ac

Summary for Subcatchment A1: Frontage

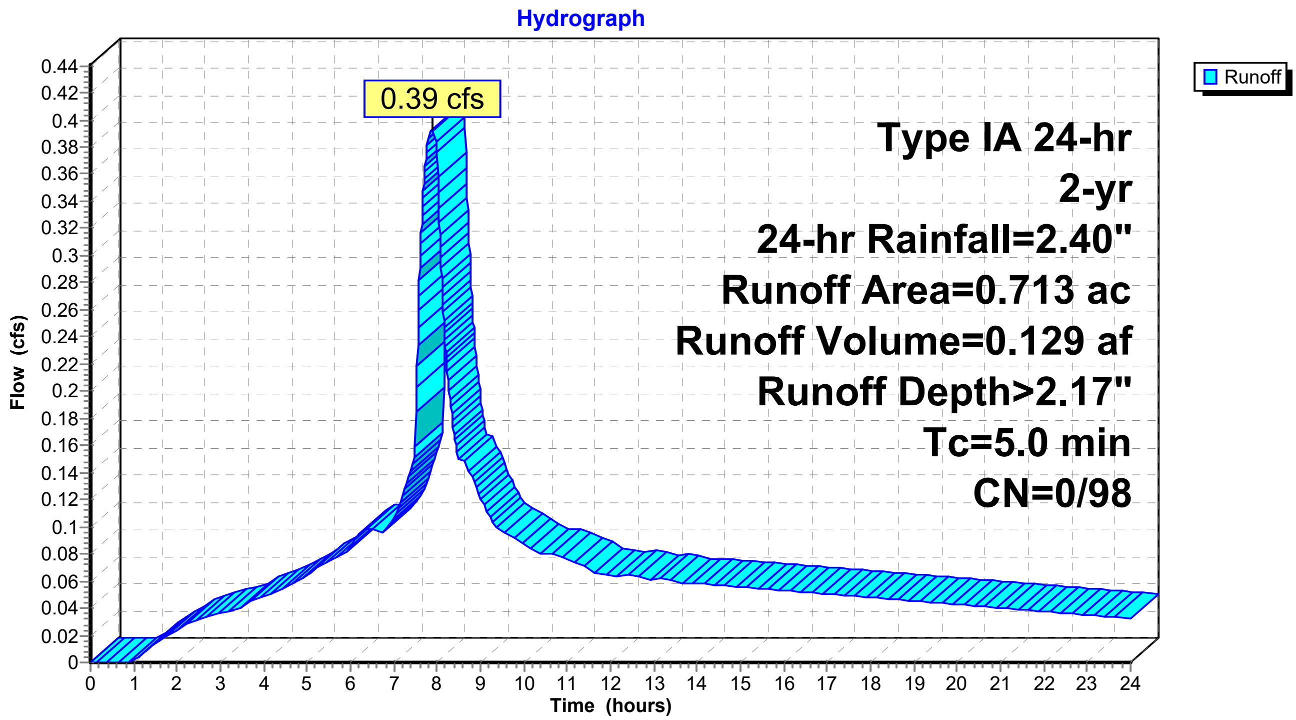
Runoff = 0.39 cfs @ 7.88 hrs, Volume= 0.129 af, Depth> 2.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	0.713	98	Road/Sidewalk
	0.713	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A1: Frontage



Summary for Subcatchment A2: West Parking 1

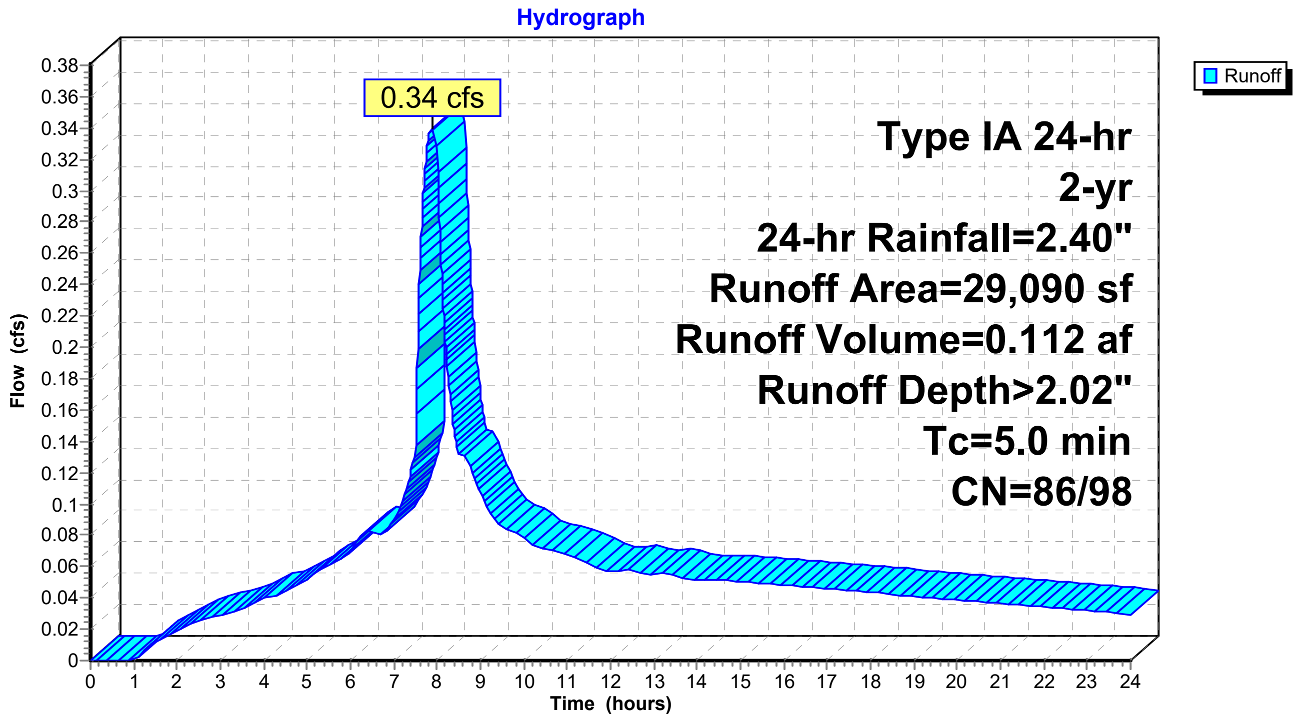
Runoff = 0.34 cfs @ 7.89 hrs, Volume= 0.112 af, Depth> 2.02"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	24,840	98	Parking Lot/Sidewalk
*	4,250	86	Bioretention/Landscape
	29,090	96	Weighted Average
	4,250	86	14.61% Pervious Area
	24,840	98	85.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A2: West Parking 1



Summary for Subcatchment A3: West Parking 2

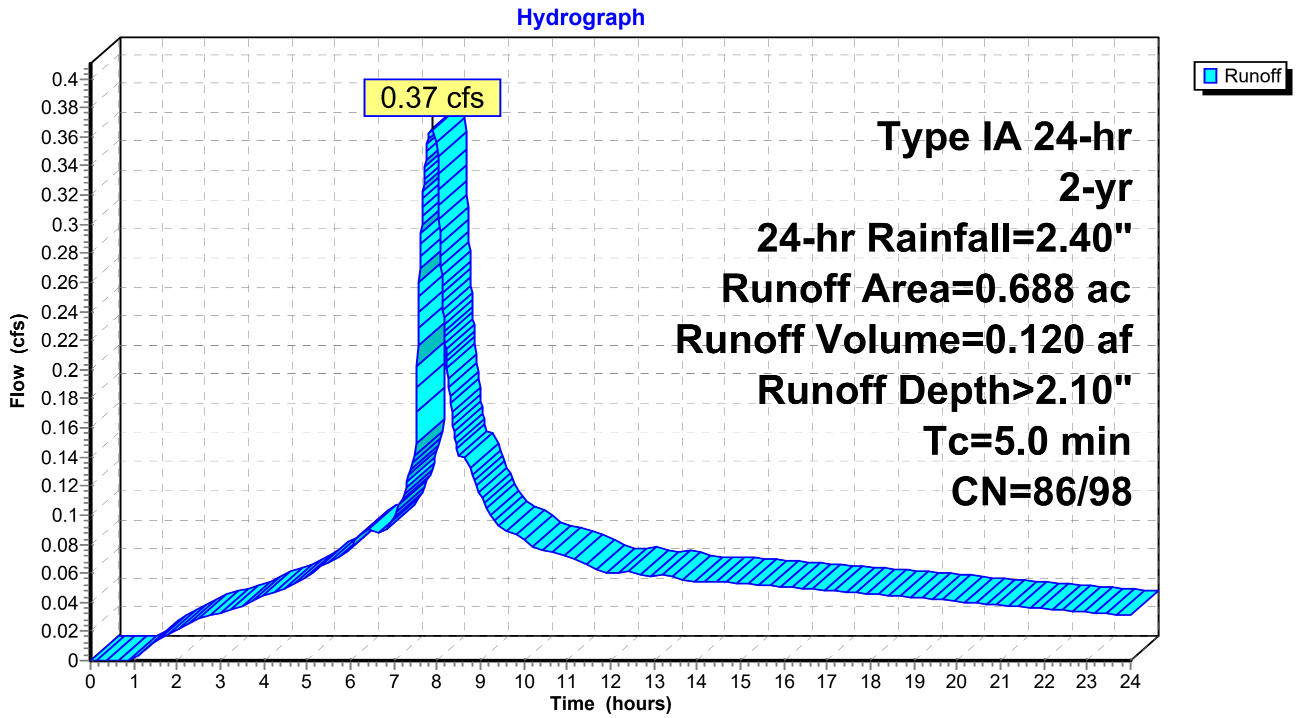
Runoff = 0.37 cfs @ 7.88 hrs, Volume= 0.120 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	0.642	98	Parking Lot/Sidewalk
*	0.046	86	Bioretention/Landscape
	0.688	97	Weighted Average
	0.046	86	6.69% Pervious Area
	0.642	98	93.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A3: West Parking 2



Summary for Subcatchment A4: North Wetland

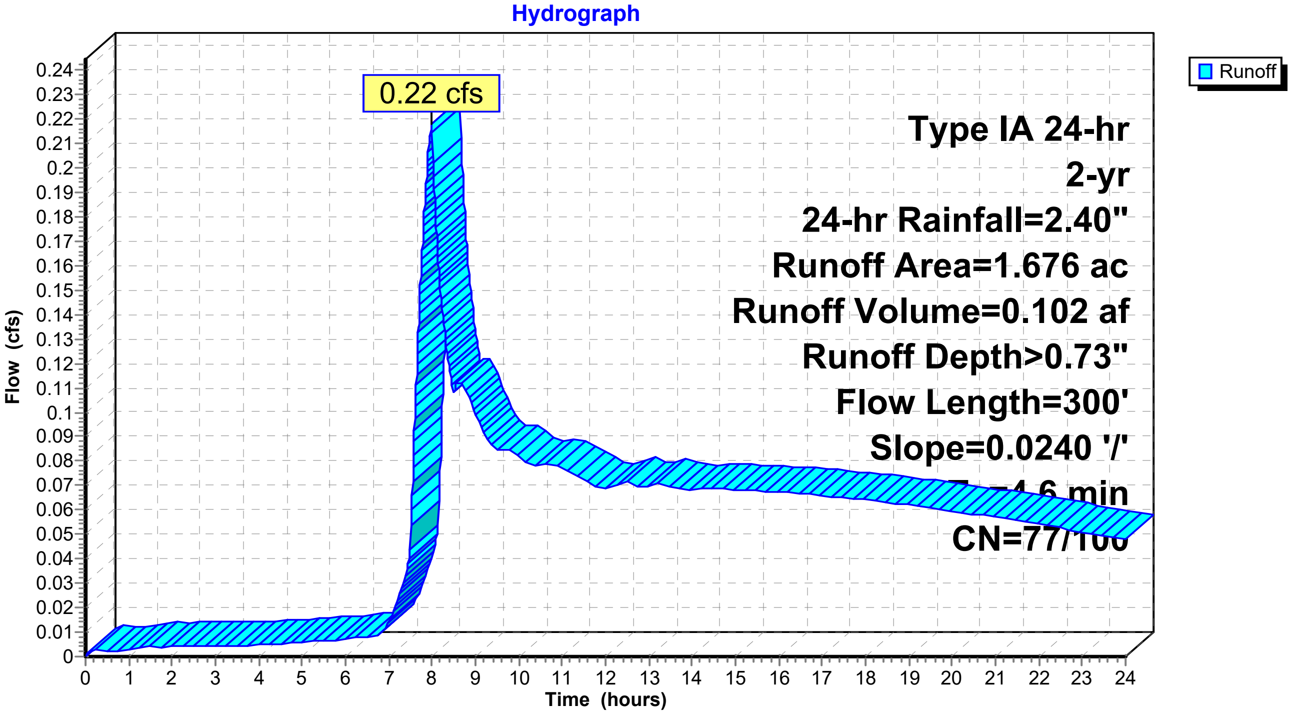
Runoff = 0.22 cfs @ 8.00 hrs, Volume= 0.102 af, Depth> 0.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment A5: Courtyard 2

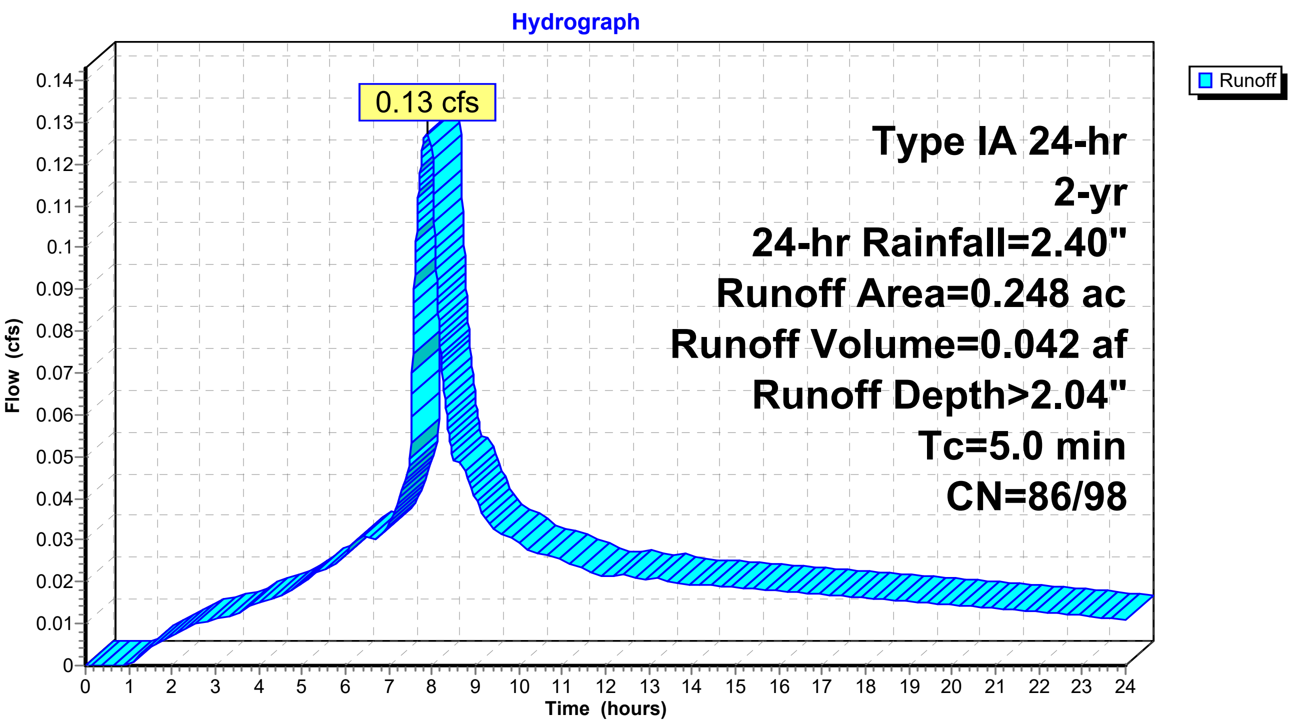
Runoff = 0.13 cfs @ 7.89 hrs, Volume= 0.042 af, Depth> 2.04"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	0.216	98	Courtyard Pavement
*	0.032	86	Courtyard Landscaping
	0.248	96	Weighted Average
	0.032	86	12.90% Pervious Area
	0.216	98	87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A5: Courtyard 2



Summary for Subcatchment A6: Fire Lane

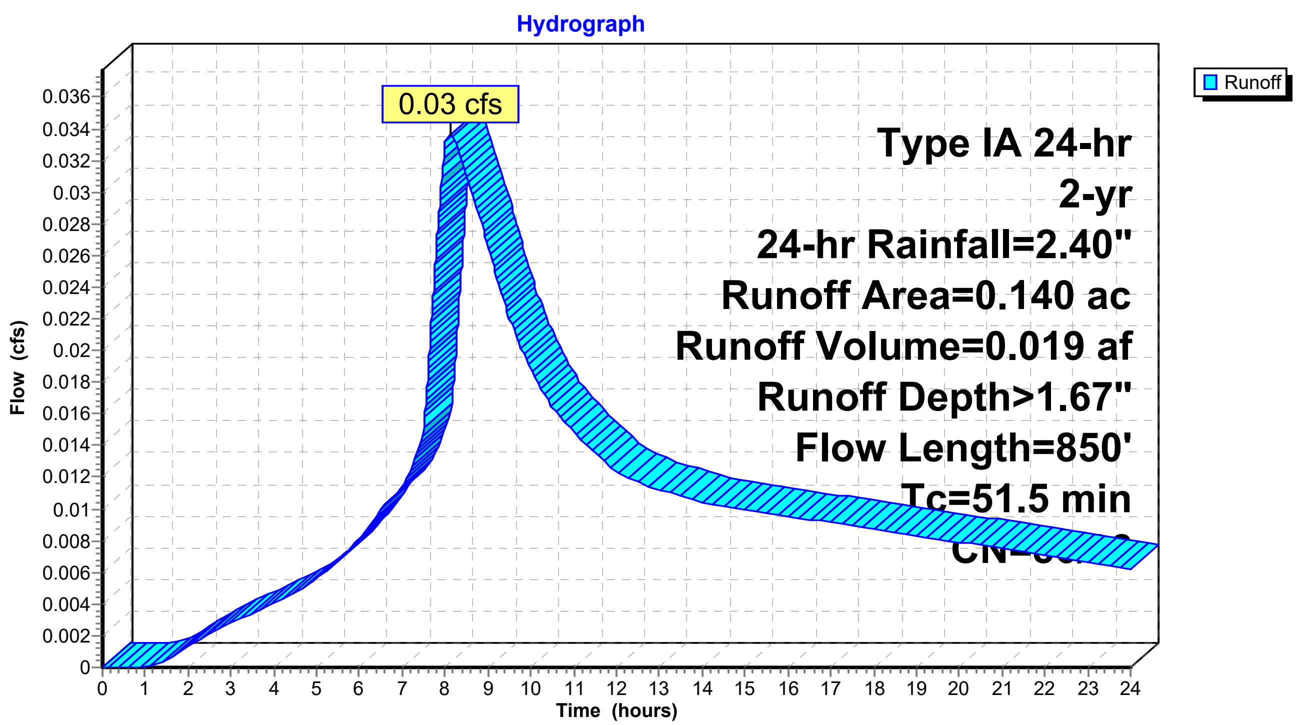
Runoff = 0.03 cfs @ 8.12 hrs, Volume= 0.019 af, Depth> 1.67"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	0.065	86	Courtyard Landscaping
*	0.075	98	Fire Lane
	0.140	92	Weighted Average
	0.065	86	46.43% Pervious Area
	0.075	98	53.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,**
					Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,**
					Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A6: Fire Lane



Summary for Subcatchment A7: Courtyard 1

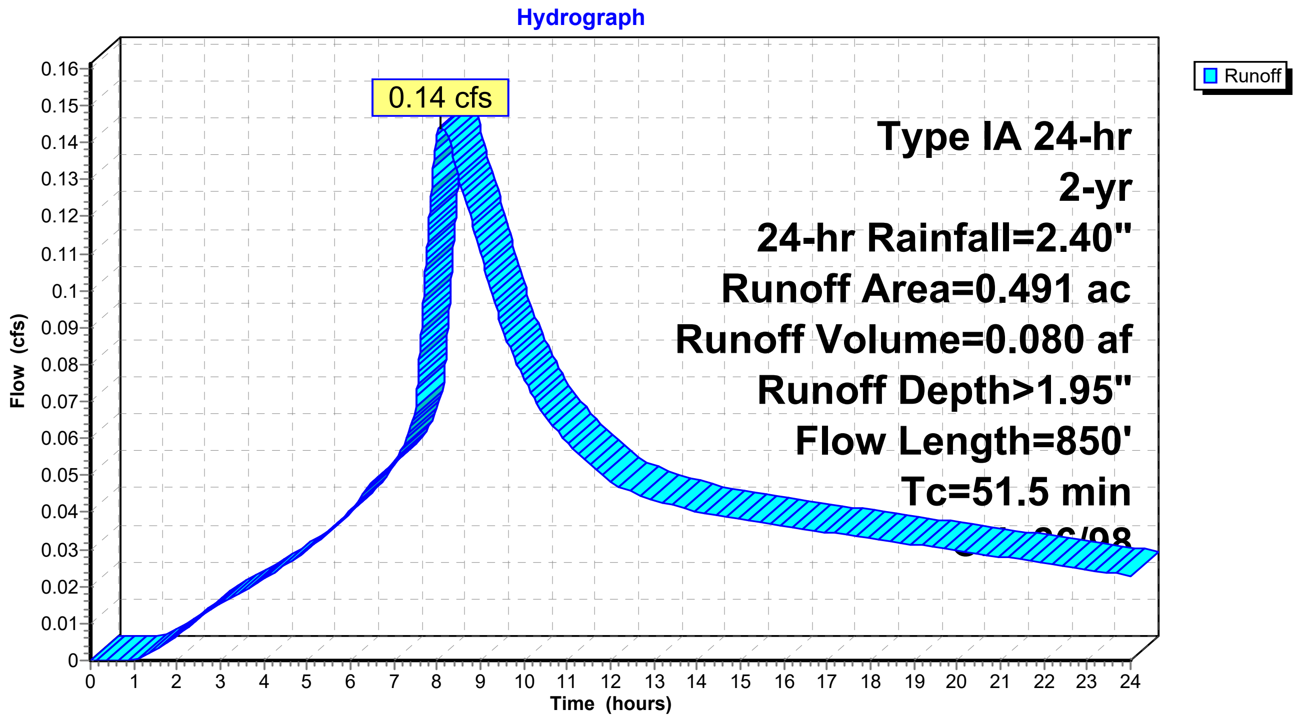
Runoff = 0.14 cfs @ 8.09 hrs, Volume= 0.080 af, Depth> 1.95"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	0.311	98	Courtyard Pavement
*	0.087	86	Courtyard Landscaping
*	0.093	98	Fire Lane
	0.491	96	Weighted Average
	0.087	86	17.72% Pervious Area
	0.404	98	82.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A7: Courtyard 1



Summary for Subcatchment A8: Pond Direct

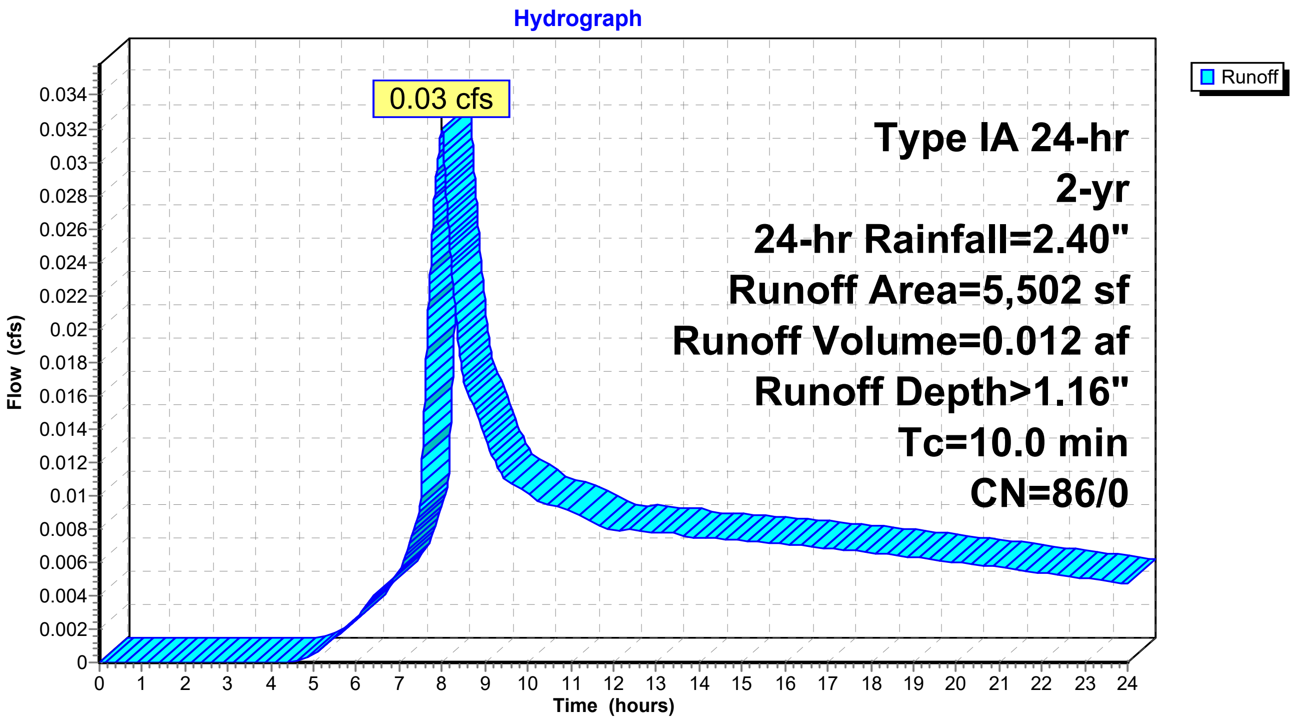
Runoff = 0.03 cfs @ 8.00 hrs, Volume= 0.012 af, Depth> 1.16"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	5,502	86	Pond Top Area
	5,502	86	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment A8: Pond Direct



Summary for Subcatchment A9: Vegetated/Wetland Bypass

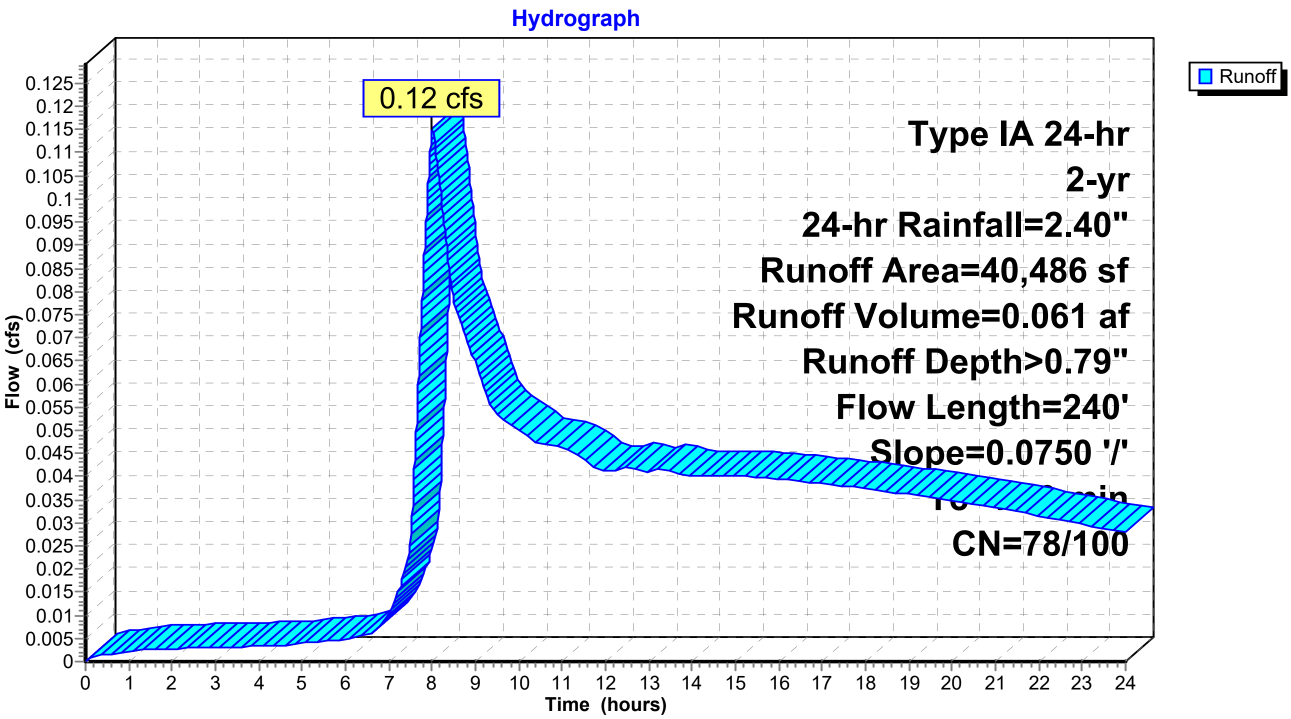
Runoff = 0.12 cfs @ 8.01 hrs, Volume= 0.061 af, Depth> 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	29,555	76	Undisturbed Forest
*	9,270	86	Fill Slope
*	1,661	100	Wetland
	40,486	79	Weighted Average
	38,825	78	95.90% Pervious Area
	1,661	100	4.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	240	0.0750	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment A9: Vegetated/Wetland Bypass



Summary for Subcatchment B1: East Parking

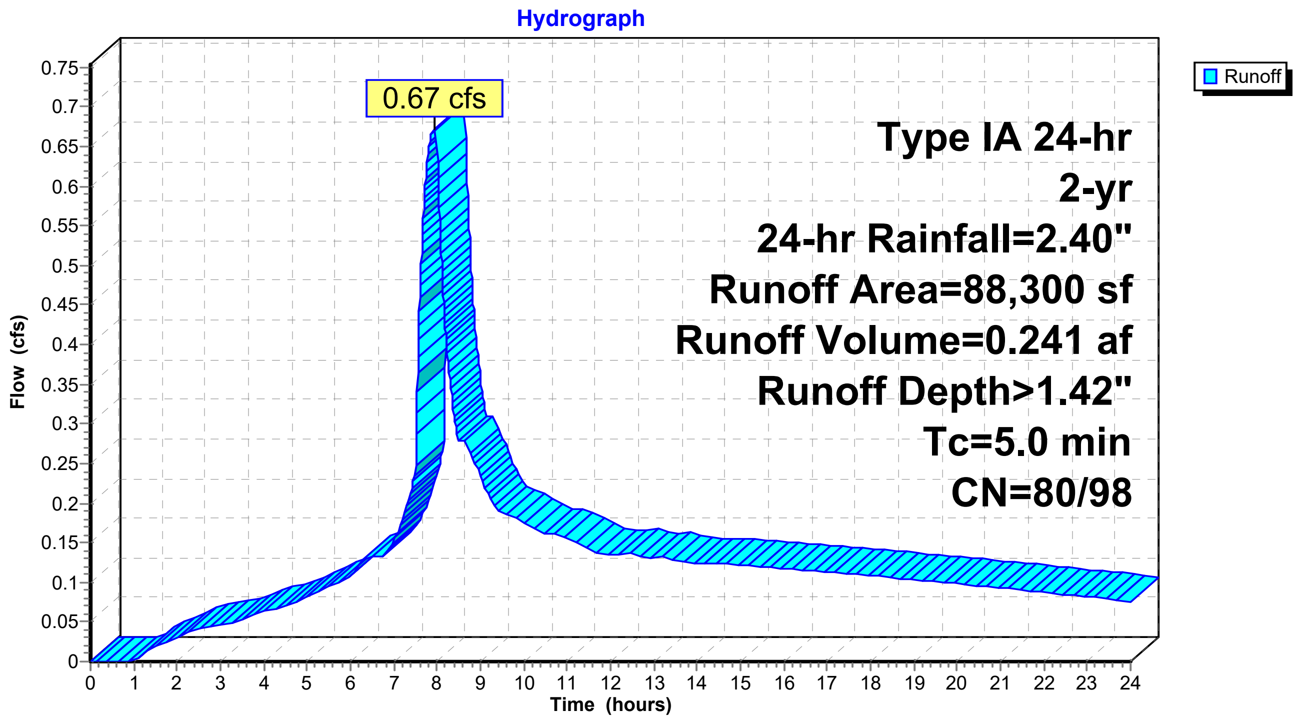
Runoff = 0.67 cfs @ 7.93 hrs, Volume= 0.241 af, Depth> 1.42"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	39,670	98	Parking Lot/Sidewalk
*	27,610	76	Undisturbed Forest
*	14,850	86	Bioretention/Landscape
*	6,170	86	Disturbed Vegetated
	88,300	88	Weighted Average
	48,630	80	55.07% Pervious Area
	39,670	98	44.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B1: East Parking



Summary for Subcatchment B2: Courtyard 3

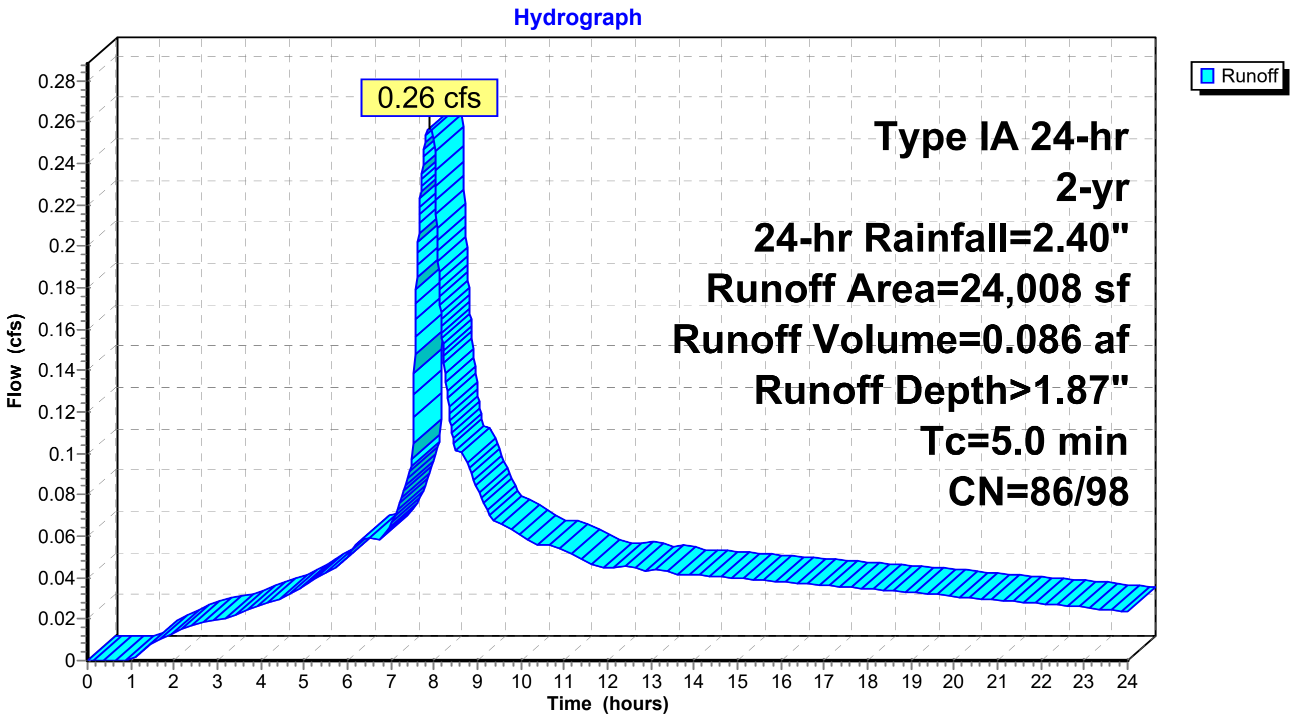
Runoff = 0.26 cfs @ 7.90 hrs, Volume= 0.086 af, Depth> 1.87"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	7,045	86	Courtyard Landscaping
*	16,963	98	Courtyard Pavement
	24,008	94	Weighted Average
	7,045	86	29.34% Pervious Area
	16,963	98	70.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B2: Courtyard 3



Summary for Subcatchment B3: Building Roof

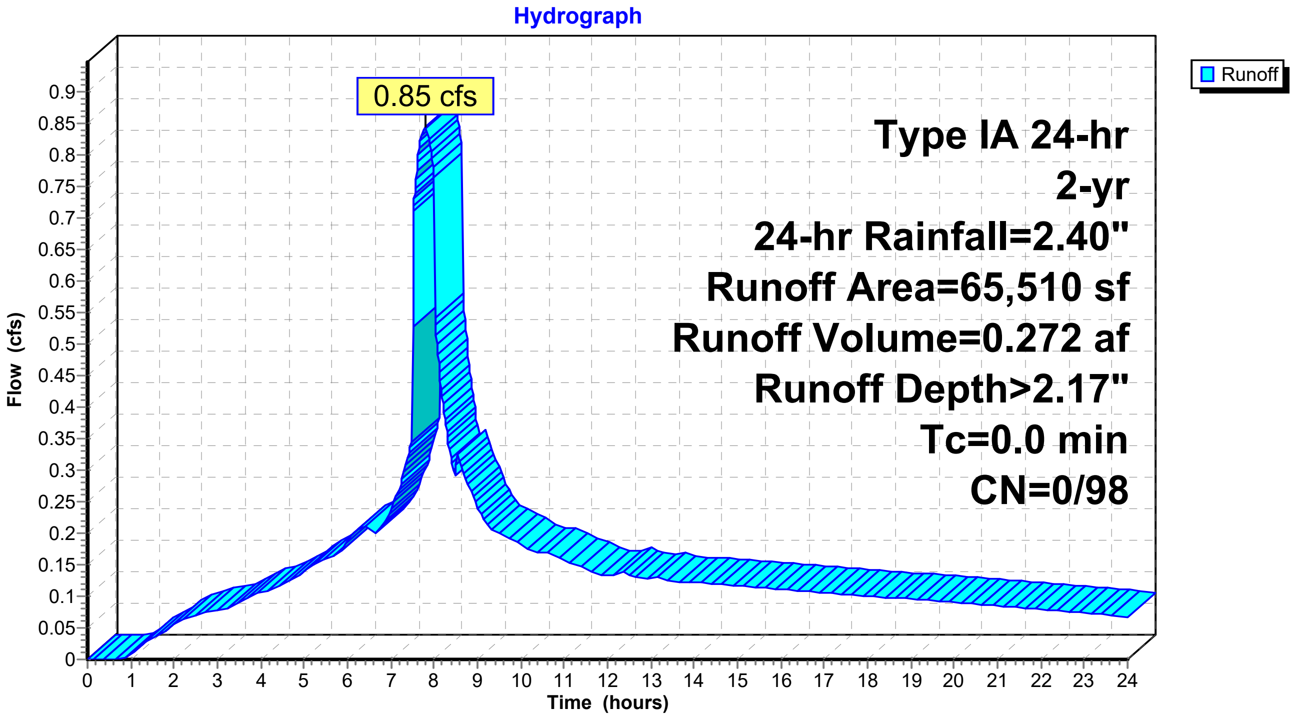
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.85 cfs @ 7.79 hrs, Volume= 0.272 af, Depth> 2.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

Area (sf)	CN	Description
65,510	98	Roofs, HSG D
65,510	98	100.00% Impervious Area

Subcatchment B3: Building Roof



Summary for Subcatchment B4: Field and Track

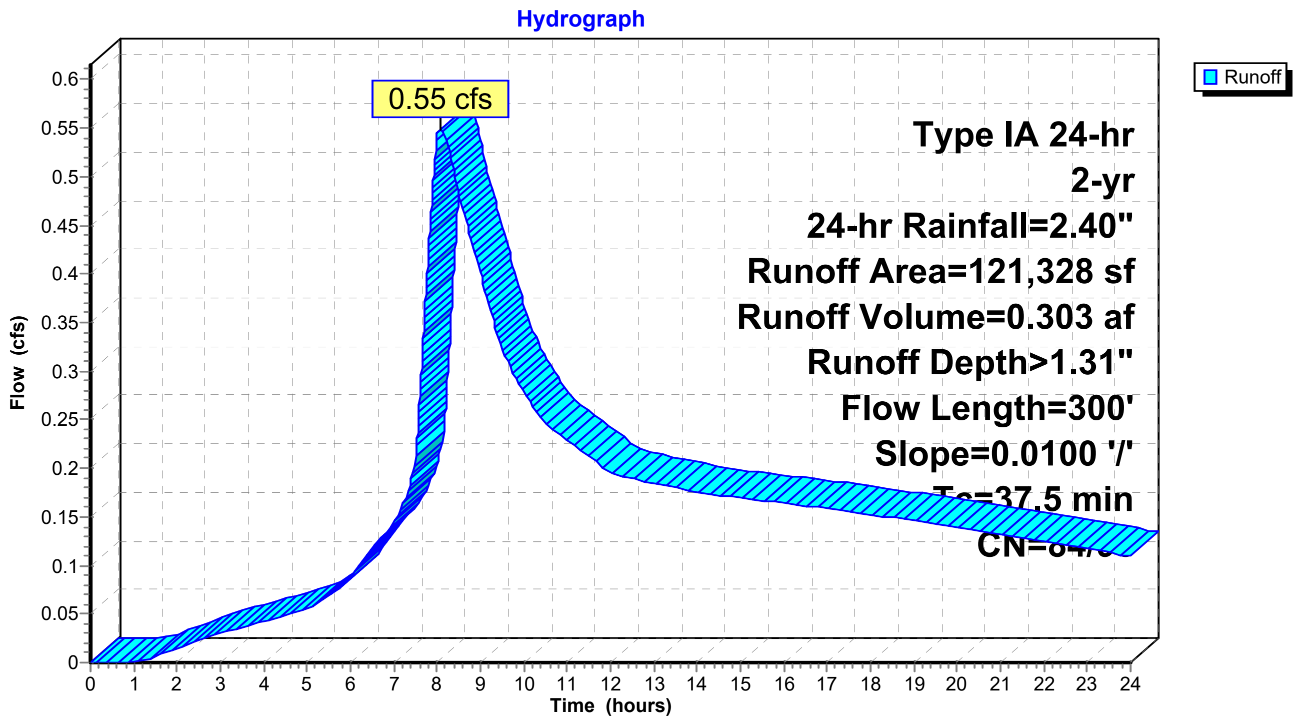
Runoff = 0.55 cfs @ 8.07 hrs, Volume= 0.303 af, Depth> 1.31"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	71,134	86	Field
*	3,750	98	Track
*	18,694	76	Undisturbed
*	27,500	98	Fire Lane/Access Road
*	250	86	Courtyard Landscaping
	121,328	88	Weighted Average
	90,078	84	74.24% Pervious Area
	31,250	98	25.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B4: Field and Track



Summary for Subcatchment B5: Access Road and Pond

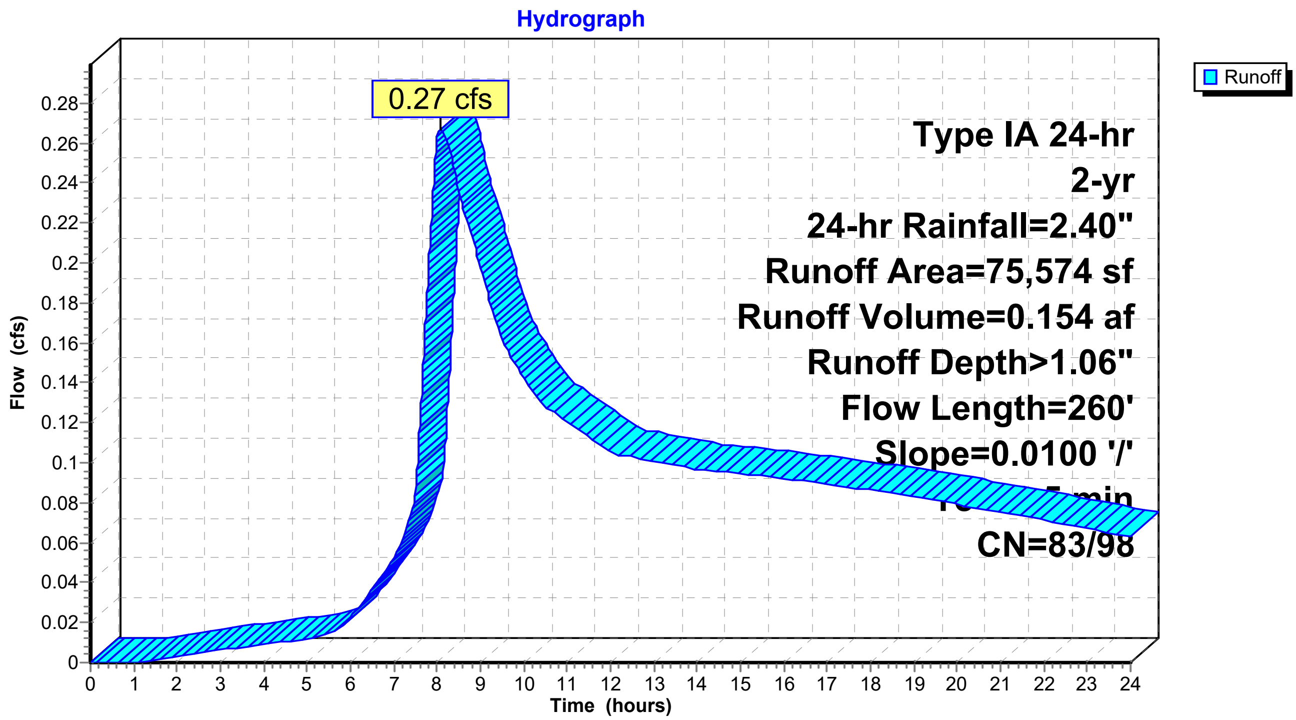
Runoff = 0.27 cfs @ 8.09 hrs, Volume= 0.154 af, Depth> 1.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	25,478	76	Undisturbed
*	5,756	96	Gravel Road
*	890	98	Paved Access Road
*	37,750	86	Pond/Landscaping
*	5,700	98	Pump Station/Access
	75,574	84	Weighted Average
	68,984	83	91.28% Pervious Area
	6,590	98	8.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	260	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B5: Access Road and Pond



Summary for Subcatchment B6: South Wetland

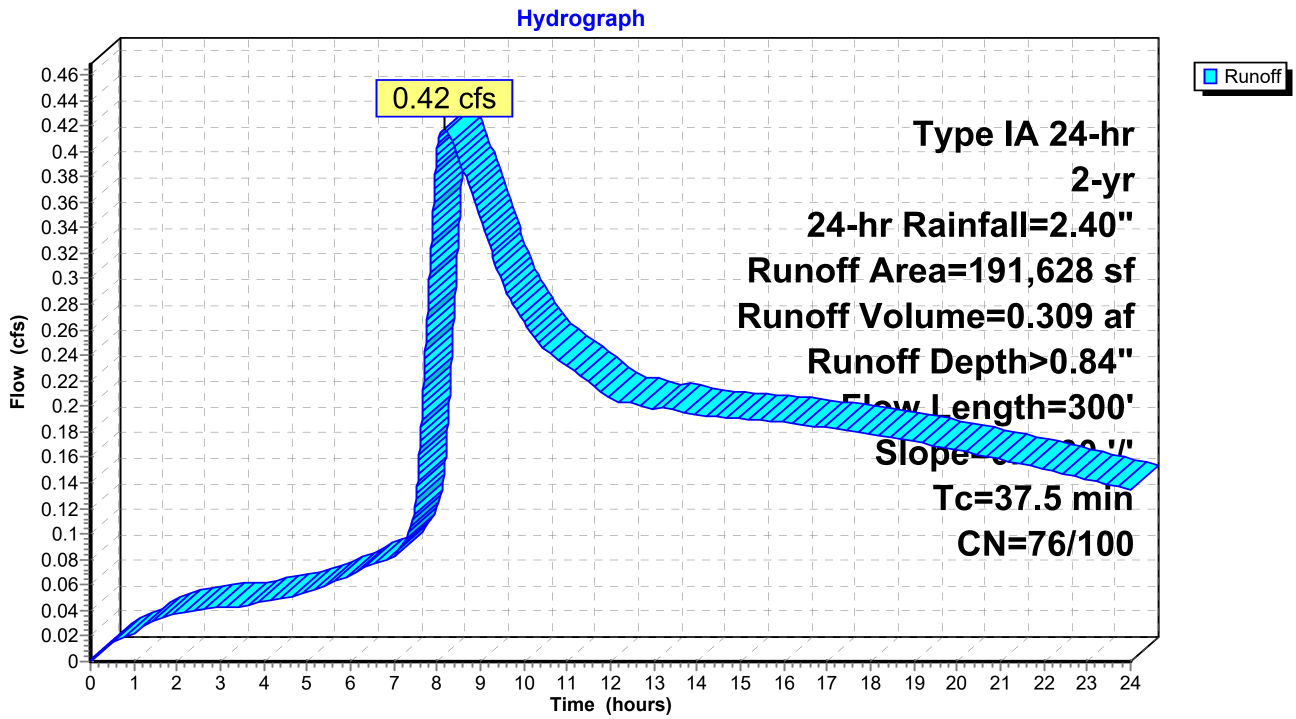
Runoff = 0.42 cfs @ 8.18 hrs, Volume= 0.309 af, Depth> 0.84"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	160,260	76	Undisturbed Forest
*	24,708	100	Wetland
*	6,660	86	Site Fill
	191,628	79	Weighted Average
	166,920	76	87.11% Pervious Area
	24,708	100	12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B6: South Wetland



Summary for Subcatchment B7: Courtyard Bypass

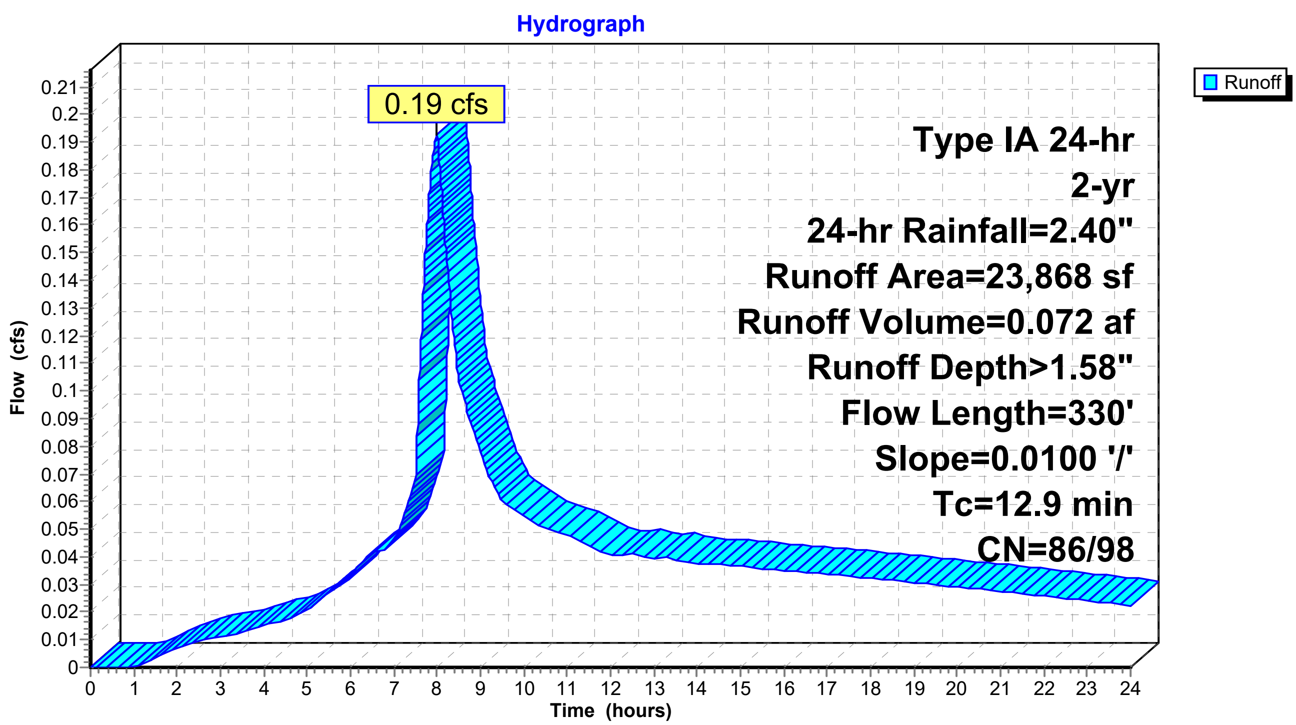
Runoff = 0.19 cfs @ 8.00 hrs, Volume= 0.072 af, Depth> 1.58"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (sf)	CN	Description
*	3,390	98	Courtyard Pavement
*	13,866	86	Courtyard Landscaping
*	6,612	98	Fire Lane
	23,868	91	Weighted Average
	13,866	86	58.09% Pervious Area
	10,002	98	41.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
7.9	330	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.9	330	Total			

Subcatchment B7: Courtyard Bypass



Summary for Reach 1R: 279 LF 18"

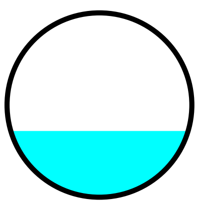
[52] Hint: Inlet/Outlet conditions not evaluated
[63] Warning: Exceeded Reach 6R INLET depth by 0.01' @ 7.55 hrs

Inflow Area = 4.082 ac, 68.69% Impervious, Inflow Depth > 1.76" for 2-yr, 24-hr event
Inflow = 1.72 cfs @ 7.90 hrs, Volume= 0.598 af
Outflow = 1.72 cfs @ 7.92 hrs, Volume= 0.597 af, Atten= 0%, Lag= 1.1 min

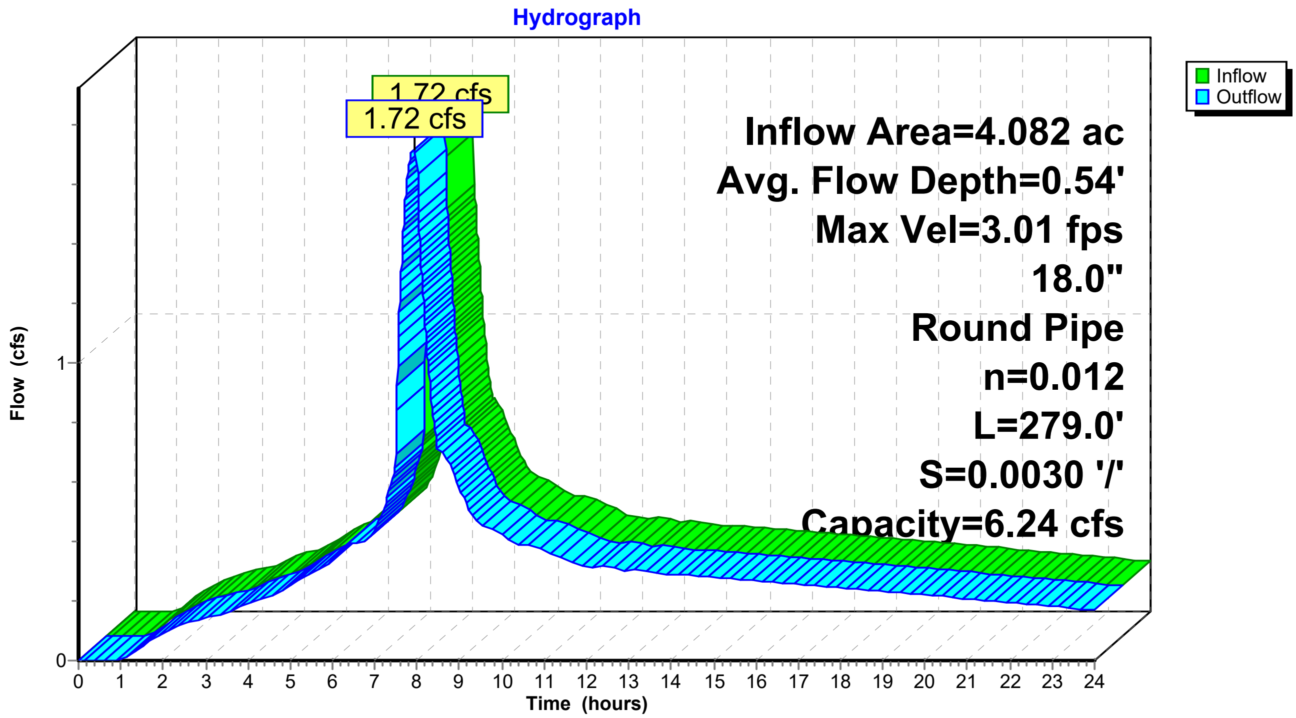
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.01 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 2.6 min

Peak Storage= 159 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.24 cfs

18.0" Round Pipe
n= 0.012
Length= 279.0' Slope= 0.0030 '/'
Inlet Invert= 132.54', Outlet Invert= 131.70'



Reach 1R: 279 LF 18"



Summary for Reach 3R: 134 LF 12"

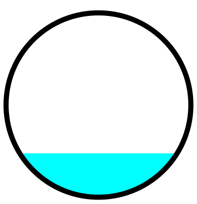
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 16R outlet invert by 0.14' @ 8.00 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 2.13" for 2-yr, 24-hr event
Inflow = 0.40 cfs @ 8.00 hrs, Volume= 0.170 af
Outflow = 0.40 cfs @ 8.00 hrs, Volume= 0.170 af, Atten= 0%, Lag= 0.2 min

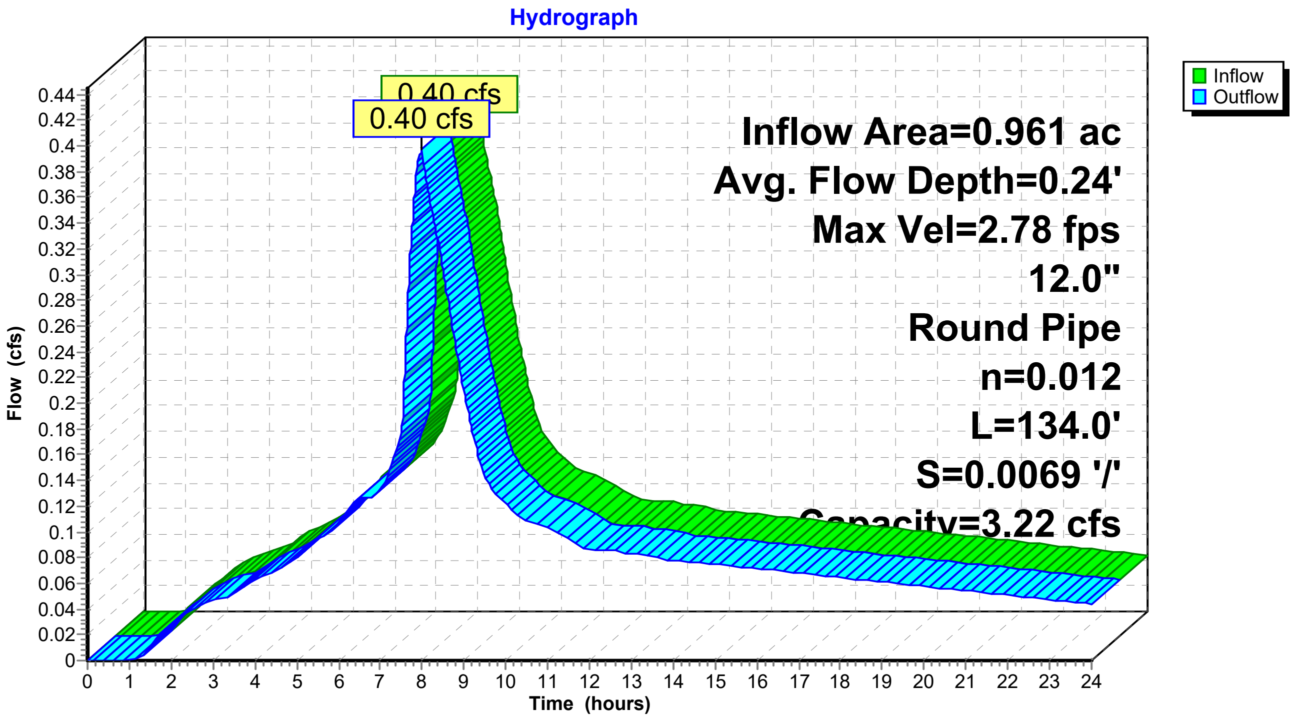
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.78 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 1.3 min

Peak Storage= 19 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.22 cfs

12.0" Round Pipe
n= 0.012
Length= 134.0' Slope= 0.0069 '/'
Inlet Invert= 132.46', Outlet Invert= 131.53'



Reach 3R: 134 LF 12"



Summary for Reach 4R: 56 LF 12"

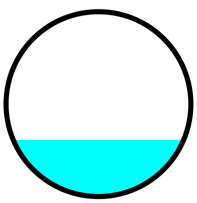
[52] Hint: Inlet/Outlet conditions not evaluated

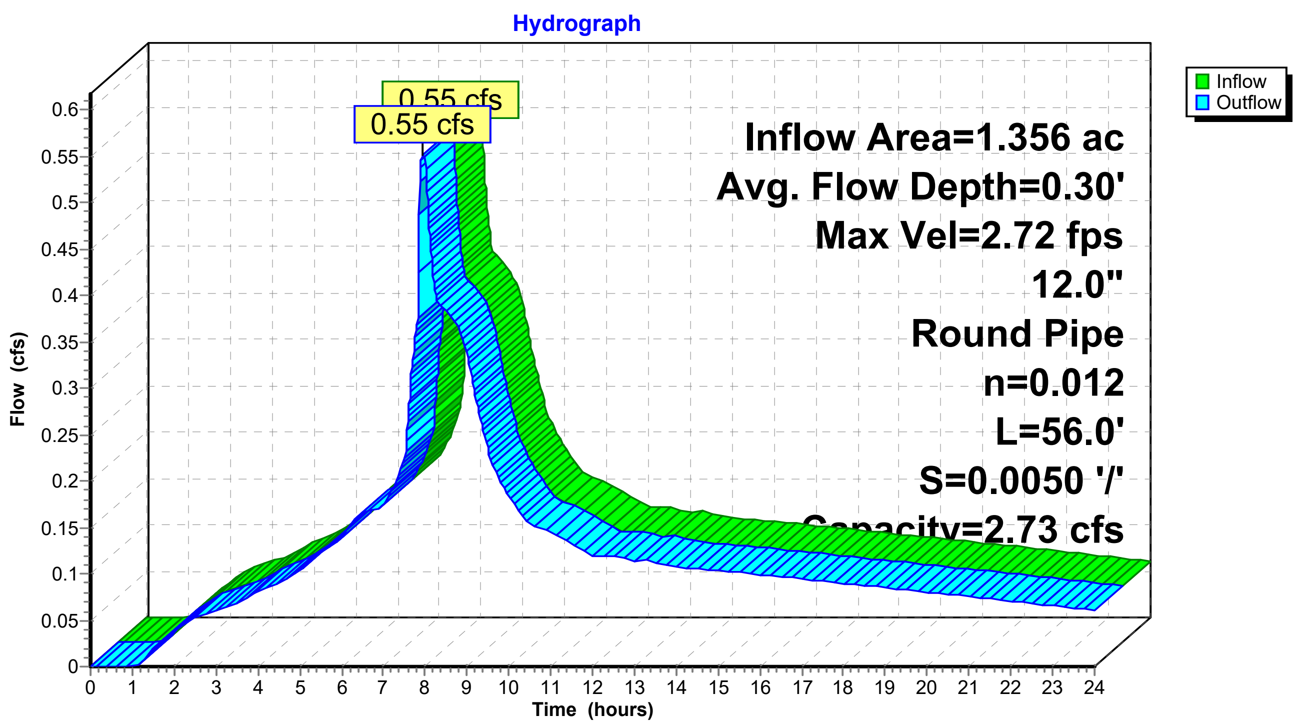
Inflow Area = 1.356 ac, 89.41% Impervious, Inflow Depth > 2.06" for 2-yr, 24-hr event
Inflow = 0.55 cfs @ 7.93 hrs, Volume= 0.232 af
Outflow = 0.55 cfs @ 7.94 hrs, Volume= 0.232 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.72 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 0.6 min

Peak Storage= 11 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.73 cfs

12.0" Round Pipe
n= 0.012
Length= 56.0' Slope= 0.0050 '/'
Inlet Invert= 132.63', Outlet Invert= 132.35'





Summary for Reach 5R: 70 LF 12"

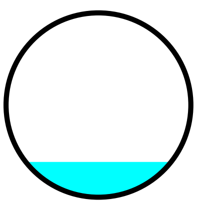
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 8R outlet invert by 0.19' @ 7.92 hrs

Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 1.87" for 2-yr, 24-hr event
Inflow = 0.26 cfs @ 7.91 hrs, Volume= 0.086 af
Outflow = 0.26 cfs @ 7.92 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.3 min

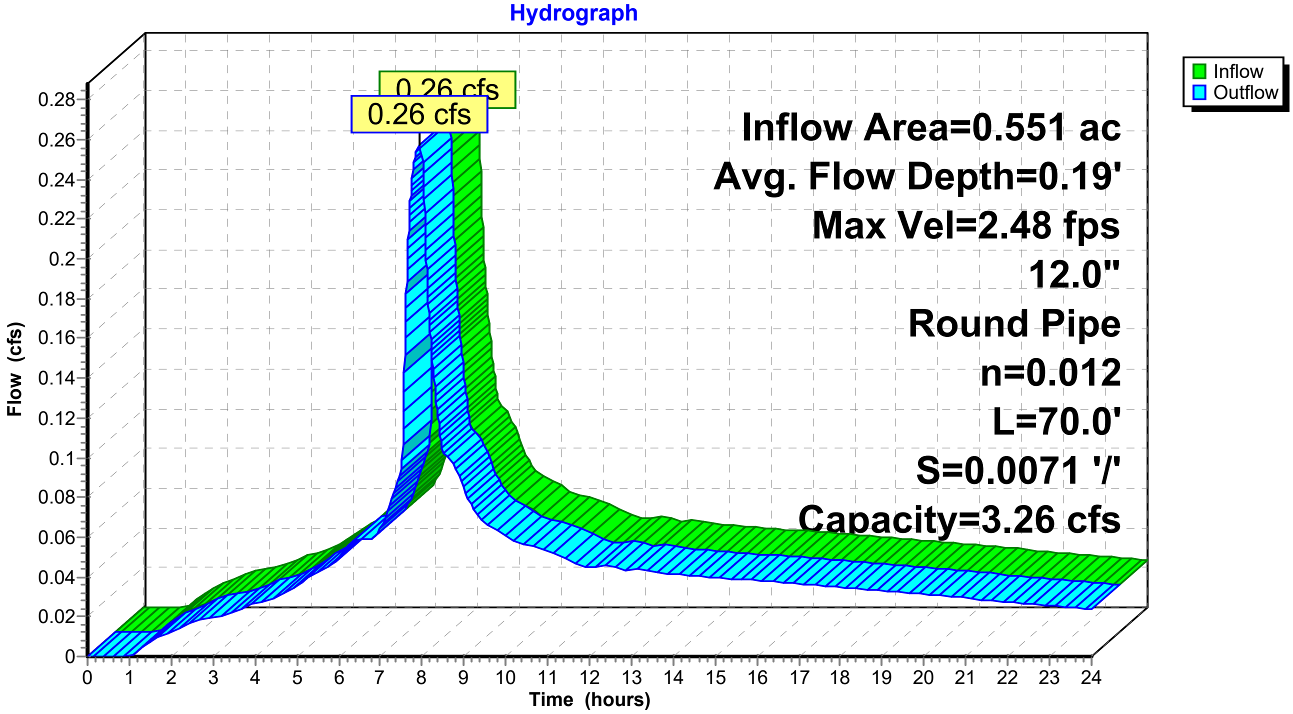
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 0.8 min

Peak Storage= 7 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.26 cfs

12.0" Round Pipe
n= 0.012
Length= 70.0' Slope= 0.0071 '/'
Inlet Invert= 133.15', Outlet Invert= 132.65'



Reach 5R: 70 LF 12"



Summary for Reach 6R: 38 LF 12"

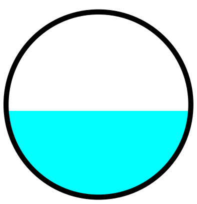
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.28' @ 8.01 hrs

Inflow Area = 2.578 ac, 50.43% Impervious, Inflow Depth > 1.52" for 2-yr, 24-hr event
Inflow = 0.91 cfs @ 7.99 hrs, Volume= 0.326 af
Outflow = 0.91 cfs @ 7.99 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.2 min

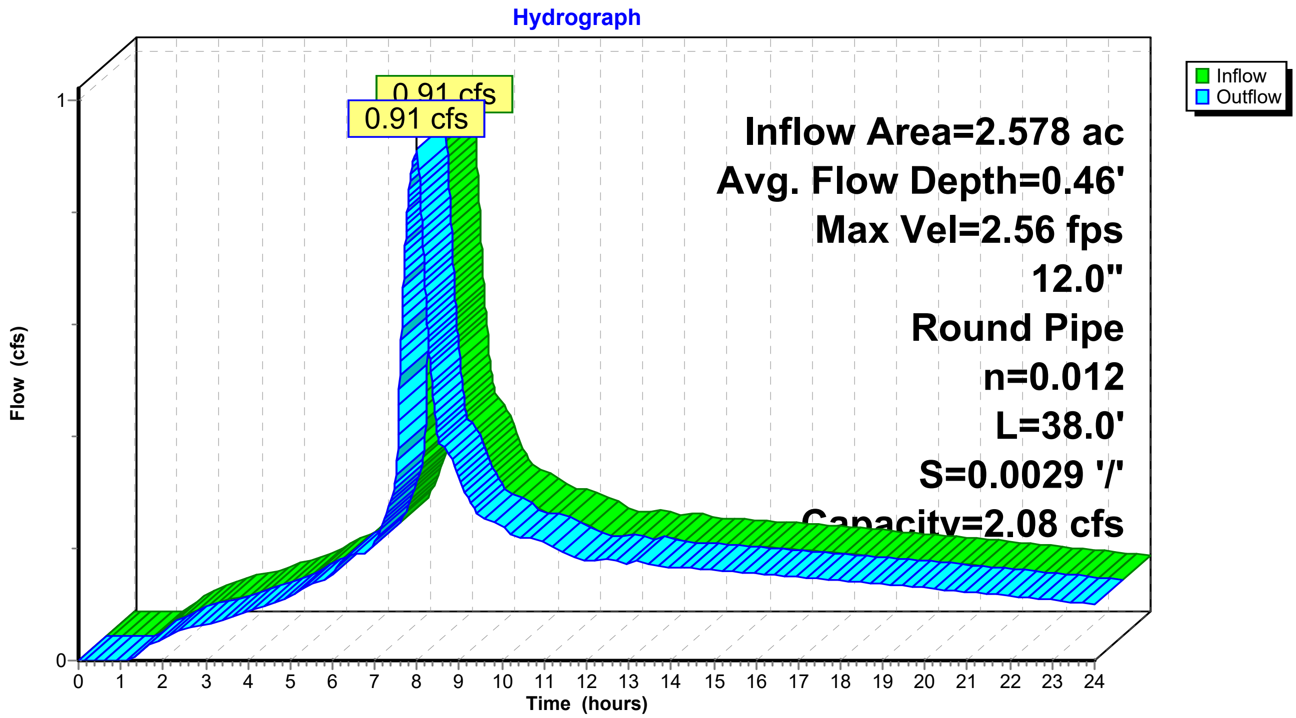
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.56 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.53 fps, Avg. Travel Time= 0.4 min

Peak Storage= 14 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.08 cfs

12.0" Round Pipe
n= 0.012
Length= 38.0' Slope= 0.0029 '/'
Inlet Invert= 132.65', Outlet Invert= 132.54'



Reach 6R: 38 LF 12"



Summary for Reach 7R: 107 LF 12"

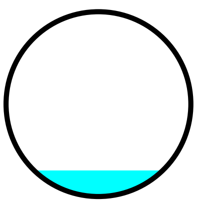
[52] Hint: Inlet/Outlet conditions not evaluated

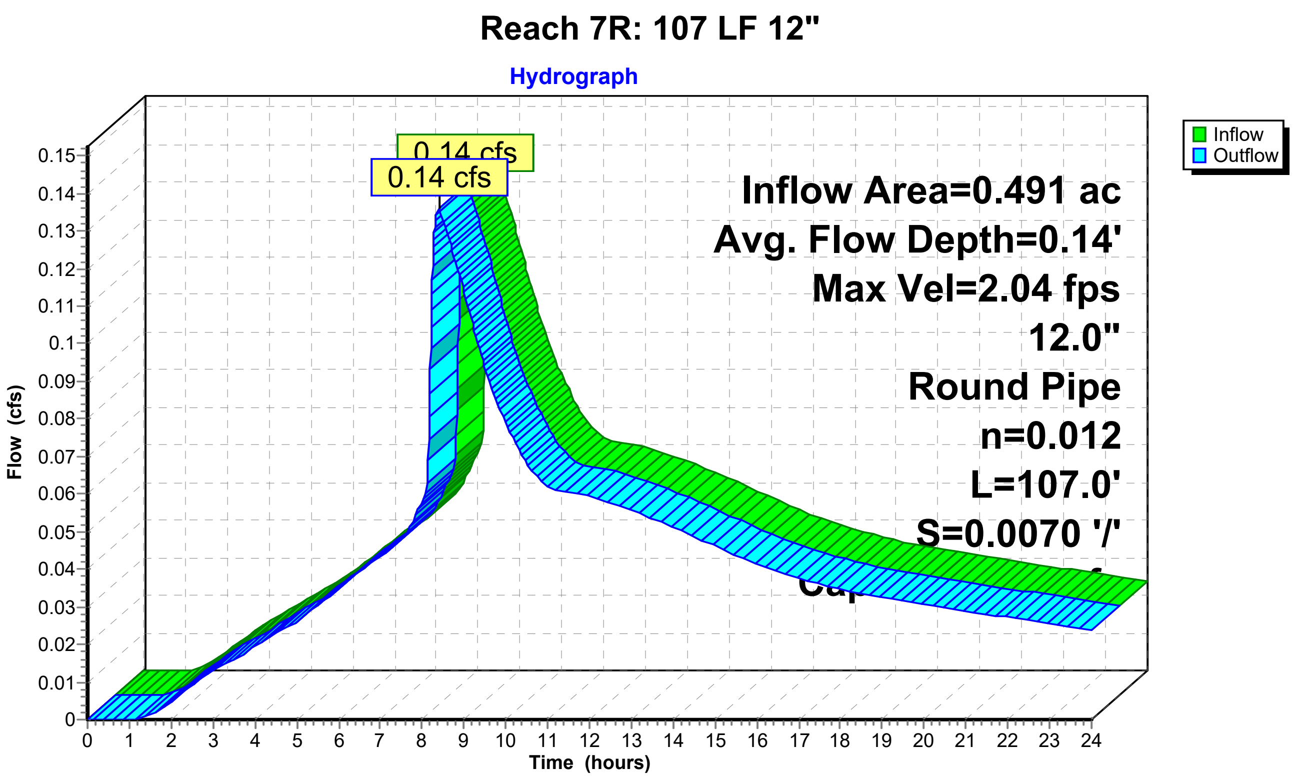
Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 1.94" for 2-yr, 24-hr event
Inflow = 0.14 cfs @ 8.38 hrs, Volume= 0.079 af
Outflow = 0.14 cfs @ 8.39 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 1.3 min

Peak Storage= 7 cf @ 8.39 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.23 cfs

12.0" Round Pipe
n= 0.012
Length= 107.0' Slope= 0.0070 '/'
Inlet Invert= 131.42', Outlet Invert= 130.67'





Summary for Reach 8R: 170 LF 12"

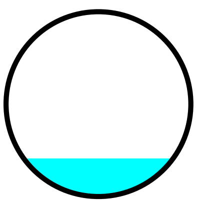
[52] Hint: Inlet/Outlet conditions not evaluated

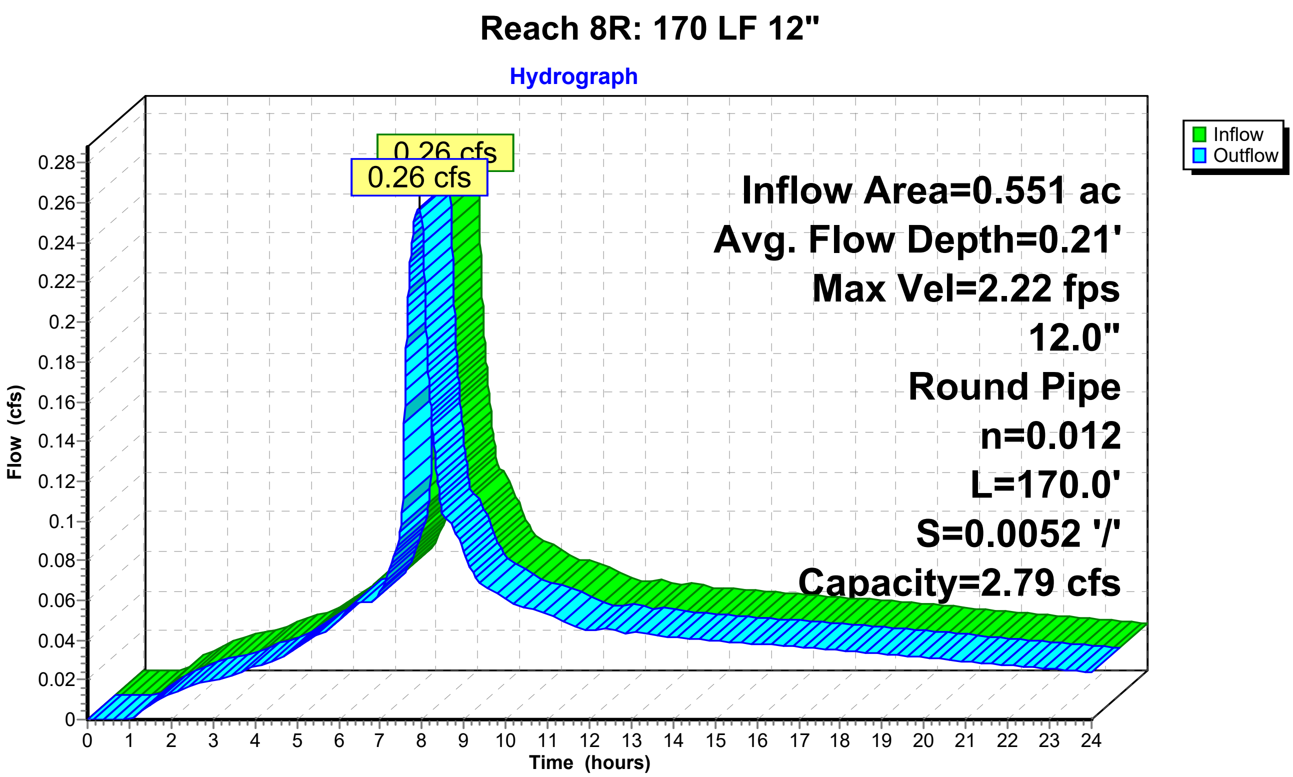
Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 1.87" for 2-yr, 24-hr event
Inflow = 0.26 cfs @ 7.90 hrs, Volume= 0.086 af
Outflow = 0.26 cfs @ 7.91 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.22 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 2.2 min

Peak Storage= 20 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.79 cfs

12.0" Round Pipe
n= 0.012
Length= 170.0' Slope= 0.0052 '/'
Inlet Invert= 134.04', Outlet Invert= 133.15'





Summary for Reach 9R: 115 LF 12"

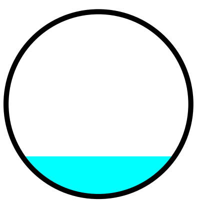
[52] Hint: Inlet/Outlet conditions not evaluated

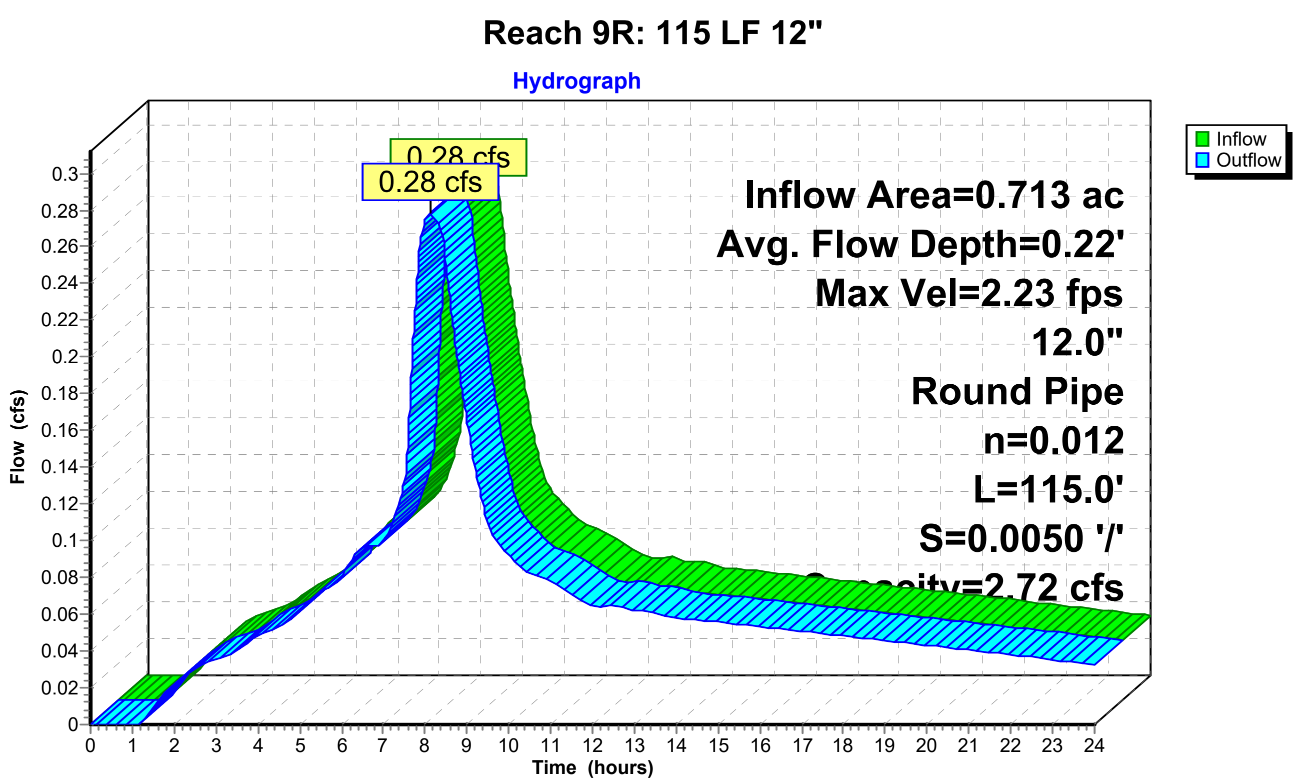
Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 2.16" for 2-yr, 24-hr event
Inflow = 0.28 cfs @ 8.11 hrs, Volume= 0.128 af
Outflow = 0.28 cfs @ 8.12 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.23 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 1.4 min

Peak Storage= 14 cf @ 8.12 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.72 cfs

12.0" Round Pipe
n= 0.012
Length= 115.0' Slope= 0.0050 '/'
Inlet Invert= 136.50', Outlet Invert= 135.93'





Summary for Reach 10R: 76 LF 12"

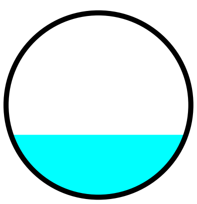
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 3R outlet invert by 0.24' @ 7.97 hrs

Inflow Area = 2.317 ac, 92.42% Impervious, Inflow Depth > 2.08" for 2-yr, 24-hr event
Inflow = 0.95 cfs @ 7.96 hrs, Volume= 0.402 af
Outflow = 0.95 cfs @ 7.97 hrs, Volume= 0.402 af, Atten= 0%, Lag= 0.2 min

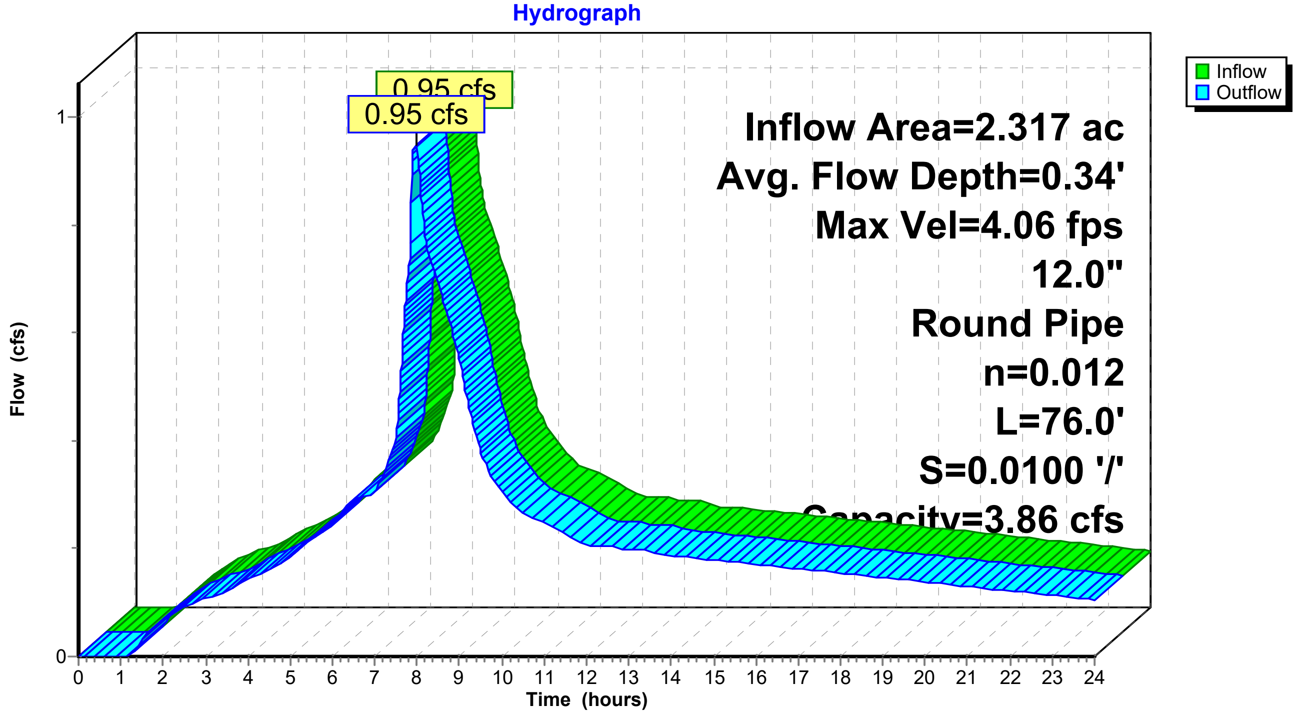
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.06 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.52 fps, Avg. Travel Time= 0.5 min

Peak Storage= 18 cf @ 7.97 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.86 cfs

12.0" Round Pipe
n= 0.012
Length= 76.0' Slope= 0.0100 '/'
Inlet Invert= 131.43', Outlet Invert= 130.67'



Reach 10R: 76 LF 12"



Summary for Reach 12R: 34 LF 12"

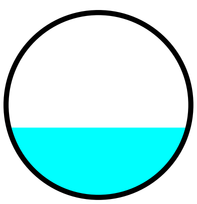
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.18' @ 7.96 hrs
[61] Hint: Exceeded Reach 10R outlet invert by 0.28' @ 7.99 hrs

Inflow Area = 2.948 ac, 88.89% Impervious, Inflow Depth > 2.04" for 2-yr, 24-hr event
Inflow = 1.04 cfs @ 7.99 hrs, Volume= 0.501 af
Outflow = 1.04 cfs @ 7.99 hrs, Volume= 0.501 af, Atten= 0%, Lag= 0.1 min

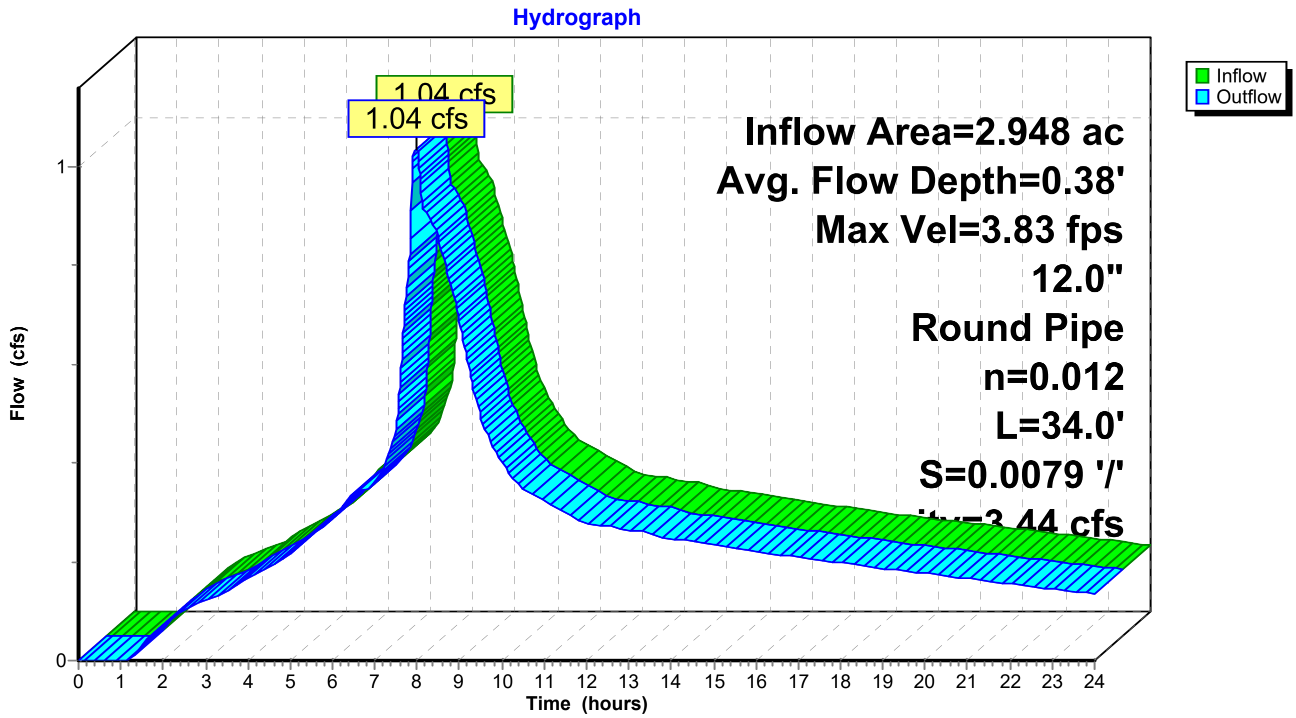
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.83 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.48 fps, Avg. Travel Time= 0.2 min

Peak Storage= 9 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.44 cfs

12.0" Round Pipe
n= 0.012
Length= 34.0' Slope= 0.0079 '/'
Inlet Invert= 130.57', Outlet Invert= 130.30'



Reach 12R: 34 LF 12"



Summary for Reach 13R: 159 LF 12"

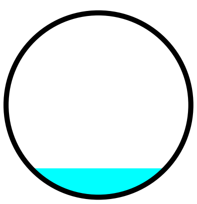
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 9R outlet invert by 0.05' @ 8.13 hrs

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 2.16" for 2-yr, 24-hr event
Inflow = 0.28 cfs @ 8.12 hrs, Volume= 0.128 af
Outflow = 0.28 cfs @ 8.13 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.5 min

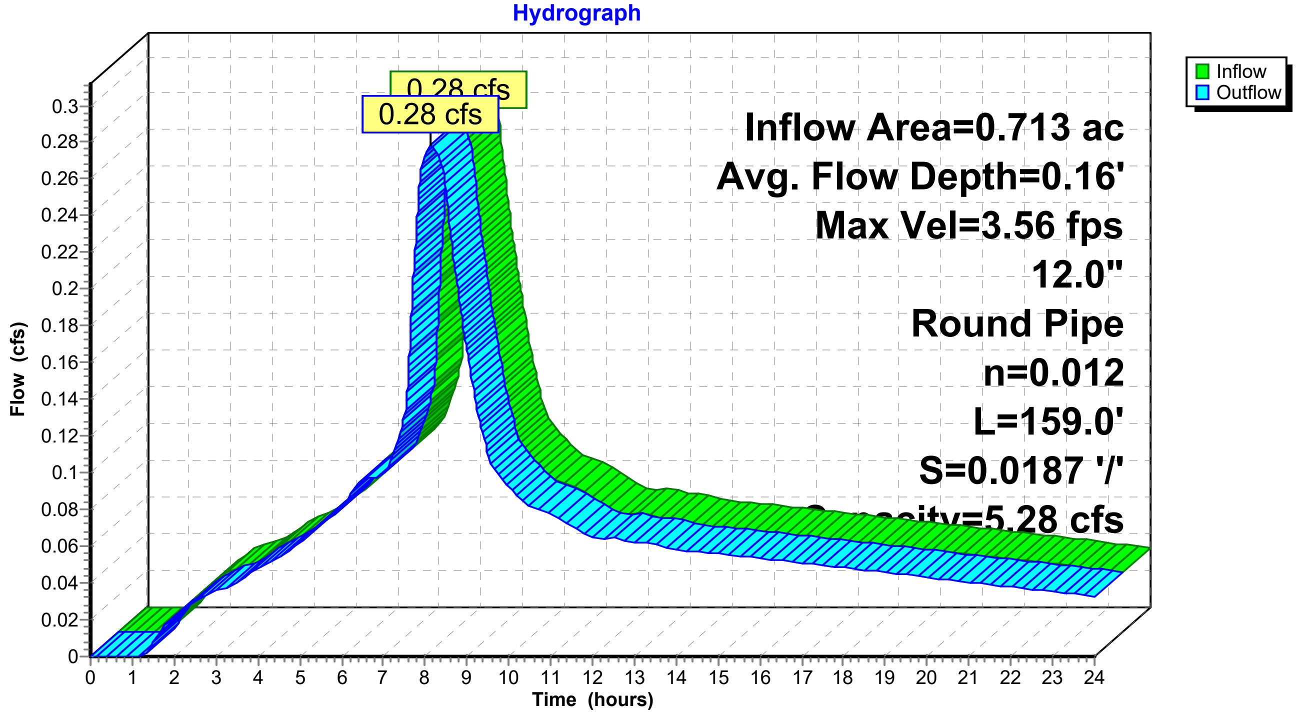
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.56 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 2.24 fps, Avg. Travel Time= 1.2 min

Peak Storage= 12 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.28 cfs

12.0" Round Pipe
n= 0.012
Length= 159.0' Slope= 0.0187 '/'
Inlet Invert= 135.82', Outlet Invert= 132.85'



Reach 13R: 159 LF 12"



Summary for Reach 16R: 39 LF 12"

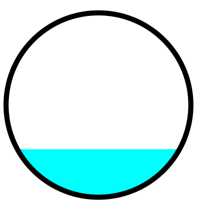
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 13R OUTLET depth by 0.01' @ 7.92 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 2.13" for 2-yr, 24-hr event
Inflow = 0.40 cfs @ 8.00 hrs, Volume= 0.170 af
Outflow = 0.40 cfs @ 8.00 hrs, Volume= 0.170 af, Atten= 0%, Lag= 0.0 min

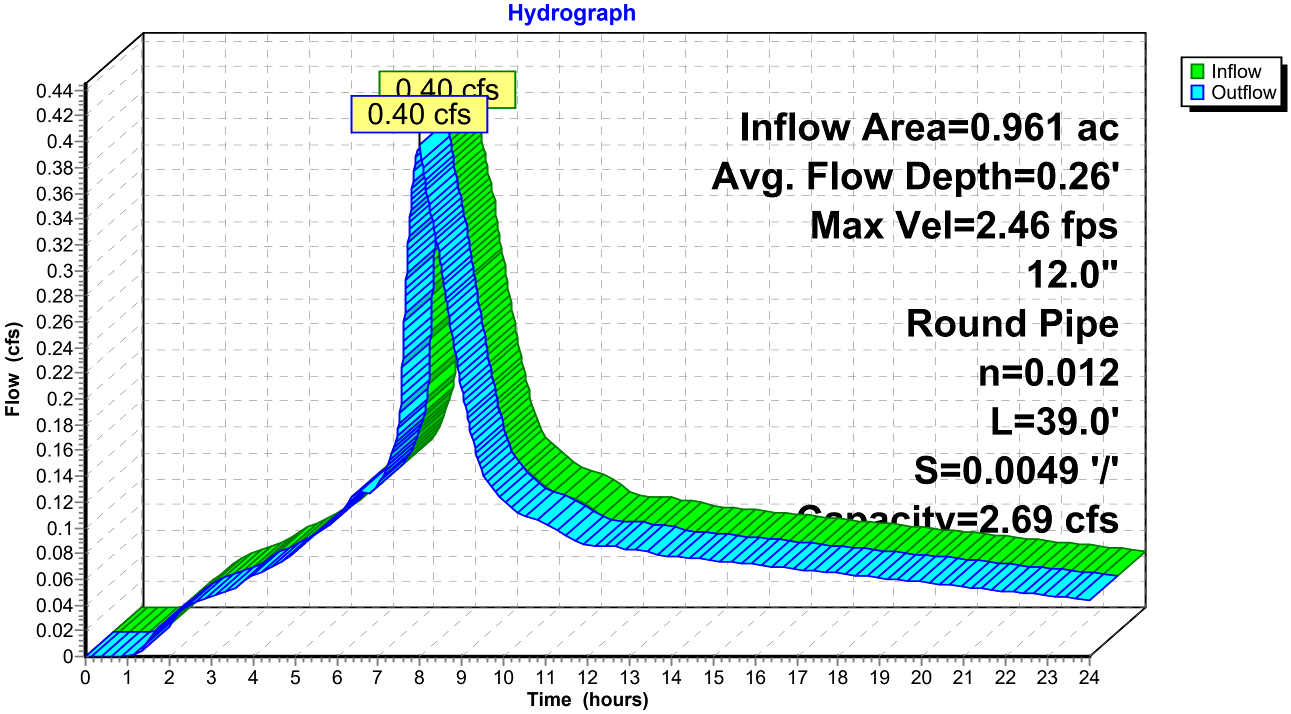
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.46 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.51 fps, Avg. Travel Time= 0.4 min

Peak Storage= 6 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.69 cfs

12.0" Round Pipe
n= 0.012
Length= 39.0' Slope= 0.0049 '/'
Inlet Invert= 132.75', Outlet Invert= 132.56'



Reach 16R: 39 LF 12"



Summary for Reach 19R: 74 LF 18"

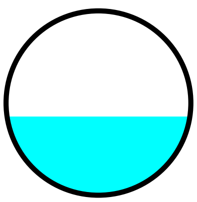
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.12' @ 8.38 hrs

Inflow Area = 6.867 ac, 51.28% Impervious, Inflow Depth > 1.57" for 2-yr, 24-hr event
Inflow = 2.23 cfs @ 7.98 hrs, Volume= 0.900 af
Outflow = 2.23 cfs @ 7.98 hrs, Volume= 0.900 af, Atten= 0%, Lag= 0.3 min

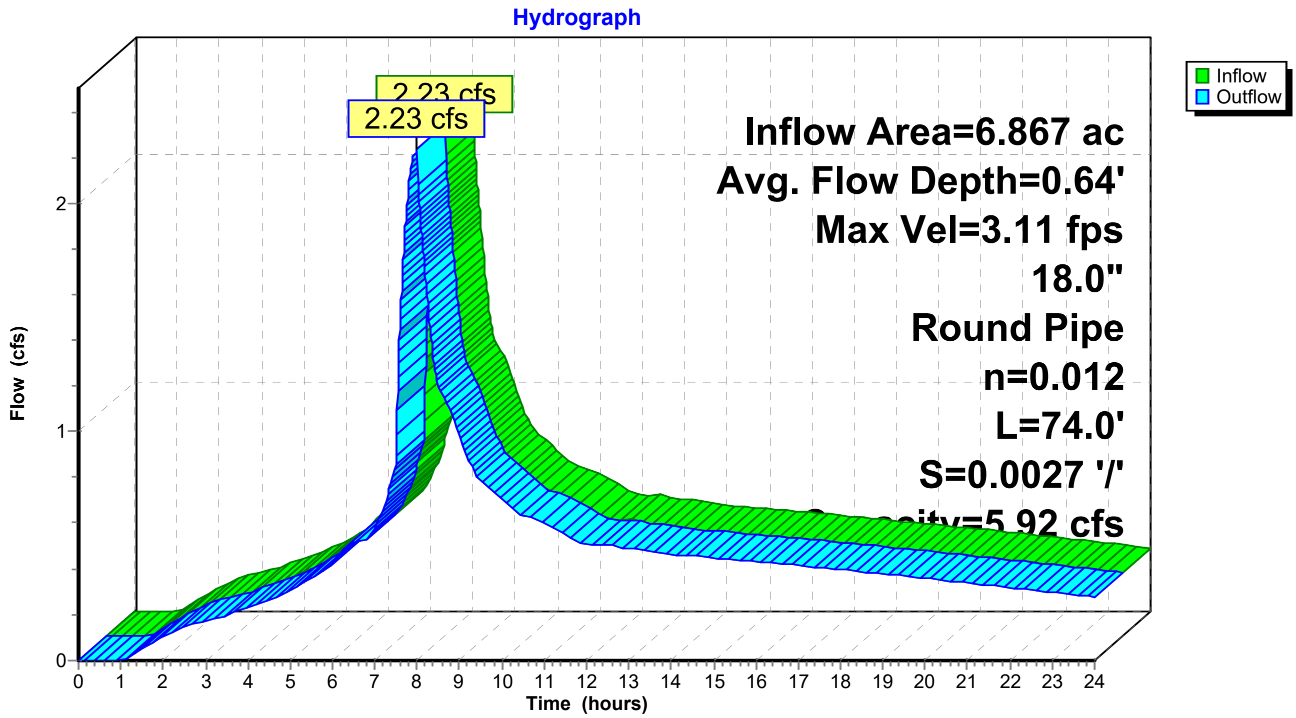
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.11 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.91 fps, Avg. Travel Time= 0.6 min

Peak Storage= 53 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 5.92 cfs

18.0" Round Pipe
n= 0.012
Length= 74.0' Slope= 0.0027 '/'
Inlet Invert= 131.70', Outlet Invert= 131.50'



Reach 19R: 74 LF 18"



Summary for Pond 1P: East Bio

Inflow Area = 2.027 ac, 44.93% Impervious, Inflow Depth > 1.42" for 2-yr, 24-hr event
Inflow = 0.67 cfs @ 7.93 hrs, Volume= 0.241 af
Outflow = 0.66 cfs @ 8.00 hrs, Volume= 0.240 af, Atten= 2%, Lag= 4.3 min
Primary = 0.66 cfs @ 8.00 hrs, Volume= 0.240 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 133.60' @ 8.00 hrs Surf.Area= 0.010 ac Storage= 0.004 af

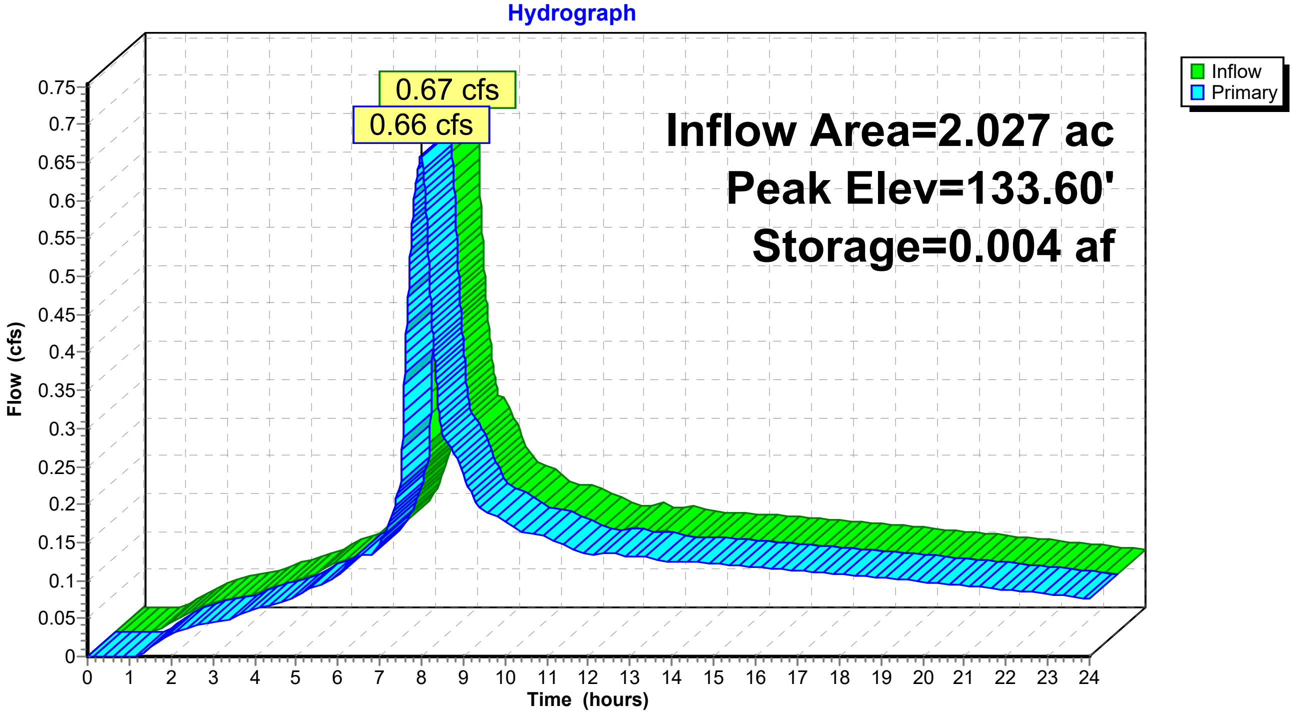
Plug-Flow detention time= 5.9 min calculated for 0.240 af (100% of inflow)
Center-of-Mass det. time= 3.5 min (733.5 - 730.0)

Volume	Invert	Avail.Storage	Storage Description
#1	135.65'	0.012 af	**20.00'W x 20.00'L x 1.00'H Prismatoid Z=3.0**
#2	132.65'	0.012 af	**20.00'W x 22.00'L x 3.00'H Prismatoid** 0.030 af Overall x 40.0% Voids
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	136.15'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	132.65'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.66 cfs @ 8.00 hrs HW=133.60' TW=133.11' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Orifice Controls 0.66 cfs @ 3.36 fps)

Pond 1P: East Bio



Summary for Pond 2P: West Bio 2

Inflow Area = 0.688 ac, 93.31% Impervious, Inflow Depth > 2.10" for 2-yr, 24-hr event
Inflow = 0.37 cfs @ 7.88 hrs, Volume= 0.120 af
Outflow = 0.37 cfs @ 7.91 hrs, Volume= 0.120 af, Atten= 0%, Lag= 1.6 min
Primary = 0.37 cfs @ 7.91 hrs, Volume= 0.120 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.54' @ 7.91 hrs Surf.Area= 0.009 ac Storage= 0.005 af

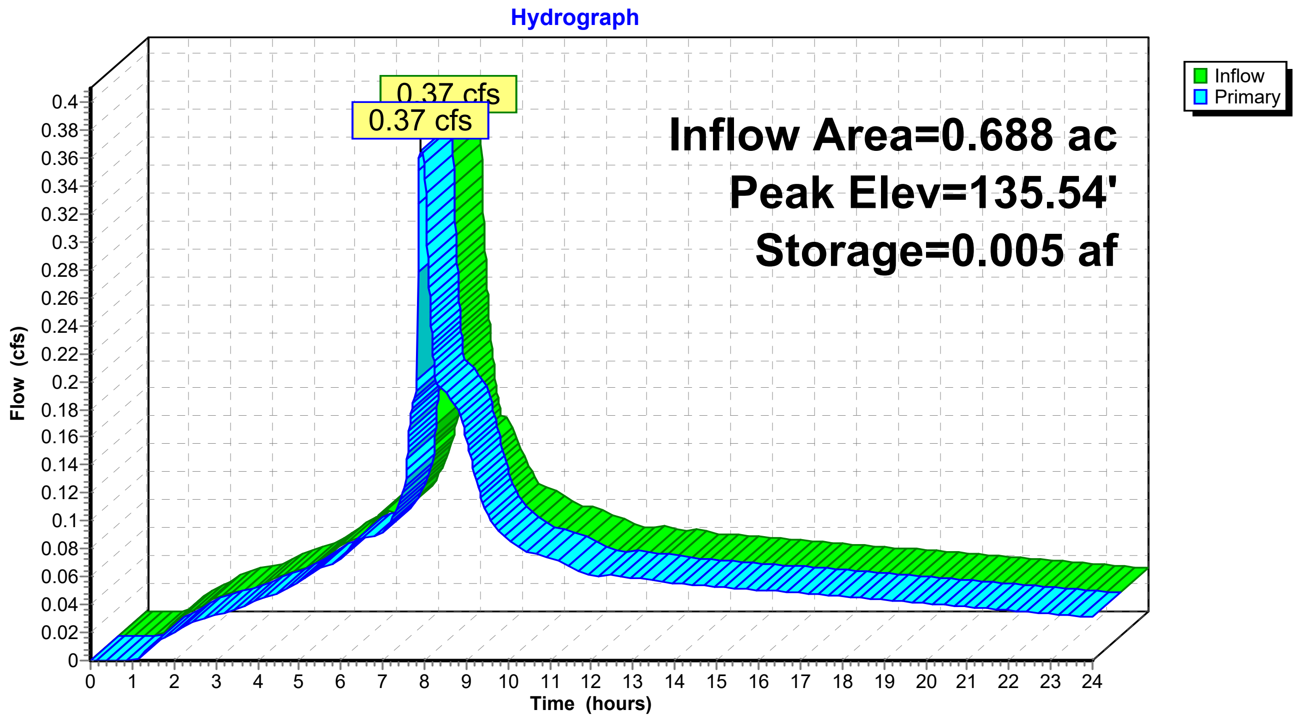
Plug-Flow detention time= 7.5 min calculated for 0.120 af (100% of inflow)
Center-of-Mass det. time= 6.1 min (683.6 - 677.5)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.006 af	**15.30'W x 10.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.003 af	**15.30'W x 10.00'L x 2.00'H Prismatoid**
			0.007 af Overall x 40.0% Voids
		0.008 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.37 cfs @ 7.91 hrs HW=135.54' TW=132.93' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.20 cfs @ 7.53 fps)
2=Orifice/Grate (Weir Controls 0.17 cfs @ 0.66 fps)

Pond 2P: West Bio 2



Summary for Pond 8P: North Bio

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 2.17" for 2-yr, 24-hr event
Inflow = 0.39 cfs @ 7.88 hrs, Volume= 0.129 af
Outflow = 0.28 cfs @ 8.11 hrs, Volume= 0.128 af, Atten= 29%, Lag= 13.6 min
Primary = 0.28 cfs @ 8.11 hrs, Volume= 0.128 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 145.23' @ 8.11 hrs Surf.Area= 0.015 ac Storage= 0.007 af

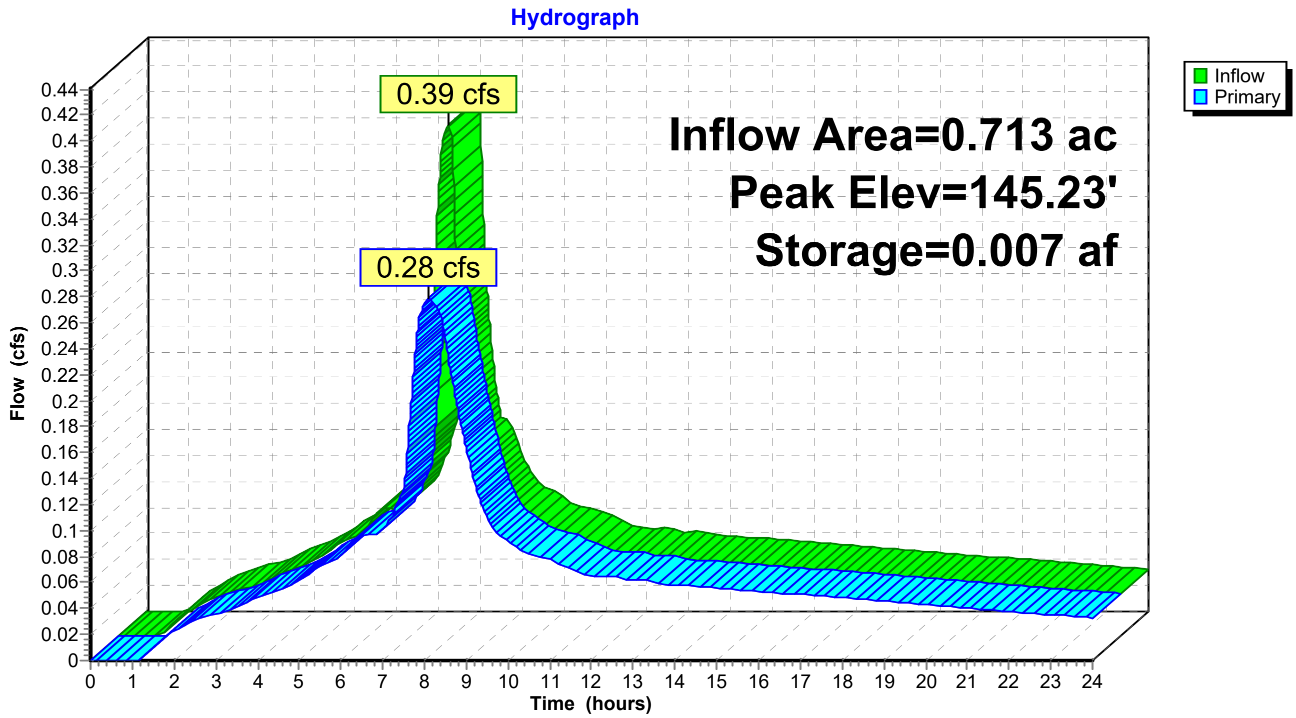
Plug-Flow detention time= 9.2 min calculated for 0.128 af (100% of inflow)
Center-of-Mass det. time= 6.9 min (679.5 - 672.6)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	0.027 af	**10.00'W x 30.00'L x 2.00'H Prismatoid Z=3.0**
#2	143.00'	0.006 af	**10.00'W x 30.00'L x 2.00'H Prismatoid** 0.014 af Overall x 40.0% Voids
		0.033 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	145.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	143.00'	**2.7" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.28 cfs @ 8.11 hrs HW=145.23' TW=136.72' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.28 cfs @ 7.01 fps)

Pond 8P: North Bio



Summary for Pond 14P: Pond2 Emergency

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

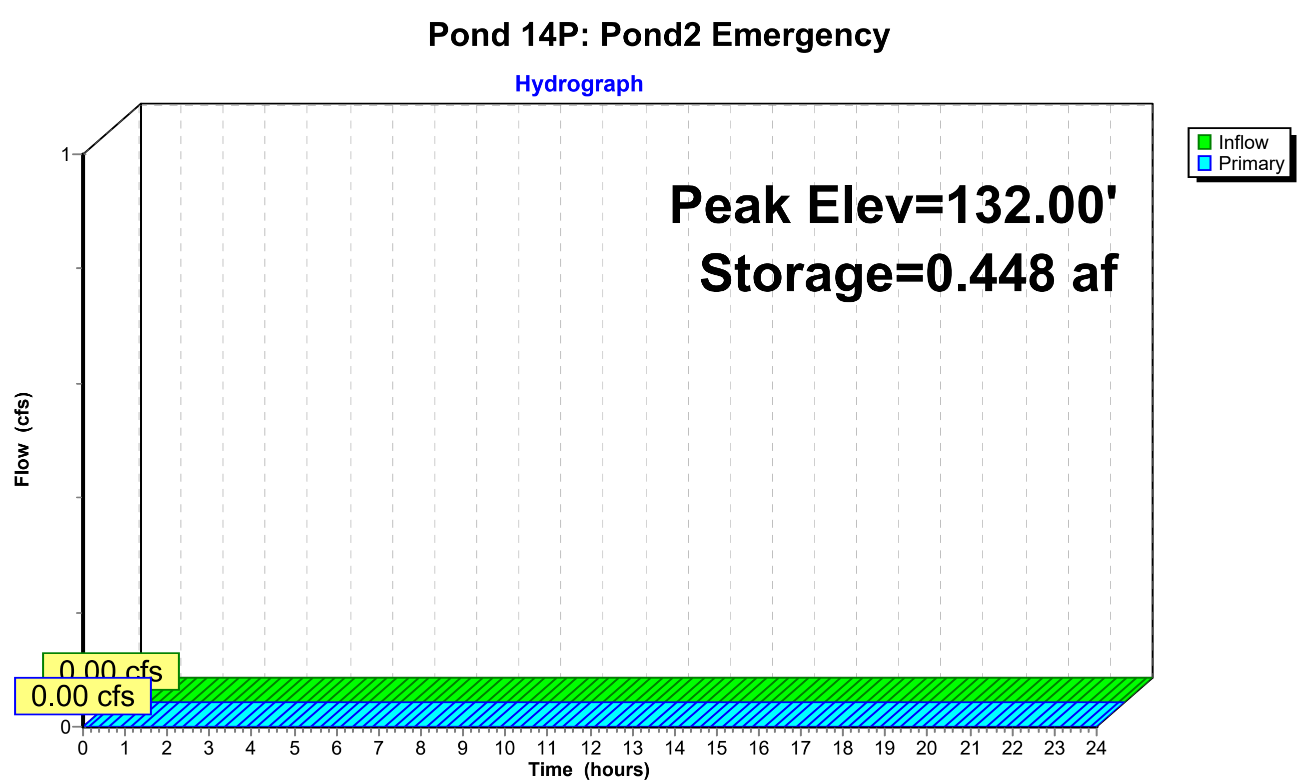
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 132.00' Surf.Area= 0.323 ac Storage= 0.448 af
Peak Elev= 132.00' @ 0.00 hrs Surf.Area= 0.323 ac Storage= 0.448 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.50'	1.791 af	**120.00'W x 100.00'L x 5.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=132.00' TW=0.00' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)



Summary for Pond 18R: 240 LF Bypass Culvert

[57] Hint: Peaked at 134.05' (Flood elevation advised)

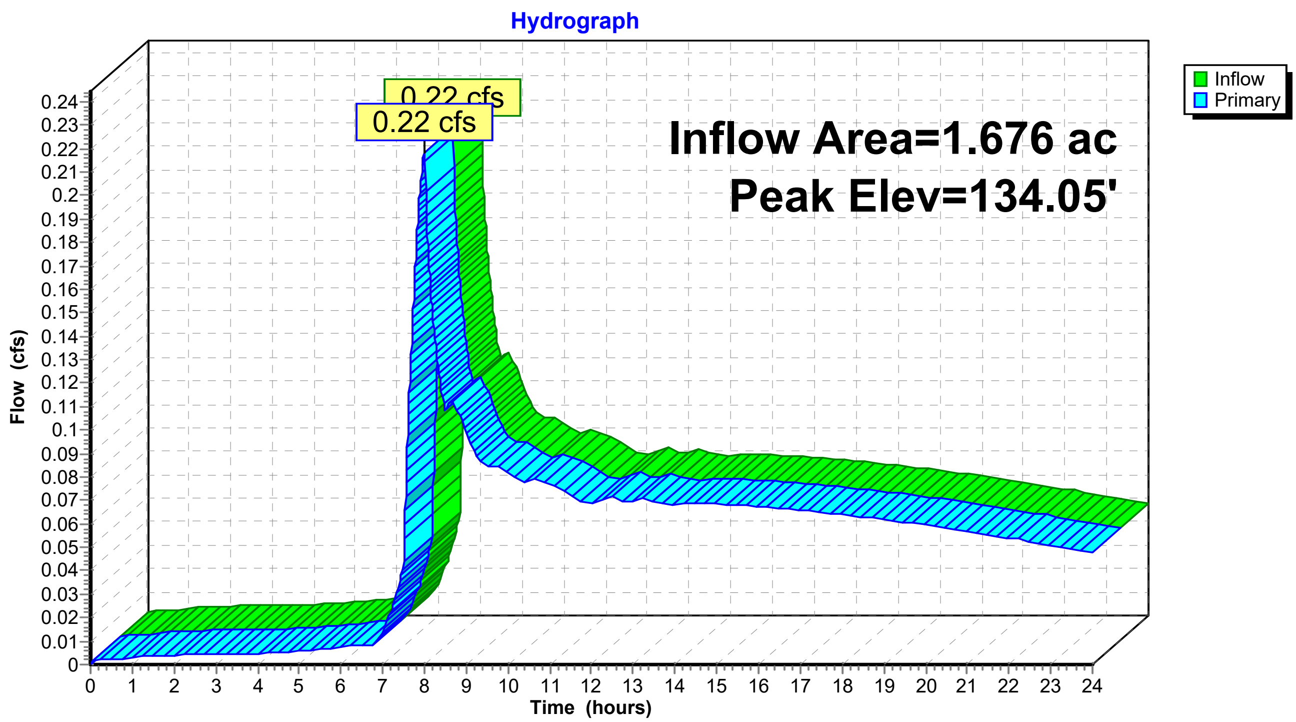
Inflow Area = 1.676 ac, 3.22% Impervious, Inflow Depth > 0.73" for 2-yr, 24-hr event
Inflow = 0.22 cfs @ 8.00 hrs, Volume= 0.102 af
Outflow = 0.22 cfs @ 8.00 hrs, Volume= 0.102 af, Atten= 0%, Lag= 0.0 min
Primary = 0.22 cfs @ 8.00 hrs, Volume= 0.102 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.05' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=0.22 cfs @ 8.00 hrs HW=134.05' TW=127.51' (Dynamic Tailwater)
1=Culvert (Passes 0.22 cfs of 12.60 cfs potential flow)
2=Sharp-Crested Rectangular Weir (Weir Controls 0.22 cfs @ 0.73 fps)

Pond 18R: 240 LF Bypass Culvert



Summary for Pond 20P: Courtyard Depressions

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 1.95" for 2-yr, 24-hr event
Inflow = 0.14 cfs @ 8.09 hrs, Volume= 0.080 af
Outflow = 0.14 cfs @ 8.38 hrs, Volume= 0.079 af, Atten= 6%, Lag= 17.5 min
Primary = 0.14 cfs @ 8.38 hrs, Volume= 0.079 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.52' @ 8.38 hrs Surf.Area= 0.030 ac Storage= 0.006 af

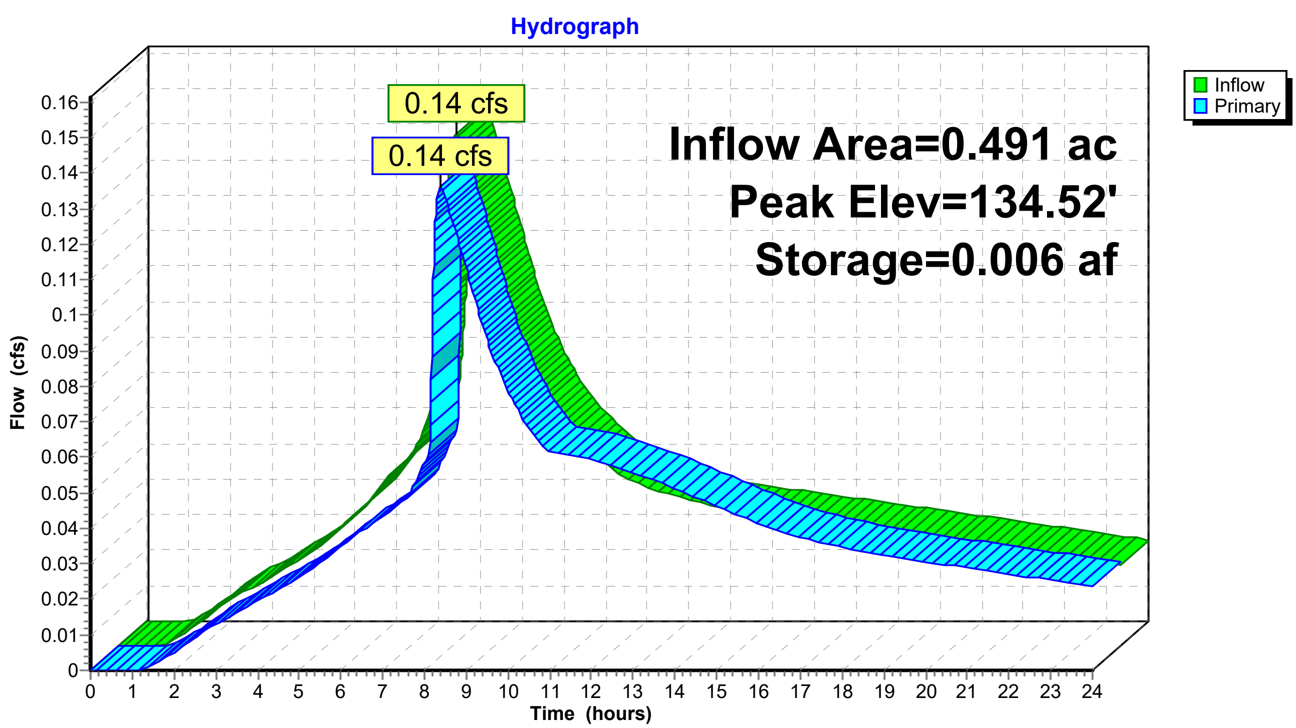
Plug-Flow detention time= 36.2 min calculated for 0.079 af (99% of inflow)
Center-of-Mass det. time= 30.8 min (749.5 - 718.6)

Volume	Invert	Avail.Storage	Storage Description
#1	134.00'	0.009 af	**5.00'W x 5.00'L x 0.60'H Prismatoid Z=30.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	134.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	134.00'	**1.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.14 cfs @ 8.38 hrs HW=134.52' TW=131.56' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 0.07 cfs @ 0.46 fps)
2=Orifice/Grate (Orifice Controls 0.06 cfs @ 3.01 fps)

Pond 20P: Courtyard Depressions



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 127.54' (Flood elevation advised)

Inflow Area = 5.680 ac, 47.76% Impervious, Inflow Depth > 1.36" for 2-yr, 24-hr event
Inflow = 0.97 cfs @ 8.70 hrs, Volume= 0.646 af
Outflow = 0.97 cfs @ 8.70 hrs, Volume= 0.646 af, Atten= 0%, Lag= 0.0 min
Primary = 0.97 cfs @ 8.70 hrs, Volume= 0.646 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

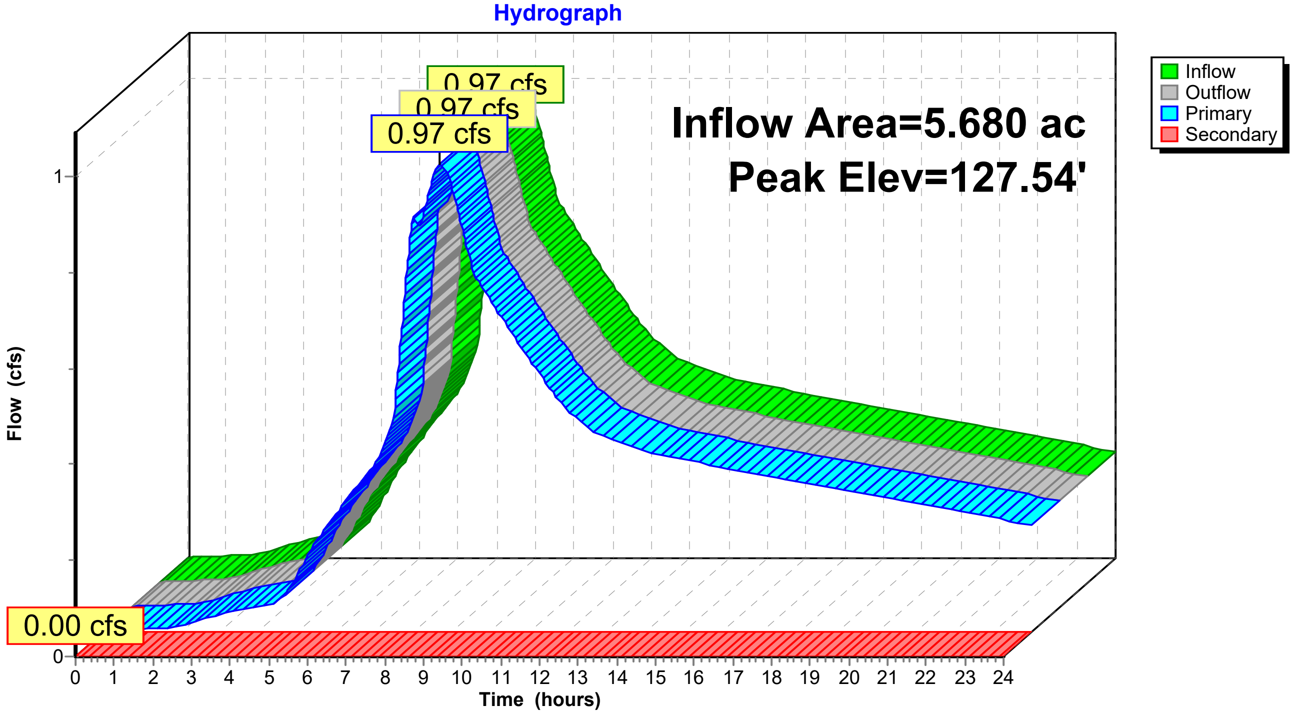
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.54' @ 8.70 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.97 cfs @ 8.70 hrs HW=127.54' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.97 cfs @ 2.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=126.99' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 25P: TDA 1 Outflow



Summary for Pond AB1: West Bio 1

Inflow Area = 0.668 ac, 85.39% Impervious, Inflow Depth > 2.02" for 2-yr, 24-hr event
Inflow = 0.34 cfs @ 7.89 hrs, Volume= 0.112 af
Outflow = 0.20 cfs @ 8.21 hrs, Volume= 0.112 af, Atten= 43%, Lag= 19.4 min
Primary = 0.20 cfs @ 8.21 hrs, Volume= 0.112 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.46' @ 8.21 hrs Surf.Area= 0.015 ac Storage= 0.009 af

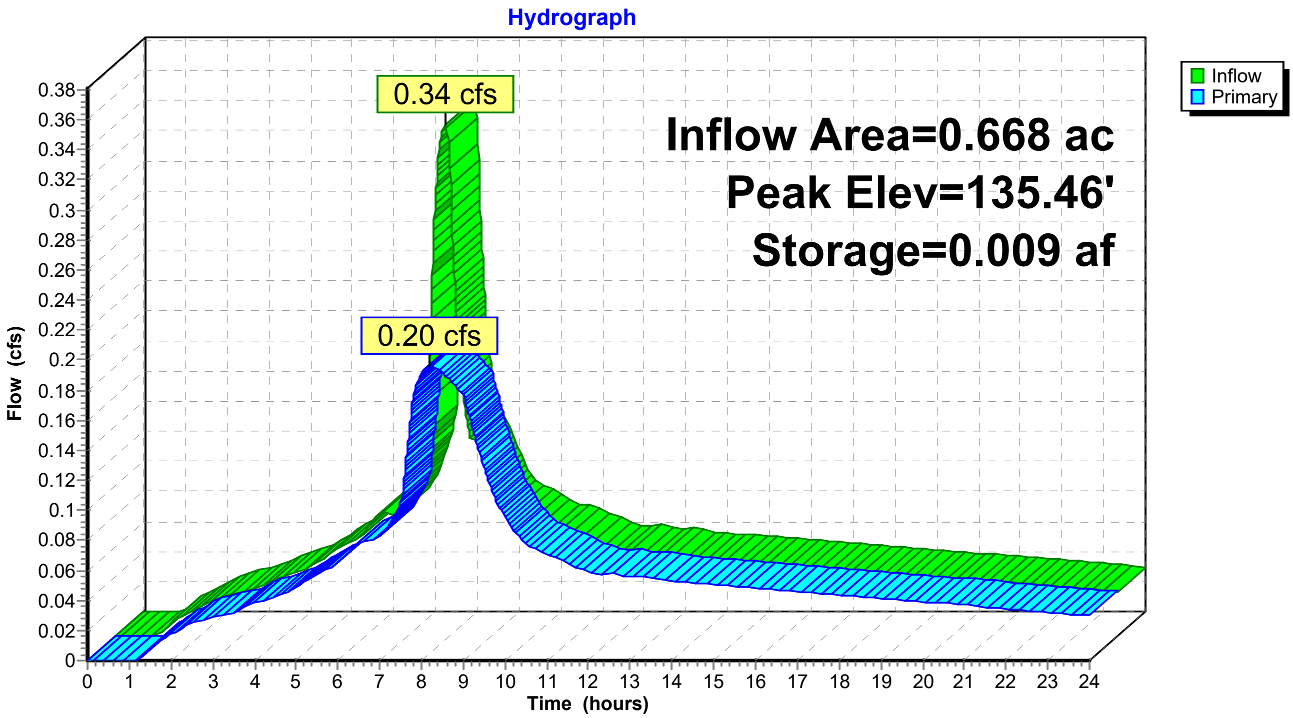
Plug-Flow detention time= 13.8 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 11.2 min (694.9 - 683.6)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.009 af	**10.00'W x 28.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.005 af	**28.00'W x 10.00'L x 2.00'H Prismatoid** 0.013 af Overall x 40.0% Voids
		0.014 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.20 cfs @ 8.21 hrs HW=135.46' TW=132.89' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 0.20 cfs @ 7.41 fps)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Pond AB1: West Bio 1



Summary for Pond PA: Pond1

[63] Warning: Exceeded Reach 12R INLET depth by 1.84' @ 9.00 hrs

Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 2.00" for 2-yr, 24-hr event
Inflow = 1.07 cfs @ 7.99 hrs, Volume= 0.513 af
Outflow = 0.79 cfs @ 8.75 hrs, Volume= 0.483 af, Atten= 26%, Lag= 45.5 min
Primary = 0.79 cfs @ 8.75 hrs, Volume= 0.483 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.37' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 132.73' @ 8.75 hrs Surf.Area= 0.059 ac Storage= 0.070 af

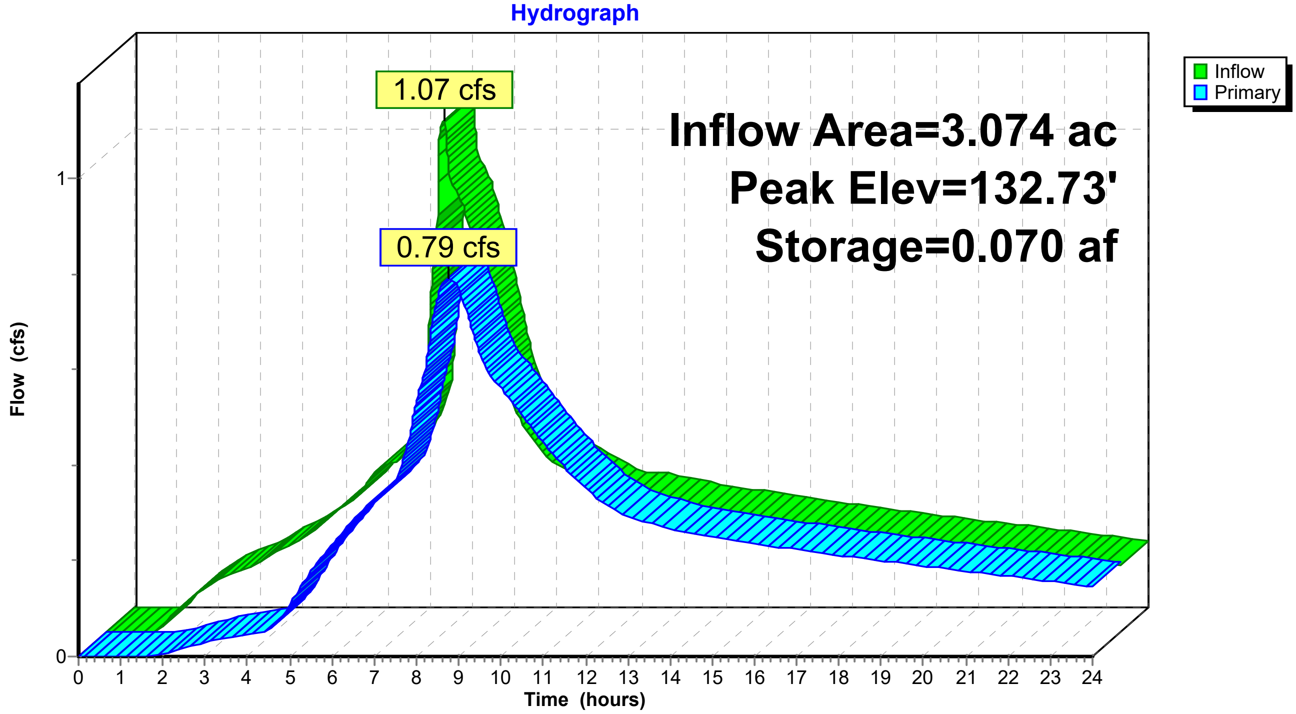
Plug-Flow detention time= 94.3 min calculated for 0.482 af (94% of inflow)
Center-of-Mass det. time= 52.2 min (754.0 - 701.7)

Volume	Invert	Avail.Storage	Storage Description
#1	131.30'	0.157 af	**42.00'W x 42.00'L x 2.70'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.60'	**1.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#2	Primary	131.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	131.30'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Primary	133.00'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.7' Crest Height

Primary OutFlow Max=0.79 cfs @ 8.75 hrs HW=132.73' TW=0.00' (Dynamic Tailwater)
—**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.15 cfs @ 1.17 fps)
—**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 4.08 fps)
—**3=Orifice/Grate** (Orifice Controls 0.09 cfs @ 5.60 fps)
—**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PA: Pond1



Summary for Pond PB: Pond2

[63] Warning: Exceeded Reach 19R INLET depth by 0.66' @ 11.78 hrs

Inflow Area =	8.602 ac, 42.69% Impervious,	Inflow Depth > 1.47"	for 2-yr, 24-hr event
Inflow =	2.50 cfs @ 8.00 hrs,	Volume=	1.054 af
Outflow =	0.72 cfs @ 11.00 hrs,	Volume=	0.803 af, Atten= 71%, Lag= 180.1 min
Primary =	0.72 cfs @ 11.00 hrs,	Volume=	0.803 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.85' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 132.67' @ 11.00 hrs Surf.Area= 0.312 ac Storage= 0.343 af

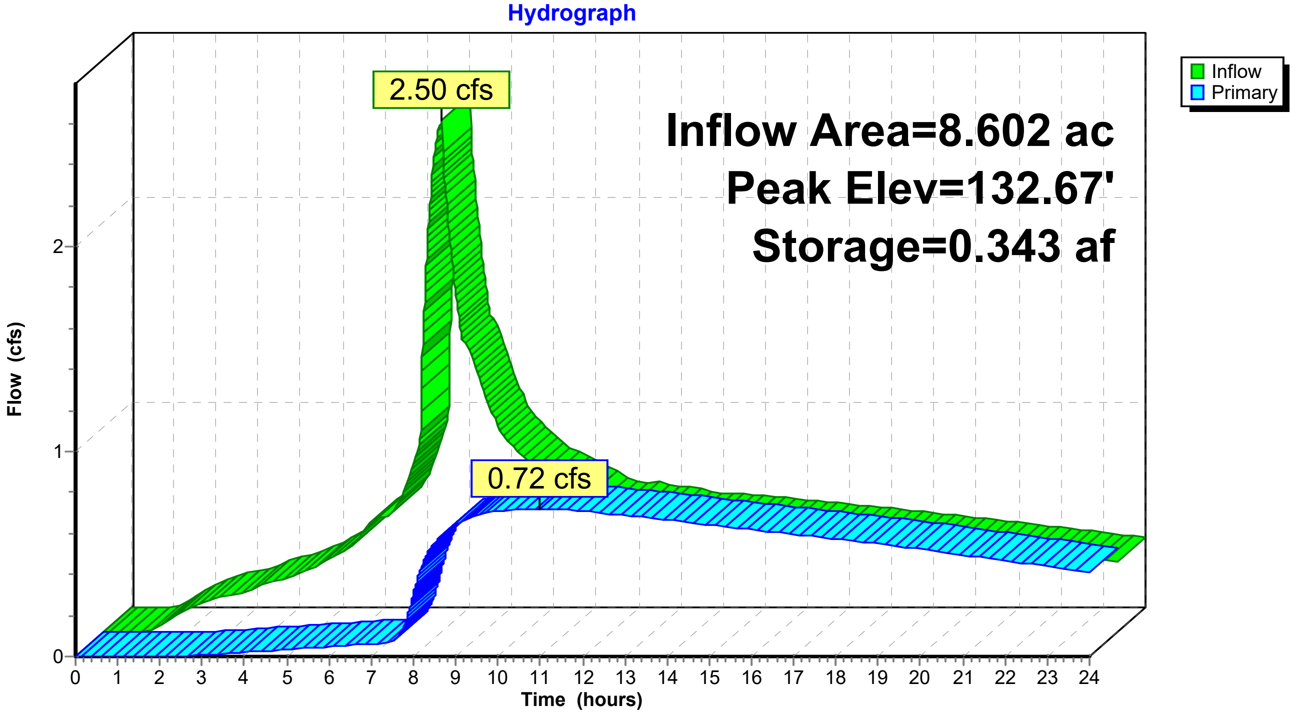
Plug-Flow detention time= 317.5 min calculated for 0.803 af (76% of inflow)
Center-of-Mass det. time= 170.4 min (911.7 - 741.2)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	0.970 af	**120.00'W x 100.00'L x 3.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	131.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.00'	**1.4' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.5' Crest Height
#4	Primary	133.47'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.6' Crest Height

Primary OutFlow Max=0.72 cfs @ 11.00 hrs HW=132.67' TW=0.00' (Dynamic Tailwater)
- **1=Orifice/Grate** (Orifice Controls 0.61 cfs @ 3.11 fps)
- **2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 5.01 fps)
- **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PB: Pond2

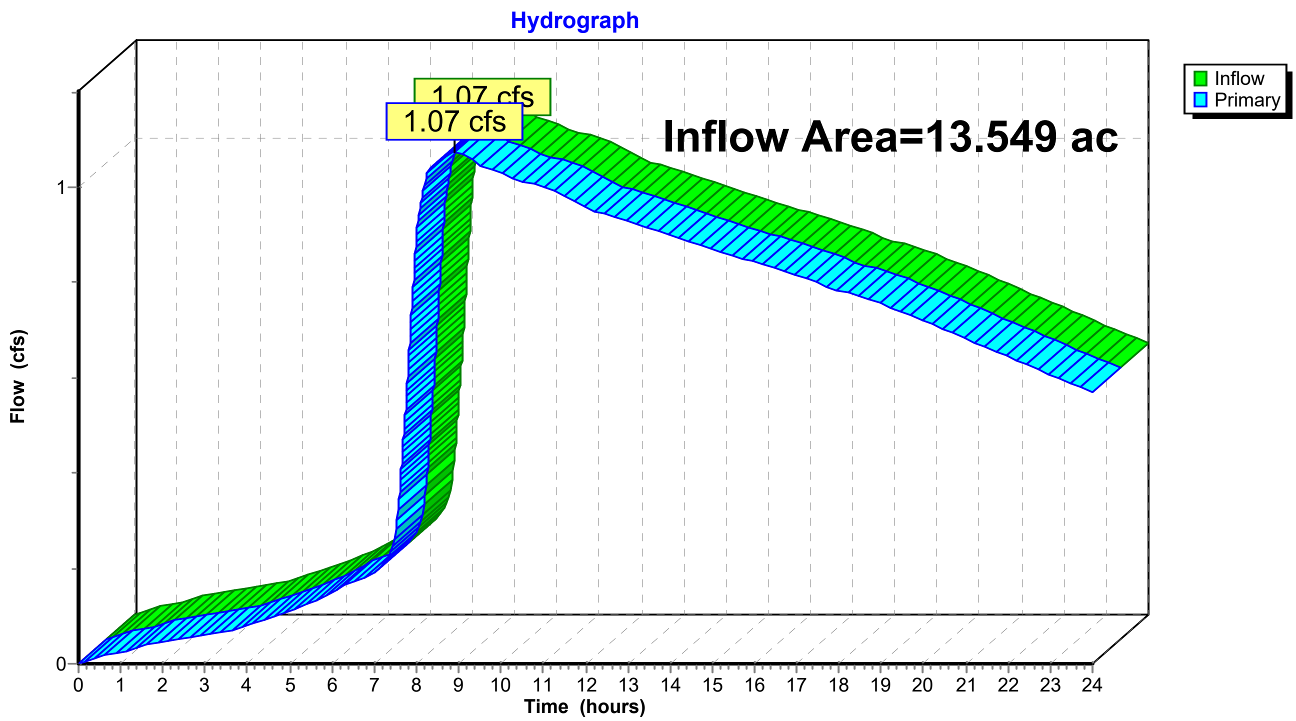


Summary for Link 11L: TDA 2 Outflow

Inflow Area = 13.549 ac, 32.99% Impervious, Inflow Depth > 1.05" for 2-yr, 24-hr event
Inflow = 1.07 cfs @ 8.91 hrs, Volume= 1.185 af
Primary = 1.07 cfs @ 8.91 hrs, Volume= 1.185 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 11L: TDA 2 Outflow

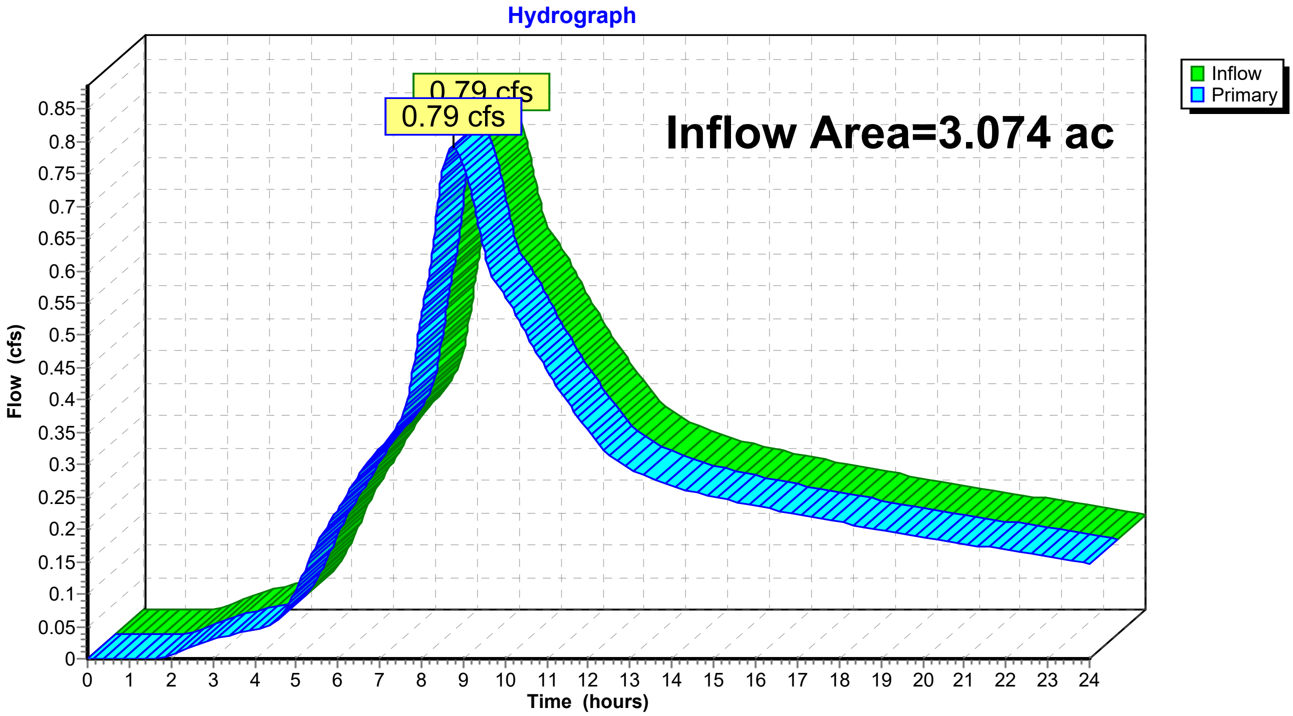


Summary for Link 12L: Site Outflow

Inflow Area =	3.074 ac,	85.24% Impervious,	Inflow Depth > 1.88"	for 2-yr, 24-hr event
Inflow =	0.79 cfs @	8.75 hrs, Volume=	0.483 af	
Primary =	0.79 cfs @	8.75 hrs, Volume=	0.483 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 12L: Site Outflow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A1: Frontage Runoff Area=0.713 ac 100.00% Impervious Runoff Depth>3.06"
Tc=5.0 min CN=0/98 Runoff=0.55 cfs 0.182 af

Subcatchment A2: West Parking 1 Runoff Area=29,090 sf 85.39% Impervious Runoff Depth>2.89"
Tc=5.0 min CN=86/98 Runoff=0.49 cfs 0.161 af

Subcatchment A3: West Parking 2 Runoff Area=0.688 ac 93.31% Impervious Runoff Depth>2.99"
Tc=5.0 min CN=86/98 Runoff=0.52 cfs 0.171 af

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>1.35"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.48 cfs 0.188 af

Subcatchment A5: Courtyard 2 Runoff Area=0.248 ac 87.10% Impervious Runoff Depth>2.91"
Tc=5.0 min CN=86/98 Runoff=0.18 cfs 0.060 af

Subcatchment A6: Fire Lane Runoff Area=0.140 ac 53.57% Impervious Runoff Depth>2.48"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.05 cfs 0.029 af

Subcatchment A7: Courtyard 1 Runoff Area=0.491 ac 82.28% Impervious Runoff Depth>2.81"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.21 cfs 0.115 af

Subcatchment A8: Pond Direct Runoff Area=5,502 sf 0.00% Impervious Runoff Depth>1.91"
Tc=10.0 min CN=86/0 Runoff=0.06 cfs 0.020 af

Subcatchment A9: Vegetated/Wetland Runoff Area=40,486 sf 4.10% Impervious Runoff Depth>1.42"
Flow Length=240' Slope=0.0750 '/' Tc=14.0 min CN=78/100 Runoff=0.25 cfs 0.110 af

Subcatchment B1: East Parking Runoff Area=88,300 sf 44.93% Impervious Runoff Depth>2.19"
Tc=5.0 min CN=80/98 Runoff=1.06 cfs 0.370 af

Subcatchment B2: Courtyard 3 Runoff Area=24,008 sf 70.66% Impervious Runoff Depth>2.73"
Tc=5.0 min CN=86/98 Runoff=0.38 cfs 0.125 af

Subcatchment B3: Building Roof Runoff Area=65,510 sf 100.00% Impervious Runoff Depth>3.07"
Tc=0.0 min CN=0/98 Runoff=1.18 cfs 0.384 af

Subcatchment B4: Field and Track Runoff Area=121,328 sf 25.76% Impervious Runoff Depth>2.07"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=84/98 Runoff=0.92 cfs 0.479 af

Subcatchment B5: Access Road and Pond Runoff Area=75,574 sf 8.72% Impervious Runoff Depth>1.78"
Flow Length=260' Slope=0.0100 '/' Tc=33.5 min CN=83/98 Runoff=0.49 cfs 0.258 af

Subcatchment B6: South Wetland Runoff Area=191,628 sf 12.89% Impervious Runoff Depth>1.46"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=76/100 Runoff=0.86 cfs 0.535 af

Subcatchment B7: Courtyard Bypass Runoff Area=23,868 sf 41.91% Impervious Runoff Depth>2.39"
Flow Length=330' Slope=0.0100 '/' Tc=12.9 min CN=86/98 Runoff=0.30 cfs 0.109 af

Reach 1R: 279 LF 18" Avg. Flow Depth=0.66' Max Vel=3.34 fps Inflow=2.50 cfs 0.878 af
18.0" Round Pipe n=0.012 L=279.0' S=0.0030 '/' Capacity=6.24 cfs Outflow=2.50 cfs 0.877 af

Reach 3R: 134 LF 12" Avg. Flow Depth=0.32' Max Vel=3.29 fps Inflow=0.71 cfs 0.241 af
12.0" Round Pipe n=0.012 L=134.0' S=0.0069 '/' Capacity=3.22 cfs Outflow=0.71 cfs 0.241 af

Reach 4R: 56 LF 12" Avg. Flow Depth=0.42' Max Vel=3.21 fps Inflow=1.00 cfs 0.331 af
12.0" Round Pipe n=0.012 L=56.0' S=0.0050 '/' Capacity=2.73 cfs Outflow=1.00 cfs 0.331 af

Reach 5R: 70 LF 12" Avg. Flow Depth=0.23' Max Vel=2.77 fps Inflow=0.38 cfs 0.125 af
12.0" Round Pipe n=0.012 L=70.0' S=0.0071 '/' Capacity=3.26 cfs Outflow=0.38 cfs 0.125 af

Reach 6R: 38 LF 12" Avg. Flow Depth=0.60' Max Vel=2.83 fps Inflow=1.39 cfs 0.494 af
12.0" Round Pipe n=0.012 L=38.0' S=0.0029 '/' Capacity=2.08 cfs Outflow=1.39 cfs 0.494 af

Reach 7R: 107 LF 12" Avg. Flow Depth=0.17' Max Vel=2.31 fps Inflow=0.21 cfs 0.114 af
12.0" Round Pipe n=0.012 L=107.0' S=0.0070 '/' Capacity=3.23 cfs Outflow=0.21 cfs 0.114 af

Reach 8R: 170 LF 12" Avg. Flow Depth=0.25' Max Vel=2.48 fps Inflow=0.38 cfs 0.125 af
12.0" Round Pipe n=0.012 L=170.0' S=0.0052 '/' Capacity=2.79 cfs Outflow=0.38 cfs 0.125 af

Reach 9R: 115 LF 12" Avg. Flow Depth=0.30' Max Vel=2.69 fps Inflow=0.54 cfs 0.181 af
12.0" Round Pipe n=0.012 L=115.0' S=0.0050 '/' Capacity=2.72 cfs Outflow=0.54 cfs 0.181 af

Reach 10R: 76 LF 12" Avg. Flow Depth=0.46' Max Vel=4.75 fps Inflow=1.69 cfs 0.573 af
12.0" Round Pipe n=0.012 L=76.0' S=0.0100 '/' Capacity=3.86 cfs Outflow=1.69 cfs 0.573 af

Reach 12R: 34 LF 12" Avg. Flow Depth=0.54' Max Vel=4.51 fps Inflow=1.93 cfs 0.715 af
12.0" Round Pipe n=0.012 L=34.0' S=0.0079 '/' Capacity=3.44 cfs Outflow=1.93 cfs 0.715 af

Reach 13R: 159 LF 12" Avg. Flow Depth=0.22' Max Vel=4.31 fps Inflow=0.54 cfs 0.181 af
12.0" Round Pipe n=0.012 L=159.0' S=0.0187 '/' Capacity=5.28 cfs Outflow=0.54 cfs 0.181 af

Reach 16R: 39 LF 12" Avg. Flow Depth=0.35' Max Vel=2.89 fps Inflow=0.71 cfs 0.242 af
12.0" Round Pipe n=0.012 L=39.0' S=0.0049 '/' Capacity=2.69 cfs Outflow=0.71 cfs 0.241 af

Reach 19R: 74 LF 18" Avg. Flow Depth=0.81' Max Vel=3.46 fps Inflow=3.38 cfs 1.357 af
18.0" Round Pipe n=0.012 L=74.0' S=0.0027 '/' Capacity=5.92 cfs Outflow=3.38 cfs 1.356 af

Pond 1P: East Bio Peak Elev=134.42' Storage=0.007 af Inflow=1.06 cfs 0.370 af
Outflow=1.03 cfs 0.369 af

Pond 2P: West Bio 2 Peak Elev=135.56' Storage=0.005 af Inflow=0.52 cfs 0.171 af
Outflow=0.52 cfs 0.171 af

Pond 8P: North Bio Peak Elev=145.55' Storage=0.010 af Inflow=0.55 cfs 0.182 af
Outflow=0.54 cfs 0.181 af

Pond 14P: Pond2 Emergency Peak Elev=132.00' Storage=0.448 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=134.08' Inflow=0.48 cfs 0.188 af
Outflow=0.48 cfs 0.188 af

Pond 20P: Courtyard Depressions Peak Elev=134.53' Storage=0.006 af Inflow=0.21 cfs 0.115 af
Outflow=0.21 cfs 0.114 af

Pond 25P: TDA 1 Outflow Peak Elev=127.85' Inflow=1.99 cfs 1.000 af
Primary=1.74 cfs 0.993 af Secondary=0.25 cfs 0.006 af Outflow=1.99 cfs 1.000 af

Pond AB1: West Bio 1 Peak Elev=135.56' Storage=0.010 af Inflow=0.49 cfs 0.161 af
Outflow=0.48 cfs 0.161 af

Pond PA: Pond1 Peak Elev=132.95' Storage=0.084 af Inflow=1.99 cfs 0.736 af
Outflow=1.43 cfs 0.702 af

Pond PB: Pond2 Peak Elev=133.15' Storage=0.498 af Inflow=3.87 cfs 1.614 af
Outflow=1.30 cfs 1.290 af

Link 11L: TDA 2 Outflow Inflow=1.92 cfs 1.934 af
Primary=1.92 cfs 1.934 af

Link 12L: Site Outflow Inflow=1.43 cfs 0.702 af
Primary=1.43 cfs 0.702 af

Total Runoff Area = 19.229 ac Runoff Volume = 3.296 af Average Runoff Depth = 2.06"
62.65% Pervious = 12.047 ac 37.35% Impervious = 7.182 ac

Summary for Subcatchment A1: Frontage

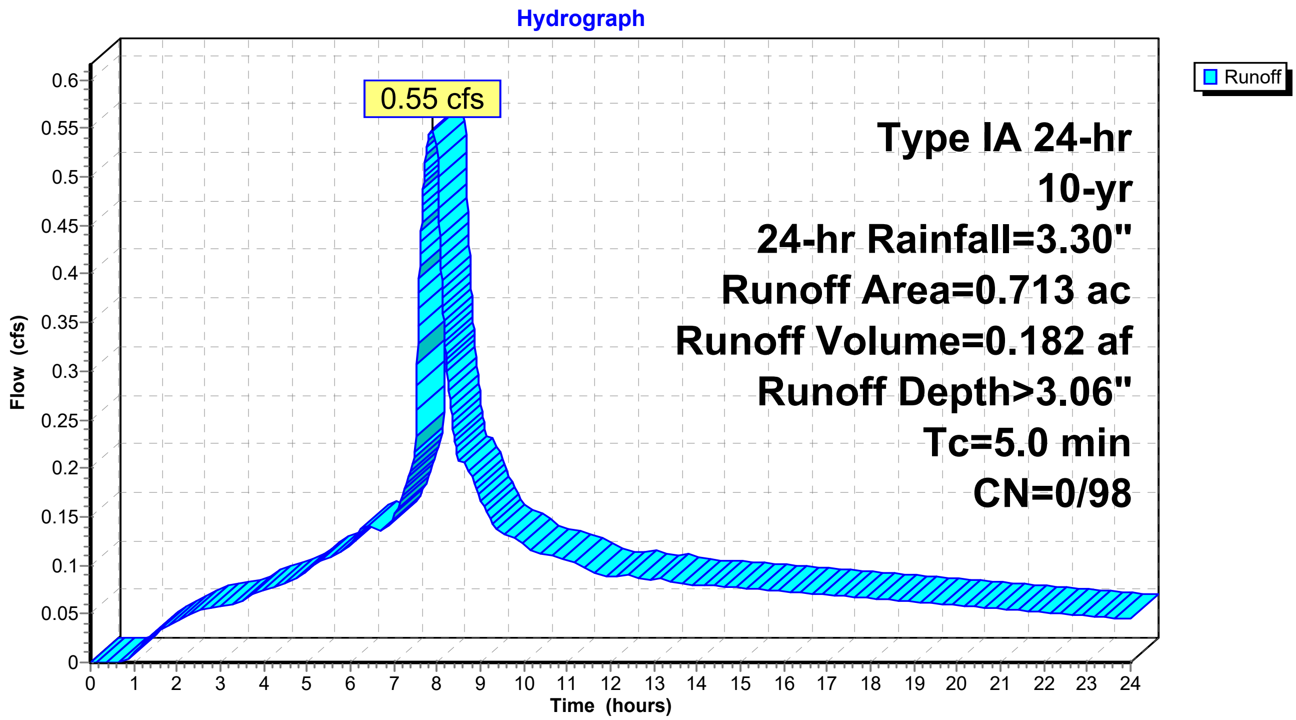
Runoff = 0.55 cfs @ 7.88 hrs, Volume= 0.182 af, Depth> 3.06"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.713	98	Road/Sidewalk
	0.713	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A1: Frontage



Summary for Subcatchment A2: West Parking 1

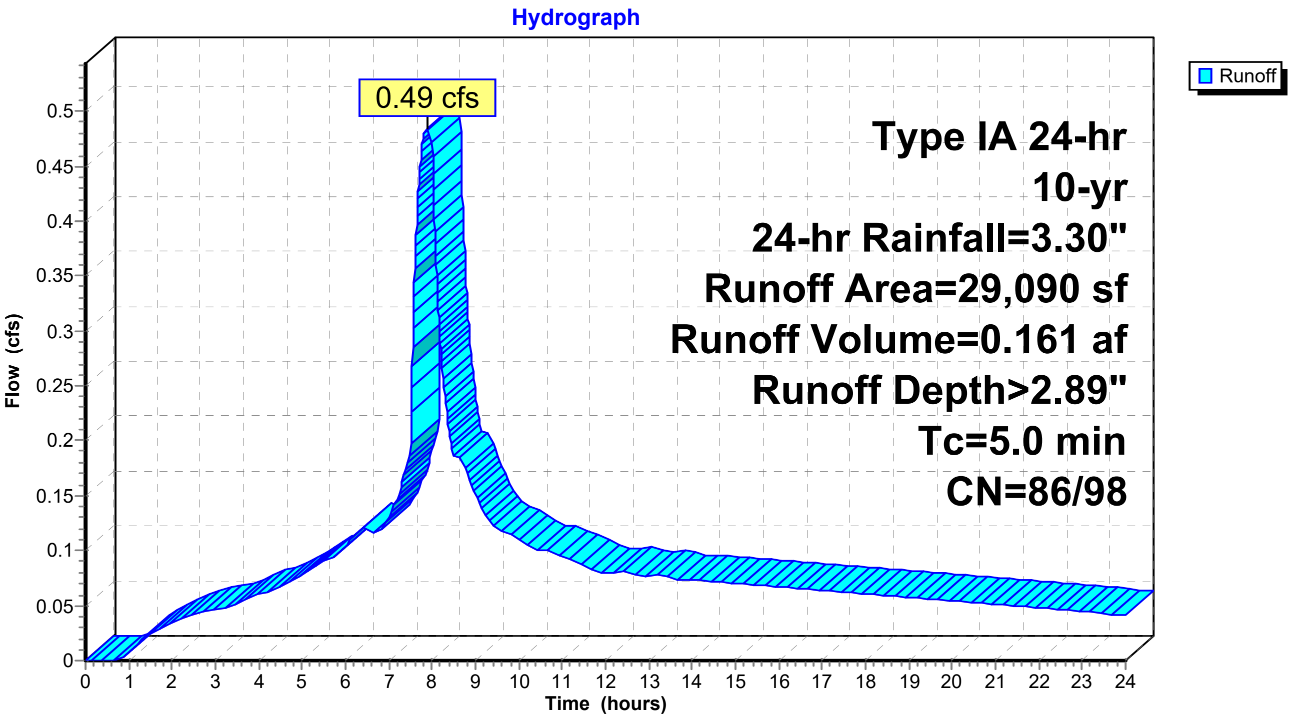
Runoff = 0.49 cfs @ 7.88 hrs, Volume= 0.161 af, Depth> 2.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	24,840	98	Parking Lot/Sidewalk
*	4,250	86	Bioretention/Landscape
	29,090	96	Weighted Average
	4,250	86	14.61% Pervious Area
	24,840	98	85.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A2: West Parking 1



Summary for Subcatchment A3: West Parking 2

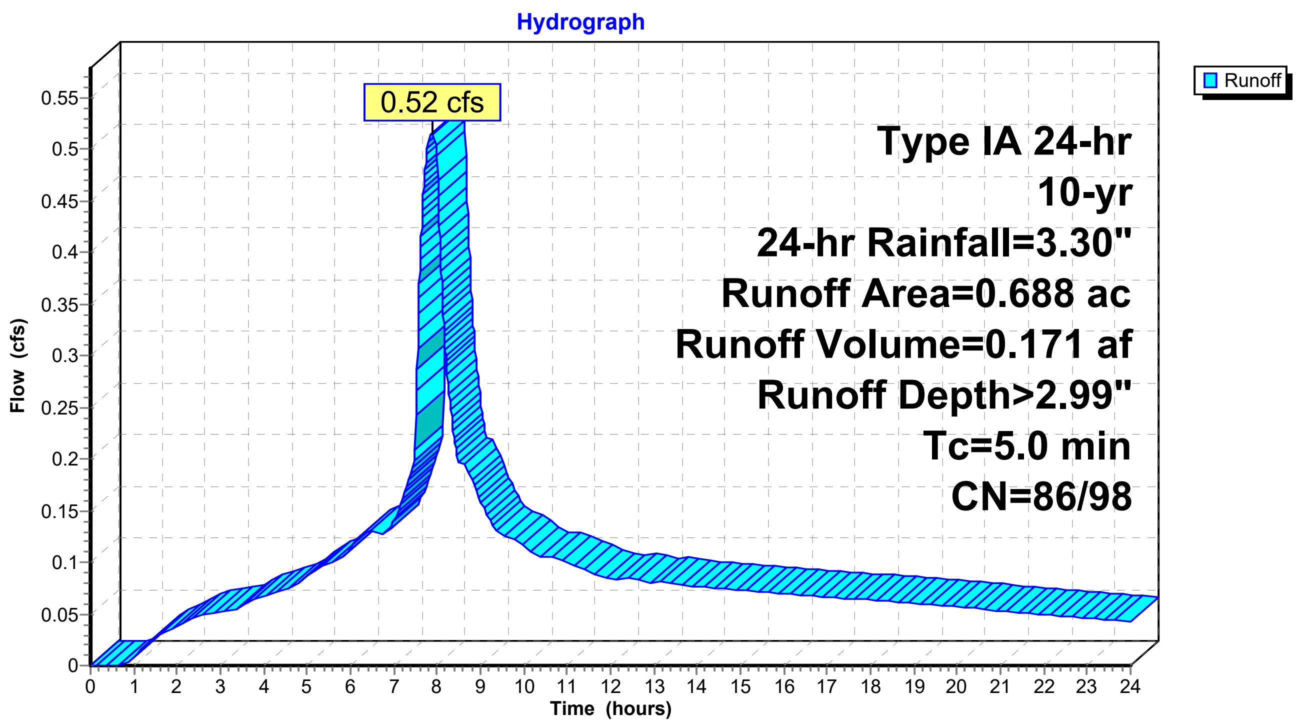
Runoff = 0.52 cfs @ 7.88 hrs, Volume= 0.171 af, Depth> 2.99"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.642	98	Parking Lot/Sidewalk
*	0.046	86	Bioretention/Landscape
	0.688	97	Weighted Average
	0.046	86	6.69% Pervious Area
	0.642	98	93.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A3: West Parking 2



Summary for Subcatchment A4: North Wetland

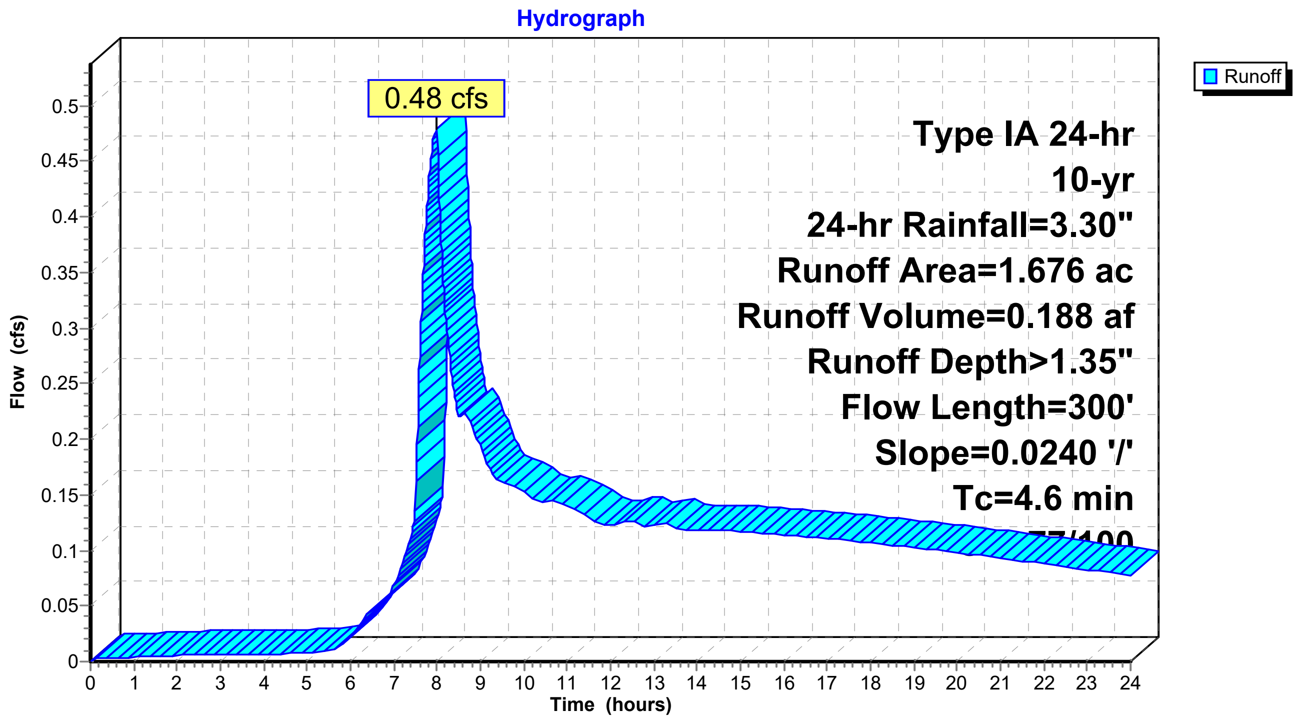
Runoff = 0.48 cfs @ 8.00 hrs, Volume= 0.188 af, Depth> 1.35"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment A5: Courtyard 2

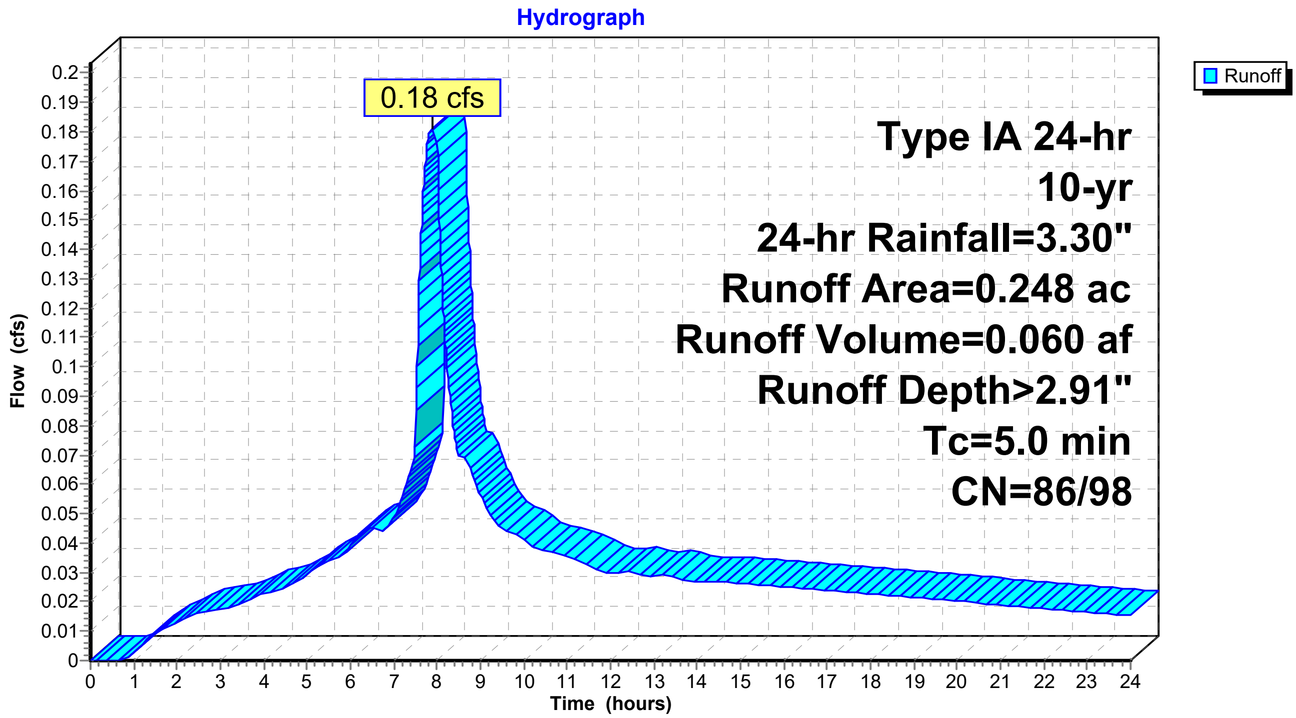
Runoff = 0.18 cfs @ 7.88 hrs, Volume= 0.060 af, Depth> 2.91"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.216	98	Courtyard Pavement
*	0.032	86	Courtyard Landscaping
	0.248	96	Weighted Average
	0.032	86	12.90% Pervious Area
	0.216	98	87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A5: Courtyard 2



Summary for Subcatchment A6: Fire Lane

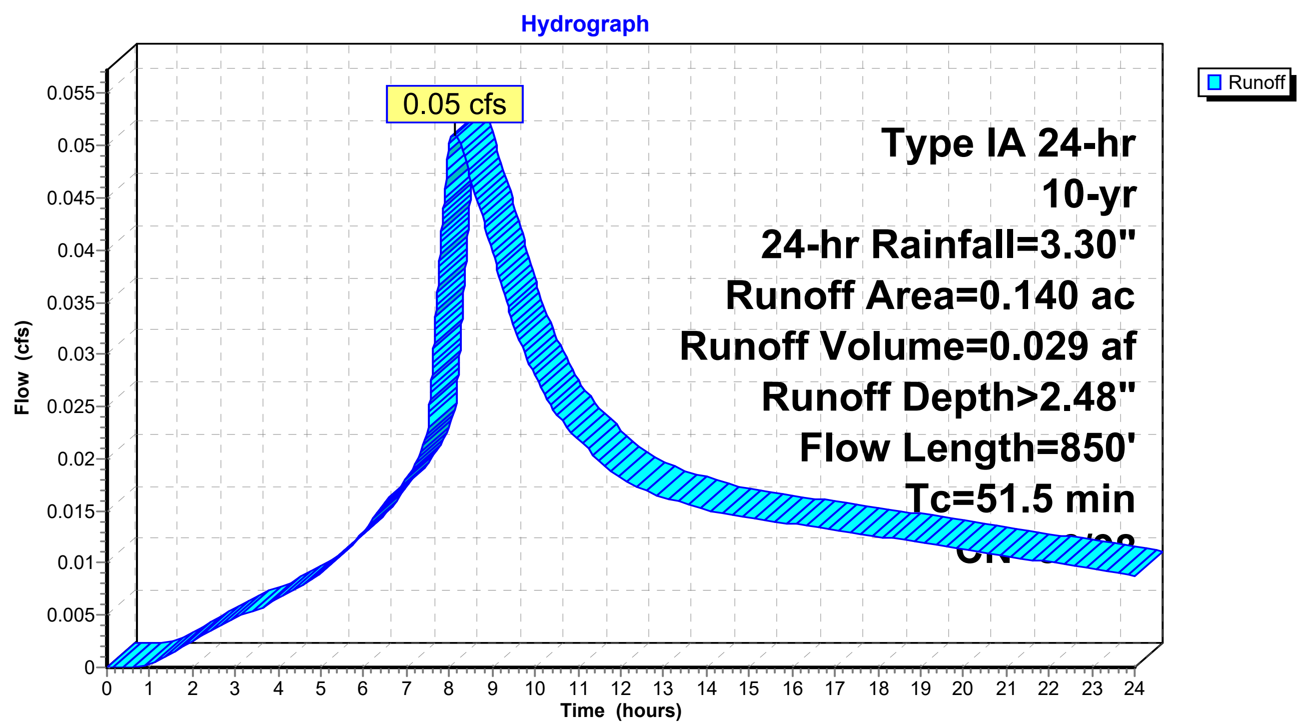
Runoff = 0.05 cfs @ 8.11 hrs, Volume= 0.029 af, Depth> 2.48"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.065	86	Courtyard Landscaping
*	0.075	98	Fire Lane
	0.140	92	Weighted Average
	0.065	86	46.43% Pervious Area
	0.075	98	53.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A6: Fire Lane



Summary for Subcatchment A7: Courtyard 1

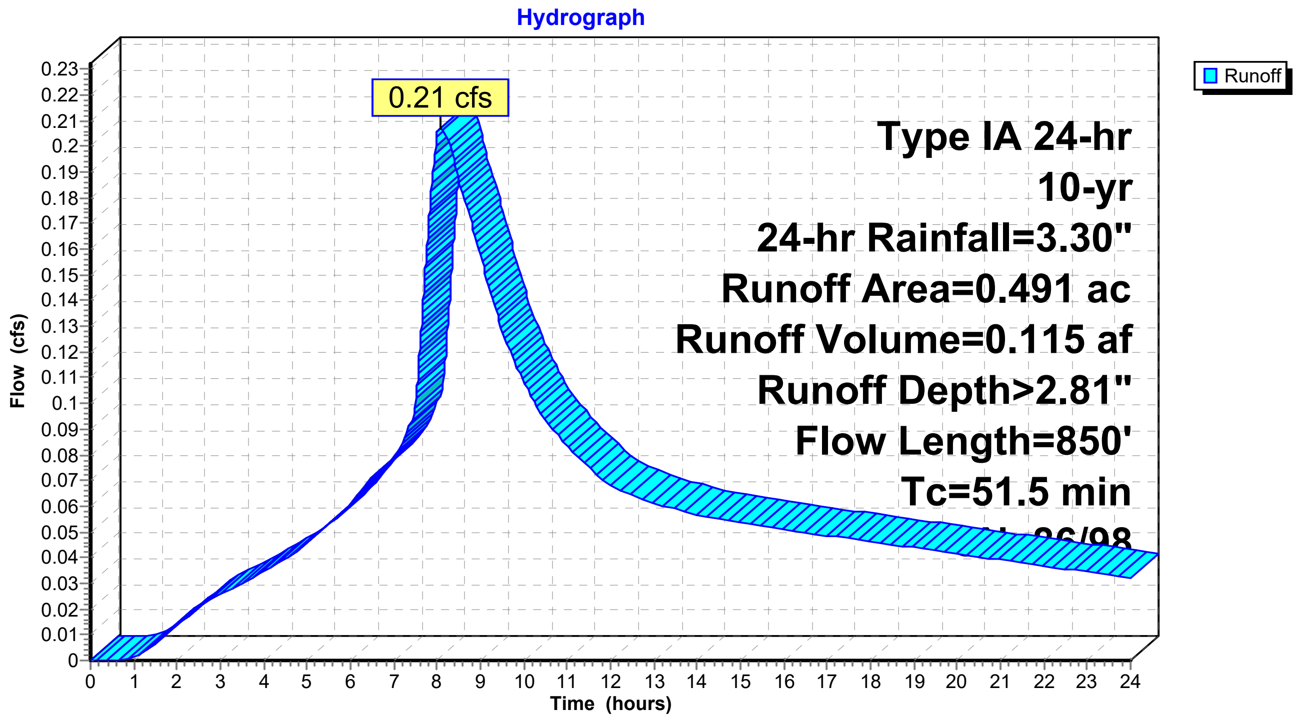
Runoff = 0.21 cfs @ 8.08 hrs, Volume= 0.115 af, Depth> 2.81"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.311	98	Courtyard Pavement
*	0.087	86	Courtyard Landscaping
*	0.093	98	Fire Lane
	0.491	96	Weighted Average
	0.087	86	17.72% Pervious Area
	0.404	98	82.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A7: Courtyard 1



Summary for Subcatchment A8: Pond Direct

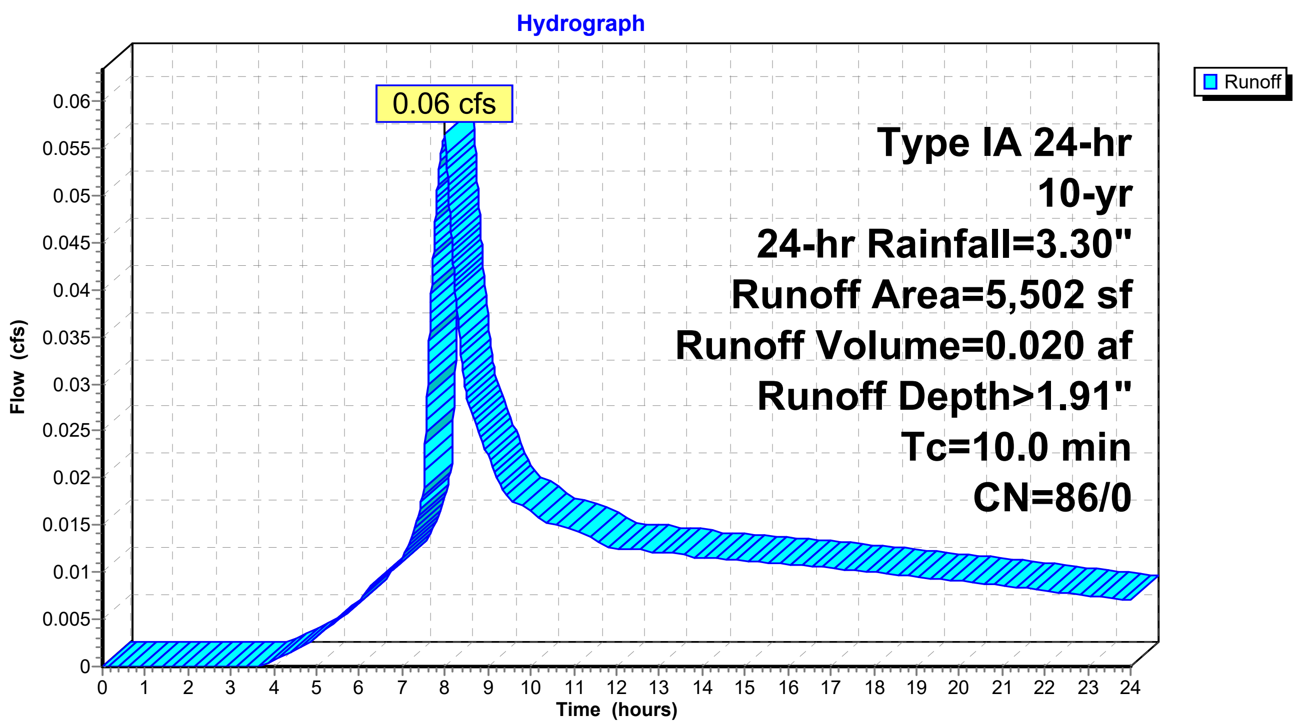
Runoff = 0.06 cfs @ 8.00 hrs, Volume= 0.020 af, Depth> 1.91"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	5,502	86	Pond Top Area
	5,502	86	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment A8: Pond Direct



Summary for Subcatchment A9: Vegetated/Wetland Bypass

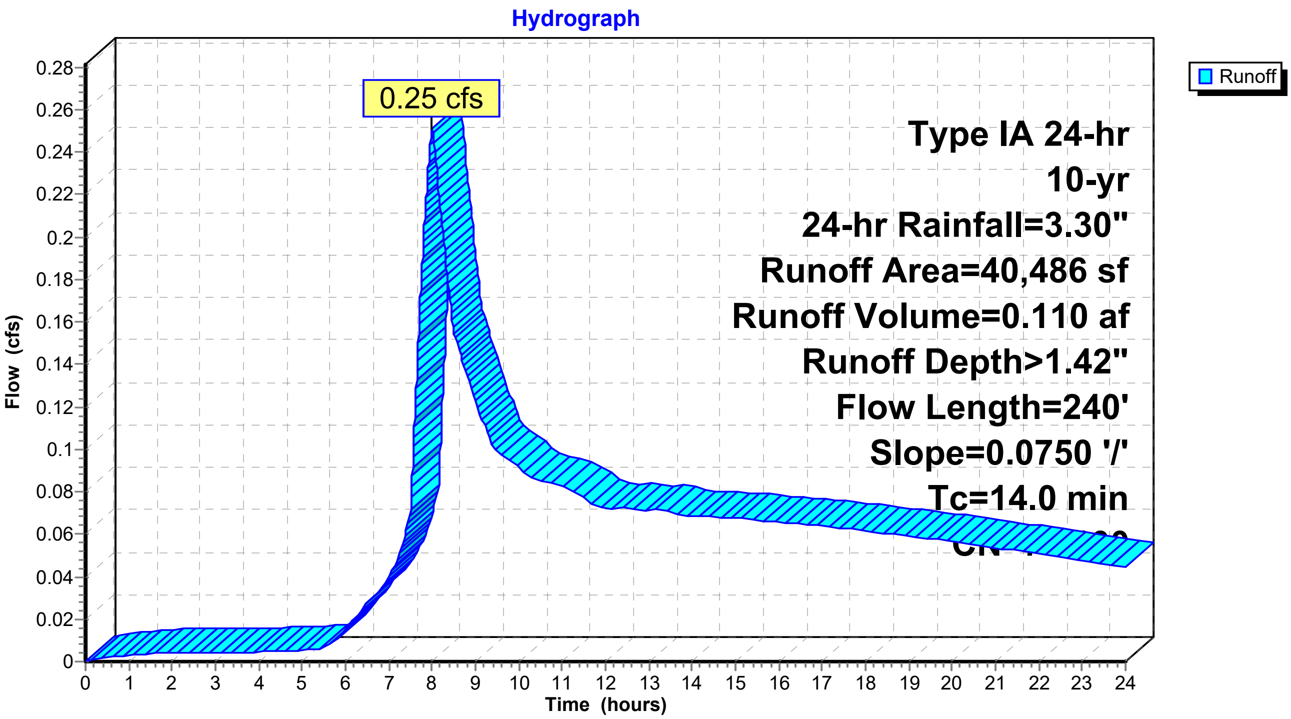
Runoff = 0.25 cfs @ 8.00 hrs, Volume= 0.110 af, Depth> 1.42"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	29,555	76	Undisturbed Forest
*	9,270	86	Fill Slope
*	1,661	100	Wetland
	40,486	79	Weighted Average
	38,825	78	95.90% Pervious Area
	1,661	100	4.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	240	0.0750	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment A9: Vegetated/Wetland Bypass



Summary for Subcatchment B1: East Parking

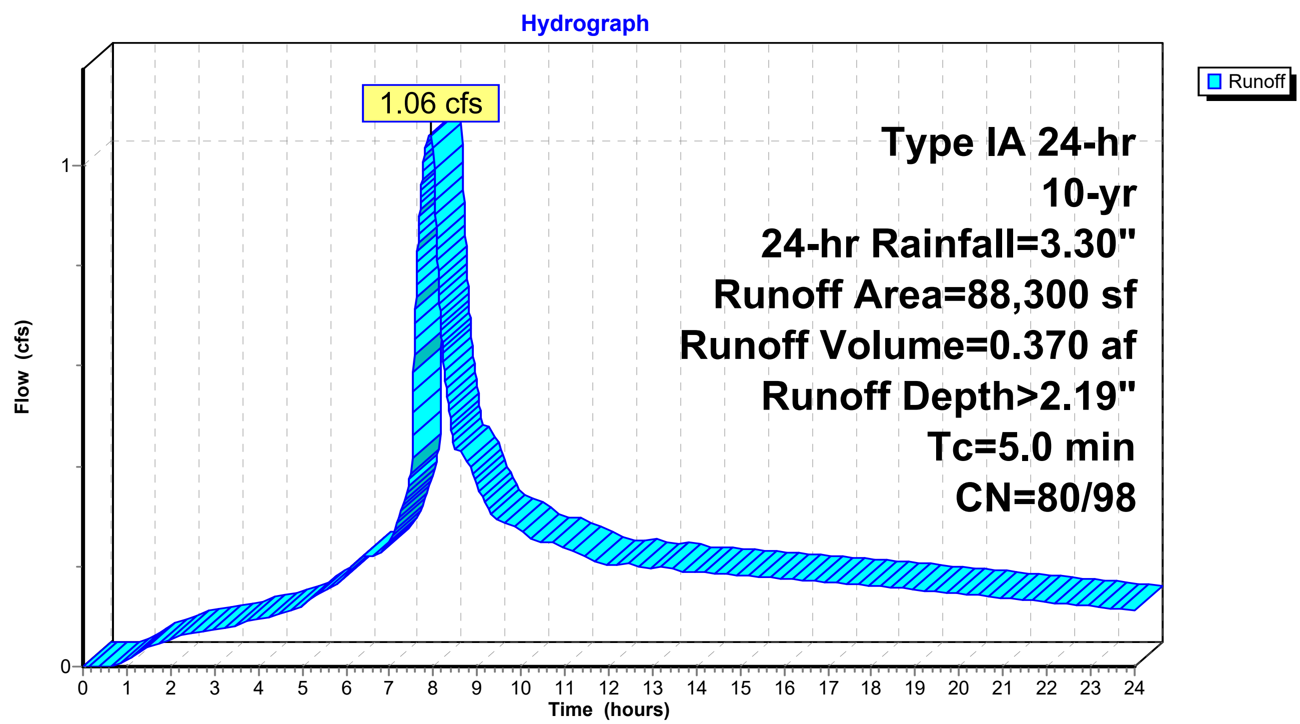
Runoff = 1.06 cfs @ 7.92 hrs, Volume= 0.370 af, Depth> 2.19"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	39,670	98	Parking Lot/Sidewalk
*	27,610	76	Undisturbed Forest
*	14,850	86	Bioretention/Landscape
*	6,170	86	Disturbed Vegetated
	88,300	88	Weighted Average
	48,630	80	55.07% Pervious Area
	39,670	98	44.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B1: East Parking



Summary for Subcatchment B2: Courtyard 3

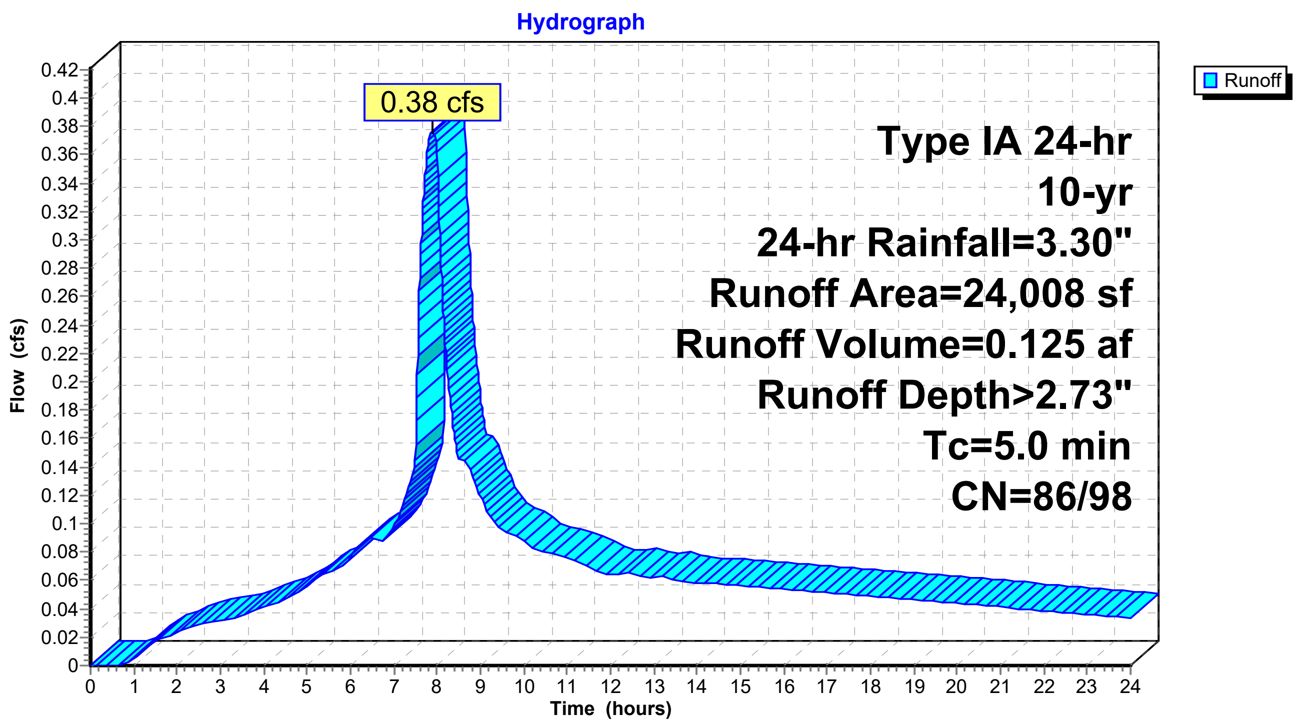
Runoff = 0.38 cfs @ 7.89 hrs, Volume= 0.125 af, Depth> 2.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	7,045	86	Courtyard Landscaping
*	16,963	98	Courtyard Pavement
	24,008	94	Weighted Average
	7,045	86	29.34% Pervious Area
	16,963	98	70.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B2: Courtyard 3



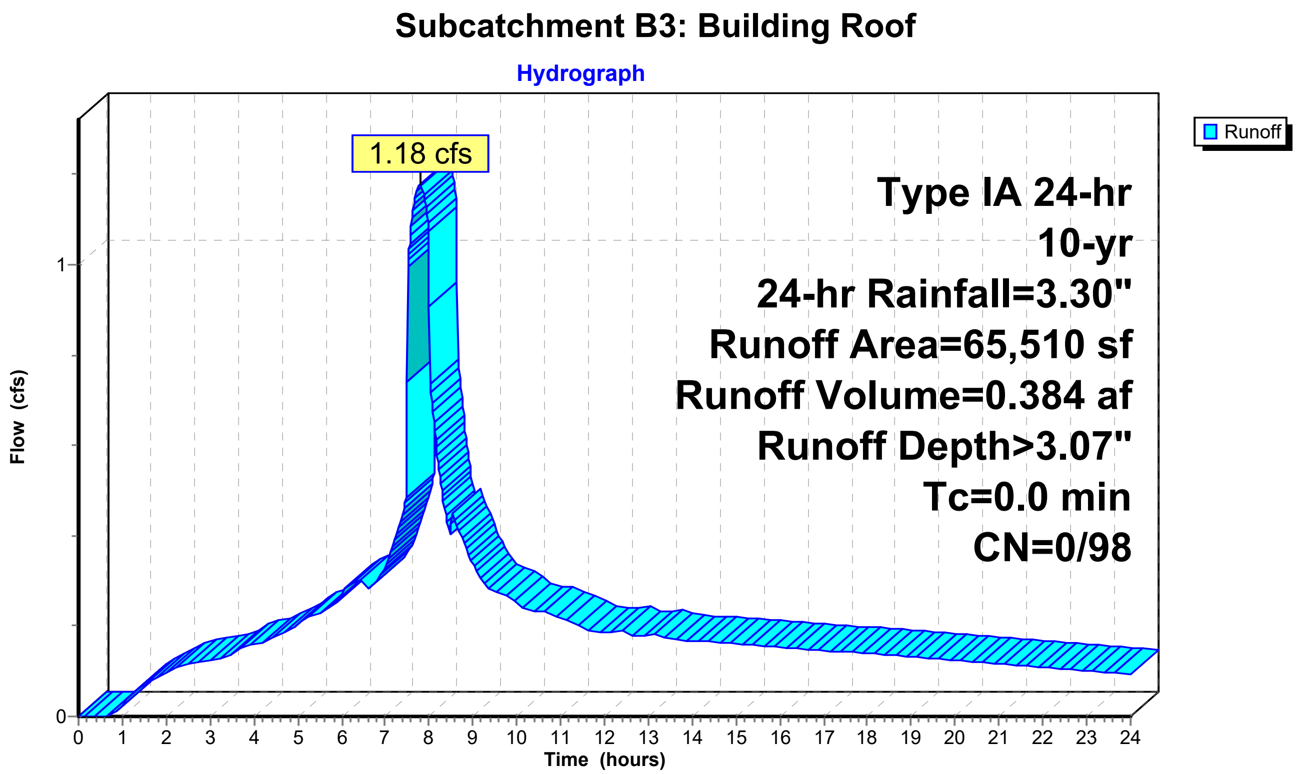
Summary for Subcatchment B3: Building Roof

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.18 cfs @ 7.79 hrs, Volume= 0.384 af, Depth> 3.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

Area (sf)	CN	Description
65,510	98	Roofs, HSG D
65,510	98	100.00% Impervious Area



Summary for Subcatchment B4: Field and Track

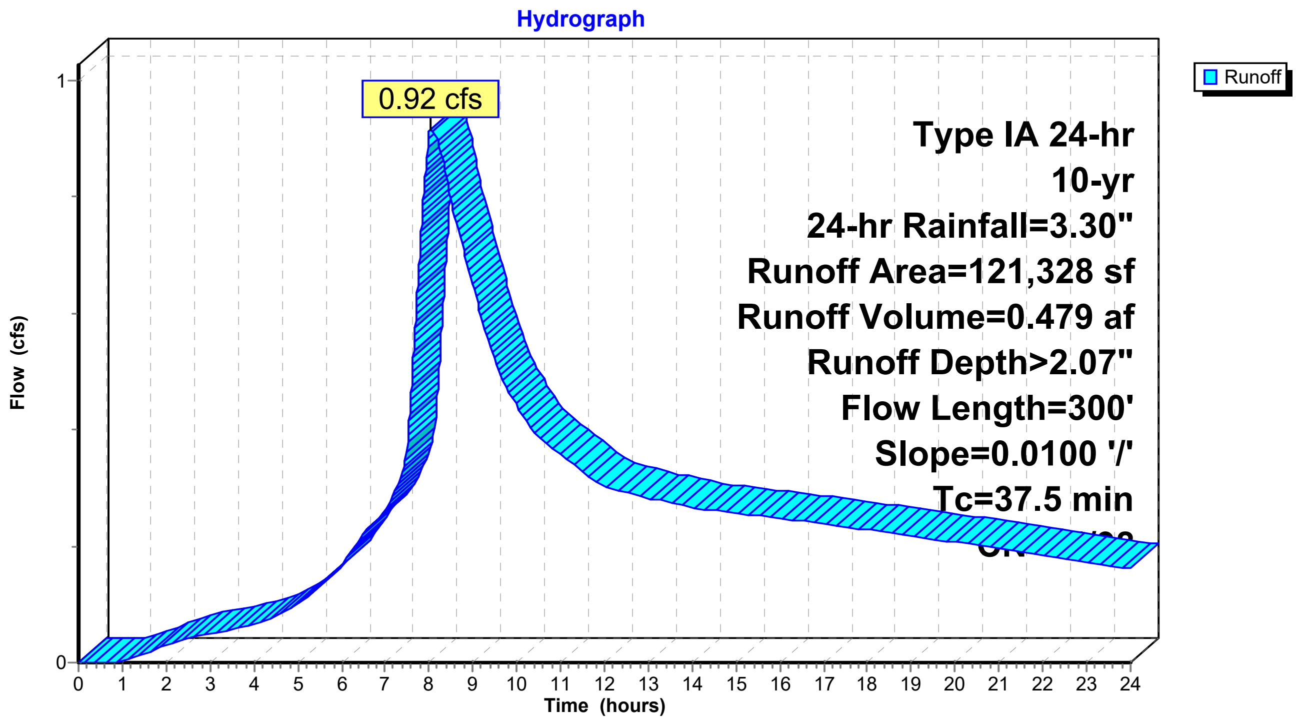
Runoff = 0.92 cfs @ 8.05 hrs, Volume= 0.479 af, Depth> 2.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	71,134	86	Field
*	3,750	98	Track
*	18,694	76	Undisturbed
*	27,500	98	Fire Lane/Access Road
*	250	86	Courtyard Landscaping
	121,328	88	Weighted Average
	90,078	84	74.24% Pervious Area
	31,250	98	25.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B4: Field and Track



Summary for Subcatchment B5: Access Road and Pond

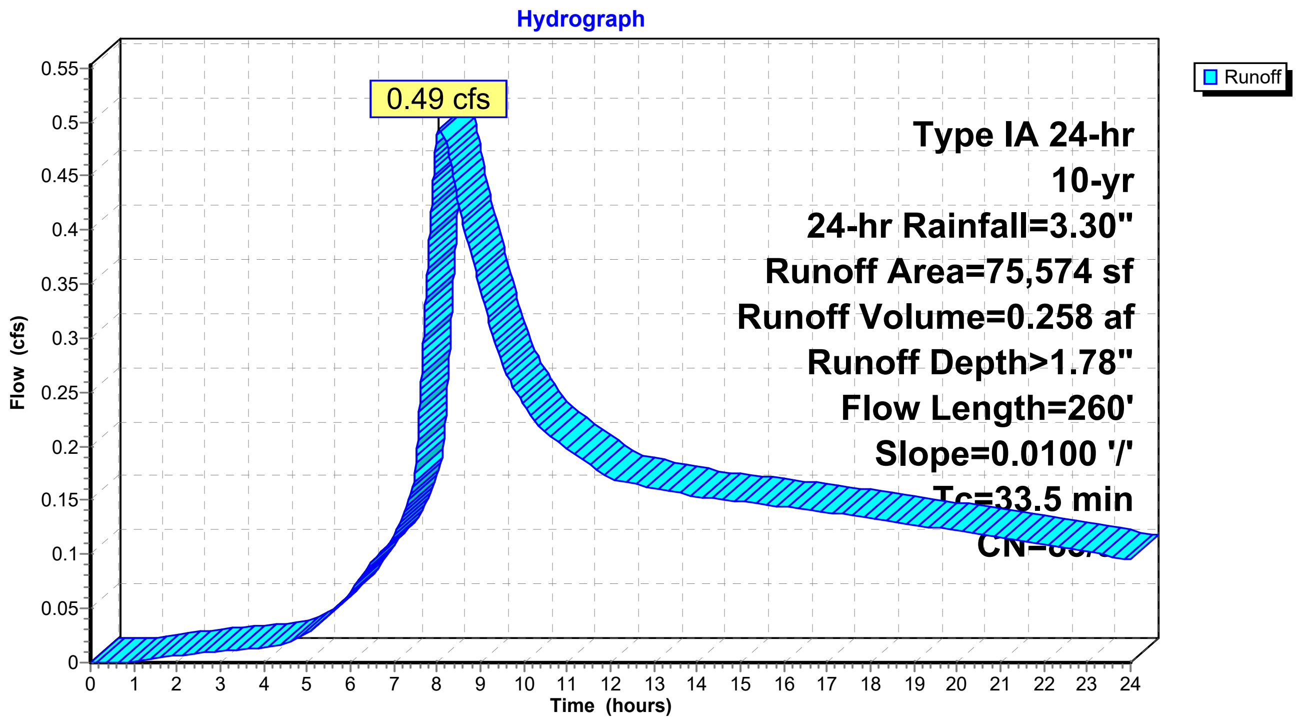
Runoff = 0.49 cfs @ 8.05 hrs, Volume= 0.258 af, Depth> 1.78"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	25,478	76	Undisturbed
*	5,756	96	Gravel Road
*	890	98	Paved Access Road
*	37,750	86	Pond/Landscaping
*	5,700	98	Pump Station/Access
	75,574	84	Weighted Average
	68,984	83	91.28% Pervious Area
	6,590	98	8.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	260	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B5: Access Road and Pond



Summary for Subcatchment B6: South Wetland

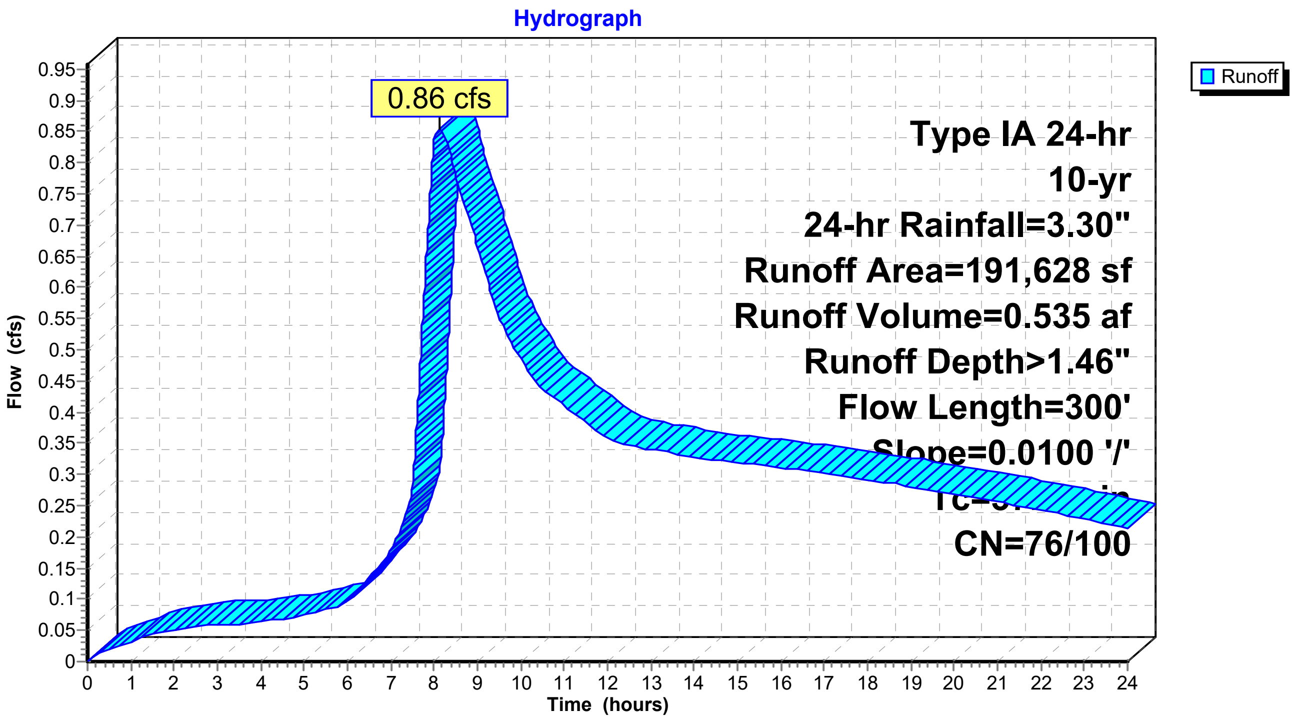
Runoff = 0.86 cfs @ 8.12 hrs, Volume= 0.535 af, Depth> 1.46"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	160,260	76	Undisturbed Forest
*	24,708	100	Wetland
*	6,660	86	Site Fill
	191,628	79	Weighted Average
	166,920	76	87.11% Pervious Area
	24,708	100	12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B6: South Wetland



Summary for Subcatchment B7: Courtyard Bypass

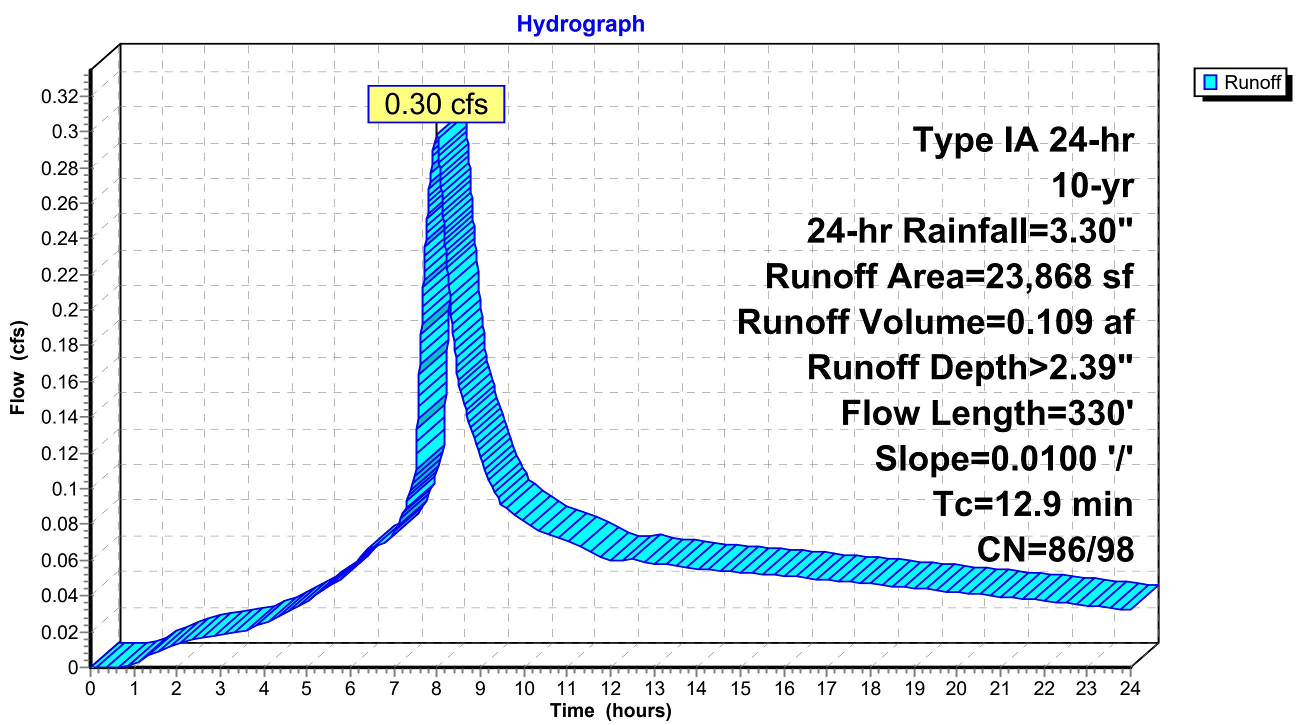
Runoff = 0.30 cfs @ 8.00 hrs, Volume= 0.109 af, Depth> 2.39"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-yr, 24-hr Rainfall=3.30"

	Area (sf)	CN	Description
*	3,390	98	Courtyard Pavement
*	13,866	86	Courtyard Landscaping
*	6,612	98	Fire Lane
	23,868	91	Weighted Average
	13,866	86	58.09% Pervious Area
	10,002	98	41.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
7.9	330	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.9	330	Total			

Subcatchment B7: Courtyard Bypass



Summary for Reach 1R: 279 LF 18"

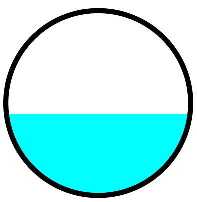
[52] Hint: Inlet/Outlet conditions not evaluated
[63] Warning: Exceeded Reach 6R INLET depth by 0.02' @ 7.55 hrs

Inflow Area = 4.082 ac, 68.69% Impervious, Inflow Depth > 2.58" for 10-yr, 24-hr event
Inflow = 2.50 cfs @ 7.91 hrs, Volume= 0.878 af
Outflow = 2.50 cfs @ 7.92 hrs, Volume= 0.877 af, Atten= 0%, Lag= 1.0 min

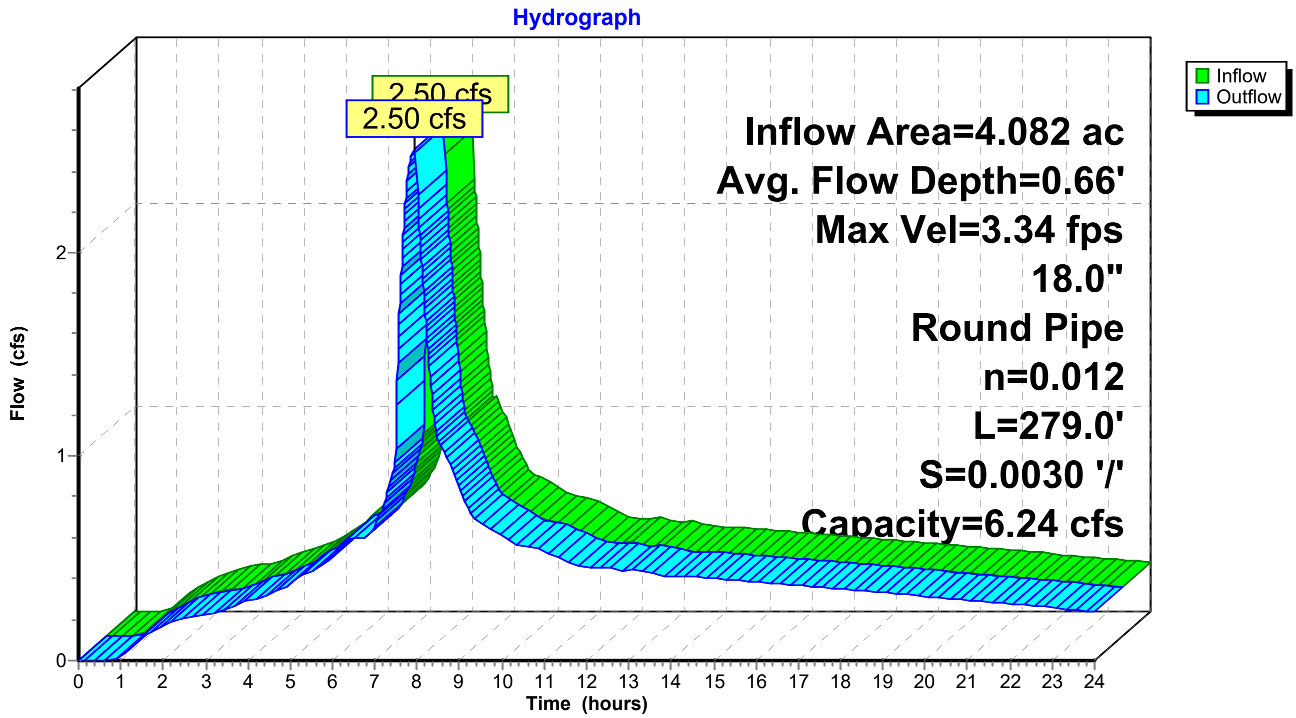
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.34 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.97 fps, Avg. Travel Time= 2.4 min

Peak Storage= 209 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.24 cfs

18.0" Round Pipe
n= 0.012
Length= 279.0' Slope= 0.0030 '/'
Inlet Invert= 132.54', Outlet Invert= 131.70'



Reach 1R: 279 LF 18"



Summary for Reach 3R: 134 LF 12"

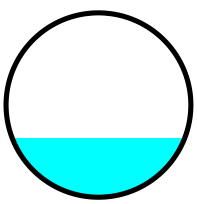
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 16R outlet invert by 0.22' @ 8.00 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 3.02" for 10-yr, 24-hr event
Inflow = 0.71 cfs @ 7.99 hrs, Volume= 0.241 af
Outflow = 0.71 cfs @ 8.00 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.5 min

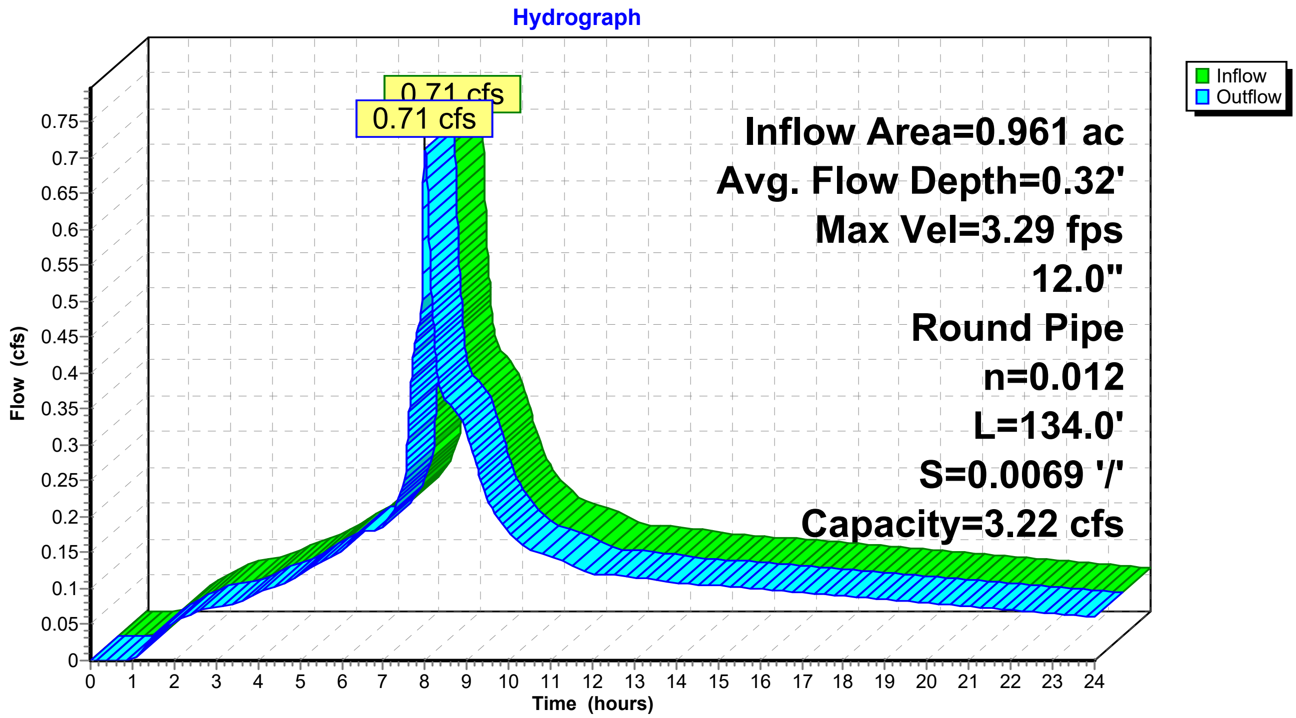
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.29 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.90 fps, Avg. Travel Time= 1.2 min

Peak Storage= 29 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.22 cfs

12.0" Round Pipe
n= 0.012
Length= 134.0' Slope= 0.0069 '/'
Inlet Invert= 132.46', Outlet Invert= 131.53'



Reach 3R: 134 LF 12"



Summary for Reach 4R: 56 LF 12"

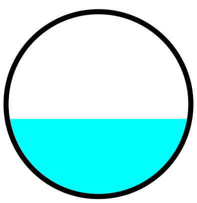
[52] Hint: Inlet/Outlet conditions not evaluated

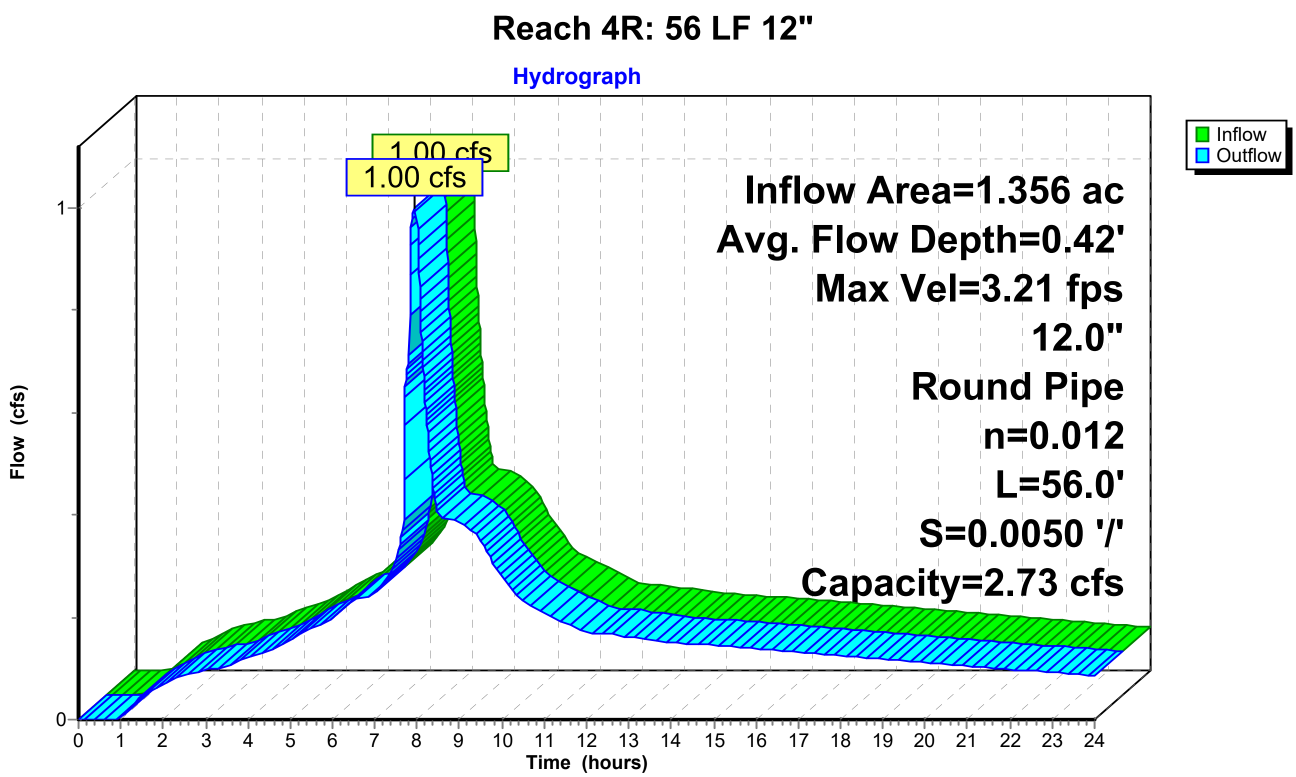
Inflow Area = 1.356 ac, 89.41% Impervious, Inflow Depth > 2.93" for 10-yr, 24-hr event
Inflow = 1.00 cfs @ 7.91 hrs, Volume= 0.331 af
Outflow = 1.00 cfs @ 7.91 hrs, Volume= 0.331 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.21 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.86 fps, Avg. Travel Time= 0.5 min

Peak Storage= 17 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.73 cfs

12.0" Round Pipe
n= 0.012
Length= 56.0' Slope= 0.0050 '/'
Inlet Invert= 132.63', Outlet Invert= 132.35'





Summary for Reach 5R: 70 LF 12"

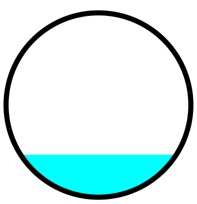
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 8R outlet invert by 0.23' @ 7.91 hrs

Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 2.72" for 10-yr, 24-hr event
Inflow = 0.38 cfs @ 7.91 hrs, Volume= 0.125 af
Outflow = 0.38 cfs @ 7.91 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.3 min

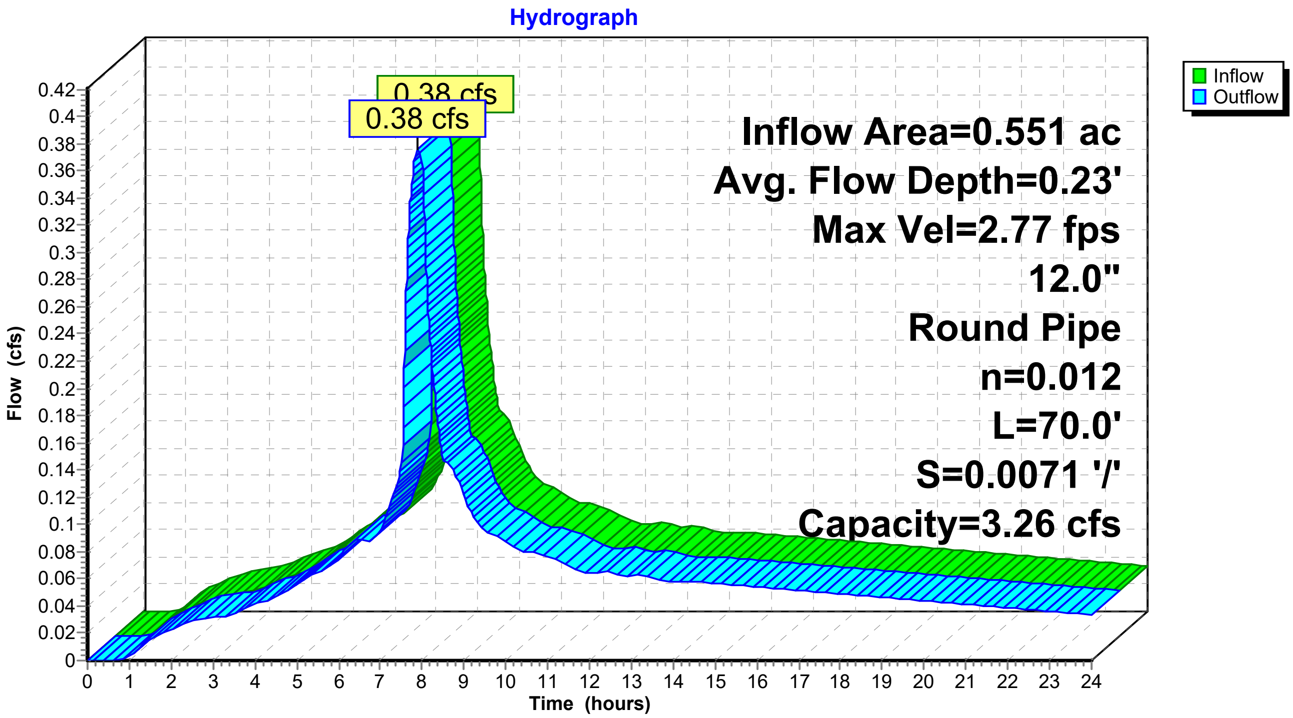
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.77 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 0.7 min

Peak Storage= 9 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.26 cfs

12.0" Round Pipe
n= 0.012
Length= 70.0' Slope= 0.0071 '/'
Inlet Invert= 133.15', Outlet Invert= 132.65'



Reach 5R: 70 LF 12"



Summary for Reach 6R: 38 LF 12"

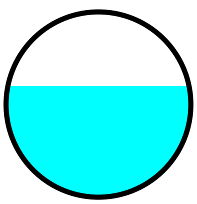
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.37' @ 8.02 hrs

Inflow Area = 2.578 ac, 50.43% Impervious, Inflow Depth > 2.30" for 10-yr, 24-hr event
Inflow = 1.39 cfs @ 8.00 hrs, Volume= 0.494 af
Outflow = 1.39 cfs @ 8.00 hrs, Volume= 0.494 af, Atten= 0%, Lag= 0.1 min

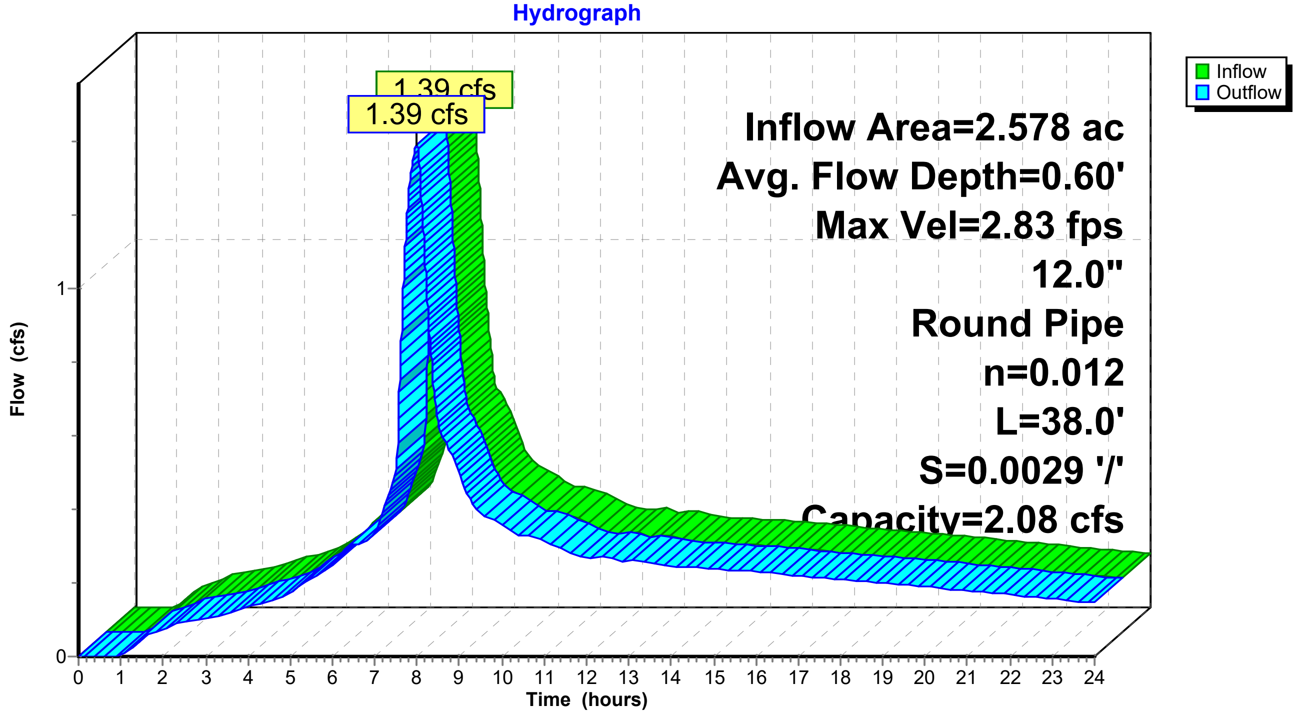
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.83 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 0.4 min

Peak Storage= 19 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.08 cfs

12.0" Round Pipe
n= 0.012
Length= 38.0' Slope= 0.0029 '/'
Inlet Invert= 132.65', Outlet Invert= 132.54'



Reach 6R: 38 LF 12"



Summary for Reach 7R: 107 LF 12"

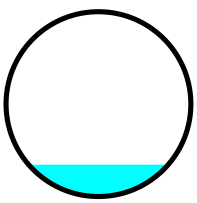
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 2.78" for 10-yr, 24-hr event
Inflow = 0.21 cfs @ 8.16 hrs, Volume= 0.114 af
Outflow = 0.21 cfs @ 8.17 hrs, Volume= 0.114 af, Atten= 0%, Lag= 0.6 min

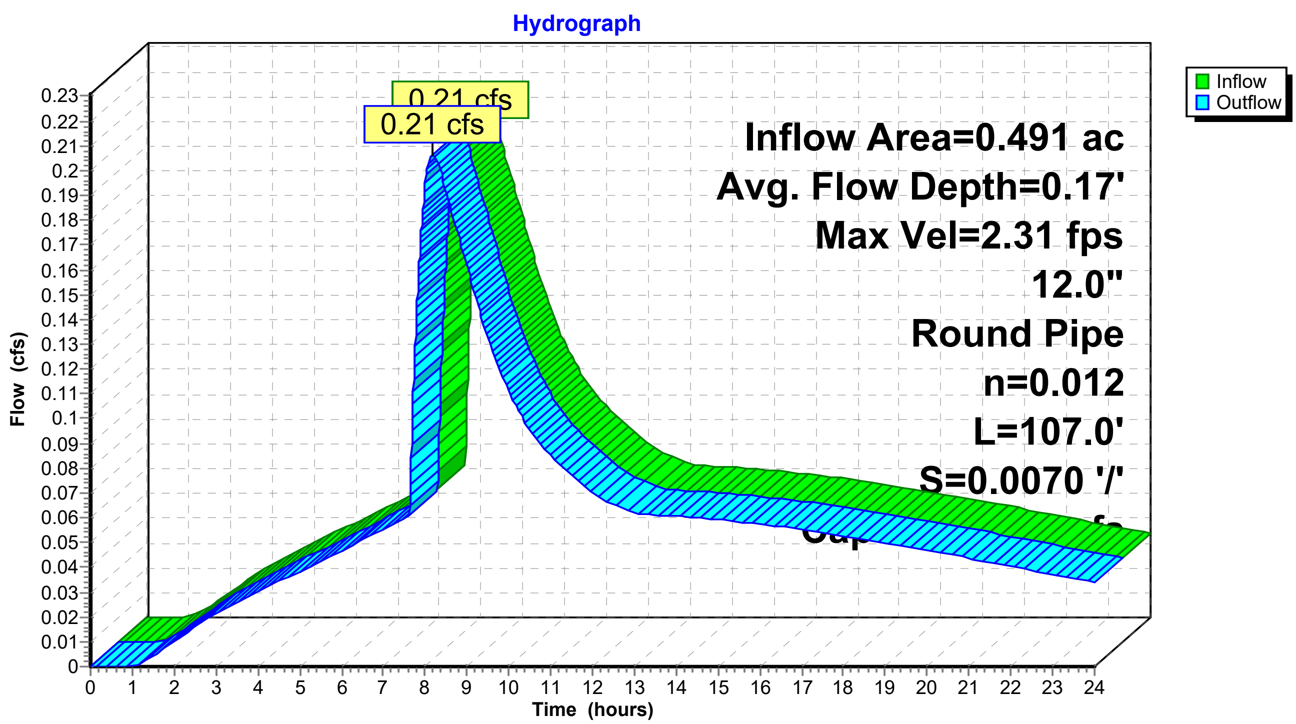
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.31 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 1.2 min

Peak Storage= 10 cf @ 8.17 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.23 cfs

12.0" Round Pipe
n= 0.012
Length= 107.0' Slope= 0.0070 '/'
Inlet Invert= 131.42', Outlet Invert= 130.67'



Reach 7R: 107 LF 12"



Summary for Reach 8R: 170 LF 12"

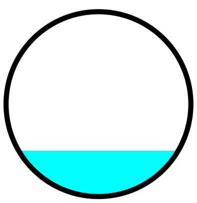
[52] Hint: Inlet/Outlet conditions not evaluated

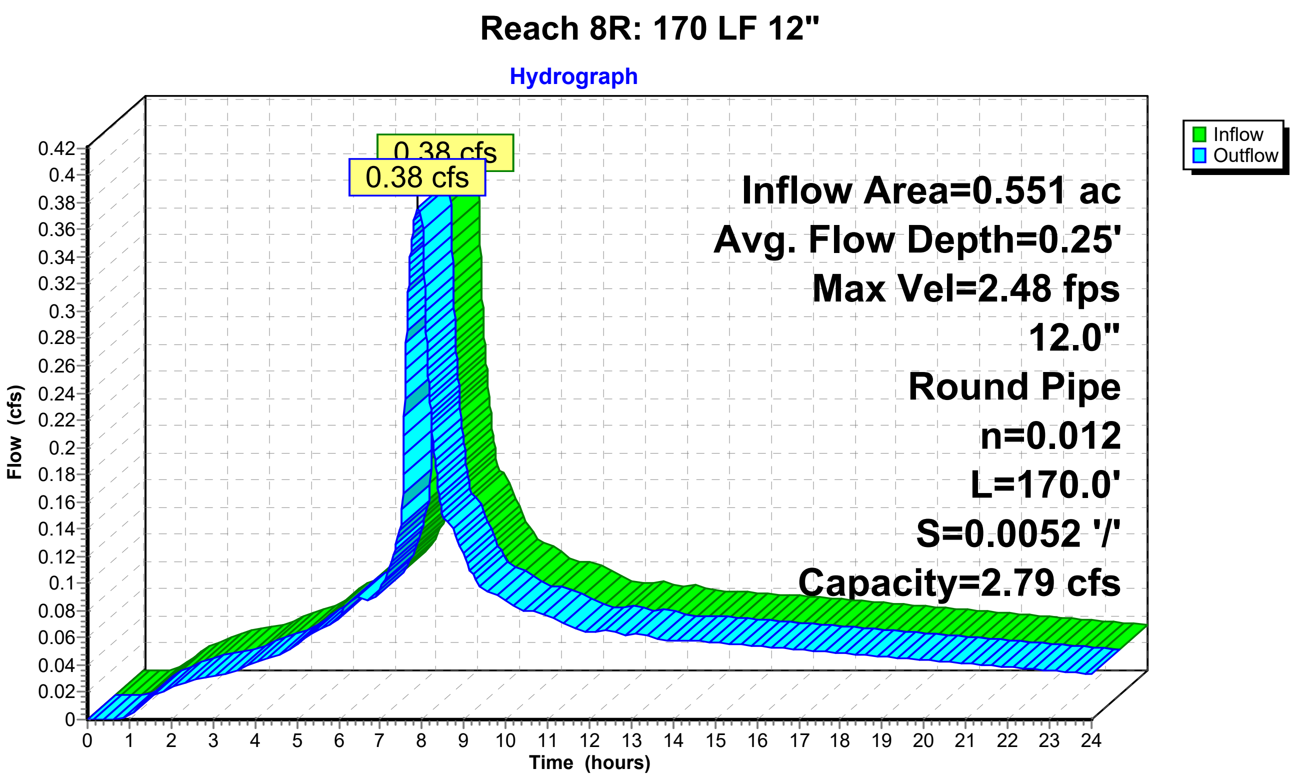
Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 2.73" for 10-yr, 24-hr event
Inflow = 0.38 cfs @ 7.89 hrs, Volume= 0.125 af
Outflow = 0.38 cfs @ 7.91 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 2.0 min

Peak Storage= 26 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.79 cfs

12.0" Round Pipe
n= 0.012
Length= 170.0' Slope= 0.0052 '/'
Inlet Invert= 134.04', Outlet Invert= 133.15'





Summary for Reach 9R: 115 LF 12"

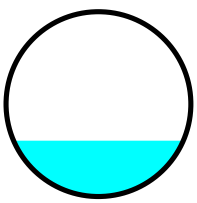
[52] Hint: Inlet/Outlet conditions not evaluated

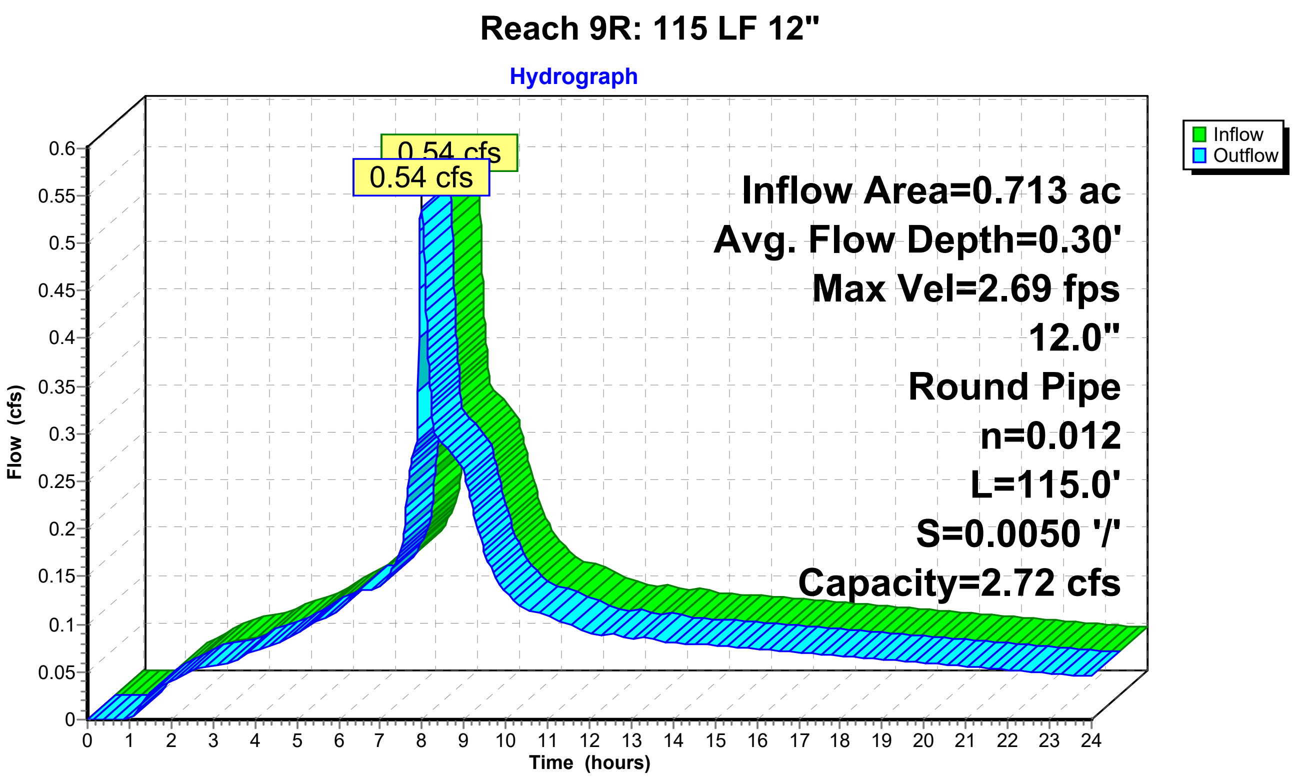
Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 3.05" for 10-yr, 24-hr event
Inflow = 0.54 cfs @ 7.98 hrs, Volume= 0.181 af
Outflow = 0.54 cfs @ 7.99 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.69 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.55 fps, Avg. Travel Time= 1.2 min

Peak Storage= 23 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.72 cfs

12.0" Round Pipe
n= 0.012
Length= 115.0' Slope= 0.0050 '/'
Inlet Invert= 136.50', Outlet Invert= 135.93'





Summary for Reach 10R: 76 LF 12"

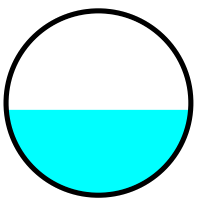
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 3R OUTLET depth by 0.07' @ 7.90 hrs

Inflow Area = 2.317 ac, 92.42% Impervious, Inflow Depth > 2.97" for 10-yr, 24-hr event
Inflow = 1.69 cfs @ 7.99 hrs, Volume= 0.573 af
Outflow = 1.69 cfs @ 7.99 hrs, Volume= 0.573 af, Atten= 0%, Lag= 0.2 min

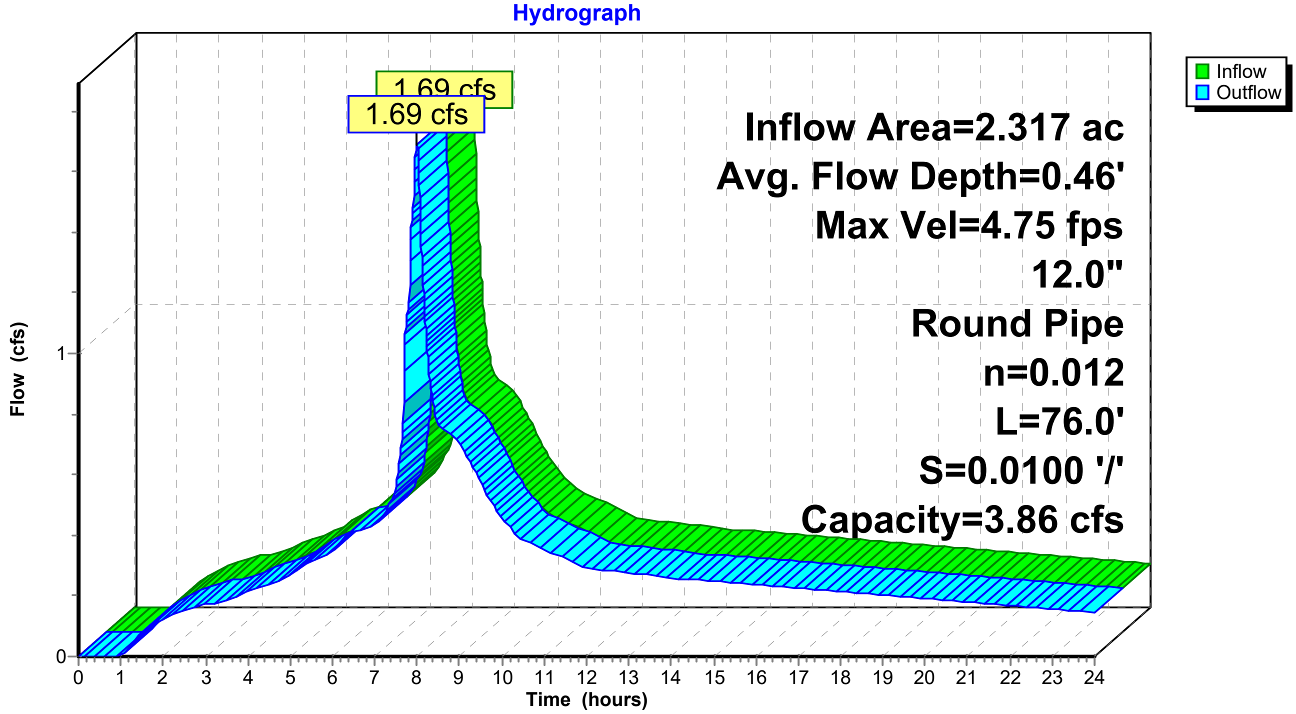
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.75 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.79 fps, Avg. Travel Time= 0.5 min

Peak Storage= 27 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.86 cfs

12.0" Round Pipe
n= 0.012
Length= 76.0' Slope= 0.0100 '/'
Inlet Invert= 131.43', Outlet Invert= 130.67'



Reach 10R: 76 LF 12"



Summary for Reach 12R: 34 LF 12"

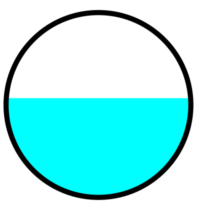
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.27' @ 7.99 hrs
[61] Hint: Exceeded Reach 10R outlet invert by 0.44' @ 8.00 hrs

Inflow Area = 2.948 ac, 88.89% Impervious, Inflow Depth > 2.91" for 10-yr, 24-hr event
Inflow = 1.93 cfs @ 8.00 hrs, Volume= 0.715 af
Outflow = 1.93 cfs @ 8.00 hrs, Volume= 0.715 af, Atten= 0%, Lag= 0.1 min

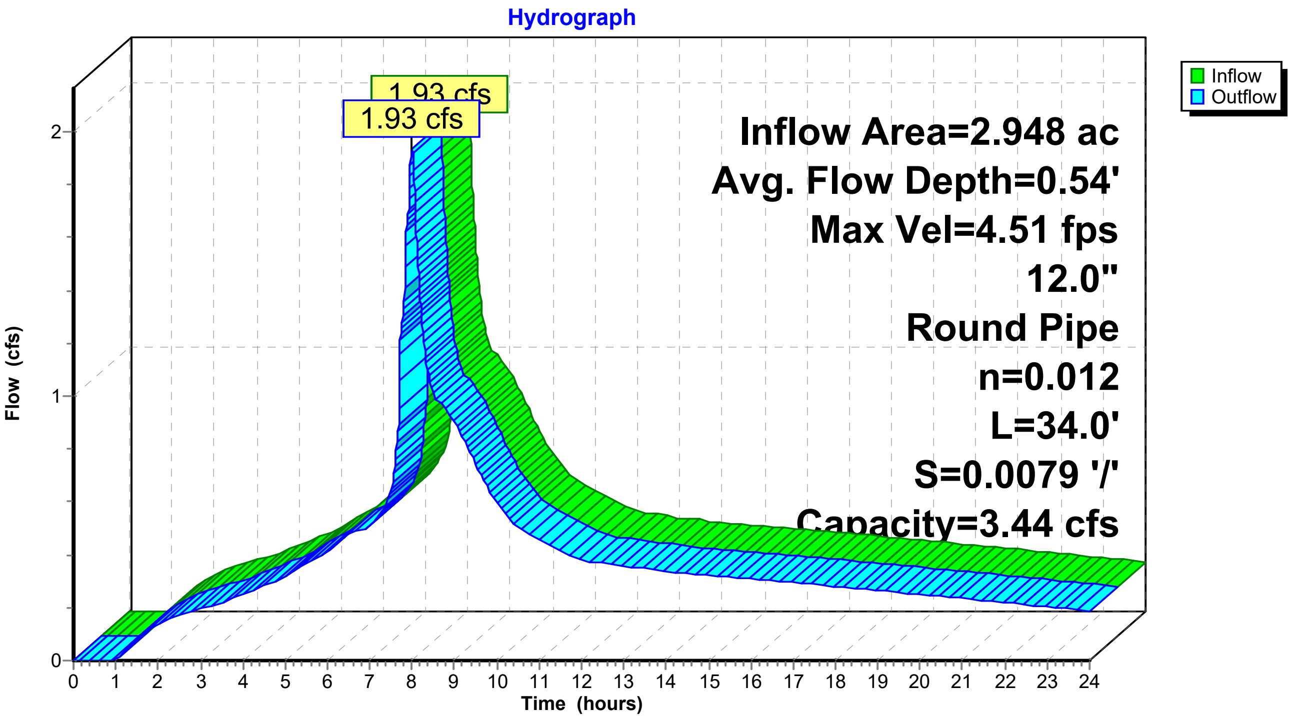
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.51 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.74 fps, Avg. Travel Time= 0.2 min

Peak Storage= 15 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.44 cfs

12.0" Round Pipe
n= 0.012
Length= 34.0' Slope= 0.0079 '/'
Inlet Invert= 130.57', Outlet Invert= 130.30'



Reach 12R: 34 LF 12"



Summary for Reach 13R: 159 LF 12"

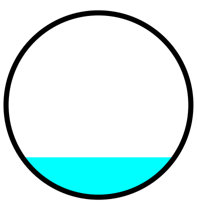
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 9R outlet invert by 0.11' @ 8.00 hrs

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 3.05" for 10-yr, 24-hr event
Inflow = 0.54 cfs @ 7.99 hrs, Volume= 0.181 af
Outflow = 0.54 cfs @ 8.00 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.5 min

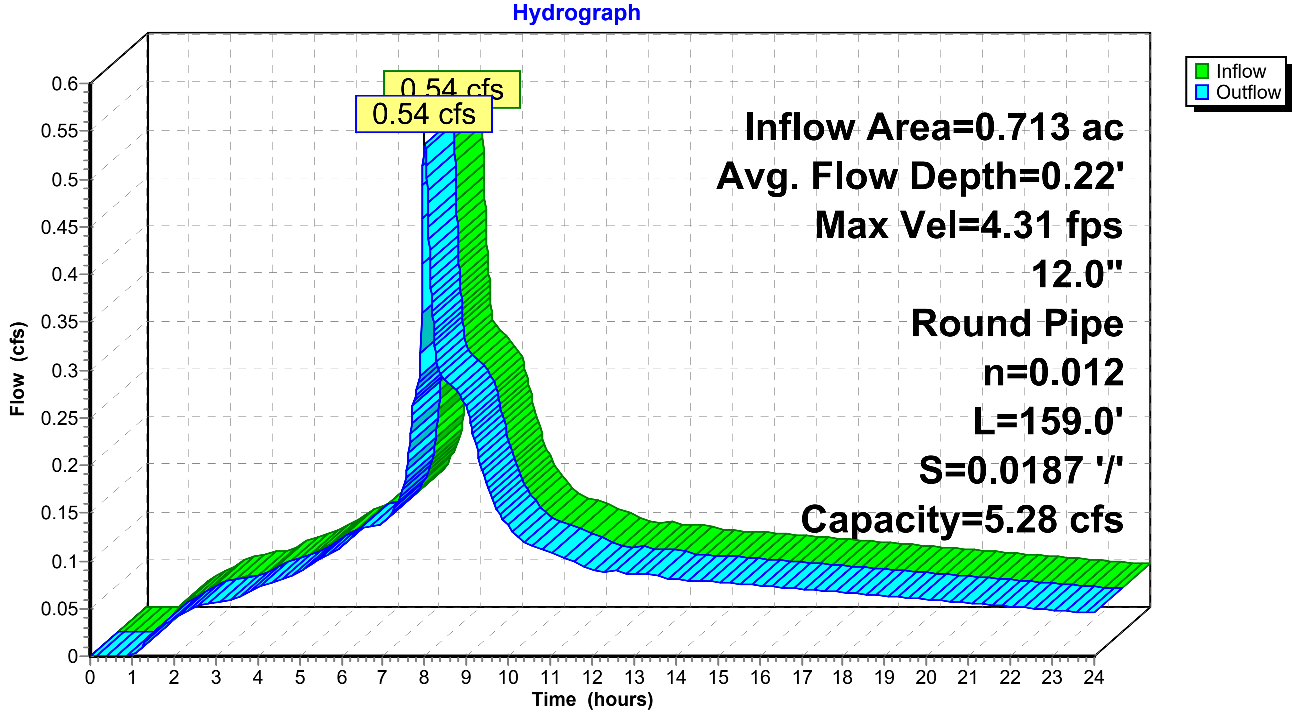
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.31 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.47 fps, Avg. Travel Time= 1.1 min

Peak Storage= 20 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.28 cfs

12.0" Round Pipe
n= 0.012
Length= 159.0' Slope= 0.0187 '/'
Inlet Invert= 135.82', Outlet Invert= 132.85'



Reach 13R: 159 LF 12"



Summary for Reach 16R: 39 LF 12"

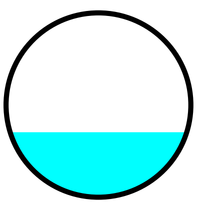
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 13R OUTLET depth by 0.04' @ 7.99 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 3.02" for 10-yr, 24-hr event
Inflow = 0.71 cfs @ 7.99 hrs, Volume= 0.242 af
Outflow = 0.71 cfs @ 7.99 hrs, Volume= 0.241 af, Atten= 0%, Lag= 0.1 min

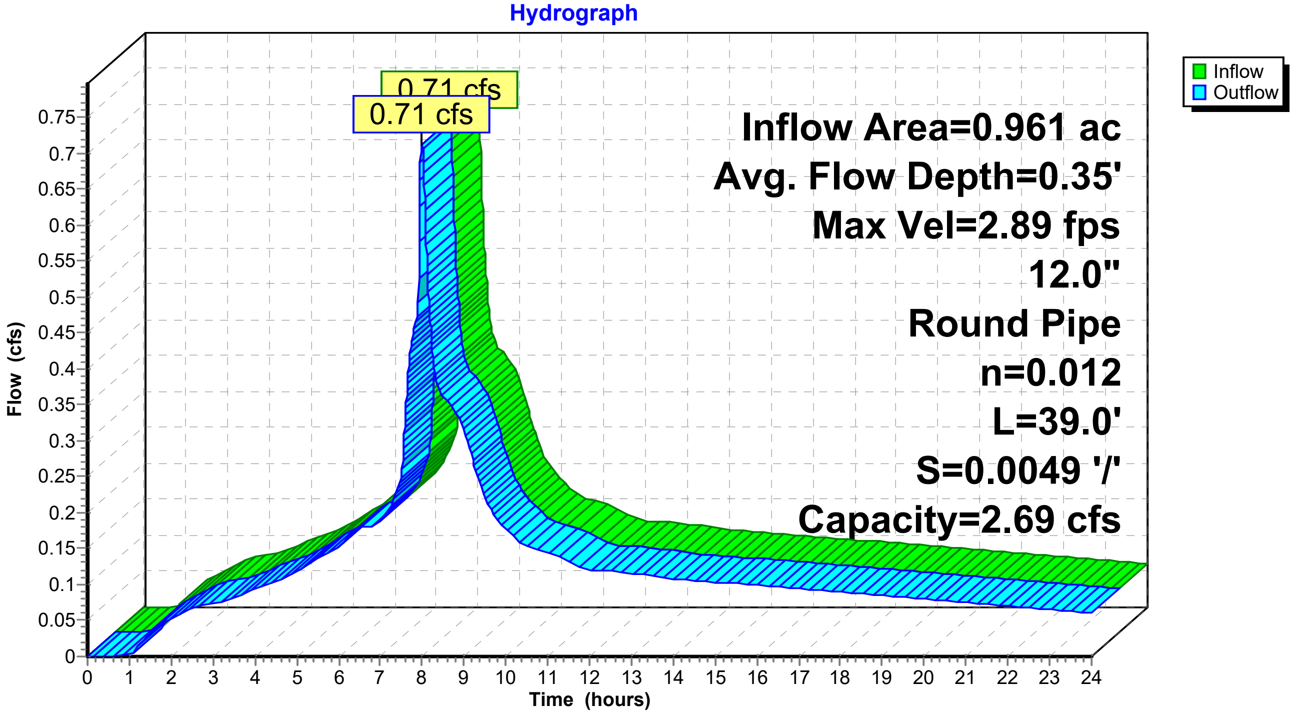
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.89 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 0.4 min

Peak Storage= 10 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.69 cfs

12.0" Round Pipe
n= 0.012
Length= 39.0' Slope= 0.0049 '/'
Inlet Invert= 132.75', Outlet Invert= 132.56'



Reach 16R: 39 LF 12"



Summary for Reach 19R: 74 LF 18"

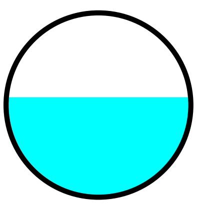
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.17' @ 8.02 hrs

Inflow Area = 6.867 ac, 51.28% Impervious, Inflow Depth > 2.37" for 10-yr, 24-hr event
Inflow = 3.38 cfs @ 7.99 hrs, Volume= 1.357 af
Outflow = 3.38 cfs @ 7.99 hrs, Volume= 1.356 af, Atten= 0%, Lag= 0.1 min

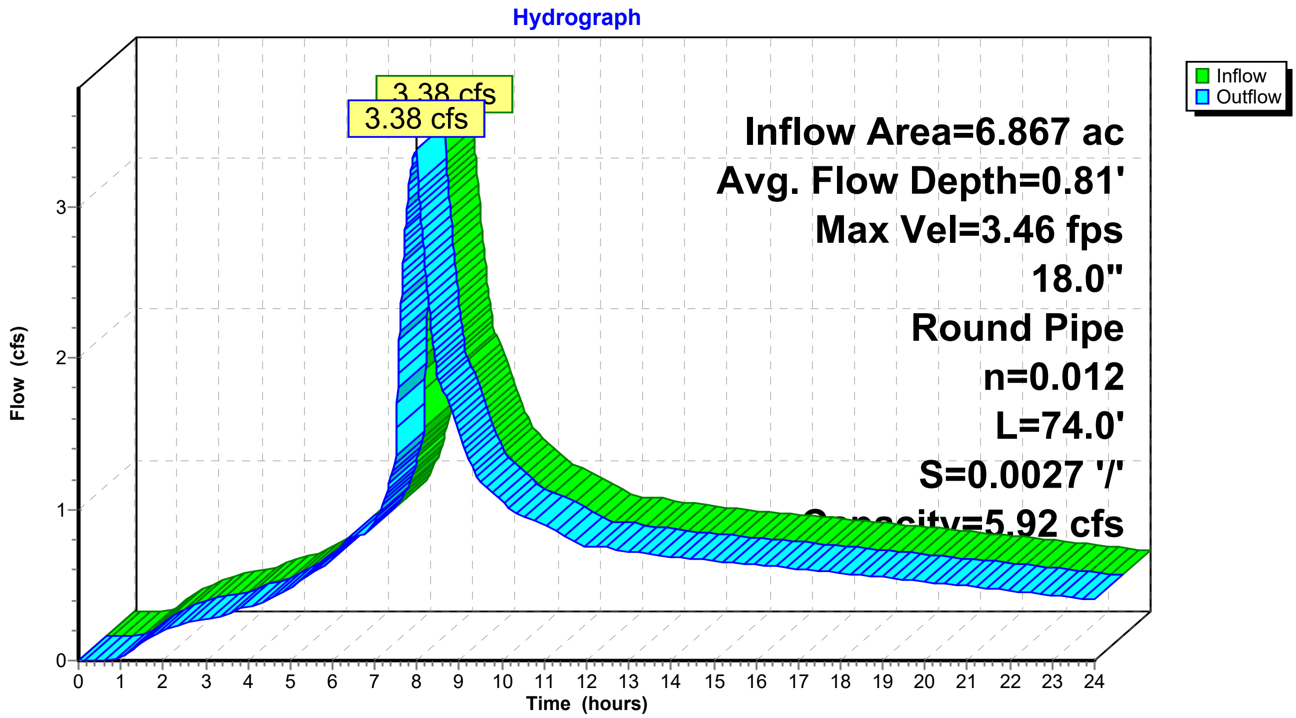
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.46 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.15 fps, Avg. Travel Time= 0.6 min

Peak Storage= 72 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 5.92 cfs

18.0" Round Pipe
n= 0.012
Length= 74.0' Slope= 0.0027 '/'
Inlet Invert= 131.70', Outlet Invert= 131.50'



Reach 19R: 74 LF 18"



Summary for Pond 1P: East Bio

Inflow Area = 2.027 ac, 44.93% Impervious, Inflow Depth > 2.19" for 10-yr, 24-hr event
Inflow = 1.06 cfs @ 7.92 hrs, Volume= 0.370 af
Outflow = 1.03 cfs @ 8.01 hrs, Volume= 0.369 af, Atten= 4%, Lag= 5.3 min
Primary = 1.03 cfs @ 8.01 hrs, Volume= 0.369 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.42' @ 8.01 hrs Surf.Area= 0.010 ac Storage= 0.007 af

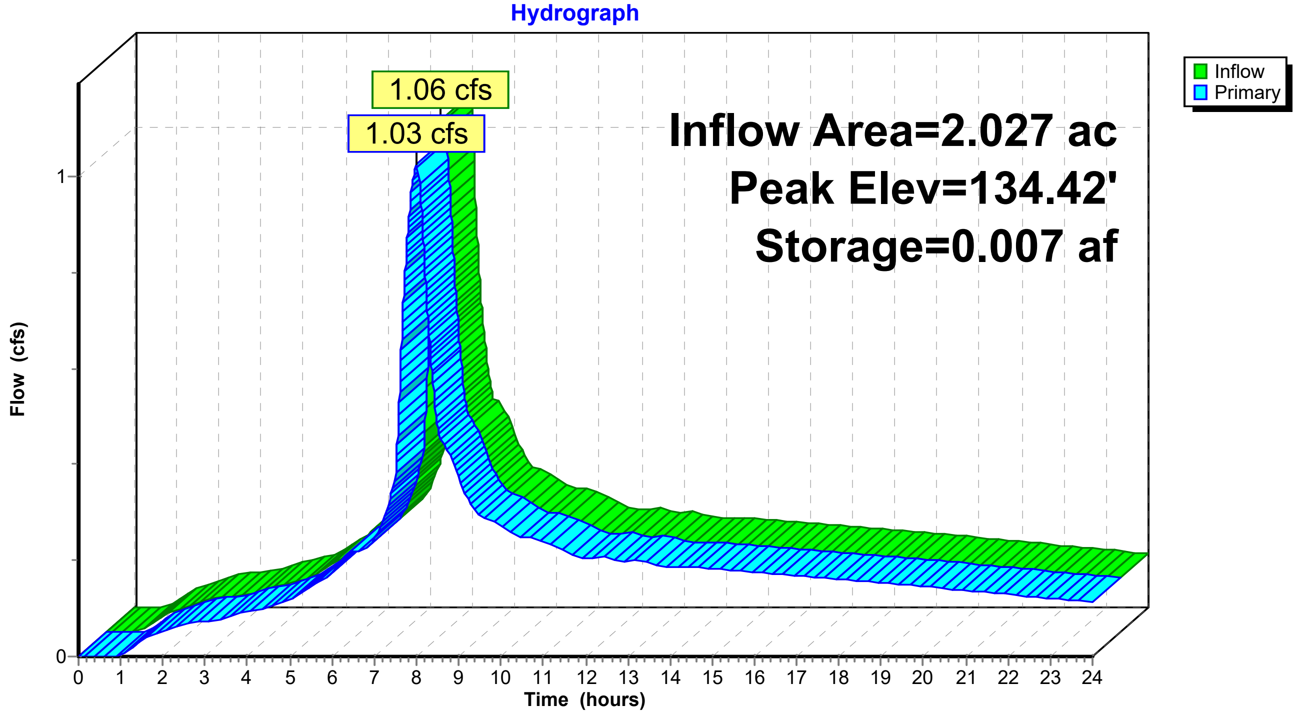
Plug-Flow detention time= 5.1 min calculated for 0.368 af (100% of inflow)
Center-of-Mass det. time= 3.2 min (722.9 - 719.7)

Volume	Invert	Avail.Storage	Storage Description
#1	135.65'	0.012 af	**20.00'W x 20.00'L x 1.00'H Prismatoid Z=3.0**
#2	132.65'	0.012 af	**20.00'W x 22.00'L x 3.00'H Prismatoid**
			0.030 af Overall x 40.0% Voids
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	136.15'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#2	Primary	132.65'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.03 cfs @ 8.01 hrs HW=134.42' TW=133.25' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 1.03 cfs @ 5.22 fps)

Pond 1P: East Bio



Summary for Pond 2P: West Bio 2

Inflow Area = 0.688 ac, 93.31% Impervious, Inflow Depth > 2.99" for 10-yr, 24-hr event
Inflow = 0.52 cfs @ 7.88 hrs, Volume= 0.171 af
Outflow = 0.52 cfs @ 7.89 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.5 min
Primary = 0.52 cfs @ 7.89 hrs, Volume= 0.171 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.56' @ 7.89 hrs Surf.Area= 0.009 ac Storage= 0.005 af

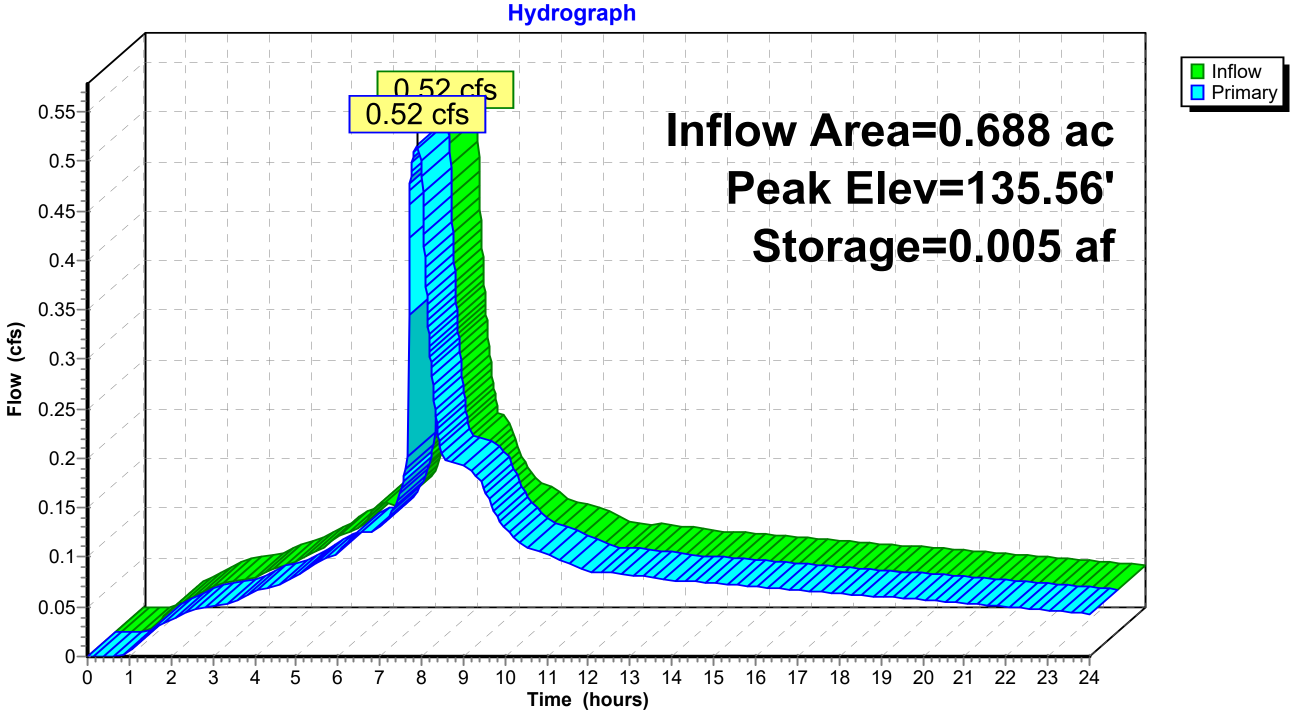
Plug-Flow detention time= 8.1 min calculated for 0.171 af (100% of inflow)
Center-of-Mass det. time= 6.8 min (674.6 - 667.8)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.006 af	**15.30'W x 10.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.003 af	**15.30'W x 10.00'L x 2.00'H Prismatoid** 0.007 af Overall x 40.0% Voids
		0.008 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.52 cfs @ 7.89 hrs HW=135.56' TW=133.05' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.20 cfs @ 7.57 fps)
2=Orifice/Grate (Weir Controls 0.32 cfs @ 0.81 fps)

Pond 2P: West Bio 2



Summary for Pond 8P: North Bio

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 3.06" for 10-yr, 24-hr event
Inflow = 0.55 cfs @ 7.88 hrs, Volume= 0.182 af
Outflow = 0.54 cfs @ 7.98 hrs, Volume= 0.181 af, Atten= 2%, Lag= 6.0 min
Primary = 0.54 cfs @ 7.98 hrs, Volume= 0.181 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 145.55' @ 7.98 hrs Surf.Area= 0.017 ac Storage= 0.010 af

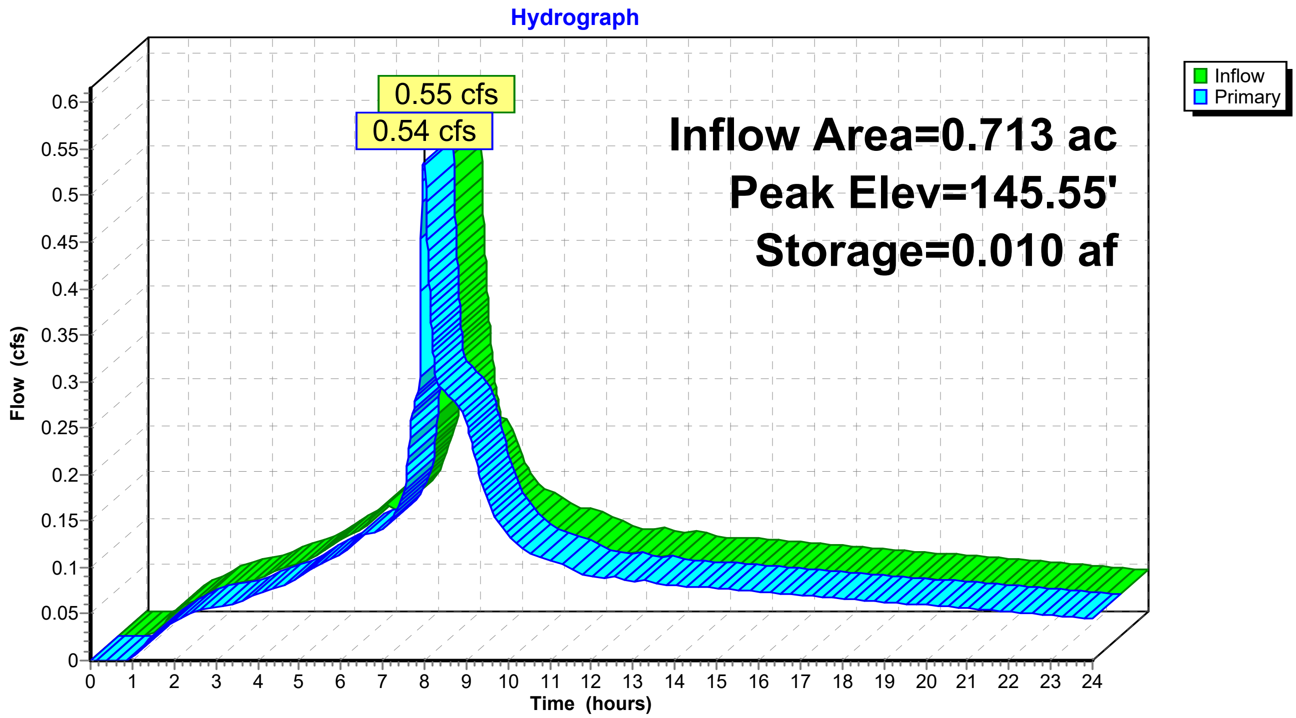
Plug-Flow detention time= 10.2 min calculated for 0.181 af (100% of inflow)
Center-of-Mass det. time= 8.2 min (671.3 - 663.1)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	0.027 af	**10.00'W x 30.00'L x 2.00'H Prismatoid Z=3.0**
#2	143.00'	0.006 af	**10.00'W x 30.00'L x 2.00'H Prismatoid** 0.014 af Overall x 40.0% Voids
		0.033 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	145.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	143.00'	**2.7" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.54 cfs @ 7.98 hrs HW=145.55' TW=136.80' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 0.24 cfs @ 0.74 fps)
2=Orifice/Grate (Orifice Controls 0.30 cfs @ 7.52 fps)

Pond 8P: North Bio



Summary for Pond 14P: Pond2 Emergency

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 132.00' Surf.Area= 0.323 ac Storage= 0.448 af
Peak Elev= 132.00' @ 0.00 hrs Surf.Area= 0.323 ac Storage= 0.448 af

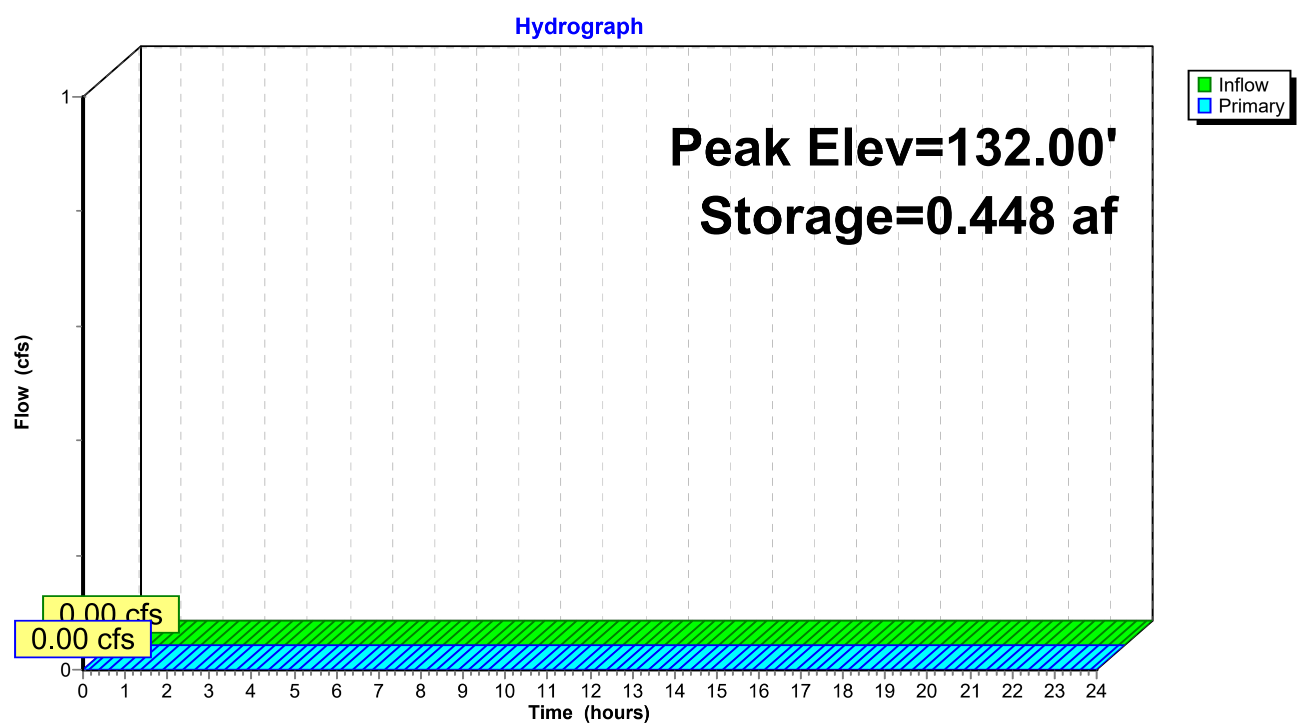
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.50'	1.791 af	**120.00'W x 100.00'L x 5.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=132.00' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: Pond2 Emergency



Summary for Pond 18R: 240 LF Bypass Culvert

[57] Hint: Peaked at 134.08' (Flood elevation advised)

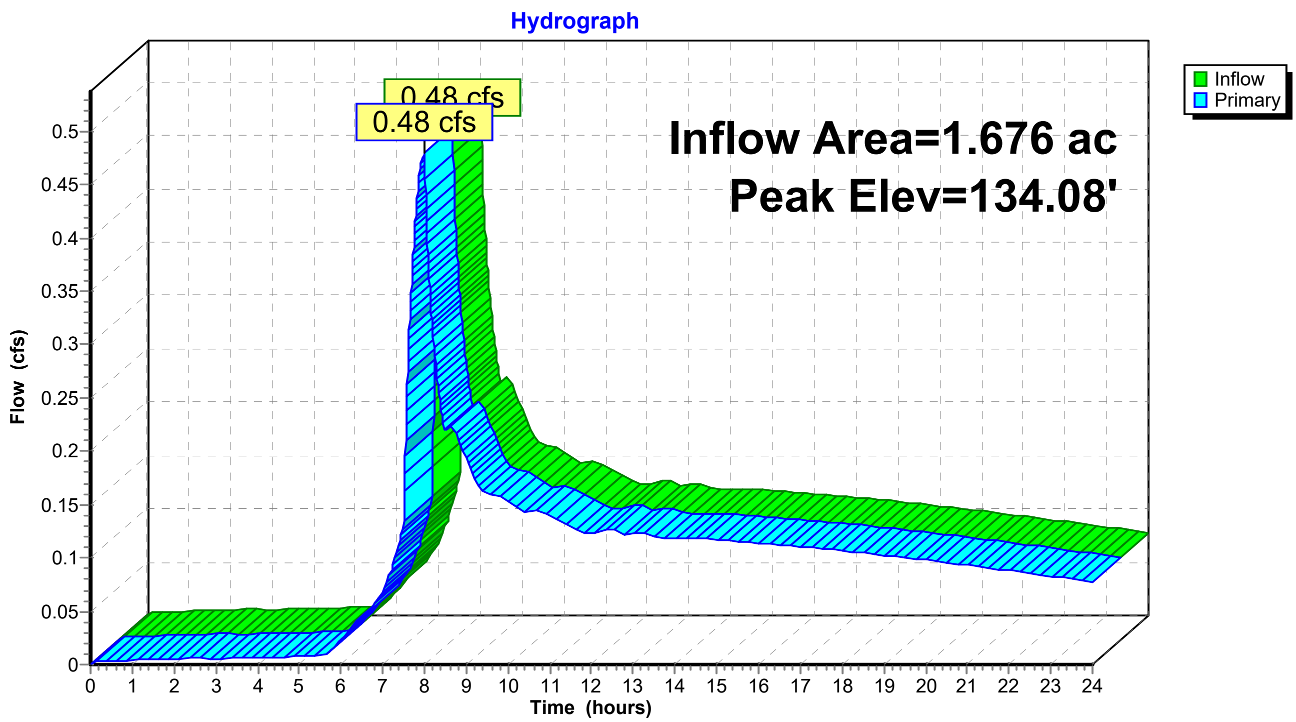
Inflow Area = 1.676 ac, 3.22% Impervious, Inflow Depth > 1.35" for 10-yr, 24-hr event
Inflow = 0.48 cfs @ 8.00 hrs, Volume= 0.188 af
Outflow = 0.48 cfs @ 8.00 hrs, Volume= 0.188 af, Atten= 0%, Lag= 0.0 min
Primary = 0.48 cfs @ 8.00 hrs, Volume= 0.188 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.08' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=0.48 cfs @ 8.00 hrs HW=134.08' TW=127.83' (Dynamic Tailwater)
1=Culvert (Passes 0.48 cfs of 13.11 cfs potential flow)
2=Sharp-Crested Rectangular Weir (Weir Controls 0.48 cfs @ 0.95 fps)

Pond 18R: 240 LF Bypass Culvert



Summary for Pond 20P: Courtyard Depressions

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 2.81" for 10-yr, 24-hr event
Inflow = 0.21 cfs @ 8.08 hrs, Volume= 0.115 af
Outflow = 0.21 cfs @ 8.16 hrs, Volume= 0.114 af, Atten= 0%, Lag= 4.6 min
Primary = 0.21 cfs @ 8.16 hrs, Volume= 0.114 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.53' @ 8.16 hrs Surf.Area= 0.031 ac Storage= 0.006 af

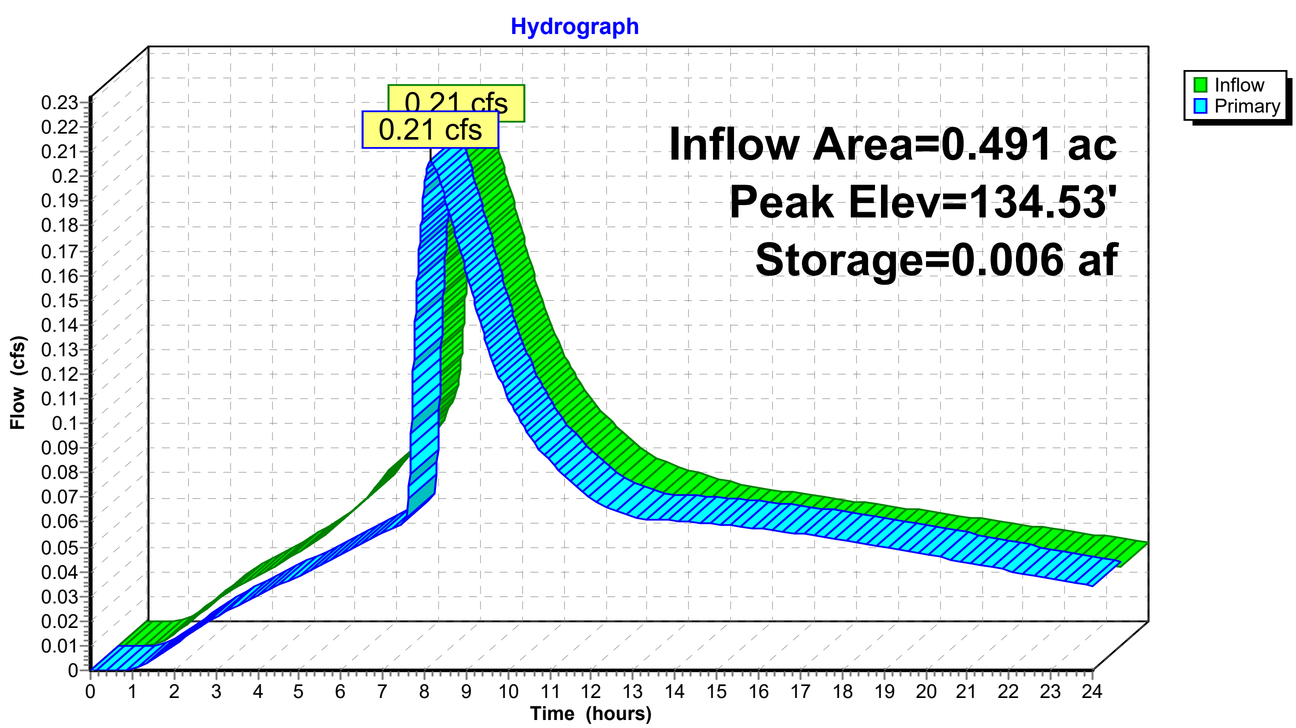
Plug-Flow detention time= 39.6 min calculated for 0.114 af (99% of inflow)
Center-of-Mass det. time= 33.1 min (742.0 - 708.9)

Volume	Invert	Avail.Storage	Storage Description
#1	134.00'	0.009 af	**5.00'W x 5.00'L x 0.60'H Prismatoid Z=30.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	134.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	134.00'	**1.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.21 cfs @ 8.16 hrs HW=134.53' TW=131.59' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 0.14 cfs @ 0.58 fps)
2=Orifice/Grate (Orifice Controls 0.06 cfs @ 3.06 fps)

Pond 20P: Courtyard Depressions



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 127.85' (Flood elevation advised)

Inflow Area = 5.680 ac, 47.76% Impervious, Inflow Depth > 2.11" for 10-yr, 24-hr event
Inflow = 1.99 cfs @ 8.12 hrs, Volume= 1.000 af
Outflow = 1.99 cfs @ 8.12 hrs, Volume= 1.000 af, Atten= 0%, Lag= 0.0 min
Primary = 1.74 cfs @ 8.12 hrs, Volume= 0.993 af
Secondary = 0.25 cfs @ 8.12 hrs, Volume= 0.006 af

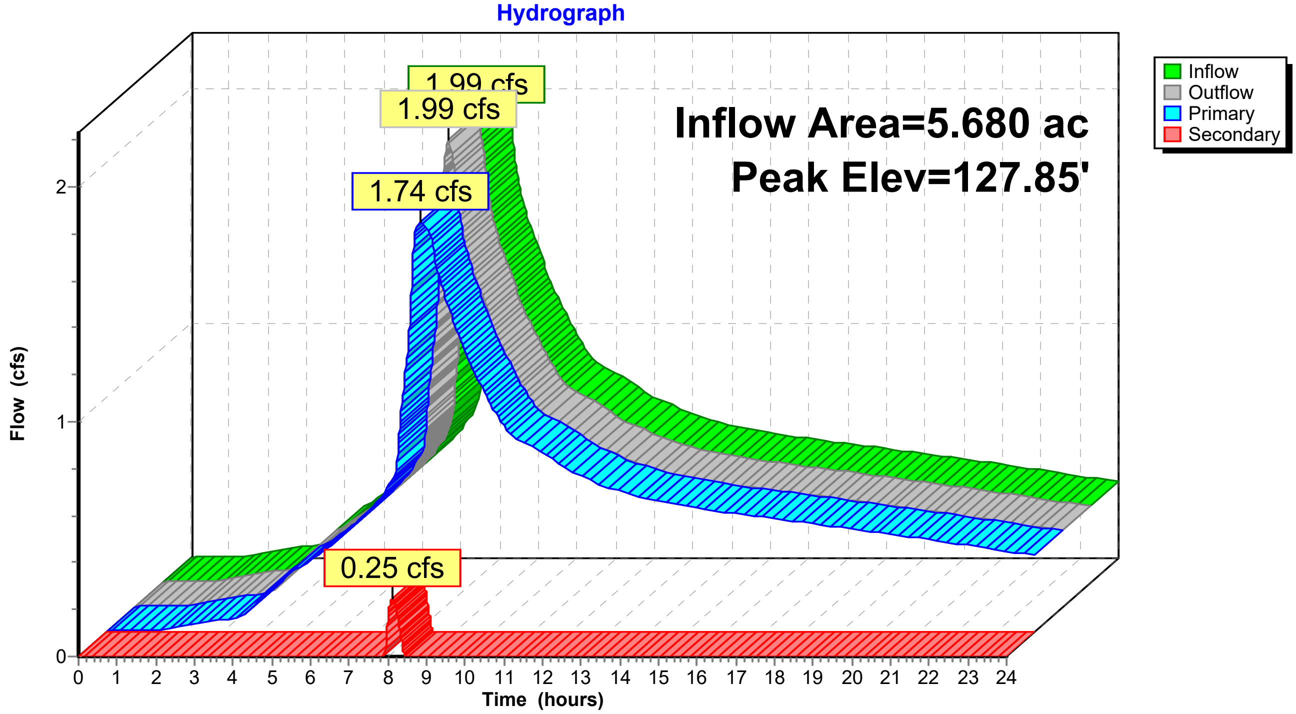
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.85' @ 8.12 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.74 cfs @ 8.12 hrs HW=127.85' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.74 cfs @ 3.20 fps)

Secondary OutFlow Max=0.25 cfs @ 8.12 hrs HW=127.85' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 0.51 fps)

Pond 25P: TDA 1 Outflow



Summary for Pond AB1: West Bio 1

Inflow Area = 0.668 ac, 85.39% Impervious, Inflow Depth > 2.89" for 10-yr, 24-hr event
Inflow = 0.49 cfs @ 7.88 hrs, Volume= 0.161 af
Outflow = 0.48 cfs @ 7.92 hrs, Volume= 0.161 af, Atten= 0%, Lag= 2.0 min
Primary = 0.48 cfs @ 7.92 hrs, Volume= 0.161 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.56' @ 7.92 hrs Surf.Area= 0.016 ac Storage= 0.010 af

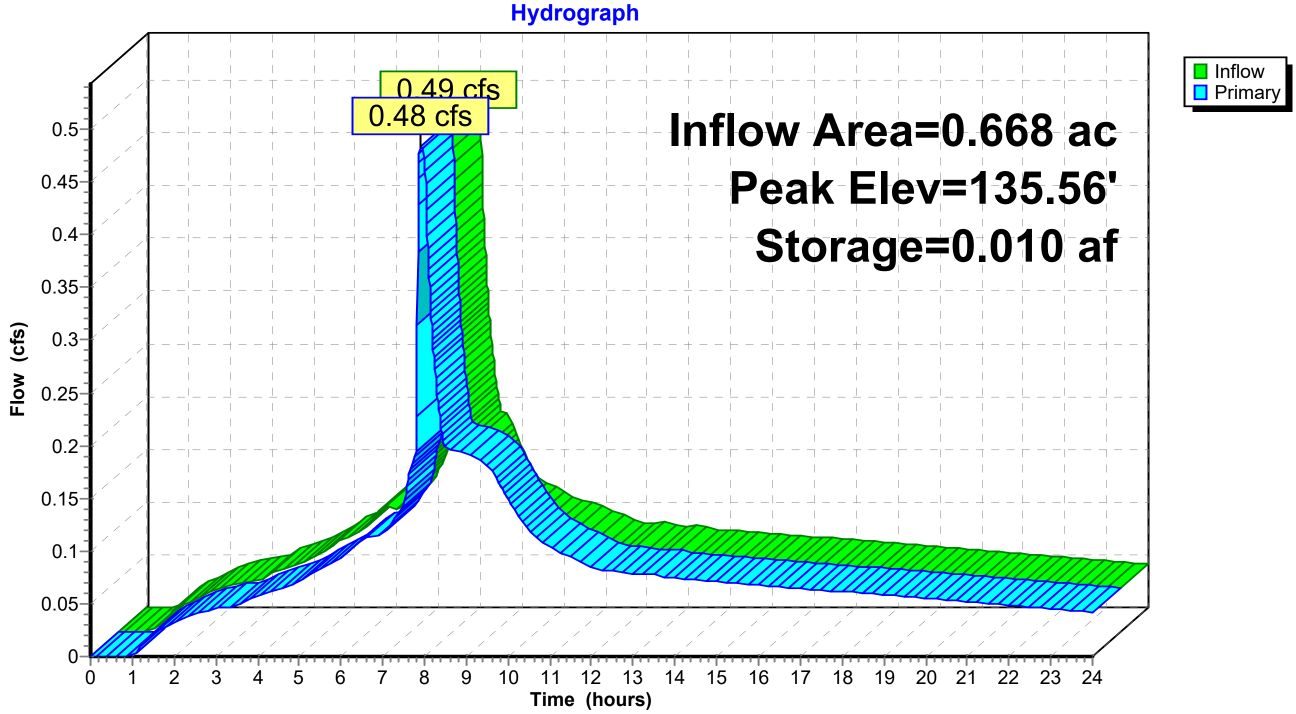
Plug-Flow detention time= 15.0 min calculated for 0.161 af (100% of inflow)
Center-of-Mass det. time= 12.6 min (686.4 - 673.8)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.009 af	**10.00'W x 28.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.005 af	**28.00'W x 10.00'L x 2.00'H Prismatoid**
			0.013 af Overall x 40.0% Voids
		0.014 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.48 cfs @ 7.92 hrs HW=135.56' TW=133.05' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.20 cfs @ 7.56 fps)
2=Orifice/Grate (Weir Controls 0.28 cfs @ 0.78 fps)

Pond AB1: West Bio 1



Summary for Pond PA: Pond1

[63] Warning: Exceeded Reach 12R INLET depth by 1.96' @ 8.31 hrs

Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 2.87" for 10-yr, 24-hr event
Inflow = 1.99 cfs @ 8.00 hrs, Volume= 0.736 af
Outflow = 1.43 cfs @ 8.18 hrs, Volume= 0.702 af, Atten= 28%, Lag= 10.8 min
Primary = 1.43 cfs @ 8.18 hrs, Volume= 0.702 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.37' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 132.95' @ 8.18 hrs Surf.Area= 0.062 ac Storage= 0.084 af

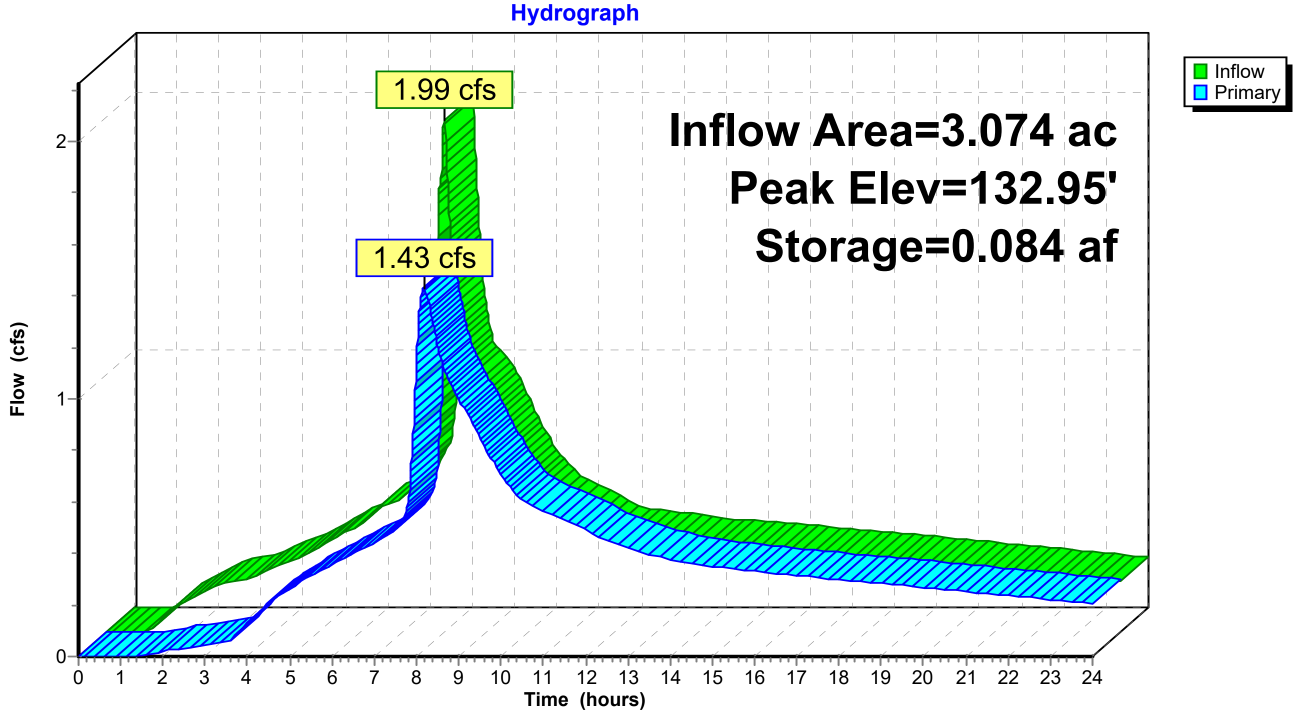
Plug-Flow detention time= 78.3 min calculated for 0.702 af (95% of inflow)
Center-of-Mass det. time= 45.4 min (738.4 - 693.0)

Volume	Invert	Avail.Storage	Storage Description
#1	131.30'	0.157 af	**42.00'W x 42.00'L x 2.70'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.60'	**1.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#2	Primary	131.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	131.30'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Primary	133.00'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.7' Crest Height

Primary OutFlow Max=1.43 cfs @ 8.18 hrs HW=132.95' TW=0.00' (Dynamic Tailwater)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.70 cfs @ 2.01 fps)
2=Orifice/Grate (Orifice Controls 0.64 cfs @ 4.67 fps)
3=Orifice/Grate (Orifice Controls 0.10 cfs @ 6.05 fps)
4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond PA: Pond1



Summary for Pond PB: Pond2

[63] Warning: Exceeded Reach 19R INLET depth by 1.04' @ 10.50 hrs

Inflow Area = 8.602 ac, 42.69% Impervious, Inflow Depth > 2.25" for 10-yr, 24-hr event
Inflow = 3.87 cfs @ 8.00 hrs, Volume= 1.614 af
Outflow = 1.30 cfs @ 9.99 hrs, Volume= 1.290 af, Atten= 66%, Lag= 119.6 min
Primary = 1.30 cfs @ 9.99 hrs, Volume= 1.290 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.85' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 133.15' @ 9.99 hrs Surf.Area= 0.328 ac Storage= 0.498 af

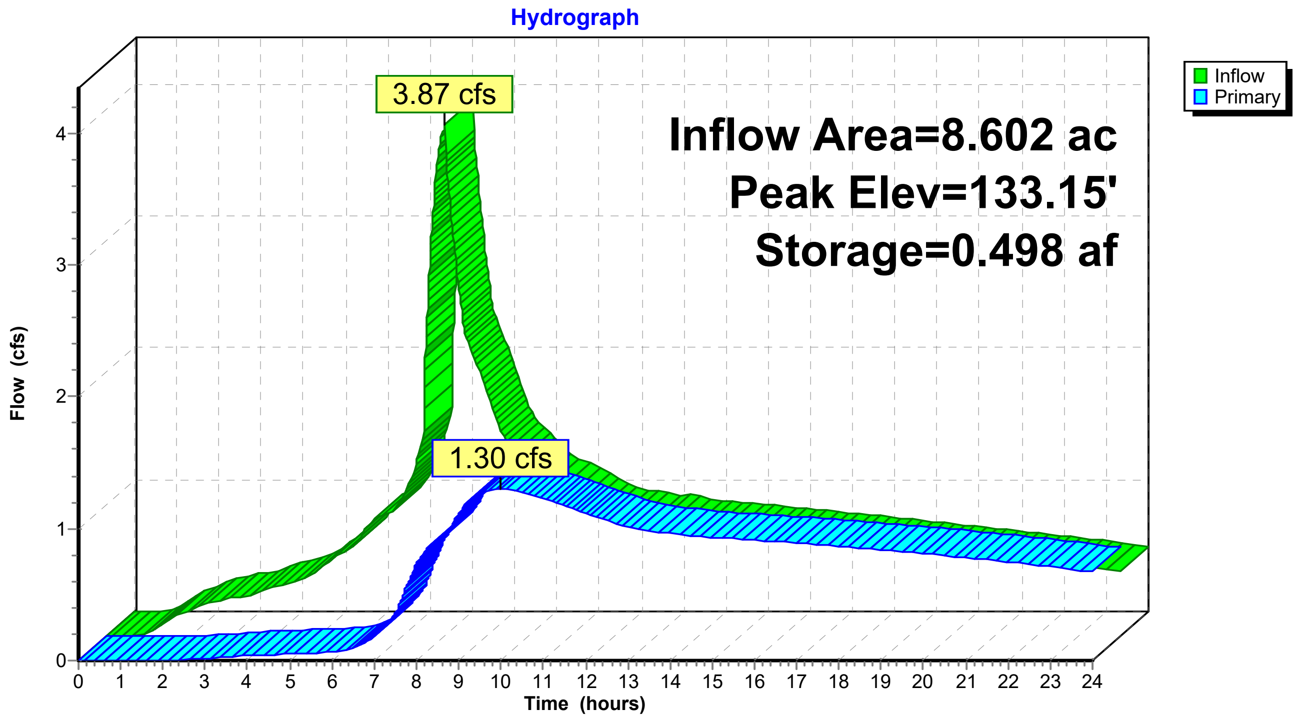
Plug-Flow detention time= 293.7 min calculated for 1.290 af (80% of inflow)
Center-of-Mass det. time= 166.3 min (895.7 - 729.4)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	0.970 af	**120.00'W x 100.00'L x 3.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	131.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.00'	**1.4' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.5' Crest Height
#4	Primary	133.47'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.6' Crest Height

Primary OutFlow Max=1.30 cfs @ 9.99 hrs HW=133.15' TW=0.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 0.90 cfs @ 4.58 fps)
├─**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 6.03 fps)
├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.27 cfs @ 1.29 fps)
└─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PB: Pond2

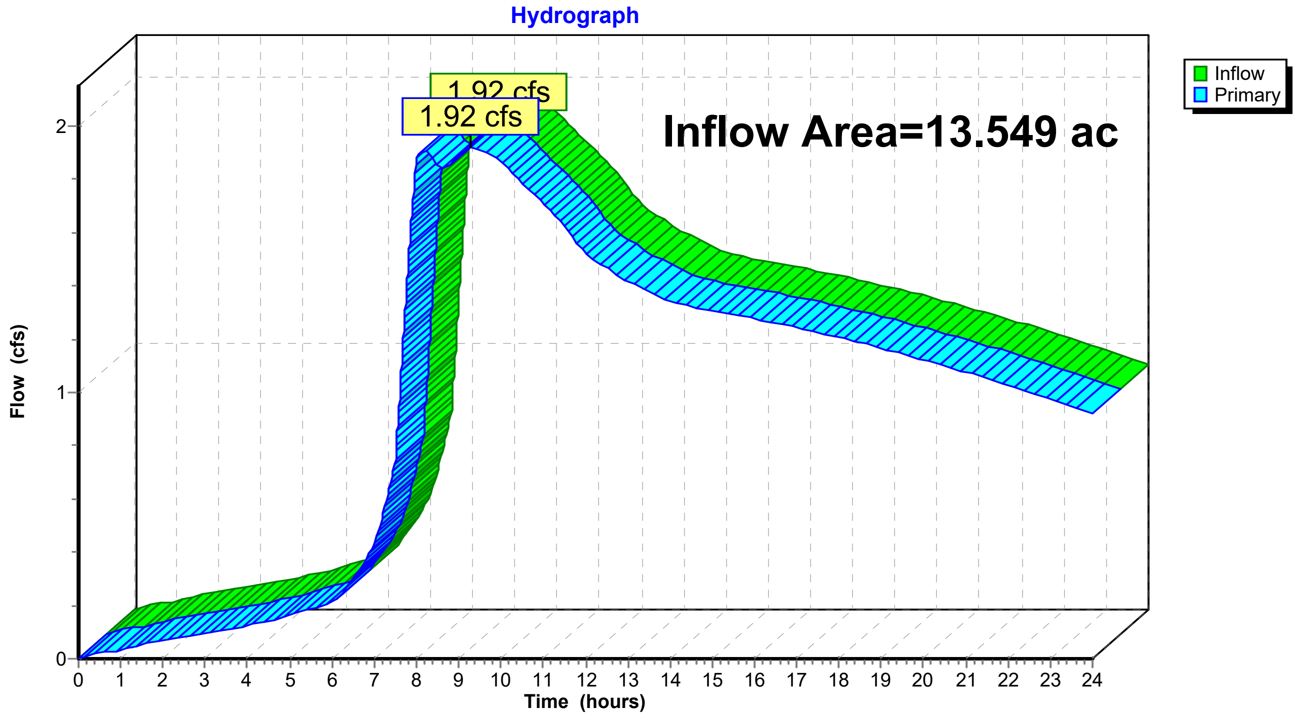


Summary for Link 11L: TDA 2 Outflow

Inflow Area = 13.549 ac, 32.99% Impervious, Inflow Depth > 1.71" for 10-yr, 24-hr event
Inflow = 1.92 cfs @ 9.28 hrs, Volume= 1.934 af
Primary = 1.92 cfs @ 9.28 hrs, Volume= 1.934 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 11L: TDA 2 Outflow

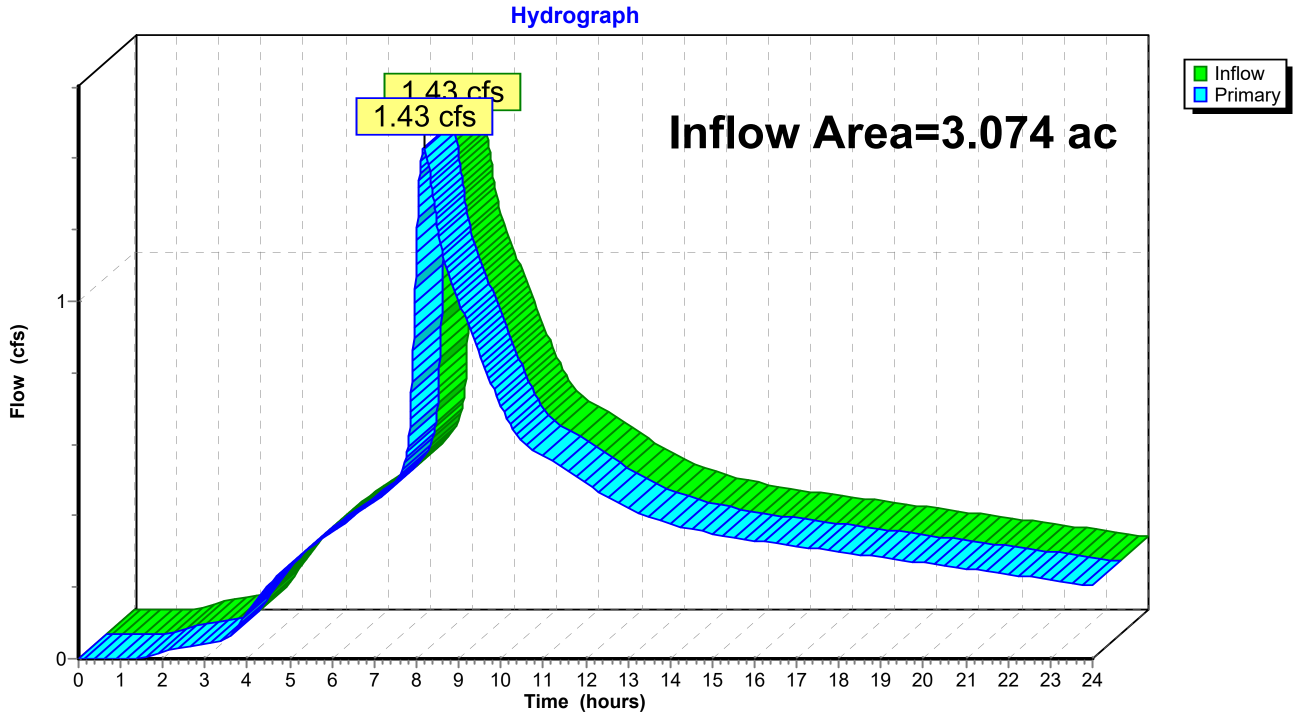


Summary for Link 12L: Site Outflow

Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 2.74" for 10-yr, 24-hr event
Inflow = 1.43 cfs @ 8.18 hrs, Volume= 0.702 af
Primary = 1.43 cfs @ 8.18 hrs, Volume= 0.702 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 12L: Site Outflow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A1: Frontage Runoff Area=0.713 ac 100.00% Impervious Runoff Depth>3.61"
Tc=5.0 min CN=0/98 Runoff=0.64 cfs 0.214 af

Subcatchment A2: West Parking 1 Runoff Area=29,090 sf 85.39% Impervious Runoff Depth>3.43"
Tc=5.0 min CN=86/98 Runoff=0.57 cfs 0.191 af

Subcatchment A3: West Parking 2 Runoff Area=0.688 ac 93.31% Impervious Runoff Depth>3.53"
Tc=5.0 min CN=86/98 Runoff=0.61 cfs 0.202 af

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>1.76"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.66 cfs 0.246 af

Subcatchment A5: Courtyard 2 Runoff Area=0.248 ac 87.10% Impervious Runoff Depth>3.45"
Tc=5.0 min CN=86/98 Runoff=0.21 cfs 0.071 af

Subcatchment A6: Fire Lane Runoff Area=0.140 ac 53.57% Impervious Runoff Depth>2.99"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.06 cfs 0.035 af

Subcatchment A7: Courtyard 1 Runoff Area=0.491 ac 82.28% Impervious Runoff Depth>3.34"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.25 cfs 0.137 af

Subcatchment A8: Pond Direct Runoff Area=5,502 sf 0.00% Impervious Runoff Depth>2.40"
Tc=10.0 min CN=86/0 Runoff=0.07 cfs 0.025 af

Subcatchment A9: Vegetated/Wetland Runoff Area=40,486 sf 4.10% Impervious Runoff Depth>1.84"
Flow Length=240' Slope=0.0750 '/' Tc=14.0 min CN=78/100 Runoff=0.34 cfs 0.143 af

Subcatchment B1: East Parking Runoff Area=88,300 sf 44.93% Impervious Runoff Depth>2.68"
Tc=5.0 min CN=80/98 Runoff=1.32 cfs 0.452 af

Subcatchment B2: Courtyard 3 Runoff Area=24,008 sf 70.66% Impervious Runoff Depth>3.26"
Tc=5.0 min CN=86/98 Runoff=0.45 cfs 0.150 af

Subcatchment B3: Building Roof Runoff Area=65,510 sf 100.00% Impervious Runoff Depth>3.62"
Tc=0.0 min CN=0/98 Runoff=1.39 cfs 0.453 af

Subcatchment B4: Field and Track Runoff Area=121,328 sf 25.76% Impervious Runoff Depth>2.55"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=84/98 Runoff=1.16 cfs 0.592 af

Subcatchment B5: Access Road and Pond Runoff Area=75,574 sf 8.72% Impervious Runoff Depth>2.25"
Flow Length=260' Slope=0.0100 '/' Tc=33.5 min CN=83/98 Runoff=0.64 cfs 0.325 af

Subcatchment B6: South Wetland Runoff Area=191,628 sf 12.89% Impervious Runoff Depth>1.87"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=76/100 Runoff=1.16 cfs 0.687 af

Subcatchment B7: Courtyard Bypass Runoff Area=23,868 sf 41.91% Impervious Runoff Depth>2.90"
Flow Length=330' Slope=0.0100 '/' Tc=12.9 min CN=86/98 Runoff=0.37 cfs 0.132 af

Reach 1R: 279 LF 18" Avg. Flow Depth=0.73' Max Vel=3.49 fps Inflow=2.98 cfs 1.053 af
18.0" Round Pipe n=0.012 L=279.0' S=0.0030 '/' Capacity=6.24 cfs Outflow=2.98 cfs 1.052 af

Reach 3R: 134 LF 12" Avg. Flow Depth=0.35' Max Vel=3.46 fps Inflow=0.86 cfs 0.285 af
12.0" Round Pipe n=0.012 L=134.0' S=0.0069 '/' Capacity=3.22 cfs Outflow=0.86 cfs 0.285 af

Reach 4R: 56 LF 12" Avg. Flow Depth=0.46' Max Vel=3.35 fps Inflow=1.18 cfs 0.392 af
12.0" Round Pipe n=0.012 L=56.0' S=0.0050 '/' Capacity=2.73 cfs Outflow=1.18 cfs 0.392 af

Reach 5R: 70 LF 12" Avg. Flow Depth=0.25' Max Vel=2.91 fps Inflow=0.45 cfs 0.149 af
12.0" Round Pipe n=0.012 L=70.0' S=0.0071 '/' Capacity=3.26 cfs Outflow=0.45 cfs 0.149 af

Reach 6R: 38 LF 12" Avg. Flow Depth=0.68' Max Vel=2.95 fps Inflow=1.69 cfs 0.600 af
12.0" Round Pipe n=0.012 L=38.0' S=0.0029 '/' Capacity=2.08 cfs Outflow=1.69 cfs 0.600 af

Reach 7R: 107 LF 12" Avg. Flow Depth=0.19' Max Vel=2.43 fps Inflow=0.25 cfs 0.135 af
12.0" Round Pipe n=0.012 L=107.0' S=0.0070 '/' Capacity=3.23 cfs Outflow=0.25 cfs 0.135 af

Reach 8R: 170 LF 12" Avg. Flow Depth=0.27' Max Vel=2.61 fps Inflow=0.45 cfs 0.150 af
12.0" Round Pipe n=0.012 L=170.0' S=0.0052 '/' Capacity=2.79 cfs Outflow=0.45 cfs 0.149 af

Reach 9R: 115 LF 12" Avg. Flow Depth=0.33' Max Vel=2.83 fps Inflow=0.64 cfs 0.214 af
12.0" Round Pipe n=0.012 L=115.0' S=0.0050 '/' Capacity=2.72 cfs Outflow=0.64 cfs 0.214 af

Reach 10R: 76 LF 12" Avg. Flow Depth=0.52' Max Vel=4.98 fps Inflow=2.04 cfs 0.677 af
12.0" Round Pipe n=0.012 L=76.0' S=0.0100 '/' Capacity=3.86 cfs Outflow=2.04 cfs 0.677 af

Reach 12R: 34 LF 12" Avg. Flow Depth=0.60' Max Vel=4.70 fps Inflow=2.31 cfs 0.847 af
12.0" Round Pipe n=0.012 L=34.0' S=0.0079 '/' Capacity=3.44 cfs Outflow=2.31 cfs 0.847 af

Reach 13R: 159 LF 12" Avg. Flow Depth=0.24' Max Vel=4.55 fps Inflow=0.64 cfs 0.214 af
12.0" Round Pipe n=0.012 L=159.0' S=0.0187 '/' Capacity=5.28 cfs Outflow=0.64 cfs 0.214 af

Reach 16R: 39 LF 12" Avg. Flow Depth=0.39' Max Vel=3.05 fps Inflow=0.86 cfs 0.285 af
12.0" Round Pipe n=0.012 L=39.0' S=0.0049 '/' Capacity=2.69 cfs Outflow=0.86 cfs 0.285 af

Reach 19R: 74 LF 18" Avg. Flow Depth=0.92' Max Vel=3.61 fps Inflow=4.10 cfs 1.644 af
18.0" Round Pipe n=0.012 L=74.0' S=0.0027 '/' Capacity=5.92 cfs Outflow=4.10 cfs 1.644 af

Pond 1P: East Bio Peak Elev=135.08' Storage=0.010 af Inflow=1.32 cfs 0.452 af
Outflow=1.25 cfs 0.451 af

Pond 2P: West Bio 2 Peak Elev=135.57' Storage=0.005 af Inflow=0.61 cfs 0.202 af
Outflow=0.61 cfs 0.202 af

Pond 8P: North Bio Peak Elev=145.57' Storage=0.010 af Inflow=0.64 cfs 0.214 af
Outflow=0.64 cfs 0.214 af

Pond 14P: Pond2 Emergency Peak Elev=132.00' Storage=0.448 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=134.10' Inflow=0.66 cfs 0.246 af
Outflow=0.66 cfs 0.246 af

Pond 20P: Courtyard Depressions Peak Elev=134.54' Storage=0.007 af Inflow=0.25 cfs 0.137 af
Outflow=0.25 cfs 0.135 af

Pond 25P: TDA 1 Outflow Peak Elev=127.93' Inflow=2.97 cfs 1.225 af
Primary=1.90 cfs 1.188 af Secondary=1.07 cfs 0.037 af Outflow=2.97 cfs 1.225 af

Pond AB1: West Bio 1 Peak Elev=135.57' Storage=0.010 af Inflow=0.57 cfs 0.191 af
Outflow=0.57 cfs 0.190 af

Pond PA: Pond1 Peak Elev=133.06' Storage=0.091 af Inflow=2.38 cfs 0.872 af
Outflow=2.09 cfs 0.837 af

Pond PB: Pond2 Peak Elev=133.33' Storage=0.556 af Inflow=4.74 cfs 1.969 af
Outflow=1.96 cfs 1.597 af

Link 11L: TDA 2 Outflow Inflow=2.94 cfs 2.416 af
Primary=2.94 cfs 2.416 af

Link 12L: Site Outflow Inflow=2.09 cfs 0.837 af
Primary=2.09 cfs 0.837 af

Total Runoff Area = 19.229 ac Runoff Volume = 4.055 af Average Runoff Depth = 2.53"
62.65% Pervious = 12.047 ac 37.35% Impervious = 7.182 ac

Summary for Subcatchment A1: Frontage

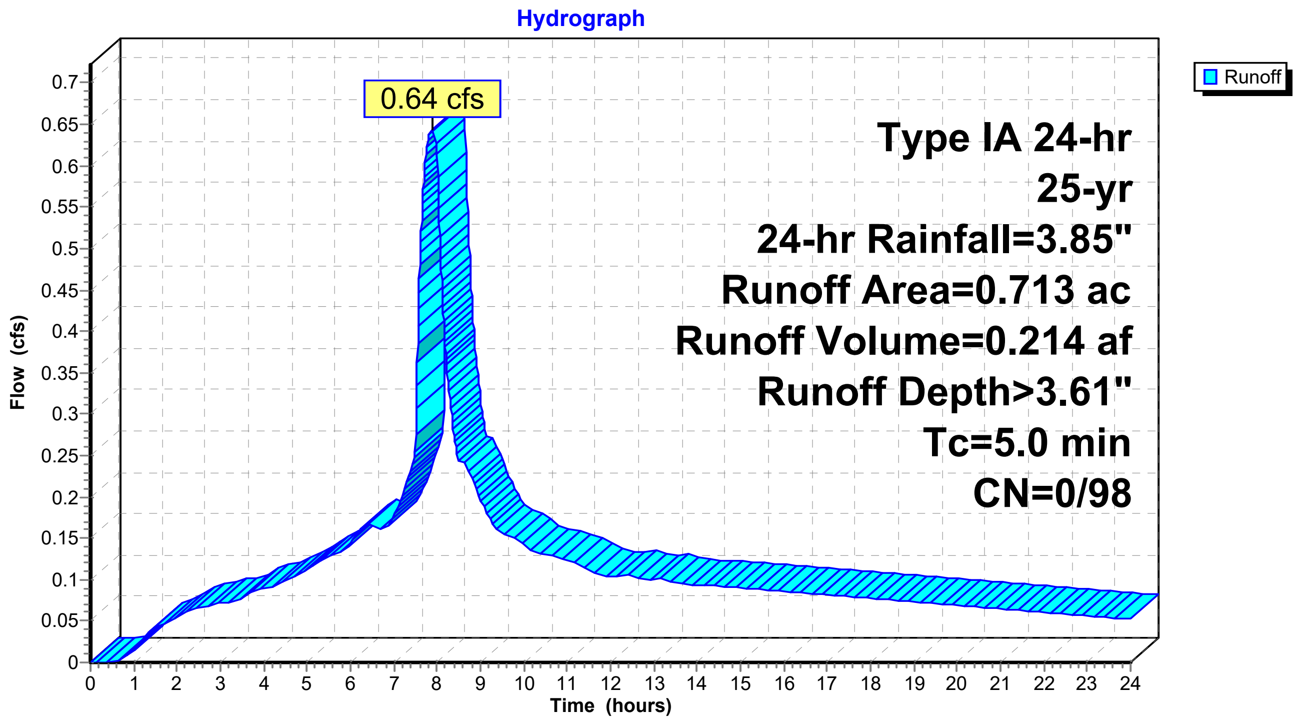
Runoff = 0.64 cfs @ 7.88 hrs, Volume= 0.214 af, Depth> 3.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.713	98	Road/Sidewalk
	0.713	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A1: Frontage



Summary for Subcatchment A2: West Parking 1

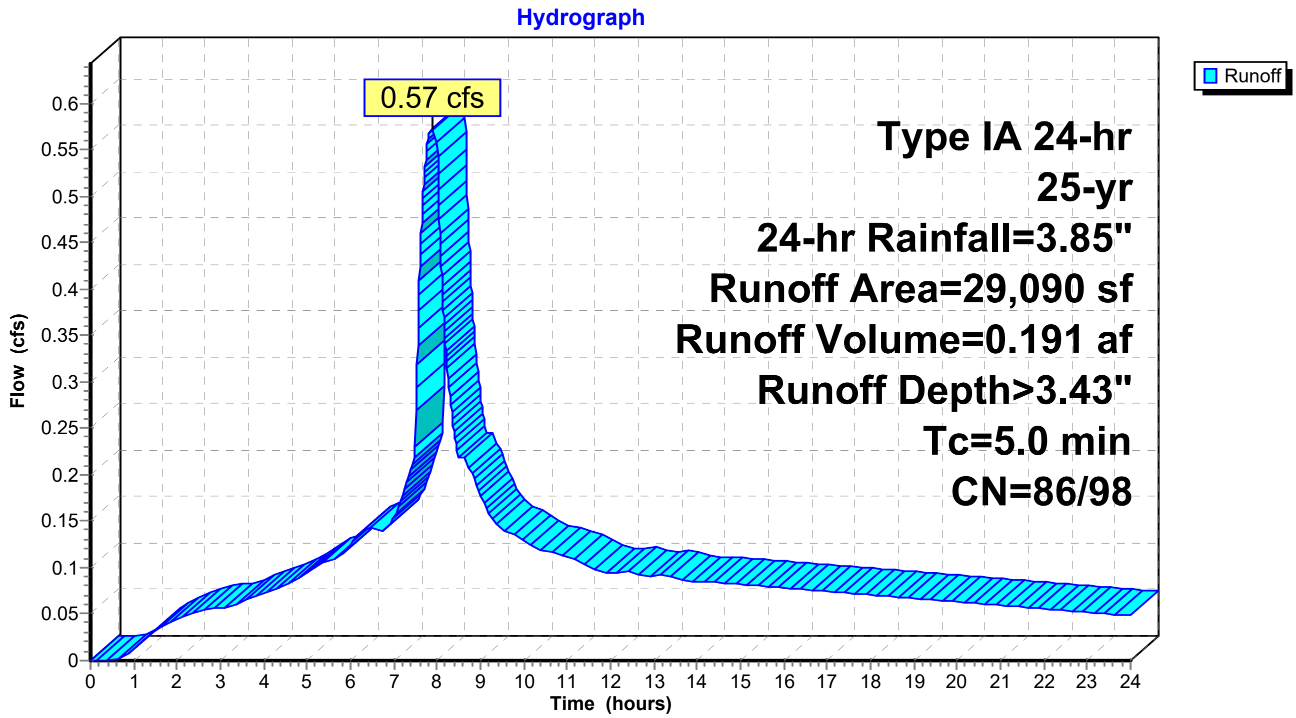
Runoff = 0.57 cfs @ 7.88 hrs, Volume= 0.191 af, Depth> 3.43"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	24,840	98	Parking Lot/Sidewalk
*	4,250	86	Bioretention/Landscape
	29,090	96	Weighted Average
	4,250	86	14.61% Pervious Area
	24,840	98	85.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A2: West Parking 1



Summary for Subcatchment A3: West Parking 2

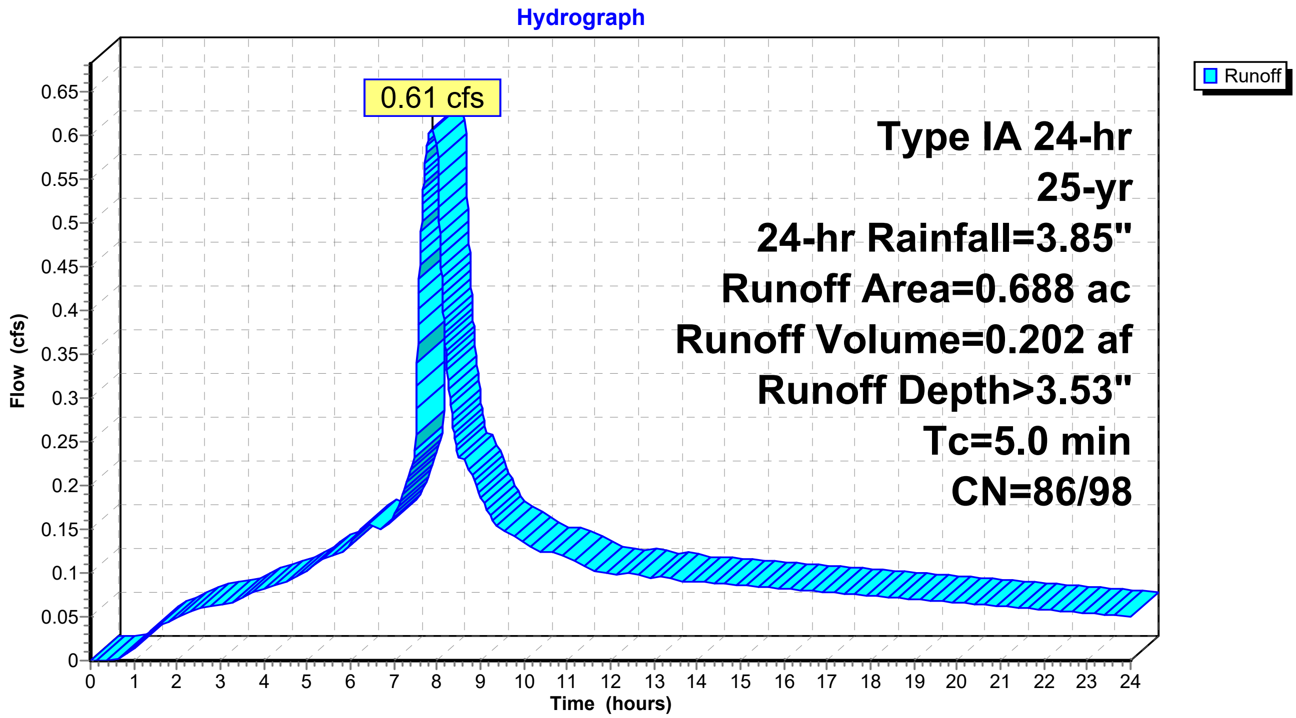
Runoff = 0.61 cfs @ 7.88 hrs, Volume= 0.202 af, Depth> 3.53"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.642	98	Parking Lot/Sidewalk
*	0.046	86	Bioretention/Landscape
	0.688	97	Weighted Average
	0.046	86	6.69% Pervious Area
	0.642	98	93.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A3: West Parking 2



Summary for Subcatchment A4: North Wetland

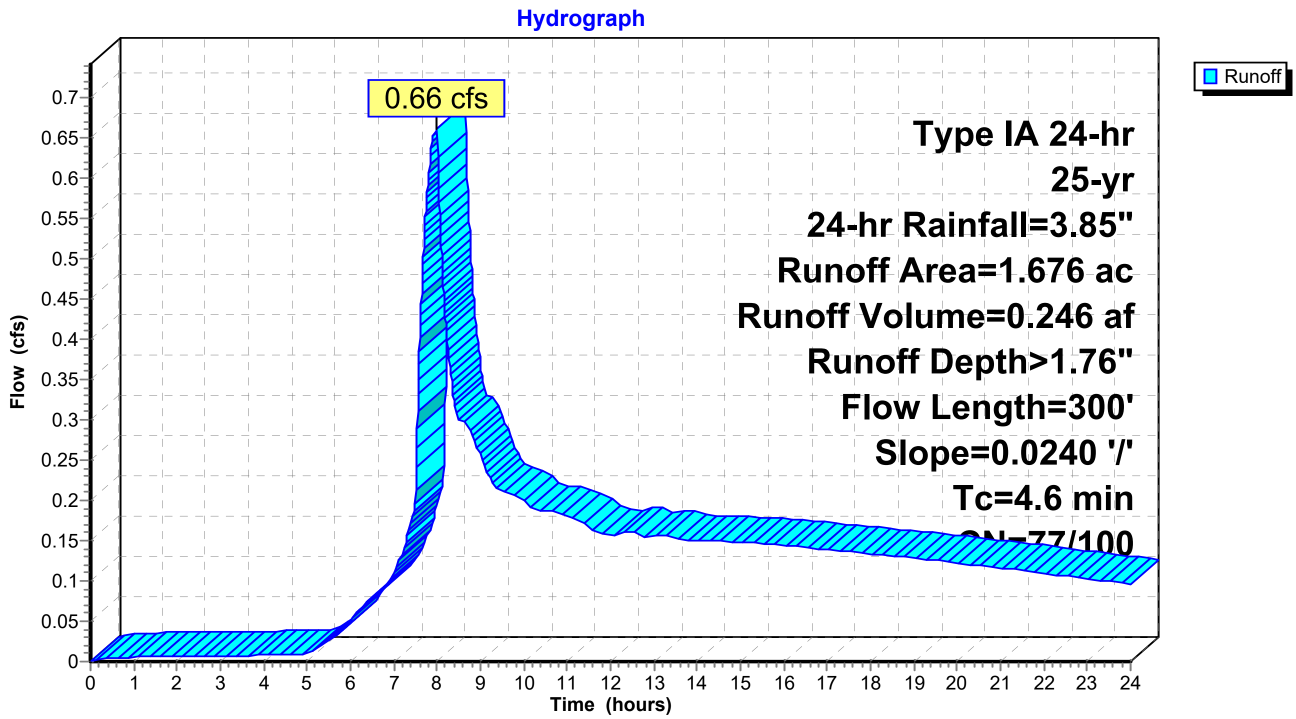
Runoff = 0.66 cfs @ 7.98 hrs, Volume= 0.246 af, Depth> 1.76"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment A5: Courtyard 2

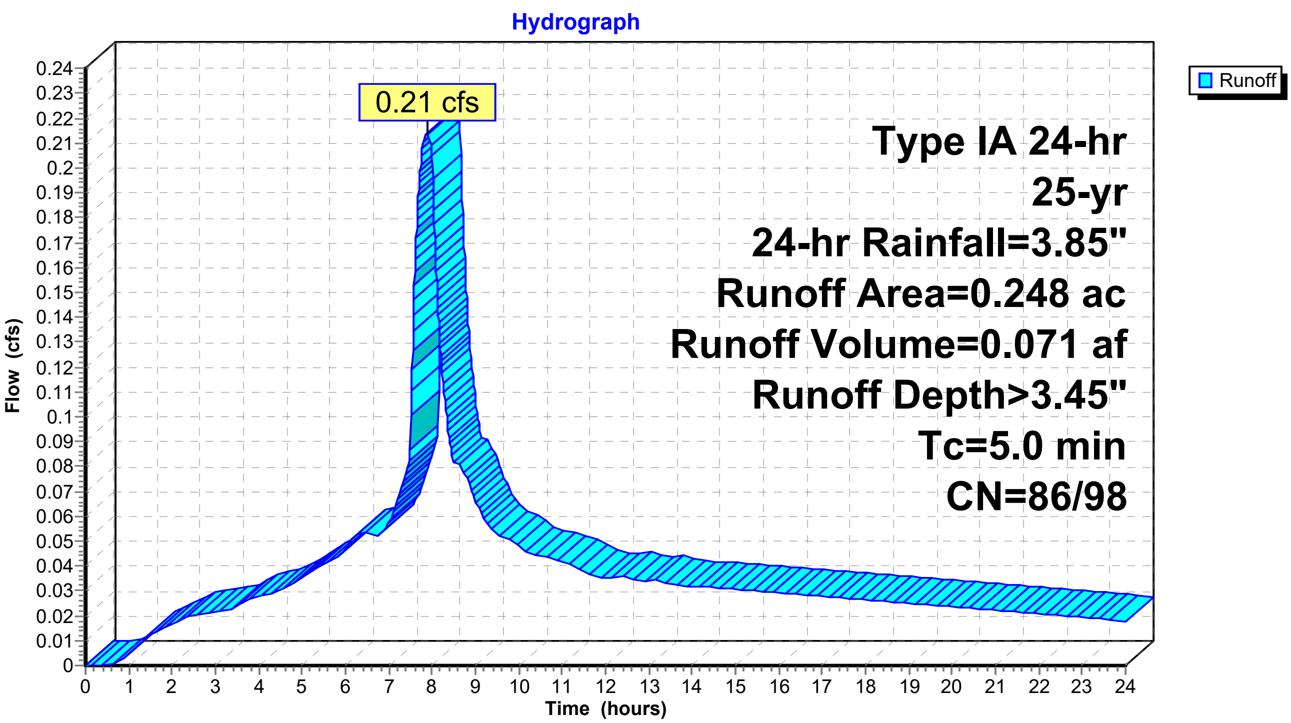
Runoff = 0.21 cfs @ 7.88 hrs, Volume= 0.071 af, Depth> 3.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.216	98	Courtyard Pavement
*	0.032	86	Courtyard Landscaping
	0.248	96	Weighted Average
	0.032	86	12.90% Pervious Area
	0.216	98	87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A5: Courtyard 2



Summary for Subcatchment A6: Fire Lane

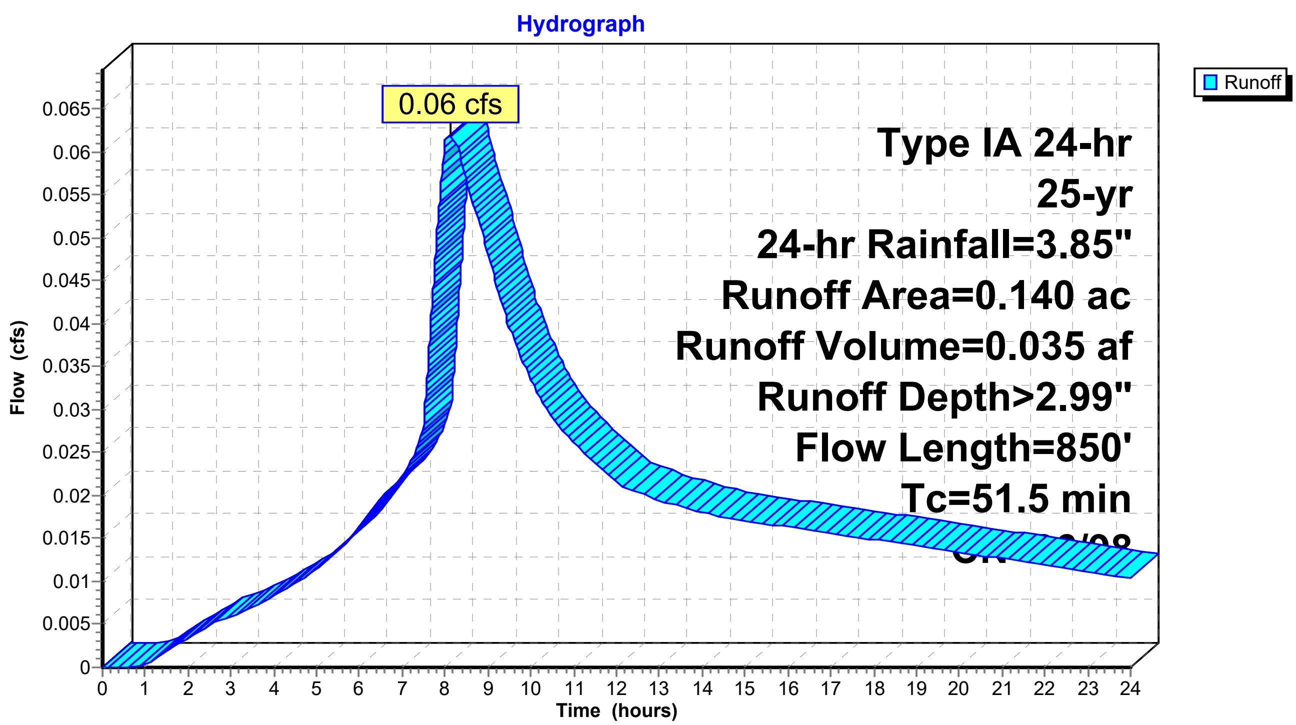
Runoff = 0.06 cfs @ 8.10 hrs, Volume= 0.035 af, Depth> 2.99"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.065	86	Courtyard Landscaping
*	0.075	98	Fire Lane
	0.140	92	Weighted Average
	0.065	86	46.43% Pervious Area
	0.075	98	53.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A6: Fire Lane



Summary for Subcatchment A7: Courtyard 1

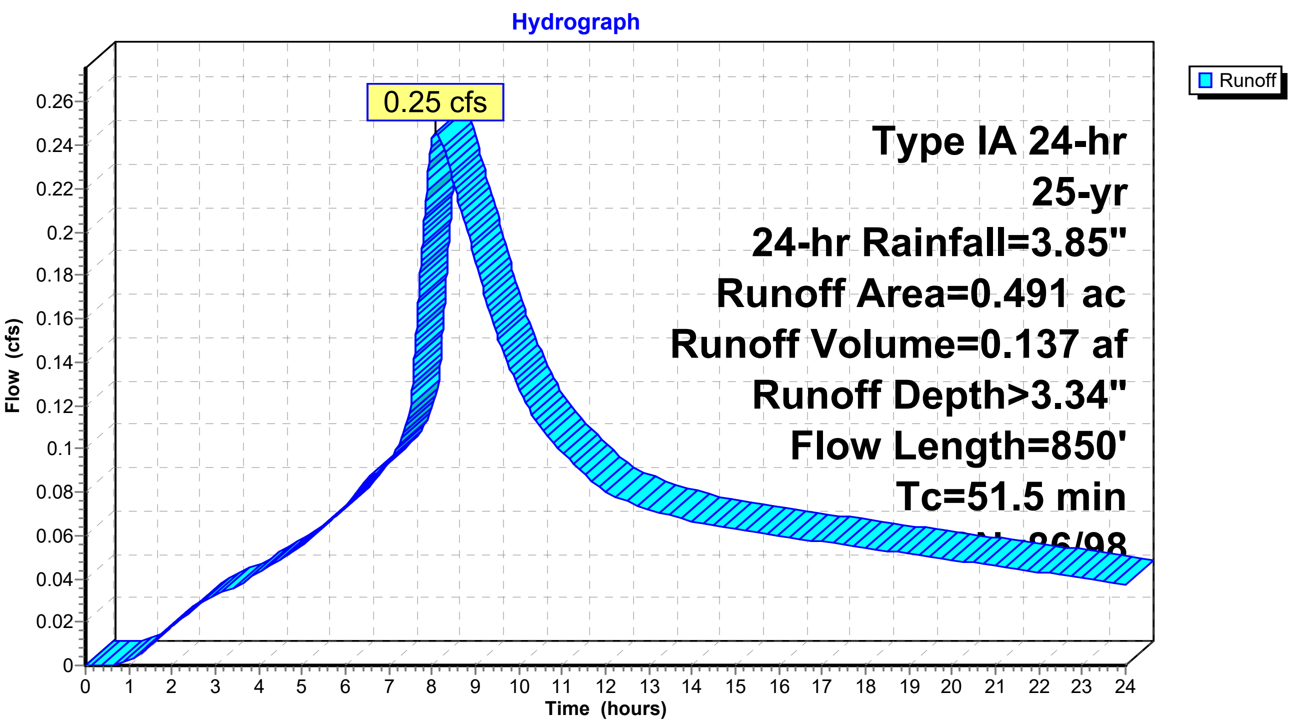
Runoff = 0.25 cfs @ 8.08 hrs, Volume= 0.137 af, Depth> 3.34"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.311	98	Courtyard Pavement
*	0.087	86	Courtyard Landscaping
*	0.093	98	Fire Lane
	0.491	96	Weighted Average
	0.087	86	17.72% Pervious Area
	0.404	98	82.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A7: Courtyard 1



Summary for Subcatchment A8: Pond Direct

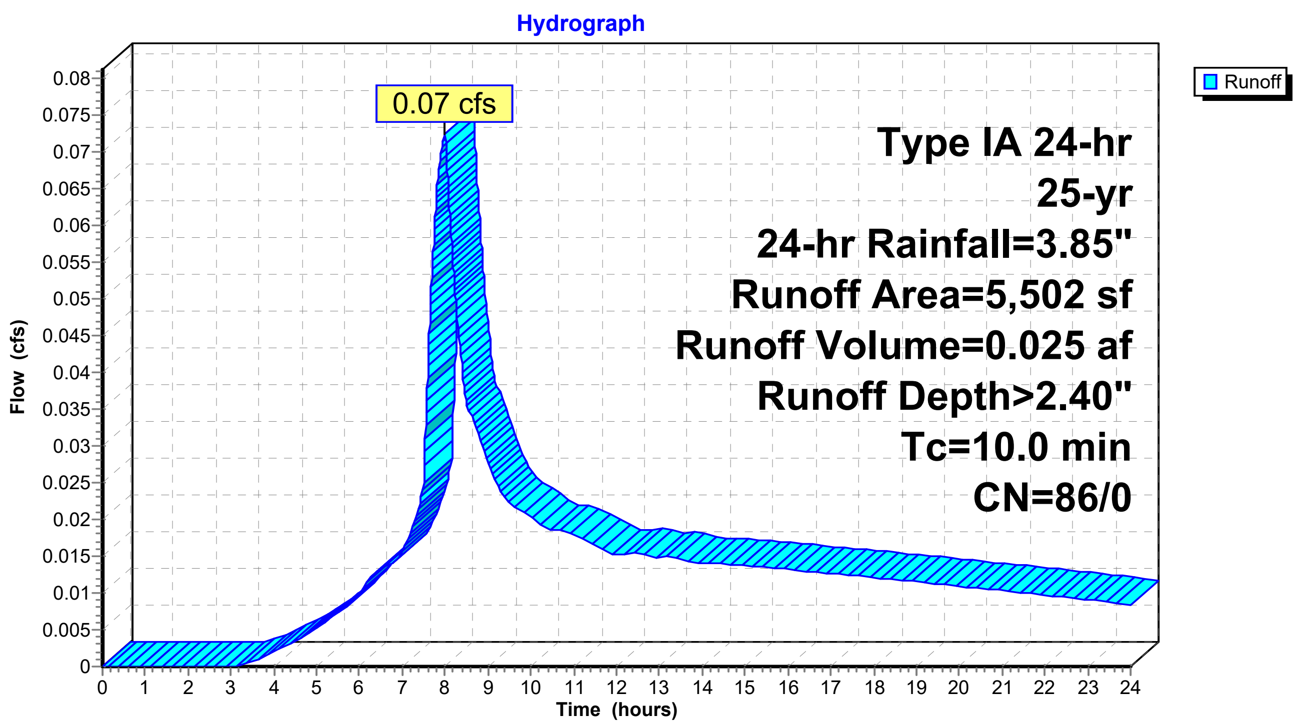
Runoff = 0.07 cfs @ 8.00 hrs, Volume= 0.025 af, Depth> 2.40"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	5,502	86	Pond Top Area
	5,502	86	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment A8: Pond Direct



Summary for Subcatchment A9: Vegetated/Wetland Bypass

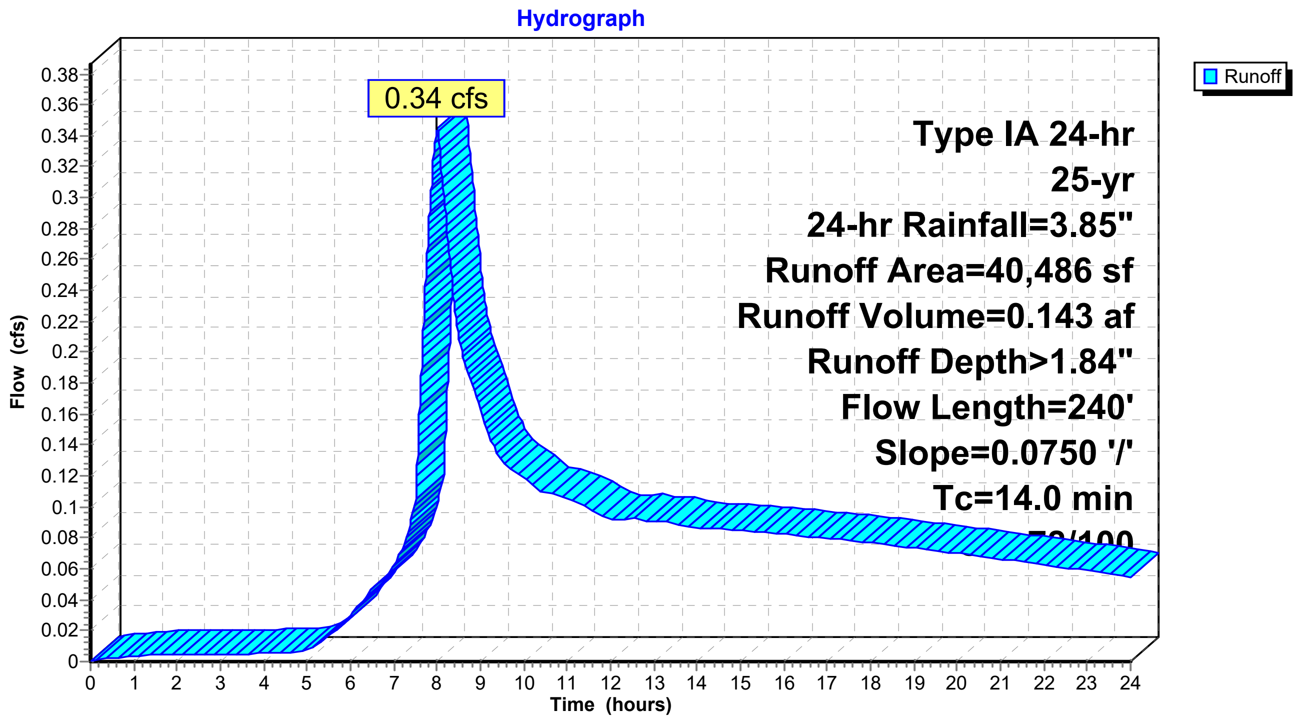
Runoff = 0.34 cfs @ 8.00 hrs, Volume= 0.143 af, Depth> 1.84"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	29,555	76	Undisturbed Forest
*	9,270	86	Fill Slope
*	1,661	100	Wetland
	40,486	79	Weighted Average
	38,825	78	95.90% Pervious Area
	1,661	100	4.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	240	0.0750	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment A9: Vegetated/Wetland Bypass



Summary for Subcatchment B1: East Parking

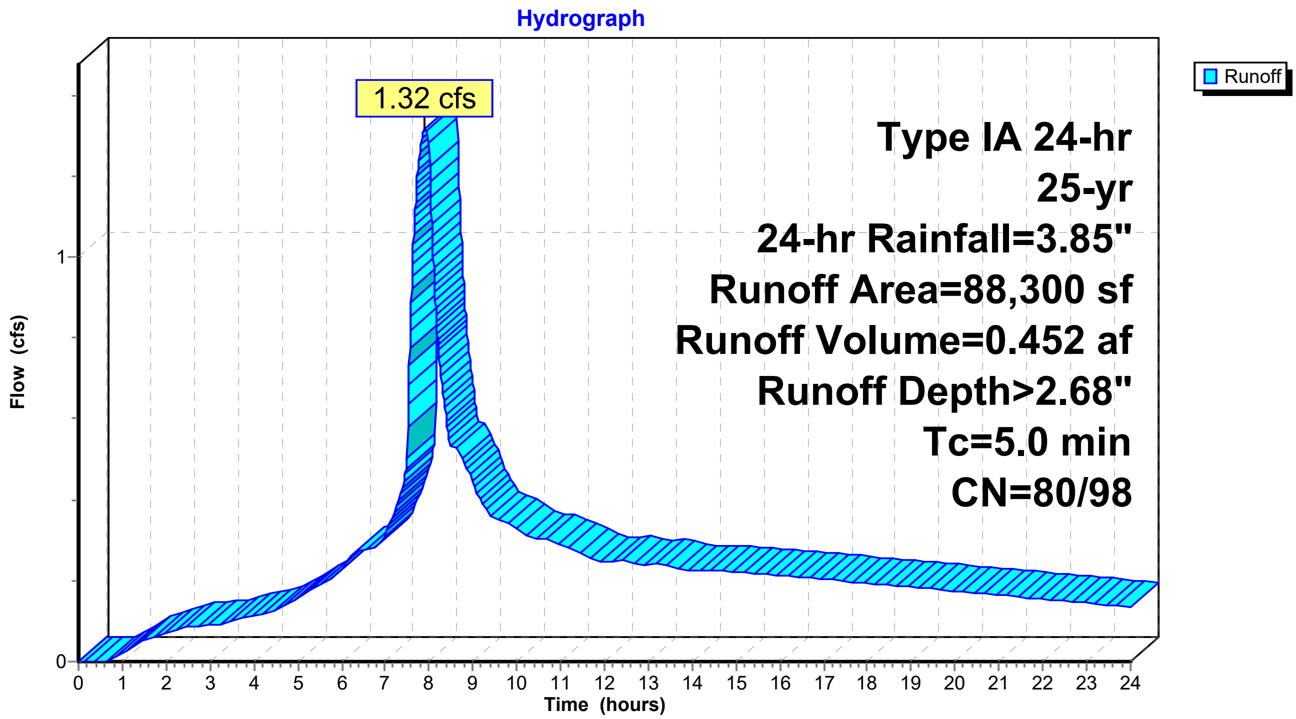
Runoff = 1.32 cfs @ 7.92 hrs, Volume= 0.452 af, Depth> 2.68"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	39,670	98	Parking Lot/Sidewalk
*	27,610	76	Undisturbed Forest
*	14,850	86	Bioretention/Landscape
*	6,170	86	Disturbed Vegetated
	88,300	88	Weighted Average
	48,630	80	55.07% Pervious Area
	39,670	98	44.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B1: East Parking



Summary for Subcatchment B2: Courtyard 3

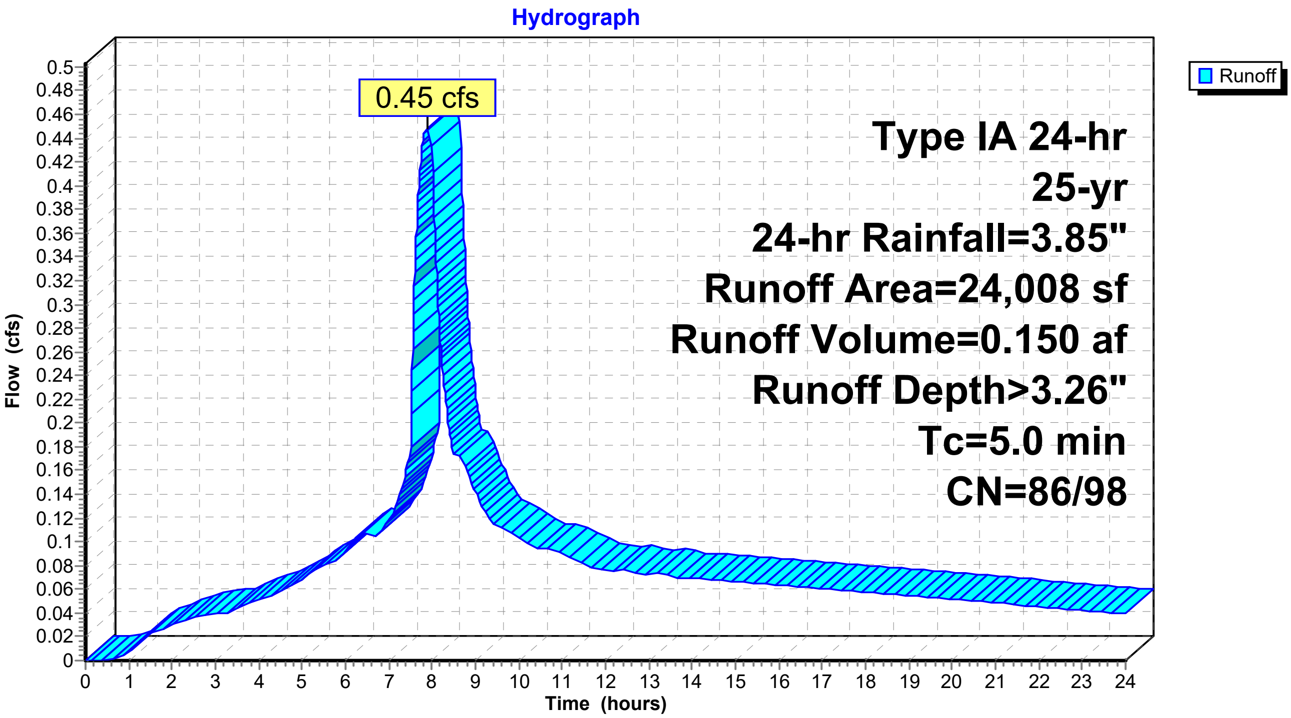
Runoff = 0.45 cfs @ 7.89 hrs, Volume= 0.150 af, Depth> 3.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	7,045	86	Courtyard Landscaping
*	16,963	98	Courtyard Pavement
	24,008	94	Weighted Average
	7,045	86	29.34% Pervious Area
	16,963	98	70.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B2: Courtyard 3



Summary for Subcatchment B3: Building Roof

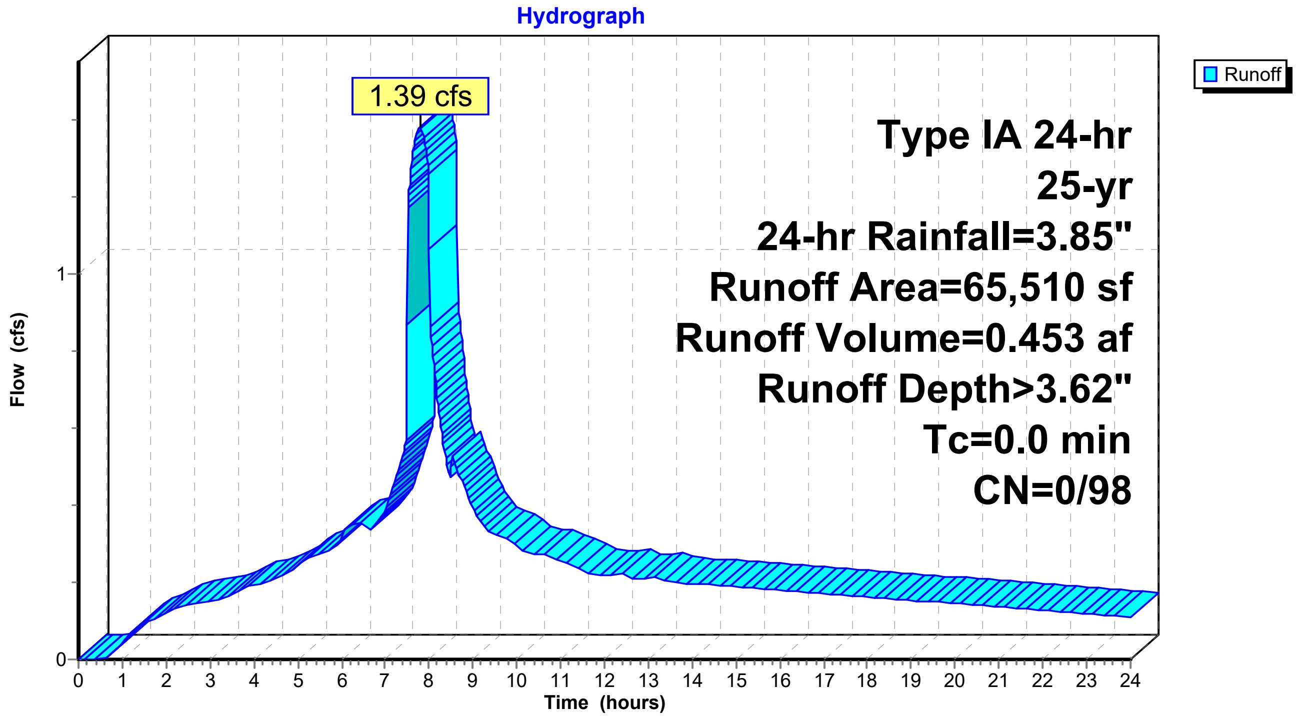
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.39 cfs @ 7.78 hrs, Volume= 0.453 af, Depth> 3.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

Area (sf)	CN	Description
65,510	98	Roofs, HSG D
65,510	98	100.00% Impervious Area

Subcatchment B3: Building Roof



Summary for Subcatchment B4: Field and Track

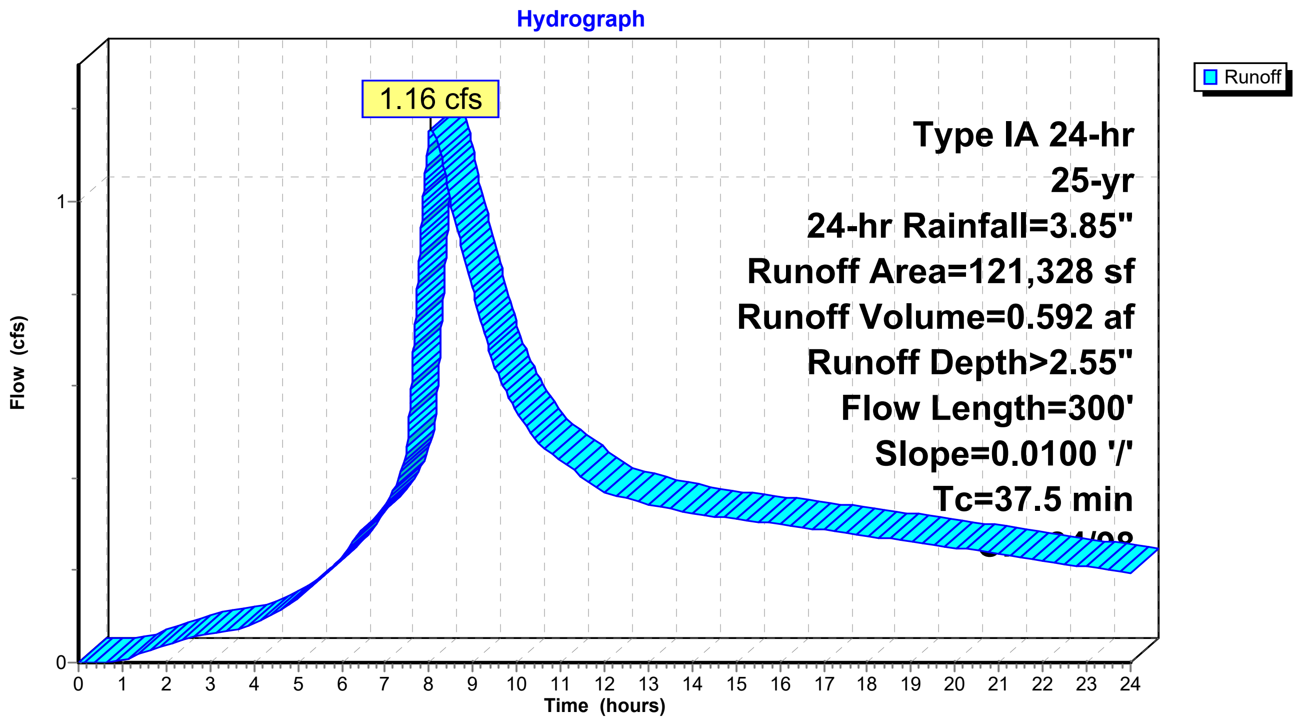
Runoff = 1.16 cfs @ 8.04 hrs, Volume= 0.592 af, Depth> 2.55"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	71,134	86	Field
*	3,750	98	Track
*	18,694	76	Undisturbed
*	27,500	98	Fire Lane/Access Road
*	250	86	Courtyard Landscaping
	121,328	88	Weighted Average
	90,078	84	74.24% Pervious Area
	31,250	98	25.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B4: Field and Track



Summary for Subcatchment B5: Access Road and Pond

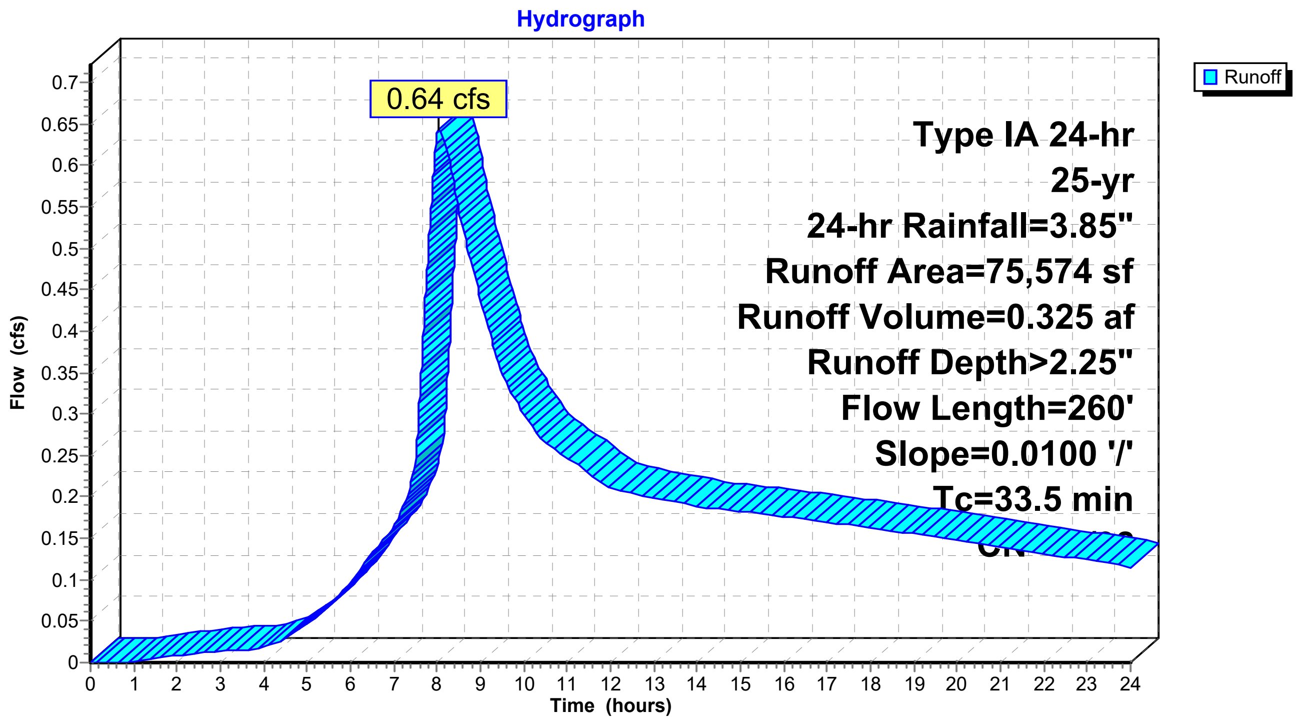
Runoff = 0.64 cfs @ 8.03 hrs, Volume= 0.325 af, Depth> 2.25"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	25,478	76	Undisturbed
*	5,756	96	Gravel Road
*	890	98	Paved Access Road
*	37,750	86	Pond/Landscaping
*	5,700	98	Pump Station/Access
	75,574	84	Weighted Average
	68,984	83	91.28% Pervious Area
	6,590	98	8.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	260	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B5: Access Road and Pond



Summary for Subcatchment B6: South Wetland

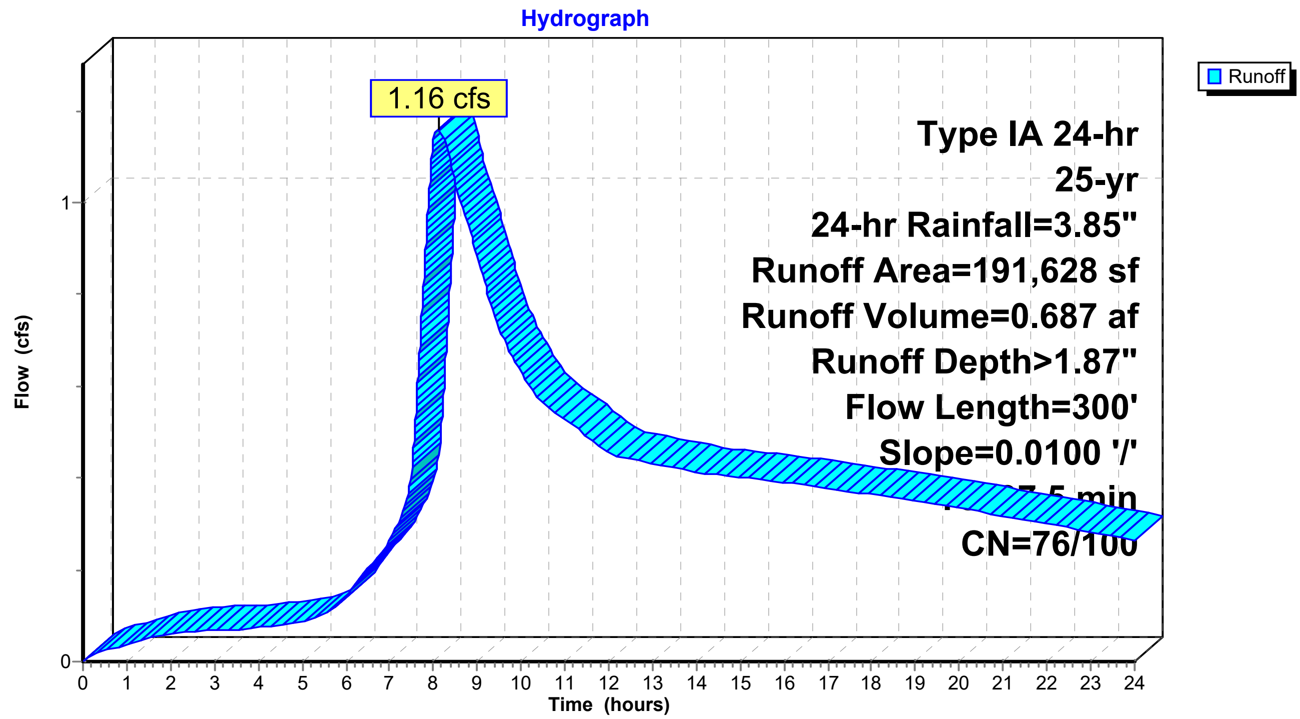
Runoff = 1.16 cfs @ 8.10 hrs, Volume= 0.687 af, Depth> 1.87"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	160,260	76	Undisturbed Forest
*	24,708	100	Wetland
*	6,660	86	Site Fill
	191,628	79	Weighted Average
	166,920	76	87.11% Pervious Area
	24,708	100	12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B6: South Wetland



Summary for Subcatchment B7: Courtyard Bypass

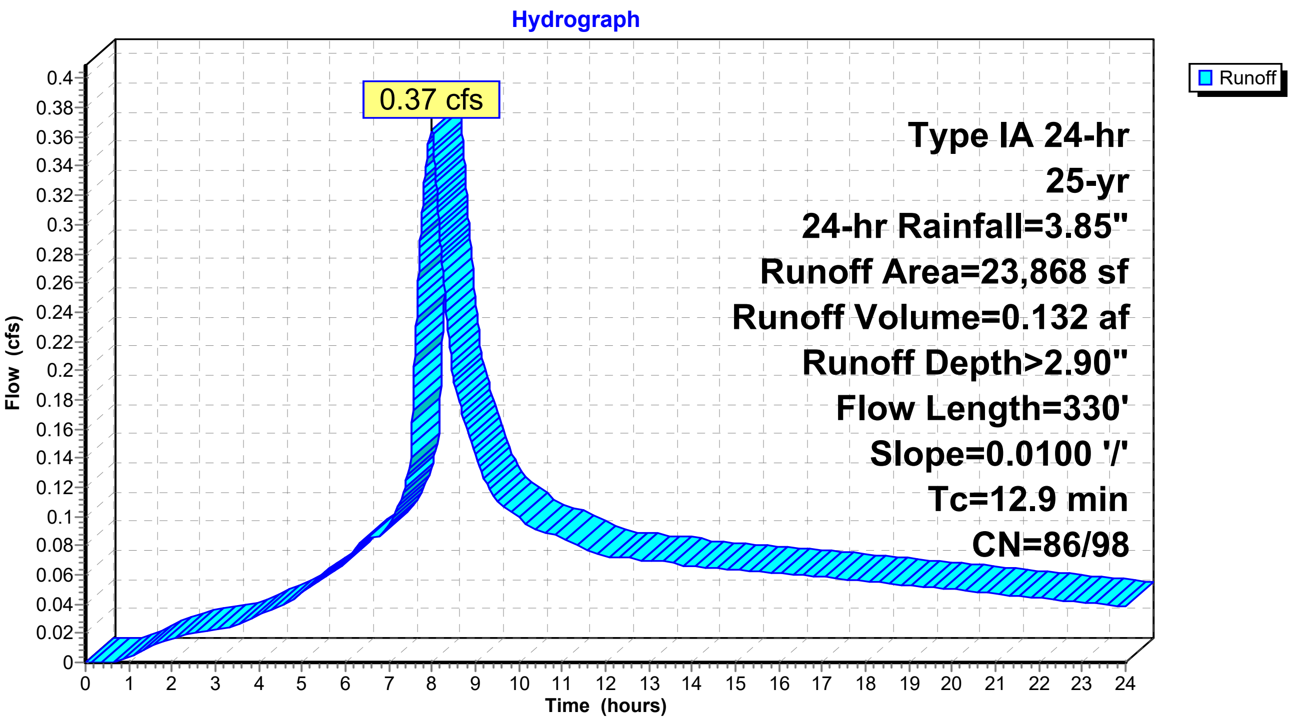
Runoff = 0.37 cfs @ 8.00 hrs, Volume= 0.132 af, Depth> 2.90"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-yr, 24-hr Rainfall=3.85"

	Area (sf)	CN	Description
*	3,390	98	Courtyard Pavement
*	13,866	86	Courtyard Landscaping
*	6,612	98	Fire Lane
	23,868	91	Weighted Average
	13,866	86	58.09% Pervious Area
	10,002	98	41.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
7.9	330	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.9	330	Total			

Subcatchment B7: Courtyard Bypass



Summary for Reach 1R: 279 LF 18"

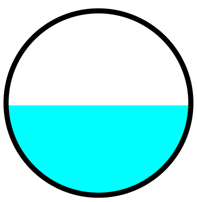
[52] Hint: Inlet/Outlet conditions not evaluated
[63] Warning: Exceeded Reach 6R INLET depth by 0.03' @ 7.55 hrs

Inflow Area = 4.082 ac, 68.69% Impervious, Inflow Depth > 3.10" for 25-yr, 24-hr event
Inflow = 2.98 cfs @ 7.91 hrs, Volume= 1.053 af
Outflow = 2.98 cfs @ 7.93 hrs, Volume= 1.052 af, Atten= 0%, Lag= 1.0 min

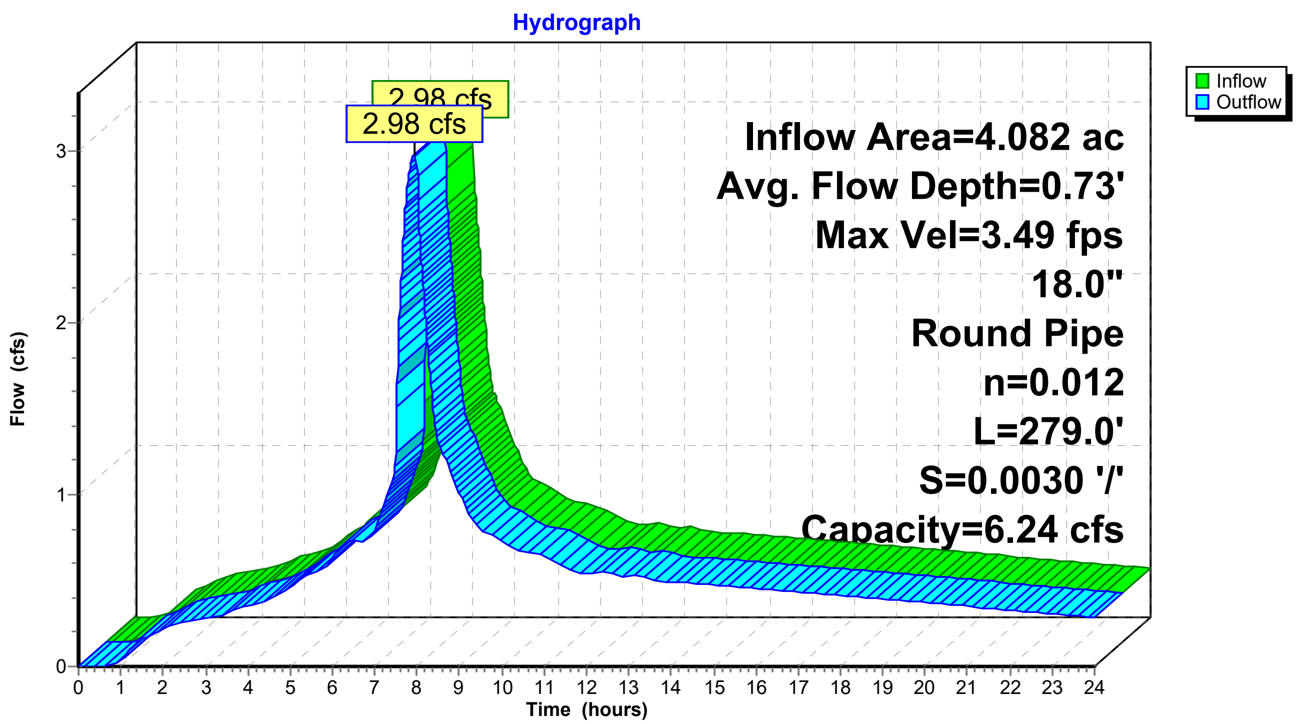
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.49 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 2.2 min

Peak Storage= 238 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.24 cfs

18.0" Round Pipe
n= 0.012
Length= 279.0' Slope= 0.0030 '/'
Inlet Invert= 132.54', Outlet Invert= 131.70'



Reach 1R: 279 LF 18"



Summary for Reach 3R: 134 LF 12"

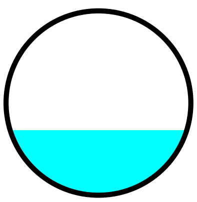
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 16R outlet invert by 0.25' @ 7.93 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 3.56" for 25-yr, 24-hr event
Inflow = 0.86 cfs @ 7.92 hrs, Volume= 0.285 af
Outflow = 0.86 cfs @ 7.93 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.5 min

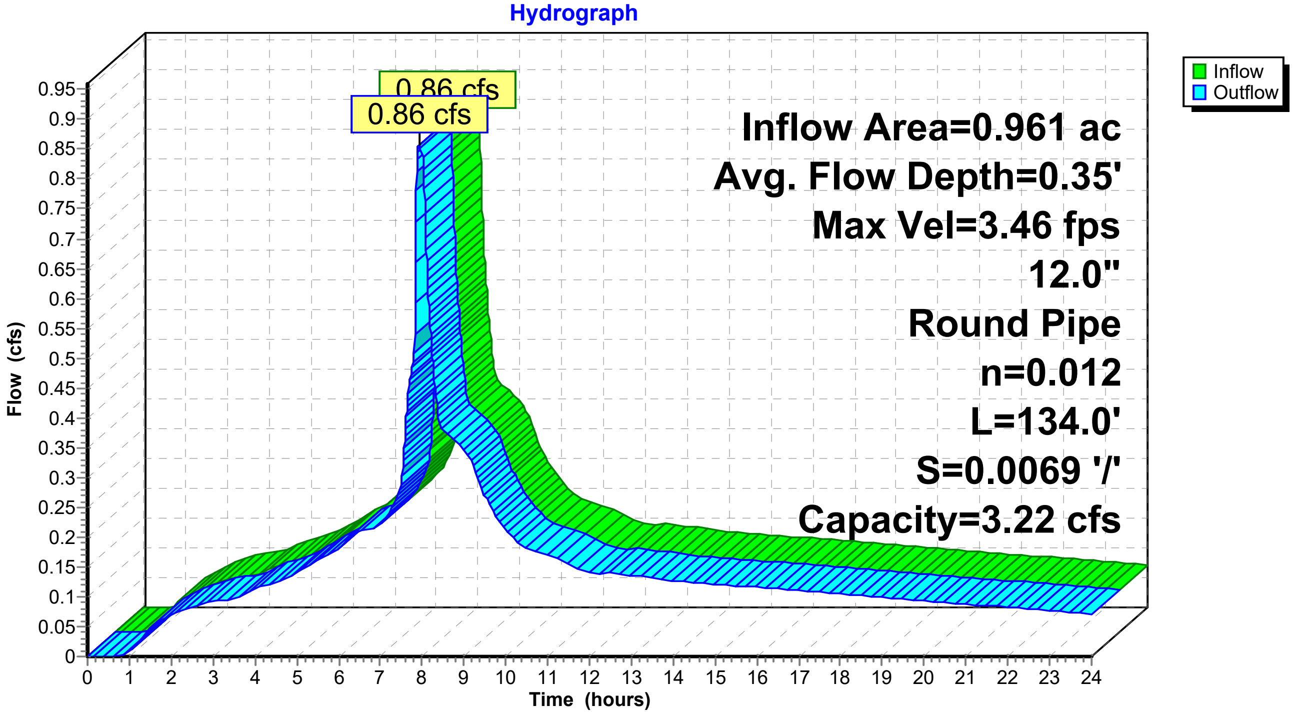
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.46 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.99 fps, Avg. Travel Time= 1.1 min

Peak Storage= 33 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.22 cfs

12.0" Round Pipe
n= 0.012
Length= 134.0' Slope= 0.0069 '/'
Inlet Invert= 132.46', Outlet Invert= 131.53'



Reach 3R: 134 LF 12"



Summary for Reach 4R: 56 LF 12"

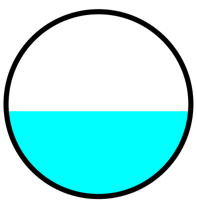
[52] Hint: Inlet/Outlet conditions not evaluated

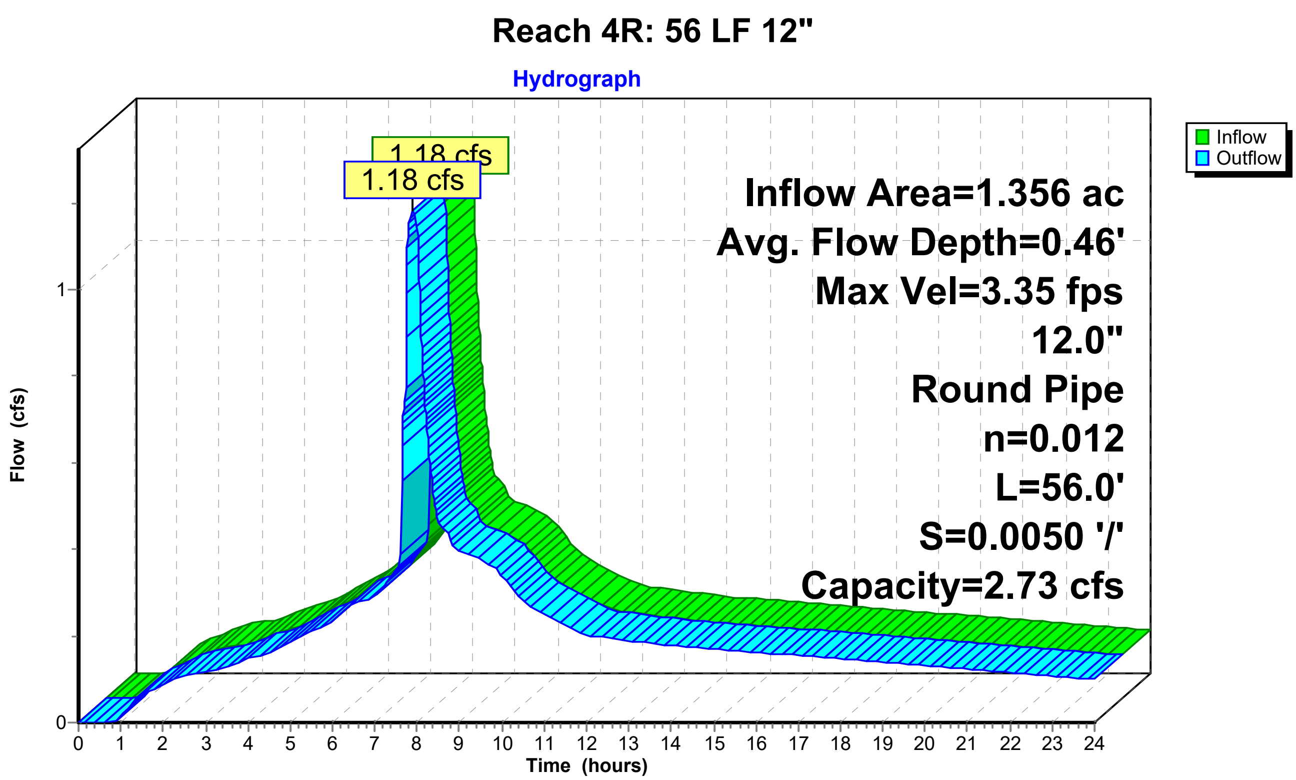
Inflow Area = 1.356 ac, 89.41% Impervious, Inflow Depth > 3.47" for 25-yr, 24-hr event
Inflow = 1.18 cfs @ 7.89 hrs, Volume= 0.392 af
Outflow = 1.18 cfs @ 7.90 hrs, Volume= 0.392 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.35 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 0.5 min

Peak Storage= 20 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.73 cfs

12.0" Round Pipe
n= 0.012
Length= 56.0' Slope= 0.0050 '/'
Inlet Invert= 132.63', Outlet Invert= 132.35'





Summary for Reach 5R: 70 LF 12"

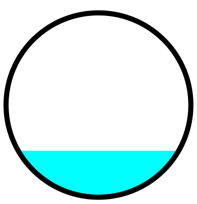
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 8R outlet invert by 0.25' @ 7.91 hrs

Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 3.25" for 25-yr, 24-hr event
Inflow = 0.45 cfs @ 7.90 hrs, Volume= 0.149 af
Outflow = 0.45 cfs @ 7.91 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.3 min

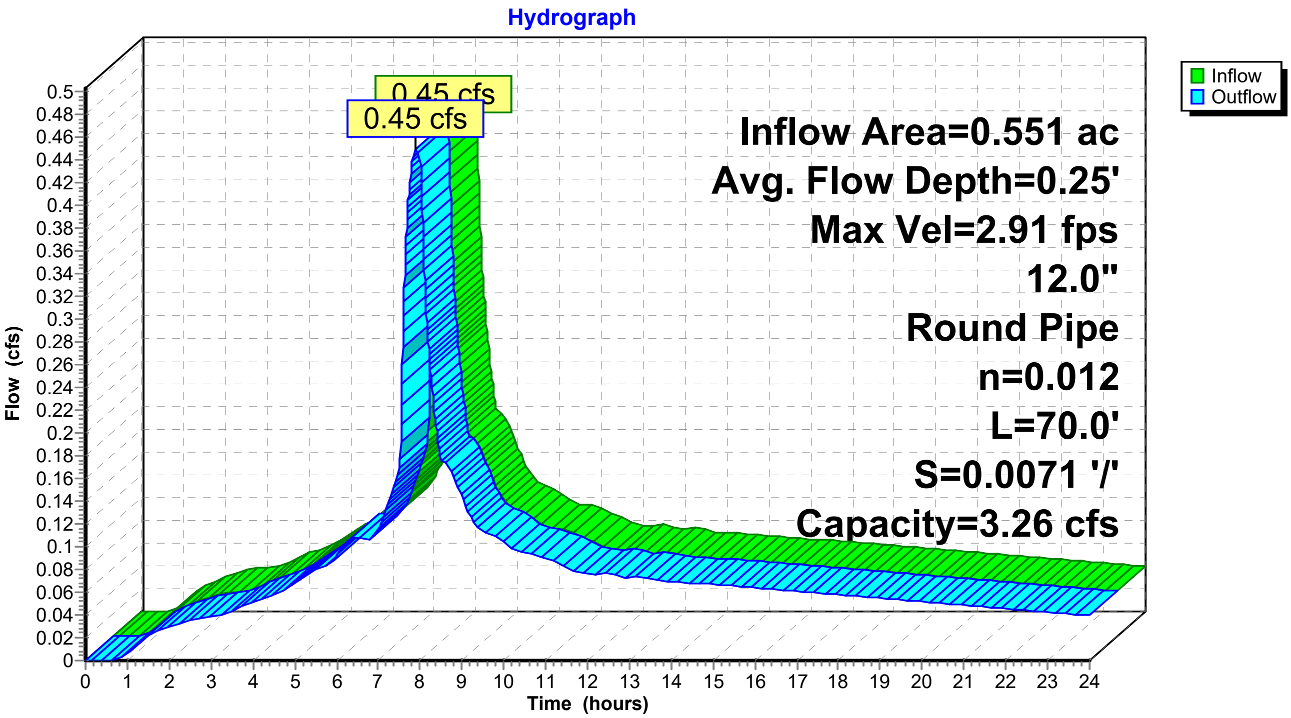
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.91 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.66 fps, Avg. Travel Time= 0.7 min

Peak Storage= 11 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.26 cfs

12.0" Round Pipe
n= 0.012
Length= 70.0' Slope= 0.0071 '/'
Inlet Invert= 133.15', Outlet Invert= 132.65'



Reach 5R: 70 LF 12"



Summary for Reach 6R: 38 LF 12"

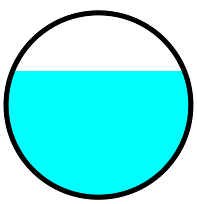
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.44' @ 8.02 hrs

Inflow Area = 2.578 ac, 50.43% Impervious, Inflow Depth > 2.79" for 25-yr, 24-hr event
Inflow = 1.69 cfs @ 8.00 hrs, Volume= 0.600 af
Outflow = 1.69 cfs @ 8.00 hrs, Volume= 0.600 af, Atten= 0%, Lag= 0.2 min

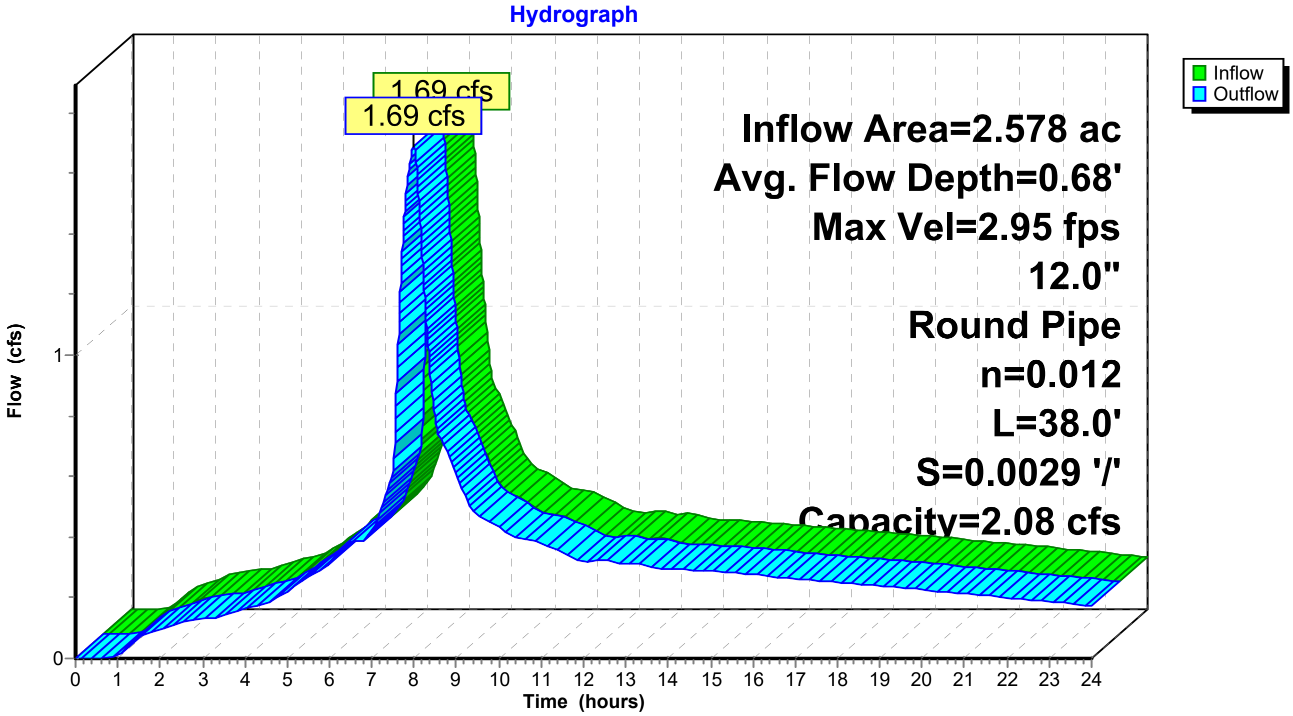
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.95 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.81 fps, Avg. Travel Time= 0.4 min

Peak Storage= 22 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.08 cfs

12.0" Round Pipe
n= 0.012
Length= 38.0' Slope= 0.0029 '/'
Inlet Invert= 132.65', Outlet Invert= 132.54'



Reach 6R: 38 LF 12"



Summary for Reach 7R: 107 LF 12"

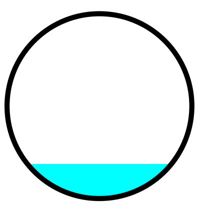
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 3.30" for 25-yr, 24-hr event
Inflow = 0.25 cfs @ 8.15 hrs, Volume= 0.135 af
Outflow = 0.25 cfs @ 8.16 hrs, Volume= 0.135 af, Atten= 0%, Lag= 0.5 min

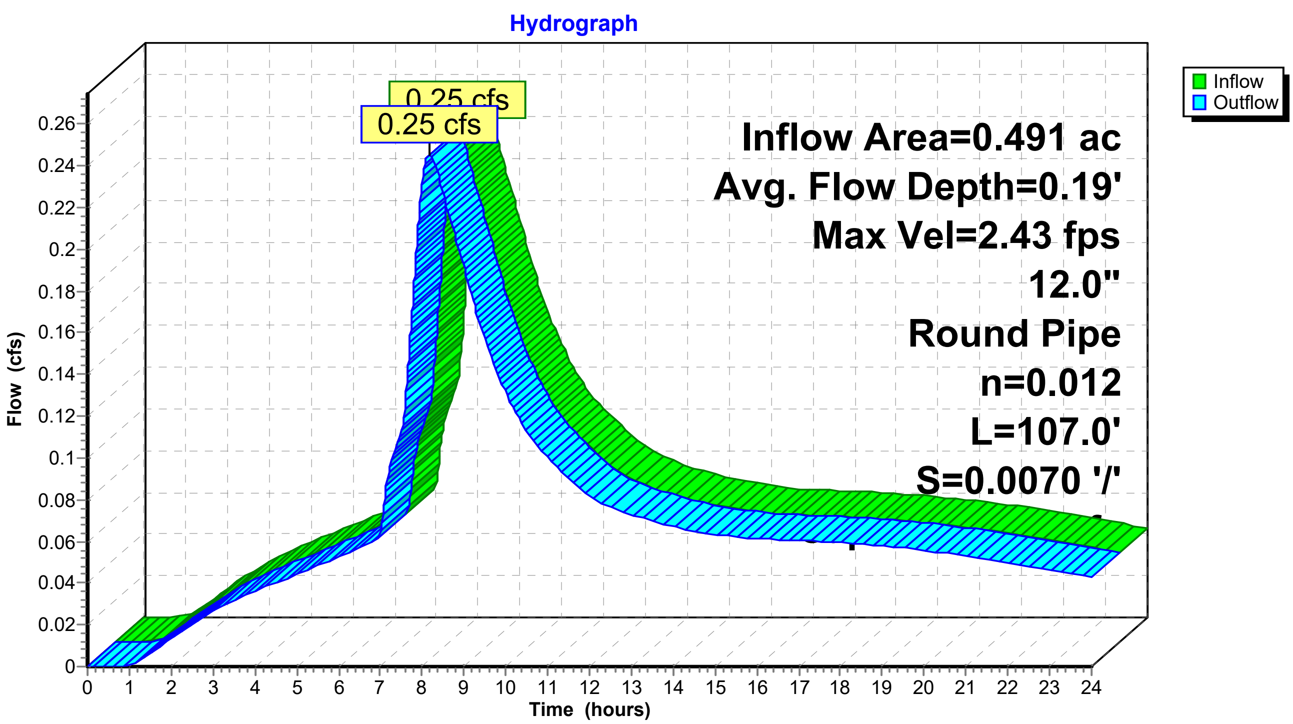
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.43 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.59 fps, Avg. Travel Time= 1.1 min

Peak Storage= 11 cf @ 8.16 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.23 cfs

12.0" Round Pipe
n= 0.012
Length= 107.0' Slope= 0.0070 '/'
Inlet Invert= 131.42', Outlet Invert= 130.67'



Reach 7R: 107 LF 12"



Summary for Reach 8R: 170 LF 12"

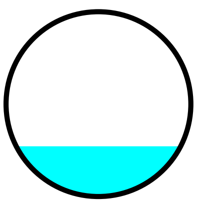
[52] Hint: Inlet/Outlet conditions not evaluated

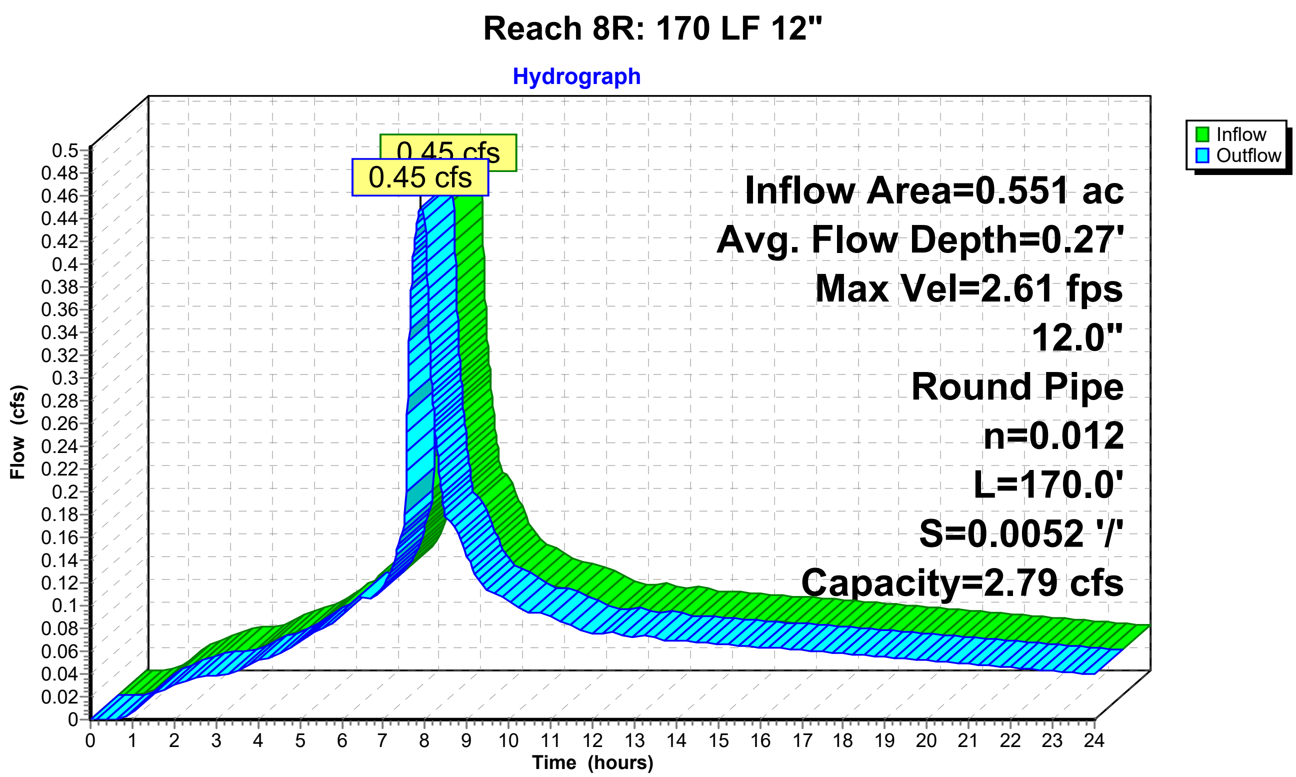
Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 3.26" for 25-yr, 24-hr event
Inflow = 0.45 cfs @ 7.89 hrs, Volume= 0.150 af
Outflow = 0.45 cfs @ 7.90 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.61 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 1.9 min

Peak Storage= 29 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.79 cfs

12.0" Round Pipe
n= 0.012
Length= 170.0' Slope= 0.0052 '/'
Inlet Invert= 134.04', Outlet Invert= 133.15'





Summary for Reach 9R: 115 LF 12"

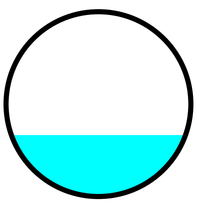
[52] Hint: Inlet/Outlet conditions not evaluated

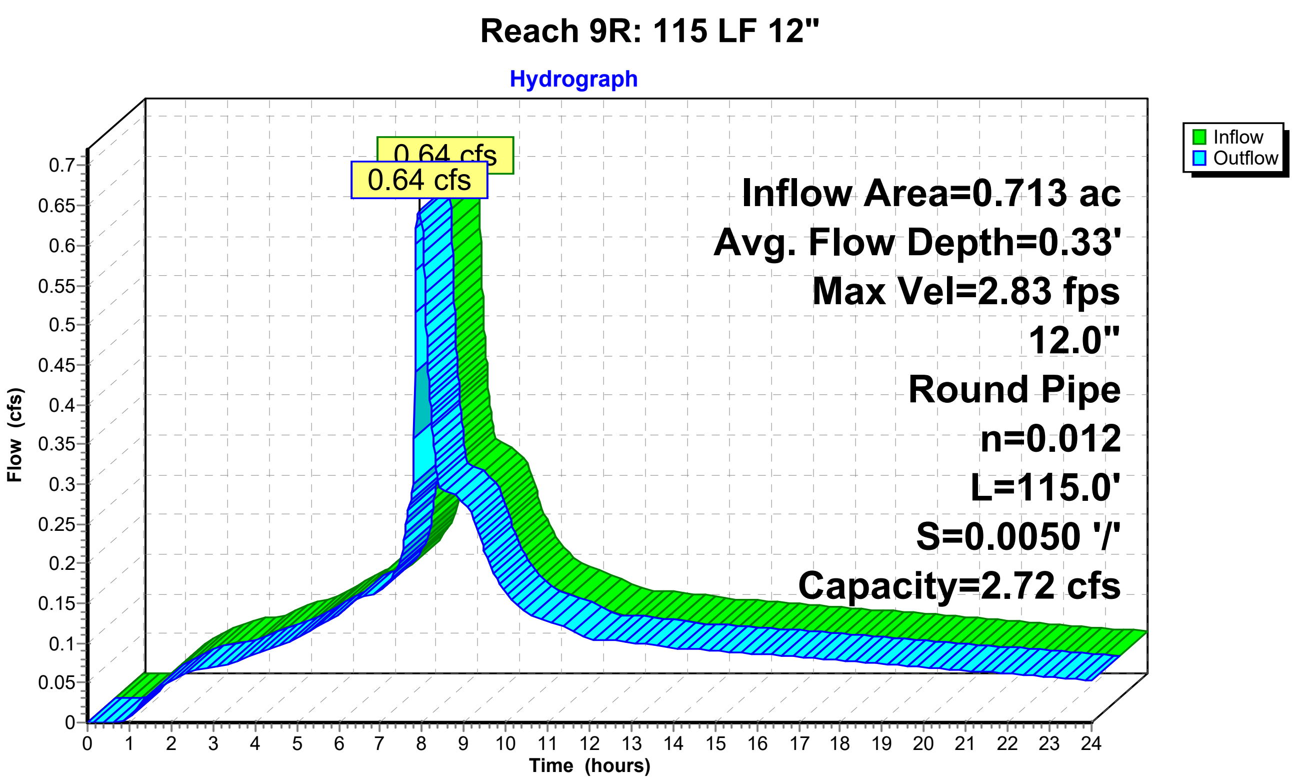
Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 3.60" for 25-yr, 24-hr event
Inflow = 0.64 cfs @ 7.90 hrs, Volume= 0.214 af
Outflow = 0.64 cfs @ 7.91 hrs, Volume= 0.214 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.83 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.63 fps, Avg. Travel Time= 1.2 min

Peak Storage= 26 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.72 cfs

12.0" Round Pipe
n= 0.012
Length= 115.0' Slope= 0.0050 '/'
Inlet Invert= 136.50', Outlet Invert= 135.93'





Summary for Reach 10R: 76 LF 12"

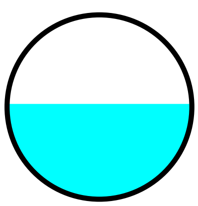
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 3R OUTLET depth by 0.09' @ 7.80 hrs

Inflow Area = 2.317 ac, 92.42% Impervious, Inflow Depth > 3.51" for 25-yr, 24-hr event
Inflow = 2.04 cfs @ 7.92 hrs, Volume= 0.677 af
Outflow = 2.04 cfs @ 7.92 hrs, Volume= 0.677 af, Atten= 0%, Lag= 0.2 min

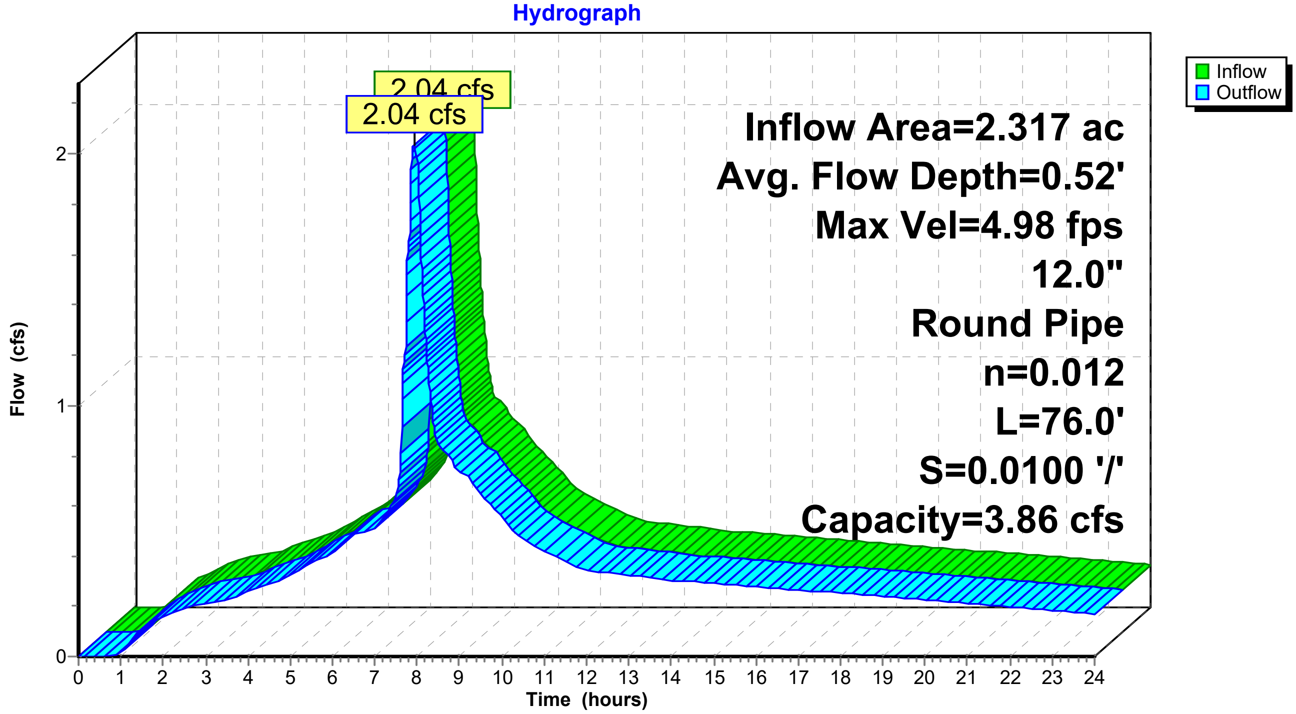
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.98 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.92 fps, Avg. Travel Time= 0.4 min

Peak Storage= 31 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.86 cfs

12.0" Round Pipe
n= 0.012
Length= 76.0' Slope= 0.0100 '/'
Inlet Invert= 131.43', Outlet Invert= 130.67'



Reach 10R: 76 LF 12"



Summary for Reach 12R: 34 LF 12"

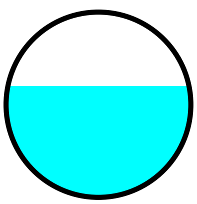
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.33' @ 7.91 hrs
[61] Hint: Exceeded Reach 10R outlet invert by 0.50' @ 7.94 hrs

Inflow Area = 2.948 ac, 88.89% Impervious, Inflow Depth > 3.45" for 25-yr, 24-hr event
Inflow = 2.31 cfs @ 7.94 hrs, Volume= 0.847 af
Outflow = 2.31 cfs @ 7.94 hrs, Volume= 0.847 af, Atten= 0%, Lag= 0.1 min

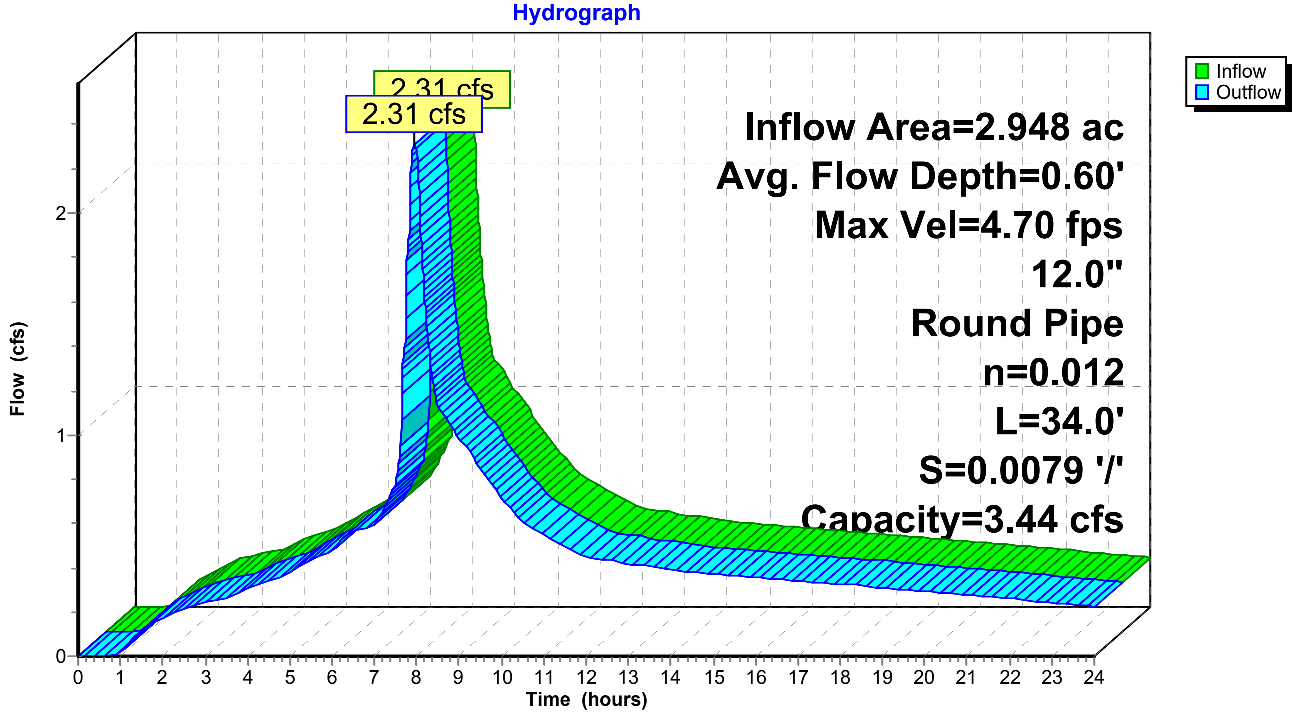
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.70 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 0.2 min

Peak Storage= 17 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.44 cfs

12.0" Round Pipe
n= 0.012
Length= 34.0' Slope= 0.0079 '/'
Inlet Invert= 130.57', Outlet Invert= 130.30'



Reach 12R: 34 LF 12"



Summary for Reach 13R: 159 LF 12"

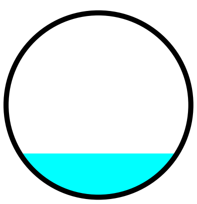
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 9R outlet invert by 0.13' @ 7.92 hrs

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 3.60" for 25-yr, 24-hr event
Inflow = 0.64 cfs @ 7.91 hrs, Volume= 0.214 af
Outflow = 0.64 cfs @ 7.92 hrs, Volume= 0.214 af, Atten= 0%, Lag= 0.5 min

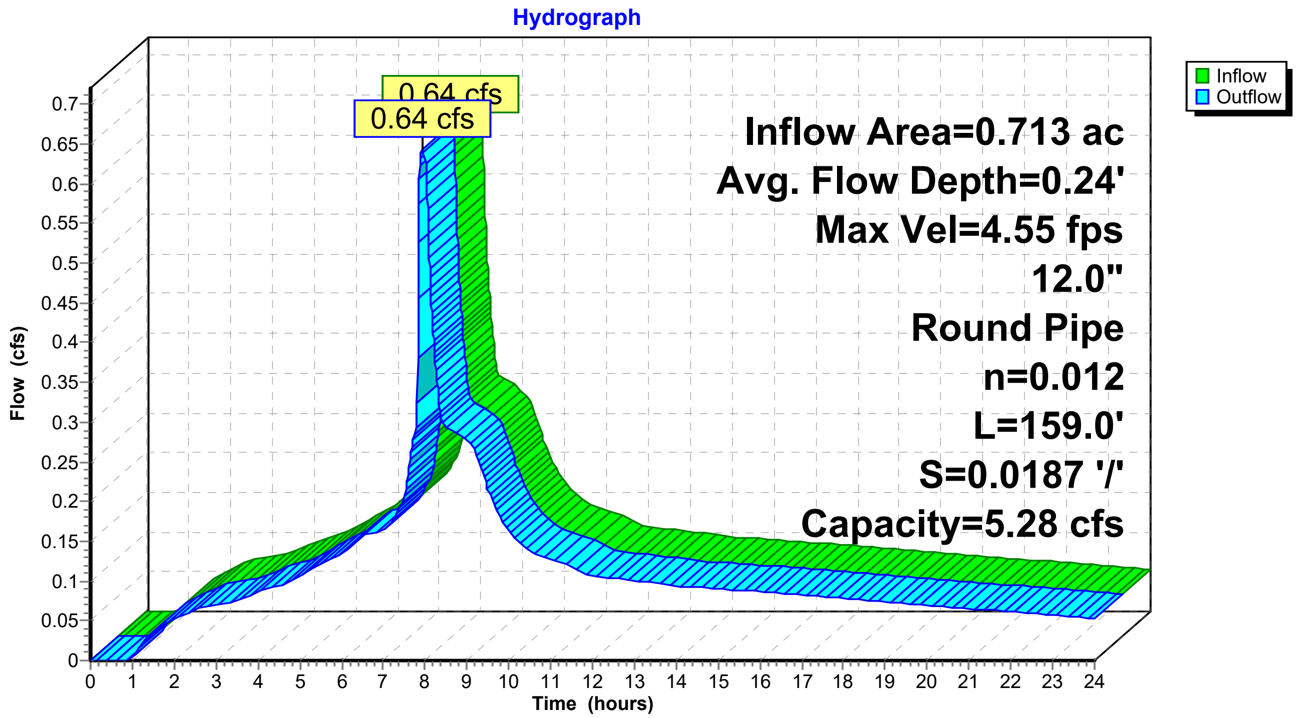
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.55 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.60 fps, Avg. Travel Time= 1.0 min

Peak Storage= 22 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.28 cfs

12.0" Round Pipe
n= 0.012
Length= 159.0' Slope= 0.0187 '/'
Inlet Invert= 135.82', Outlet Invert= 132.85'



Reach 13R: 159 LF 12"



Summary for Reach 16R: 39 LF 12"

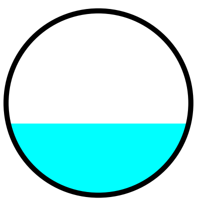
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 13R OUTLET depth by 0.05' @ 7.91 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 3.56" for 25-yr, 24-hr event
Inflow = 0.86 cfs @ 7.92 hrs, Volume= 0.285 af
Outflow = 0.86 cfs @ 7.92 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.2 min

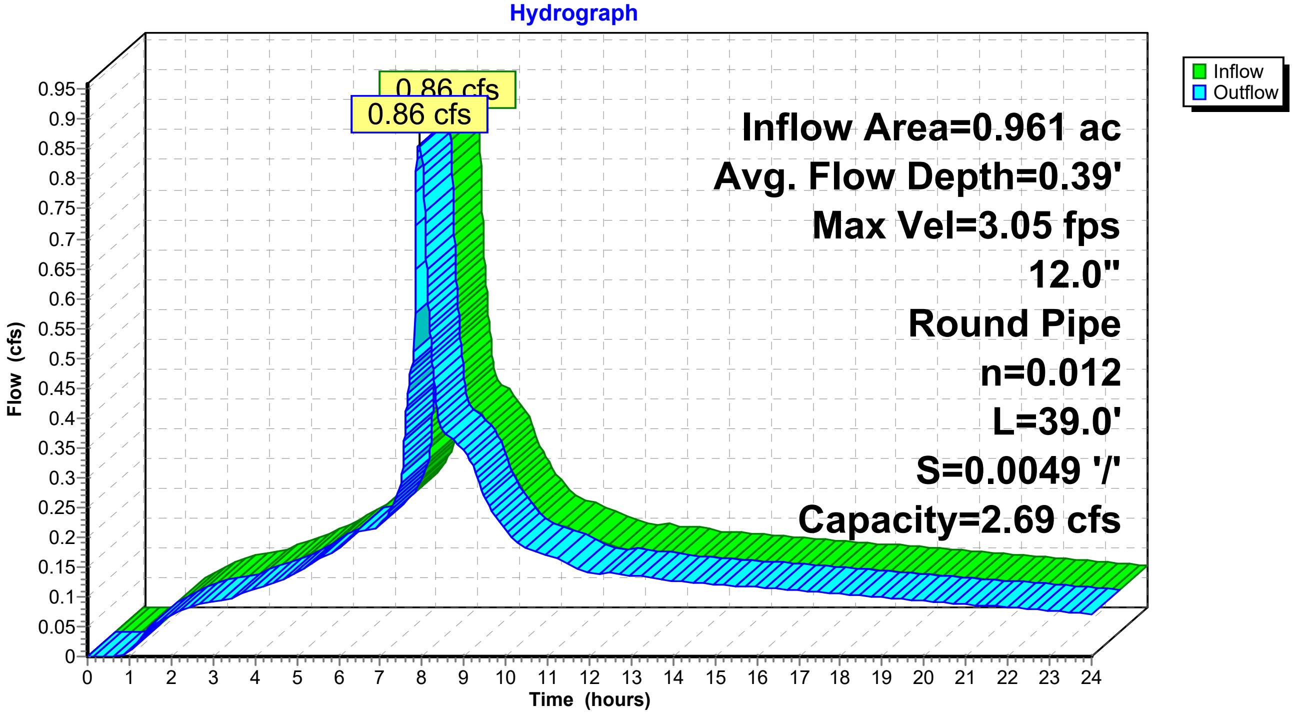
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.75 fps, Avg. Travel Time= 0.4 min

Peak Storage= 11 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.69 cfs

12.0" Round Pipe
n= 0.012
Length= 39.0' Slope= 0.0049 '/'
Inlet Invert= 132.75', Outlet Invert= 132.56'



Reach 16R: 39 LF 12"



Summary for Reach 19R: 74 LF 18"

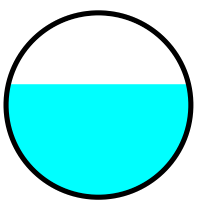
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.20' @ 8.02 hrs

Inflow Area = 6.867 ac, 51.28% Impervious, Inflow Depth > 2.87" for 25-yr, 24-hr event
Inflow = 4.10 cfs @ 7.99 hrs, Volume= 1.644 af
Outflow = 4.10 cfs @ 8.00 hrs, Volume= 1.644 af, Atten= 0%, Lag= 0.4 min

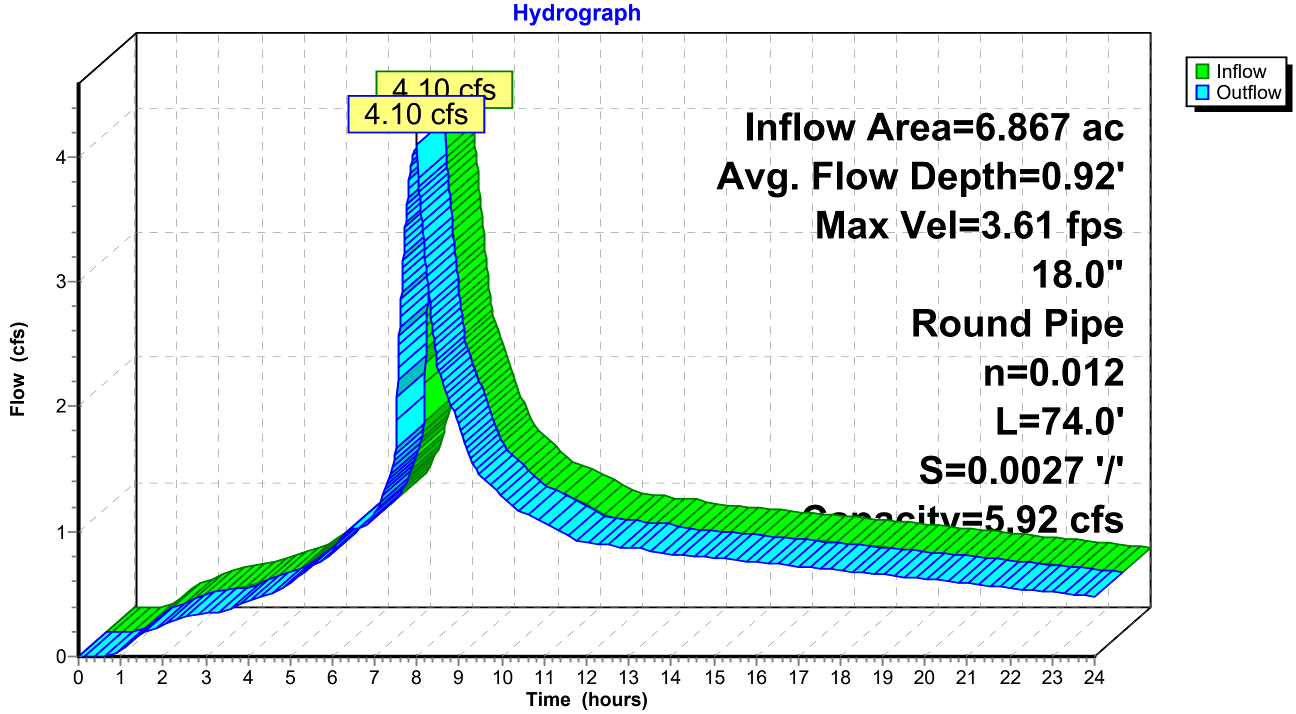
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.26 fps, Avg. Travel Time= 0.5 min

Peak Storage= 84 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 5.92 cfs

18.0" Round Pipe
n= 0.012
Length= 74.0' Slope= 0.0027 '/'
Inlet Invert= 131.70', Outlet Invert= 131.50'



Reach 19R: 74 LF 18"



Summary for Pond 1P: East Bio

Inflow Area = 2.027 ac, 44.93% Impervious, Inflow Depth > 2.68" for 25-yr, 24-hr event
Inflow = 1.32 cfs @ 7.92 hrs, Volume= 0.452 af
Outflow = 1.25 cfs @ 8.01 hrs, Volume= 0.451 af, Atten= 5%, Lag= 5.9 min
Primary = 1.25 cfs @ 8.01 hrs, Volume= 0.451 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.08' @ 8.01 hrs Surf.Area= 0.010 ac Storage= 0.010 af

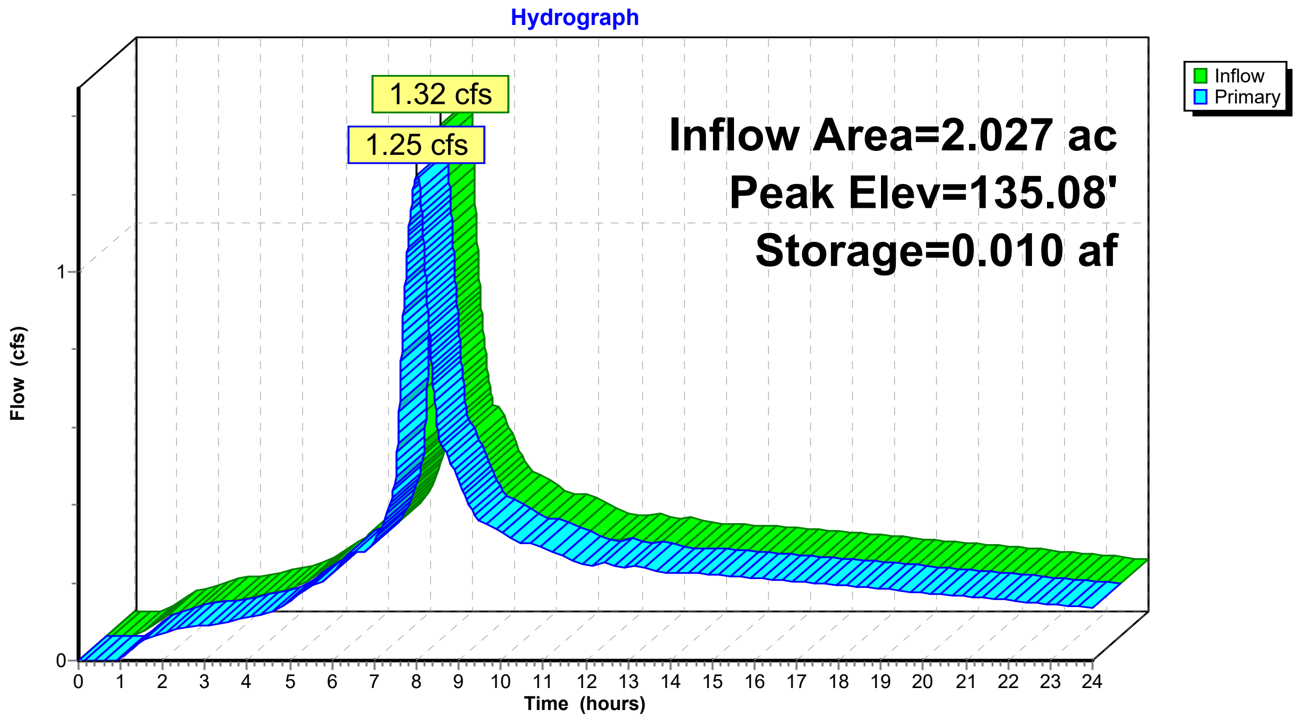
Plug-Flow detention time= 4.8 min calculated for 0.451 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (717.5 - 714.4)

Volume	Invert	Avail.Storage	Storage Description
#1	135.65'	0.012 af	**20.00'W x 20.00'L x 1.00'H Prismatoid Z=3.0**
#2	132.65'	0.012 af	**20.00'W x 22.00'L x 3.00'H Prismatoid** 0.030 af Overall x 40.0% Voids
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	136.15'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	132.65'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.25 cfs @ 8.01 hrs HW=135.08' TW=133.33' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 1.25 cfs @ 6.37 fps)

Pond 1P: East Bio



Summary for Pond 2P: West Bio 2

Inflow Area =	0.688 ac, 93.31% Impervious, Inflow Depth > 3.53" for 25-yr, 24-hr event			
Inflow =	0.61 cfs @	7.88 hrs, Volume=	0.202 af	
Outflow =	0.61 cfs @	7.89 hrs, Volume=	0.202 af,	Atten= 0%, Lag= 0.5 min
Primary =	0.61 cfs @	7.89 hrs, Volume=	0.202 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.57' @ 7.89 hrs Surf.Area= 0.009 ac Storage= 0.005 af

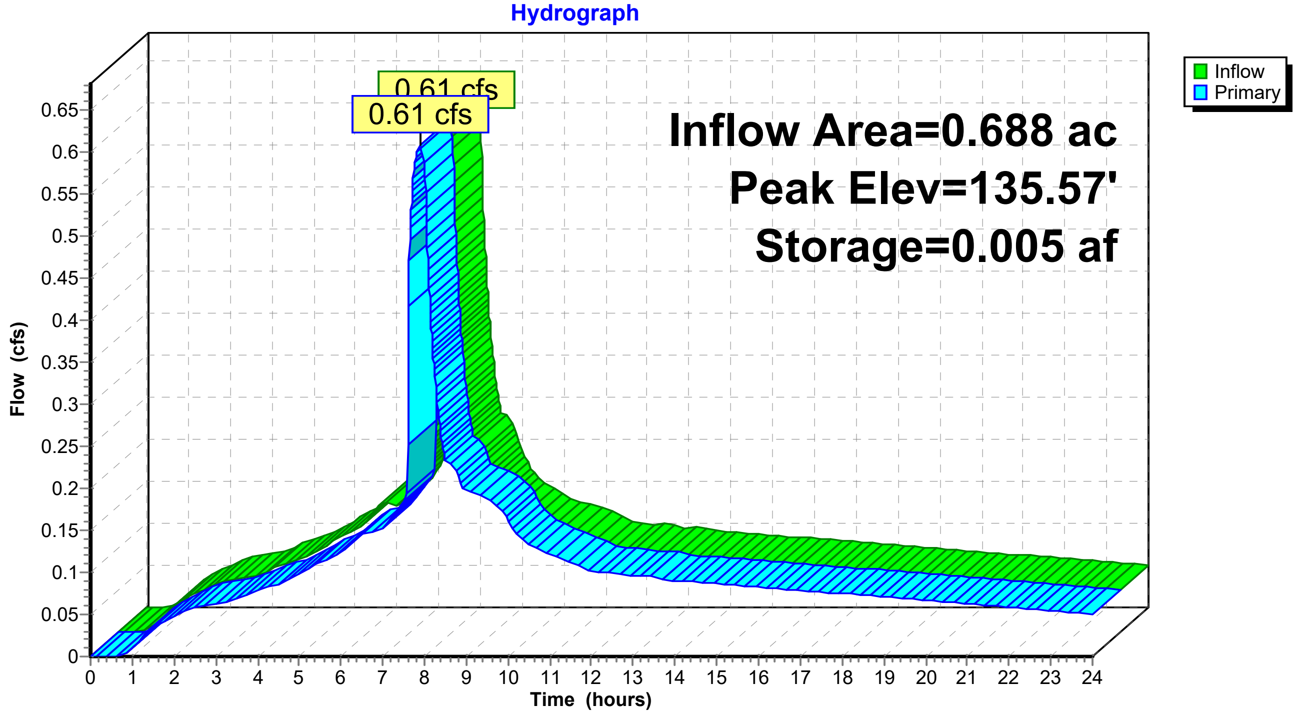
Plug-Flow detention time= 8.5 min calculated for 0.202 af (100% of inflow)
Center-of-Mass det. time= 7.1 min (670.9 - 663.8)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.006 af	**15.30'W x 10.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.003 af	**15.30'W x 10.00'L x 2.00'H Prismatoid**
			0.007 af Overall x 40.0% Voids
		0.008 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.61 cfs @ 7.89 hrs HW=135.57' TW=133.09' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 0.20 cfs @ 7.59 fps)
└─**2=Orifice/Grate** (Weir Controls 0.41 cfs @ 0.89 fps)

Pond 2P: West Bio 2



Summary for Pond 8P: North Bio

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 3.61" for 25-yr, 24-hr event
Inflow = 0.64 cfs @ 7.88 hrs, Volume= 0.214 af
Outflow = 0.64 cfs @ 7.90 hrs, Volume= 0.214 af, Atten= 0%, Lag= 1.6 min
Primary = 0.64 cfs @ 7.90 hrs, Volume= 0.214 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 145.57' @ 7.90 hrs Surf.Area= 0.017 ac Storage= 0.010 af

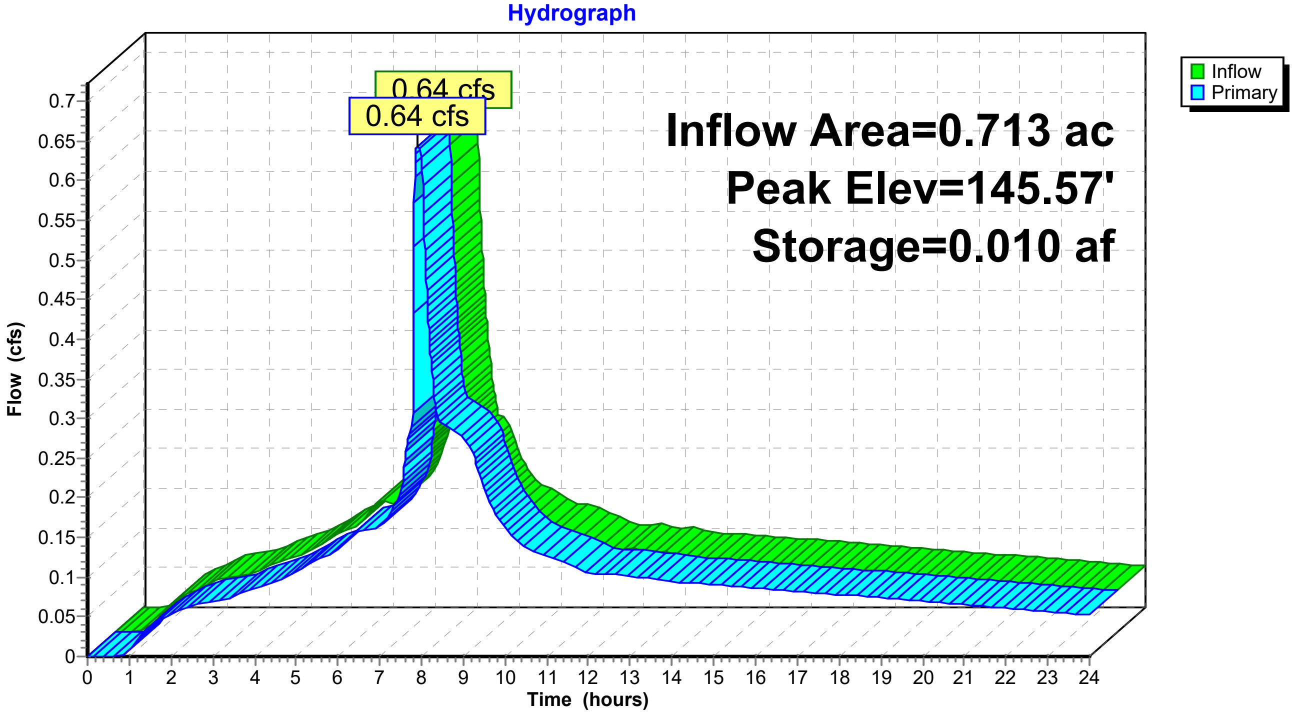
Plug-Flow detention time= 10.4 min calculated for 0.214 af (100% of inflow)
Center-of-Mass det. time= 8.6 min (667.7 - 659.1)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	0.027 af	**10.00'W x 30.00'L x 2.00'H Prismatoid Z=3.0**
#2	143.00'	0.006 af	**10.00'W x 30.00'L x 2.00'H Prismatoid** 0.014 af Overall x 40.0% Voids
		0.033 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	145.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	143.00'	**2.7" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.64 cfs @ 7.90 hrs HW=145.57' TW=136.83' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Weir Controls 0.34 cfs @ 0.84 fps)
└─**2=Orifice/Grate** (Orifice Controls 0.30 cfs @ 7.54 fps)

Pond 8P: North Bio



Summary for Pond 14P: Pond2 Emergency

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 132.00' Surf.Area= 0.323 ac Storage= 0.448 af
Peak Elev= 132.00' @ 0.00 hrs Surf.Area= 0.323 ac Storage= 0.448 af

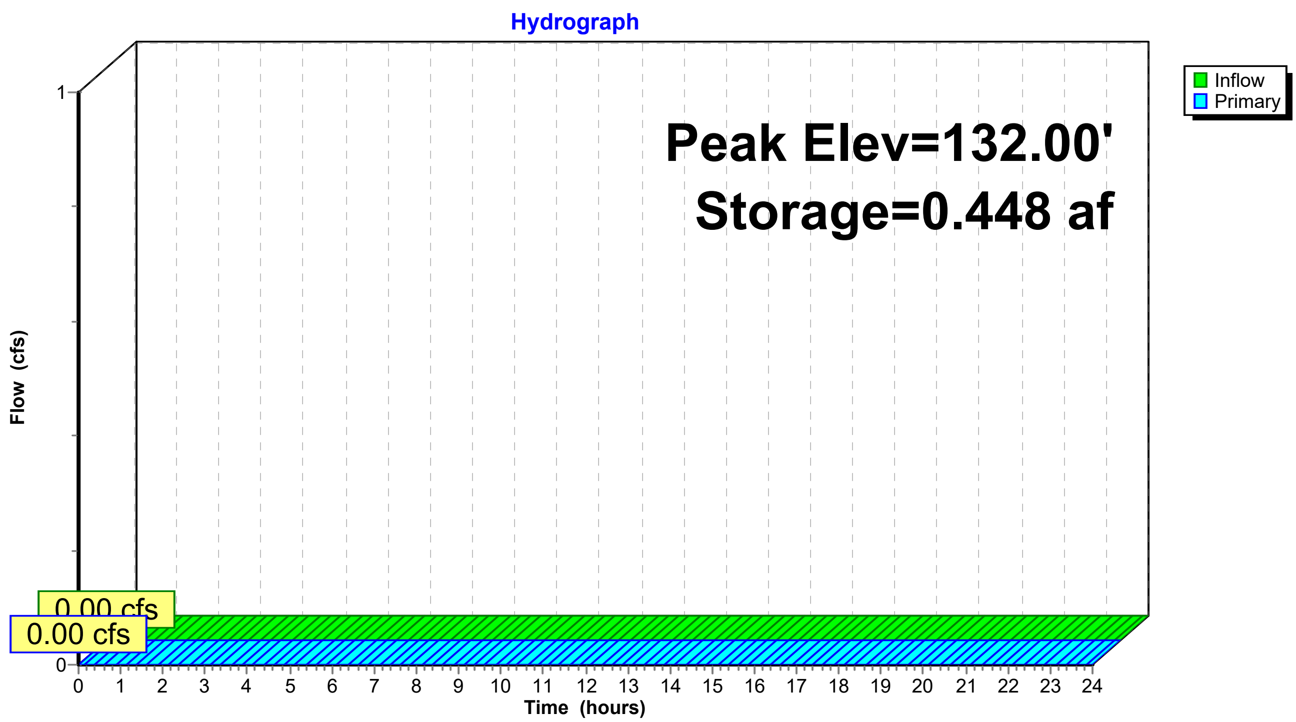
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.50'	1.791 af	**120.00'W x 100.00'L x 5.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=132.00' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: Pond2 Emergency



Summary for Pond 18R: 240 LF Bypass Culvert

[57] Hint: Peaked at 134.10' (Flood elevation advised)

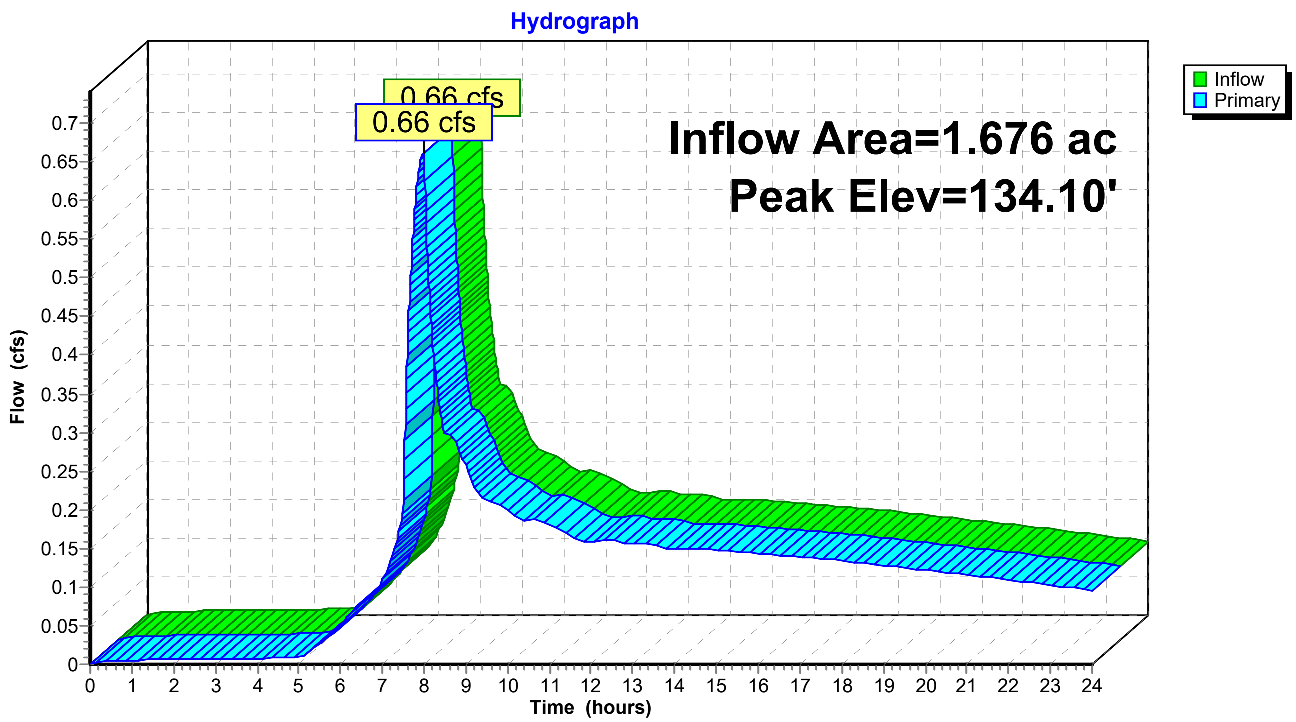
Inflow Area =	1.676 ac,	3.22% Impervious, Inflow Depth > 1.76"	for 25-yr, 24-hr event	
Inflow =	0.66 cfs @	7.98 hrs, Volume=	0.246 af	
Outflow =	0.66 cfs @	7.98 hrs, Volume=	0.246 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.66 cfs @	7.98 hrs, Volume=	0.246 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.10' @ 7.98 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=0.66 cfs @ 7.98 hrs HW=134.10' TW=127.91' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.66 cfs of 13.41 cfs potential flow)
  └─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.66 cfs @ 1.06 fps)

Pond 18R: 240 LF Bypass Culvert



Summary for Pond 20P: Courtyard Depressions

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 3.34" for 25-yr, 24-hr event
Inflow = 0.25 cfs @ 8.08 hrs, Volume= 0.137 af
Outflow = 0.25 cfs @ 8.15 hrs, Volume= 0.135 af, Atten= 0%, Lag= 4.3 min
Primary = 0.25 cfs @ 8.15 hrs, Volume= 0.135 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.54' @ 8.15 hrs Surf.Area= 0.032 ac Storage= 0.007 af

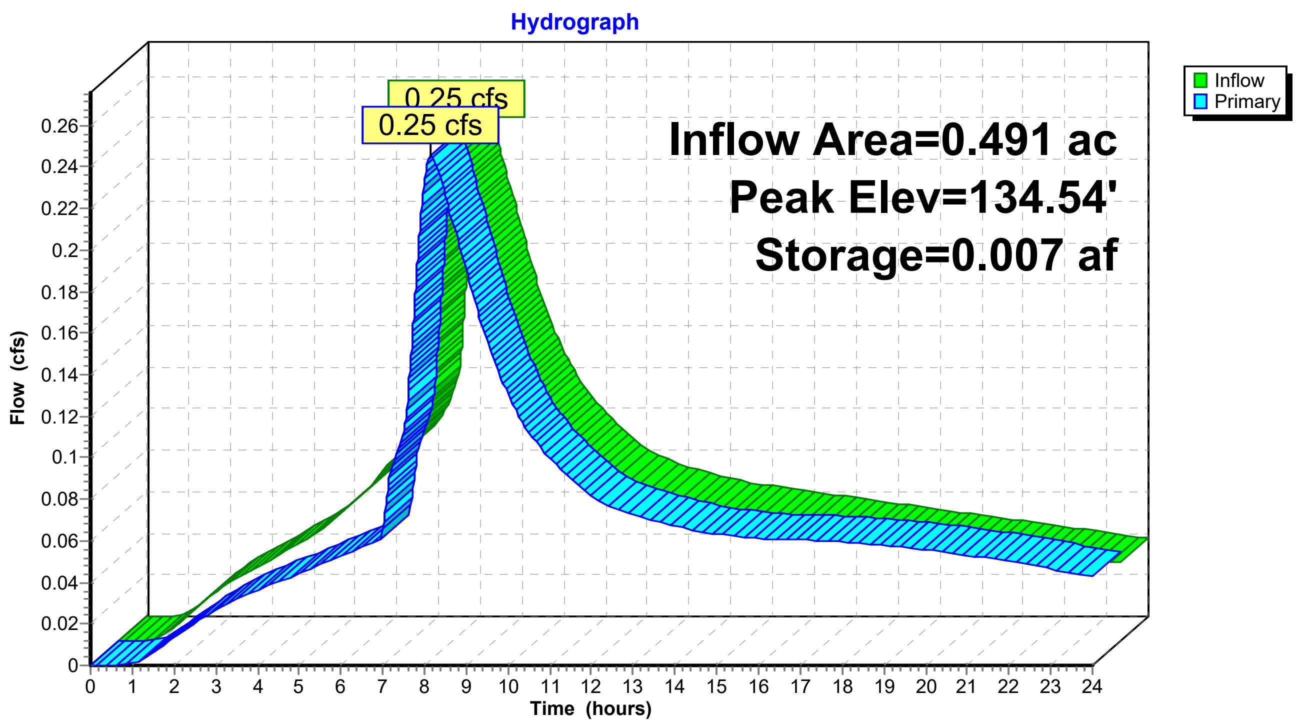
Plug-Flow detention time= 40.9 min calculated for 0.135 af (99% of inflow)
Center-of-Mass det. time= 31.9 min (736.6 - 704.7)

Volume	Invert	Avail.Storage	Storage Description
#1	134.00'	0.009 af	**5.00'W x 5.00'L x 0.60'H Prismatoid Z=30.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	134.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	134.00'	**1.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.25 cfs @ 8.15 hrs HW=134.54' TW=131.61' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 0.18 cfs @ 0.62 fps)
2=Orifice/Grate (Orifice Controls 0.06 cfs @ 3.08 fps)

Pond 20P: Courtyard Depressions



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

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[57] Hint: Peaked at 127.93' (Flood elevation advised)

Inflow Area =	5.680 ac,	47.76% Impervious,	Inflow Depth > 2.59"	for 25-yr, 24-hr event
Inflow =	2.97 cfs @	8.05 hrs, Volume=	1.225 af	
Outflow =	2.97 cfs @	8.05 hrs, Volume=	1.225 af,	Atten= 0%, Lag= 0.0 min
Primary =	1.90 cfs @	8.05 hrs, Volume=	1.188 af	
Secondary =	1.07 cfs @	8.05 hrs, Volume=	0.037 af	

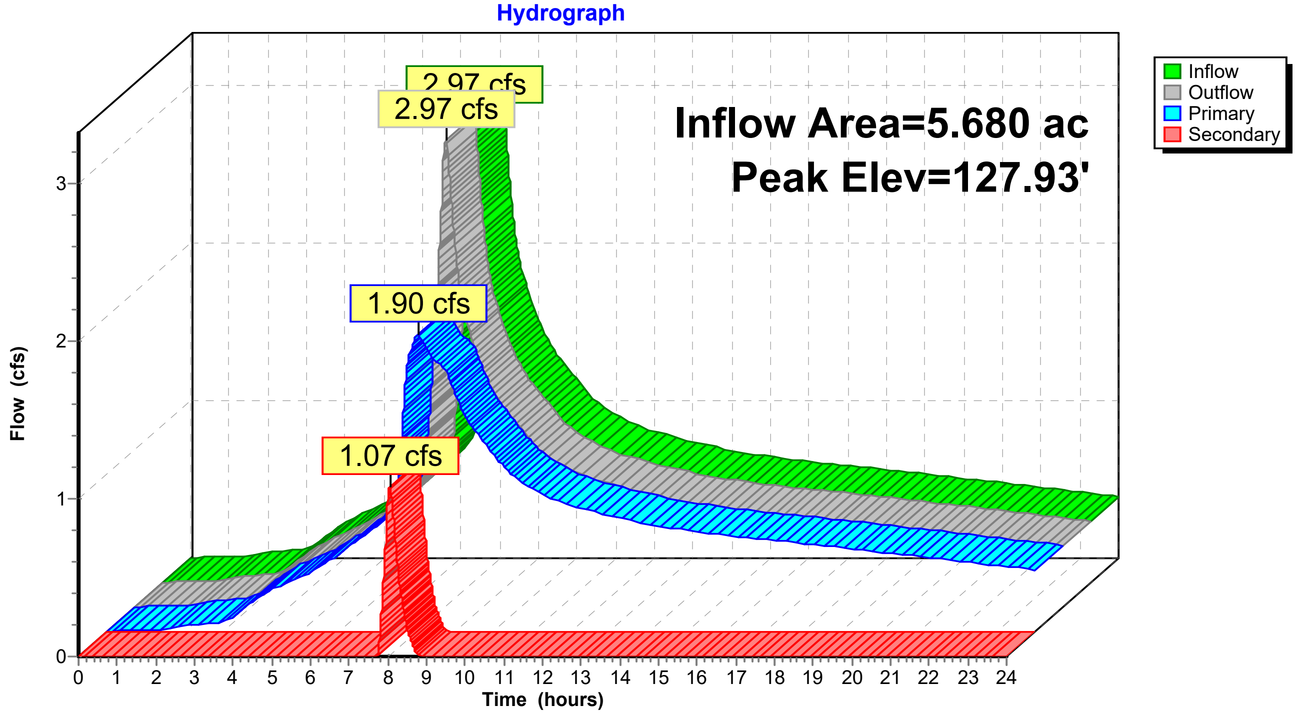
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.93' @ 8.05 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.90 cfs @ 8.05 hrs HW=127.93' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.90 cfs @ 3.48 fps)

Secondary OutFlow Max=1.07 cfs @ 8.05 hrs HW=127.93' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.07 cfs @ 0.84 fps)

Pond 25P: TDA 1 Outflow



Summary for Pond AB1: West Bio 1

Inflow Area = 0.668 ac, 85.39% Impervious, Inflow Depth > 3.43" for 25-yr, 24-hr event
Inflow = 0.57 cfs @ 7.88 hrs, Volume= 0.191 af
Outflow = 0.57 cfs @ 7.90 hrs, Volume= 0.190 af, Atten= 0%, Lag= 0.9 min
Primary = 0.57 cfs @ 7.90 hrs, Volume= 0.190 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.57' @ 7.90 hrs Surf.Area= 0.016 ac Storage= 0.010 af

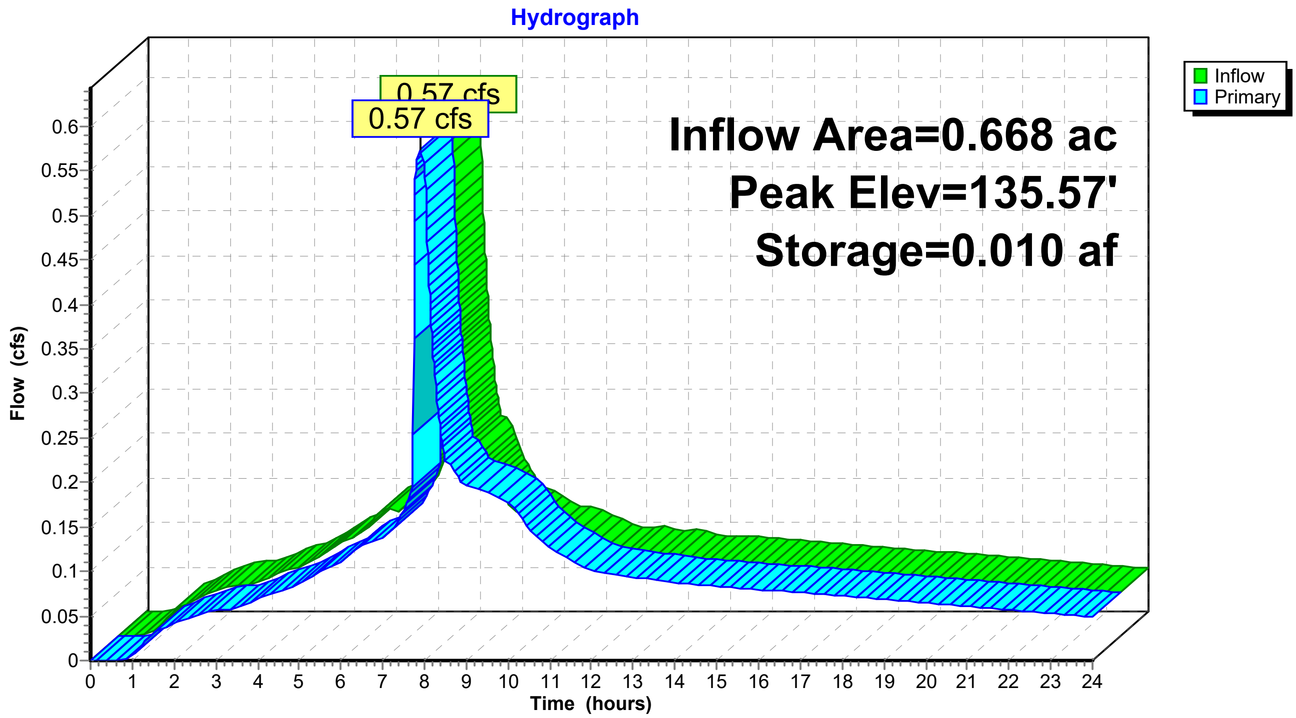
Plug-Flow detention time= 15.6 min calculated for 0.190 af (100% of inflow)
Center-of-Mass det. time= 13.1 min (682.7 - 669.5)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.009 af	**10.00'W x 28.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.005 af	**28.00'W x 10.00'L x 2.00'H Prismatoid**
			0.013 af Overall x 40.0% Voids
		0.014 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.57 cfs @ 7.90 hrs HW=135.57' TW=133.09' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.20 cfs @ 7.58 fps)
2=Orifice/Grate (Weir Controls 0.37 cfs @ 0.86 fps)

Pond AB1: West Bio 1



Summary for Pond PA: Pond1

[63] Warning: Exceeded Reach 12R INLET depth by 2.00' @ 8.31 hrs

Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 3.40" for 25-yr, 24-hr event
Inflow = 2.38 cfs @ 7.94 hrs, Volume= 0.872 af
Outflow = 2.09 cfs @ 8.07 hrs, Volume= 0.837 af, Atten= 12%, Lag= 7.9 min
Primary = 2.09 cfs @ 8.07 hrs, Volume= 0.837 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.37' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 133.06' @ 8.07 hrs Surf.Area= 0.063 ac Storage= 0.091 af

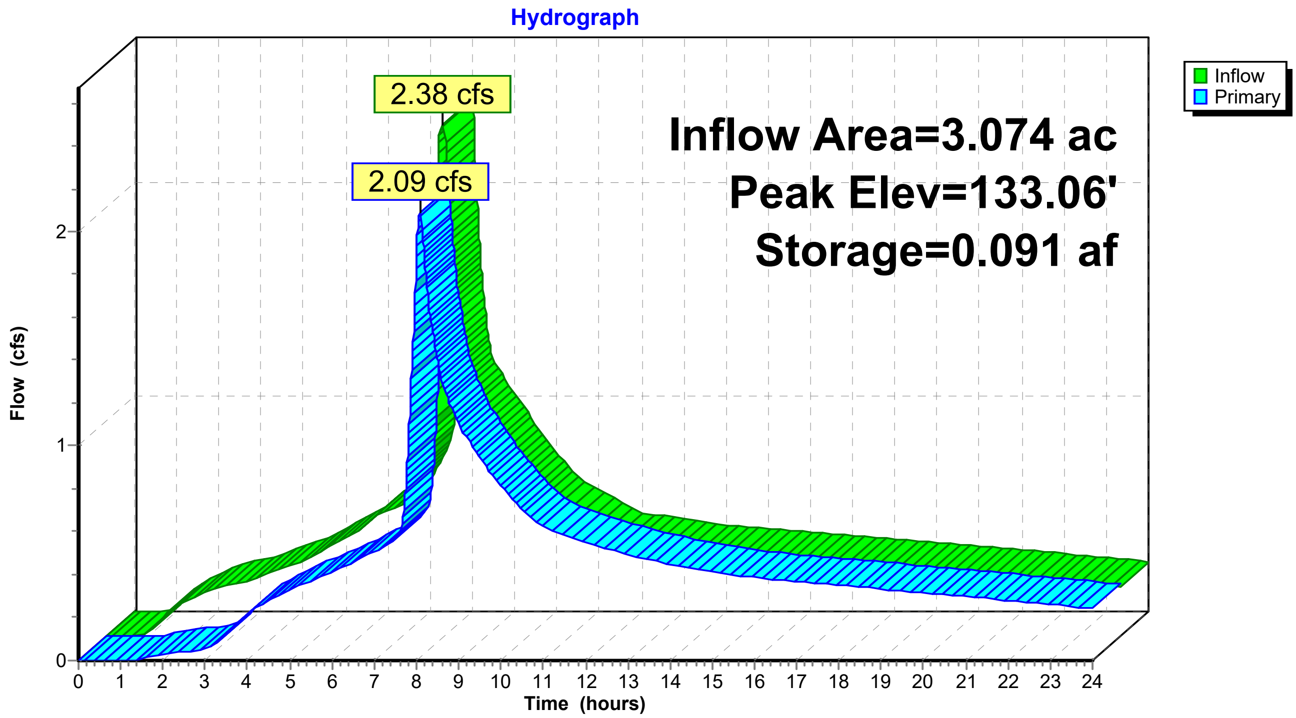
Plug-Flow detention time= 72.2 min calculated for 0.836 af (96% of inflow)
Center-of-Mass det. time= 42.7 min (731.5 - 688.8)

Volume	Invert	Avail.Storage	Storage Description
#1	131.30'	0.157 af	**42.00'W x 42.00'L x 2.70'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.60'	**1.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#2	Primary	131.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	131.30'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Primary	133.00'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.7' Crest Height

Primary OutFlow Max=2.09 cfs @ 8.07 hrs HW=133.06' TW=0.00' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.08 cfs @ 2.35 fps)
├─**2=Orifice/Grate** (Orifice Controls 0.67 cfs @ 4.94 fps)
├─**3=Orifice/Grate** (Orifice Controls 0.10 cfs @ 6.26 fps)
└─**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.23 cfs @ 0.81 fps)

Pond PA: Pond1



Summary for Pond PB: Pond2

[63] Warning: Exceeded Reach 19R INLET depth by 1.12' @ 10.09 hrs

Inflow Area = 8.602 ac, 42.69% Impervious, Inflow Depth > 2.75" for 25-yr, 24-hr event
Inflow = 4.74 cfs @ 8.00 hrs, Volume= 1.969 af
Outflow = 1.96 cfs @ 9.28 hrs, Volume= 1.597 af, Atten= 59%, Lag= 77.0 min
Primary = 1.96 cfs @ 9.28 hrs, Volume= 1.597 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.85' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 133.33' @ 9.28 hrs Surf.Area= 0.334 ac Storage= 0.556 af

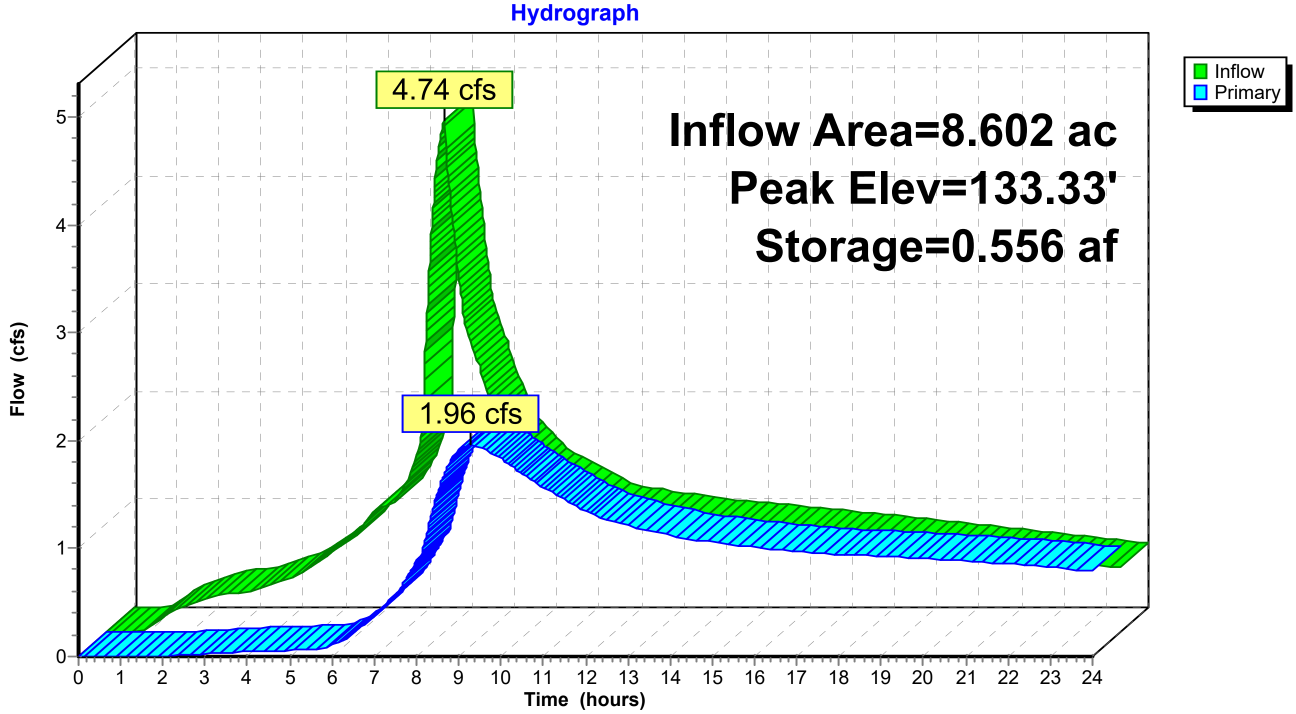
Plug-Flow detention time= 264.2 min calculated for 1.597 af (81% of inflow)
Center-of-Mass det. time= 143.1 min (866.7 - 723.6)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	0.970 af	**120.00'W x 100.00'L x 3.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	131.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.00'	**1.4' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.5' Crest Height
#4	Primary	133.47'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.6' Crest Height

Primary OutFlow Max=1.96 cfs @ 9.28 hrs HW=133.33' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.98 cfs @ 5.00 fps)
2=Orifice/Grate (Orifice Controls 0.14 cfs @ 6.36 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 0.84 cfs @ 1.92 fps)
4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond PB: Pond2

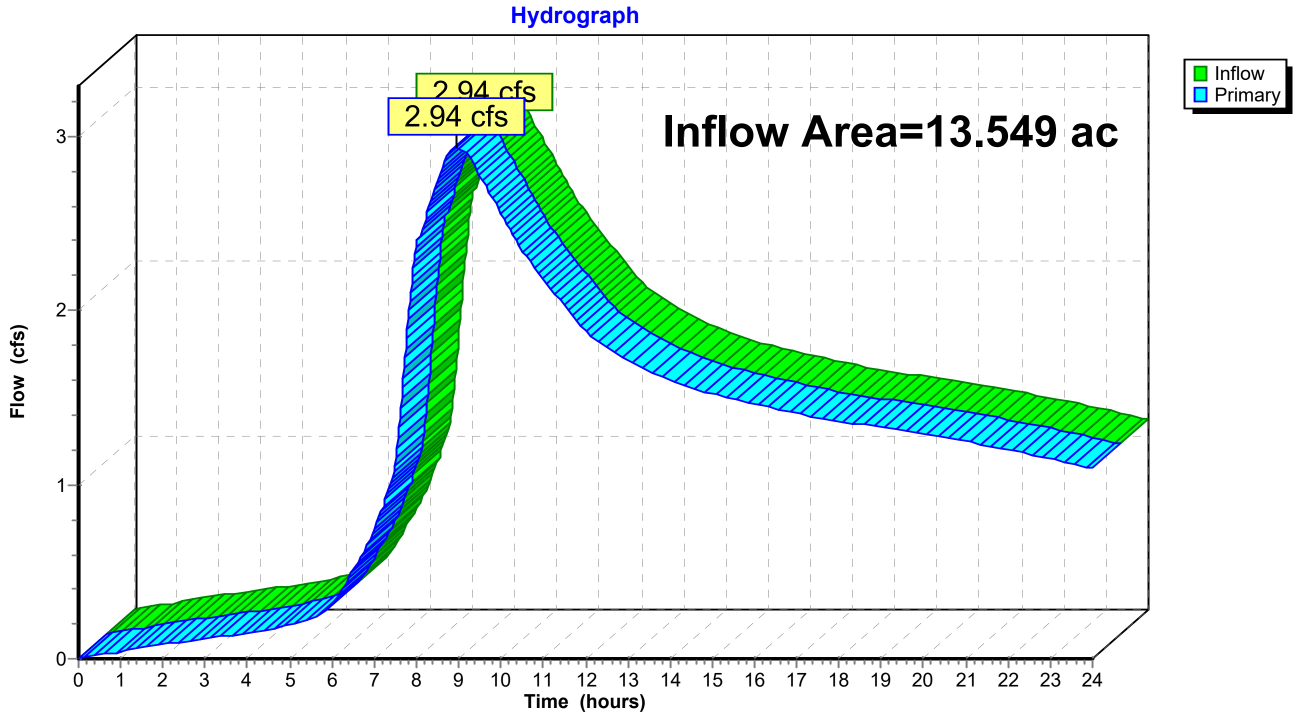


Summary for Link 11L: TDA 2 Outflow

Inflow Area = 13.549 ac, 32.99% Impervious, Inflow Depth > 2.14" for 25-yr, 24-hr event
Inflow = 2.94 cfs @ 8.97 hrs, Volume= 2.416 af
Primary = 2.94 cfs @ 8.97 hrs, Volume= 2.416 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 11L: TDA 2 Outflow

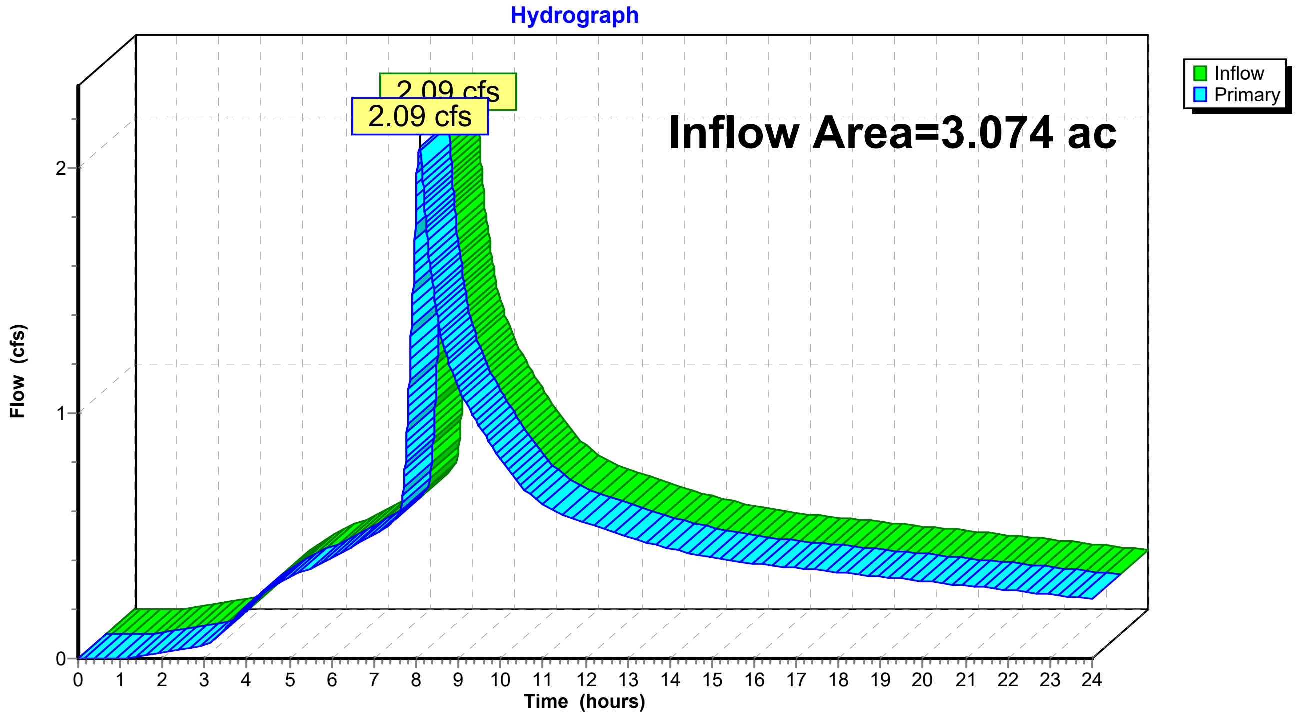


Summary for Link 12L: Site Outflow

Inflow Area =	3.074 ac, 85.24% Impervious,	Inflow Depth > 3.27"	for 25-yr, 24-hr event
Inflow =	2.09 cfs @ 8.07 hrs,	Volume=	0.837 af
Primary =	2.09 cfs @ 8.07 hrs,	Volume=	0.837 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 12L: Site Outflow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A1: Frontage Runoff Area=0.713 ac 100.00% Impervious Runoff Depth>4.26"
Tc=5.0 min CN=0/98 Runoff=0.76 cfs 0.253 af

Subcatchment A2: West Parking 1 Runoff Area=29,090 sf 85.39% Impervious Runoff Depth>4.07"
Tc=5.0 min CN=86/98 Runoff=0.68 cfs 0.227 af

Subcatchment A3: West Parking 2 Runoff Area=0.688 ac 93.31% Impervious Runoff Depth>4.17"
Tc=5.0 min CN=86/98 Runoff=0.72 cfs 0.239 af

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>2.28"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.89 cfs 0.318 af

Subcatchment A5: Courtyard 2 Runoff Area=0.248 ac 87.10% Impervious Runoff Depth>4.09"
Tc=5.0 min CN=86/98 Runoff=0.25 cfs 0.085 af

Subcatchment A6: Fire Lane Runoff Area=0.140 ac 53.57% Impervious Runoff Depth>3.60"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.08 cfs 0.042 af

Subcatchment A7: Courtyard 1 Runoff Area=0.491 ac 82.28% Impervious Runoff Depth>3.96"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.29 cfs 0.162 af

Subcatchment A8: Pond Direct Runoff Area=5,502 sf 0.00% Impervious Runoff Depth>2.99"
Tc=10.0 min CN=86/0 Runoff=0.09 cfs 0.031 af

Subcatchment A9: Vegetated/Wetland Runoff Area=40,486 sf 4.10% Impervious Runoff Depth>2.37"
Flow Length=240' Slope=0.0750 '/' Tc=14.0 min CN=78/100 Runoff=0.46 cfs 0.183 af

Subcatchment B1: East Parking Runoff Area=88,300 sf 44.93% Impervious Runoff Depth>3.26"
Tc=5.0 min CN=80/98 Runoff=1.62 cfs 0.552 af

Subcatchment B2: Courtyard 3 Runoff Area=24,008 sf 70.66% Impervious Runoff Depth>3.89"
Tc=5.0 min CN=86/98 Runoff=0.54 cfs 0.179 af

Subcatchment B3: Building Roof Runoff Area=65,510 sf 100.00% Impervious Runoff Depth>4.26"
Tc=0.0 min CN=0/98 Runoff=1.63 cfs 0.534 af

Subcatchment B4: Field and Track Runoff Area=121,328 sf 25.76% Impervious Runoff Depth>3.14"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=84/98 Runoff=1.45 cfs 0.728 af

Subcatchment B5: Access Road and Pond Runoff Area=75,574 sf 8.72% Impervious Runoff Depth>2.82"
Flow Length=260' Slope=0.0100 '/' Tc=33.5 min CN=83/98 Runoff=0.83 cfs 0.407 af

Subcatchment B6: South Wetland Runoff Area=191,628 sf 12.89% Impervious Runoff Depth>2.39"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=76/100 Runoff=1.55 cfs 0.876 af

Subcatchment B7: Courtyard Bypass Runoff Area=23,868 sf 41.91% Impervious Runoff Depth>3.51"
Flow Length=330' Slope=0.0100 '/' Tc=12.9 min CN=86/98 Runoff=0.44 cfs 0.160 af

Reach 1R: 279 LF 18" Avg. Flow Depth=0.81' Max Vel=3.64 fps Inflow=3.54 cfs 1.263 af
18.0" Round Pipe n=0.012 L=279.0' S=0.0030 '/' Capacity=6.24 cfs Outflow=3.53 cfs 1.262 af

Reach 3R: 134 LF 12" Avg. Flow Depth=0.38' Max Vel=3.62 fps Inflow=1.01 cfs 0.337 af
12.0" Round Pipe n=0.012 L=134.0' S=0.0069 '/' Capacity=3.22 cfs Outflow=1.01 cfs 0.337 af

Reach 4R: 56 LF 12" Avg. Flow Depth=0.51' Max Vel=3.49 fps Inflow=1.39 cfs 0.465 af
12.0" Round Pipe n=0.012 L=56.0' S=0.0050 '/' Capacity=2.73 cfs Outflow=1.39 cfs 0.465 af

Reach 5R: 70 LF 12" Avg. Flow Depth=0.27' Max Vel=3.07 fps Inflow=0.54 cfs 0.178 af
12.0" Round Pipe n=0.012 L=70.0' S=0.0071 '/' Capacity=3.26 cfs Outflow=0.54 cfs 0.178 af

Reach 6R: 38 LF 12" Avg. Flow Depth=0.78' Max Vel=3.01 fps Inflow=1.99 cfs 0.729 af
12.0" Round Pipe n=0.012 L=38.0' S=0.0029 '/' Capacity=2.08 cfs Outflow=1.98 cfs 0.729 af

Reach 7R: 107 LF 12" Avg. Flow Depth=0.20' Max Vel=2.55 fps Inflow=0.29 cfs 0.159 af
12.0" Round Pipe n=0.012 L=107.0' S=0.0070 '/' Capacity=3.23 cfs Outflow=0.29 cfs 0.159 af

Reach 8R: 170 LF 12" Avg. Flow Depth=0.30' Max Vel=2.74 fps Inflow=0.54 cfs 0.179 af
12.0" Round Pipe n=0.012 L=170.0' S=0.0052 '/' Capacity=2.79 cfs Outflow=0.54 cfs 0.178 af

Reach 9R: 115 LF 12" Avg. Flow Depth=0.36' Max Vel=2.96 fps Inflow=0.76 cfs 0.252 af
12.0" Round Pipe n=0.012 L=115.0' S=0.0050 '/' Capacity=2.72 cfs Outflow=0.76 cfs 0.252 af

Reach 10R: 76 LF 12" Avg. Flow Depth=0.57' Max Vel=5.18 fps Inflow=2.40 cfs 0.801 af
12.0" Round Pipe n=0.012 L=76.0' S=0.0100 '/' Capacity=3.86 cfs Outflow=2.40 cfs 0.801 af

Reach 12R: 34 LF 12" Avg. Flow Depth=0.67' Max Vel=4.86 fps Inflow=2.73 cfs 1.002 af
12.0" Round Pipe n=0.012 L=34.0' S=0.0079 '/' Capacity=3.44 cfs Outflow=2.73 cfs 1.002 af

Reach 13R: 159 LF 12" Avg. Flow Depth=0.26' Max Vel=4.77 fps Inflow=0.76 cfs 0.252 af
12.0" Round Pipe n=0.012 L=159.0' S=0.0187 '/' Capacity=5.28 cfs Outflow=0.76 cfs 0.252 af

Reach 16R: 39 LF 12" Avg. Flow Depth=0.42' Max Vel=3.18 fps Inflow=1.01 cfs 0.337 af
12.0" Round Pipe n=0.012 L=39.0' S=0.0049 '/' Capacity=2.69 cfs Outflow=1.01 cfs 0.337 af

Reach 19R: 74 LF 18" Avg. Flow Depth=1.04' Max Vel=3.74 fps Inflow=4.90 cfs 1.990 af
18.0" Round Pipe n=0.012 L=74.0' S=0.0027 '/' Capacity=5.92 cfs Outflow=4.90 cfs 1.990 af

Pond 1P: East Bio Peak Elev=135.84' Storage=0.014 af Inflow=1.62 cfs 0.552 af
Outflow=1.47 cfs 0.550 af

Pond 2P: West Bio 2 Peak Elev=135.59' Storage=0.006 af Inflow=0.72 cfs 0.239 af
Outflow=0.72 cfs 0.239 af

Pond 8P: North Bio Peak Elev=145.58' Storage=0.010 af Inflow=0.76 cfs 0.253 af
Outflow=0.76 cfs 0.252 af

Pond 14P: Pond2 Emergency Peak Elev=132.00' Storage=0.448 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=134.13' Inflow=0.89 cfs 0.318 af
Outflow=0.89 cfs 0.318 af

Pond 20P: Courtyard Depressions Peak Elev=134.54' Storage=0.007 af Inflow=0.29 cfs 0.162 af
Outflow=0.29 cfs 0.159 af

Pond 25P: TDA 1 Outflow Peak Elev=128.00' Inflow=4.06 cfs 1.498 af
Primary=2.02 cfs 1.408 af Secondary=2.05 cfs 0.090 af Outflow=4.06 cfs 1.498 af

Pond AB1: West Bio 1 Peak Elev=135.58' Storage=0.010 af Inflow=0.68 cfs 0.227 af
Outflow=0.68 cfs 0.226 af

Pond PA: Pond1 Peak Elev=133.12' Storage=0.094 af Inflow=2.82 cfs 1.033 af
Outflow=2.73 cfs 0.996 af

Pond PB: Pond2 Peak Elev=133.51' Storage=0.616 af Inflow=5.73 cfs 2.397 af
Outflow=2.90 cfs 1.978 af

Link 11L: TDA 2 Outflow Inflow=4.32 cfs 3.015 af
Primary=4.32 cfs 3.015 af

Link 12L: Site Outflow Inflow=2.73 cfs 0.996 af
Primary=2.73 cfs 0.996 af

Total Runoff Area = 19.229 ac Runoff Volume = 4.977 af Average Runoff Depth = 3.11"
62.65% Pervious = 12.047 ac 37.35% Impervious = 7.182 ac

Summary for Subcatchment A1: Frontage

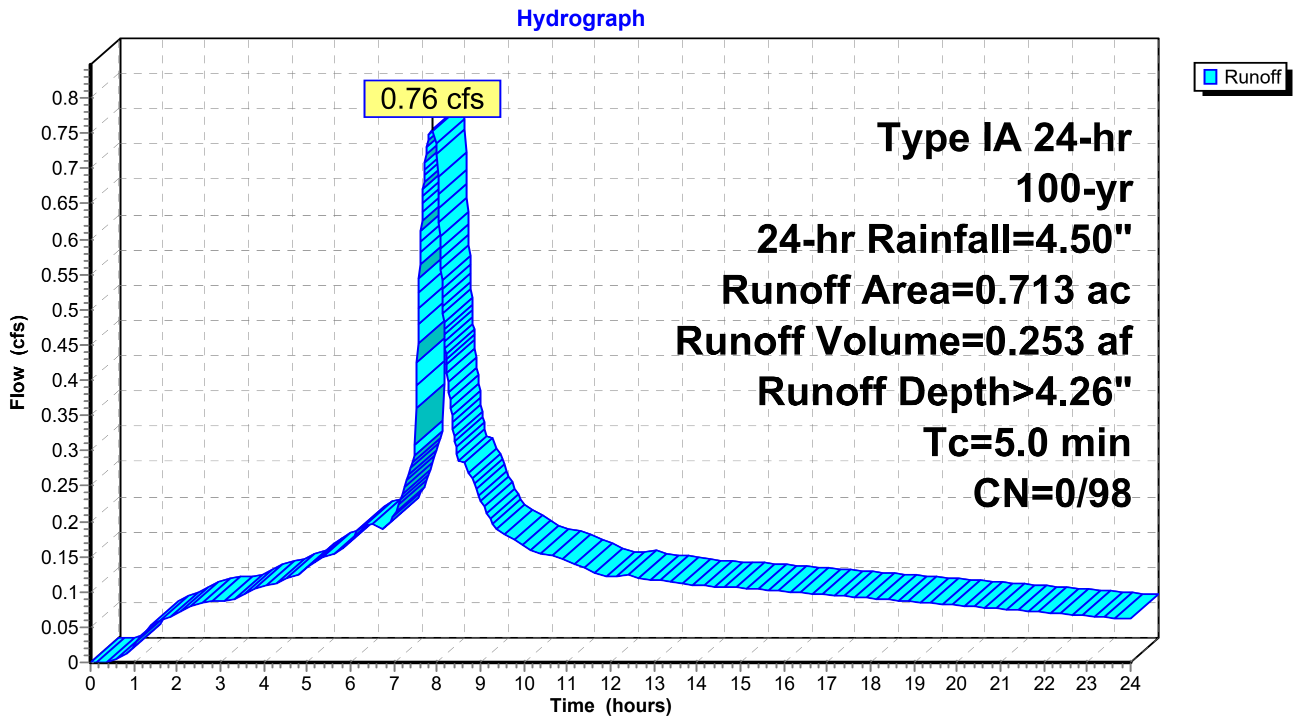
Runoff = 0.76 cfs @ 7.88 hrs, Volume= 0.253 af, Depth> 4.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	0.713	98	Road/Sidewalk
	0.713	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A1: Frontage



Summary for Subcatchment A2: West Parking 1

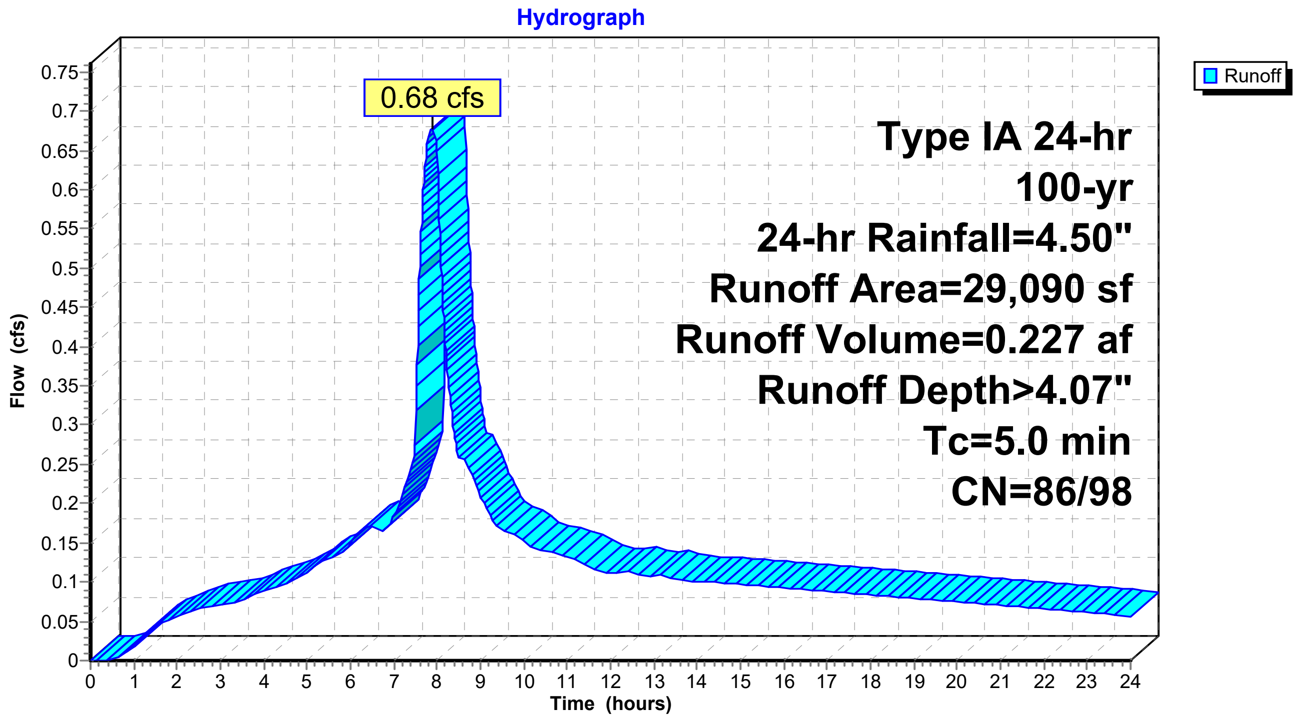
Runoff = 0.68 cfs @ 7.88 hrs, Volume= 0.227 af, Depth> 4.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	24,840	98	Parking Lot/Sidewalk
*	4,250	86	Bioretention/Landscape
	29,090	96	Weighted Average
	4,250	86	14.61% Pervious Area
	24,840	98	85.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A2: West Parking 1



Summary for Subcatchment A3: West Parking 2

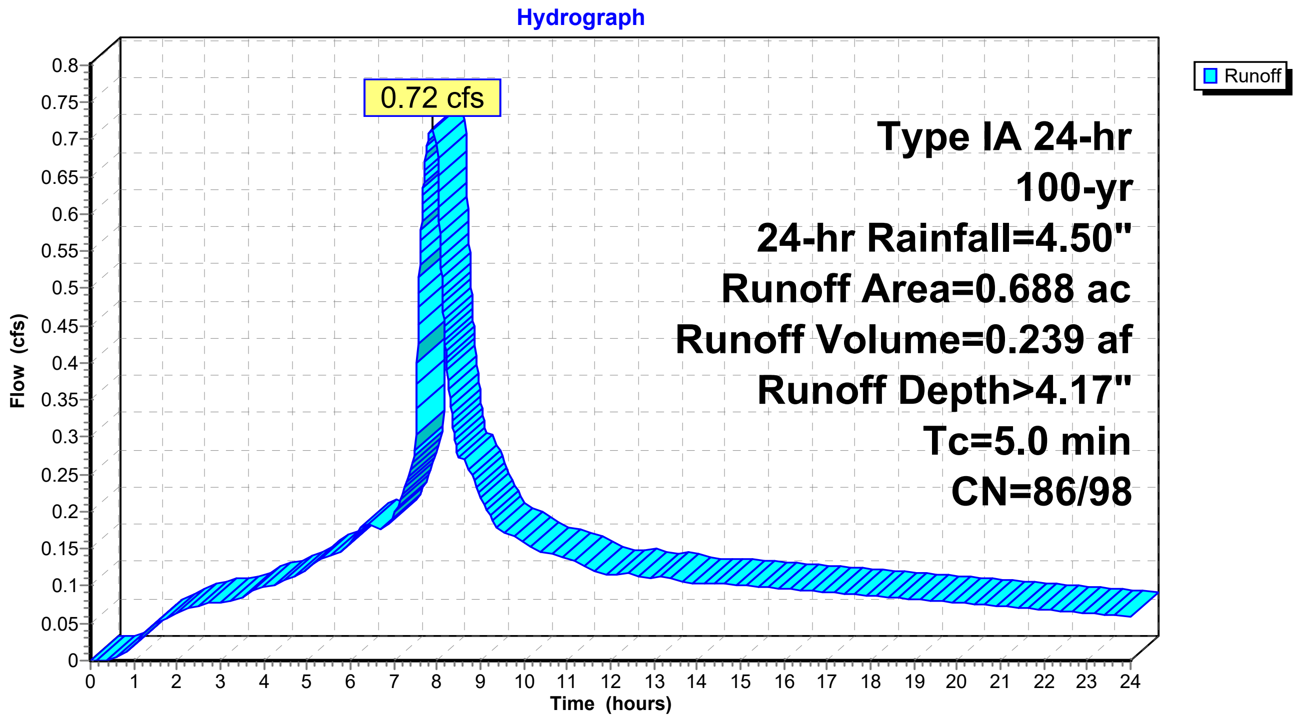
Runoff = 0.72 cfs @ 7.88 hrs, Volume= 0.239 af, Depth> 4.17"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	0.642	98	Parking Lot/Sidewalk
*	0.046	86	Bioretention/Landscape
	0.688	97	Weighted Average
	0.046	86	6.69% Pervious Area
	0.642	98	93.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A3: West Parking 2



Summary for Subcatchment A4: North Wetland

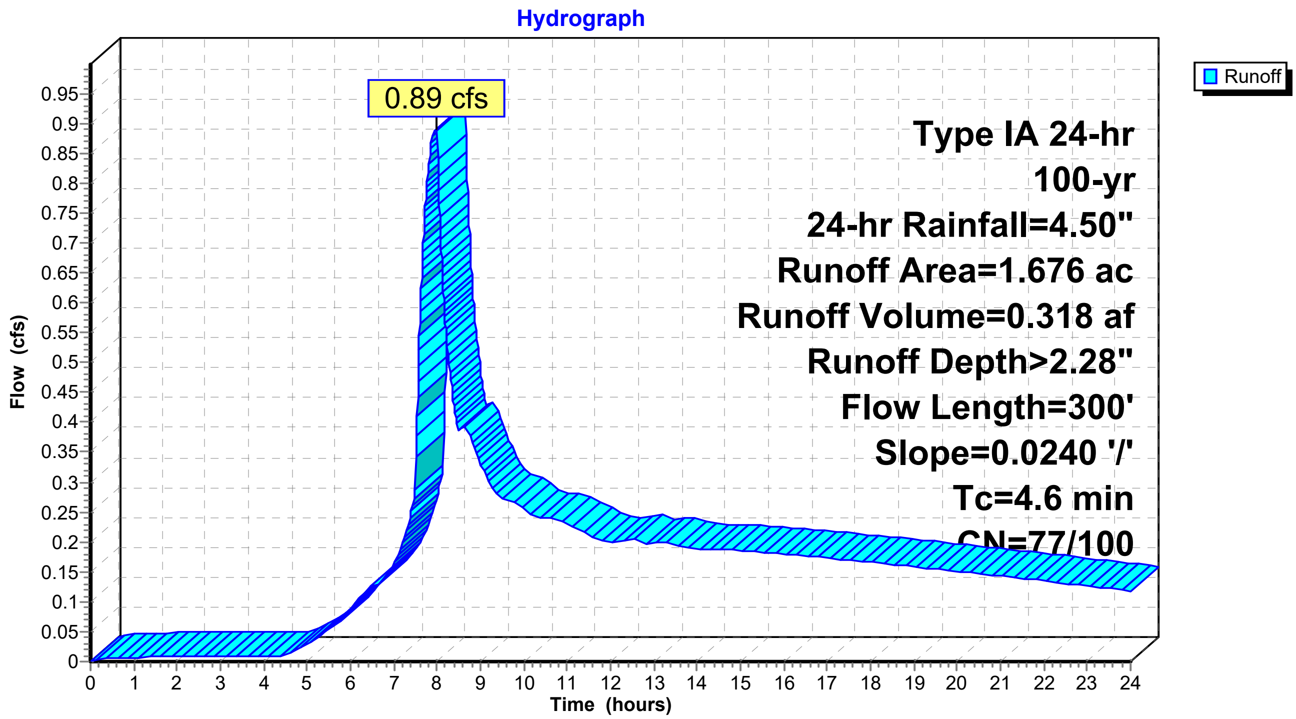
Runoff = 0.89 cfs @ 7.96 hrs, Volume= 0.318 af, Depth> 2.28"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment A5: Courtyard 2

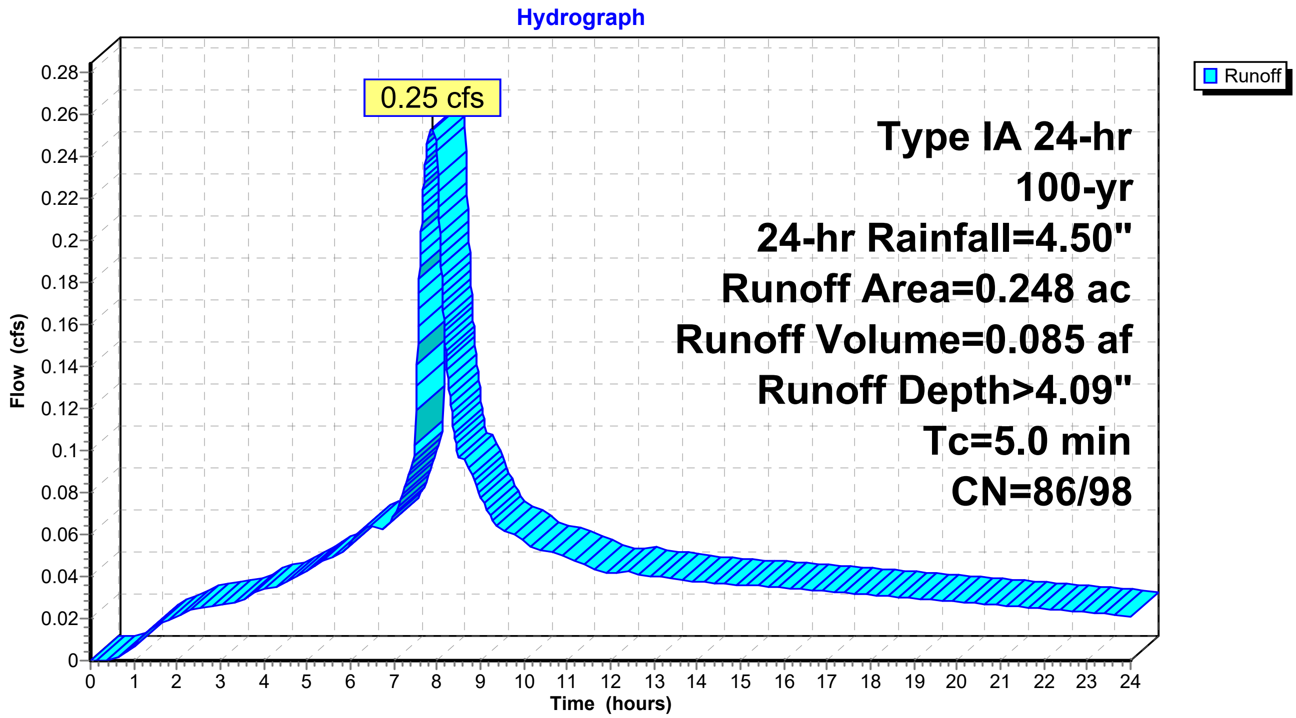
Runoff = 0.25 cfs @ 7.88 hrs, Volume= 0.085 af, Depth> 4.09"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	0.216	98	Courtyard Pavement
*	0.032	86	Courtyard Landscaping
	0.248	96	Weighted Average
	0.032	86	12.90% Pervious Area
	0.216	98	87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A5: Courtyard 2



Summary for Subcatchment A6: Fire Lane

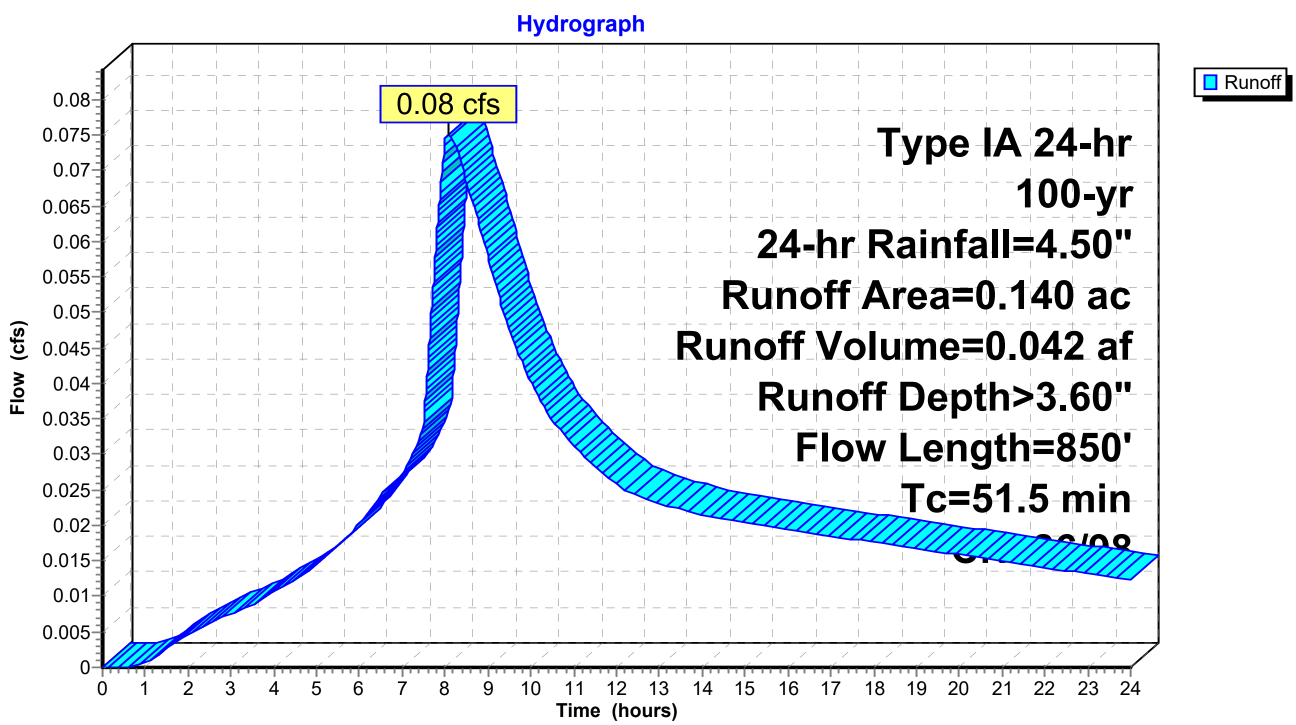
Runoff = 0.08 cfs @ 8.10 hrs, Volume= 0.042 af, Depth> 3.60"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	0.065	86	Courtyard Landscaping
*	0.075	98	Fire Lane
	0.140	92	Weighted Average
	0.065	86	46.43% Pervious Area
	0.075	98	53.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A6: Fire Lane



Summary for Subcatchment A7: Courtyard 1

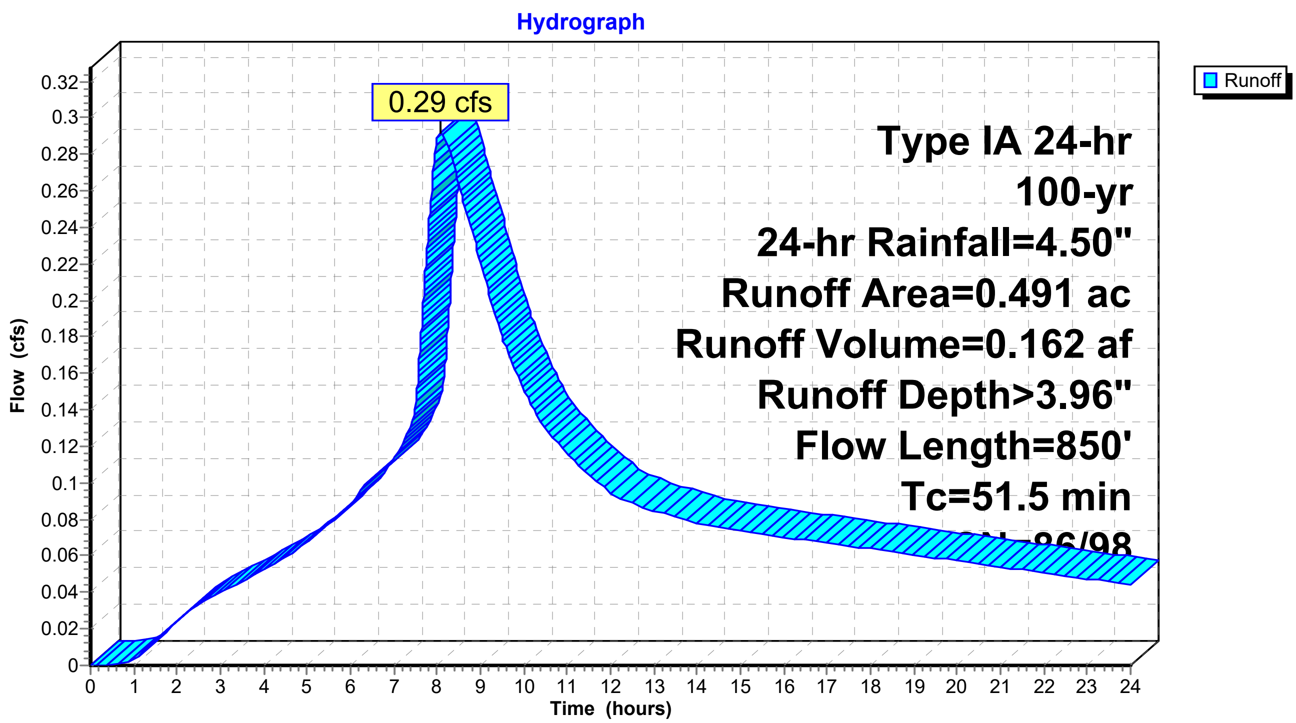
Runoff = 0.29 cfs @ 8.08 hrs, Volume= 0.162 af, Depth> 3.96"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	0.311	98	Courtyard Pavement
*	0.087	86	Courtyard Landscaping
*	0.093	98	Fire Lane
	0.491	96	Weighted Average
	0.087	86	17.72% Pervious Area
	0.404	98	82.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A7: Courtyard 1



Summary for Subcatchment A8: Pond Direct

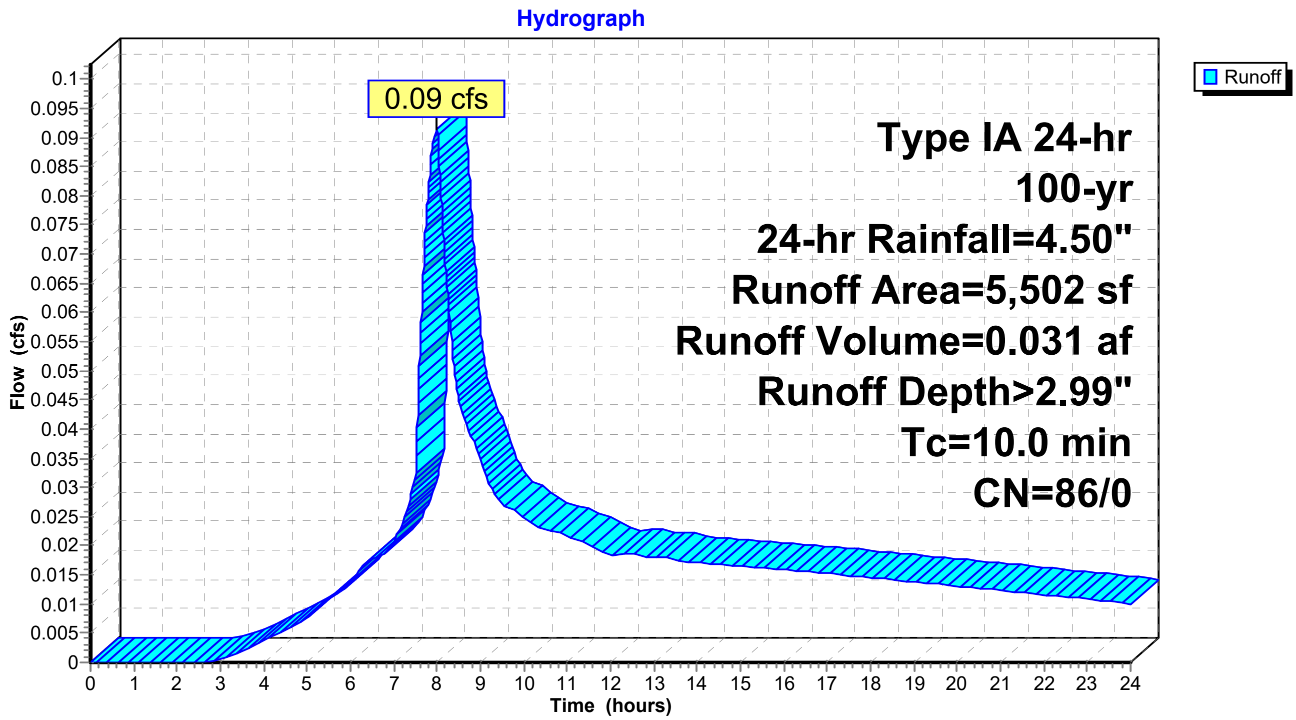
Runoff = 0.09 cfs @ 8.00 hrs, Volume= 0.031 af, Depth> 2.99"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	5,502	86	Pond Top Area
	5,502	86	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment A8: Pond Direct



Summary for Subcatchment A9: Vegetated/Wetland Bypass

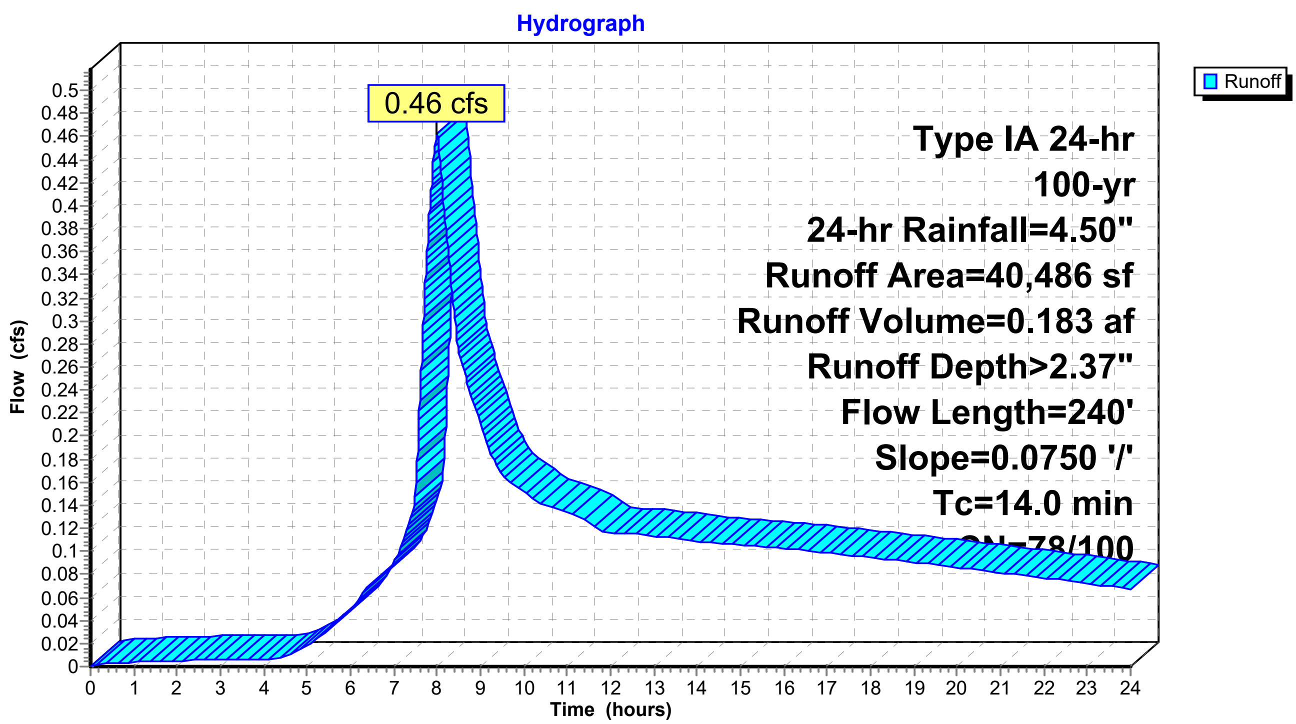
Runoff = 0.46 cfs @ 8.00 hrs, Volume= 0.183 af, Depth> 2.37"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	29,555	76	Undisturbed Forest
*	9,270	86	Fill Slope
*	1,661	100	Wetland
	40,486	79	Weighted Average
	38,825	78	95.90% Pervious Area
	1,661	100	4.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	240	0.0750	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment A9: Vegetated/Wetland Bypass



Summary for Subcatchment B1: East Parking

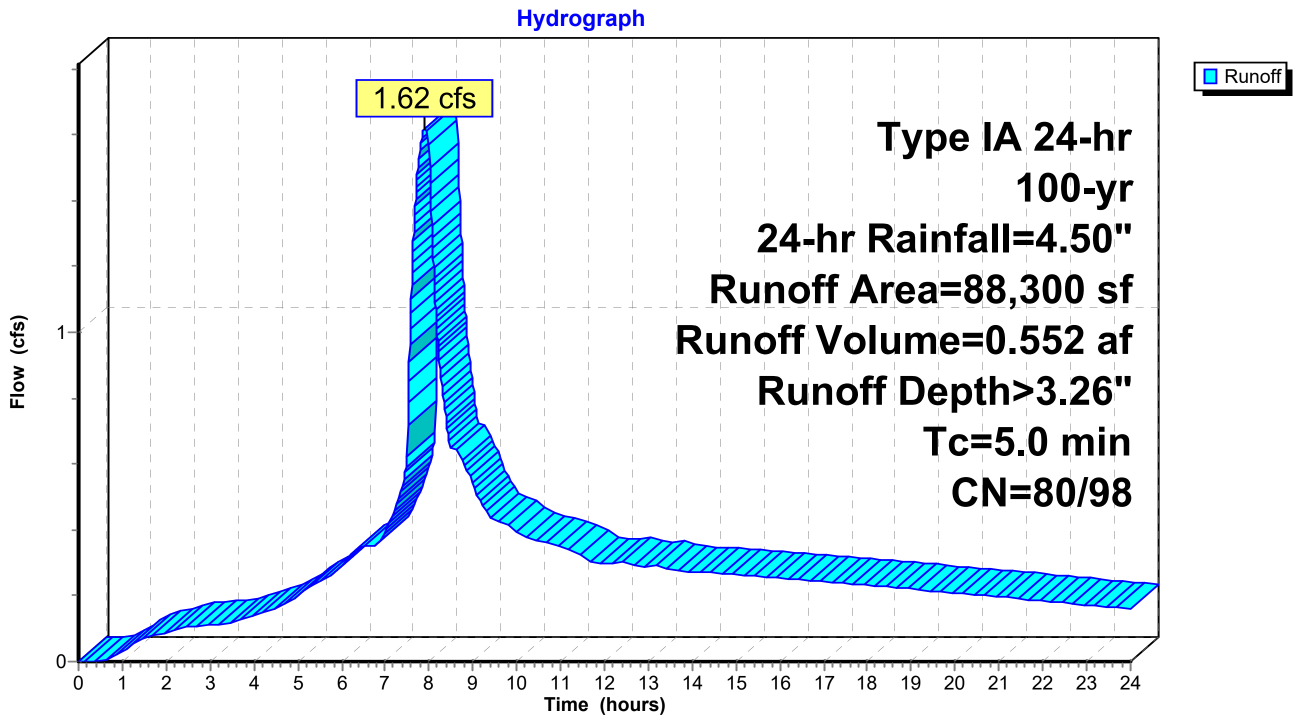
Runoff = 1.62 cfs @ 7.91 hrs, Volume= 0.552 af, Depth> 3.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	39,670	98	Parking Lot/Sidewalk
*	27,610	76	Undisturbed Forest
*	14,850	86	Bioretention/Landscape
*	6,170	86	Disturbed Vegetated
	88,300	88	Weighted Average
	48,630	80	55.07% Pervious Area
	39,670	98	44.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B1: East Parking



Summary for Subcatchment B2: Courtyard 3

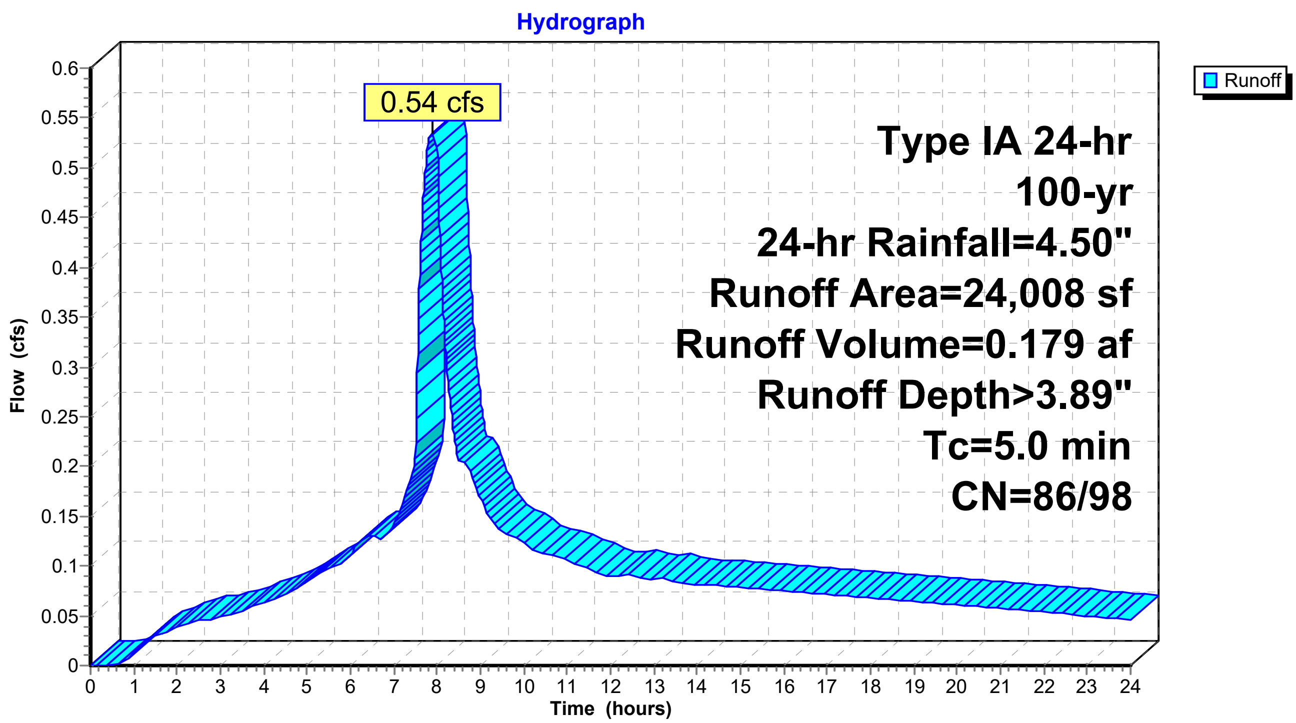
Runoff = 0.54 cfs @ 7.89 hrs, Volume= 0.179 af, Depth> 3.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	7,045	86	Courtyard Landscaping
*	16,963	98	Courtyard Pavement
	24,008	94	Weighted Average
	7,045	86	29.34% Pervious Area
	16,963	98	70.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B2: Courtyard 3



Summary for Subcatchment B3: Building Roof

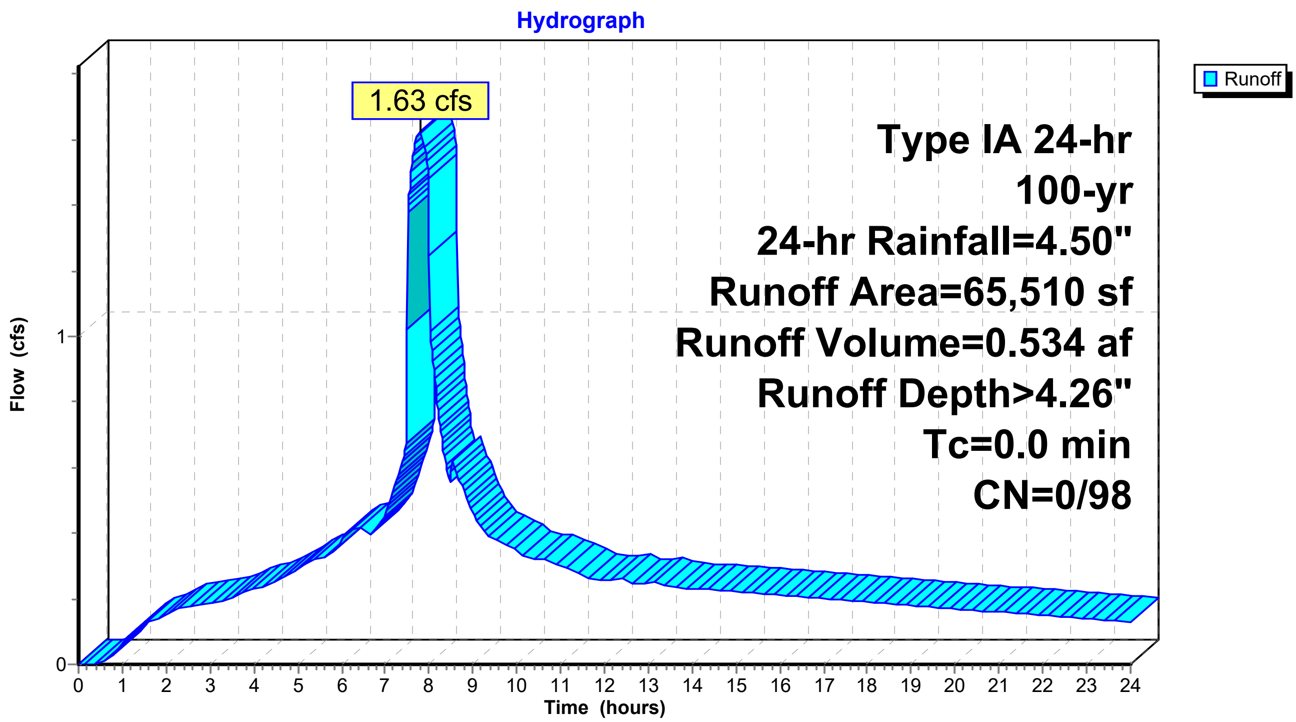
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 1.63 cfs @ 7.78 hrs, Volume= 0.534 af, Depth> 4.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

Area (sf)	CN	Description
65,510	98	Roofs, HSG D
65,510	98	100.00% Impervious Area

Subcatchment B3: Building Roof



Summary for Subcatchment B4: Field and Track

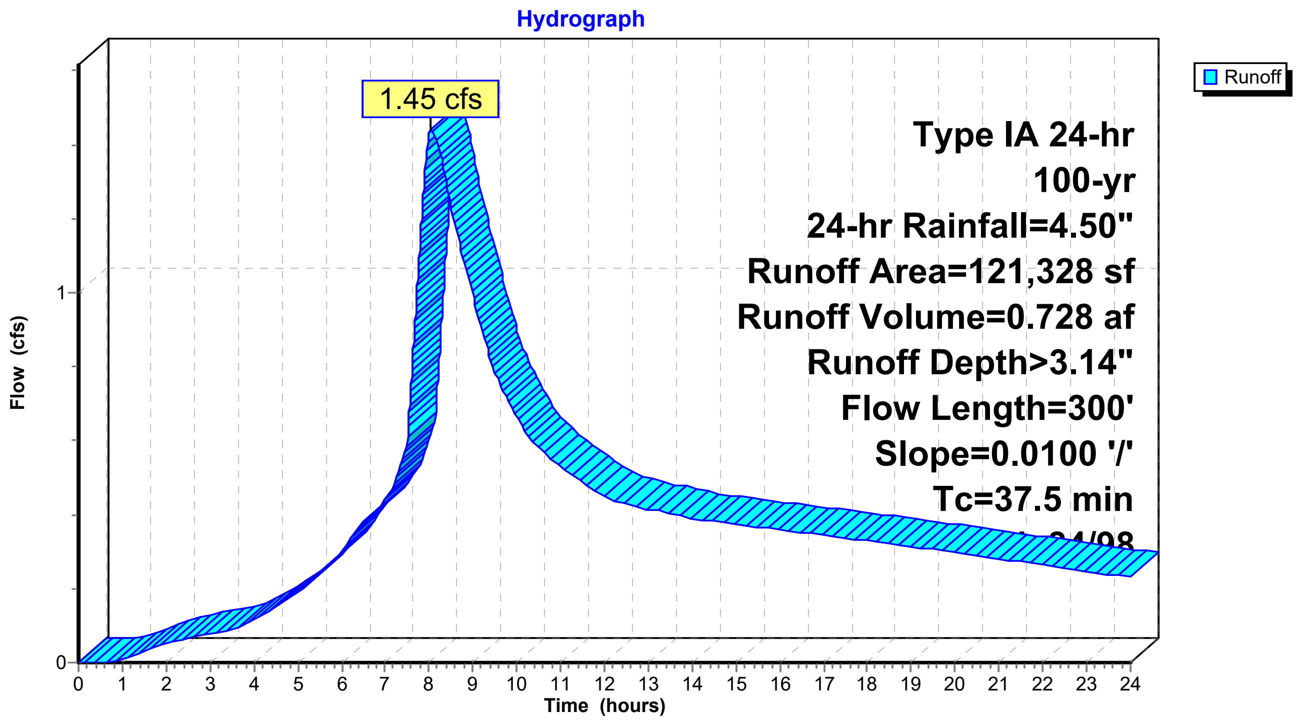
Runoff = 1.45 cfs @ 8.03 hrs, Volume= 0.728 af, Depth> 3.14"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	71,134	86	Field
*	3,750	98	Track
*	18,694	76	Undisturbed
*	27,500	98	Fire Lane/Access Road
*	250	86	Courtyard Landscaping
	121,328	88	Weighted Average
	90,078	84	74.24% Pervious Area
	31,250	98	25.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B4: Field and Track



Summary for Subcatchment B5: Access Road and Pond

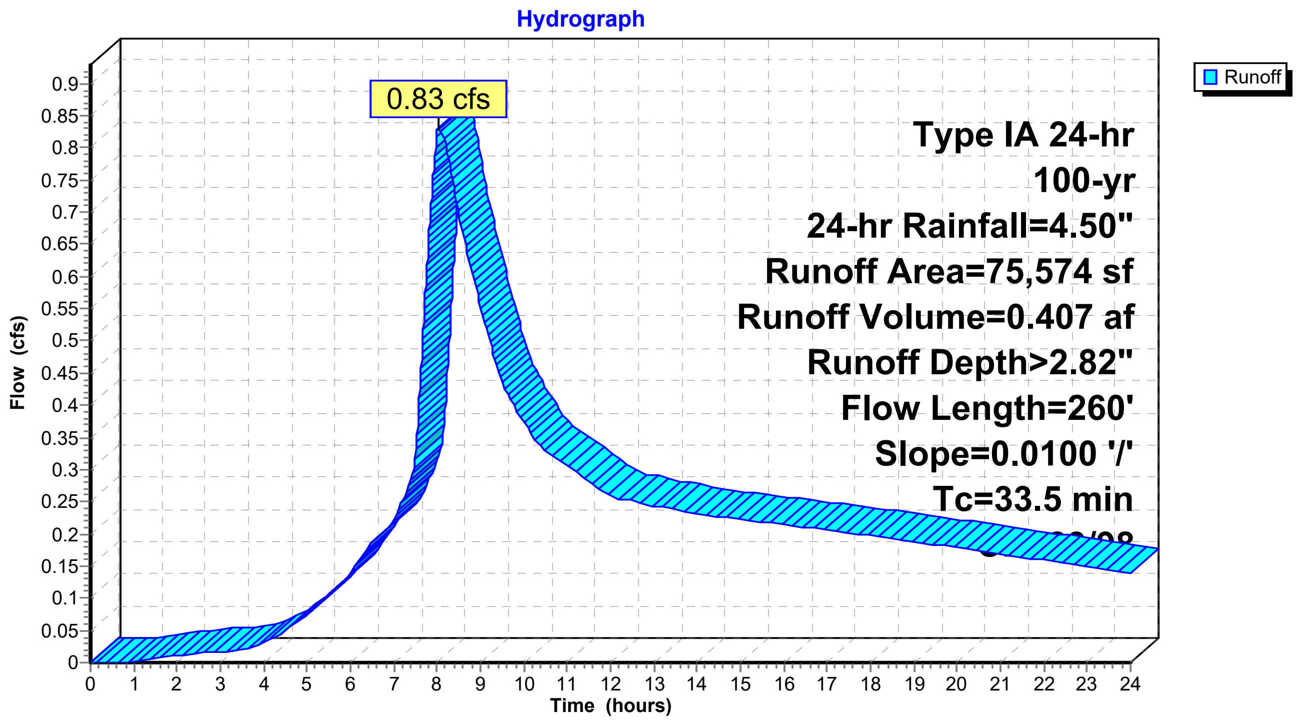
Runoff = 0.83 cfs @ 8.02 hrs, Volume= 0.407 af, Depth> 2.82"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	25,478	76	Undisturbed
*	5,756	96	Gravel Road
*	890	98	Paved Access Road
*	37,750	86	Pond/Landscaping
*	5,700	98	Pump Station/Access
	75,574	84	Weighted Average
	68,984	83	91.28% Pervious Area
	6,590	98	8.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	260	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B5: Access Road and Pond



Summary for Subcatchment B6: South Wetland

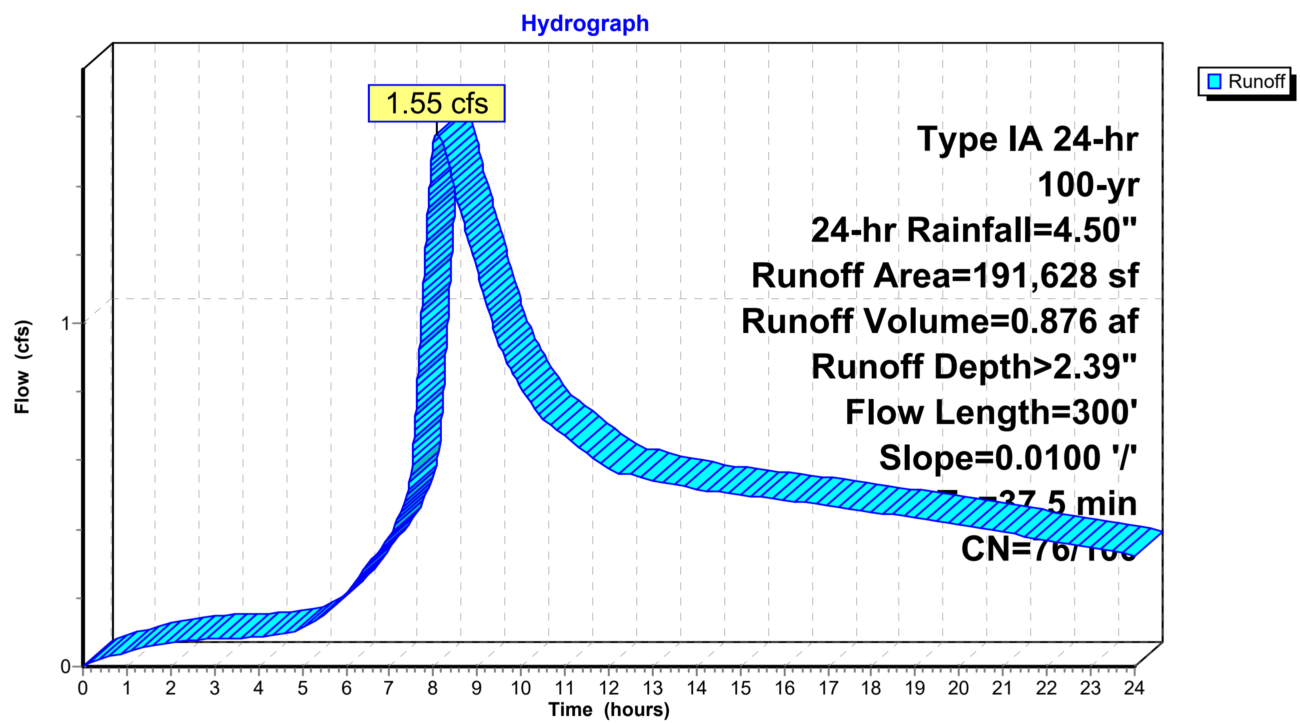
Runoff = 1.55 cfs @ 8.09 hrs, Volume= 0.876 af, Depth> 2.39"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	160,260	76	Undisturbed Forest
*	24,708	100	Wetland
*	6,660	86	Site Fill
	191,628	79	Weighted Average
	166,920	76	87.11% Pervious Area
	24,708	100	12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B6: South Wetland



Summary for Subcatchment B7: Courtyard Bypass

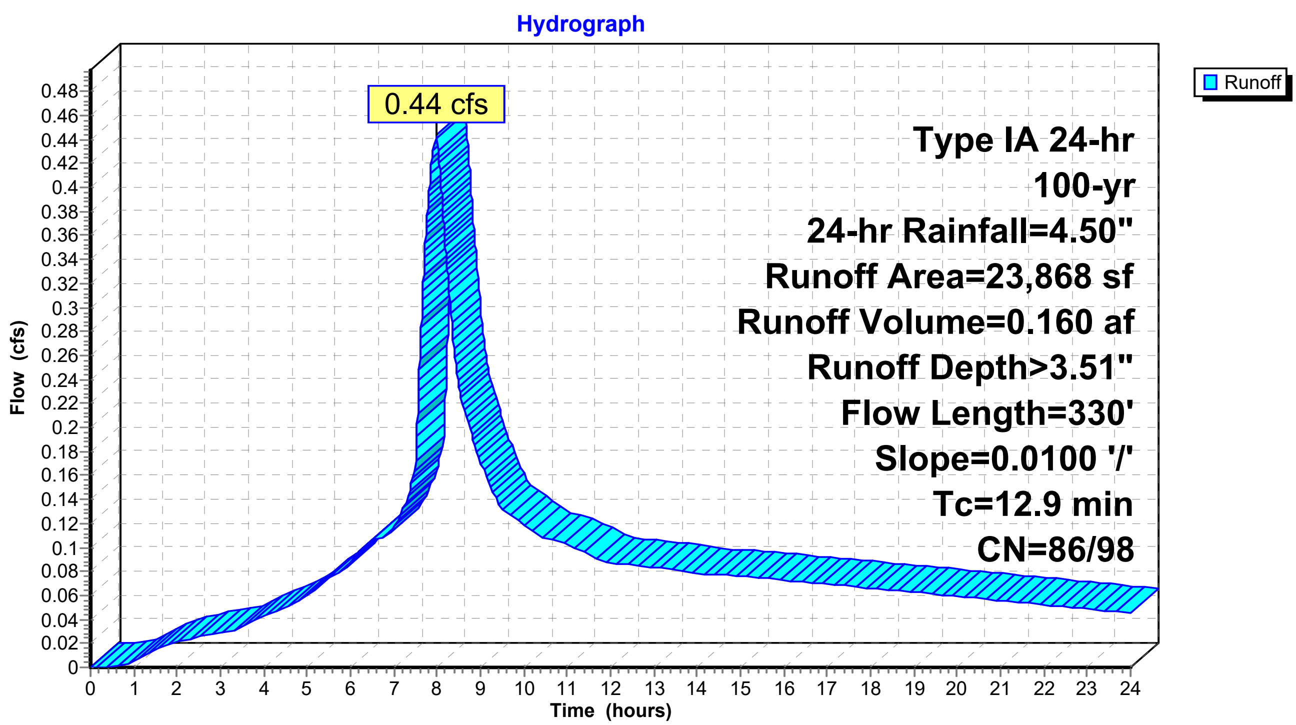
Runoff = 0.44 cfs @ 8.00 hrs, Volume= 0.160 af, Depth> 3.51"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (sf)	CN	Description
*	3,390	98	Courtyard Pavement
*	13,866	86	Courtyard Landscaping
*	6,612	98	Fire Lane
	23,868	91	Weighted Average
	13,866	86	58.09% Pervious Area
	10,002	98	41.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
7.9	330	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.9	330	Total			

Subcatchment B7: Courtyard Bypass



Summary for Reach 1R: 279 LF 18"

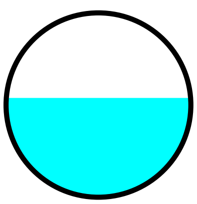
[52] Hint: Inlet/Outlet conditions not evaluated
[63] Warning: Exceeded Reach 6R INLET depth by 0.04' @ 7.55 hrs

Inflow Area = 4.082 ac, 68.69% Impervious, Inflow Depth > 3.71" for 100-yr, 24-hr event
Inflow = 3.54 cfs @ 7.89 hrs, Volume= 1.263 af
Outflow = 3.53 cfs @ 7.91 hrs, Volume= 1.262 af, Atten= 0%, Lag= 1.0 min

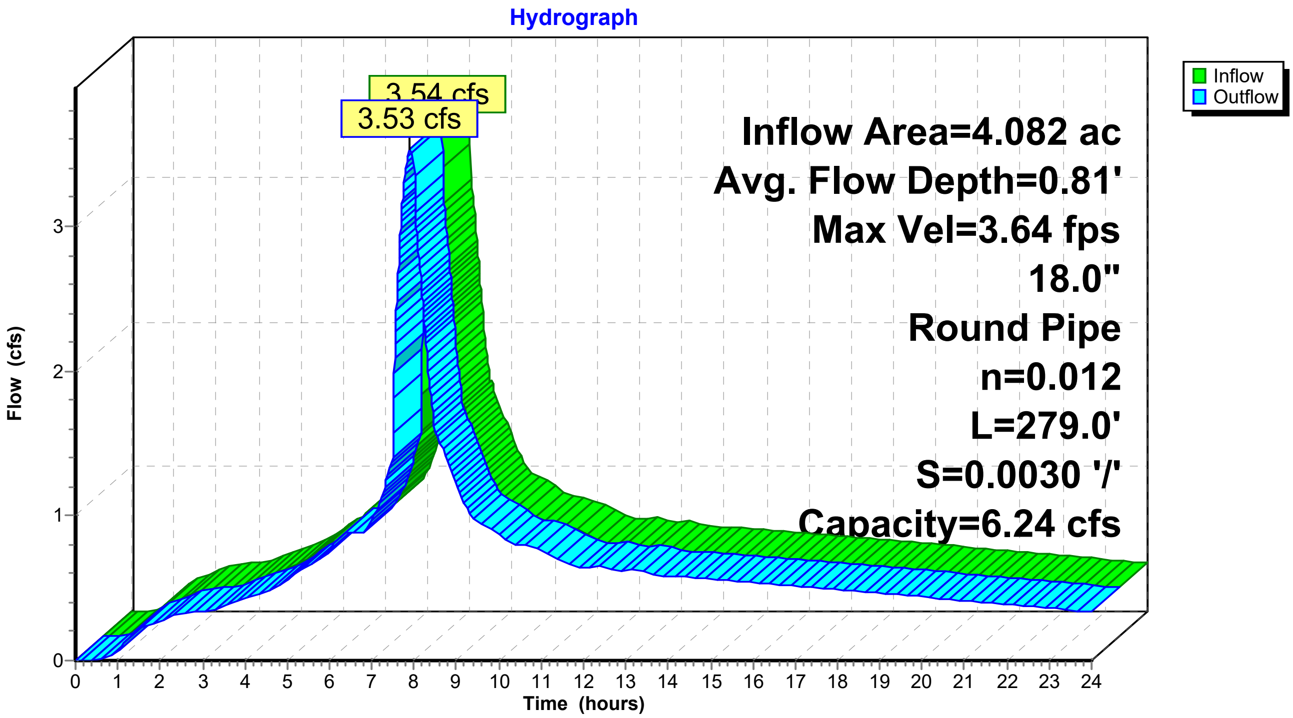
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.64 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.18 fps, Avg. Travel Time= 2.1 min

Peak Storage= 270 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.24 cfs

18.0" Round Pipe
n= 0.012
Length= 279.0' Slope= 0.0030 '/'
Inlet Invert= 132.54', Outlet Invert= 131.70'



Reach 1R: 279 LF 18"



Summary for Reach 3R: 134 LF 12"

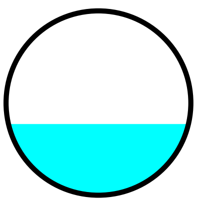
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 16R outlet invert by 0.28' @ 7.91 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 4.20" for 100-yr, 24-hr event
Inflow = 1.01 cfs @ 7.90 hrs, Volume= 0.337 af
Outflow = 1.01 cfs @ 7.91 hrs, Volume= 0.337 af, Atten= 0%, Lag= 0.5 min

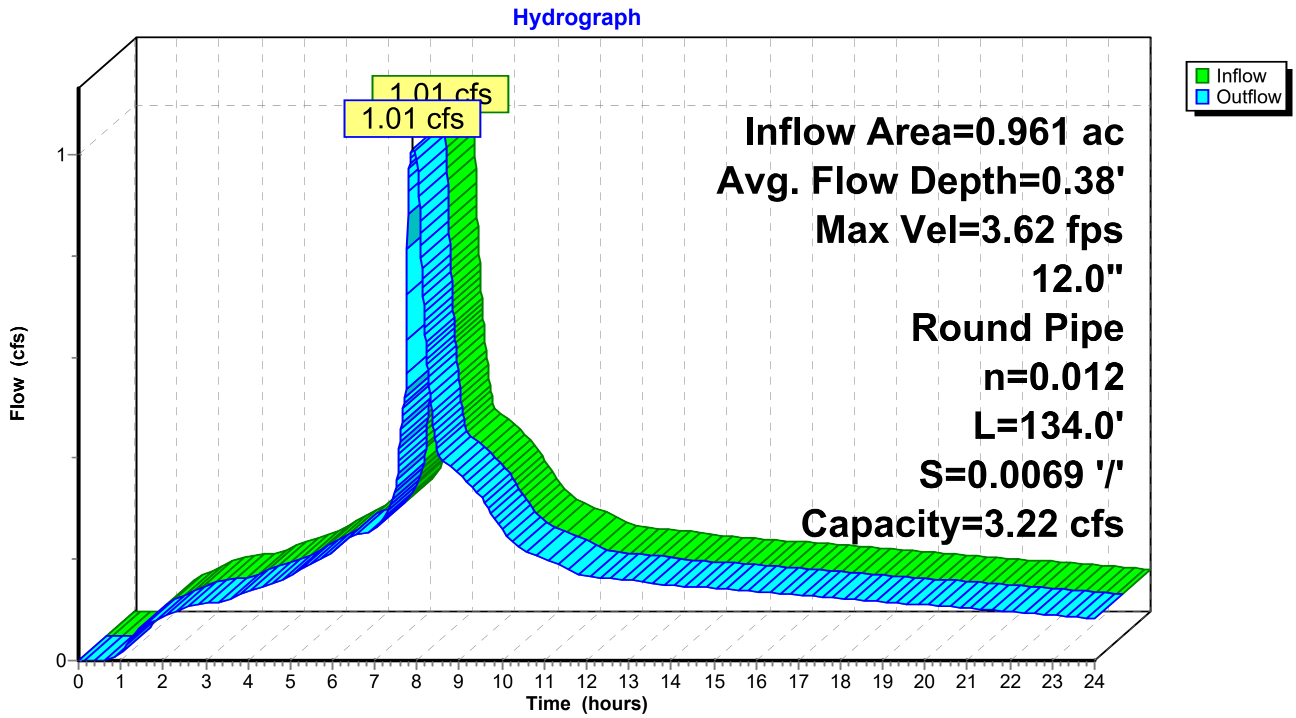
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.62 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 1.1 min

Peak Storage= 37 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.22 cfs

12.0" Round Pipe
n= 0.012
Length= 134.0' Slope= 0.0069 '/'
Inlet Invert= 132.46', Outlet Invert= 131.53'



Reach 3R: 134 LF 12"



Summary for Reach 4R: 56 LF 12"

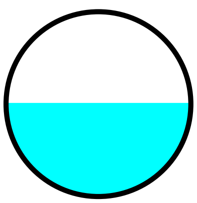
[52] Hint: Inlet/Outlet conditions not evaluated

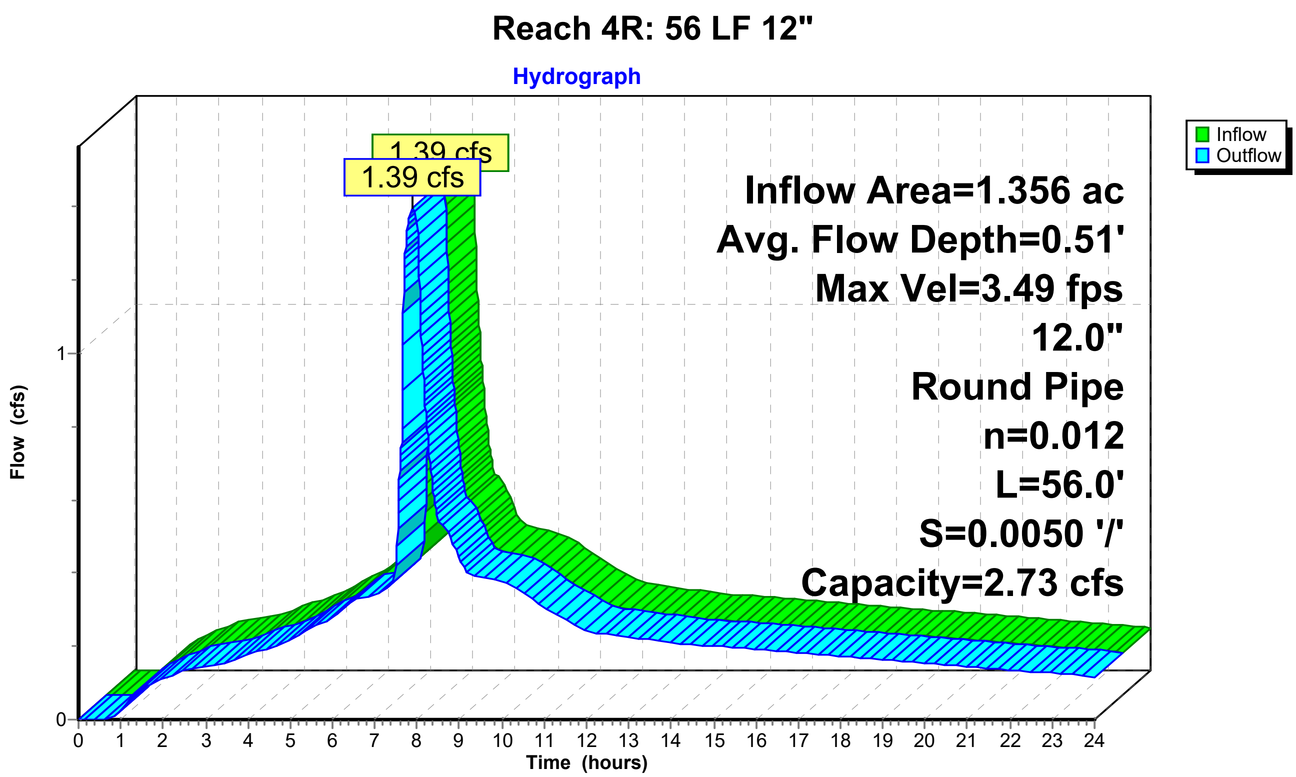
Inflow Area = 1.356 ac, 89.41% Impervious, Inflow Depth > 4.11" for 100-yr, 24-hr event
Inflow = 1.39 cfs @ 7.89 hrs, Volume= 0.465 af
Outflow = 1.39 cfs @ 7.89 hrs, Volume= 0.465 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.49 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.05 fps, Avg. Travel Time= 0.5 min

Peak Storage= 22 cf @ 7.89 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.73 cfs

12.0" Round Pipe
n= 0.012
Length= 56.0' Slope= 0.0050 '/'
Inlet Invert= 132.63', Outlet Invert= 132.35'





Summary for Reach 5R: 70 LF 12"

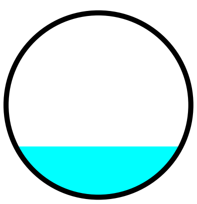
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 8R outlet invert by 0.27' @ 7.90 hrs

Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 3.88" for 100-yr, 24-hr event
Inflow = 0.54 cfs @ 7.90 hrs, Volume= 0.178 af
Outflow = 0.54 cfs @ 7.90 hrs, Volume= 0.178 af, Atten= 0%, Lag= 0.3 min

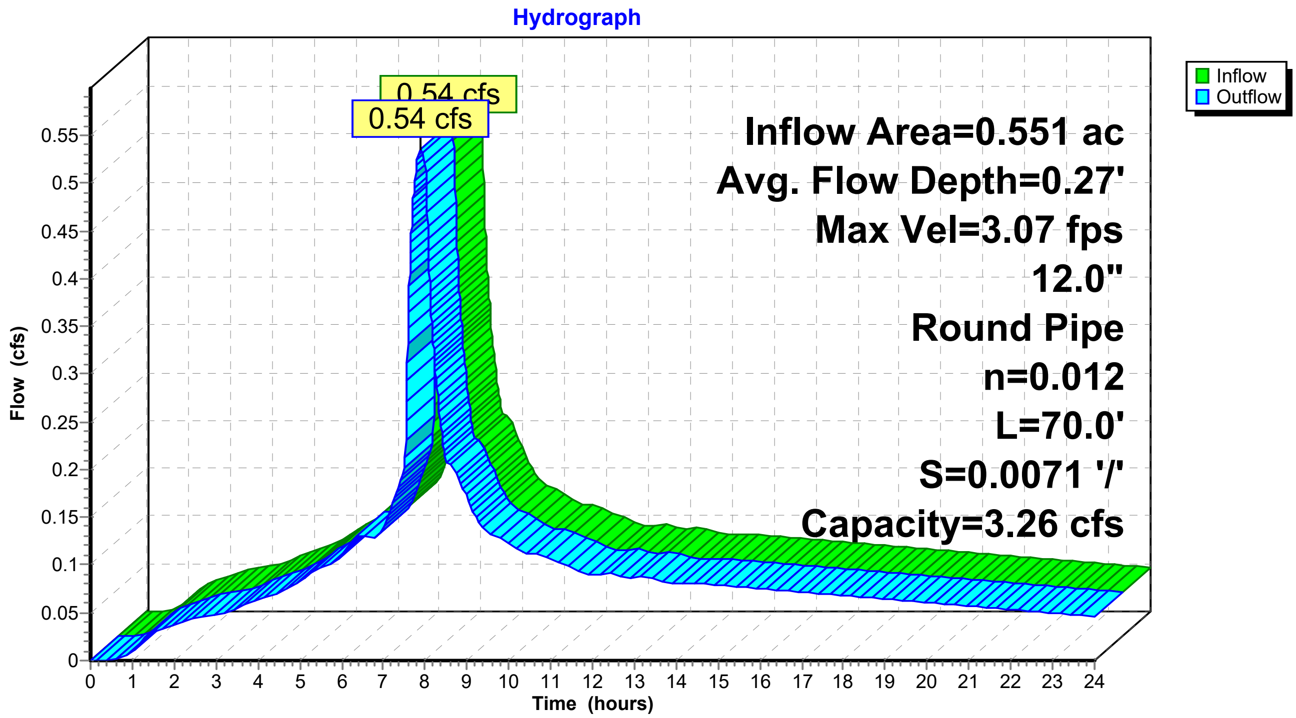
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.07 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.74 fps, Avg. Travel Time= 0.7 min

Peak Storage= 12 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.26 cfs

12.0" Round Pipe
n= 0.012
Length= 70.0' Slope= 0.0071 '/'
Inlet Invert= 133.15', Outlet Invert= 132.65'



Reach 5R: 70 LF 12"



Summary for Reach 6R: 38 LF 12"

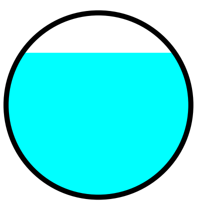
[52] Hint: Inlet/Outlet conditions not evaluated
[63] Warning: Exceeded Reach 5R INLET depth by 0.01' @ 8.02 hrs

Inflow Area = 2.578 ac, 50.43% Impervious, Inflow Depth > 3.39" for 100-yr, 24-hr event
Inflow = 1.99 cfs @ 8.00 hrs, Volume= 0.729 af
Outflow = 1.98 cfs @ 8.00 hrs, Volume= 0.729 af, Atten= 0%, Lag= 0.2 min

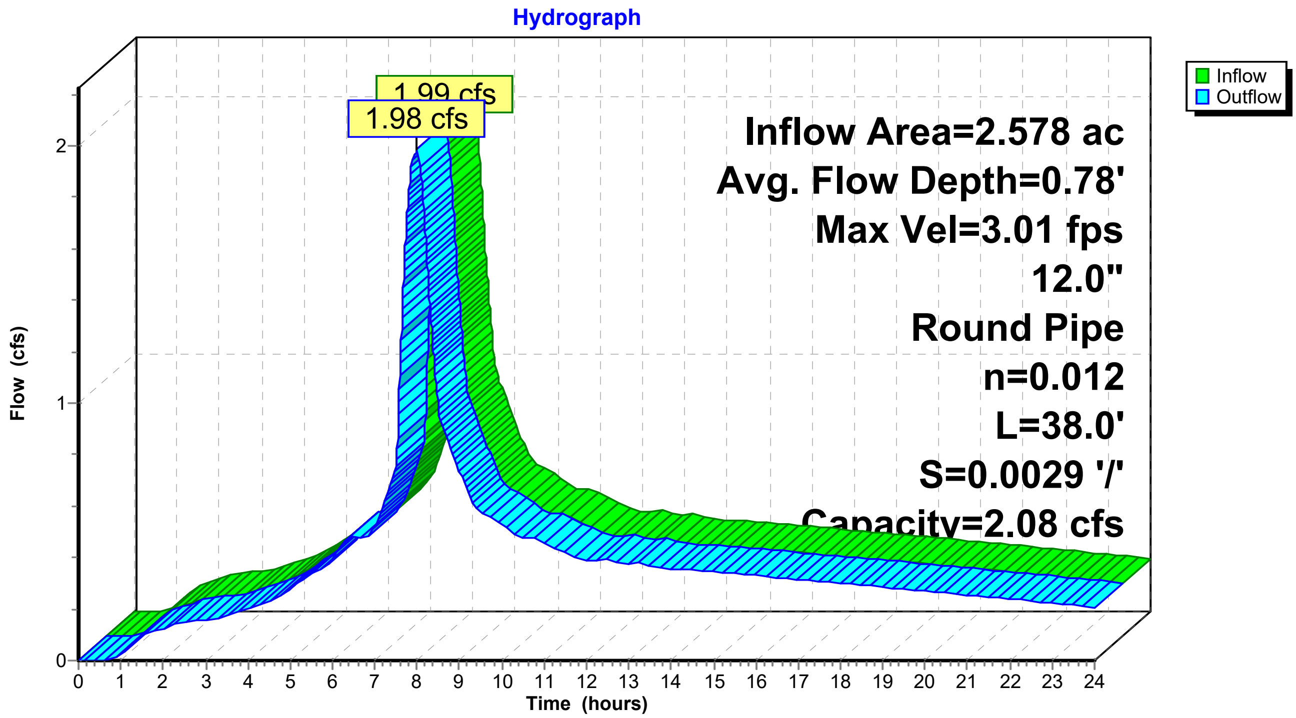
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.01 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.91 fps, Avg. Travel Time= 0.3 min

Peak Storage= 25 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.78'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.08 cfs

12.0" Round Pipe
n= 0.012
Length= 38.0' Slope= 0.0029 '/'
Inlet Invert= 132.65', Outlet Invert= 132.54'



Reach 6R: 38 LF 12"



Summary for Reach 7R: 107 LF 12"

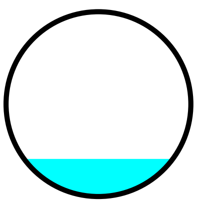
[52] Hint: Inlet/Outlet conditions not evaluated

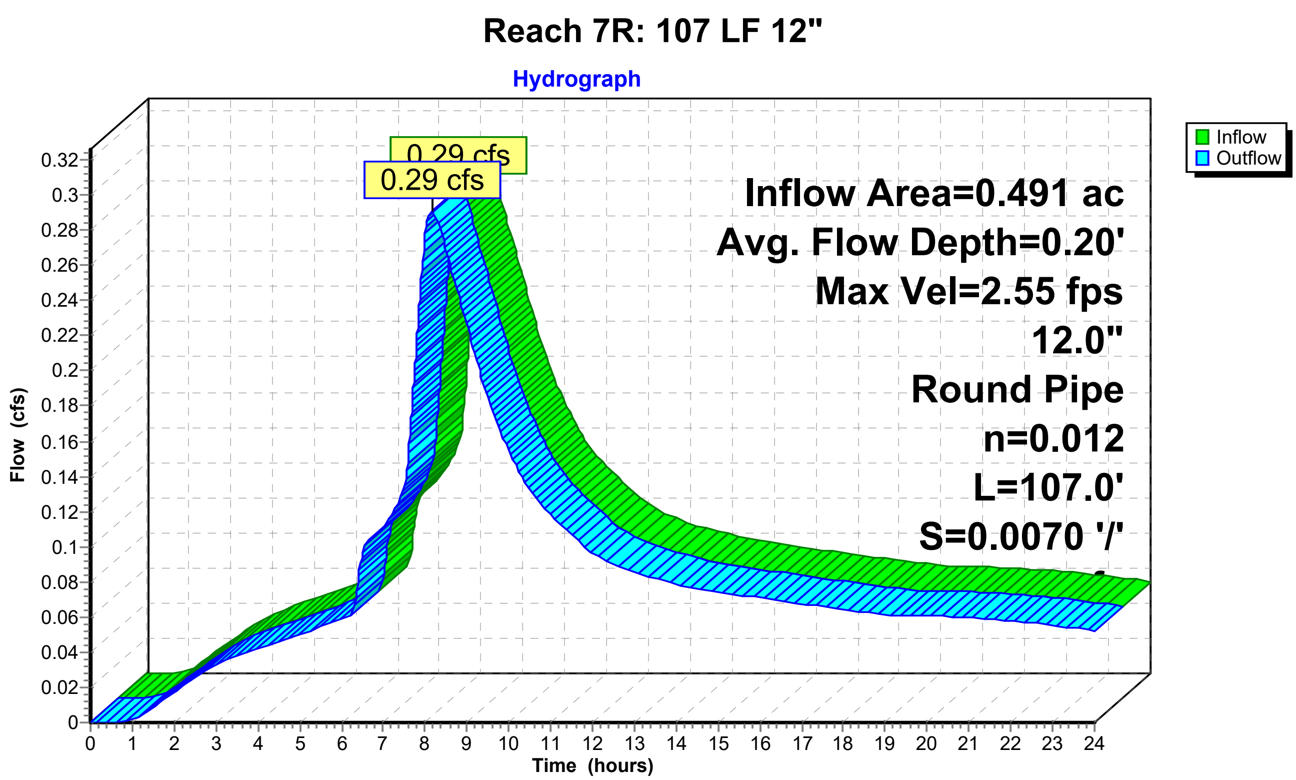
Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 3.89" for 100-yr, 24-hr event
Inflow = 0.29 cfs @ 8.15 hrs, Volume= 0.159 af
Outflow = 0.29 cfs @ 8.15 hrs, Volume= 0.159 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.55 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 1.1 min

Peak Storage= 12 cf @ 8.15 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.23 cfs

12.0" Round Pipe
n= 0.012
Length= 107.0' Slope= 0.0070 '/'
Inlet Invert= 131.42', Outlet Invert= 130.67'





Summary for Reach 8R: 170 LF 12"

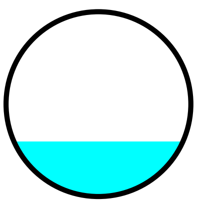
[52] Hint: Inlet/Outlet conditions not evaluated

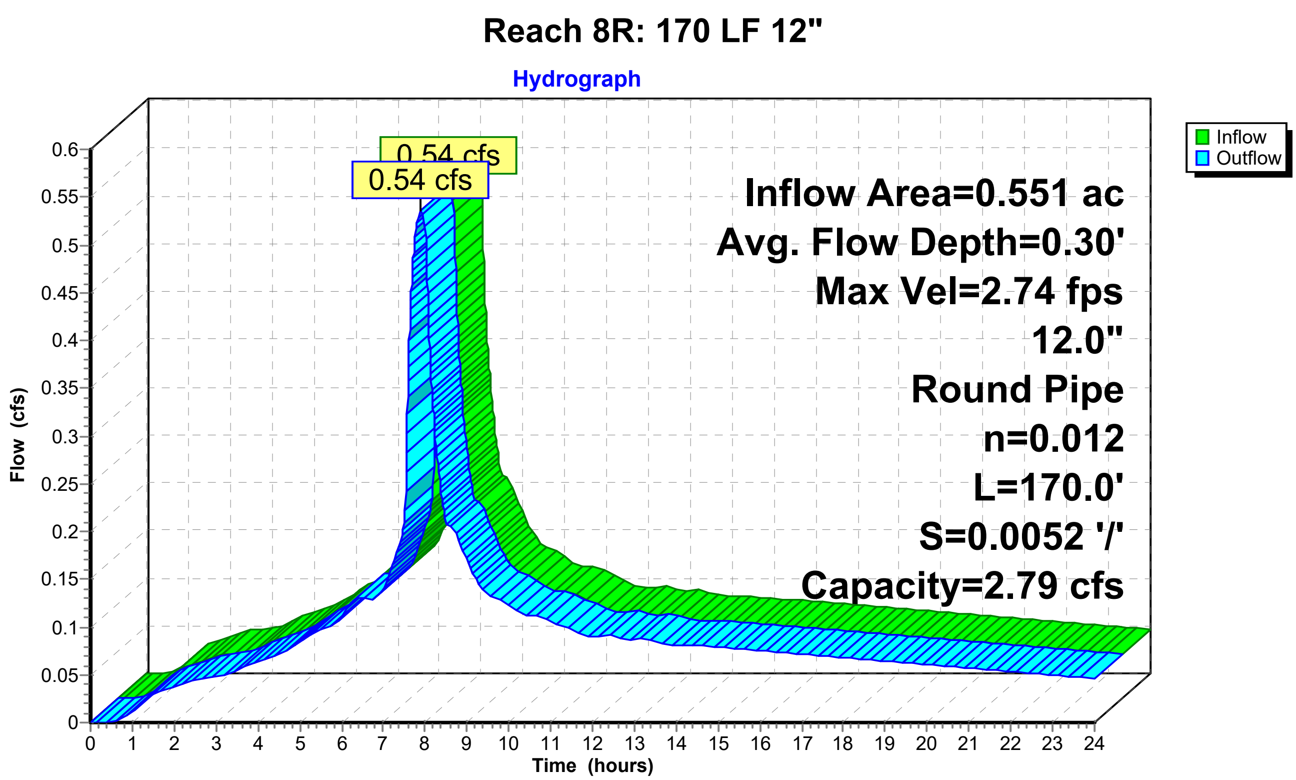
Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 3.89" for 100-yr, 24-hr event
Inflow = 0.54 cfs @ 7.89 hrs, Volume= 0.179 af
Outflow = 0.54 cfs @ 7.90 hrs, Volume= 0.178 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.74 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.56 fps, Avg. Travel Time= 1.8 min

Peak Storage= 33 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.79 cfs

12.0" Round Pipe
n= 0.012
Length= 170.0' Slope= 0.0052 '/'
Inlet Invert= 134.04', Outlet Invert= 133.15'





Summary for Reach 9R: 115 LF 12"

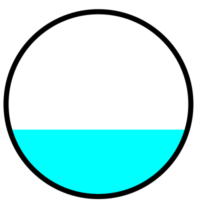
[52] Hint: Inlet/Outlet conditions not evaluated

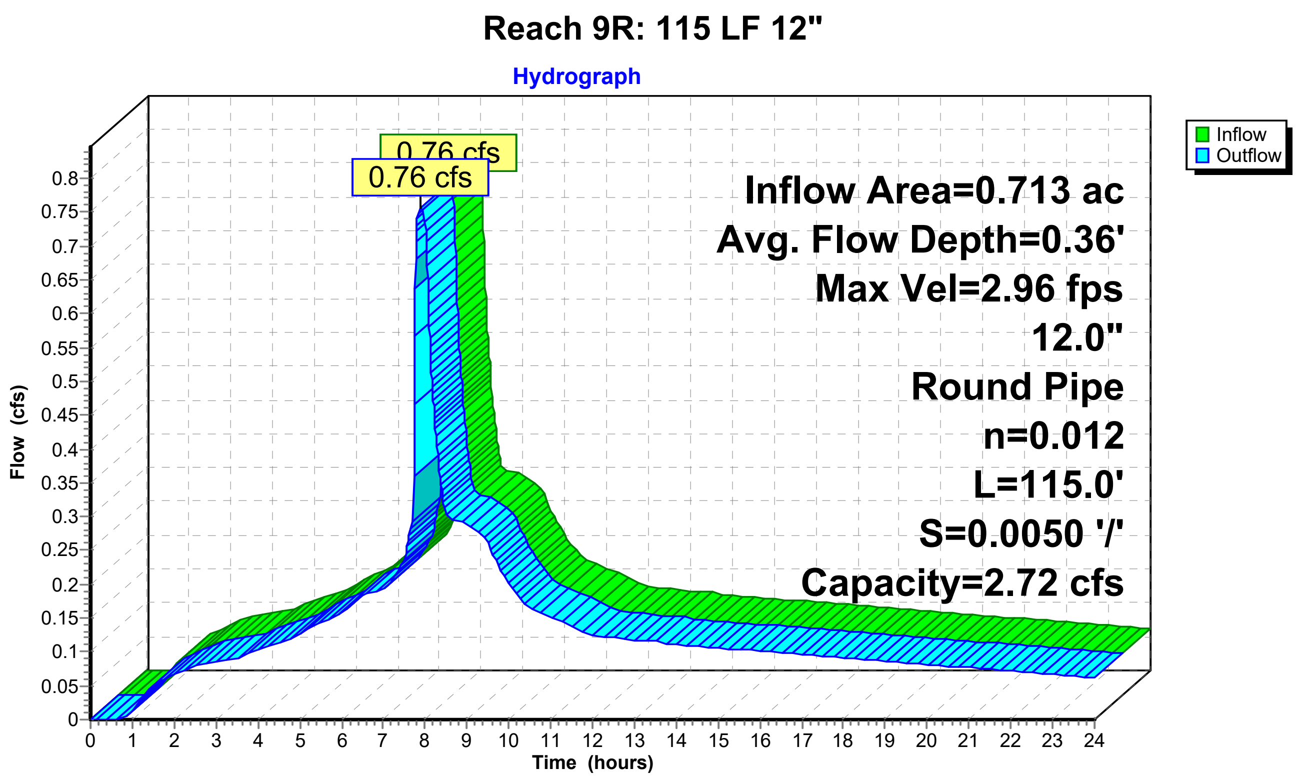
Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 4.25" for 100-yr, 24-hr event
Inflow = 0.76 cfs @ 7.89 hrs, Volume= 0.252 af
Outflow = 0.76 cfs @ 7.90 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.96 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 1.1 min

Peak Storage= 29 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.72 cfs

12.0" Round Pipe
n= 0.012
Length= 115.0' Slope= 0.0050 '/'
Inlet Invert= 136.50', Outlet Invert= 135.93'





Summary for Reach 10R: 76 LF 12"

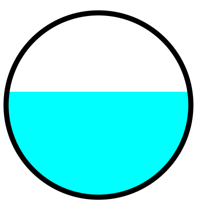
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 3R OUTLET depth by 0.11' @ 7.73 hrs

Inflow Area = 2.317 ac, 92.42% Impervious, Inflow Depth > 4.15" for 100-yr, 24-hr event
Inflow = 2.40 cfs @ 7.90 hrs, Volume= 0.801 af
Outflow = 2.40 cfs @ 7.90 hrs, Volume= 0.801 af, Atten= 0%, Lag= 0.2 min

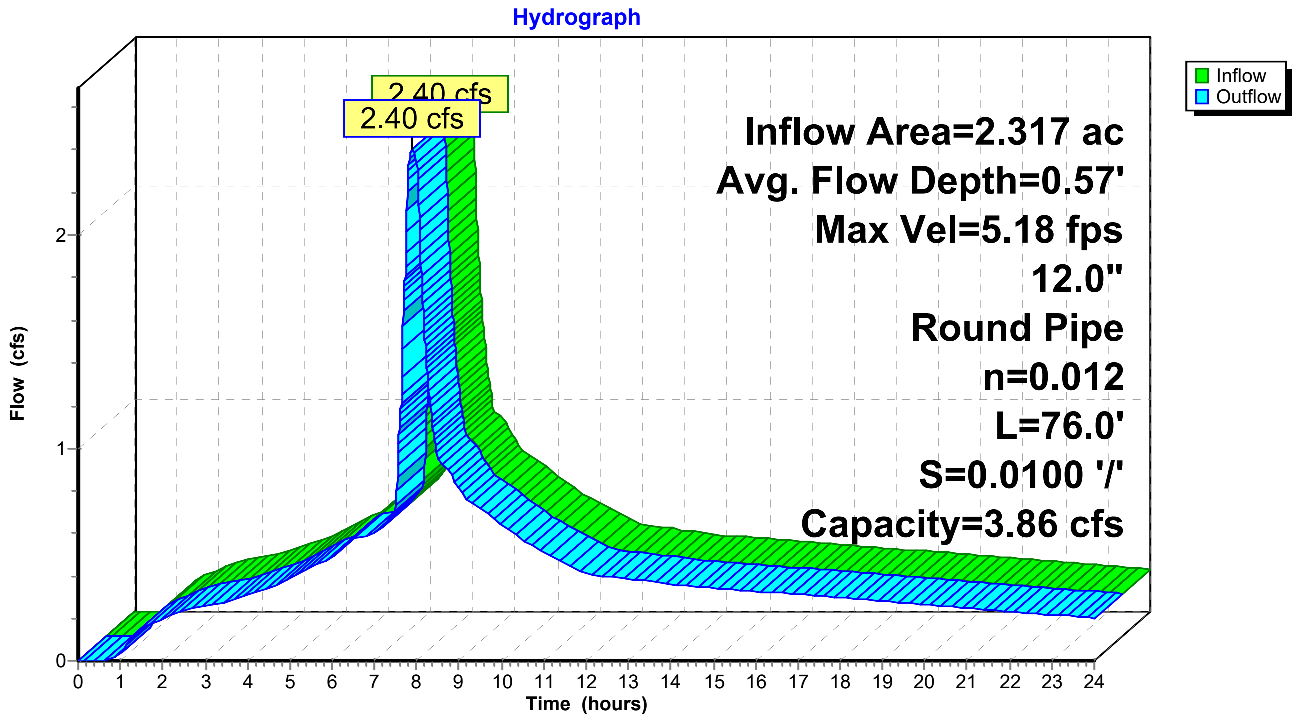
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.18 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.07 fps, Avg. Travel Time= 0.4 min

Peak Storage= 35 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.86 cfs

12.0" Round Pipe
n= 0.012
Length= 76.0' Slope= 0.0100 '/'
Inlet Invert= 131.43', Outlet Invert= 130.67'



Reach 10R: 76 LF 12"



Summary for Reach 12R: 34 LF 12"

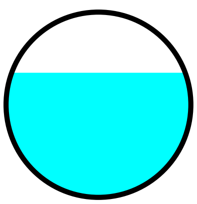
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.38' @ 7.88 hrs
[61] Hint: Exceeded Reach 10R outlet invert by 0.57' @ 7.93 hrs

Inflow Area = 2.948 ac, 88.89% Impervious, Inflow Depth > 4.08" for 100-yr, 24-hr event
Inflow = 2.73 cfs @ 7.93 hrs, Volume= 1.002 af
Outflow = 2.73 cfs @ 7.93 hrs, Volume= 1.002 af, Atten= 0%, Lag= 0.1 min

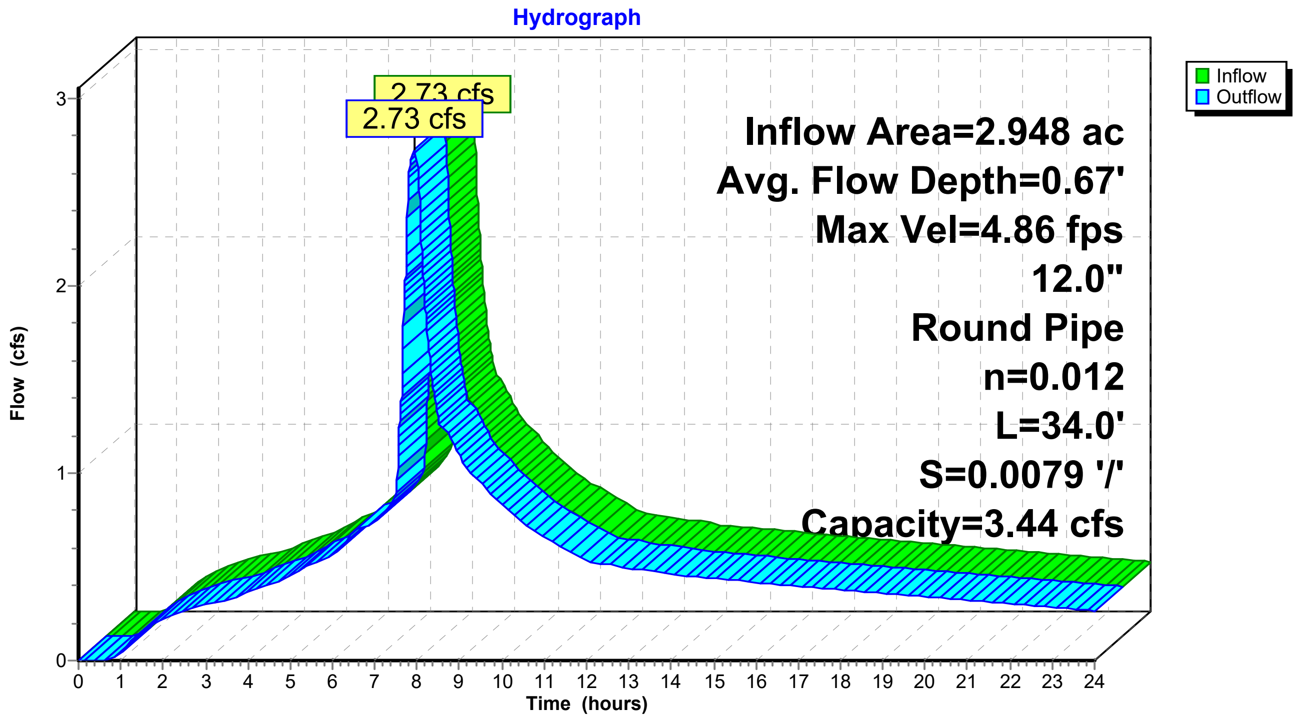
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.01 fps, Avg. Travel Time= 0.2 min

Peak Storage= 19 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.44 cfs

12.0" Round Pipe
n= 0.012
Length= 34.0' Slope= 0.0079 '/'
Inlet Invert= 130.57', Outlet Invert= 130.30'



Reach 12R: 34 LF 12"



Summary for Reach 13R: 159 LF 12"

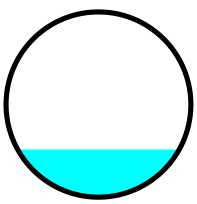
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 9R outlet invert by 0.15' @ 7.90 hrs

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 4.25" for 100-yr, 24-hr event
Inflow = 0.76 cfs @ 7.90 hrs, Volume= 0.252 af
Outflow = 0.76 cfs @ 7.90 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.4 min

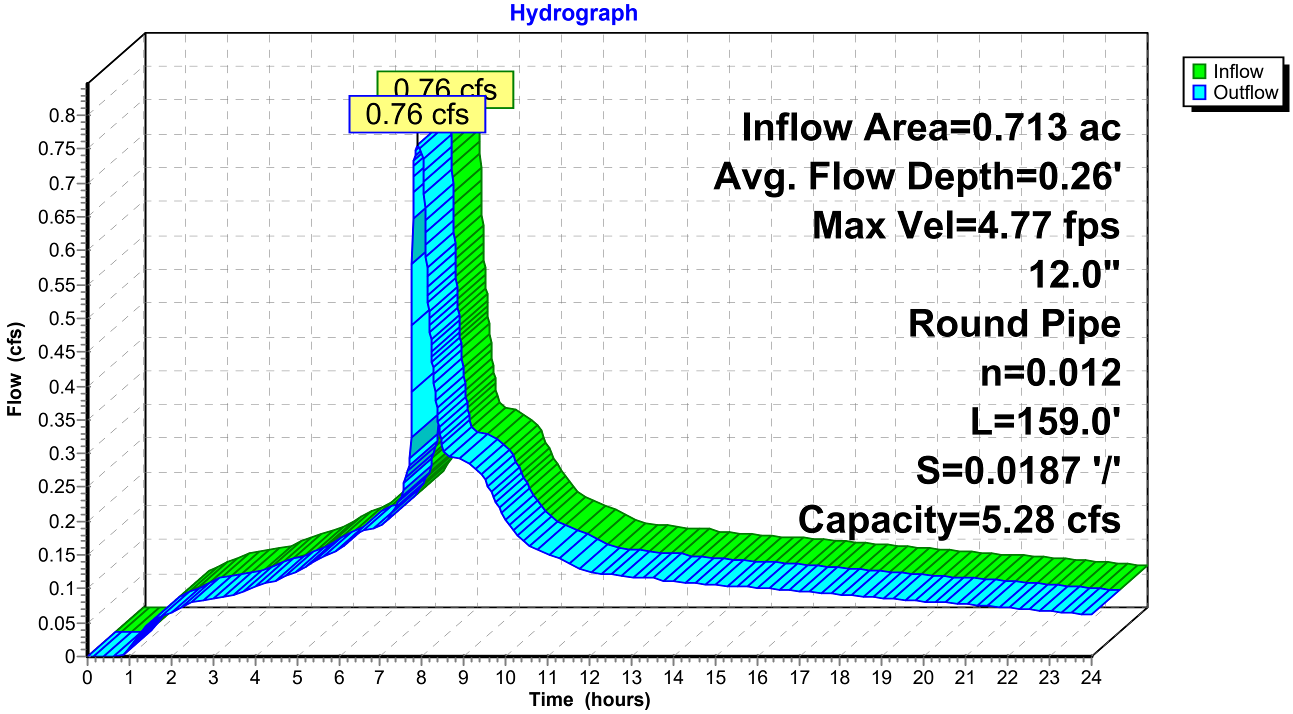
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.77 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.72 fps, Avg. Travel Time= 1.0 min

Peak Storage= 25 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.28 cfs

12.0" Round Pipe
n= 0.012
Length= 159.0' Slope= 0.0187 '/'
Inlet Invert= 135.82', Outlet Invert= 132.85'



Reach 13R: 159 LF 12"



Summary for Reach 16R: 39 LF 12"

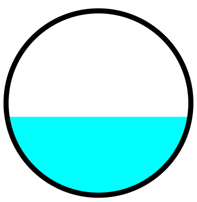
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 13R OUTLET depth by 0.07' @ 7.90 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 4.20" for 100-yr, 24-hr event
Inflow = 1.01 cfs @ 7.90 hrs, Volume= 0.337 af
Outflow = 1.01 cfs @ 7.90 hrs, Volume= 0.337 af, Atten= 0%, Lag= 0.2 min

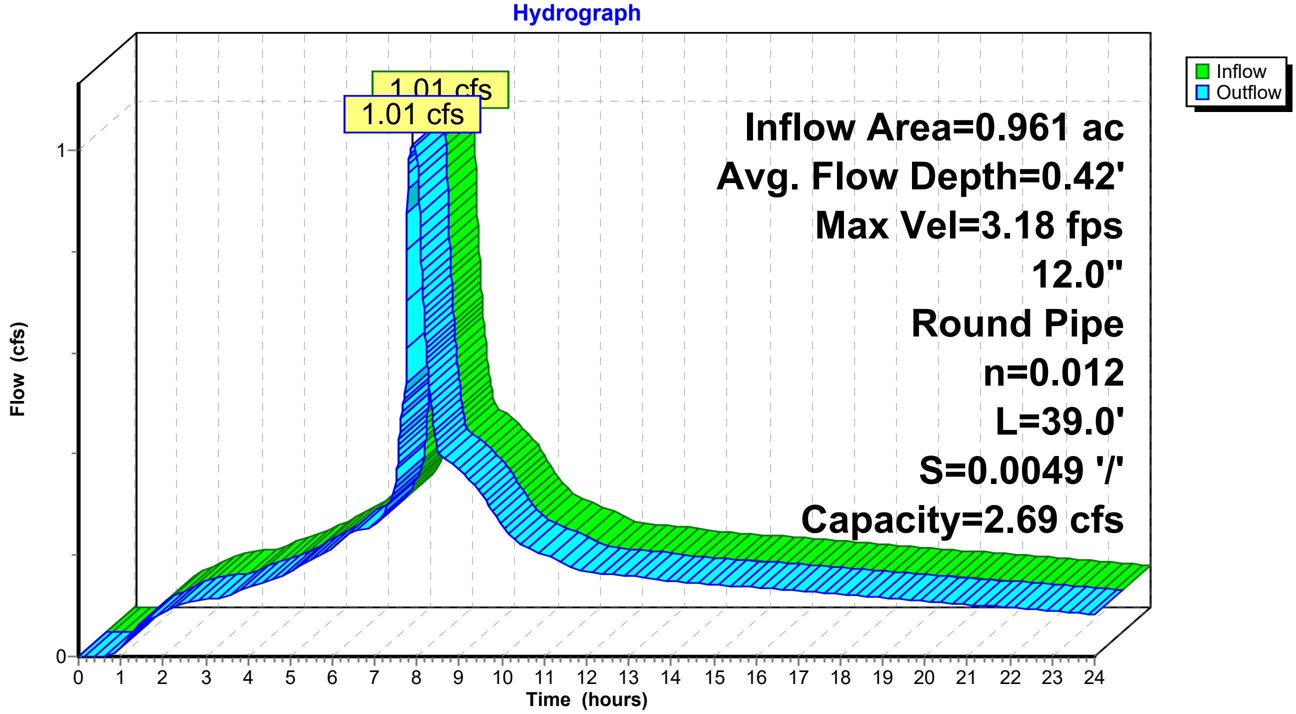
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.18 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.84 fps, Avg. Travel Time= 0.4 min

Peak Storage= 12 cf @ 7.90 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.69 cfs

12.0" Round Pipe
n= 0.012
Length= 39.0' Slope= 0.0049 '/'
Inlet Invert= 132.75', Outlet Invert= 132.56'



Reach 16R: 39 LF 12"



Summary for Reach 19R: 74 LF 18"

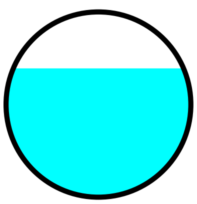
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.25' @ 8.02 hrs

Inflow Area = 6.867 ac, 51.28% Impervious, Inflow Depth > 3.48" for 100-yr, 24-hr event
Inflow = 4.90 cfs @ 7.98 hrs, Volume= 1.990 af
Outflow = 4.90 cfs @ 7.99 hrs, Volume= 1.990 af, Atten= 0%, Lag= 0.3 min

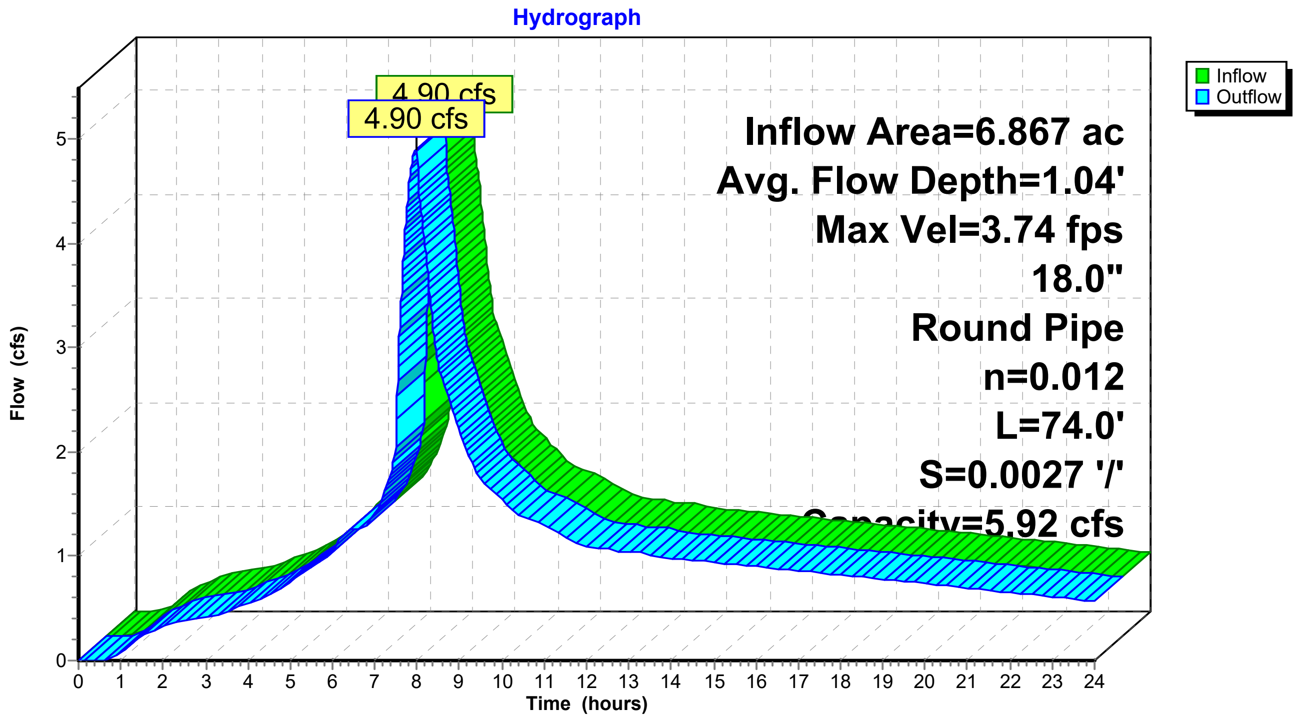
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.74 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 0.5 min

Peak Storage= 97 cf @ 7.99 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 5.92 cfs

18.0" Round Pipe
n= 0.012
Length= 74.0' Slope= 0.0027 '/'
Inlet Invert= 131.70', Outlet Invert= 131.50'



Reach 19R: 74 LF 18"



Summary for Pond 1P: East Bio

Inflow Area = 2.027 ac, 44.93% Impervious, Inflow Depth > 3.26" for 100-yr, 24-hr event
Inflow = 1.62 cfs @ 7.91 hrs, Volume= 0.552 af
Outflow = 1.47 cfs @ 8.04 hrs, Volume= 0.550 af, Atten= 10%, Lag= 7.6 min
Primary = 1.47 cfs @ 8.04 hrs, Volume= 0.550 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.84' @ 8.03 hrs Surf.Area= 0.020 ac Storage= 0.014 af

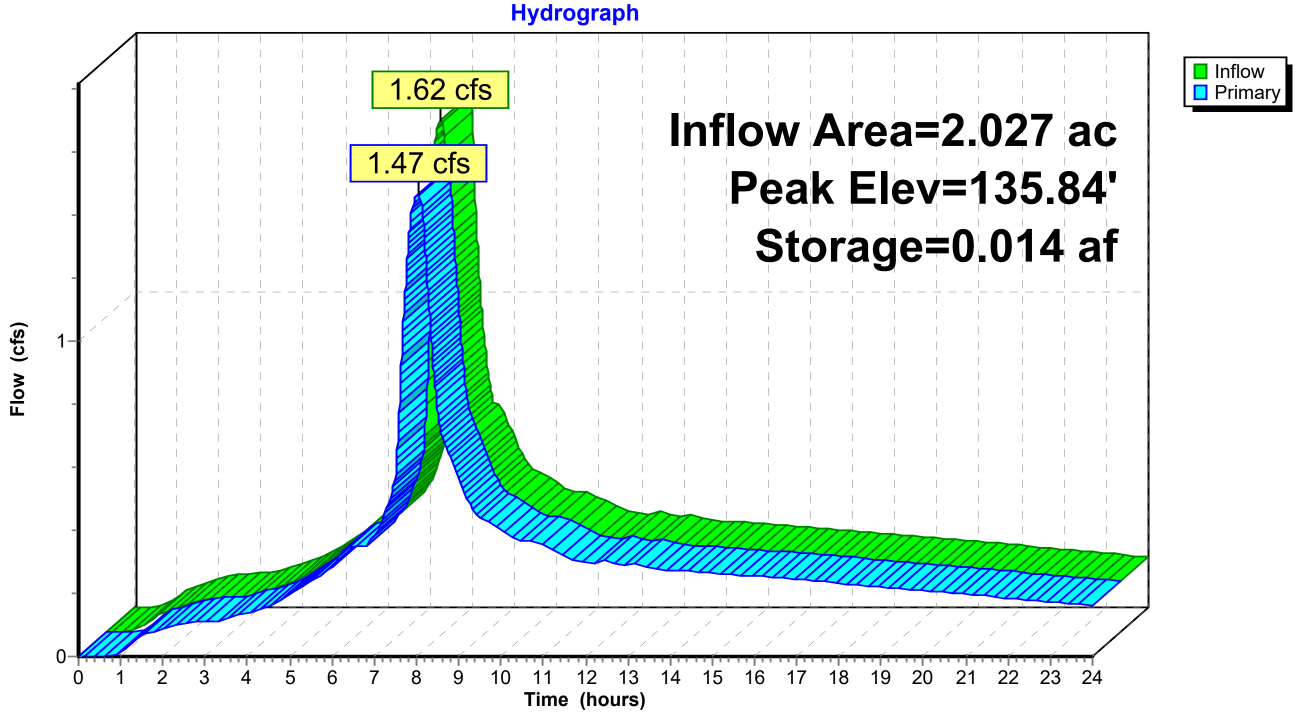
Plug-Flow detention time= 4.7 min calculated for 0.550 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (712.1 - 709.0)

Volume	Invert	Avail.Storage	Storage Description
#1	135.65'	0.012 af	**20.00'W x 20.00'L x 1.00'H Prismatoid Z=3.0**
#2	132.65'	0.012 af	**20.00'W x 22.00'L x 3.00'H Prismatoid**
			0.030 af Overall x 40.0% Voids
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	136.15'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#2	Primary	132.65'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.47 cfs @ 8.04 hrs HW=135.83' TW=133.42' (Dynamic Tailwater)
1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 1.47 cfs @ 7.48 fps)

Pond 1P: East Bio



Summary for Pond 2P: West Bio 2

Inflow Area = 0.688 ac, 93.31% Impervious, Inflow Depth > 4.17" for 100-yr, 24-hr event
Inflow = 0.72 cfs @ 7.88 hrs, Volume= 0.239 af
Outflow = 0.72 cfs @ 7.89 hrs, Volume= 0.239 af, Atten= 0%, Lag= 0.5 min
Primary = 0.72 cfs @ 7.89 hrs, Volume= 0.239 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.59' @ 7.89 hrs Surf.Area= 0.009 ac Storage= 0.006 af

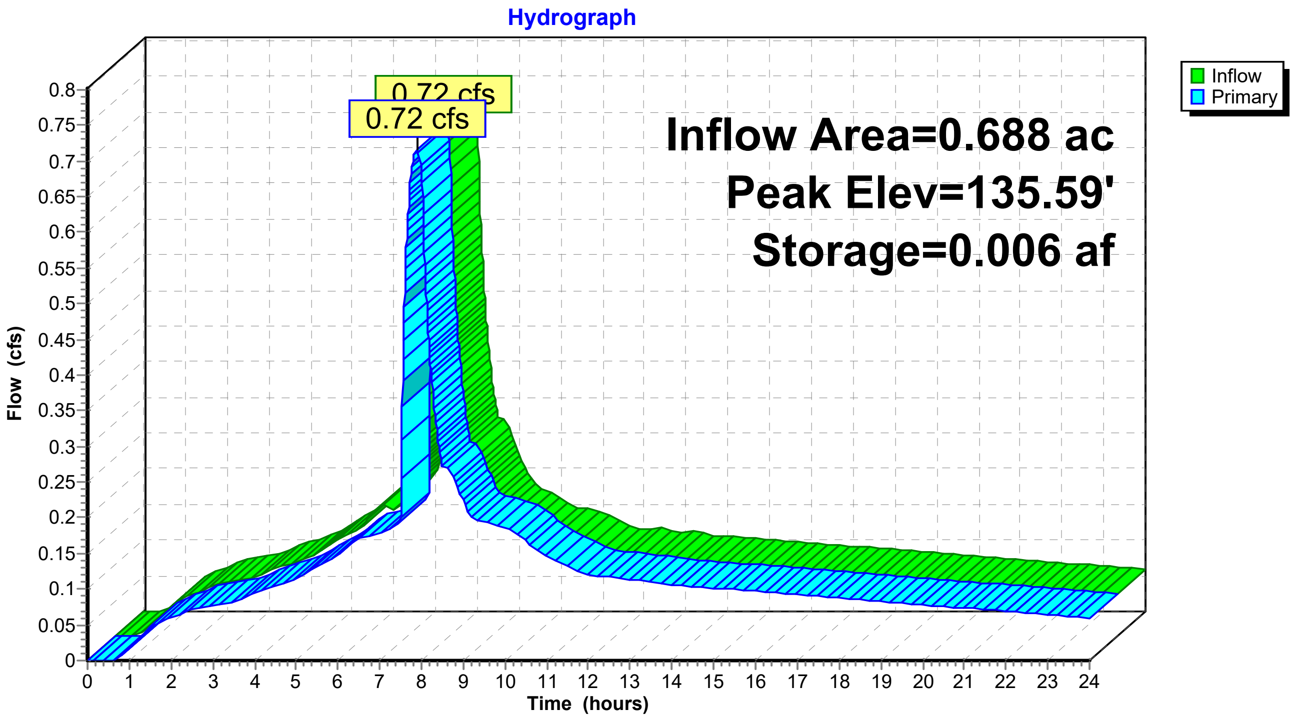
Plug-Flow detention time= 8.9 min calculated for 0.239 af (100% of inflow)
Center-of-Mass det. time= 7.5 min (667.6 - 660.1)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.006 af	**15.30'W x 10.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.003 af	**15.30'W x 10.00'L x 2.00'H Prismatoid** 0.007 af Overall x 40.0% Voids
		0.008 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.72 cfs @ 7.89 hrs HW=135.59' TW=133.14' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 0.20 cfs @ 7.54 fps)
└─**2=Orifice/Grate** (Weir Controls 0.52 cfs @ 0.96 fps)

Pond 2P: West Bio 2



Summary for Pond 8P: North Bio

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 4.26" for 100-yr, 24-hr event
Inflow = 0.76 cfs @ 7.88 hrs, Volume= 0.253 af
Outflow = 0.76 cfs @ 7.89 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.9 min
Primary = 0.76 cfs @ 7.89 hrs, Volume= 0.252 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 145.58' @ 7.89 hrs Surf.Area= 0.017 ac Storage= 0.010 af

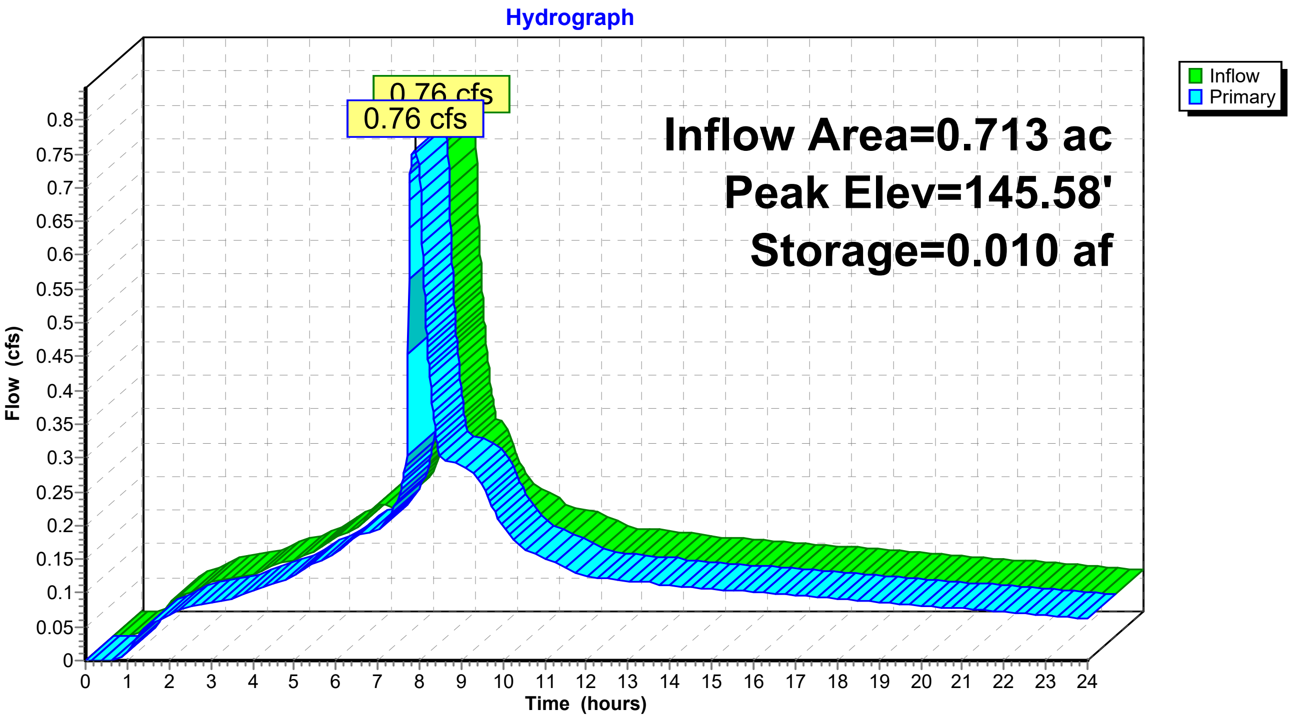
Plug-Flow detention time= 10.8 min calculated for 0.252 af (100% of inflow)
Center-of-Mass det. time= 9.0 min (664.6 - 655.6)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	0.027 af	**10.00'W x 30.00'L x 2.00'H Prismatoid Z=3.0**
#2	143.00'	0.006 af	**10.00'W x 30.00'L x 2.00'H Prismatoid** 0.014 af Overall x 40.0% Voids
		0.033 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	145.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	143.00'	**2.7" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.76 cfs @ 7.89 hrs HW=145.58' TW=136.86' (Dynamic Tailwater)
—**1=Orifice/Grate** (Weir Controls 0.46 cfs @ 0.92 fps)
—**2=Orifice/Grate** (Orifice Controls 0.30 cfs @ 7.56 fps)

Pond 8P: North Bio



Summary for Pond 14P: Pond2 Emergency

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 132.00' Surf.Area= 0.323 ac Storage= 0.448 af
Peak Elev= 132.00' @ 0.00 hrs Surf.Area= 0.323 ac Storage= 0.448 af

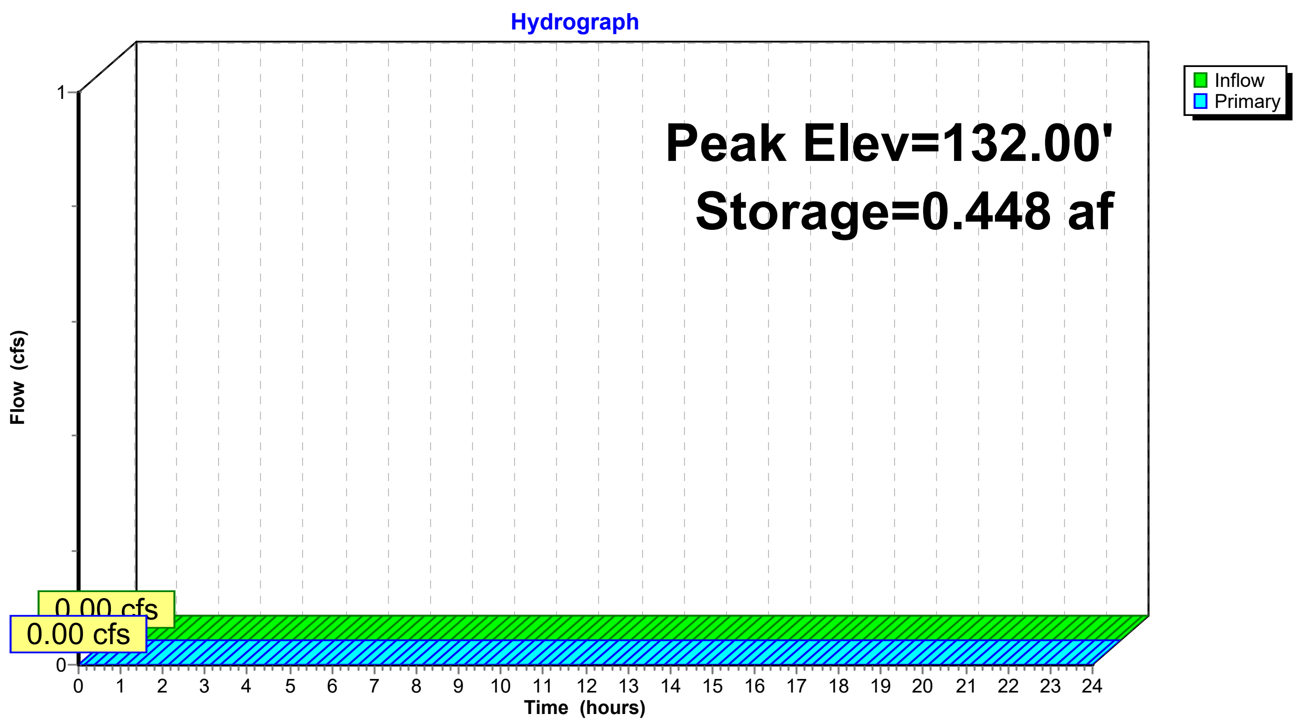
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.50'	1.791 af	**120.00'W x 100.00'L x 5.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=132.00' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: Pond2 Emergency



Summary for Pond 18R: 240 LF Bypass Culvert

[57] Hint: Peaked at 134.13' (Flood elevation advised)

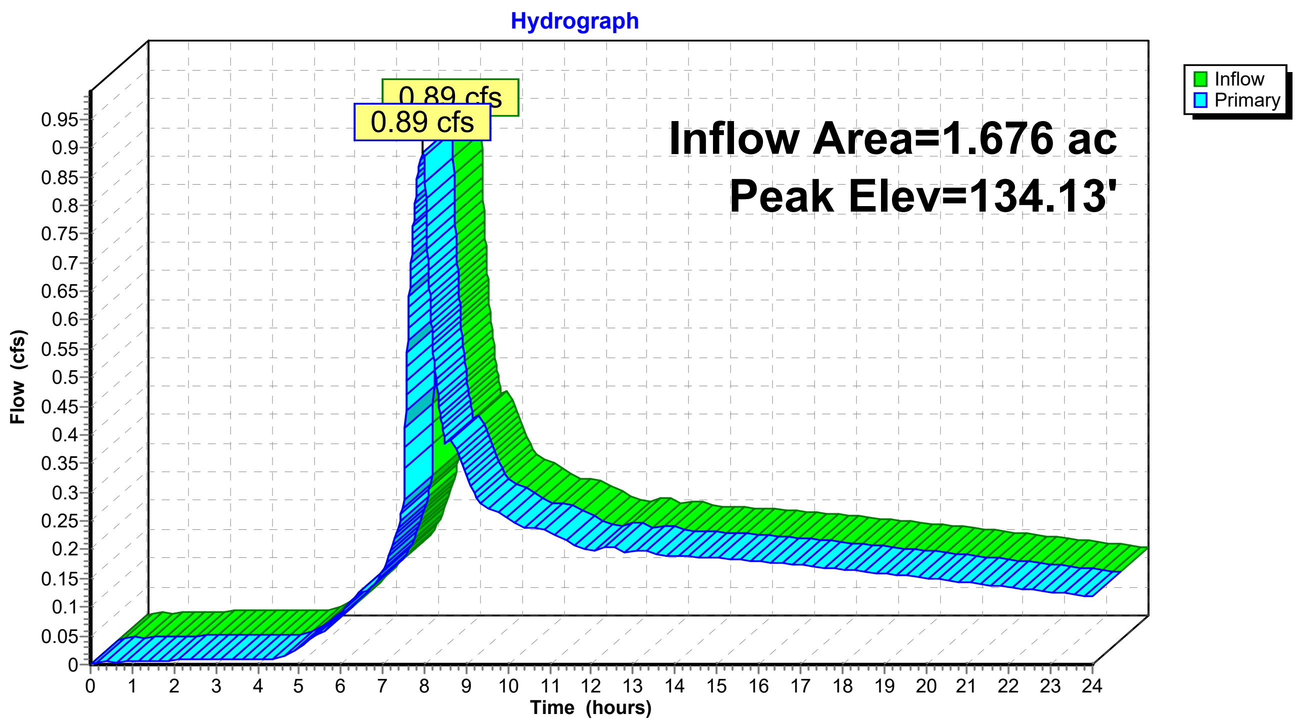
Inflow Area =	1.676 ac,	3.22% Impervious, Inflow Depth > 2.28"		for 100-yr, 24-hr event
Inflow =	0.89 cfs @	7.96 hrs, Volume=	0.318 af	
Outflow =	0.89 cfs @	7.96 hrs, Volume=	0.318 af, Atten= 0%, Lag= 0.0 min	
Primary =	0.89 cfs @	7.96 hrs, Volume=	0.318 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.13' @ 7.96 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=0.89 cfs @ 7.96 hrs HW=134.13' TW=127.99' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.89 cfs of 13.76 cfs potential flow)
  ↑—**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.89 cfs @ 1.17 fps)

Pond 18R: 240 LF Bypass Culvert



Summary for Pond 20P: Courtyard Depressions

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 3.96" for 100-yr, 24-hr event
Inflow = 0.29 cfs @ 8.08 hrs, Volume= 0.162 af
Outflow = 0.29 cfs @ 8.15 hrs, Volume= 0.159 af, Atten= 0%, Lag= 4.1 min
Primary = 0.29 cfs @ 8.15 hrs, Volume= 0.159 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.54' @ 8.15 hrs Surf.Area= 0.032 ac Storage= 0.007 af

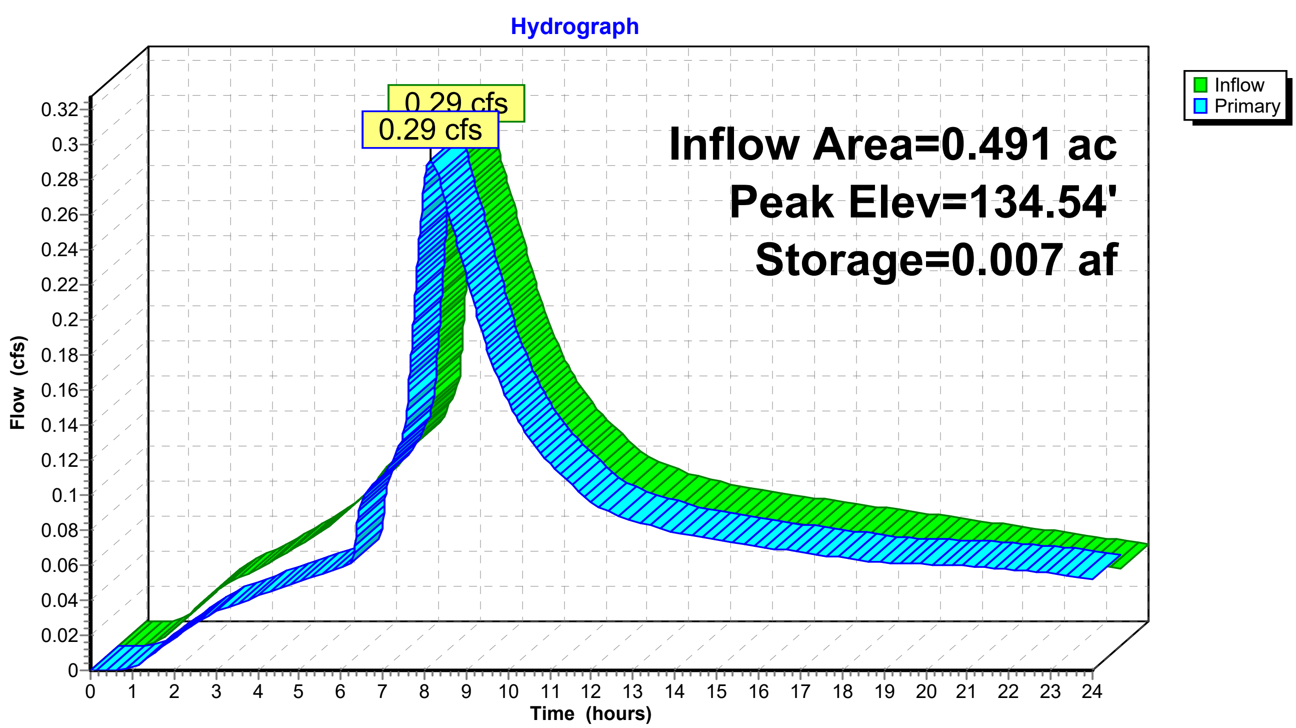
Plug-Flow detention time= 39.7 min calculated for 0.159 af (98% of inflow)
Center-of-Mass det. time= 25.7 min (726.5 - 700.7)

Volume	Invert	Avail.Storage	Storage Description
#1	134.00'	0.009 af	**5.00'W x 5.00'L x 0.60'H Prismatoid Z=30.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	134.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	134.00'	**1.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.29 cfs @ 8.15 hrs HW=134.54' TW=131.62' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 0.23 cfs @ 0.67 fps)
2=Orifice/Grate (Orifice Controls 0.06 cfs @ 3.10 fps)

Pond 20P: Courtyard Depressions



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 128.00' (Flood elevation advised)

Inflow Area = 5.680 ac, 47.76% Impervious, Inflow Depth > 3.16" for 100-yr, 24-hr event
Inflow = 4.06 cfs @ 8.00 hrs, Volume= 1.498 af
Outflow = 4.06 cfs @ 8.00 hrs, Volume= 1.498 af, Atten= 0%, Lag= 0.0 min
Primary = 2.02 cfs @ 8.00 hrs, Volume= 1.408 af
Secondary = 2.05 cfs @ 8.00 hrs, Volume= 0.090 af

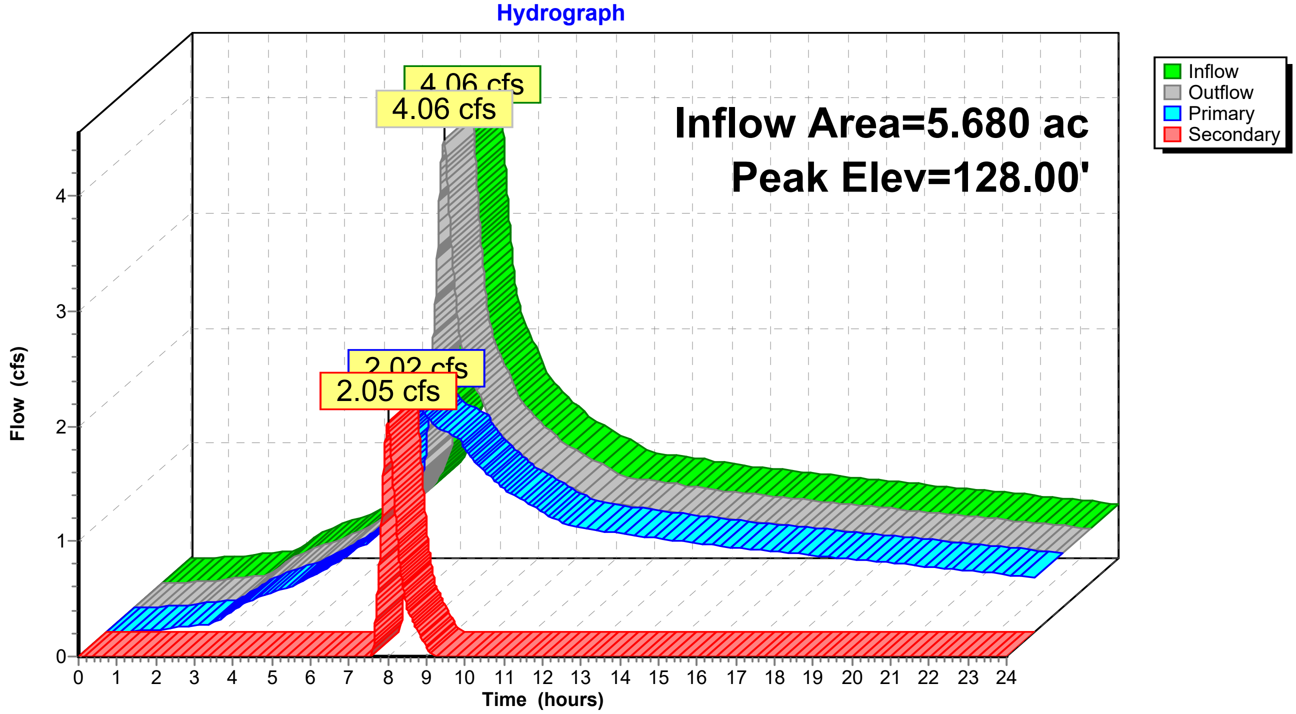
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.00' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.02 cfs @ 8.00 hrs HW=128.00' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.02 cfs @ 3.70 fps)

Secondary OutFlow Max=2.04 cfs @ 8.00 hrs HW=128.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.04 cfs @ 1.04 fps)

Pond 25P: TDA 1 Outflow



Summary for Pond AB1: West Bio 1

Inflow Area = 0.668 ac, 85.39% Impervious, Inflow Depth > 4.07" for 100-yr, 24-hr event
Inflow = 0.68 cfs @ 7.88 hrs, Volume= 0.227 af
Outflow = 0.68 cfs @ 7.90 hrs, Volume= 0.226 af, Atten= 0%, Lag= 0.8 min
Primary = 0.68 cfs @ 7.90 hrs, Volume= 0.226 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.58' @ 7.90 hrs Surf.Area= 0.016 ac Storage= 0.010 af

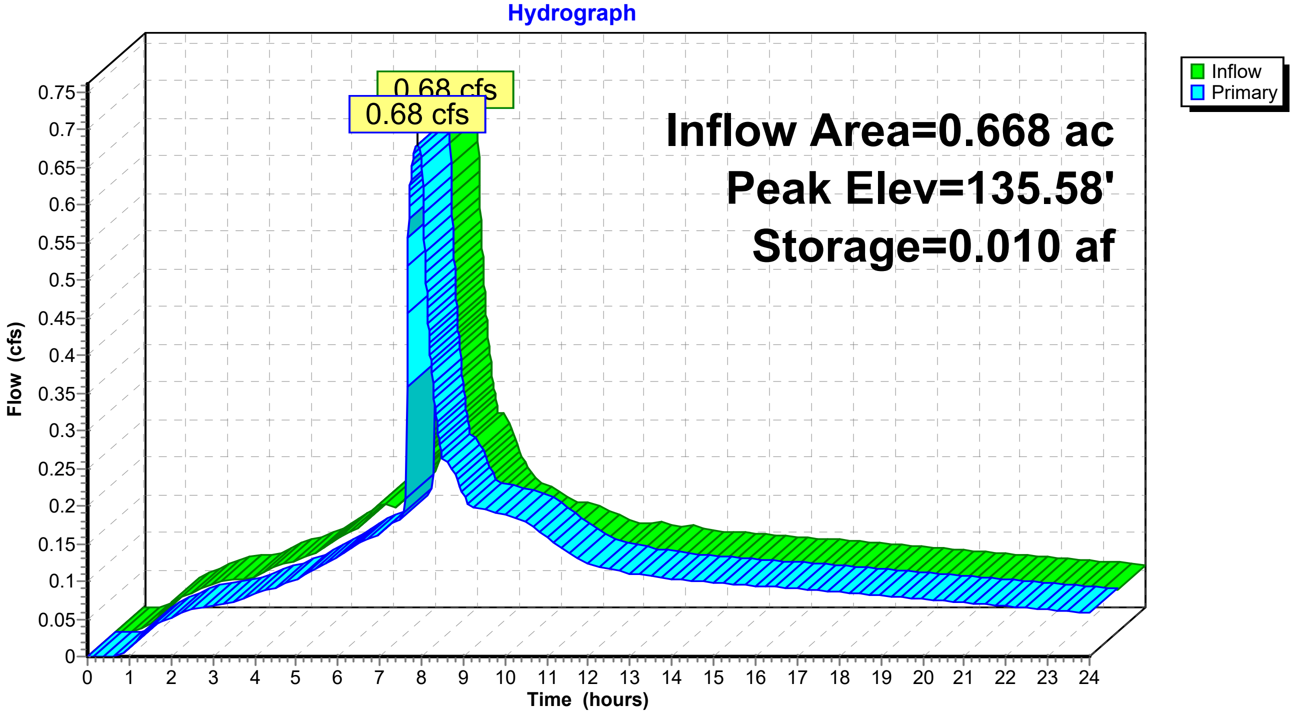
Plug-Flow detention time= 16.3 min calculated for 0.226 af (100% of inflow)
Center-of-Mass det. time= 13.7 min (679.3 - 665.6)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.009 af	**10.00'W x 28.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.005 af	**28.00'W x 10.00'L x 2.00'H Prismatoid** 0.013 af Overall x 40.0% Voids
		0.014 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.68 cfs @ 7.90 hrs HW=135.58' TW=133.14' (Dynamic Tailwater)
├—**1=Orifice/Grate** (Orifice Controls 0.20 cfs @ 7.53 fps)
└—**2=Orifice/Grate** (Weir Controls 0.48 cfs @ 0.93 fps)

Pond AB1: West Bio 1



Summary for Pond PA: Pond1

[63] Warning: Exceeded Reach 12R INLET depth by 1.99' @ 8.41 hrs

Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 4.03" for 100-yr, 24-hr event
Inflow = 2.82 cfs @ 7.94 hrs, Volume= 1.033 af
Outflow = 2.73 cfs @ 8.03 hrs, Volume= 0.996 af, Atten= 3%, Lag= 5.4 min
Primary = 2.73 cfs @ 8.03 hrs, Volume= 0.996 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.37' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 133.12' @ 8.03 hrs Surf.Area= 0.064 ac Storage= 0.094 af

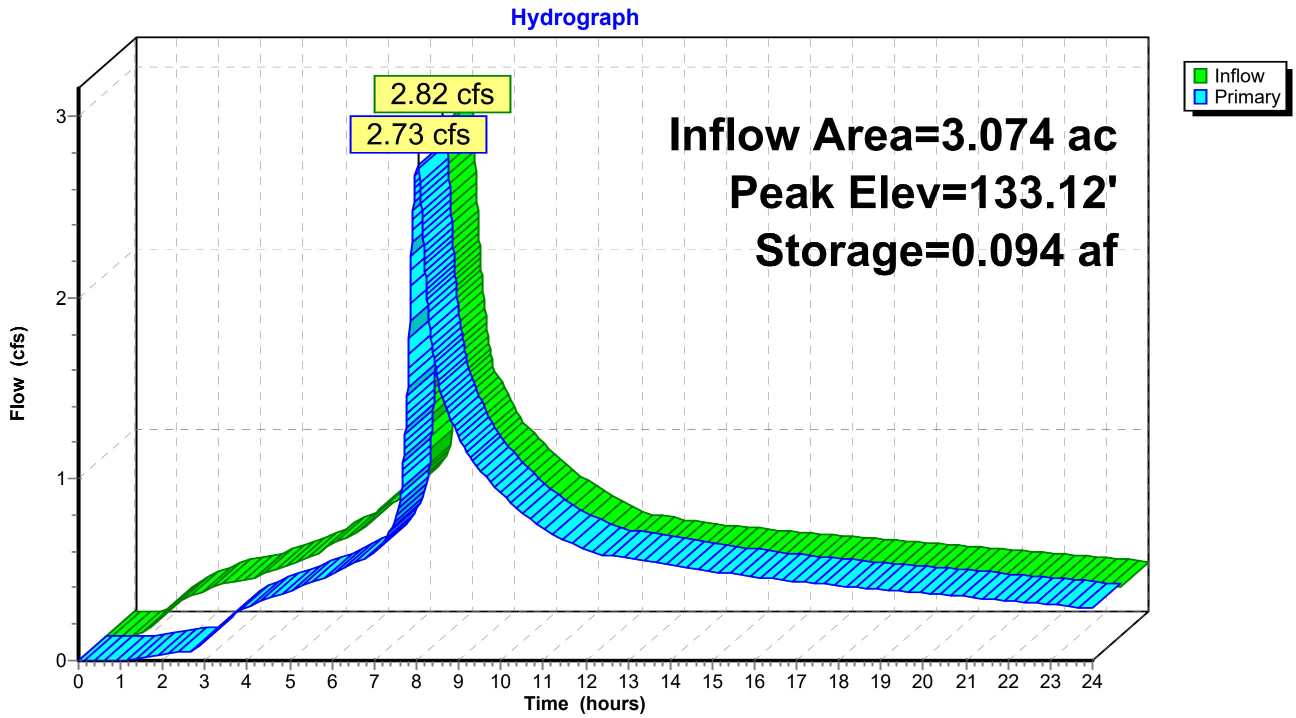
Plug-Flow detention time= 67.0 min calculated for 0.996 af (96% of inflow)
Center-of-Mass det. time= 40.4 min (724.5 - 684.1)

Volume	Invert	Avail.Storage	Storage Description
#1	131.30'	0.157 af	**42.00'W x 42.00'L x 2.70'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.60'	**1.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#2	Primary	131.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	131.30'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Primary	133.00'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.7' Crest Height

Primary OutFlow Max=2.73 cfs @ 8.03 hrs HW=133.12' TW=0.00' (Dynamic Tailwater)
├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.30 cfs @ 2.51 fps)
├─**2=Orifice/Grate** (Orifice Controls 0.69 cfs @ 5.08 fps)
├─**3=Orifice/Grate** (Orifice Controls 0.10 cfs @ 6.37 fps)
└─**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.64 cfs @ 1.14 fps)

Pond PA: Pond1



Summary for Pond PB: Pond2

[63] Warning: Exceeded Reach 19R INLET depth by 1.21' @ 9.50 hrs

Inflow Area = 8.602 ac, 42.69% Impervious, Inflow Depth > 3.34" for 100-yr, 24-hr event
Inflow = 5.73 cfs @ 8.00 hrs, Volume= 2.397 af
Outflow = 2.90 cfs @ 8.91 hrs, Volume= 1.978 af, Atten= 49%, Lag= 54.9 min
Primary = 2.90 cfs @ 8.91 hrs, Volume= 1.978 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.85' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 133.51' @ 8.91 hrs Surf.Area= 0.340 ac Storage= 0.616 af

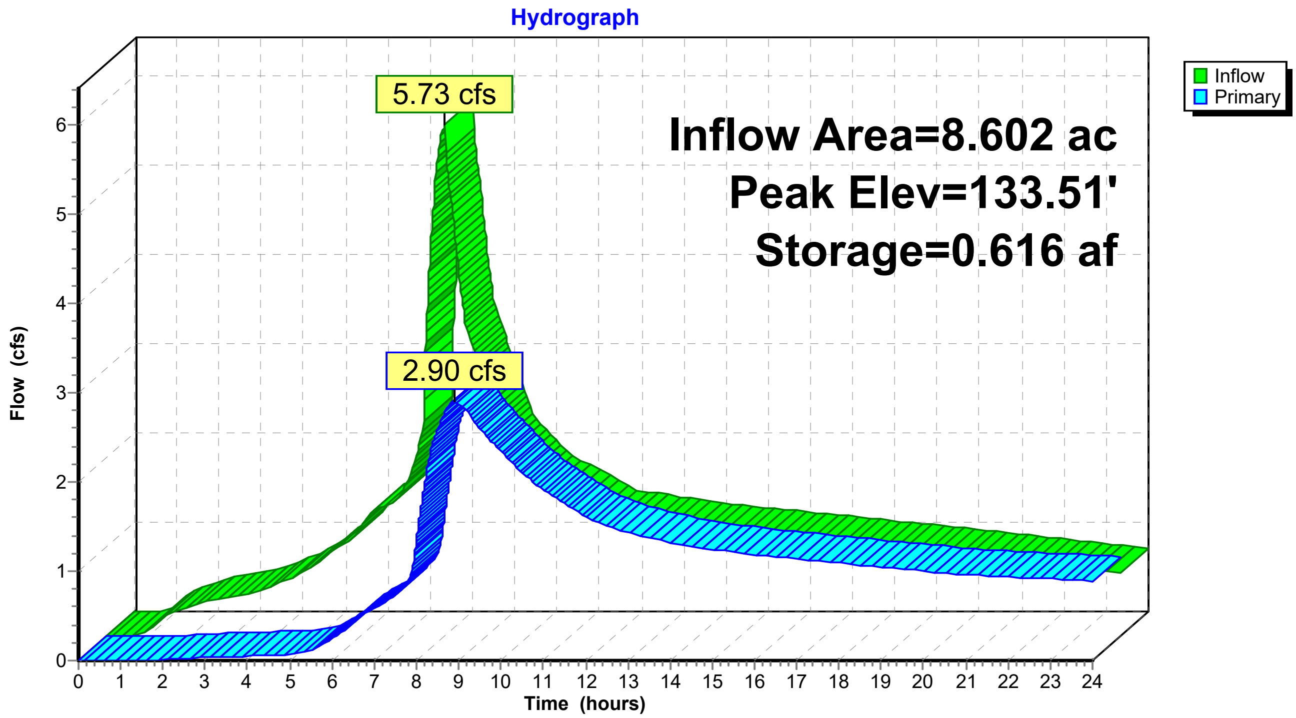
Plug-Flow detention time= 233.2 min calculated for 1.977 af (82% of inflow)
Center-of-Mass det. time= 120.0 min (837.8 - 717.8)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	0.970 af	**120.00'W x 100.00'L x 3.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	131.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.00'	**1.4' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.5' Crest Height
#4	Primary	133.47'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.6' Crest Height

Primary OutFlow Max=2.90 cfs @ 8.91 hrs HW=133.51' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 1.06 cfs @ 5.40 fps)
2=Orifice/Grate (Orifice Controls 0.15 cfs @ 6.68 fps)
3=Sharp-Crested Rectangular Weir (Weir Controls 1.59 cfs @ 2.42 fps)
4=Sharp-Crested Rectangular Weir (Weir Controls 0.10 cfs @ 0.62 fps)

Pond PB: Pond2

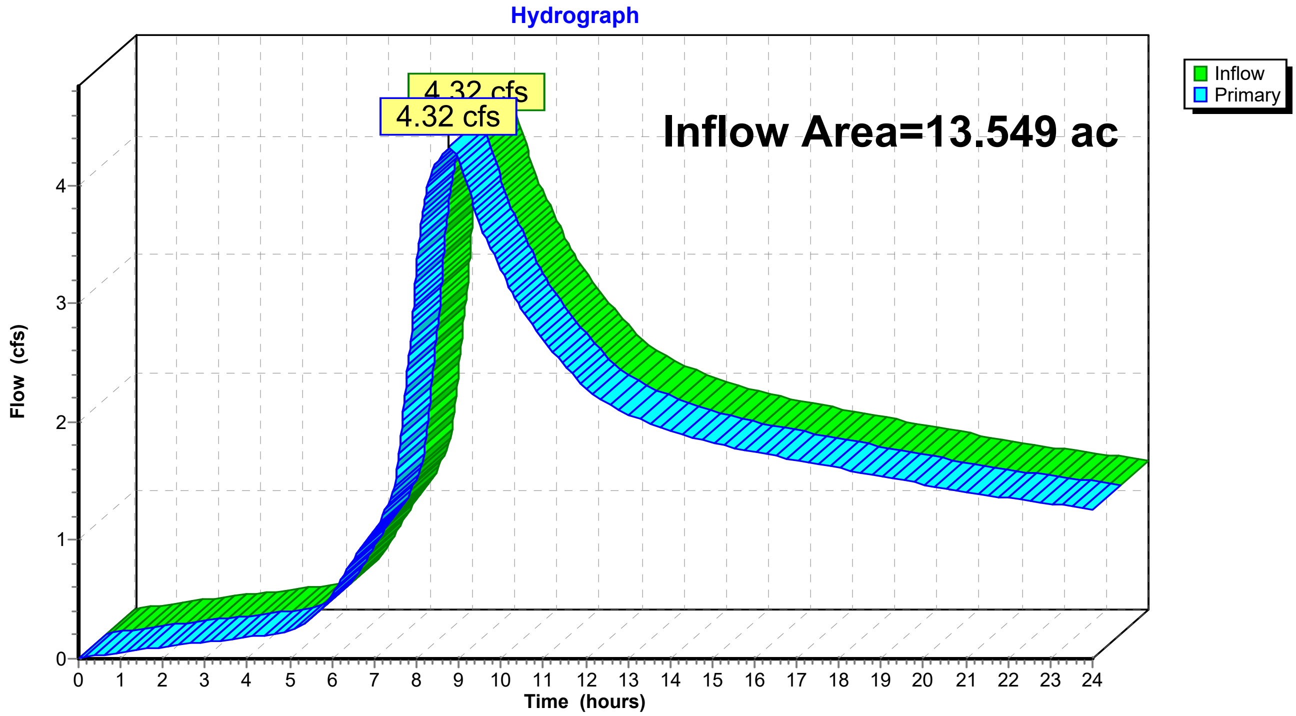


Summary for Link 11L: TDA 2 Outflow

Inflow Area = 13.549 ac, 32.99% Impervious, Inflow Depth > 2.67" for 100-yr, 24-hr event
Inflow = 4.32 cfs @ 8.77 hrs, Volume= 3.015 af
Primary = 4.32 cfs @ 8.77 hrs, Volume= 3.015 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 11L: TDA 2 Outflow

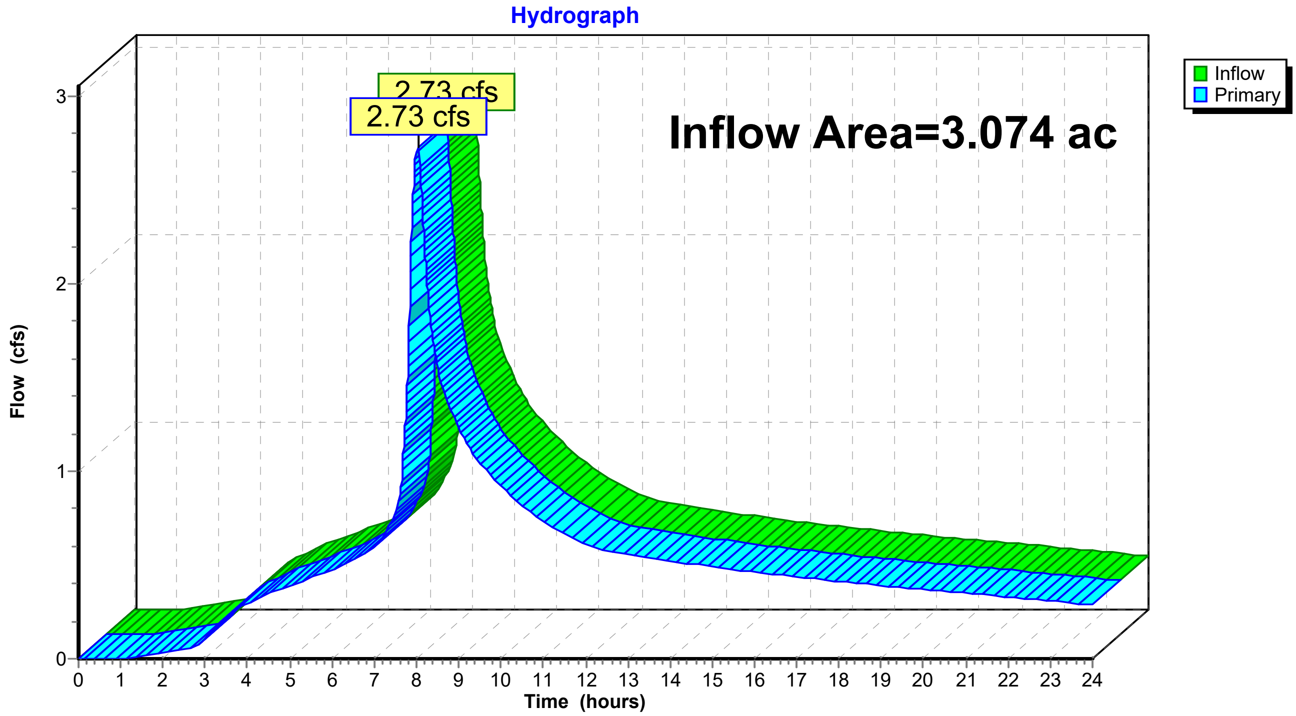


Summary for Link 12L: Site Outflow

Inflow Area =	3.074 ac,	85.24% Impervious,	Inflow Depth > 3.89"	for 100-yr, 24-hr event
Inflow =	2.73 cfs @	8.03 hrs, Volume=	0.996 af	
Primary =	2.73 cfs @	8.03 hrs, Volume=	0.996 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 12L: Site Outflow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A1: Frontage Runoff Area=0.713 ac 100.00% Impervious Runoff Depth>1.45"
Tc=5.0 min CN=0/98 Runoff=0.27 cfs 0.086 af

Subcatchment A2: West Parking 1 Runoff Area=29,090 sf 85.39% Impervious Runoff Depth>1.32"
Tc=5.0 min CN=86/98 Runoff=0.22 cfs 0.074 af

Subcatchment A3: West Parking 2 Runoff Area=0.688 ac 93.31% Impervious Runoff Depth>1.39"
Tc=5.0 min CN=86/98 Runoff=0.24 cfs 0.080 af

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>0.33"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.05 cfs 0.046 af

Subcatchment A5: Courtyard 2 Runoff Area=0.248 ac 87.10% Impervious Runoff Depth>1.34"
Tc=5.0 min CN=86/98 Runoff=0.08 cfs 0.028 af

Subcatchment A6: Fire Lane Runoff Area=0.140 ac 53.57% Impervious Runoff Depth>1.03"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.02 cfs 0.012 af

Subcatchment A7: Courtyard 1 Runoff Area=0.491 ac 82.28% Impervious Runoff Depth>1.27"
Flow Length=850' Tc=51.5 min CN=86/98 Runoff=0.09 cfs 0.052 af

Subcatchment A8: Pond Direct Runoff Area=5,502 sf 0.00% Impervious Runoff Depth>0.60"
Tc=10.0 min CN=86/0 Runoff=0.01 cfs 0.006 af

Subcatchment A9: Vegetated/Wetland Runoff Area=40,486 sf 4.10% Impervious Runoff Depth>0.36"
Flow Length=240' Slope=0.0750 '/' Tc=14.0 min CN=78/100 Runoff=0.03 cfs 0.028 af

Subcatchment B1: East Parking Runoff Area=88,300 sf 44.93% Impervious Runoff Depth>0.85"
Tc=5.0 min CN=80/98 Runoff=0.39 cfs 0.144 af

Subcatchment B2: Courtyard 3 Runoff Area=24,008 sf 70.66% Impervious Runoff Depth>1.20"
Tc=5.0 min CN=86/98 Runoff=0.16 cfs 0.055 af

Subcatchment B3: Building Roof Runoff Area=65,510 sf 100.00% Impervious Runoff Depth>1.45"
Tc=0.0 min CN=0/98 Runoff=0.57 cfs 0.181 af

Subcatchment B4: Field and Track Runoff Area=121,328 sf 25.76% Impervious Runoff Depth>0.74"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=84/98 Runoff=0.29 cfs 0.173 af

Subcatchment B5: Access Road and Pond Runoff Area=75,574 sf 8.72% Impervious Runoff Depth>0.55"
Flow Length=260' Slope=0.0100 '/' Tc=33.5 min CN=83/98 Runoff=0.11 cfs 0.080 af

Subcatchment B6: South Wetland Runoff Area=191,628 sf 12.89% Impervious Runoff Depth>0.43"
Flow Length=300' Slope=0.0100 '/' Tc=37.5 min CN=76/100 Runoff=0.17 cfs 0.157 af

Subcatchment B7: Courtyard Bypass Runoff Area=23,868 sf 41.91% Impervious Runoff Depth>0.95"
Flow Length=330' Slope=0.0100 '/' Tc=12.9 min CN=86/98 Runoff=0.11 cfs 0.044 af

Reach 1R: 279 LF 18" Avg. Flow Depth=0.42' Max Vel=2.66 fps Inflow=1.09 cfs 0.380 af
18.0" Round Pipe n=0.012 L=279.0' S=0.0030 '/' Capacity=6.24 cfs Outflow=1.09 cfs 0.379 af

Reach 3R: 134 LF 12" Avg. Flow Depth=0.20' Max Vel=2.55 fps Inflow=0.29 cfs 0.113 af
12.0" Round Pipe n=0.012 L=134.0' S=0.0069 '/' Capacity=3.22 cfs Outflow=0.29 cfs 0.113 af

Reach 4R: 56 LF 12" Avg. Flow Depth=0.24' Max Vel=2.38 fps Inflow=0.35 cfs 0.153 af
12.0" Round Pipe n=0.012 L=56.0' S=0.0050 '/' Capacity=2.73 cfs Outflow=0.35 cfs 0.153 af

Reach 5R: 70 LF 12" Avg. Flow Depth=0.15' Max Vel=2.17 fps Inflow=0.16 cfs 0.055 af
12.0" Round Pipe n=0.012 L=70.0' S=0.0071 '/' Capacity=3.26 cfs Outflow=0.16 cfs 0.055 af

Reach 6R: 38 LF 12" Avg. Flow Depth=0.35' Max Vel=2.23 fps Inflow=0.54 cfs 0.199 af
12.0" Round Pipe n=0.012 L=38.0' S=0.0029 '/' Capacity=2.08 cfs Outflow=0.54 cfs 0.199 af

Reach 7R: 107 LF 12" Avg. Flow Depth=0.09' Max Vel=1.59 fps Inflow=0.06 cfs 0.052 af
12.0" Round Pipe n=0.012 L=107.0' S=0.0070 '/' Capacity=3.23 cfs Outflow=0.06 cfs 0.052 af

Reach 8R: 170 LF 12" Avg. Flow Depth=0.16' Max Vel=1.94 fps Inflow=0.16 cfs 0.055 af
12.0" Round Pipe n=0.012 L=170.0' S=0.0052 '/' Capacity=2.79 cfs Outflow=0.16 cfs 0.055 af

Reach 9R: 115 LF 12" Avg. Flow Depth=0.19' Max Vel=2.07 fps Inflow=0.22 cfs 0.086 af
12.0" Round Pipe n=0.012 L=115.0' S=0.0050 '/' Capacity=2.72 cfs Outflow=0.22 cfs 0.086 af

Reach 10R: 76 LF 12" Avg. Flow Depth=0.27' Max Vel=3.63 fps Inflow=0.64 cfs 0.266 af
12.0" Round Pipe n=0.012 L=76.0' S=0.0100 '/' Capacity=3.86 cfs Outflow=0.64 cfs 0.266 af

Reach 12R: 34 LF 12" Avg. Flow Depth=0.31' Max Vel=3.44 fps Inflow=0.70 cfs 0.329 af
12.0" Round Pipe n=0.012 L=34.0' S=0.0079 '/' Capacity=3.44 cfs Outflow=0.70 cfs 0.329 af

Reach 13R: 159 LF 12" Avg. Flow Depth=0.14' Max Vel=3.31 fps Inflow=0.22 cfs 0.086 af
12.0" Round Pipe n=0.012 L=159.0' S=0.0187 '/' Capacity=5.28 cfs Outflow=0.22 cfs 0.085 af

Reach 16R: 39 LF 12" Avg. Flow Depth=0.22' Max Vel=2.25 fps Inflow=0.29 cfs 0.113 af
12.0" Round Pipe n=0.012 L=39.0' S=0.0049 '/' Capacity=2.69 cfs Outflow=0.29 cfs 0.113 af

Reach 19R: 74 LF 18" Avg. Flow Depth=0.49' Max Vel=2.72 fps Inflow=1.35 cfs 0.552 af
18.0" Round Pipe n=0.012 L=74.0' S=0.0027 '/' Capacity=5.92 cfs Outflow=1.35 cfs 0.552 af

Pond 1P: East Bio Peak Elev=133.16' Storage=0.002 af Inflow=0.39 cfs 0.144 af
Outflow=0.38 cfs 0.144 af

Pond 2P: West Bio 2 Peak Elev=135.22' Storage=0.004 af Inflow=0.24 cfs 0.080 af
Outflow=0.19 cfs 0.079 af

Pond 8P: North Bio Peak Elev=144.41' Storage=0.004 af Inflow=0.27 cfs 0.086 af
Outflow=0.22 cfs 0.086 af

Pond 14P: Pond2 Emergency Peak Elev=132.00' Storage=0.448 af Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=134.02' Inflow=0.05 cfs 0.046 af
Outflow=0.05 cfs 0.046 af

Pond 20P: Courtyard Depressions Peak Elev=134.48' Storage=0.005 af Inflow=0.09 cfs 0.052 af
Outflow=0.06 cfs 0.052 af

Pond 25P: TDA 1 Outflow Peak Elev=127.39' Inflow=0.57 cfs 0.382 af
Primary=0.57 cfs 0.382 af Secondary=0.00 cfs 0.000 af Outflow=0.57 cfs 0.382 af

Pond AB1: West Bio 1 Peak Elev=134.71' Storage=0.004 af Inflow=0.22 cfs 0.074 af
Outflow=0.16 cfs 0.073 af

Pond PA: Pond1 Peak Elev=132.43' Storage=0.053 af Inflow=0.72 cfs 0.336 af
Outflow=0.50 cfs 0.308 af

Pond PB: Pond2 Peak Elev=132.33' Storage=0.240 af Inflow=1.46 cfs 0.632 af
Outflow=0.36 cfs 0.416 af

Link 11L: TDA 2 Outflow Inflow=0.49 cfs 0.617 af
Primary=0.49 cfs 0.617 af

Link 12L: Site Outflow Inflow=0.50 cfs 0.308 af
Primary=0.50 cfs 0.308 af

Total Runoff Area = 19.229 ac Runoff Volume = 1.245 af Average Runoff Depth = 0.78"
62.65% Pervious = 12.047 ac 37.35% Impervious = 7.182 ac

Summary for Subcatchment A1: Frontage

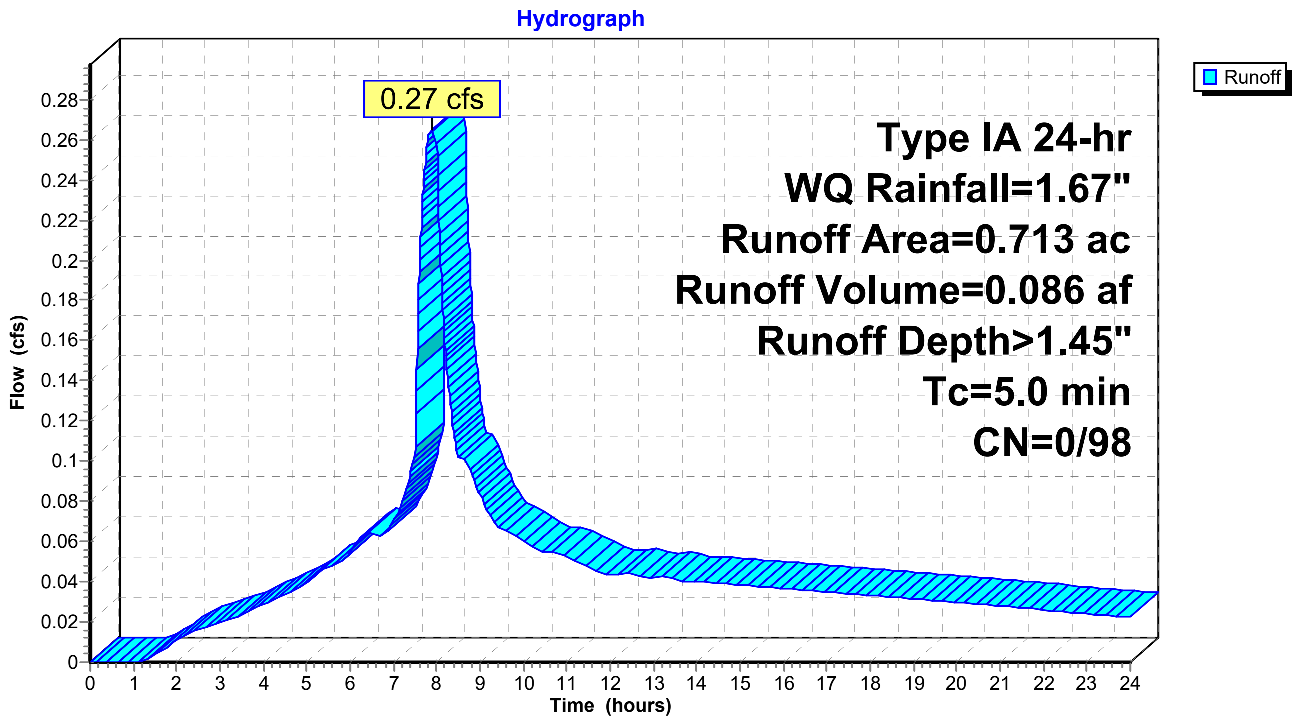
Runoff = 0.27 cfs @ 7.89 hrs, Volume= 0.086 af, Depth> 1.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (ac)	CN	Description
*	0.713	98	Road/Sidewalk
	0.713	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A1: Frontage



Summary for Subcatchment A2: West Parking 1

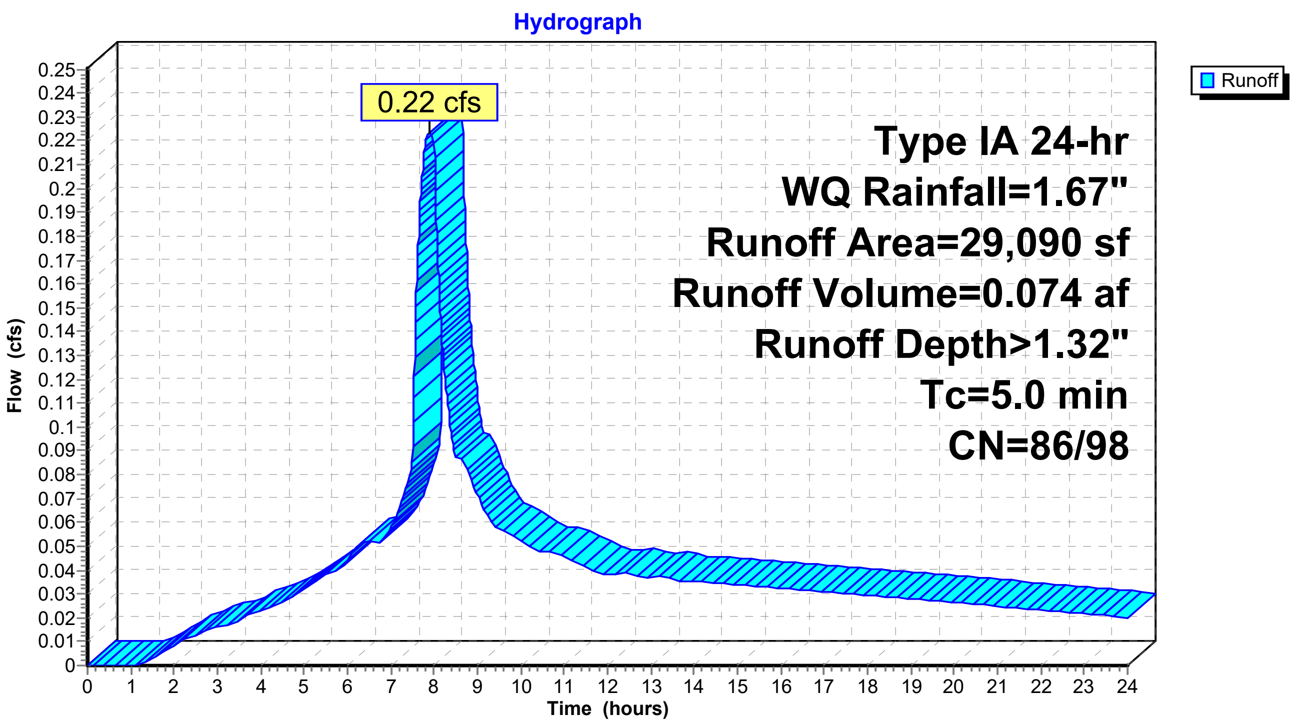
Runoff = 0.22 cfs @ 7.90 hrs, Volume= 0.074 af, Depth> 1.32"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	24,840	98	Parking Lot/Sidewalk
*	4,250	86	Bioretention/Landscape
	29,090	96	Weighted Average
	4,250	86	14.61% Pervious Area
	24,840	98	85.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A2: West Parking 1



Summary for Subcatchment A3: West Parking 2

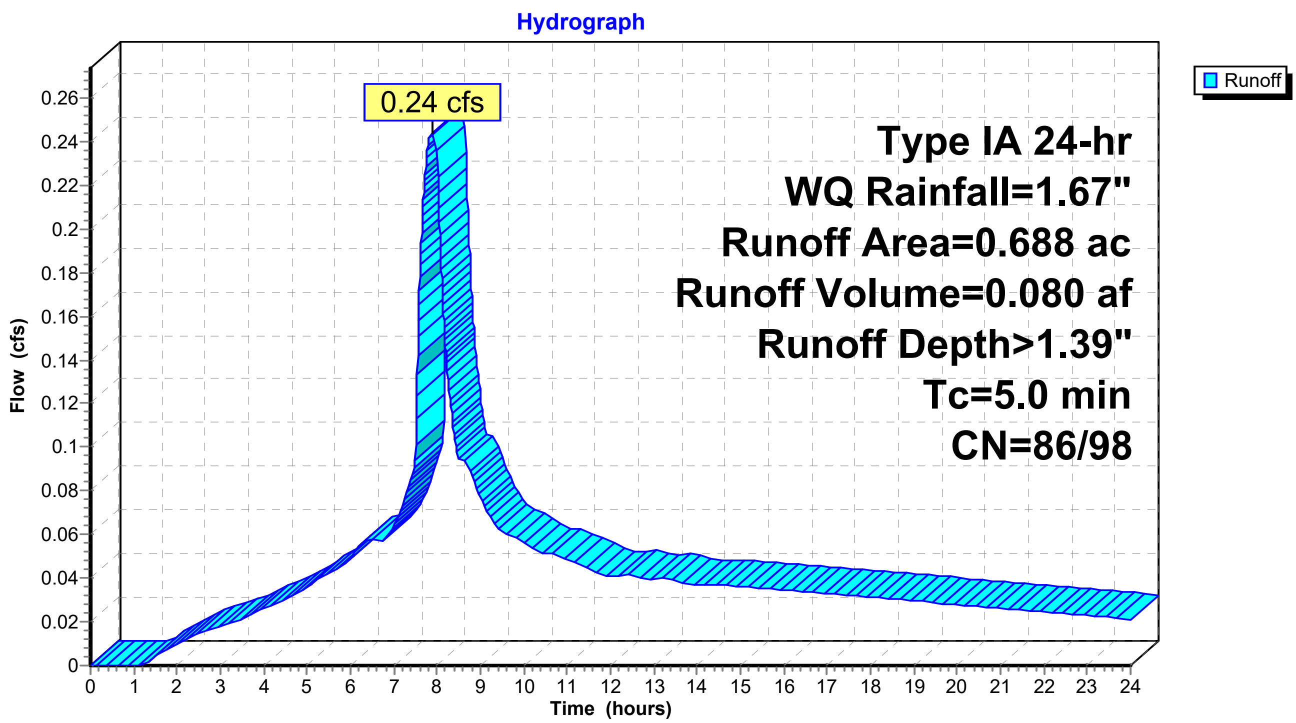
Runoff = 0.24 cfs @ 7.89 hrs, Volume= 0.080 af, Depth> 1.39"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (ac)	CN	Description
*	0.642	98	Parking Lot/Sidewalk
*	0.046	86	Bioretention/Landscape
	0.688	97	Weighted Average
	0.046	86	6.69% Pervious Area
	0.642	98	93.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A3: West Parking 2



Summary for Subcatchment A4: North Wetland

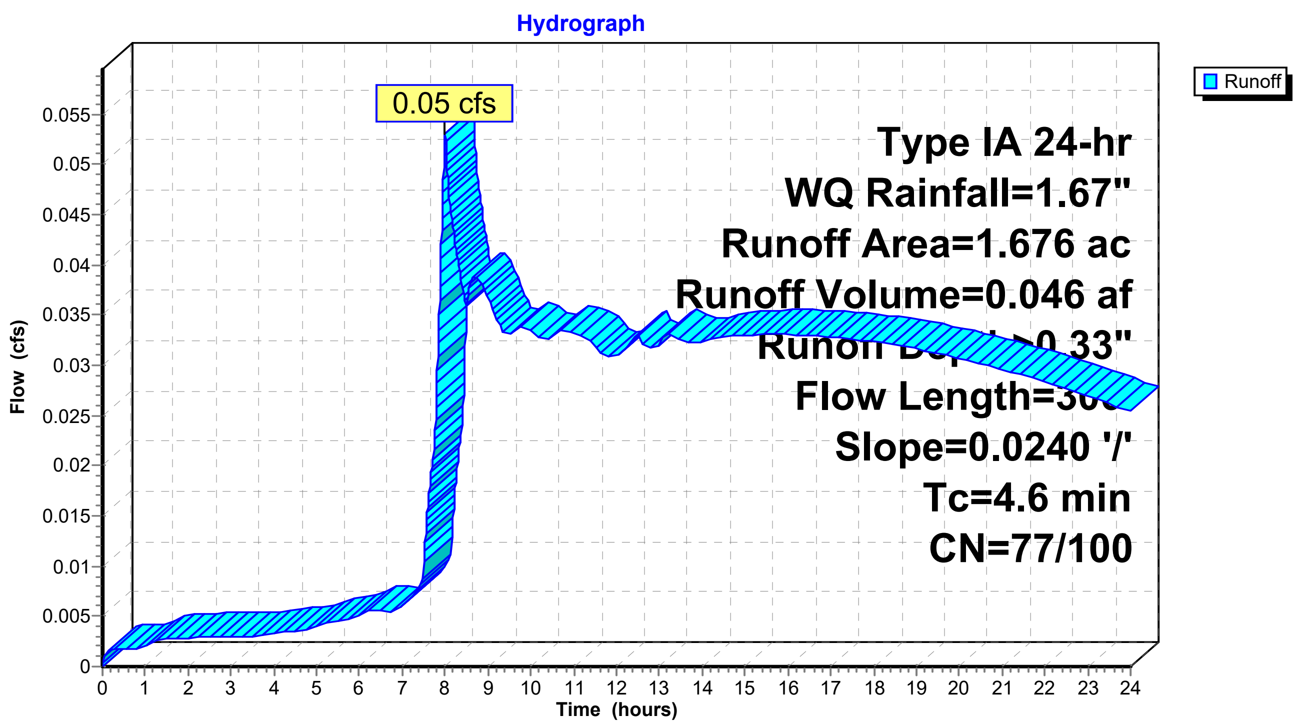
Runoff = 0.05 cfs @ 8.00 hrs, Volume= 0.046 af, Depth> 0.33"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment A5: Courtyard 2

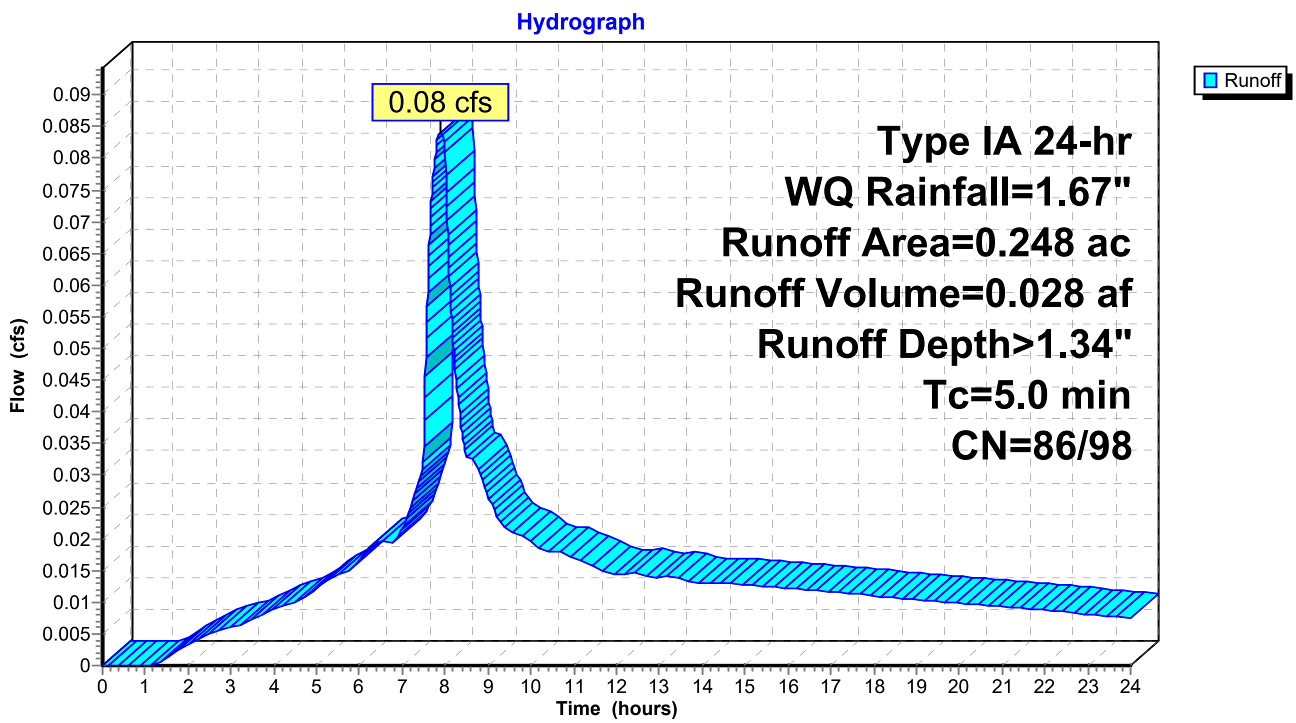
Runoff = 0.08 cfs @ 7.89 hrs, Volume= 0.028 af, Depth> 1.34"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (ac)	CN	Description
*	0.216	98	Courtyard Pavement
*	0.032	86	Courtyard Landscaping
	0.248	96	Weighted Average
	0.032	86	12.90% Pervious Area
	0.216	98	87.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment A5: Courtyard 2



Summary for Subcatchment A6: Fire Lane

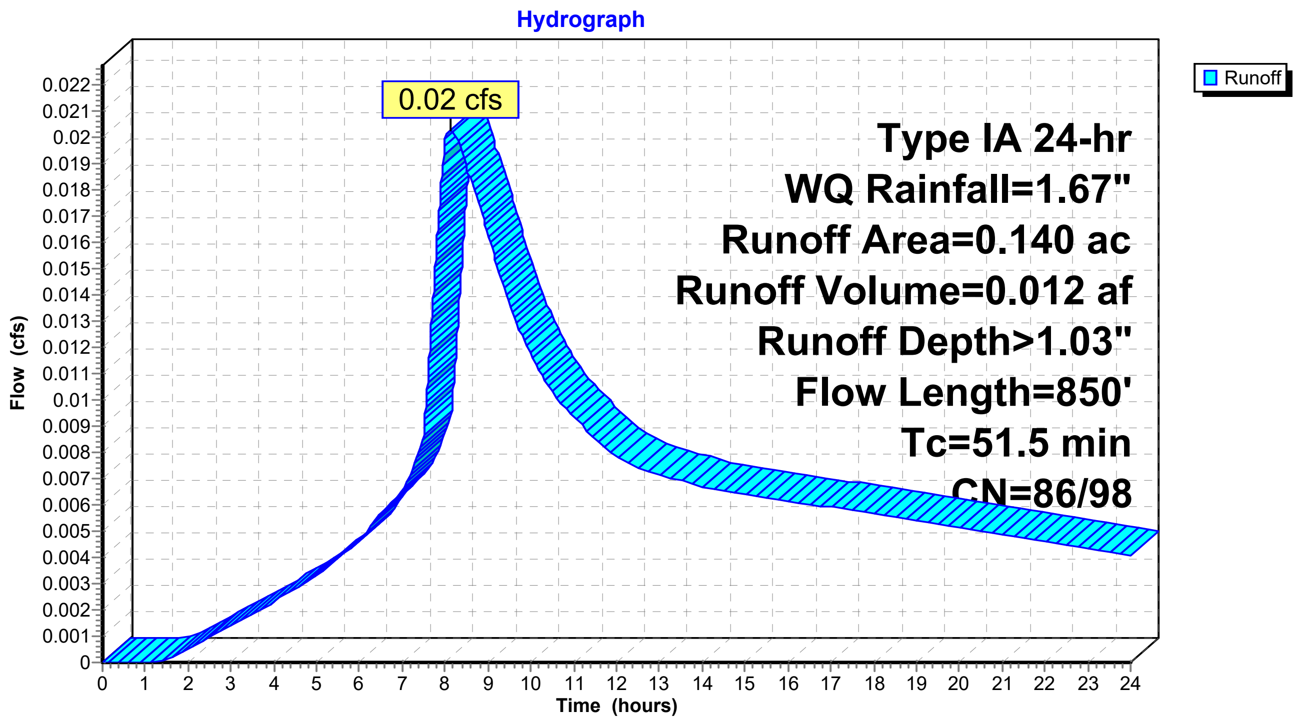
Runoff = 0.02 cfs @ 8.13 hrs, Volume= 0.012 af, Depth> 1.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (ac)	CN	Description
*	0.065	86	Courtyard Landscaping
*	0.075	98	Fire Lane
	0.140	92	Weighted Average
	0.065	86	46.43% Pervious Area
	0.075	98	53.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A6: Fire Lane



Summary for Subcatchment A7: Courtyard 1

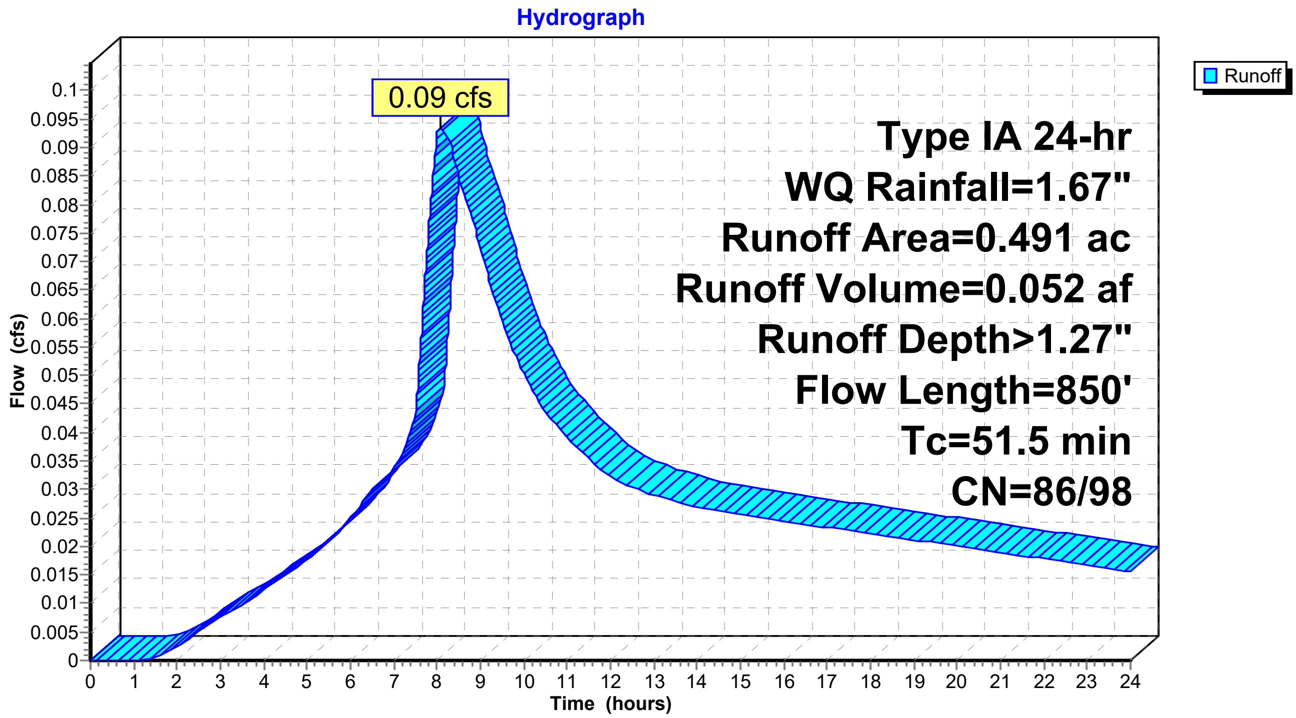
Runoff = 0.09 cfs @ 8.10 hrs, Volume= 0.052 af, Depth> 1.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (ac)	CN	Description
*	0.311	98	Courtyard Pavement
*	0.087	86	Courtyard Landscaping
*	0.093	98	Fire Lane
	0.491	96	Weighted Average
	0.087	86	17.72% Pervious Area
	0.404	98	82.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"
14.0	550	0.0088	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
51.5	850	Total			

Subcatchment A7: Courtyard 1



Summary for Subcatchment A8: Pond Direct

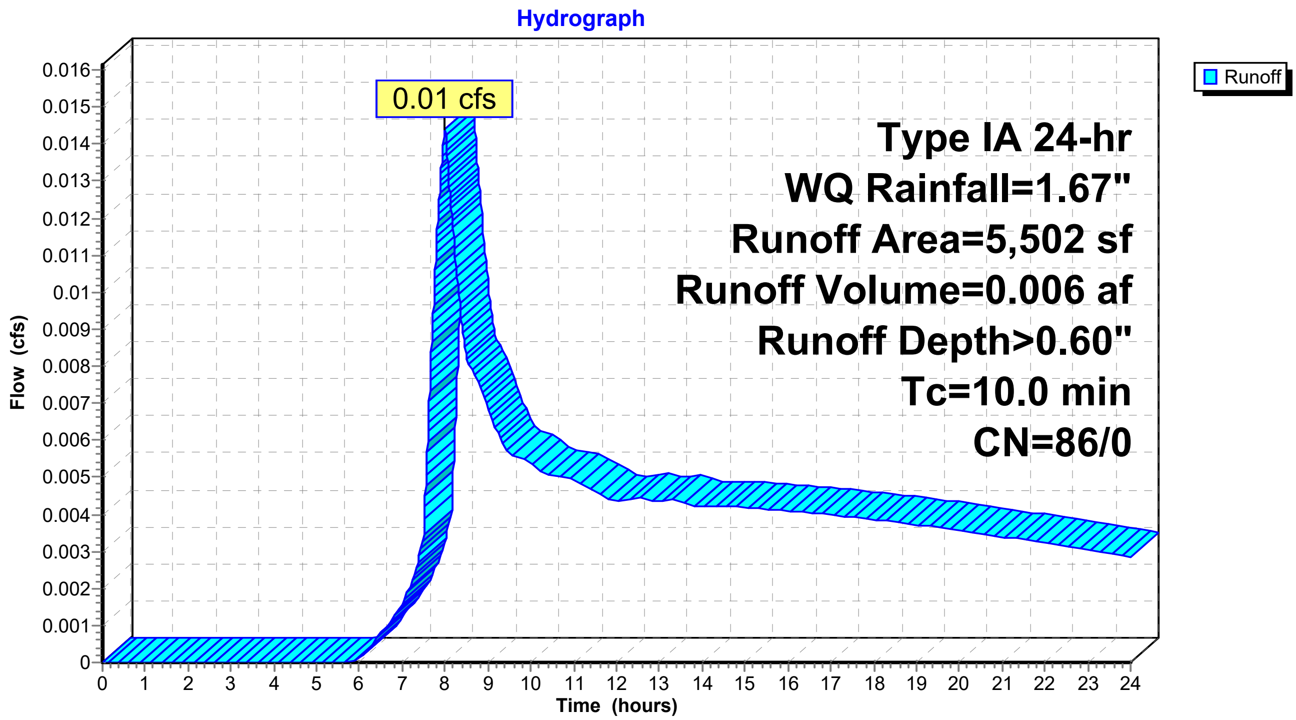
Runoff = 0.01 cfs @ 8.00 hrs, Volume= 0.006 af, Depth> 0.60"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	5,502	86	Pond Top Area
	5,502	86	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment A8: Pond Direct



Summary for Subcatchment A9: Vegetated/Wetland Bypass

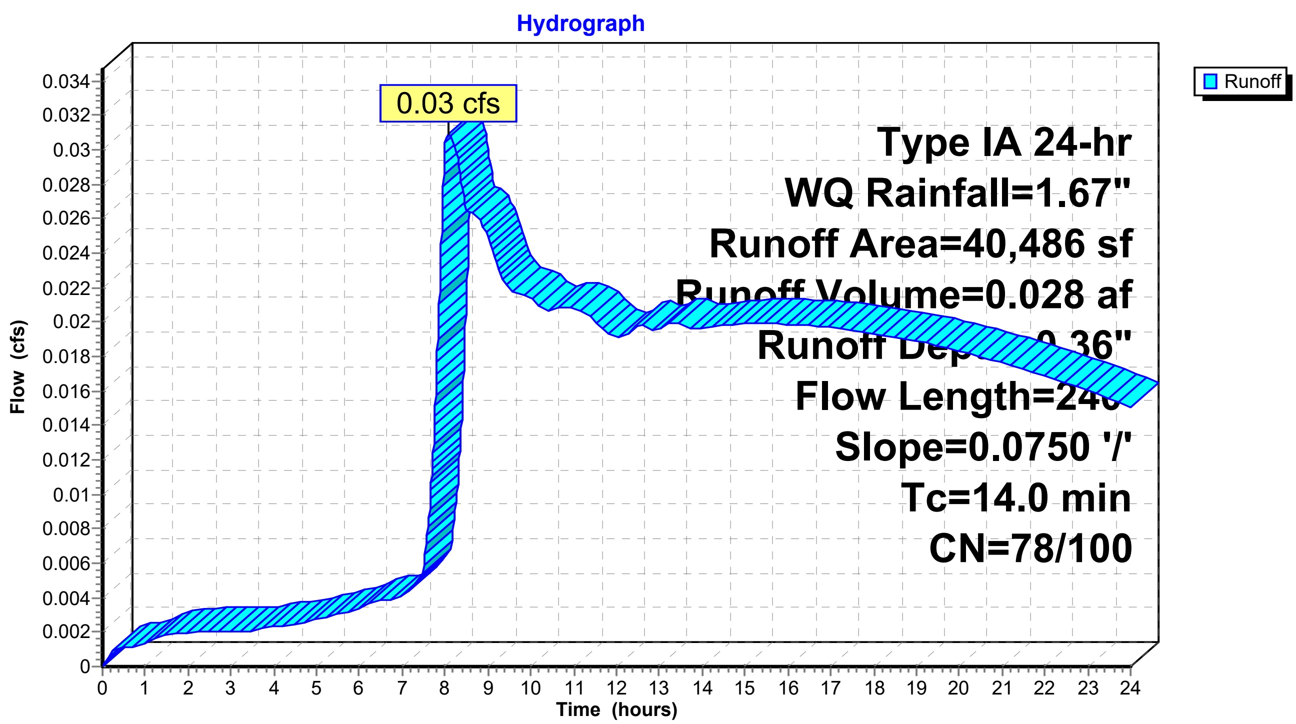
Runoff = 0.03 cfs @ 8.08 hrs, Volume= 0.028 af, Depth> 0.36"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	29,555	76	Undisturbed Forest
*	9,270	86	Fill Slope
*	1,661	100	Wetland
	40,486	79	Weighted Average
	38,825	78	95.90% Pervious Area
	1,661	100	4.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.0	240	0.0750	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment A9: Vegetated/Wetland Bypass



Summary for Subcatchment B1: East Parking

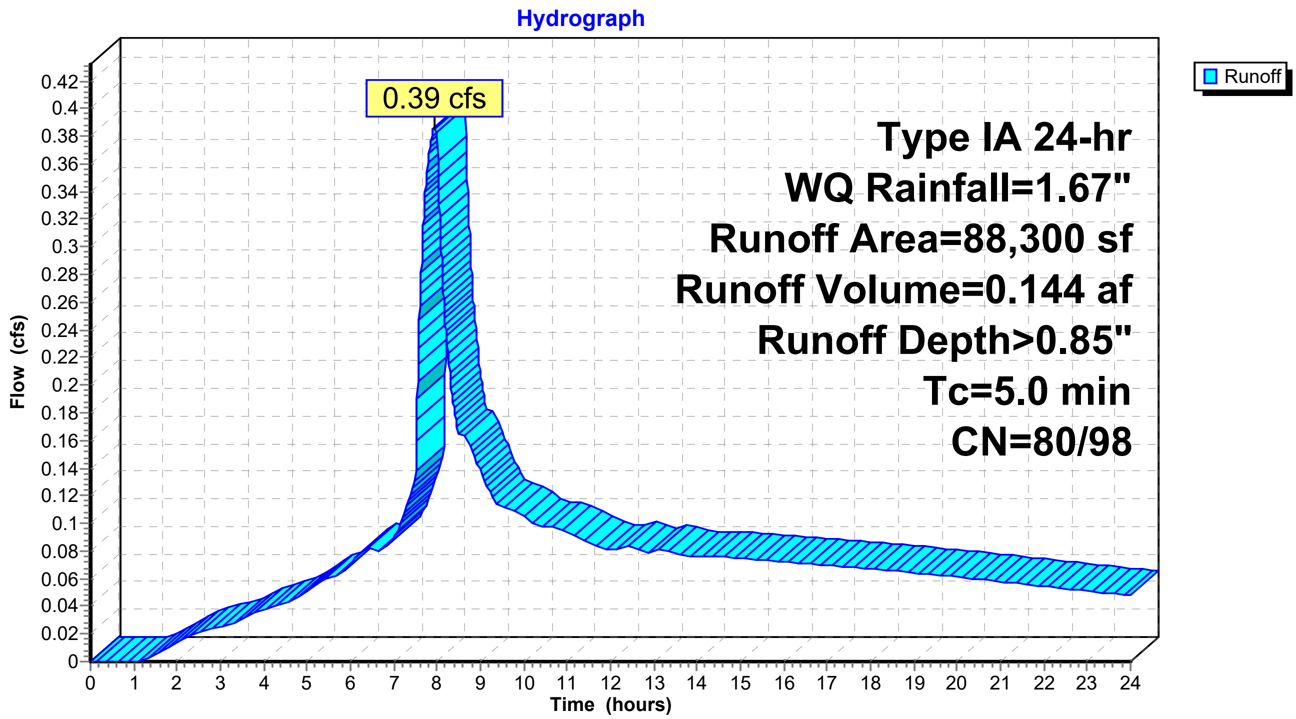
Runoff = 0.39 cfs @ 7.94 hrs, Volume= 0.144 af, Depth> 0.85"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	39,670	98	Parking Lot/Sidewalk
*	27,610	76	Undisturbed Forest
*	14,850	86	Bioretention/Landscape
*	6,170	86	Disturbed Vegetated
	88,300	88	Weighted Average
	48,630	80	55.07% Pervious Area
	39,670	98	44.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B1: East Parking



Summary for Subcatchment B2: Courtyard 3

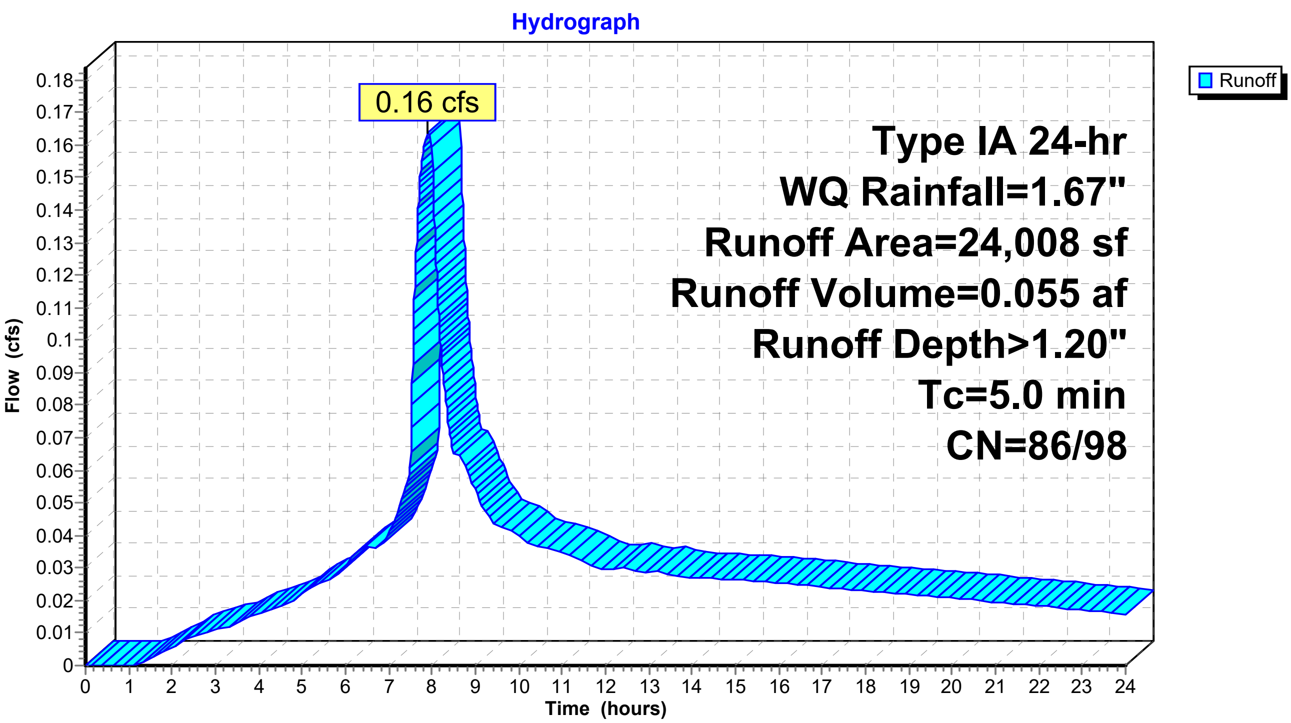
Runoff = 0.16 cfs @ 7.91 hrs, Volume= 0.055 af, Depth> 1.20"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	7,045	86	Courtyard Landscaping
*	16,963	98	Courtyard Pavement
	24,008	94	Weighted Average
	7,045	86	29.34% Pervious Area
	16,963	98	70.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment B2: Courtyard 3



Summary for Subcatchment B3: Building Roof

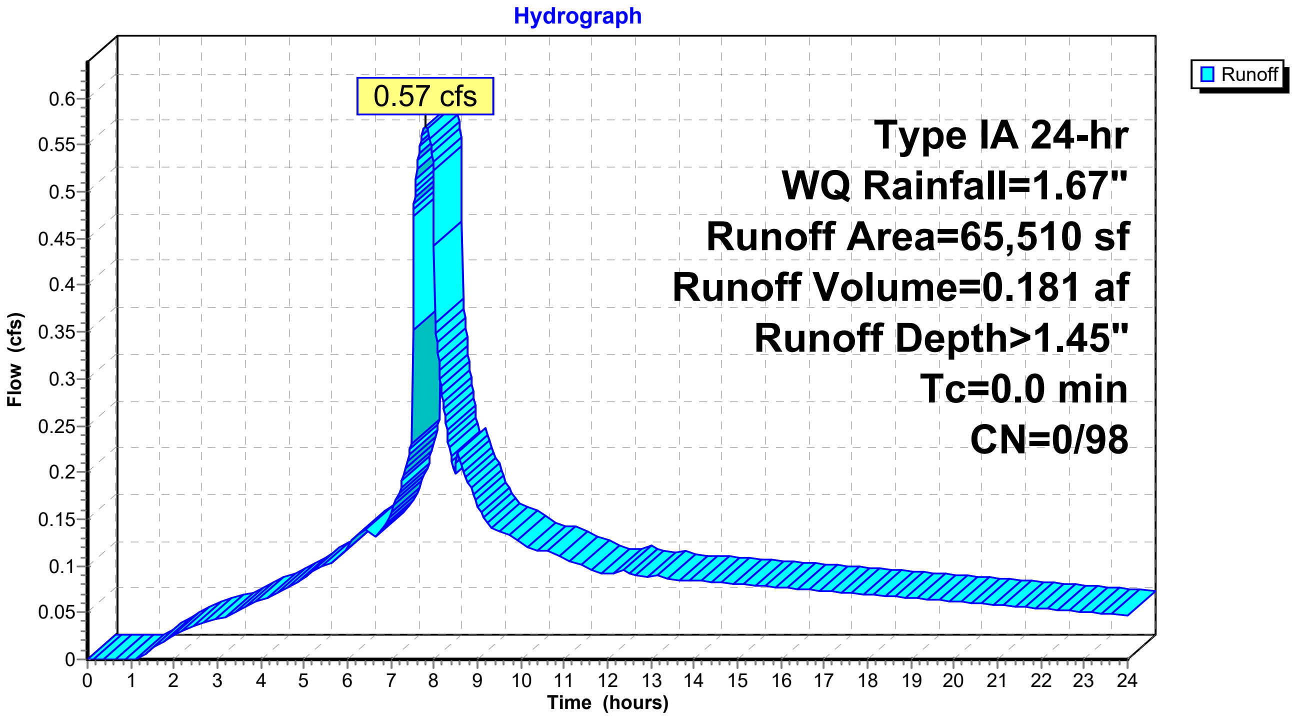
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.57 cfs @ 7.80 hrs, Volume= 0.181 af, Depth> 1.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

Area (sf)	CN	Description
65,510	98	Roofs, HSG D
65,510	98	100.00% Impervious Area

Subcatchment B3: Building Roof



Summary for Subcatchment B4: Field and Track

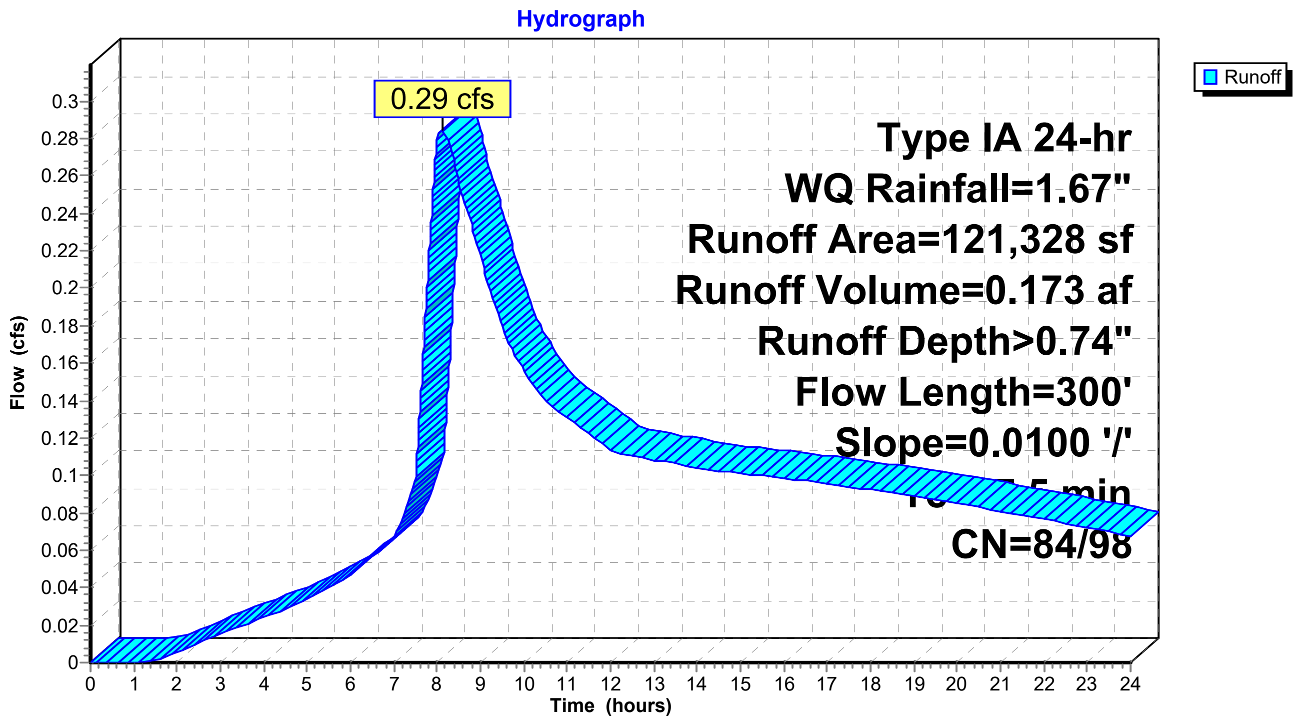
Runoff = 0.29 cfs @ 8.11 hrs, Volume= 0.173 af, Depth> 0.74"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	71,134	86	Field
*	3,750	98	Track
*	18,694	76	Undisturbed
*	27,500	98	Fire Lane/Access Road
*	250	86	Courtyard Landscaping
	121,328	88	Weighted Average
	90,078	84	74.24% Pervious Area
	31,250	98	25.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B4: Field and Track



Summary for Subcatchment B5: Access Road and Pond

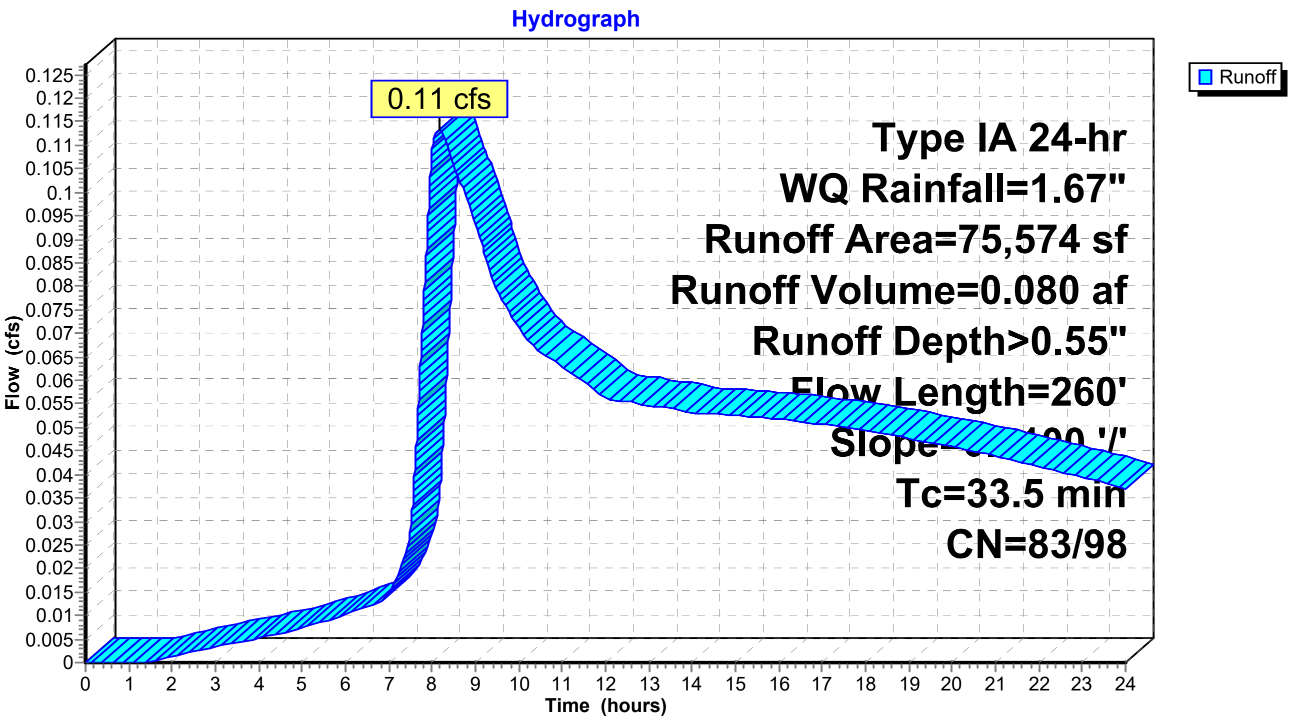
Runoff = 0.11 cfs @ 8.17 hrs, Volume= 0.080 af, Depth> 0.55"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	25,478	76	Undisturbed
*	5,756	96	Gravel Road
*	890	98	Paved Access Road
*	37,750	86	Pond/Landscaping
*	5,700	98	Pump Station/Access
	75,574	84	Weighted Average
	68,984	83	91.28% Pervious Area
	6,590	98	8.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.5	260	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B5: Access Road and Pond



Summary for Subcatchment B6: South Wetland

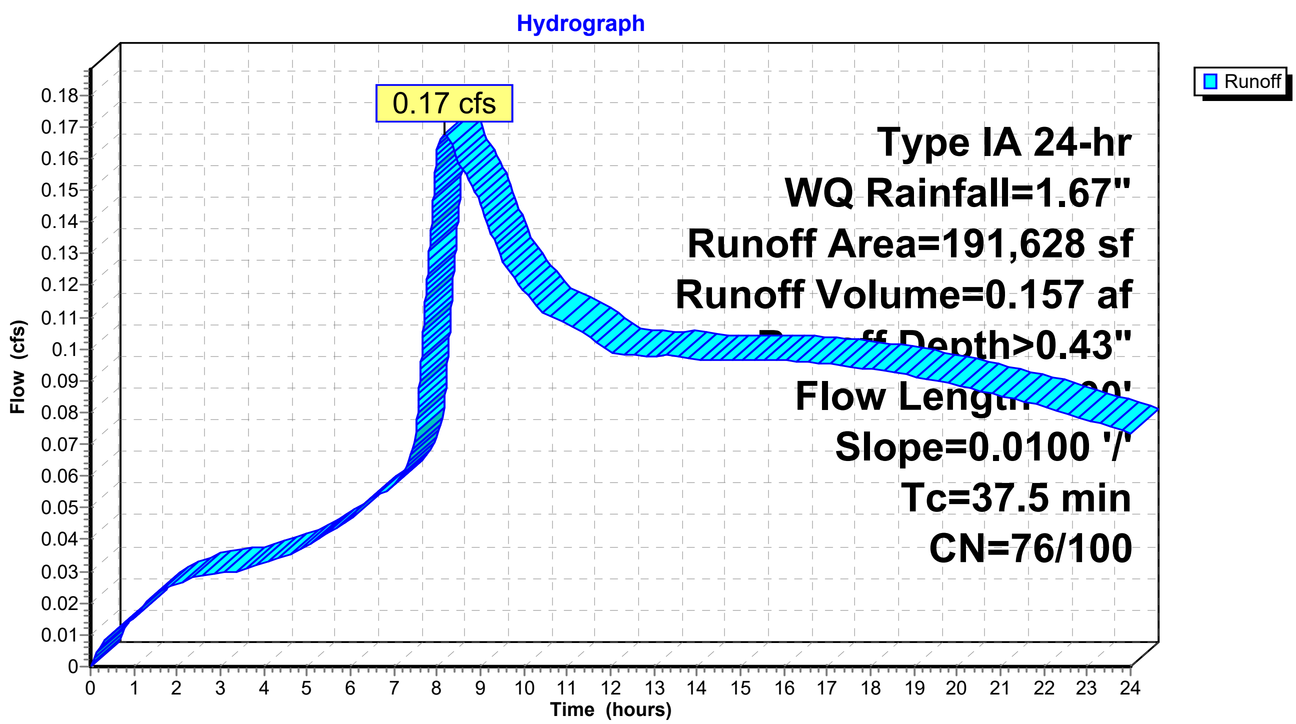
Runoff = 0.17 cfs @ 8.18 hrs, Volume= 0.157 af, Depth> 0.43"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	160,260	76	Undisturbed Forest
*	24,708	100	Wetland
*	6,660	86	Site Fill
	191,628	79	Weighted Average
	166,920	76	87.11% Pervious Area
	24,708	100	12.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	300	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.20"

Subcatchment B6: South Wetland



Summary for Subcatchment B7: Courtyard Bypass

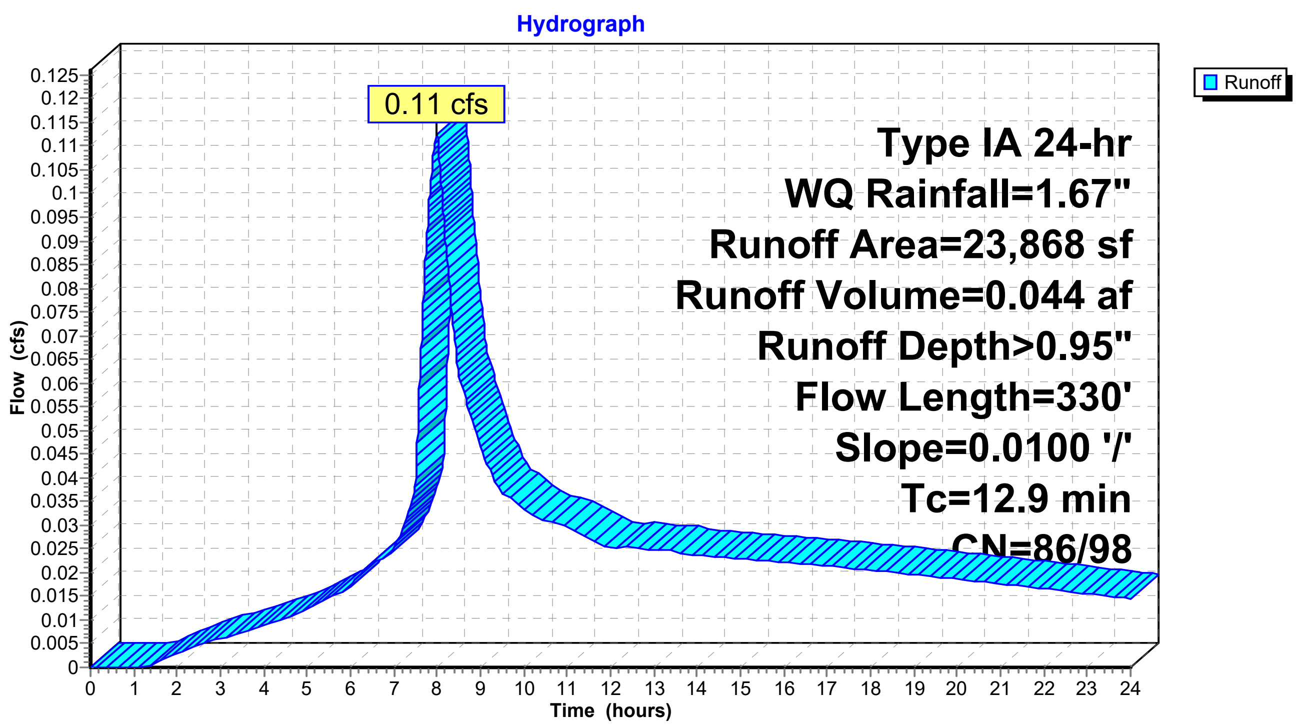
Runoff = 0.11 cfs @ 8.00 hrs, Volume= 0.044 af, Depth> 0.95"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.67"

	Area (sf)	CN	Description
*	3,390	98	Courtyard Pavement
*	13,866	86	Courtyard Landscaping
*	6,612	98	Fire Lane
	23,868	91	Weighted Average
	13,866	86	58.09% Pervious Area
	10,002	98	41.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**
7.9	330	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.9	330	Total			

Subcatchment B7: Courtyard Bypass



Summary for Reach 1R: 279 LF 18"

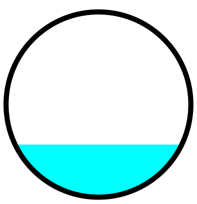
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 6R OUTLET depth by 0.10' @ 7.56 hrs

Inflow Area = 4.082 ac, 68.69% Impervious, Inflow Depth > 1.12" for WQ event
Inflow = 1.09 cfs @ 7.89 hrs, Volume= 0.380 af
Outflow = 1.09 cfs @ 7.91 hrs, Volume= 0.379 af, Atten= 0%, Lag= 1.3 min

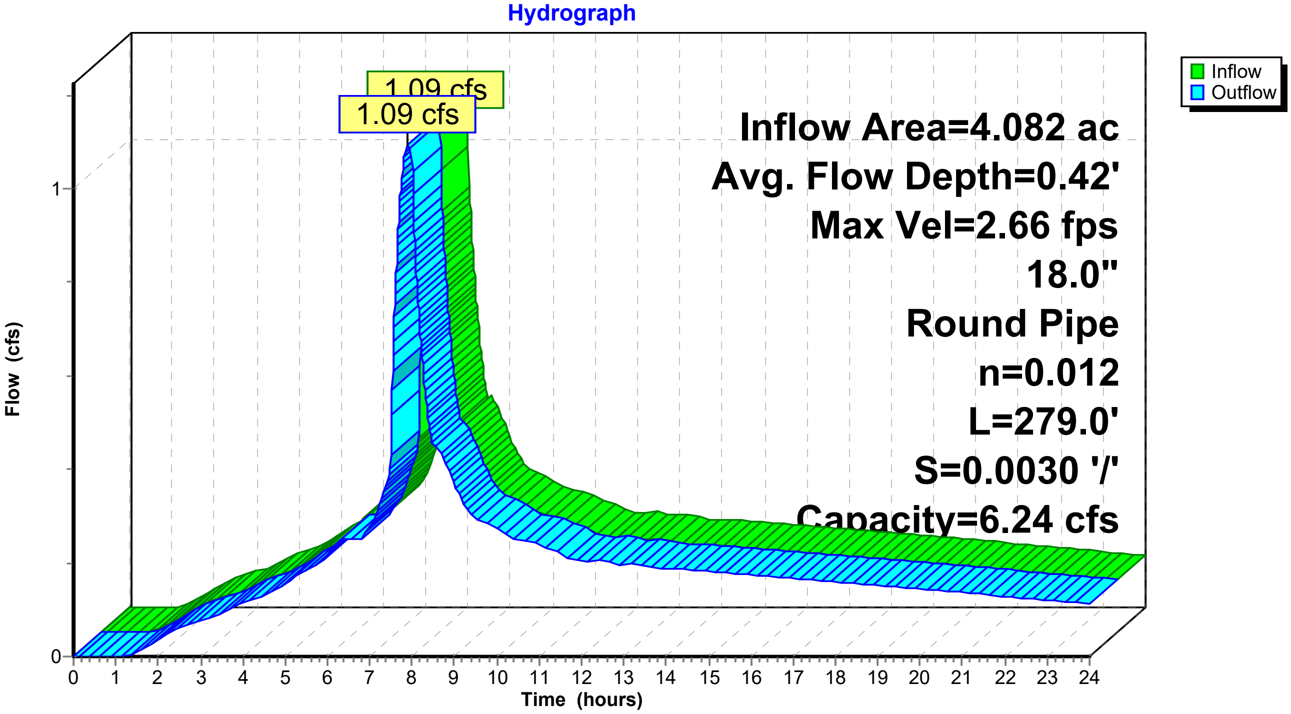
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.66 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 3.0 min

Peak Storage= 115 cf @ 7.91 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.24 cfs

18.0" Round Pipe
n= 0.012
Length= 279.0' Slope= 0.0030 '/'
Inlet Invert= 132.54', Outlet Invert= 131.70'



Reach 1R: 279 LF 18"



Summary for Reach 3R: 134 LF 12"

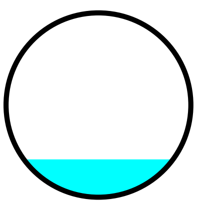
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 16R outlet invert by 0.10' @ 8.01 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 1.41" for WQ event
Inflow = 0.29 cfs @ 8.01 hrs, Volume= 0.113 af
Outflow = 0.29 cfs @ 8.01 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.4 min

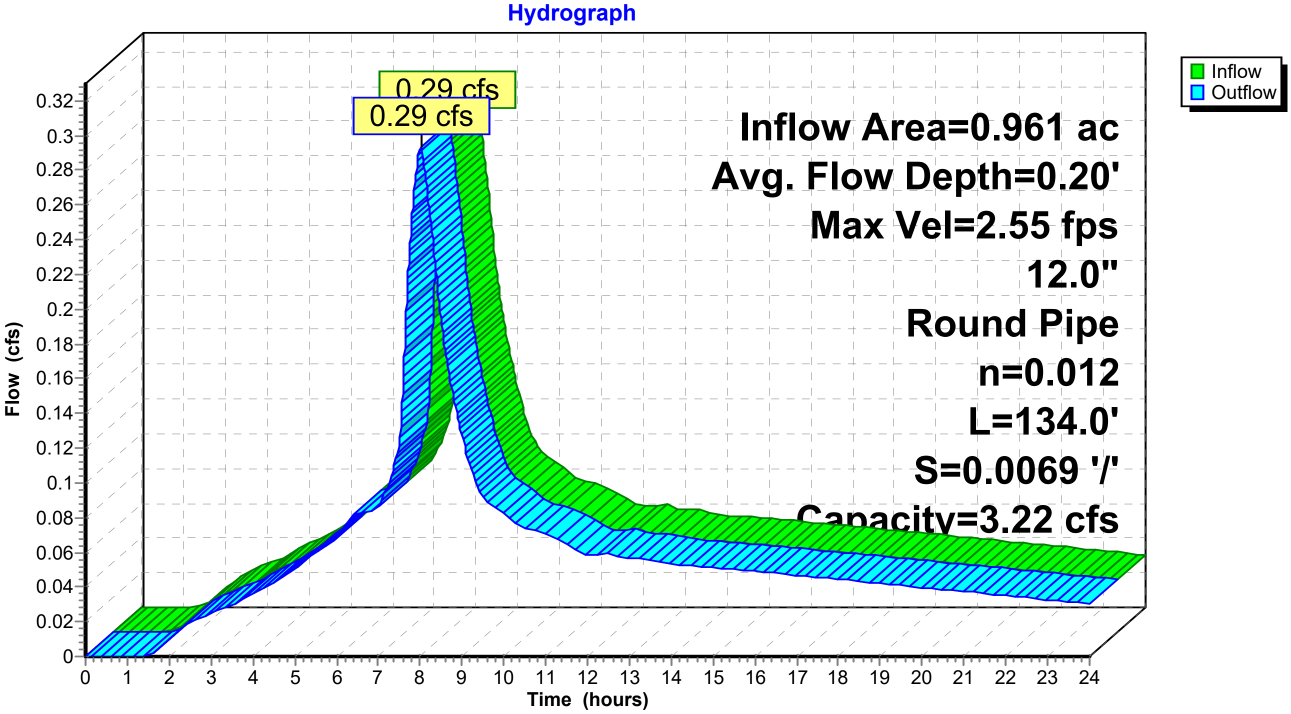
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.55 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 1.5 min

Peak Storage= 15 cf @ 8.01 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.22 cfs

12.0" Round Pipe
n= 0.012
Length= 134.0' Slope= 0.0069 '/'
Inlet Invert= 132.46', Outlet Invert= 131.53'



Reach 3R: 134 LF 12"



Summary for Reach 4R: 56 LF 12"

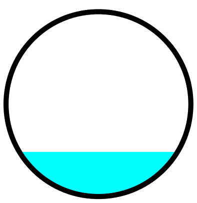
[52] Hint: Inlet/Outlet conditions not evaluated

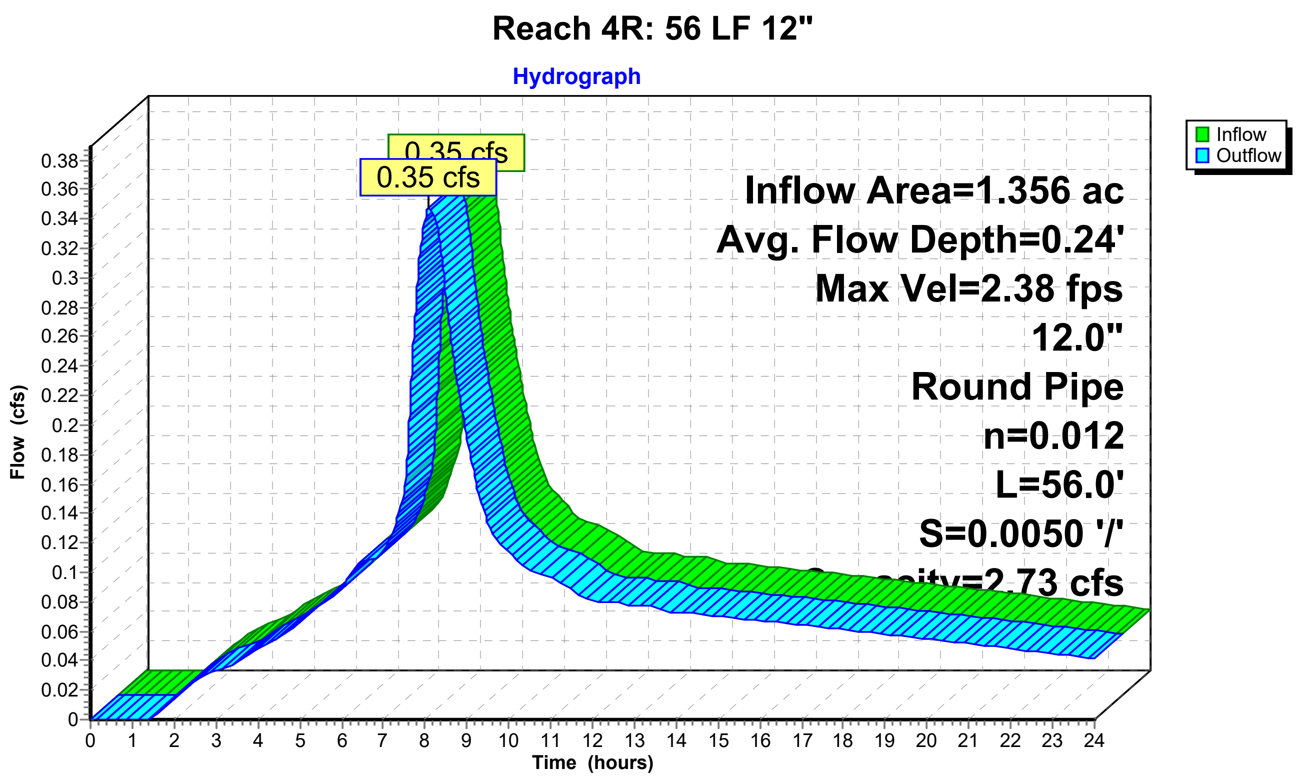
Inflow Area = 1.356 ac, 89.41% Impervious, Inflow Depth > 1.35" for WQ event
Inflow = 0.35 cfs @ 8.10 hrs, Volume= 0.153 af
Outflow = 0.35 cfs @ 8.10 hrs, Volume= 0.153 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.38 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.49 fps, Avg. Travel Time= 0.6 min

Peak Storage= 8 cf @ 8.10 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.73 cfs

12.0" Round Pipe
n= 0.012
Length= 56.0' Slope= 0.0050 '/'
Inlet Invert= 132.63', Outlet Invert= 132.35'





Summary for Reach 5R: 70 LF 12"

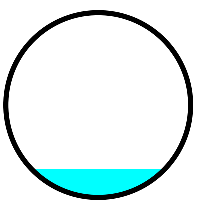
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 8R outlet invert by 0.15' @ 7.93 hrs

Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 1.20" for WQ event
Inflow = 0.16 cfs @ 7.92 hrs, Volume= 0.055 af
Outflow = 0.16 cfs @ 7.93 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.4 min

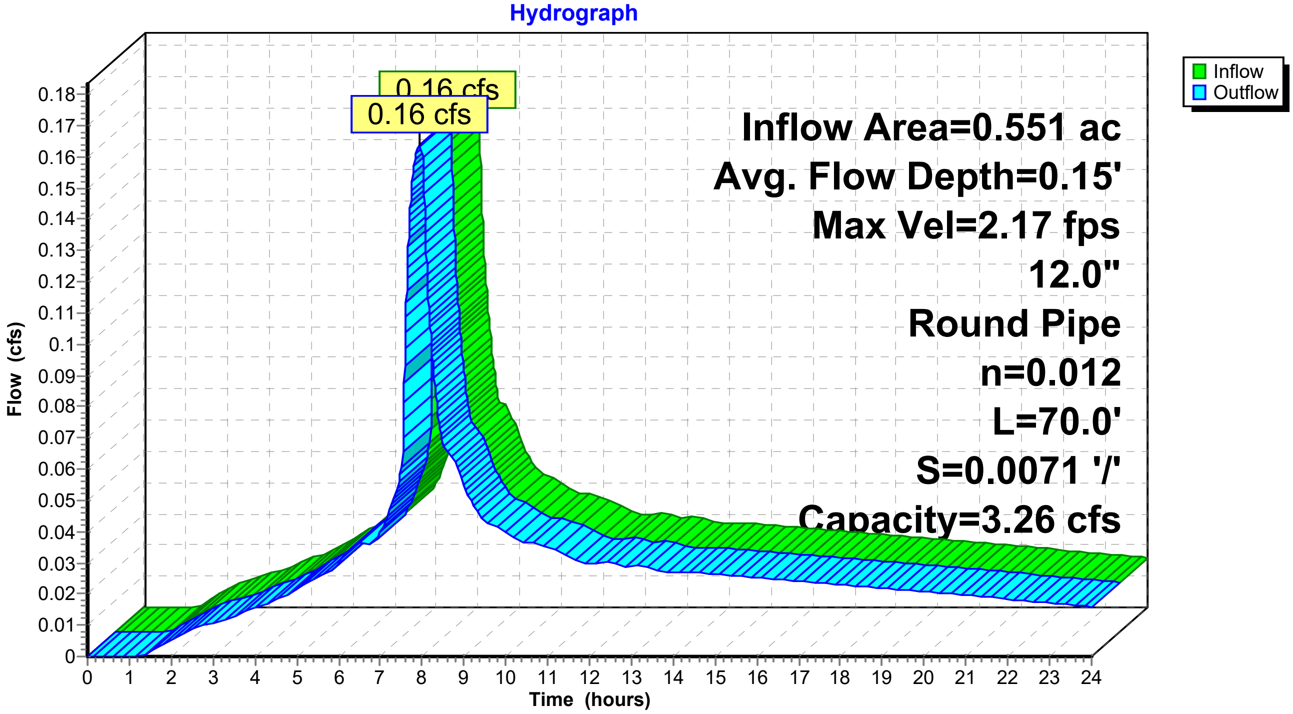
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.17 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.24 fps, Avg. Travel Time= 0.9 min

Peak Storage= 5 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.26 cfs

12.0" Round Pipe
n= 0.012
Length= 70.0' Slope= 0.0071 '/'
Inlet Invert= 133.15', Outlet Invert= 132.65'



Reach 5R: 70 LF 12"



Summary for Reach 6R: 38 LF 12"

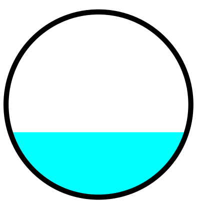
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 5R OUTLET depth by 0.20' @ 8.01 hrs

Inflow Area = 2.578 ac, 50.43% Impervious, Inflow Depth > 0.92" for WQ event
Inflow = 0.54 cfs @ 7.98 hrs, Volume= 0.199 af
Outflow = 0.54 cfs @ 7.98 hrs, Volume= 0.199 af, Atten= 0%, Lag= 0.2 min

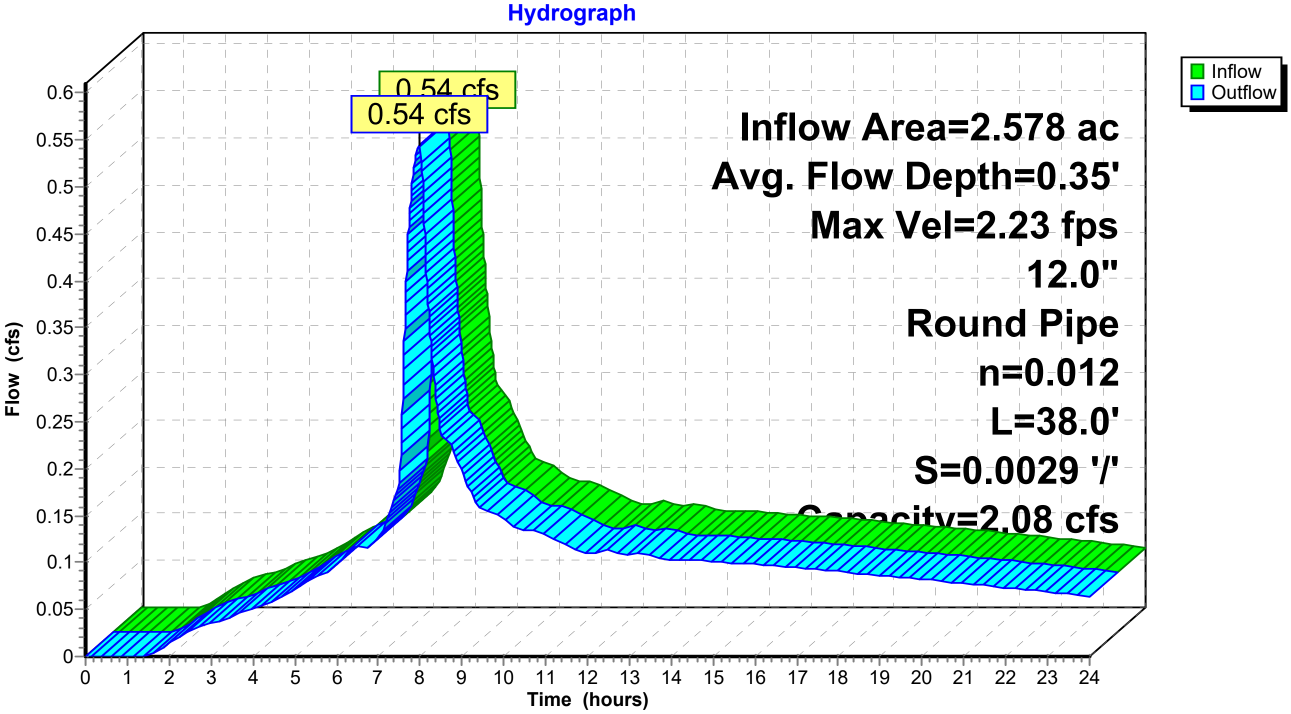
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.23 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 0.5 min

Peak Storage= 9 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.08 cfs

12.0" Round Pipe
n= 0.012
Length= 38.0' Slope= 0.0029 '/'
Inlet Invert= 132.65', Outlet Invert= 132.54'



Reach 6R: 38 LF 12"



Summary for Reach 7R: 107 LF 12"

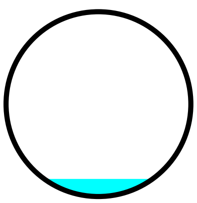
[52] Hint: Inlet/Outlet conditions not evaluated

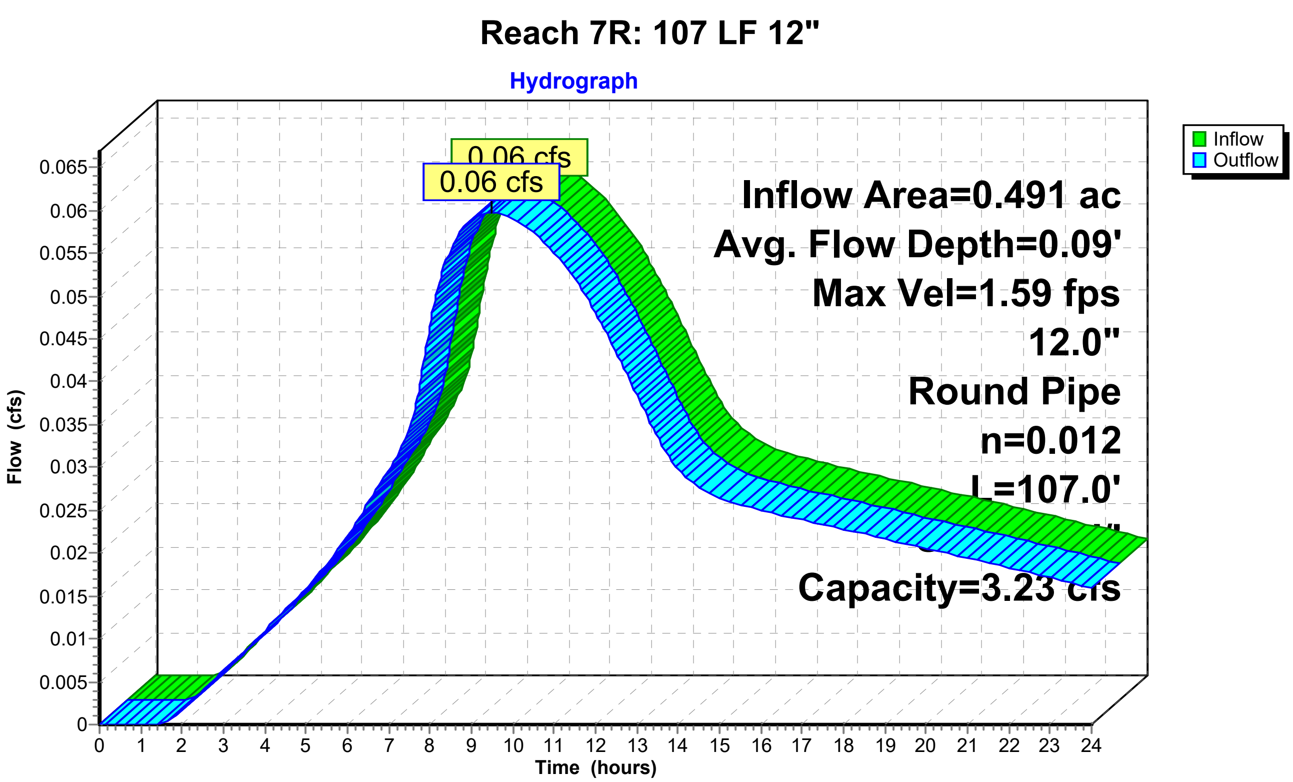
Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 1.26" for WQ event
Inflow = 0.06 cfs @ 9.48 hrs, Volume= 0.052 af
Outflow = 0.06 cfs @ 9.50 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.59 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 1.5 min

Peak Storage= 4 cf @ 9.50 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.23 cfs

12.0" Round Pipe
n= 0.012
Length= 107.0' Slope= 0.0070 '/'
Inlet Invert= 131.42', Outlet Invert= 130.67'





Summary for Reach 8R: 170 LF 12"

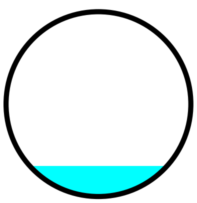
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.551 ac, 70.66% Impervious, Inflow Depth > 1.20" for WQ event
Inflow = 0.16 cfs @ 7.91 hrs, Volume= 0.055 af
Outflow = 0.16 cfs @ 7.92 hrs, Volume= 0.055 af, Atten= 0%, Lag= 1.0 min

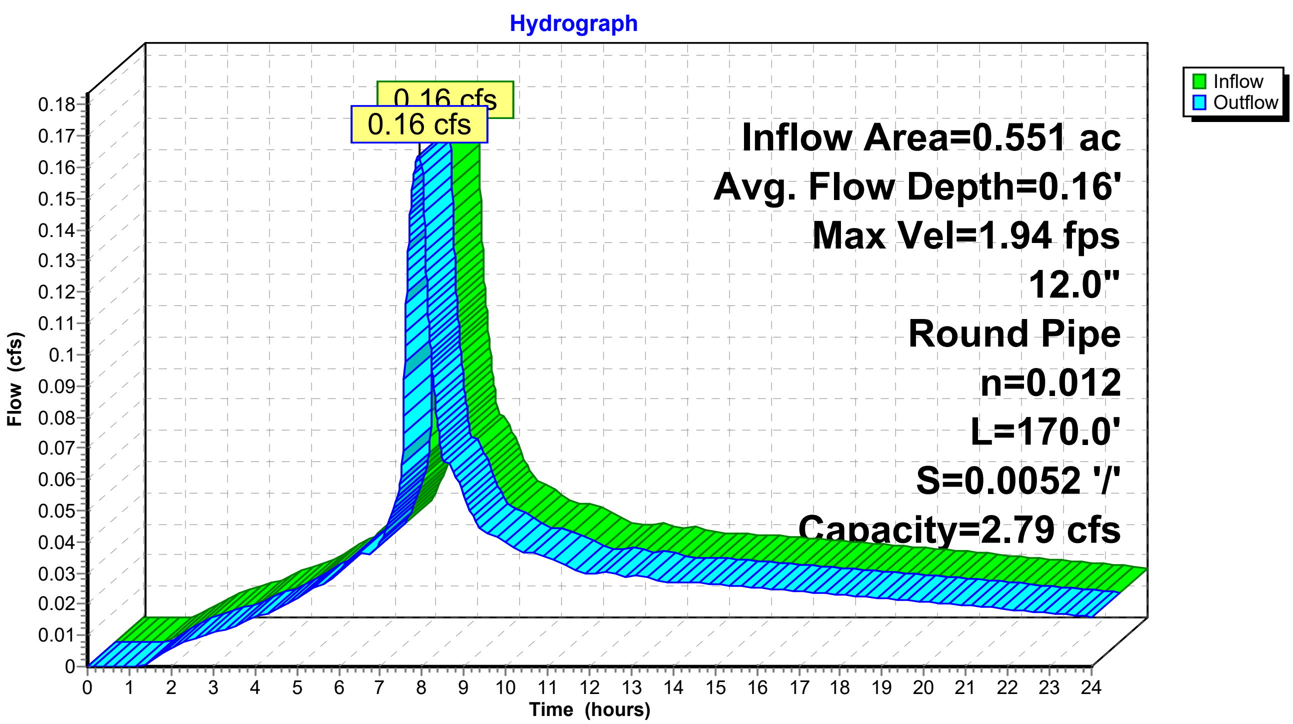
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.94 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.11 fps, Avg. Travel Time= 2.6 min

Peak Storage= 14 cf @ 7.92 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.79 cfs

12.0" Round Pipe
n= 0.012
Length= 170.0' Slope= 0.0052 '/'
Inlet Invert= 134.04', Outlet Invert= 133.15'



Reach 8R: 170 LF 12"



Summary for Reach 9R: 115 LF 12"

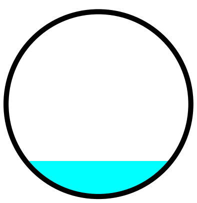
[52] Hint: Inlet/Outlet conditions not evaluated

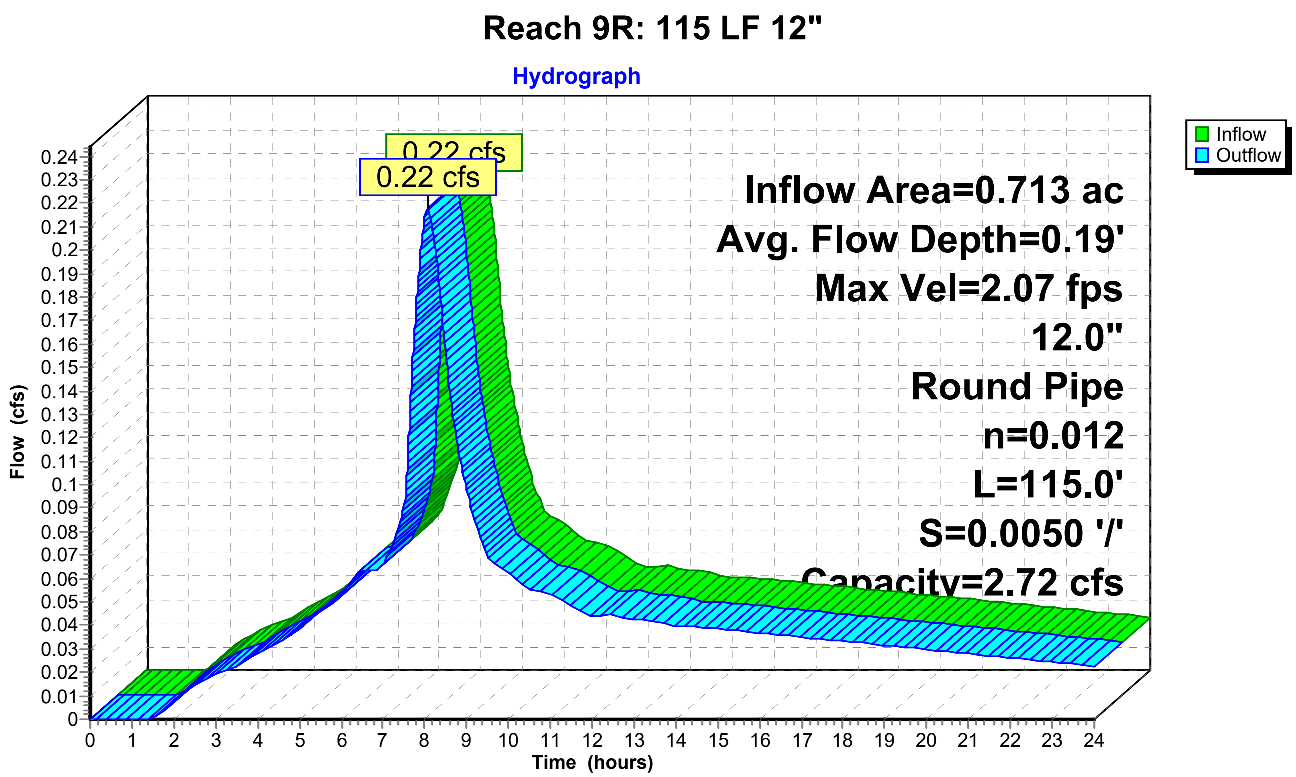
Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 1.44" for WQ event
Inflow = 0.22 cfs @ 8.05 hrs, Volume= 0.086 af
Outflow = 0.22 cfs @ 8.06 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.07 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.24 fps, Avg. Travel Time= 1.5 min

Peak Storage= 12 cf @ 8.06 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.72 cfs

12.0" Round Pipe
n= 0.012
Length= 115.0' Slope= 0.0050 '/'
Inlet Invert= 136.50', Outlet Invert= 135.93'





Summary for Reach 10R: 76 LF 12"

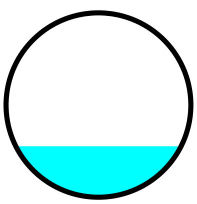
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 3R outlet invert by 0.17' @ 8.03 hrs

Inflow Area = 2.317 ac, 92.42% Impervious, Inflow Depth > 1.38" for WQ event
Inflow = 0.64 cfs @ 8.03 hrs, Volume= 0.266 af
Outflow = 0.64 cfs @ 8.03 hrs, Volume= 0.266 af, Atten= 0%, Lag= 0.3 min

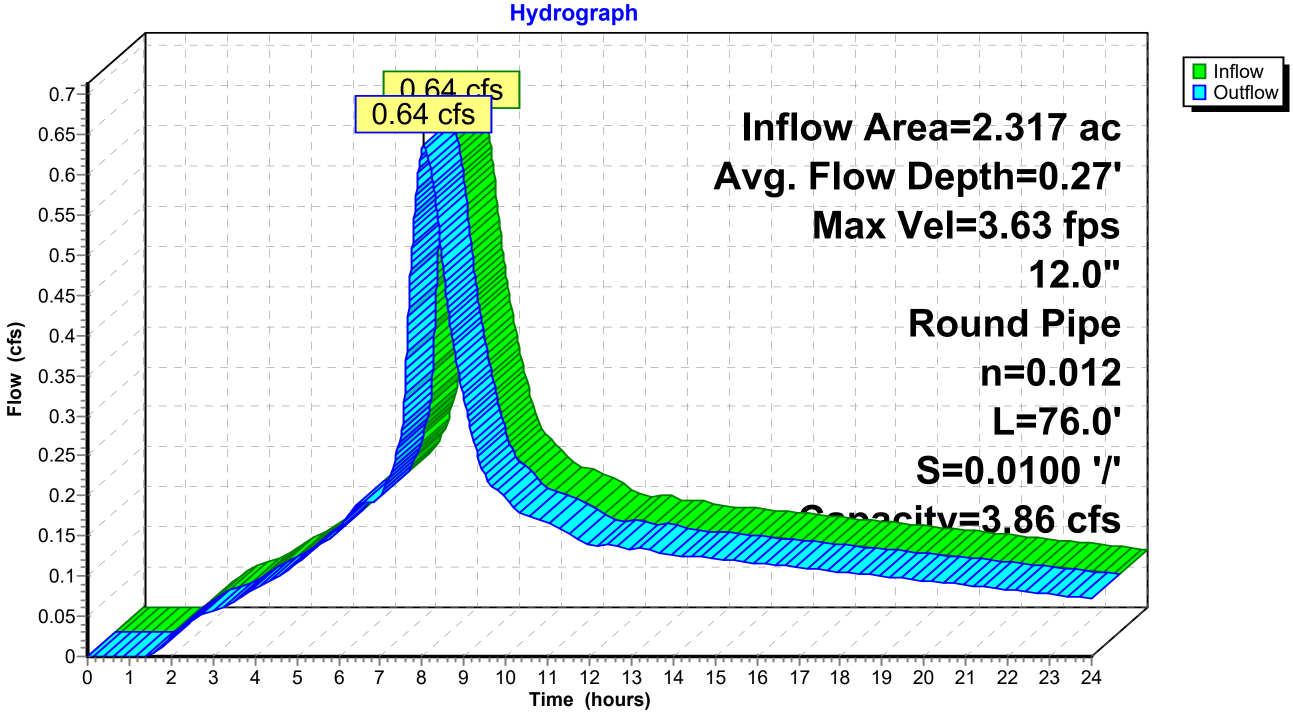
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.63 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 0.6 min

Peak Storage= 13 cf @ 8.03 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.86 cfs

12.0" Round Pipe
n= 0.012
Length= 76.0' Slope= 0.0100 '/'
Inlet Invert= 131.43', Outlet Invert= 130.67'



Reach 10R: 76 LF 12"



Summary for Reach 12R: 34 LF 12"

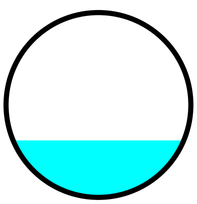
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.12' @ 8.03 hrs
[61] Hint: Exceeded Reach 10R outlet invert by 0.21' @ 8.04 hrs

Inflow Area = 2.948 ac, 88.89% Impervious, Inflow Depth > 1.34" for WQ event
Inflow = 0.70 cfs @ 8.03 hrs, Volume= 0.329 af
Outflow = 0.70 cfs @ 8.04 hrs, Volume= 0.329 af, Atten= 0%, Lag= 0.1 min

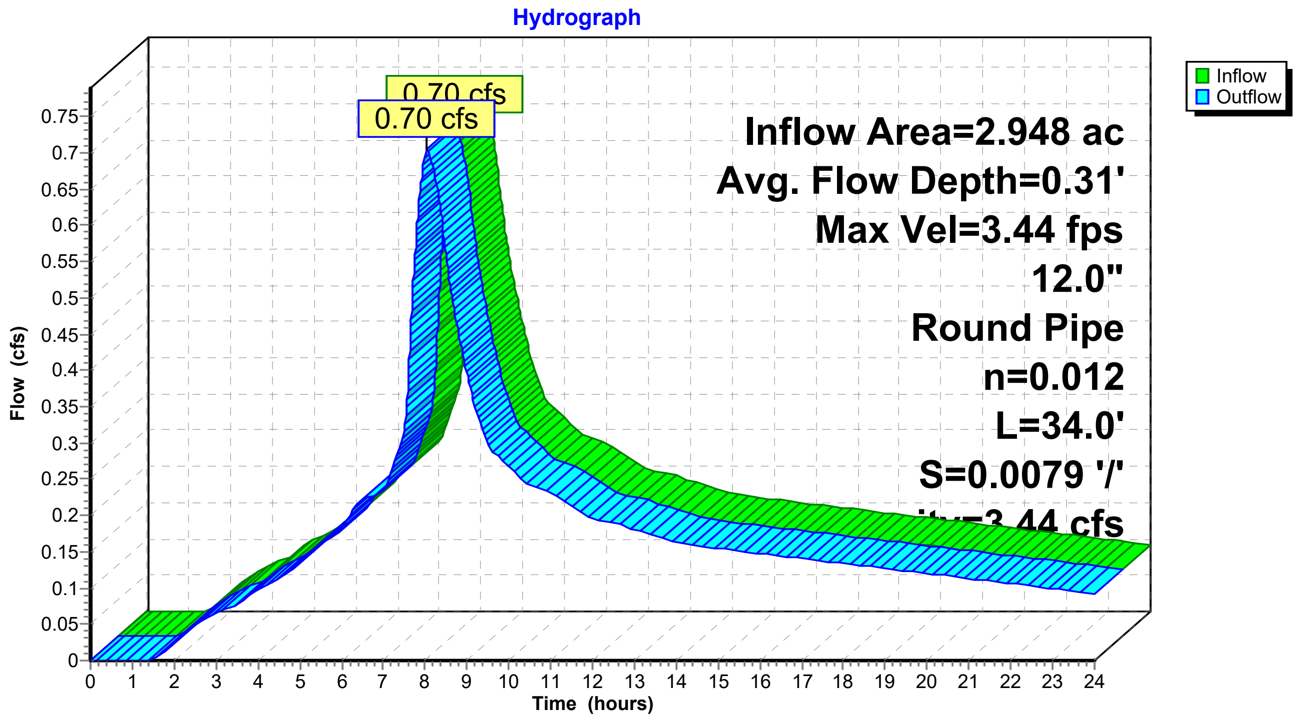
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.44 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.20 fps, Avg. Travel Time= 0.3 min

Peak Storage= 7 cf @ 8.04 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.44 cfs

12.0" Round Pipe
n= 0.012
Length= 34.0' Slope= 0.0079 '/'
Inlet Invert= 130.57', Outlet Invert= 130.30'



Reach 12R: 34 LF 12"



Summary for Reach 13R: 159 LF 12"

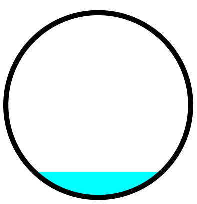
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 9R outlet invert by 0.03' @ 8.07 hrs

Inflow Area = 0.713 ac,100.00% Impervious, Inflow Depth > 1.44" for WQ event
Inflow = 0.22 cfs @ 8.06 hrs, Volume= 0.086 af
Outflow = 0.22 cfs @ 8.07 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.6 min

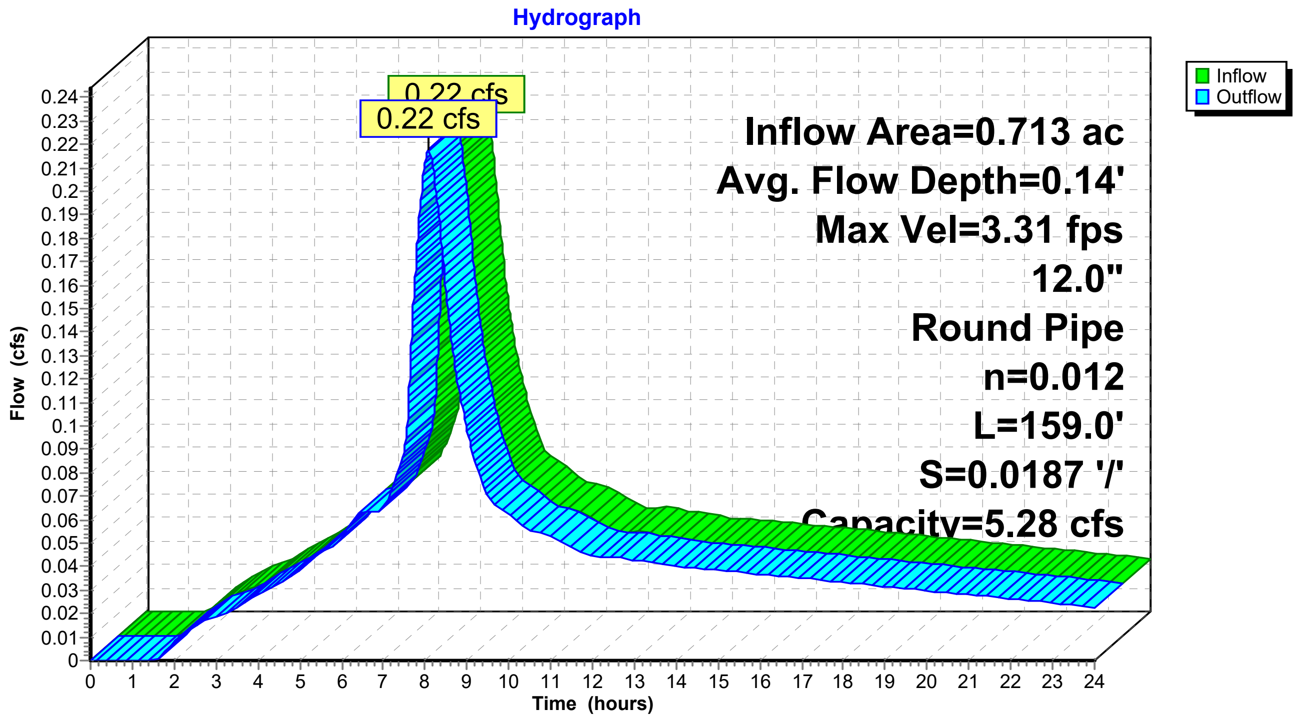
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.31 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.98 fps, Avg. Travel Time= 1.3 min

Peak Storage= 10 cf @ 8.07 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.28 cfs

12.0" Round Pipe
n= 0.012
Length= 159.0' Slope= 0.0187 '/'
Inlet Invert= 135.82', Outlet Invert= 132.85'



Reach 13R: 159 LF 12"



Summary for Reach 16R: 39 LF 12"

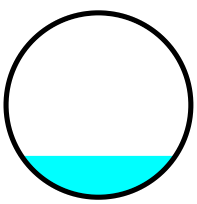
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 13R outlet invert by 0.12' @ 8.01 hrs

Inflow Area = 0.961 ac, 96.67% Impervious, Inflow Depth > 1.41" for WQ event
Inflow = 0.29 cfs @ 8.00 hrs, Volume= 0.113 af
Outflow = 0.29 cfs @ 8.01 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.2 min

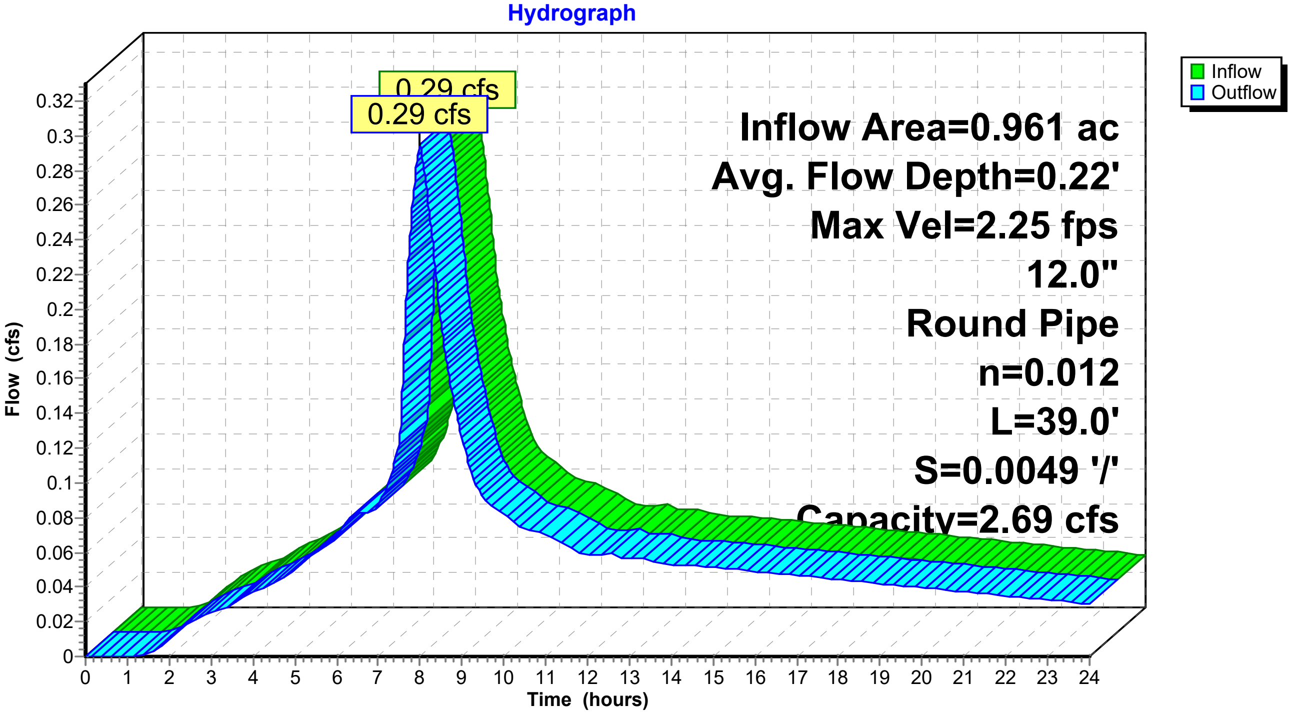
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.25 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 0.5 min

Peak Storage= 5 cf @ 8.01 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.69 cfs

12.0" Round Pipe
n= 0.012
Length= 39.0' Slope= 0.0049 '/'
Inlet Invert= 132.75', Outlet Invert= 132.56'



Reach 16R: 39 LF 12"



Summary for Reach 19R: 74 LF 18"

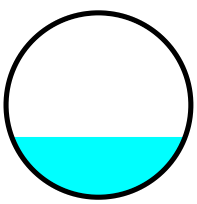
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 1R OUTLET depth by 0.08' @ 8.43 hrs

Inflow Area = 6.867 ac, 51.28% Impervious, Inflow Depth > 0.96" for WQ event
Inflow = 1.35 cfs @ 7.97 hrs, Volume= 0.552 af
Outflow = 1.35 cfs @ 7.97 hrs, Volume= 0.552 af, Atten= 0%, Lag= 0.3 min

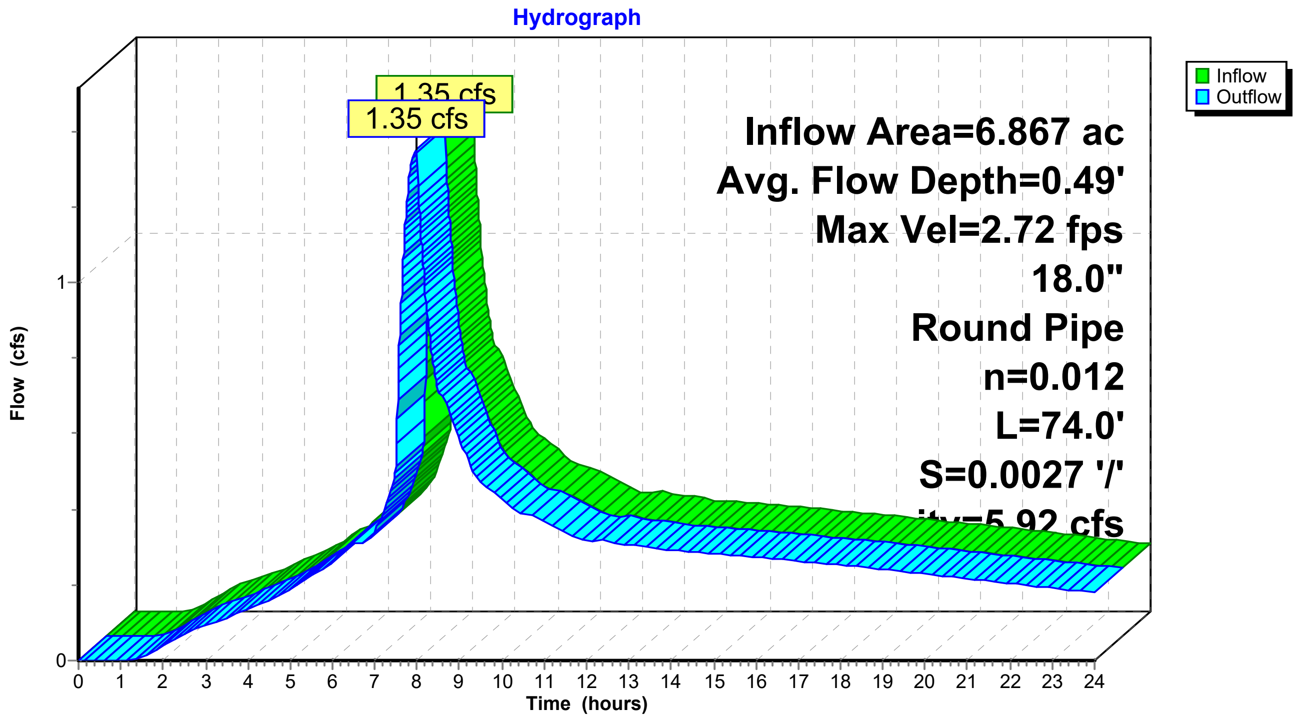
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.72 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 0.7 min

Peak Storage= 37 cf @ 7.97 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 5.92 cfs

18.0" Round Pipe
n= 0.012
Length= 74.0' Slope= 0.0027 '/'
Inlet Invert= 131.70', Outlet Invert= 131.50'



Reach 19R: 74 LF 18"



Summary for Pond 1P: East Bio

Inflow Area = 2.027 ac, 44.93% Impervious, Inflow Depth > 0.85" for WQ event
Inflow = 0.39 cfs @ 7.94 hrs, Volume= 0.144 af
Outflow = 0.38 cfs @ 8.00 hrs, Volume= 0.144 af, Atten= 1%, Lag= 3.3 min
Primary = 0.38 cfs @ 8.00 hrs, Volume= 0.144 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 133.16' @ 8.00 hrs Surf.Area= 0.010 ac Storage= 0.002 af

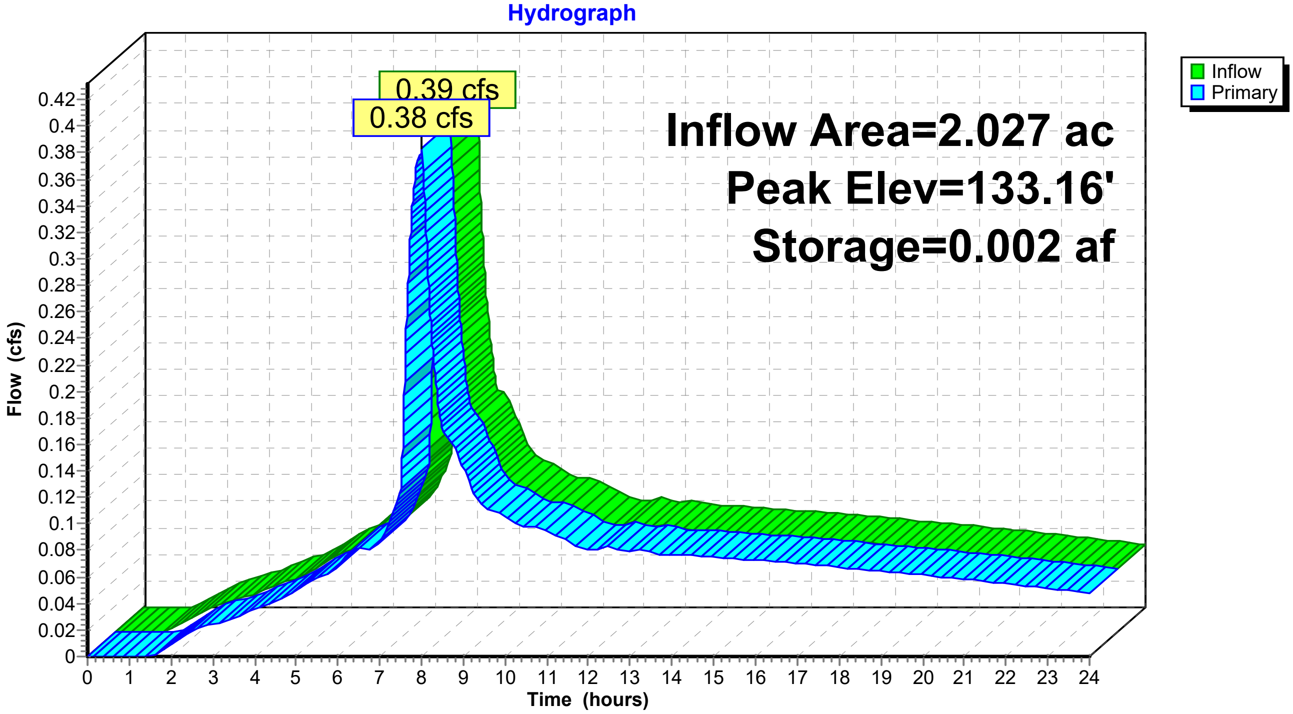
Plug-Flow detention time= 7.3 min calculated for 0.144 af (100% of inflow)
Center-of-Mass det. time= 4.3 min (744.3 - 740.0)

Volume	Invert	Avail.Storage	Storage Description
#1	135.65'	0.012 af	**20.00'W x 20.00'L x 1.00'H Prismatoid Z=3.0**
#2	132.65'	0.012 af	**20.00'W x 22.00'L x 3.00'H Prismatoid**
			0.030 af Overall x 40.0% Voids
		0.024 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	136.15'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#2	Primary	132.65'	**6.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.38 cfs @ 8.00 hrs HW=133.16' TW=133.00' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Orifice Controls 0.38 cfs @ 1.95 fps)

Pond 1P: East Bio



Summary for Pond 2P: West Bio 2

Inflow Area = 0.688 ac, 93.31% Impervious, Inflow Depth > 1.39" for WQ event
Inflow = 0.24 cfs @ 7.89 hrs, Volume= 0.080 af
Outflow = 0.19 cfs @ 8.08 hrs, Volume= 0.079 af, Atten= 24%, Lag= 11.5 min
Primary = 0.19 cfs @ 8.08 hrs, Volume= 0.079 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.22' @ 8.08 hrs Surf.Area= 0.008 ac Storage= 0.004 af

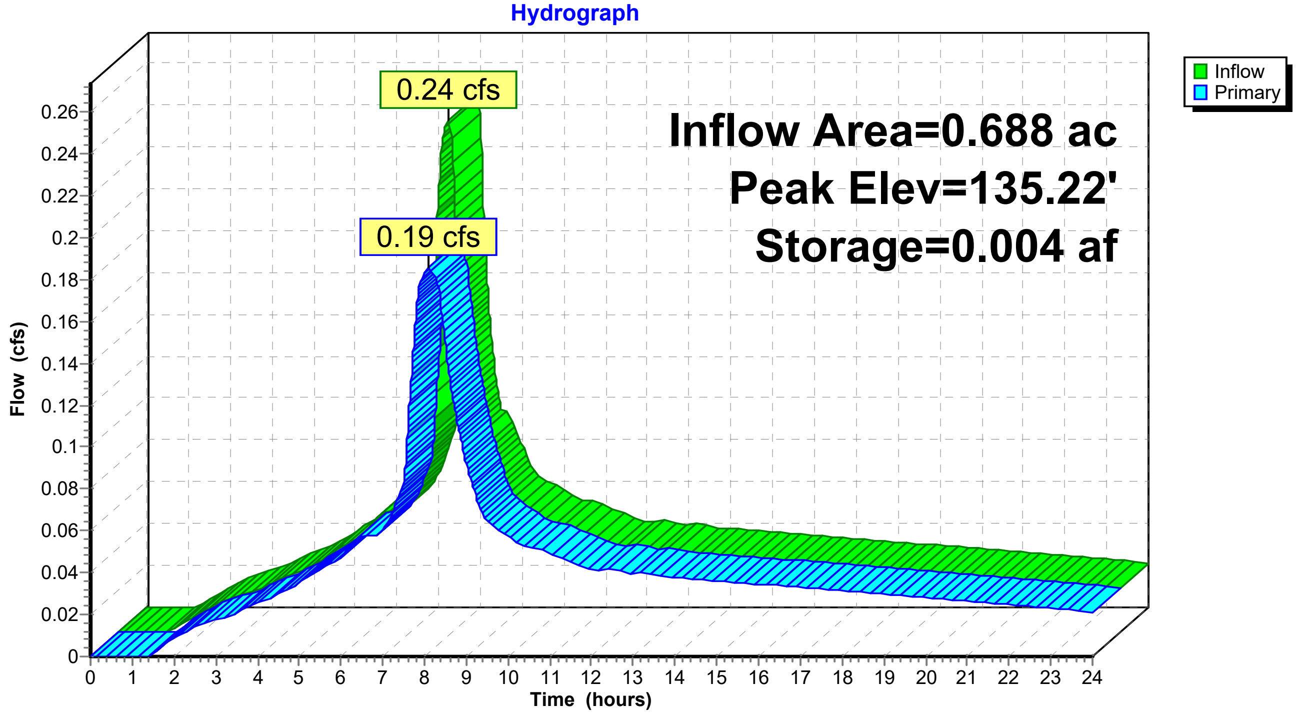
Plug-Flow detention time= 6.5 min calculated for 0.079 af (100% of inflow)
Center-of-Mass det. time= 4.9 min (695.8 - 690.9)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.006 af	**15.30'W x 10.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.003 af	**15.30'W x 10.00'L x 2.00'H Prismatoid**
			0.007 af Overall x 40.0% Voids
		0.008 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.19 cfs @ 8.08 hrs HW=135.22' TW=132.87' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Orifice Controls 0.19 cfs @ 7.03 fps)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: West Bio 2



Summary for Pond 8P: North Bio

Inflow Area =	0.713 ac,100.00% Impervious,	Inflow Depth > 1.45"	for WQ event	
Inflow =	0.27 cfs @	7.89 hrs, Volume=	0.086 af	
Outflow =	0.22 cfs @	8.05 hrs, Volume=	0.086 af,	Atten= 18%, Lag= 10.0 min
Primary =	0.22 cfs @	8.05 hrs, Volume=	0.086 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 144.41' @ 8.05 hrs Surf.Area= 0.007 ac Storage= 0.004 af

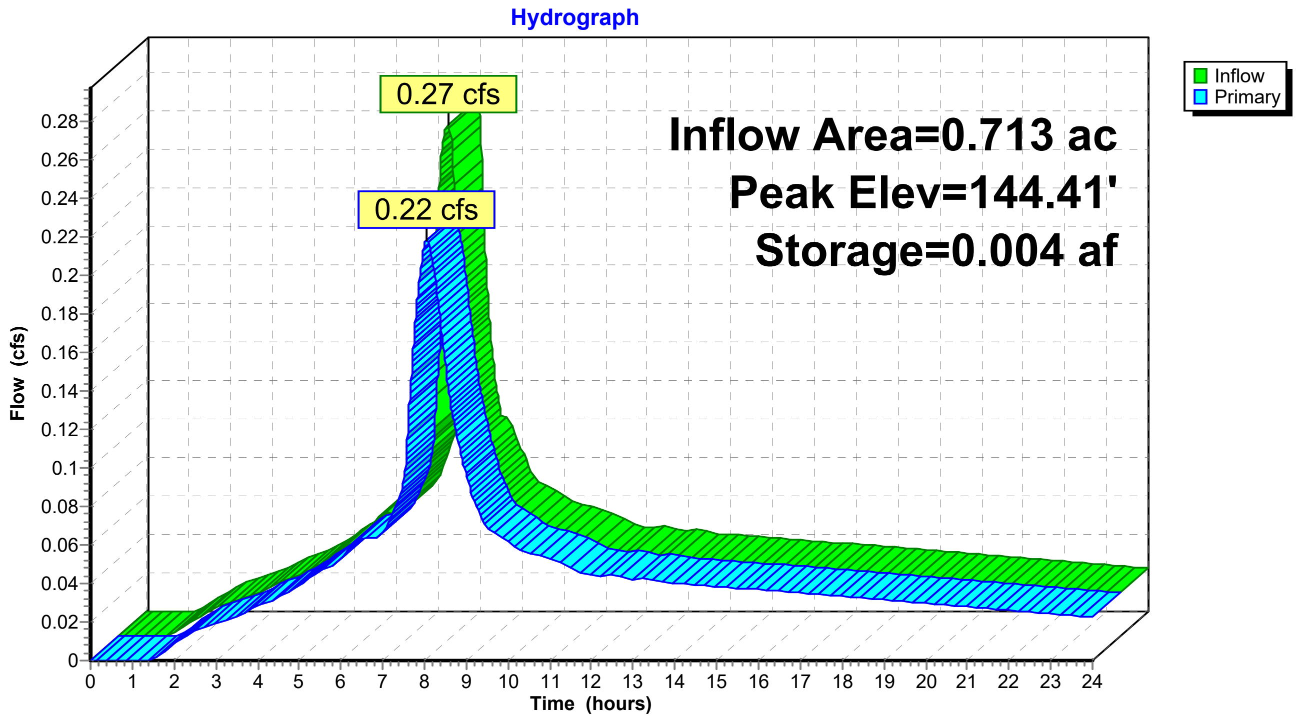
Plug-Flow detention time= 8.6 min calculated for 0.086 af (100% of inflow)
Center-of-Mass det. time= 5.9 min (692.1 - 686.2)

Volume	Invert	Avail.Storage	Storage Description
#1	145.00'	0.027 af	**10.00'W x 30.00'L x 2.00'H Prismatoid Z=3.0**
#2	143.00'	0.006 af	**10.00'W x 30.00'L x 2.00'H Prismatoid** 0.014 af Overall x 40.0% Voids
		0.033 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	145.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	143.00'	**2.7" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.22 cfs @ 8.05 hrs HW=144.41' TW=136.69' (Dynamic Tailwater)
├─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Orifice Controls 0.22 cfs @ 5.48 fps)

Pond 8P: North Bio



Summary for Pond 14P: Pond2 Emergency

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 132.00' Surf.Area= 0.323 ac Storage= 0.448 af
Peak Elev= 132.00' @ 0.00 hrs Surf.Area= 0.323 ac Storage= 0.448 af

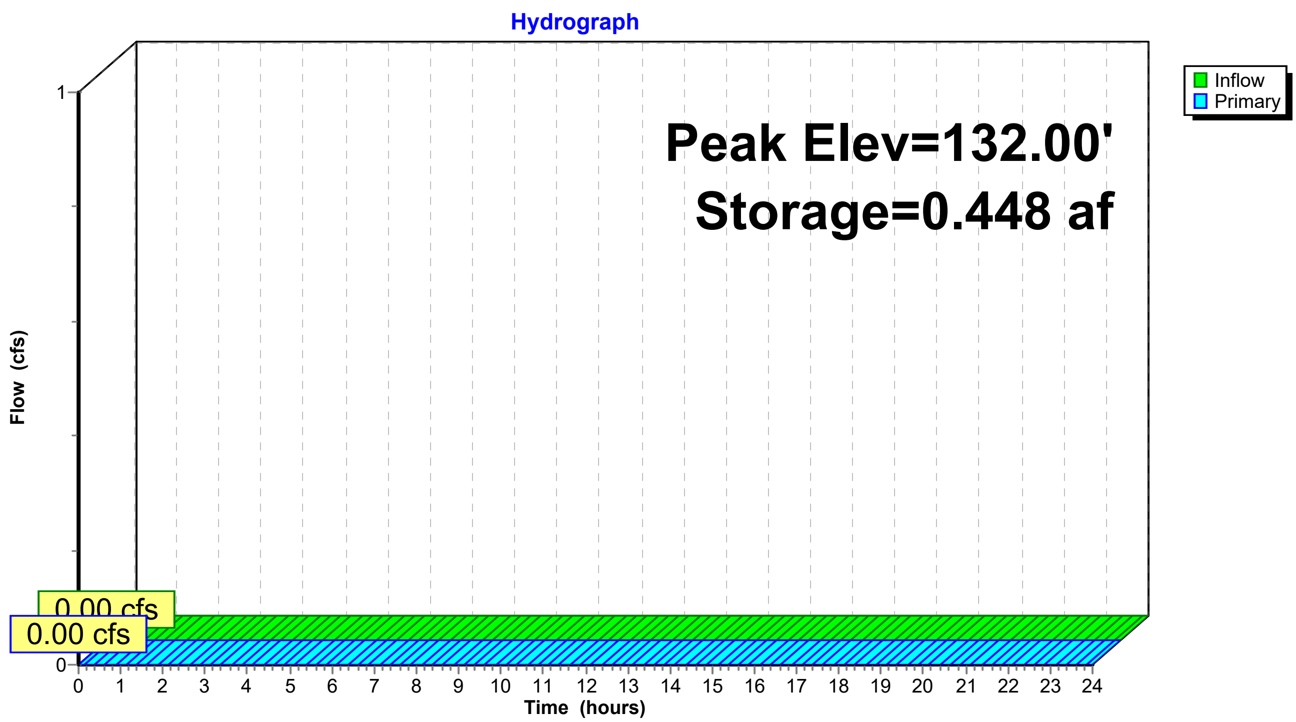
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	130.50'	1.791 af	**120.00'W x 100.00'L x 5.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=132.00' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: Pond2 Emergency



Summary for Pond 18R: 240 LF Bypass Culvert

[57] Hint: Peaked at 134.02' (Flood elevation advised)

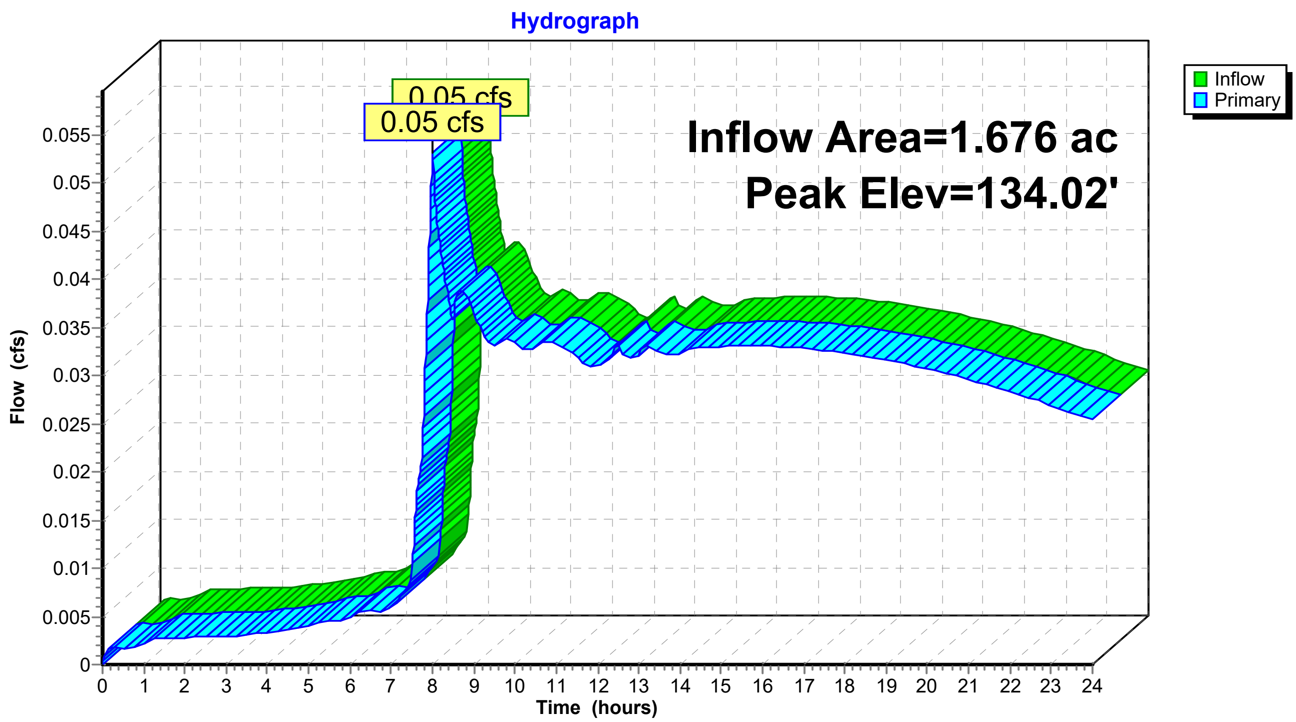
Inflow Area = 1.676 ac, 3.22% Impervious, Inflow Depth > 0.33" for WQ event
Inflow = 0.05 cfs @ 8.00 hrs, Volume= 0.046 af
Outflow = 0.05 cfs @ 8.00 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min
Primary = 0.05 cfs @ 8.00 hrs, Volume= 0.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.02' @ 8.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=0.05 cfs @ 8.00 hrs HW=134.02' TW=127.36' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.05 cfs of 12.16 cfs potential flow)
  └─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.05 cfs @ 0.46 fps)

Pond 18R: 240 LF Bypass Culvert



Summary for Pond 20P: Courtyard Depressions

Inflow Area = 0.491 ac, 82.28% Impervious, Inflow Depth > 1.27" for WQ event
Inflow = 0.09 cfs @ 8.10 hrs, Volume= 0.052 af
Outflow = 0.06 cfs @ 9.48 hrs, Volume= 0.052 af, Atten= 36%, Lag= 83.0 min
Primary = 0.06 cfs @ 9.48 hrs, Volume= 0.052 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.48' @ 9.48 hrs Surf.Area= 0.027 ac Storage= 0.005 af

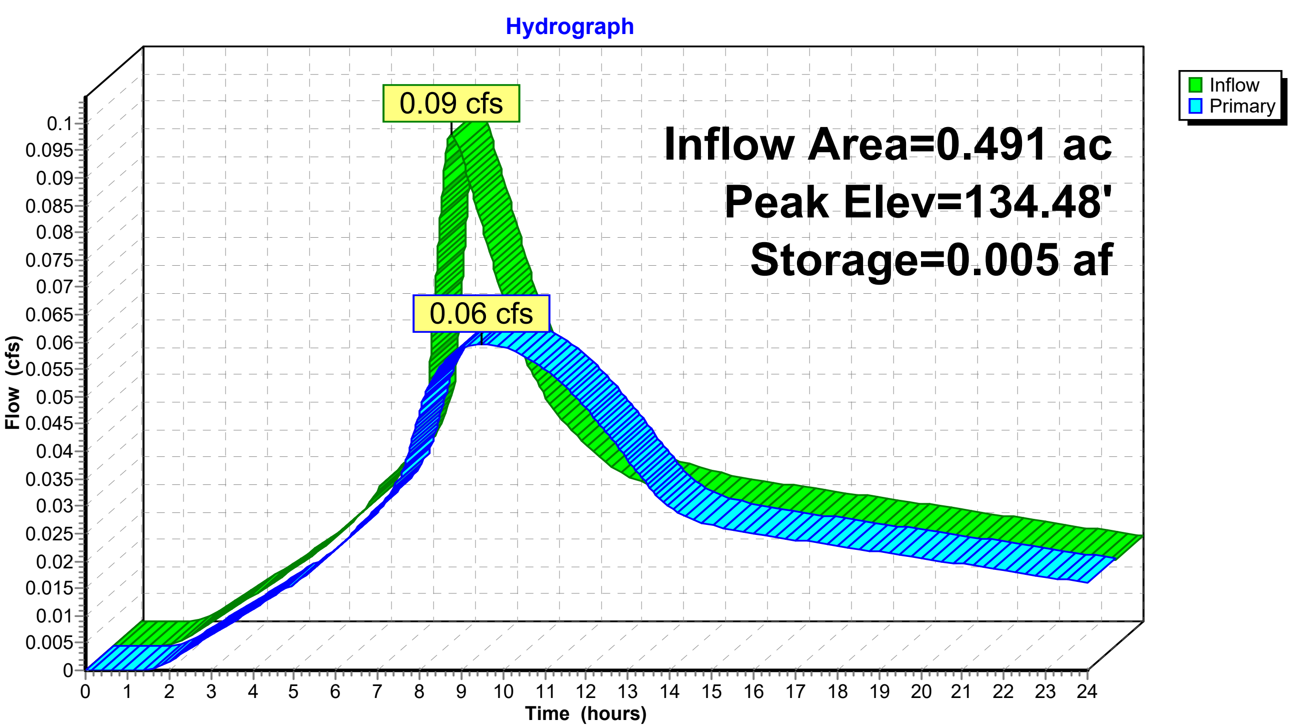
Plug-Flow detention time= 31.4 min calculated for 0.052 af (99% of inflow)
Center-of-Mass det. time= 26.7 min (758.2 - 731.5)

Volume	Invert	Avail.Storage	Storage Description
#1	134.00'	0.009 af	**5.00'W x 5.00'L x 0.60'H Prismatoid Z=30.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	134.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	134.00'	**1.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.06 cfs @ 9.48 hrs HW=134.48' TW=131.51' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Controls 0.00 cfs)
└─**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 2.87 fps)

Pond 20P: Courtyard Depressions



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 127.39' (Flood elevation advised)

Inflow Area =	5.680 ac, 47.76% Impervious,	Inflow Depth > 0.81"	for WQ event
Inflow =	0.57 cfs @ 8.66 hrs,	Volume=	0.382 af
Outflow =	0.57 cfs @ 8.66 hrs,	Volume=	0.382 af, Atten= 0%, Lag= 0.0 min
Primary =	0.57 cfs @ 8.66 hrs,	Volume=	0.382 af
Secondary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af

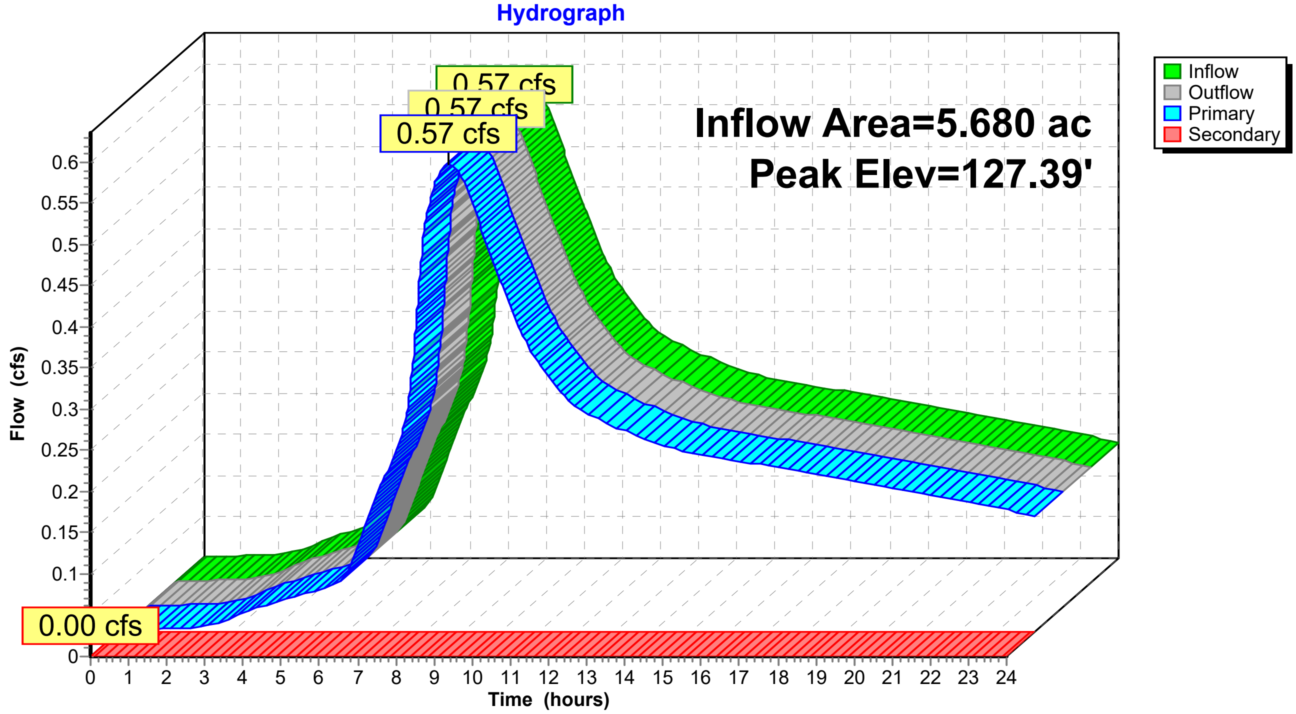
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 127.39' @ 8.66 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.57 cfs @ 8.66 hrs HW=127.39' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.57 cfs @ 2.16 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=126.99' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 25P: TDA 1 Outflow



Summary for Pond AB1: West Bio 1

Inflow Area = 0.668 ac, 85.39% Impervious, Inflow Depth > 1.32" for WQ event
Inflow = 0.22 cfs @ 7.90 hrs, Volume= 0.074 af
Outflow = 0.16 cfs @ 8.10 hrs, Volume= 0.073 af, Atten= 28%, Lag= 12.5 min
Primary = 0.16 cfs @ 8.10 hrs, Volume= 0.073 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.71' @ 8.10 hrs Surf.Area= 0.006 ac Storage= 0.004 af

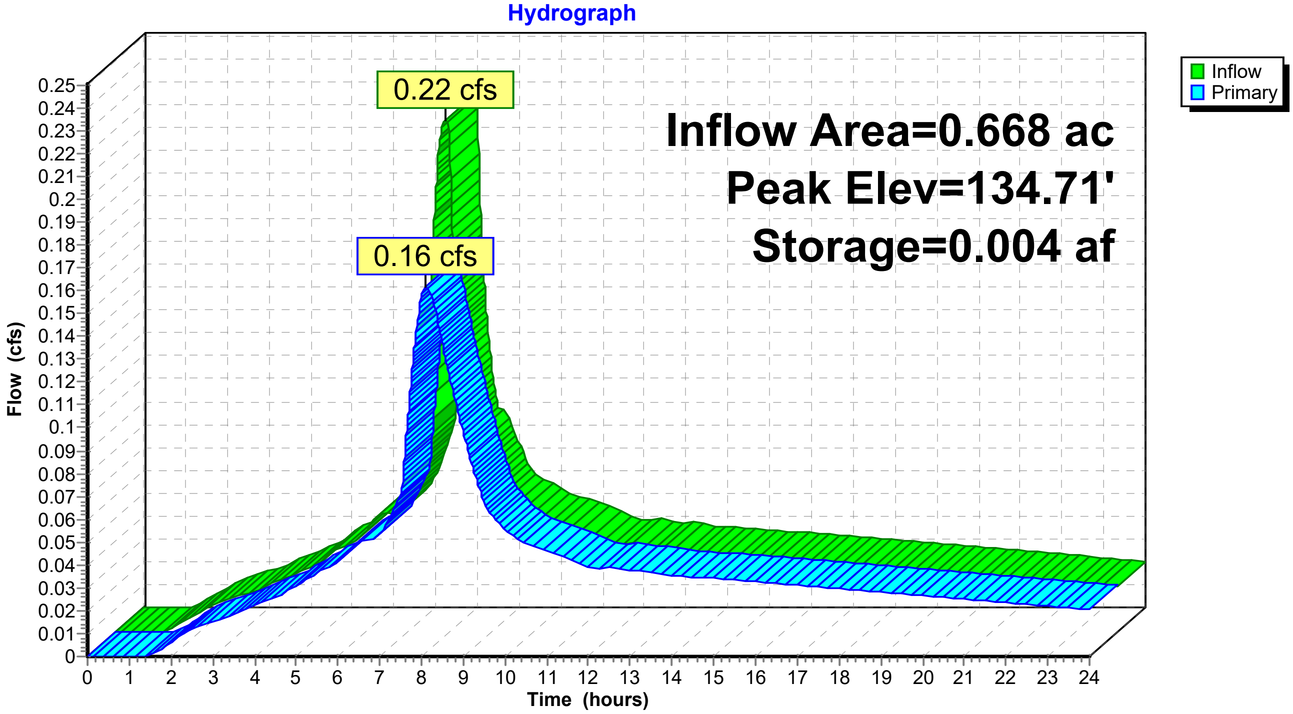
Plug-Flow detention time= 11.2 min calculated for 0.073 af (100% of inflow)
Center-of-Mass det. time= 8.2 min (705.0 - 696.9)

Volume	Invert	Avail.Storage	Storage Description
#1	135.00'	0.009 af	**10.00'W x 28.00'L x 1.00'H Prismatoid Z=3.0**
#2	133.00'	0.005 af	**28.00'W x 10.00'L x 2.00'H Prismatoid**
			0.013 af Overall x 40.0% Voids
		0.014 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	133.00'	**2.2" Vert. Orifice/Grate** C= 0.600
#2	Primary	135.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 8.10 hrs HW=134.71' TW=132.87' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.16 cfs @ 6.13 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond AB1: West Bio 1



Summary for Pond PA: Pond1

[63] Warning: Exceeded Reach 12R INLET depth by 1.61' @ 8.84 hrs

Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 1.31" for WQ event
Inflow = 0.72 cfs @ 8.03 hrs, Volume= 0.336 af
Outflow = 0.50 cfs @ 8.66 hrs, Volume= 0.308 af, Atten= 30%, Lag= 37.5 min
Primary = 0.50 cfs @ 8.66 hrs, Volume= 0.308 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.37' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 132.43' @ 8.66 hrs Surf.Area= 0.055 ac Storage= 0.053 af

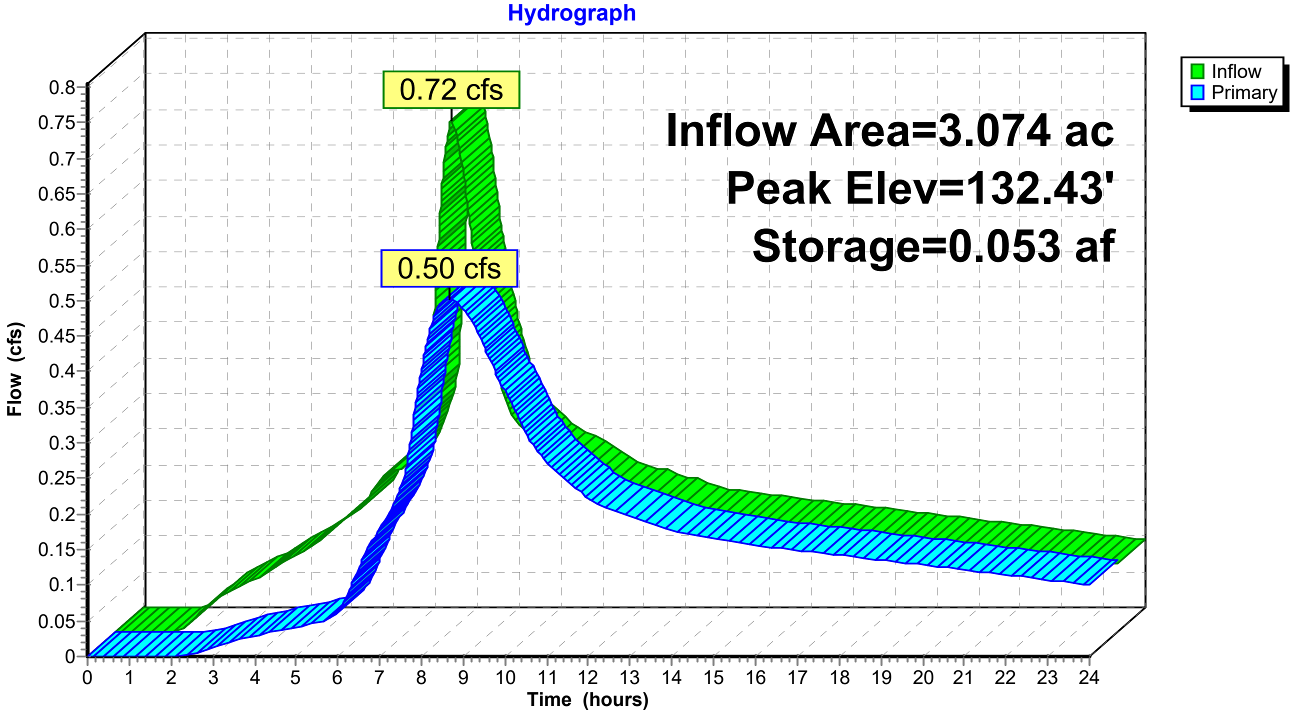
Plug-Flow detention time= 116.9 min calculated for 0.308 af (92% of inflow)
Center-of-Mass det. time= 60.1 min (773.3 - 713.2)

Volume	Invert	Avail.Storage	Storage Description
#1	131.30'	0.157 af	**42.00'W x 42.00'L x 2.70'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.60'	**1.0' long Sharp-Crested Rectangular Weir** 0 End Contraction(s) 1.0' Crest Height
#2	Primary	131.80'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	131.30'	**1.7" Vert. Orifice/Grate** C= 0.600
#4	Primary	133.00'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.7' Crest Height

Primary OutFlow Max=0.50 cfs @ 8.66 hrs HW=132.43' TW=0.00' (Dynamic Tailwater)
1=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
2=Orifice/Grate (Orifice Controls 0.42 cfs @ 3.11 fps)
3=Orifice/Grate (Orifice Controls 0.08 cfs @ 4.95 fps)
4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond PA: Pond1



Summary for Pond PB: Pond2

[63] Warning: Exceeded Reach 19R INLET depth by 0.40' @ 13.92 hrs

Inflow Area = 8.602 ac, 42.69% Impervious, Inflow Depth > 0.88" for WQ event
Inflow = 1.46 cfs @ 8.00 hrs, Volume= 0.632 af
Outflow = 0.36 cfs @ 12.73 hrs, Volume= 0.416 af, Atten= 75%, Lag= 283.6 min
Primary = 0.36 cfs @ 12.73 hrs, Volume= 0.416 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 129.85' Surf.Area= 0.000 ac Storage= 0.000 af
Peak Elev= 132.33' @ 12.73 hrs Surf.Area= 0.301 ac Storage= 0.240 af

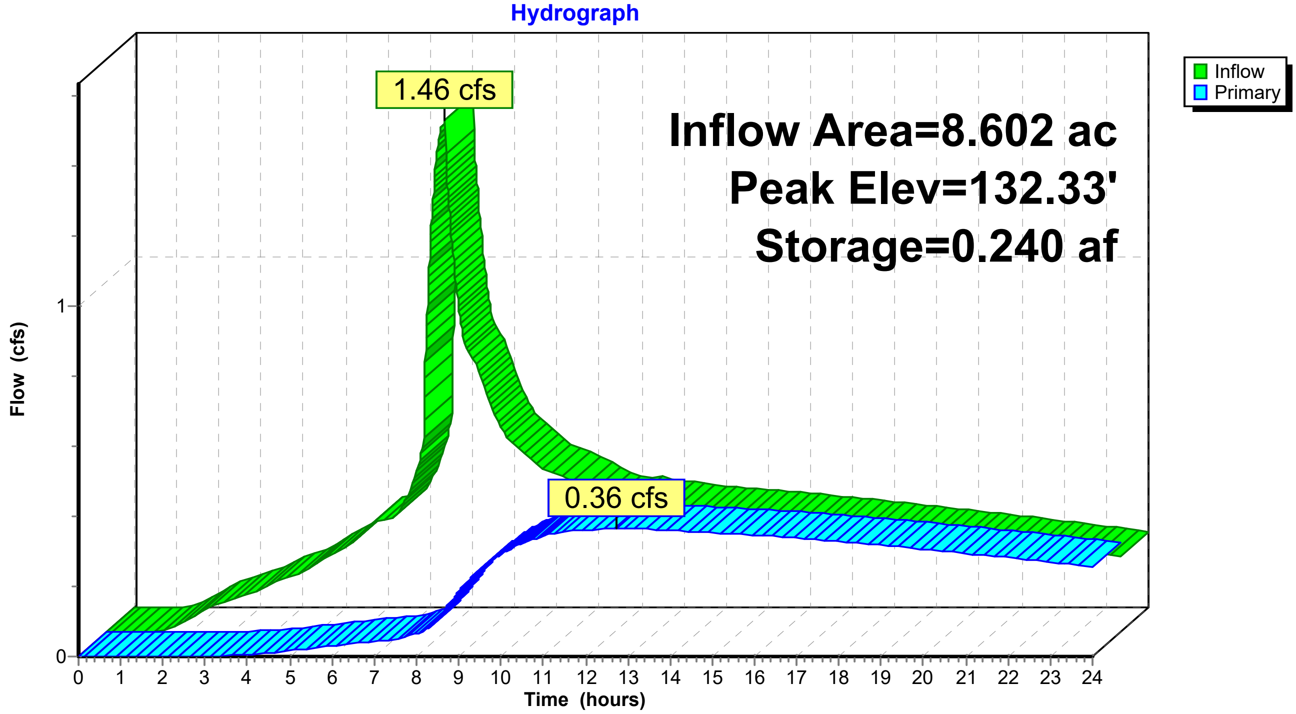
Plug-Flow detention time= 400.6 min calculated for 0.416 af (66% of inflow)
Center-of-Mass det. time= 199.2 min (953.0 - 753.8)

Volume	Invert	Avail.Storage	Storage Description
#1	131.50'	0.970 af	**120.00'W x 100.00'L x 3.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	132.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	131.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.00'	**1.4' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.5' Crest Height
#4	Primary	133.47'	**4.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.6' Crest Height

Primary OutFlow Max=0.36 cfs @ 12.73 hrs HW=132.33' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.27 cfs @ 1.97 fps)
2=Orifice/Grate (Orifice Controls 0.09 cfs @ 4.17 fps)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond PB: Pond2

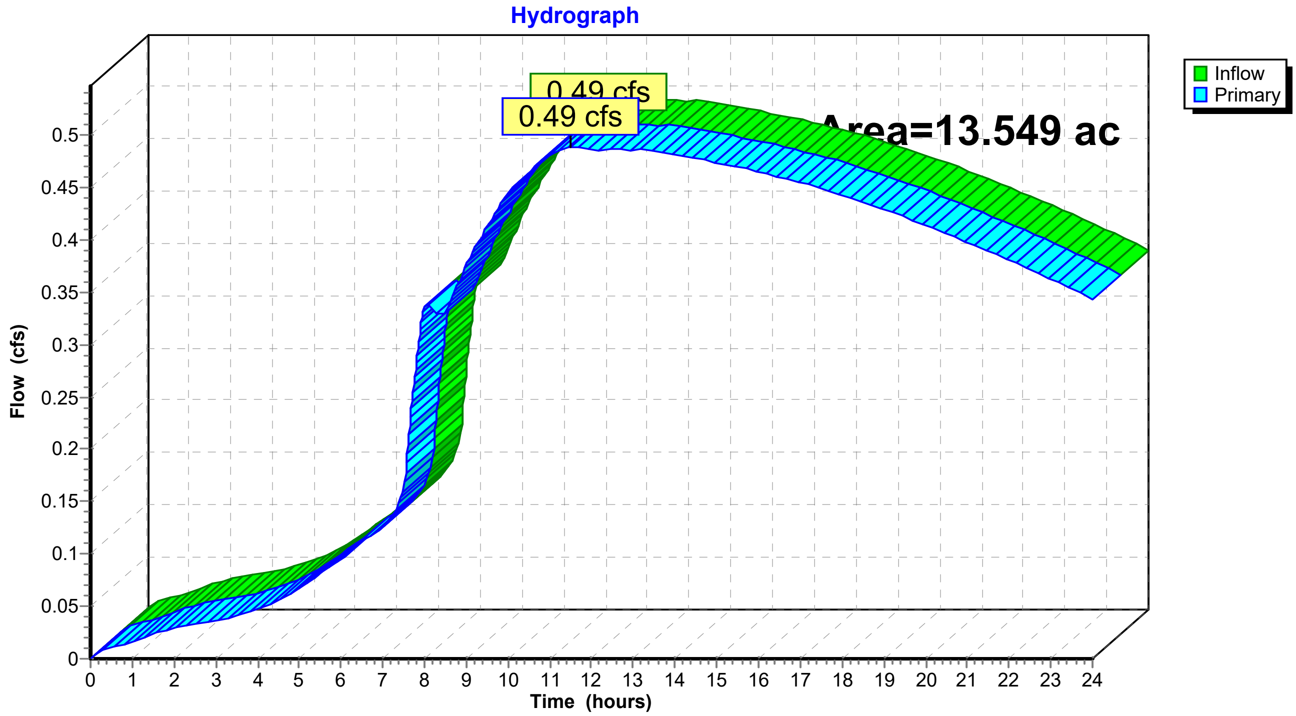


Summary for Link 11L: TDA 2 Outflow

Inflow Area = 13.549 ac, 32.99% Impervious, Inflow Depth > 0.55" for WQ event
Inflow = 0.49 cfs @ 11.50 hrs, Volume= 0.617 af
Primary = 0.49 cfs @ 11.50 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 11L: TDA 2 Outflow

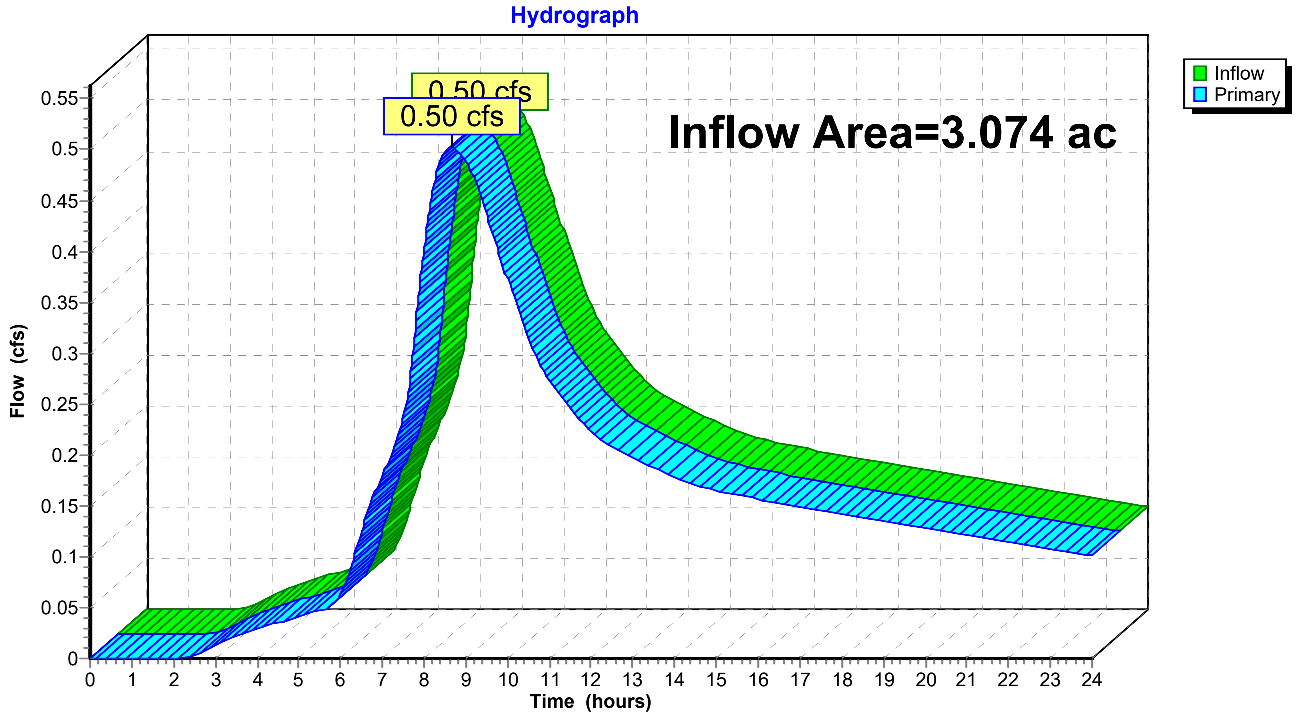


Summary for Link 12L: Site Outflow

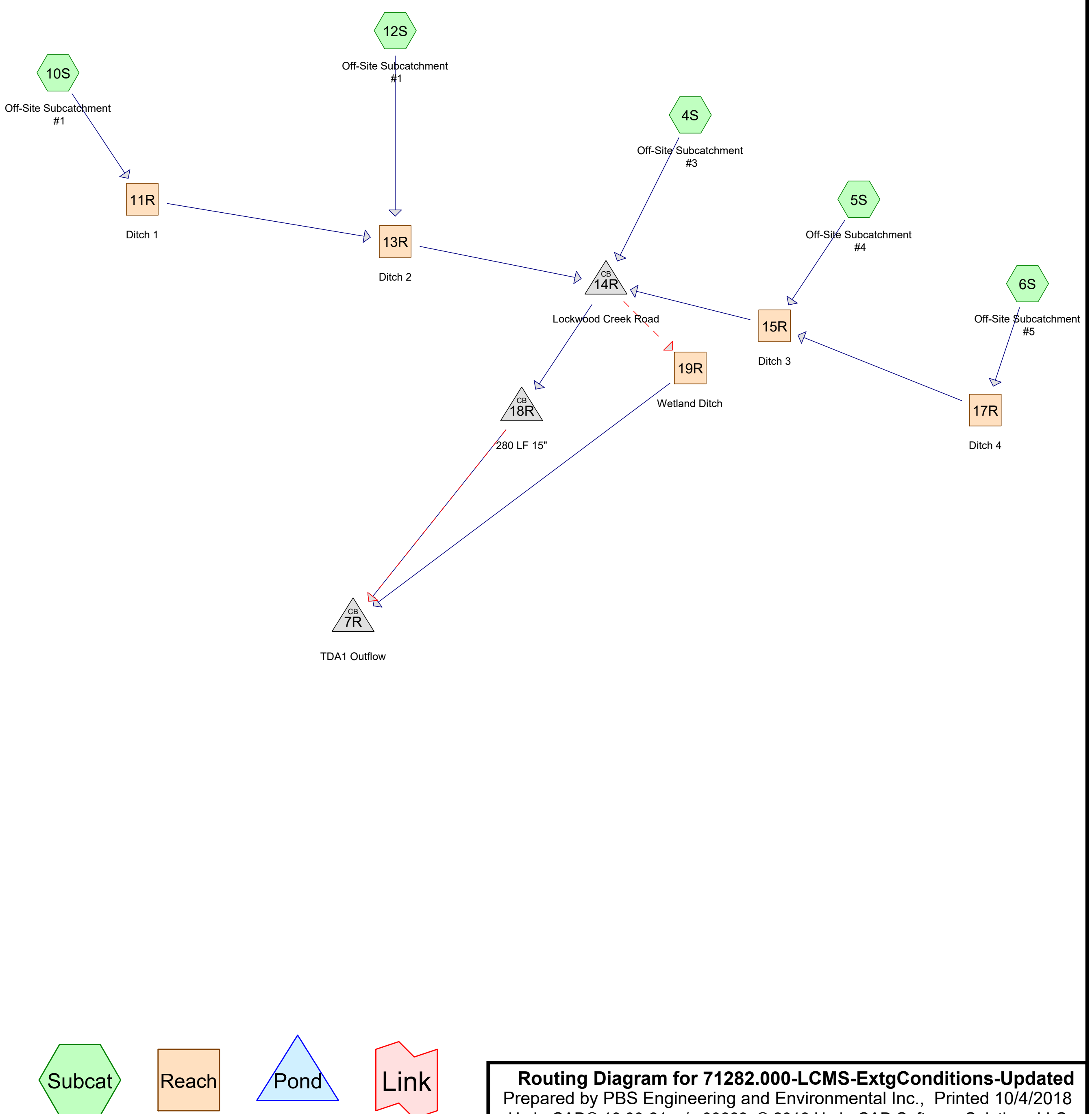
Inflow Area = 3.074 ac, 85.24% Impervious, Inflow Depth > 1.20" for WQ event
Inflow = 0.50 cfs @ 8.66 hrs, Volume= 0.308 af
Primary = 0.50 cfs @ 8.66 hrs, Volume= 0.308 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 12L: Site Outflow



HydroCAD Existing Off-Site Model (Includes Only Off-Site Flow to TDA #1 Discharge)



Routing Diagram for 71282.000-LCMS-ExtgConditions-Updated
Prepared by PBS Engineering and Environmental Inc., Printed 10/4/2018
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
74.760	76	(4S, 5S, 6S, 10S, 12S)
74.760	**76**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
74.760	Other	4S, 5S, 6S, 10S, 12S
74.760		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	74.760	74.760		4S, 5S, 6S, 10S, 12S
0.000	**0.000**	**0.000**	**0.000**	**74.760**	**74.760**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	7R	126.99	120.35	247.0	0.0269	0.012	10.0	0.0	0.0
2	14R	141.50	139.20	42.0	0.0548	0.013	24.0	0.0	0.0
3	14R	142.60	139.90	36.0	0.0750	0.013	8.0	0.0	0.0
4	18R	139.70	130.50	280.0	0.0329	0.013	15.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 4S: Off-Site Subcatchment Runoff Area=39.520 ac 0.00% Impervious Runoff Depth>0.62"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=2.56 cfs 2.052 af

Subcatchment 5S: Off-Site Subcatchment #4 Runoff Area=7.030 ac 0.00% Impervious Runoff Depth>0.62"
Flow Length=1,200' Tc=23.0 min CN=76/0 Runoff=0.47 cfs 0.366 af

Subcatchment 6S: Off-Site Subcatchment #5 Runoff Area=3.600 ac 0.00% Impervious Runoff Depth>0.63"
Flow Length=680' Tc=18.3 min CN=76/0 Runoff=0.26 cfs 0.188 af

Subcatchment 10S: Off-Site Subcatchment Runoff Area=6.040 ac 0.00% Impervious Runoff Depth>0.61"
Flow Length=840' Tc=43.0 min CN=76/0 Runoff=0.32 cfs 0.309 af

Subcatchment 12S: Off-Site Subcatchment Runoff Area=18.570 ac 0.00% Impervious Runoff Depth>0.62"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=1.20 cfs 0.964 af

Reach 11R: Ditch 1 Avg. Flow Depth=0.45' Max Vel=0.78 fps Inflow=0.32 cfs 0.309 af
n=0.030 L=940.0' S=0.0021 '/' Capacity=50.03 cfs Outflow=0.32 cfs 0.304 af

Reach 13R: Ditch 2 Avg. Flow Depth=0.42' Max Vel=3.94 fps Inflow=1.42 cfs 1.268 af
n=0.030 L=95.0' S=0.0579 '/' Capacity=260.96 cfs Outflow=1.42 cfs 1.268 af

Reach 15R: Ditch 3 Avg. Flow Depth=0.36' Max Vel=2.85 fps Inflow=0.73 cfs 0.553 af
n=0.030 L=184.0' S=0.0380 '/' Capacity=211.54 cfs Outflow=0.73 cfs 0.553 af

Reach 17R: Ditch 4 Avg. Flow Depth=0.30' Max Vel=1.44 fps Inflow=0.26 cfs 0.188 af
n=0.030 L=330.0' S=0.0121 '/' Capacity=119.41 cfs Outflow=0.26 cfs 0.187 af

Reach 19R: Wetland Ditch Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.035 L=428.0' S=0.0206 '/' Capacity=11.16 cfs Outflow=0.00 cfs 0.000 af

Pond 7R: TDA1 Outflow Peak Elev=128.03' Inflow=4.70 cfs 3.873 af
Primary=2.07 cfs 2.550 af Secondary=2.62 cfs 1.323 af Outflow=4.70 cfs 3.873 af

Pond 14R: Lockwood Creek Road Peak Elev=142.43' Inflow=4.70 cfs 3.873 af
Primary=4.70 cfs 3.873 af Secondary=0.00 cfs 0.000 af Outflow=4.70 cfs 3.873 af

Pond 18R: 280 LF 15" Peak Elev=140.96' Inflow=4.70 cfs 3.873 af
Primary=4.70 cfs 3.873 af Secondary=0.00 cfs 0.000 af Outflow=4.70 cfs 3.873 af

Total Runoff Area = 74.760 ac Runoff Volume = 3.880 af Average Runoff Depth = 0.62"
100.00% Pervious = 74.760 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 4S: Off-Site Subcatchment #3

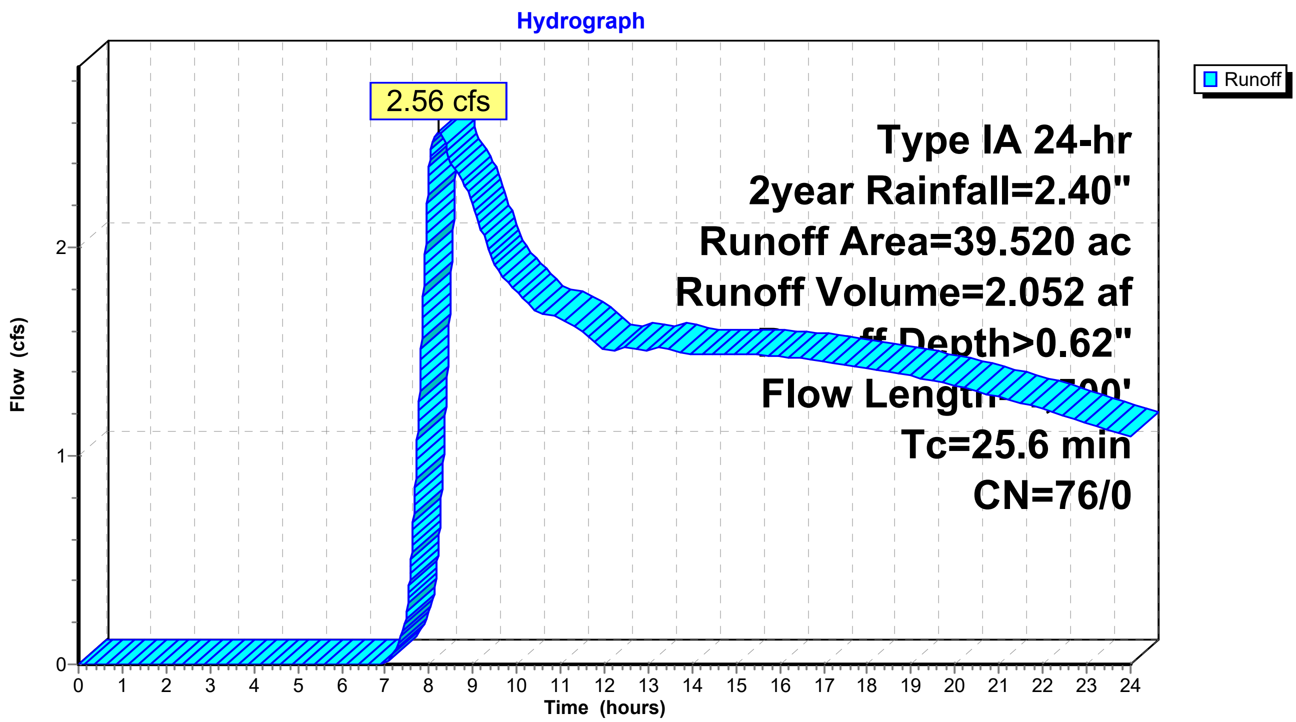
Runoff = 2.56 cfs @ 8.21 hrs, Volume= 2.052 af, Depth> 0.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (ac)	CN	Description
*	39.520	76	
	39.520	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment 4S: Off-Site Subcatchment #3



Summary for Subcatchment 5S: Off-Site Subcatchment #4

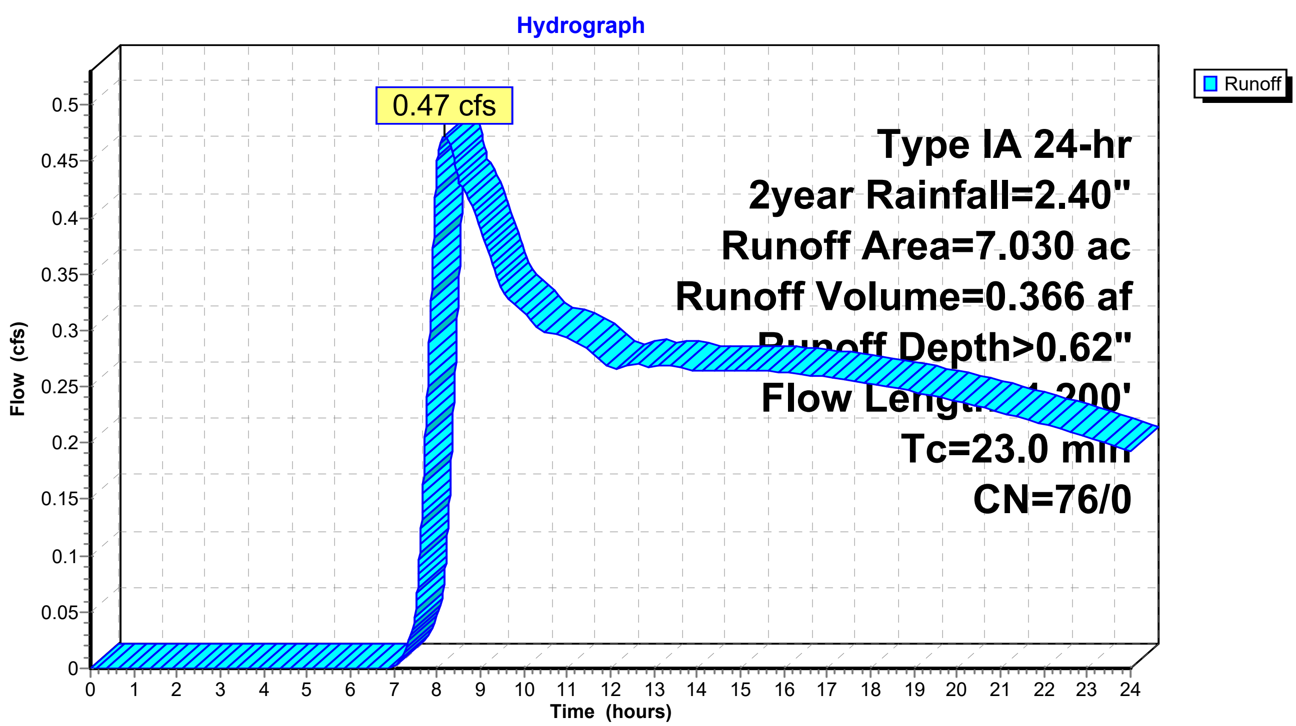
Runoff = 0.47 cfs @ 8.17 hrs, Volume= 0.366 af, Depth> 0.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (ac)	CN	Description
*	7.030	76	
	7.030	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	900	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
23.0	1,200	Total			

Subcatchment 5S: Off-Site Subcatchment #4



Summary for Subcatchment 6S: Off-Site Subcatchment #5

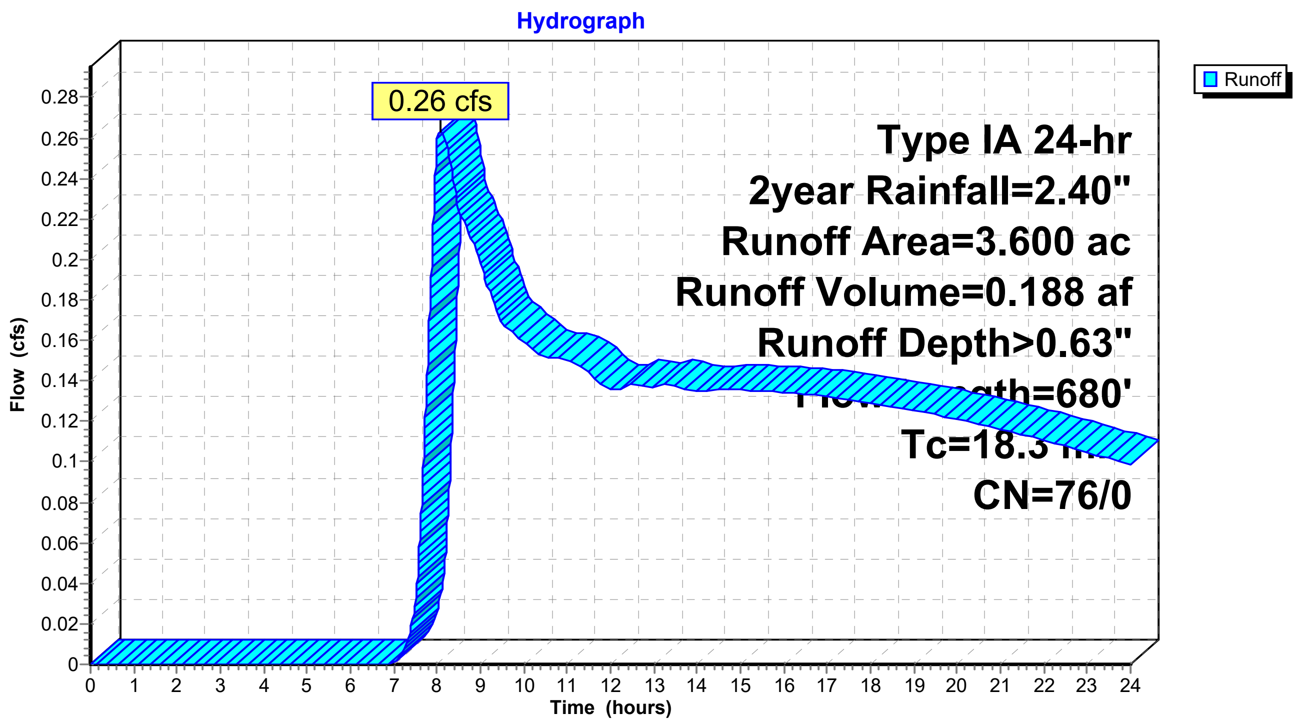
Runoff = 0.26 cfs @ 8.08 hrs, Volume= 0.188 af, Depth> 0.63"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (ac)	CN	Description
*	3.600	76	
	3.600	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	380	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
18.3	680	Total			

Subcatchment 6S: Off-Site Subcatchment #5



Summary for Subcatchment 10S: Off-Site Subcatchment #1

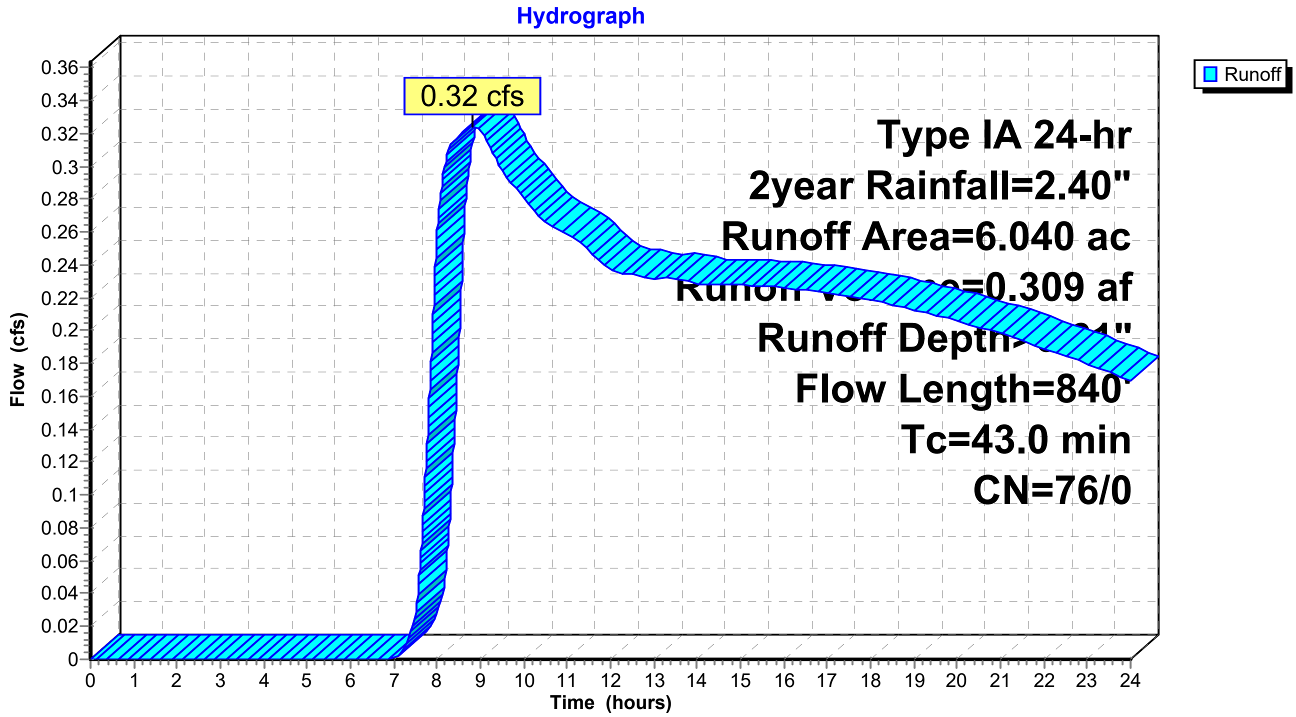
Runoff = 0.32 cfs @ 8.80 hrs, Volume= 0.309 af, Depth> 0.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (ac)	CN	Description
*	6.040	76	
	6.040	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1	540	0.0021	0.32		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
43.0	840	Total			

Subcatchment 10S: Off-Site Subcatchment #1



Summary for Subcatchment 12S: Off-Site Subcatchment #1

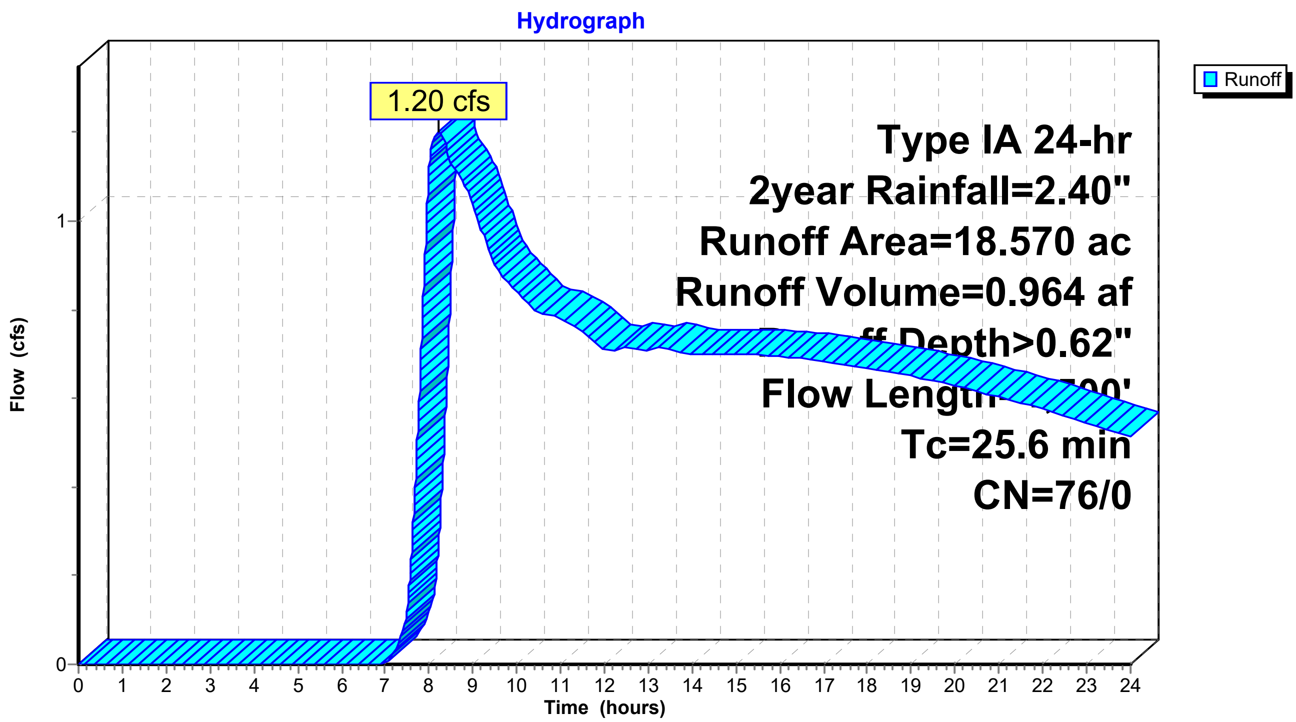
Runoff = 1.20 cfs @ 8.21 hrs, Volume= 0.964 af, Depth> 0.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2year Rainfall=2.40"

	Area (ac)	CN	Description
*	18.570	76	
	18.570	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment 12S: Off-Site Subcatchment #1



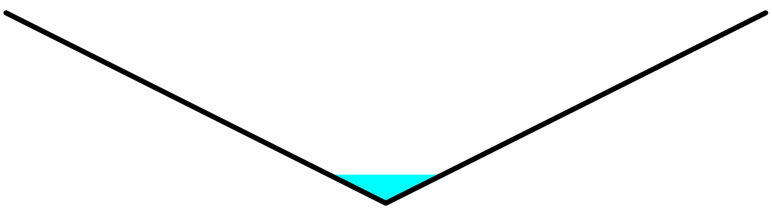
Summary for Reach 11R: Ditch 1

Inflow Area = 6.040 ac, 0.00% Impervious, Inflow Depth > 0.61" for 2year event
Inflow = 0.32 cfs @ 8.80 hrs, Volume= 0.309 af
Outflow = 0.32 cfs @ 9.10 hrs, Volume= 0.304 af, Atten= 2%, Lag= 18.3 min

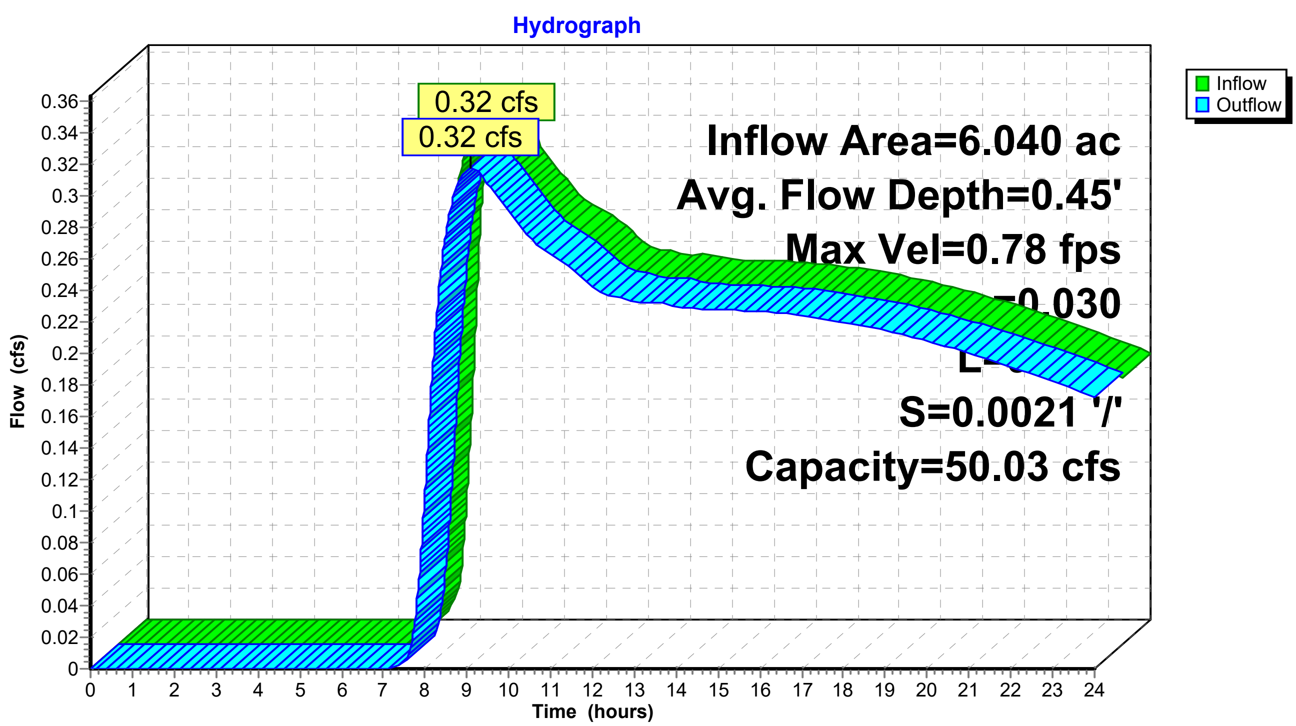
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.78 fps, Min. Travel Time= 20.0 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 22.4 min

Peak Storage= 380 cf @ 9.10 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 50.03 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 940.0' Slope= 0.0021 '/'
Inlet Invert= 149.00', Outlet Invert= 147.00'



Reach 11R: Ditch 1



Summary for Reach 13R: Ditch 2

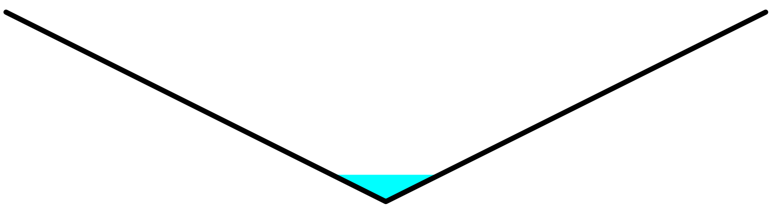
[62] Hint: Exceeded Reach 11R OUTLET depth by 0.12' @ 7.76 hrs

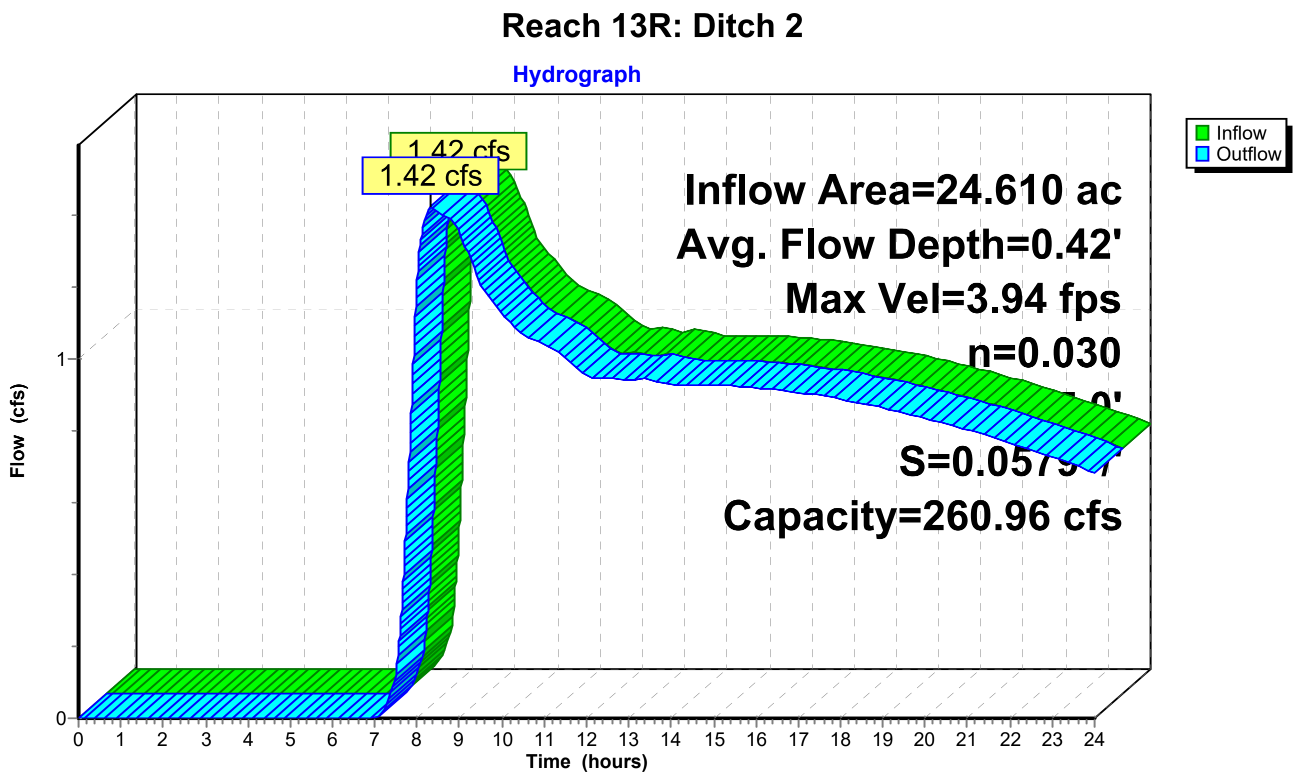
Inflow Area = 24.610 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2year event
Inflow = 1.42 cfs @ 8.33 hrs, Volume= 1.268 af
Outflow = 1.42 cfs @ 8.34 hrs, Volume= 1.268 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.94 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.46 fps, Avg. Travel Time= 0.5 min

Peak Storage= 34 cf @ 8.34 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 260.96 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 95.0' Slope= 0.0579 '/'
Inlet Invert= 147.00', Outlet Invert= 141.50'





Summary for Reach 15R: Ditch 3

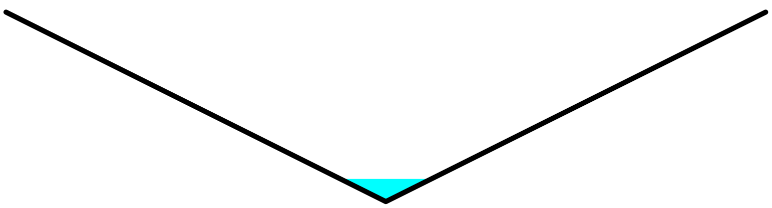
[62] Hint: Exceeded Reach 17R OUTLET depth by 0.06' @ 8.66 hrs

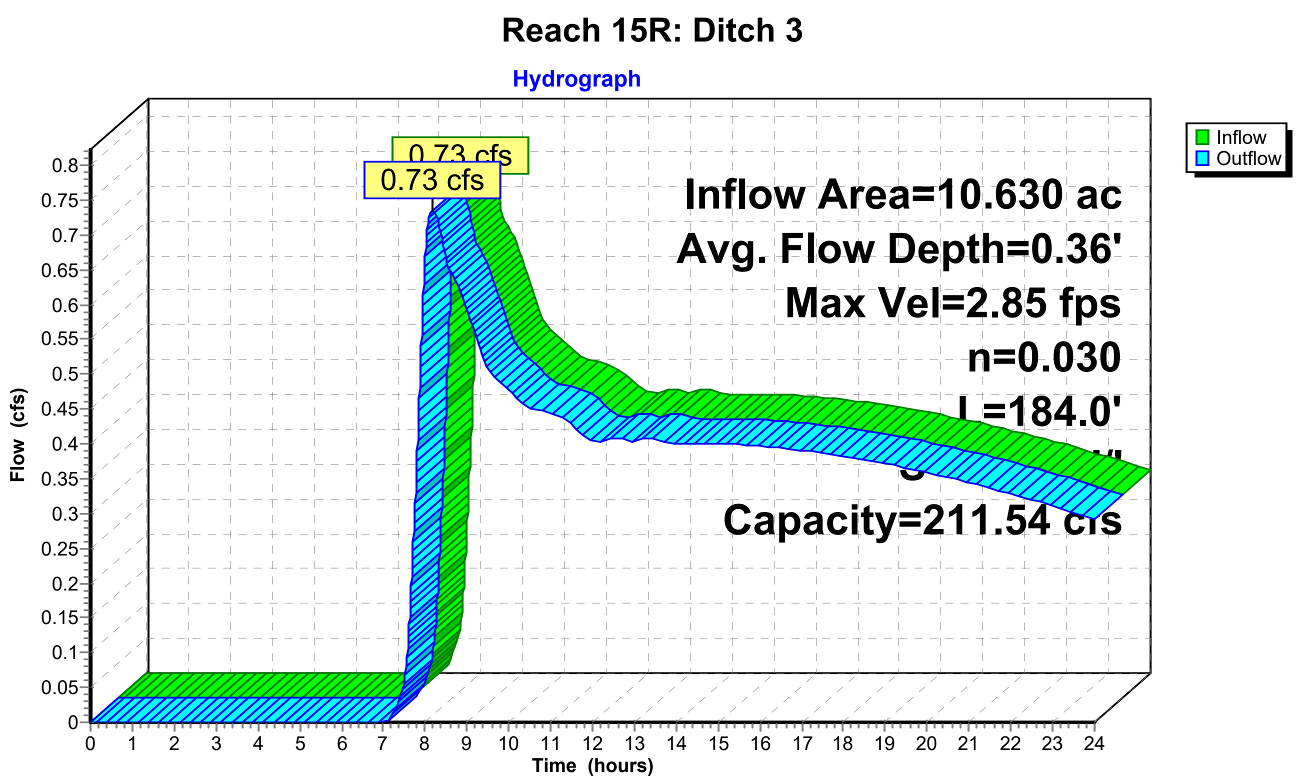
Inflow Area = 10.630 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2year event
Inflow = 0.73 cfs @ 8.16 hrs, Volume= 0.553 af
Outflow = 0.73 cfs @ 8.18 hrs, Volume= 0.553 af, Atten= 0%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.85 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.41 fps, Avg. Travel Time= 1.3 min

Peak Storage= 47 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 211.54 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 184.0' Slope= 0.0380 '/'
Inlet Invert= 148.50', Outlet Invert= 141.50'





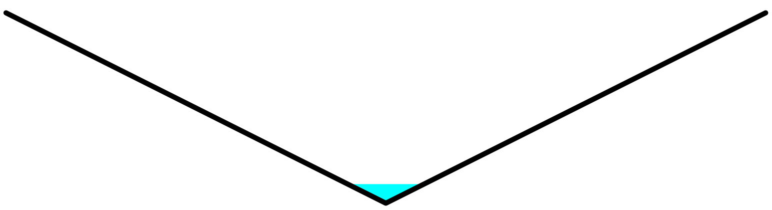
Summary for Reach 17R: Ditch 4

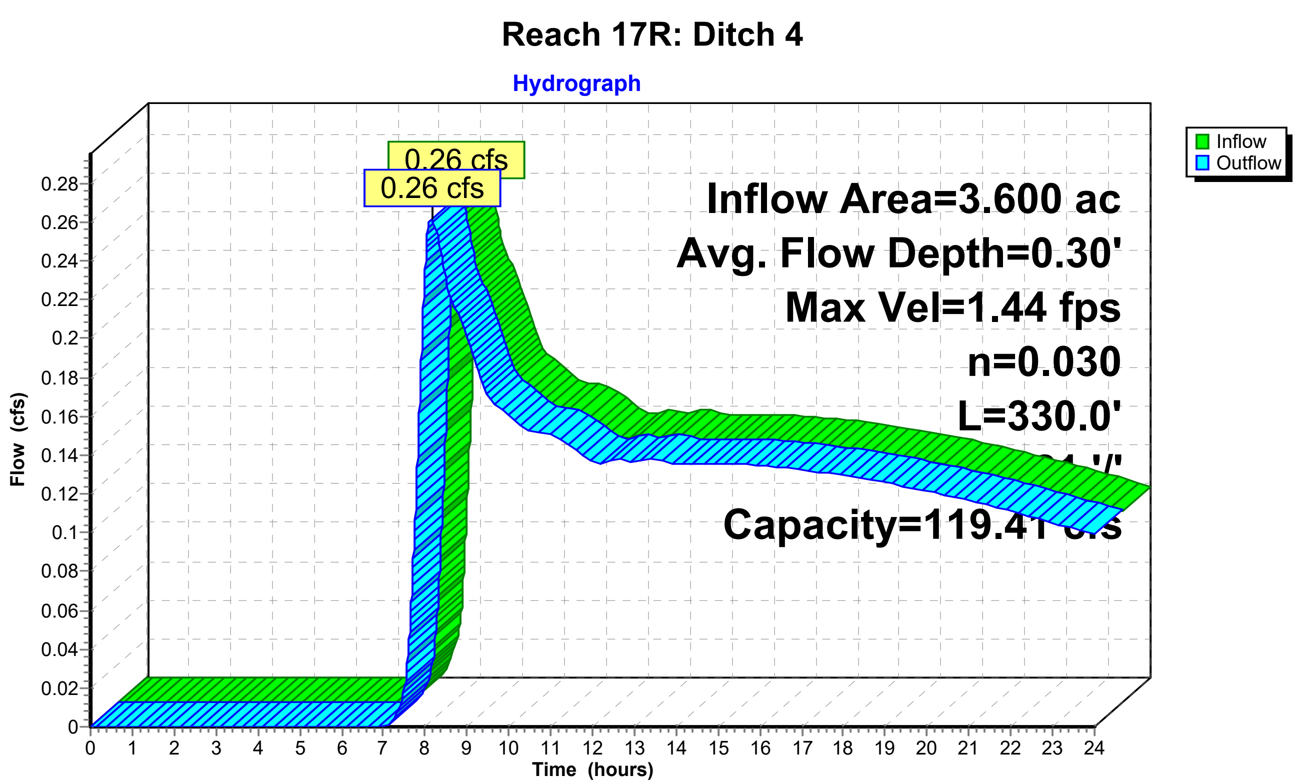
Inflow Area = 3.600 ac, 0.00% Impervious, Inflow Depth > 0.63" for 2year event
Inflow = 0.26 cfs @ 8.08 hrs, Volume= 0.188 af
Outflow = 0.26 cfs @ 8.15 hrs, Volume= 0.187 af, Atten= 1%, Lag= 4.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.44 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 1.20 fps, Avg. Travel Time= 4.6 min

Peak Storage= 60 cf @ 8.15 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 119.41 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 330.0' Slope= 0.0121 '/'
Inlet Invert= 152.50', Outlet Invert= 148.50'





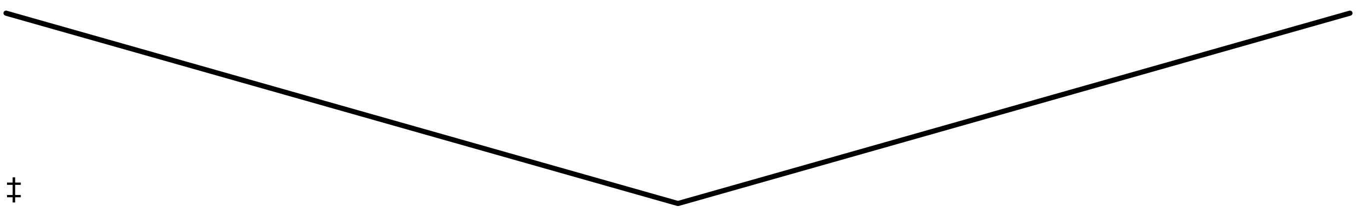
Summary for Reach 19R: Wetland Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.40' Flow Area= 5.4 sf, Capacity= 11.16 cfs

0.00' x 0.40' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 33.5 '/' Top Width= 26.80'
Length= 428.0' Slope= 0.0206 '/'
Inlet Invert= 139.80', Outlet Invert= 131.00'



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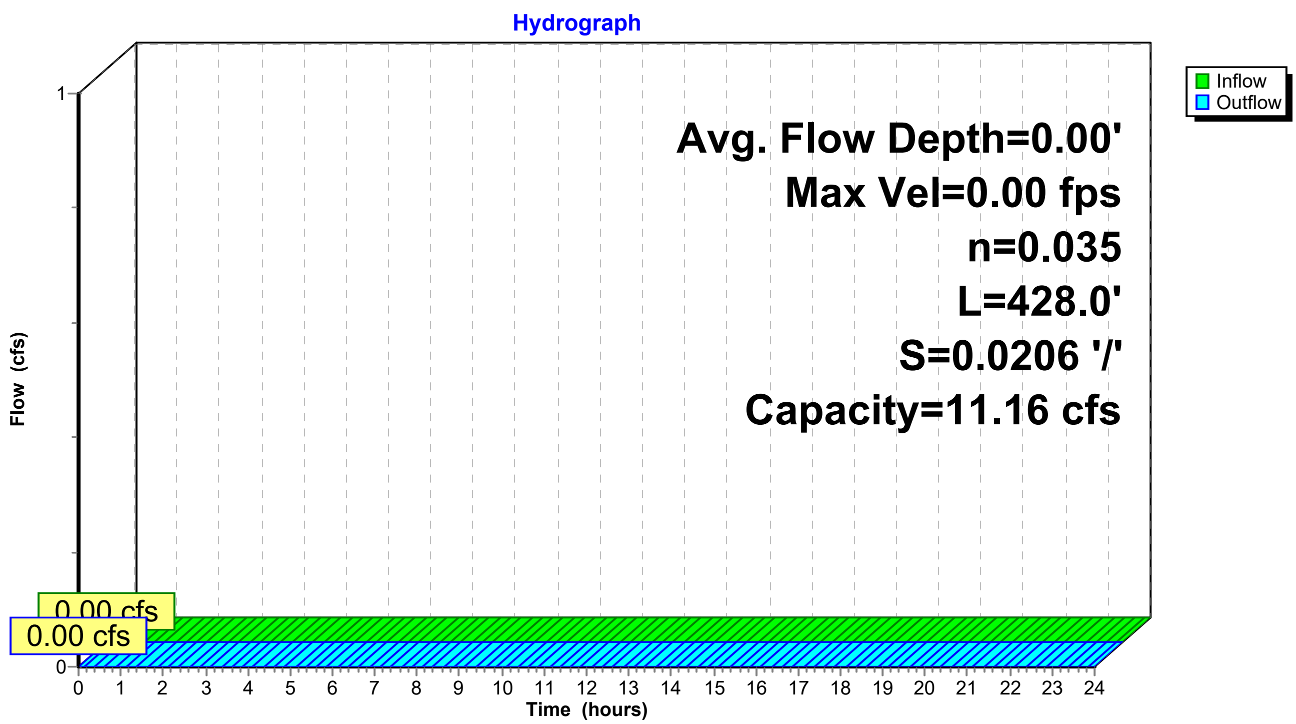
Reach 19R: Wetland Ditch



Summary for Pond 7R: TDA1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 128.03' (Flood elevation advised)

Inflow Area =	74.760 ac,	0.00% Impervious, Inflow Depth > 0.62"	for 2year event
Inflow =	4.70 cfs @	8.24 hrs, Volume=	3.873 af
Outflow =	4.70 cfs @	8.24 hrs, Volume=	3.873 af, Atten= 0%, Lag= 0.0 min
Primary =	2.07 cfs @	8.24 hrs, Volume=	2.550 af
Secondary =	2.62 cfs @	8.24 hrs, Volume=	1.323 af

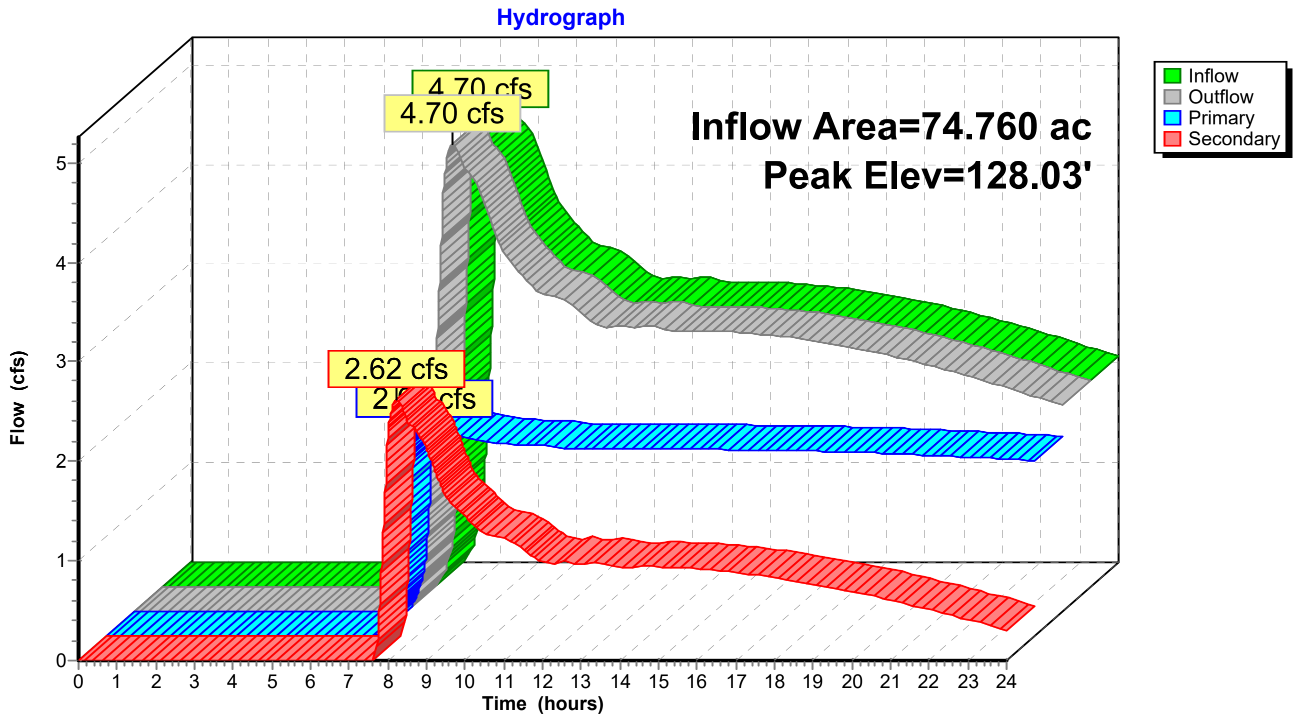
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.03' @ 8.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.07 cfs @ 8.24 hrs HW=128.03' (Free Discharge)
1=Culvert (Inlet Controls 2.07 cfs @ 3.80 fps)

Secondary OutFlow Max=2.62 cfs @ 8.24 hrs HW=128.03' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 2.62 cfs @ 1.14 fps)

Pond 7R: TDA1 Outflow



Summary for Pond 14R: Lockwood Creek Road

[57] Hint: Peaked at 142.43' (Flood elevation advised)
[62] Hint: Exceeded Reach 13R OUTLET depth by 0.51' @ 8.20 hrs
[62] Hint: Exceeded Reach 15R OUTLET depth by 0.57' @ 8.27 hrs

Inflow Area = 74.760 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2year event
Inflow = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af
Outflow = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af, Atten= 0%, Lag= 0.0 min
Primary = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

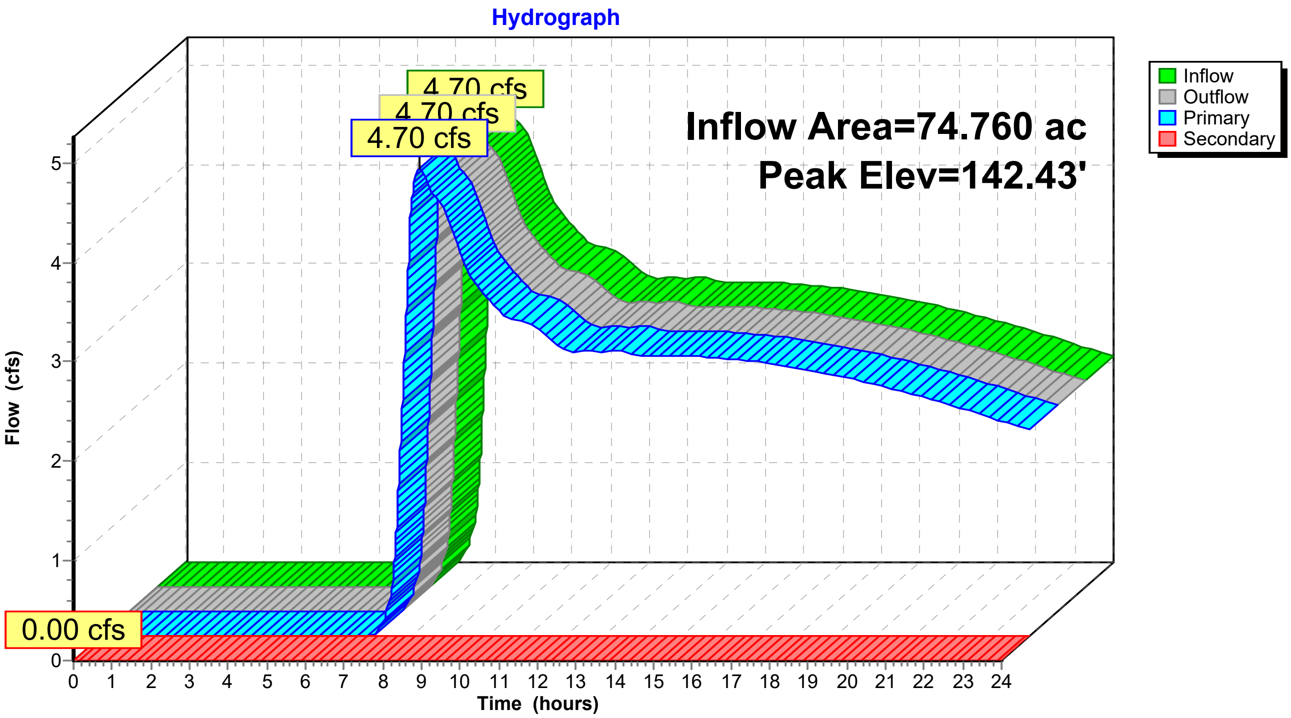
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 142.43' @ 8.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	**24.0" Round Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 141.50' / 139.20' S= 0.0548 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 3.14 sf
#2	Secondary	145.60'	**210.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Secondary	142.60'	**8.0" Round Culvert** L= 36.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 142.60' / 139.90' S= 0.0750 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=4.70 cfs @ 8.24 hrs HW=142.43' TW=140.96' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.70 cfs @ 3.28 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=141.50' TW=139.80' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Controls 0.00 cfs)

Pond 14R: Lockwood Creek Road



Summary for Pond 18R: 280 LF 15"

[57] Hint: Peaked at 140.96' (Flood elevation advised)

Inflow Area =	74.760 ac,	0.00% Impervious, Inflow Depth > 0.62"	for 2year event	
Inflow =	4.70 cfs @	8.24 hrs, Volume=	3.873 af	
Outflow =	4.70 cfs @	8.24 hrs, Volume=	3.873 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.70 cfs @	8.24 hrs, Volume=	3.873 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

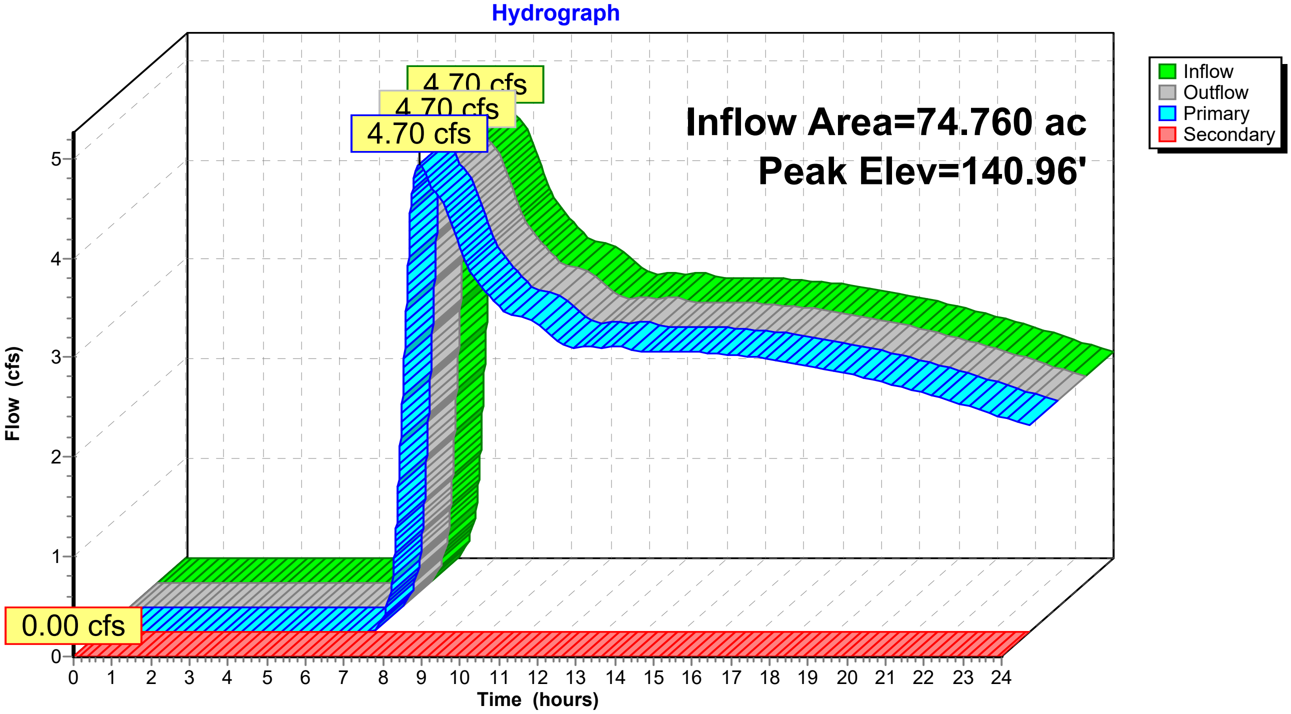
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 140.96' @ 8.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	139.70'	**15.0" Round Culvert** L= 280.0' Ke= 0.500 Inlet / Outlet Invert= 139.70' / 130.50' S= 0.0329 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Secondary	142.60'	**12.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=4.70 cfs @ 8.24 hrs HW=140.96' TW=128.03' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.70 cfs @ 3.83 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.70' TW=126.99' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 18R: 280 LF 15"



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 4S: Off-Site Subcatchment Runoff Area=39.520 ac 0.00% Impervious Runoff Depth>2.10"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=13.91 cfs 6.916 af

Subcatchment 5S: Off-Site Subcatchment #4 Runoff Area=7.030 ac 0.00% Impervious Runoff Depth>2.10"
Flow Length=1,200' Tc=23.0 min CN=76/0 Runoff=2.58 cfs 1.232 af

Subcatchment 6S: Off-Site Subcatchment #5 Runoff Area=3.600 ac 0.00% Impervious Runoff Depth>2.11"
Flow Length=680' Tc=18.3 min CN=76/0 Runoff=1.43 cfs 0.633 af

Subcatchment 10S: Off-Site Subcatchment Runoff Area=6.040 ac 0.00% Impervious Runoff Depth>2.08"
Flow Length=840' Tc=43.0 min CN=76/0 Runoff=1.70 cfs 1.046 af

Subcatchment 12S: Off-Site Subcatchment Runoff Area=18.570 ac 0.00% Impervious Runoff Depth>2.10"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=6.54 cfs 3.250 af

Reach 11R: Ditch 1 Avg. Flow Depth=0.83' Max Vel=1.18 fps Inflow=1.70 cfs 1.046 af
n=0.030 L=940.0' S=0.0021 '/' Capacity=50.03 cfs Outflow=1.64 cfs 1.035 af

Reach 13R: Ditch 2 Avg. Flow Depth=0.81' Max Vel=6.05 fps Inflow=7.89 cfs 4.285 af
n=0.030 L=95.0' S=0.0579 '/' Capacity=260.96 cfs Outflow=7.89 cfs 4.284 af

Reach 15R: Ditch 3 Avg. Flow Depth=0.68' Max Vel=4.36 fps Inflow=3.99 cfs 1.863 af
n=0.030 L=184.0' S=0.0380 '/' Capacity=211.54 cfs Outflow=3.99 cfs 1.862 af

Reach 17R: Ditch 4 Avg. Flow Depth=0.57' Max Vel=2.19 fps Inflow=1.43 cfs 0.633 af
n=0.030 L=330.0' S=0.0121 '/' Capacity=119.41 cfs Outflow=1.41 cfs 0.631 af

Reach 19R: Wetland Ditch Avg. Flow Depth=0.22' Max Vel=1.41 fps Inflow=2.39 cfs 0.555 af
n=0.035 L=428.0' S=0.0206 '/' Capacity=11.16 cfs Outflow=2.35 cfs 0.555 af

Pond 7R: TDA1 Outflow Peak Elev=128.69' Inflow=25.61 cfs 13.063 af
Primary=2.98 cfs 3.520 af Secondary=22.63 cfs 9.543 af Outflow=25.61 cfs 13.063 af

Pond 14R: Lockwood Creek Road Peak Elev=145.54' Inflow=25.72 cfs 13.063 af
Primary=23.33 cfs 12.508 af Secondary=2.39 cfs 0.555 af Outflow=25.72 cfs 13.063 af

Pond 18R: 280 LF 15" Peak Elev=143.16' Inflow=23.33 cfs 12.508 af
Primary=9.95 cfs 11.102 af Secondary=13.38 cfs 1.406 af Outflow=23.33 cfs 12.508 af

Total Runoff Area = 74.760 ac Runoff Volume = 13.077 af Average Runoff Depth = 2.10"
100.00% Pervious = 74.760 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 4S: Off-Site Subcatchment #3

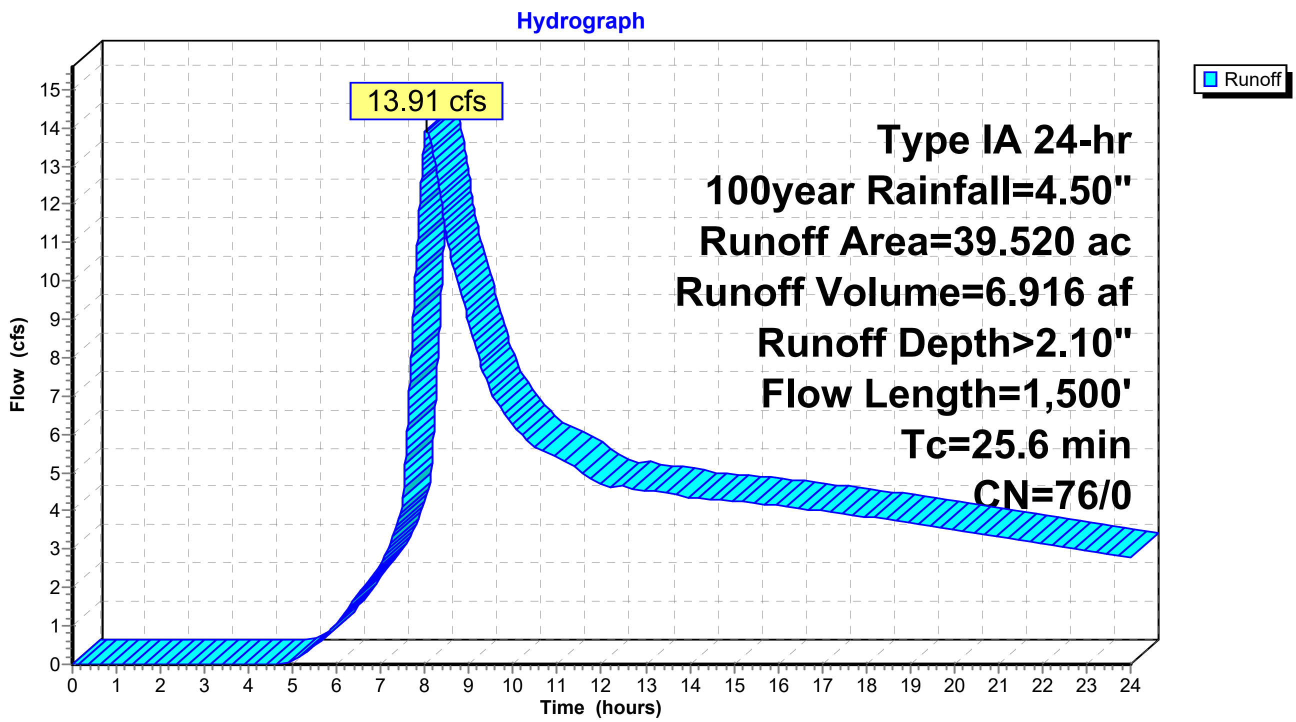
Runoff = 13.91 cfs @ 8.01 hrs, Volume= 6.916 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (ac)	CN	Description
*	39.520	76	
	39.520	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment 4S: Off-Site Subcatchment #3



Summary for Subcatchment 5S: Off-Site Subcatchment #4

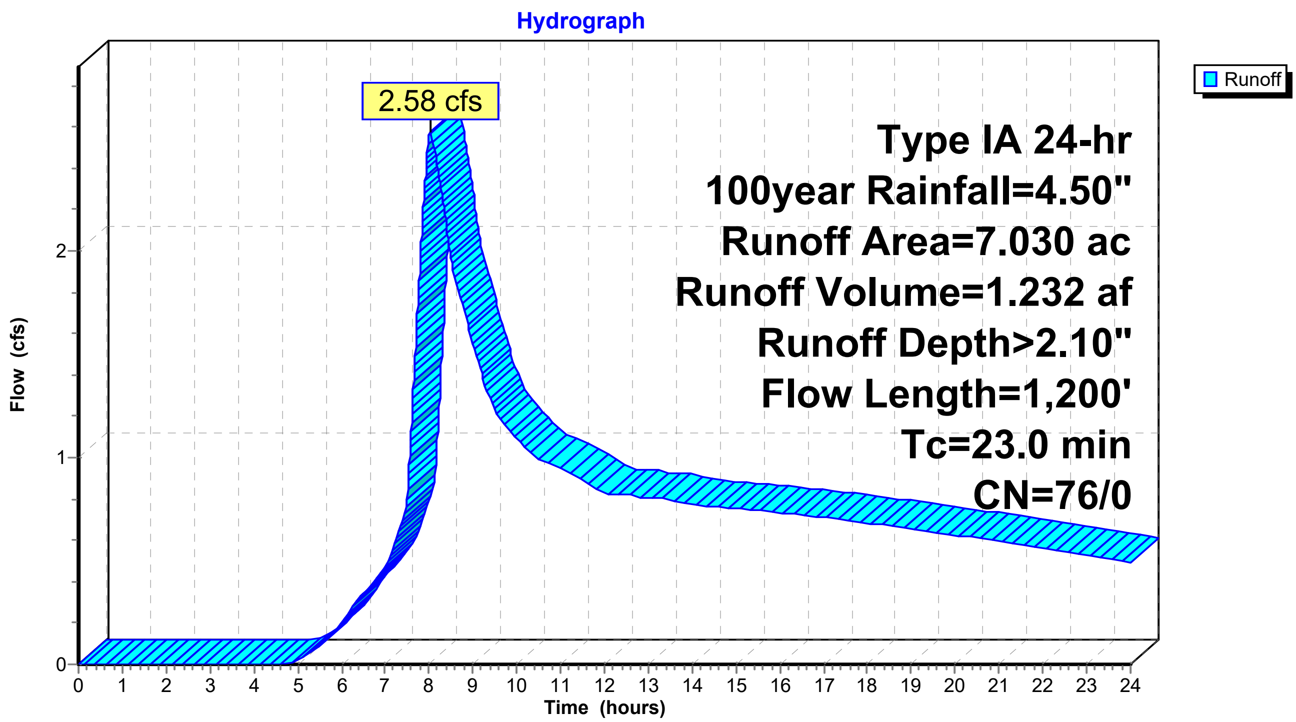
Runoff = 2.58 cfs @ 8.01 hrs, Volume= 1.232 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (ac)	CN	Description
*	7.030	76	
	7.030	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	900	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
23.0	1,200	Total			

Subcatchment 5S: Off-Site Subcatchment #4



Summary for Subcatchment 6S: Off-Site Subcatchment #5

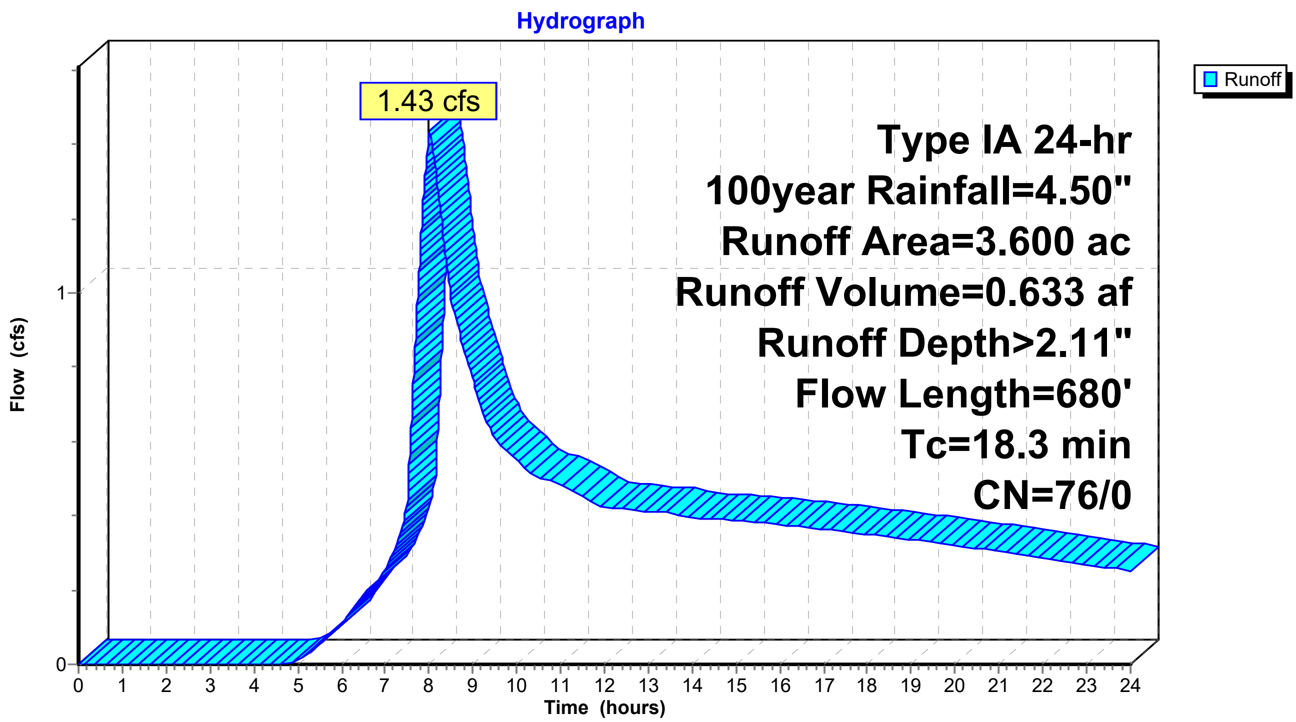
Runoff = 1.43 cfs @ 8.01 hrs, Volume= 0.633 af, Depth> 2.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (ac)	CN	Description
*	3.600	76	
	3.600	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	380	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
18.3	680	Total			

Subcatchment 6S: Off-Site Subcatchment #5



Summary for Subcatchment 10S: Off-Site Subcatchment #1

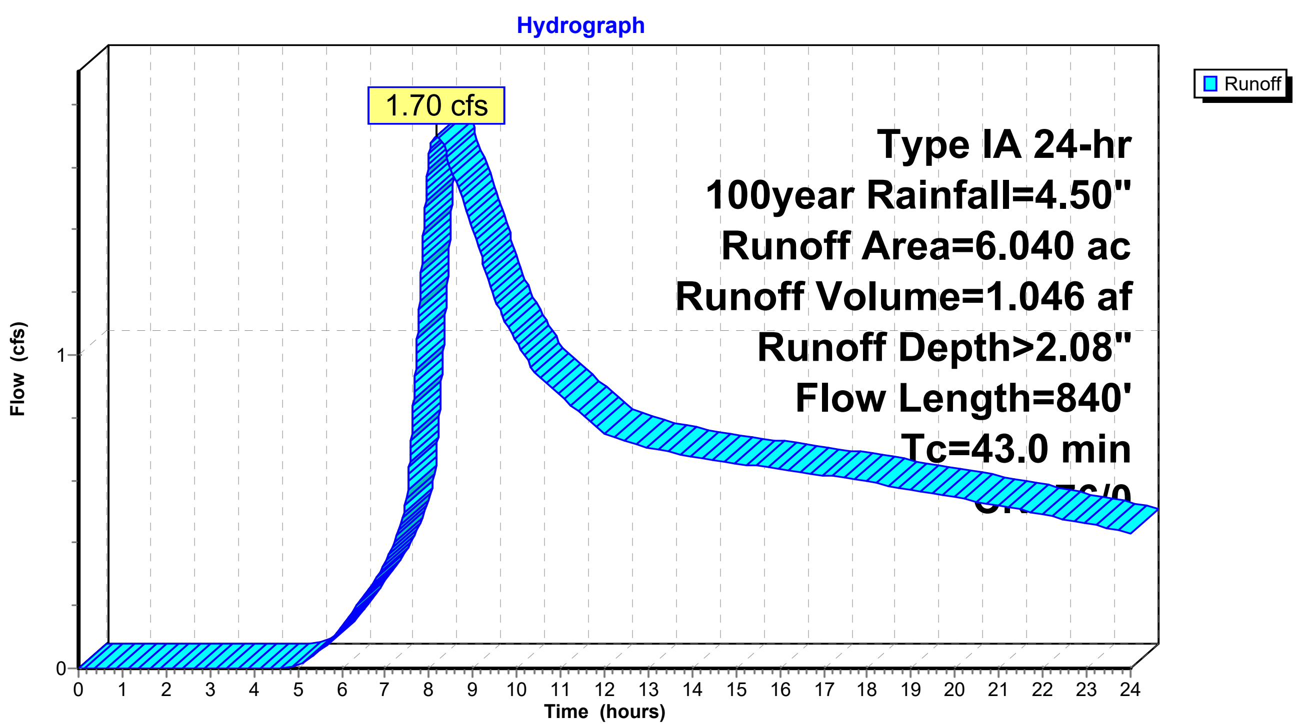
Runoff = 1.70 cfs @ 8.17 hrs, Volume= 1.046 af, Depth> 2.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (ac)	CN	Description
*	6.040	76	
	6.040	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1	540	0.0021	0.32		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
43.0	840	Total			

Subcatchment 10S: Off-Site Subcatchment #1



Summary for Subcatchment 12S: Off-Site Subcatchment #1

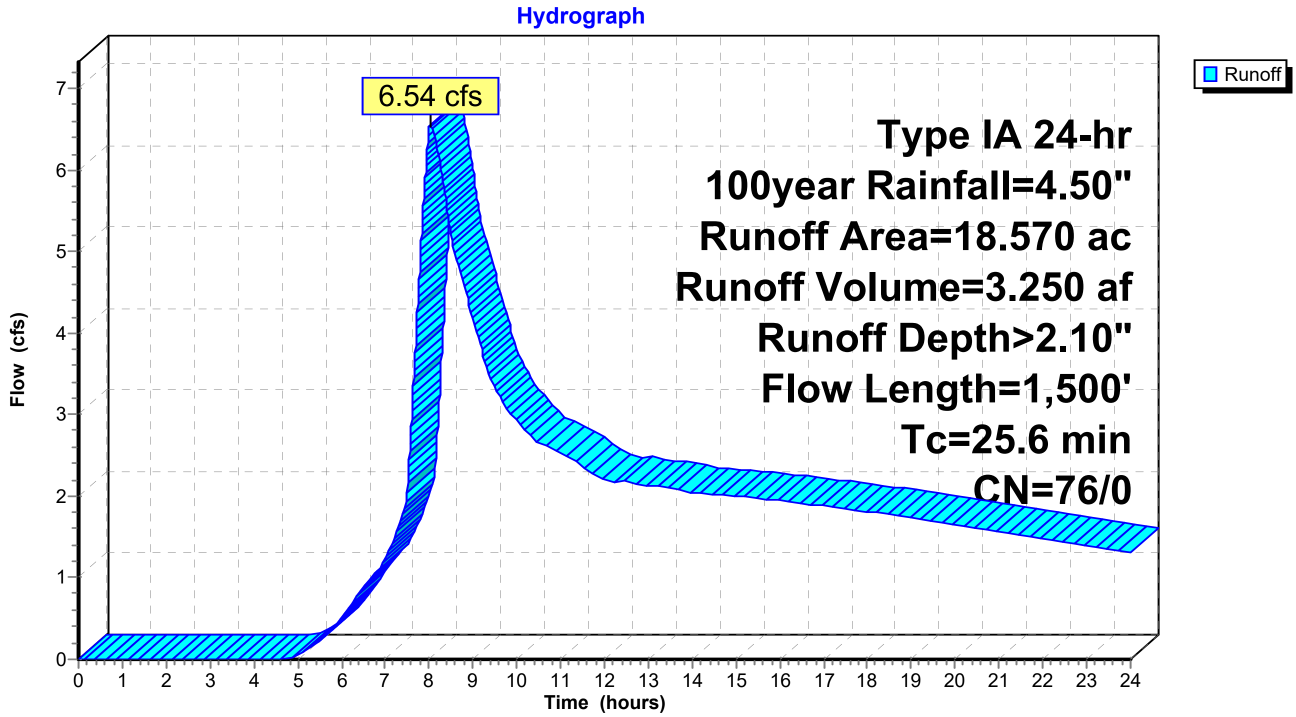
Runoff = 6.54 cfs @ 8.01 hrs, Volume= 3.250 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100year Rainfall=4.50"

	Area (ac)	CN	Description
*	18.570	76	
	18.570	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment 12S: Off-Site Subcatchment #1



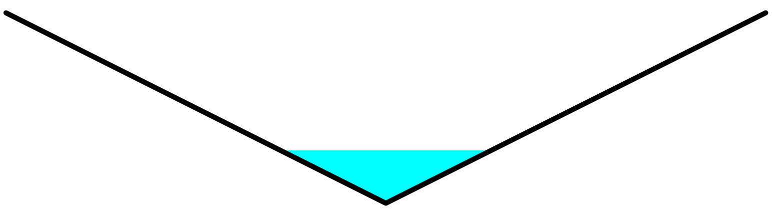
Summary for Reach 11R: Ditch 1

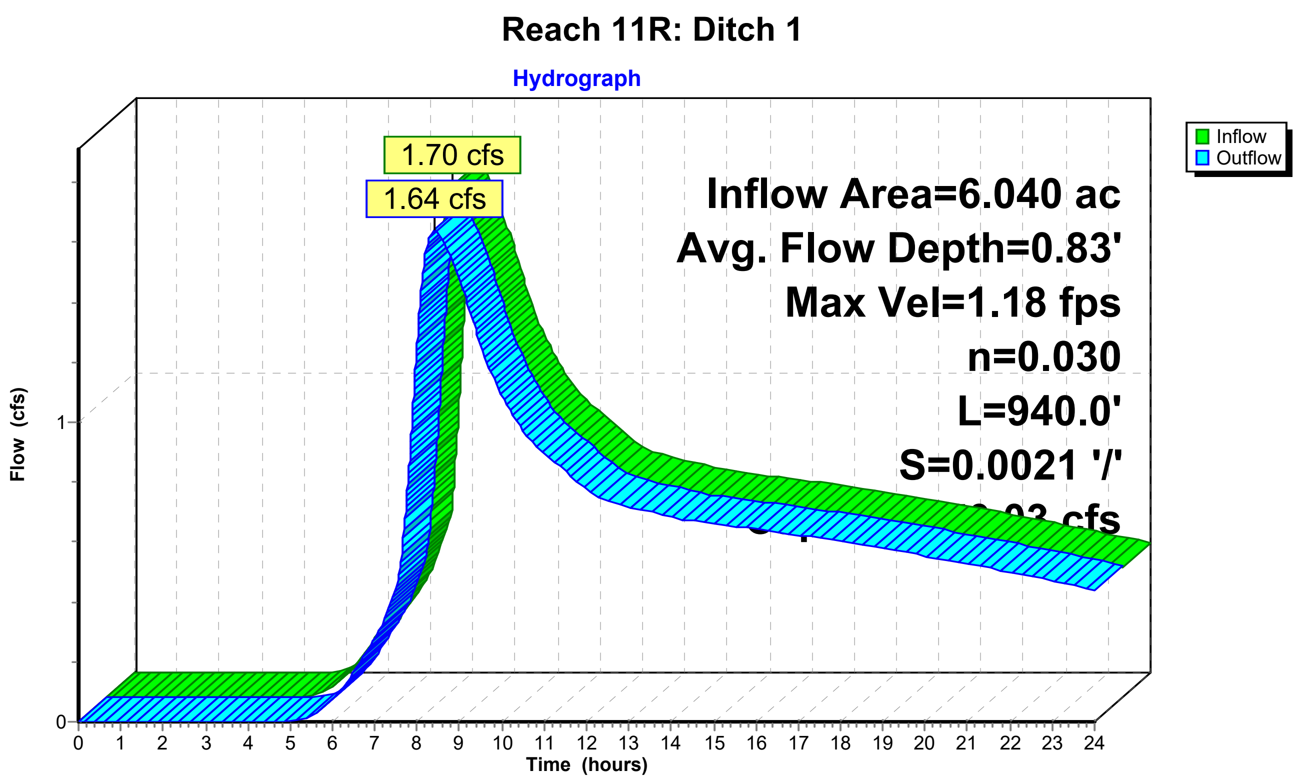
Inflow Area = 6.040 ac, 0.00% Impervious, Inflow Depth > 2.08" for 100year event
Inflow = 1.70 cfs @ 8.17 hrs, Volume= 1.046 af
Outflow = 1.64 cfs @ 8.41 hrs, Volume= 1.035 af, Atten= 4%, Lag= 14.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.18 fps, Min. Travel Time= 13.3 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 17.5 min

Peak Storage= 1,302 cf @ 8.41 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 50.03 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 940.0' Slope= 0.0021 '/'
Inlet Invert= 149.00', Outlet Invert= 147.00'





Summary for Reach 13R: Ditch 2

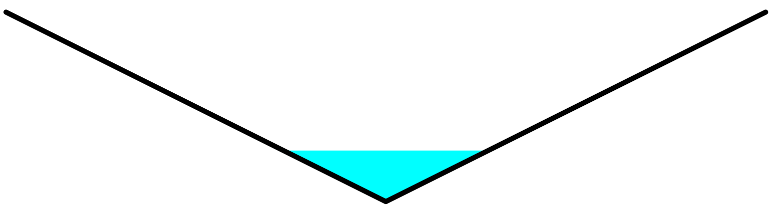
[62] Hint: Exceeded Reach 11R OUTLET depth by 0.08' @ 5.13 hrs

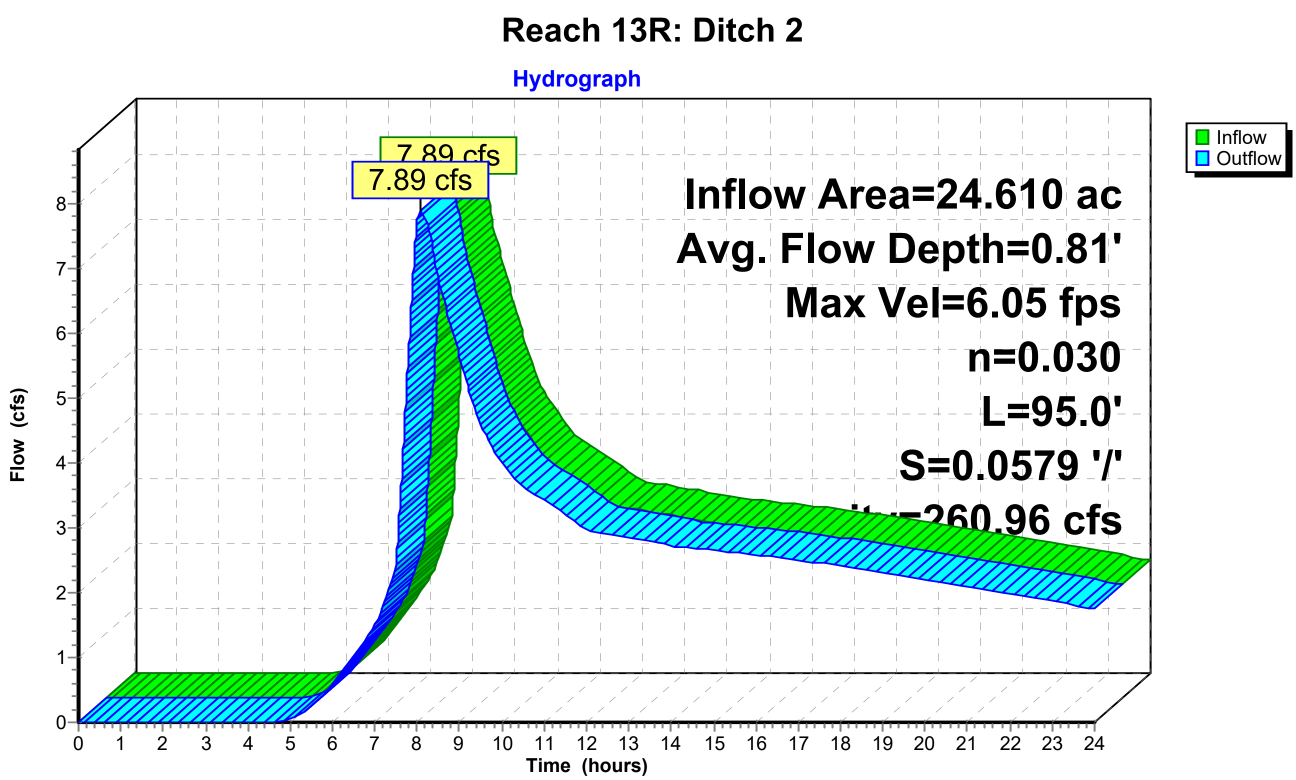
Inflow Area = 24.610 ac, 0.00% Impervious, Inflow Depth > 2.09" for 100year event
Inflow = 7.89 cfs @ 8.09 hrs, Volume= 4.285 af
Outflow = 7.89 cfs @ 8.09 hrs, Volume= 4.284 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.05 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 4.45 fps, Avg. Travel Time= 0.4 min

Peak Storage= 124 cf @ 8.09 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 260.96 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 95.0' Slope= 0.0579 '/'
Inlet Invert= 147.00', Outlet Invert= 141.50'





Summary for Reach 15R: Ditch 3

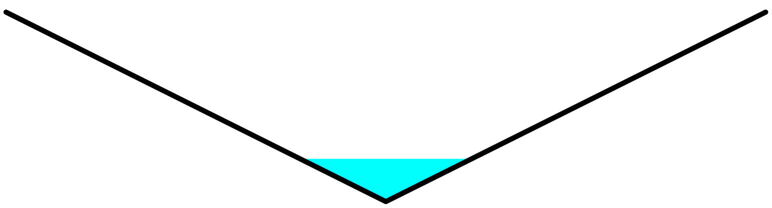
[62] Hint: Exceeded Reach 17R OUTLET depth by 0.11' @ 8.20 hrs

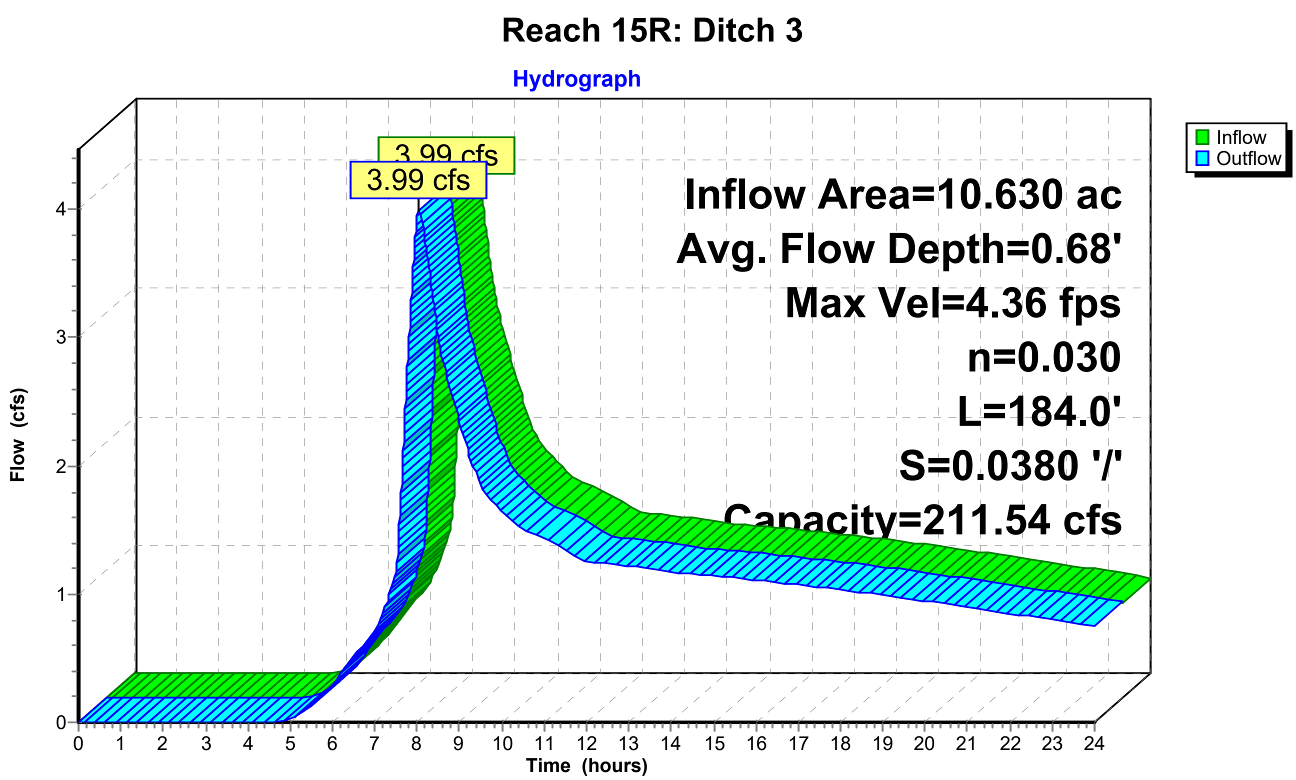
Inflow Area = 10.630 ac, 0.00% Impervious, Inflow Depth > 2.10" for 100year event
Inflow = 3.99 cfs @ 8.02 hrs, Volume= 1.863 af
Outflow = 3.99 cfs @ 8.03 hrs, Volume= 1.862 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.36 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.09 fps, Avg. Travel Time= 1.0 min

Peak Storage= 168 cf @ 8.03 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 211.54 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 184.0' Slope= 0.0380 '/'
Inlet Invert= 148.50', Outlet Invert= 141.50'





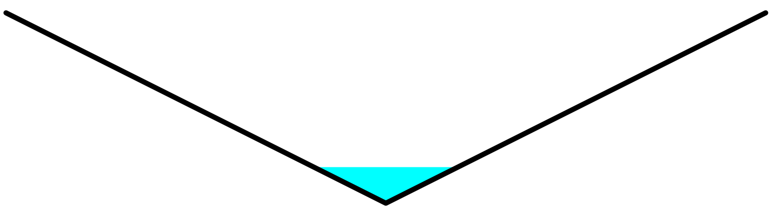
Summary for Reach 17R: Ditch 4

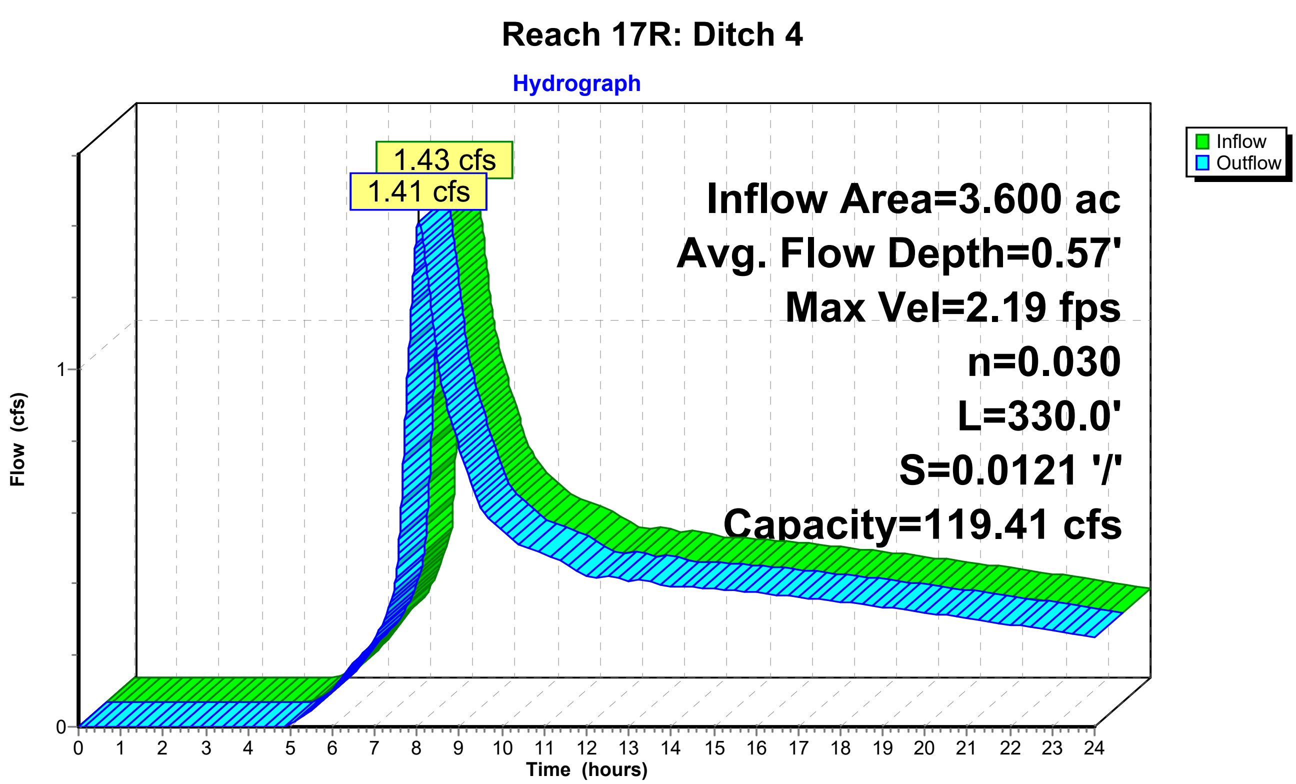
Inflow Area = 3.600 ac, 0.00% Impervious, Inflow Depth > 2.11" for 100year event
Inflow = 1.43 cfs @ 8.01 hrs, Volume= 0.633 af
Outflow = 1.41 cfs @ 8.04 hrs, Volume= 0.631 af, Atten= 1%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.19 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 3.6 min

Peak Storage= 213 cf @ 8.04 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 119.41 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 330.0' Slope= 0.0121 '/'
Inlet Invert= 152.50', Outlet Invert= 148.50'





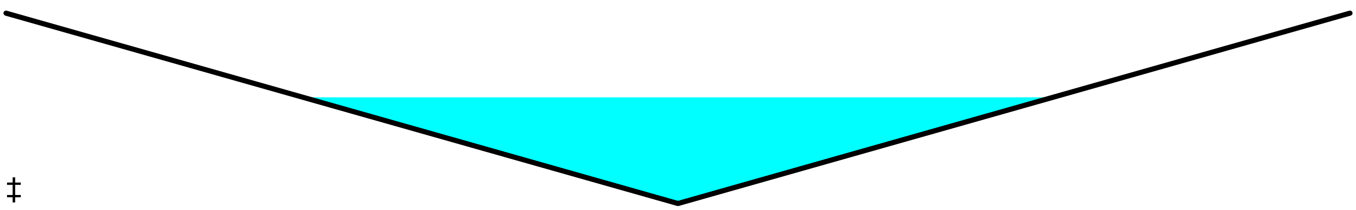
Summary for Reach 19R: Wetland Ditch

Inflow	=	2.39 cfs @	8.03 hrs, Volume=	0.555 af
Outflow	=	2.35 cfs @	8.14 hrs, Volume=	0.555 af, Atten= 2%, Lag= 6.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.41 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.68 fps, Avg. Travel Time= 10.6 min

Peak Storage= 714 cf @ 8.14 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 0.40' Flow Area= 5.4 sf, Capacity= 11.16 cfs

0.00' x 0.40' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 33.5 '/' Top Width= 26.80'
Length= 428.0' Slope= 0.0206 '/'
Inlet Invert= 139.80', Outlet Invert= 131.00'



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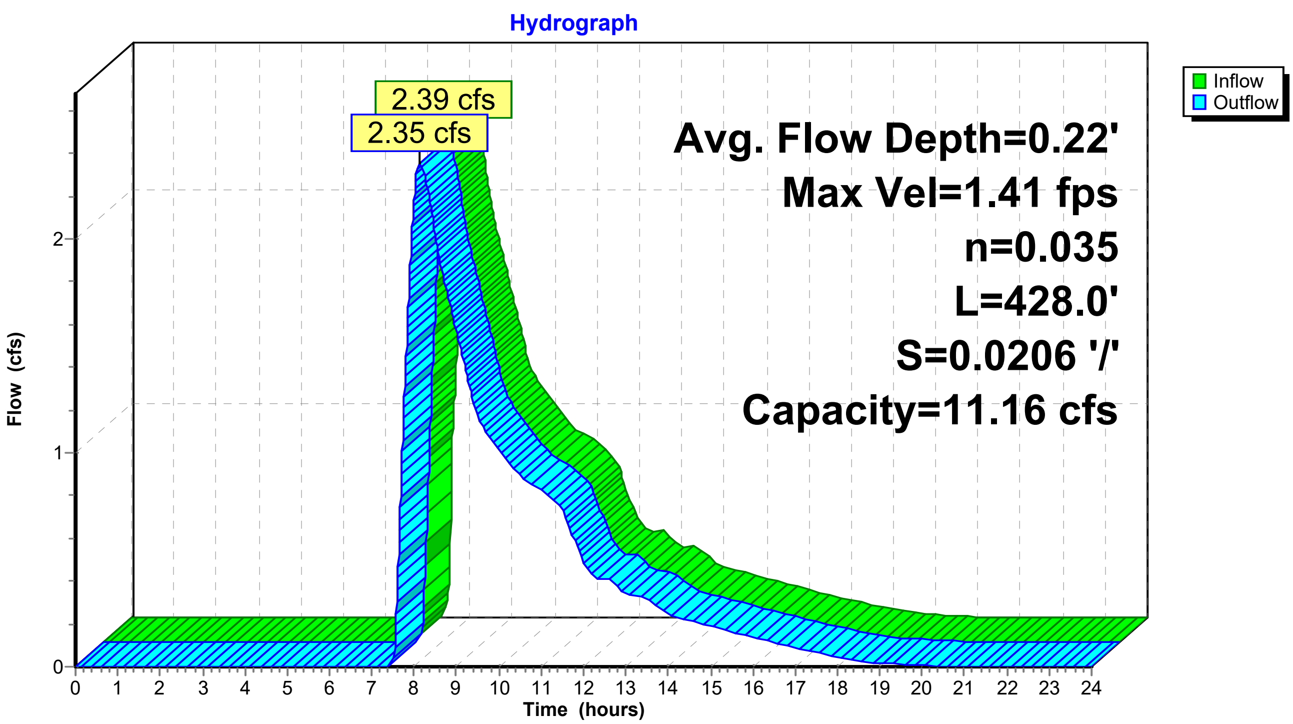
Reach 19R: Wetland Ditch



Summary for Pond 7R: TDA1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

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[57] Hint: Peaked at 128.69' (Flood elevation advised)

Inflow Area =	74.760 ac,	0.00% Impervious,	Inflow Depth > 2.10"	for 100year event
Inflow =	25.61 cfs @	8.05 hrs,	Volume=	13.063 af
Outflow =	25.61 cfs @	8.05 hrs,	Volume=	13.063 af, Atten= 0%, Lag= 0.0 min
Primary =	2.98 cfs @	8.05 hrs,	Volume=	3.520 af
Secondary =	22.63 cfs @	8.05 hrs,	Volume=	9.543 af

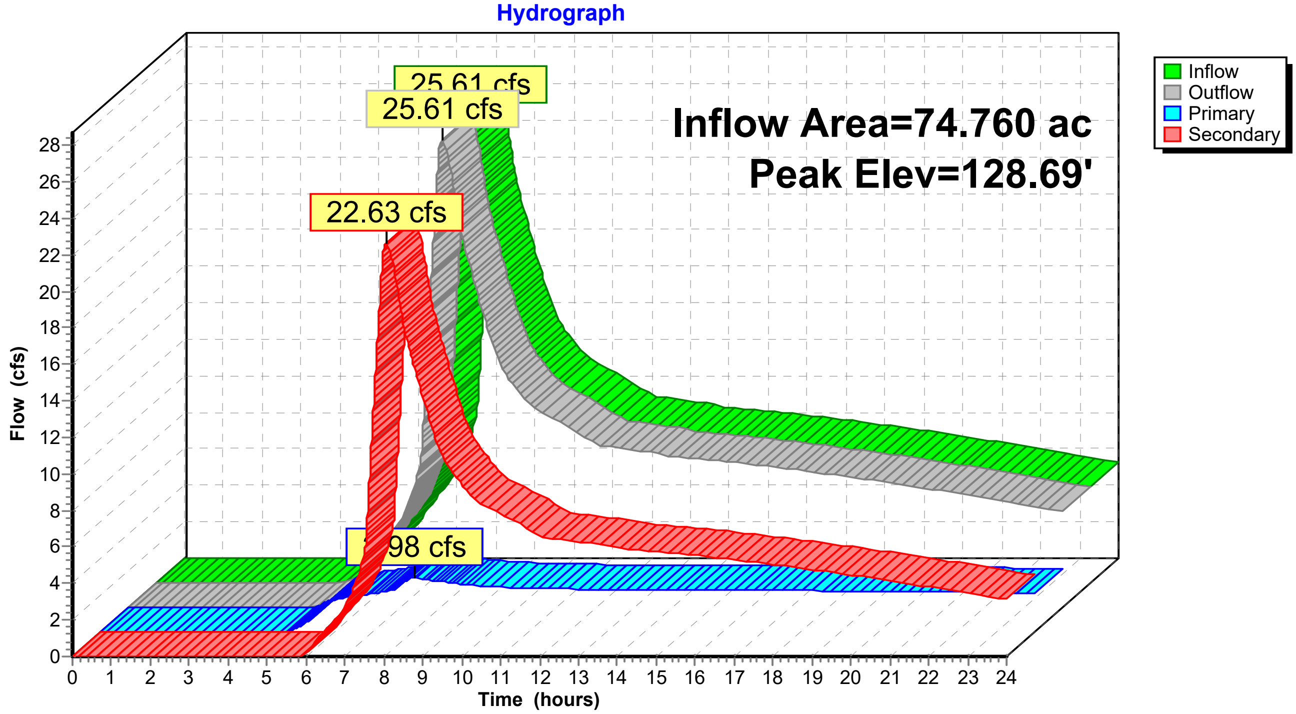
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.69' @ 8.05 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.98 cfs @ 8.05 hrs HW=128.69' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.98 cfs @ 5.46 fps)

Secondary OutFlow Max=22.63 cfs @ 8.05 hrs HW=128.69' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 22.63 cfs @ 2.53 fps)

Pond 7R: TDA1 Outflow



Summary for Pond 14R: Lockwood Creek Road

[57] Hint: Peaked at 145.54' (Flood elevation advised)
[62] Hint: Exceeded Reach 13R OUTLET depth by 3.23' @ 8.03 hrs
[62] Hint: Exceeded Reach 15R OUTLET depth by 3.36' @ 8.03 hrs

Inflow Area = 74.760 ac, 0.00% Impervious, Inflow Depth > 2.10" for 100year event
Inflow = 25.72 cfs @ 8.03 hrs, Volume= 13.063 af
Outflow = 25.72 cfs @ 8.03 hrs, Volume= 13.063 af, Atten= 0%, Lag= 0.0 min
Primary = 23.33 cfs @ 8.03 hrs, Volume= 12.508 af
Secondary = 2.39 cfs @ 8.03 hrs, Volume= 0.555 af

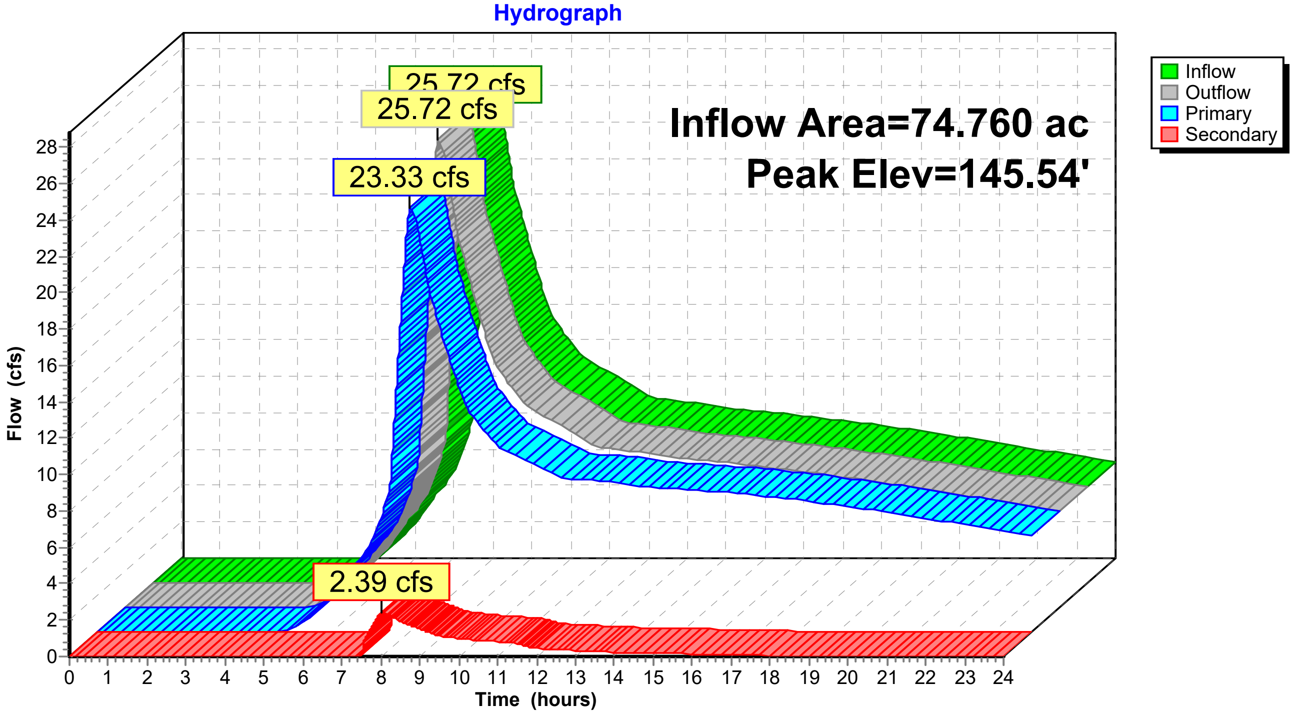
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 145.54' @ 8.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	**24.0" Round Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 141.50' / 139.20' S= 0.0548 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 3.14 sf
#2	Secondary	145.60'	**210.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Secondary	142.60'	**8.0" Round Culvert** L= 36.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 142.60' / 139.90' S= 0.0750 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=23.33 cfs @ 8.03 hrs HW=145.54' TW=143.16' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 23.33 cfs @ 7.43 fps)

Secondary OutFlow Max=2.39 cfs @ 8.03 hrs HW=145.54' TW=140.02' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Inlet Controls 2.39 cfs @ 6.86 fps)

Pond 14R: Lockwood Creek Road



Summary for Pond 18R: 280 LF 15"

[57] Hint: Peaked at 143.16' (Flood elevation advised)

Inflow Area =	74.760 ac,	0.00% Impervious,	Inflow Depth > 2.01"	for 100year event
Inflow =	23.33 cfs @	8.03 hrs, Volume=	12.508 af	
Outflow =	23.33 cfs @	8.03 hrs, Volume=	12.508 af,	Atten= 0%, Lag= 0.0 min
Primary =	9.95 cfs @	8.03 hrs, Volume=	11.102 af	
Secondary =	13.38 cfs @	8.03 hrs, Volume=	1.406 af	

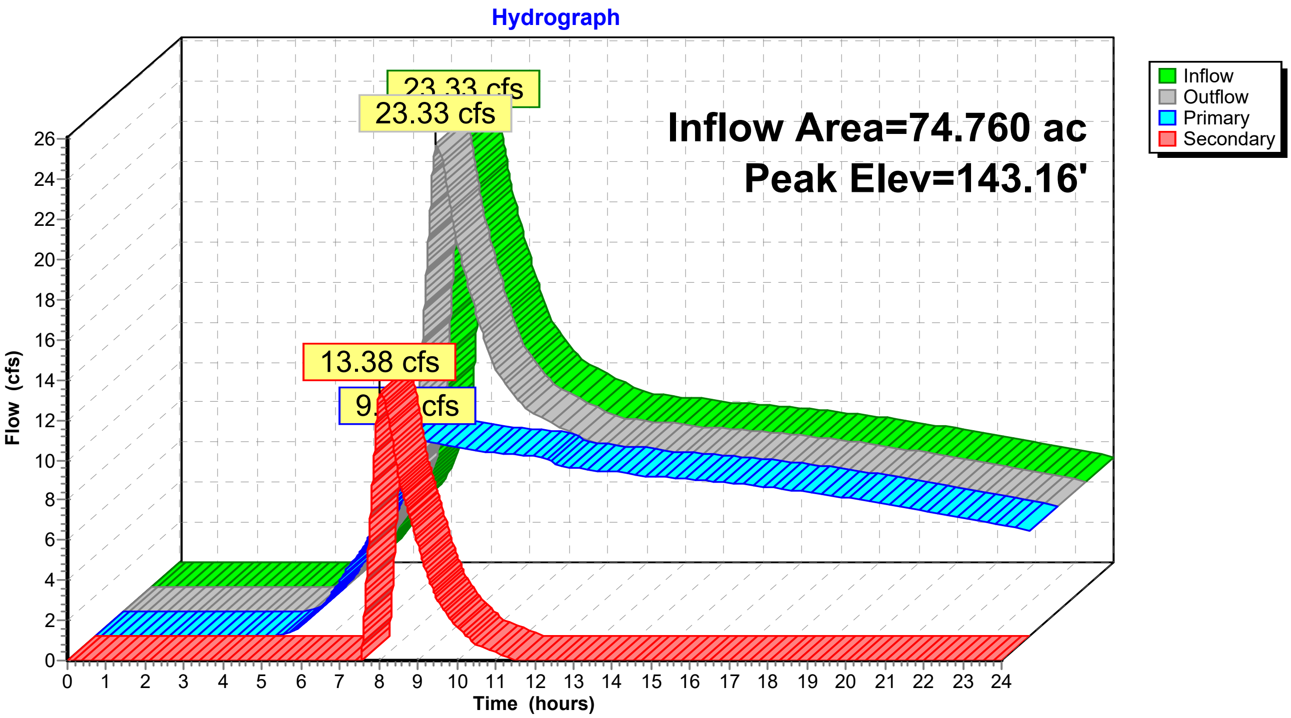
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 143.16' @ 8.03 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	139.70'	**15.0" Round Culvert** L= 280.0' Ke= 0.500 Inlet / Outlet Invert= 139.70' / 130.50' S= 0.0329 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Secondary	142.60'	**12.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

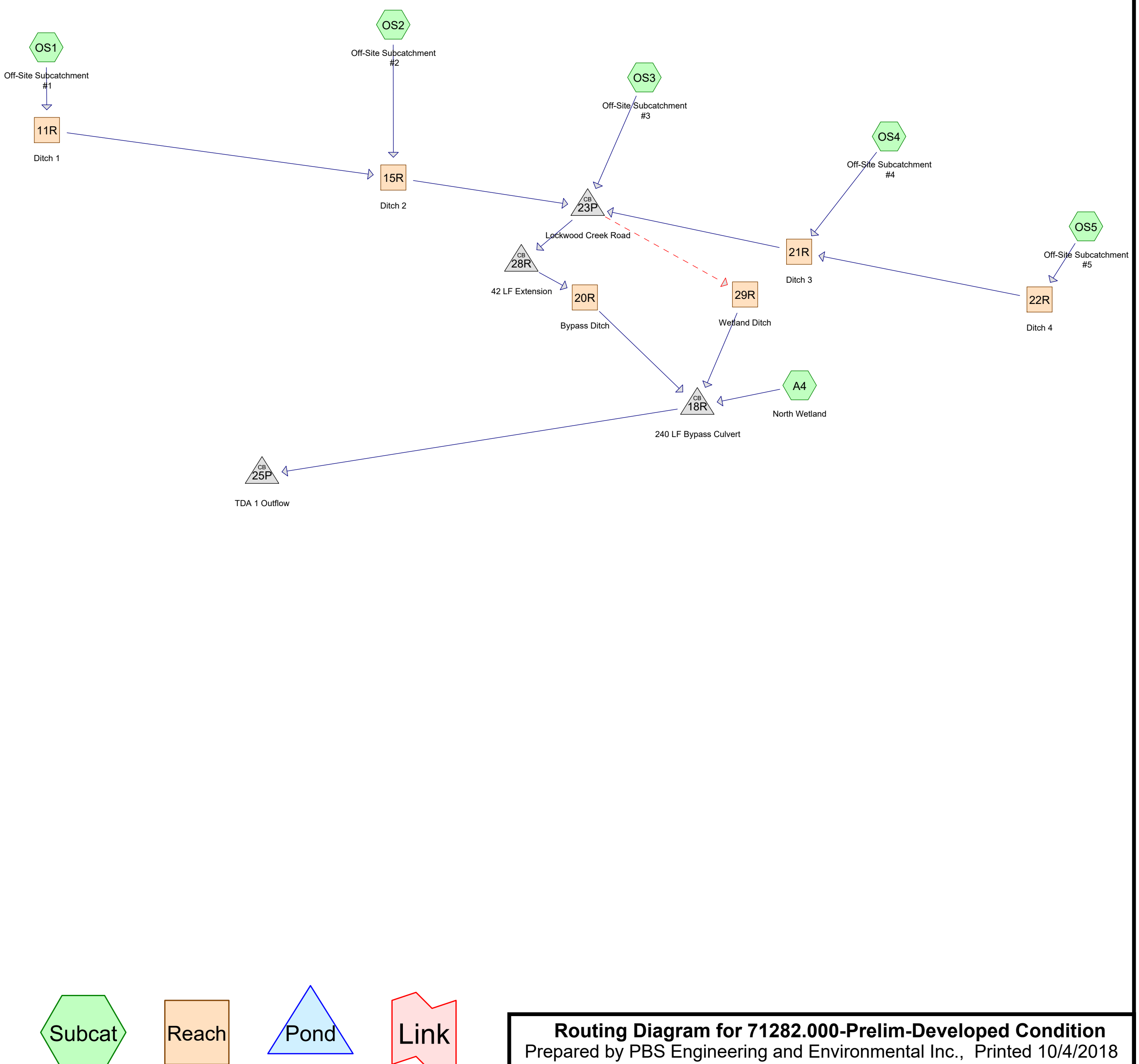
Primary OutFlow Max=9.95 cfs @ 8.03 hrs HW=143.16' TW=128.69' (Dynamic Tailwater)
1=Culvert (Inlet Controls 9.95 cfs @ 8.11 fps)

Secondary OutFlow Max=13.38 cfs @ 8.03 hrs HW=143.16' TW=128.69' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 13.38 cfs @ 1.99 fps)

Pond 18R: 280 LF 15"



HydroCAD Bypass Pipe Model (Includes On-Site Flow from North Wetland Area)



Routing Diagram for 71282.000-Prelim-Developed Condition
Prepared by PBS Engineering and Environmental Inc., Printed 10/4/2018

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
74.760	76	(OS1, OS2, OS3, OS4, OS5)
0.118	86	Landscaping/Fill Slope (A4)
1.504	76	Undisturbed Buffer (A4)
0.054	100	Wetland (A4)
76.436	**76**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
76.436	Other	A4, OS1, OS2, OS3, OS4, OS5
76.436		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	74.760	74.760		OS1, OS2, OS3, OS4, OS5
0.000	0.000	0.000	0.000	0.118	0.118	Landscaping/Fill Slope	A4
0.000	0.000	0.000	0.000	1.504	1.504	Undisturbed Buffer	A4
0.000	0.000	0.000	0.000	0.054	0.054	Wetland	A4
0.000	**0.000**	**0.000**	**0.000**	**76.436**	**76.436**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	18R	132.50	131.70	240.0	0.0033	0.012	36.0	0.0	0.0
2	23P	141.50	139.00	52.0	0.0481	0.013	24.0	0.0	0.0
3	23P	142.60	138.14	82.0	0.0544	0.013	8.0	0.0	0.0
4	25P	126.99	120.35	247.0	0.0269	0.012	10.0	0.0	0.0
5	28R	139.00	138.90	33.2	0.0030	0.013	24.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>0.73"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.22 cfs 0.102 af

Subcatchment OS1: Off-Site Subcatchment Runoff Area=6.040 ac 0.00% Impervious Runoff Depth>0.61"
Flow Length=840' Tc=43.0 min CN=76/0 Runoff=0.32 cfs 0.309 af

Subcatchment OS2: Off-Site Subcatchment Runoff Area=18.570 ac 0.00% Impervious Runoff Depth>0.62"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=1.20 cfs 0.964 af

Subcatchment OS3: Off-Site Subcatchment Runoff Area=39.520 ac 0.00% Impervious Runoff Depth>0.62"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=2.56 cfs 2.052 af

Subcatchment OS4: Off-Site Subcatchment Runoff Area=7.030 ac 0.00% Impervious Runoff Depth>0.62"
Flow Length=1,200' Tc=23.0 min CN=76/0 Runoff=0.47 cfs 0.366 af

Subcatchment OS5: Off-Site Subcatchment Runoff Area=3.600 ac 0.00% Impervious Runoff Depth>0.63"
Flow Length=680' Tc=18.3 min CN=76/0 Runoff=0.26 cfs 0.188 af

Reach 11R: Ditch 1 Avg. Flow Depth=0.45' Max Vel=0.78 fps Inflow=0.32 cfs 0.309 af
n=0.030 L=940.0' S=0.0021 '/' Capacity=50.03 cfs Outflow=0.32 cfs 0.304 af

Reach 15R: Ditch 2 Avg. Flow Depth=0.42' Max Vel=3.94 fps Inflow=1.42 cfs 1.268 af
n=0.030 L=95.0' S=0.0579 '/' Capacity=260.96 cfs Outflow=1.42 cfs 1.268 af

Reach 20R: Bypass Ditch Avg. Flow Depth=0.61' Max Vel=2.01 fps Inflow=4.70 cfs 3.873 af
n=0.040 L=89.0' S=0.0100 '/' Capacity=63.04 cfs Outflow=4.70 cfs 3.870 af

Reach 21R: Ditch 3 Avg. Flow Depth=0.36' Max Vel=2.85 fps Inflow=0.73 cfs 0.553 af
n=0.030 L=184.0' S=0.0380 '/' Capacity=211.54 cfs Outflow=0.73 cfs 0.553 af

Reach 22R: Ditch 4 Avg. Flow Depth=0.30' Max Vel=1.44 fps Inflow=0.26 cfs 0.188 af
n=0.030 L=330.0' S=0.0121 '/' Capacity=119.41 cfs Outflow=0.26 cfs 0.187 af

Reach 29R: Wetland Ditch Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.035 L=187.0' S=0.0310 '/' Capacity=13.70 cfs Outflow=0.00 cfs 0.000 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=134.39' Inflow=4.84 cfs 3.972 af
Outflow=4.84 cfs 3.972 af

Pond 23P: Lockwood Creek Road Peak Elev=142.43' Inflow=4.70 cfs 3.873 af
Primary=4.70 cfs 3.873 af Secondary=0.00 cfs 0.000 af Outflow=4.70 cfs 3.873 af

Pond 25P: TDA 1 Outflow Peak Elev=128.04' Inflow=4.84 cfs 3.972 af
Primary=2.09 cfs 2.566 af Secondary=2.75 cfs 1.406 af Outflow=4.84 cfs 3.972 af

Pond 28R: 42 LF Extension Peak Elev=140.21' Inflow=4.70 cfs 3.873 af
24.0" Round Culvert n=0.013 L=33.2' S=0.0030 '/' Outflow=4.70 cfs 3.873 af

Total Runoff Area = 76.436 ac Runoff Volume = 3.982 af Average Runoff Depth = 0.63"
99.93% Pervious = 76.382 ac 0.07% Impervious = 0.054 ac

Summary for Subcatchment A4: North Wetland

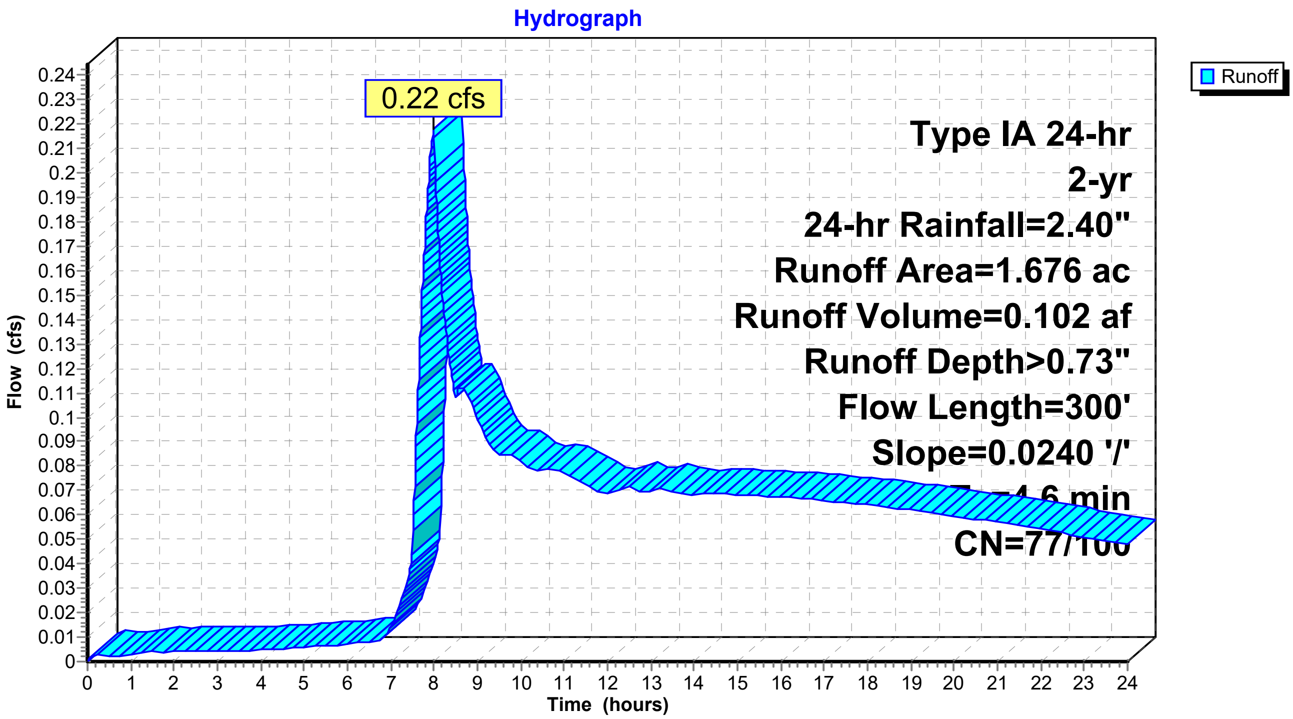
Runoff = 0.22 cfs @ 8.00 hrs, Volume= 0.102 af, Depth> 0.73"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment OS1: Off-Site Subcatchment #1

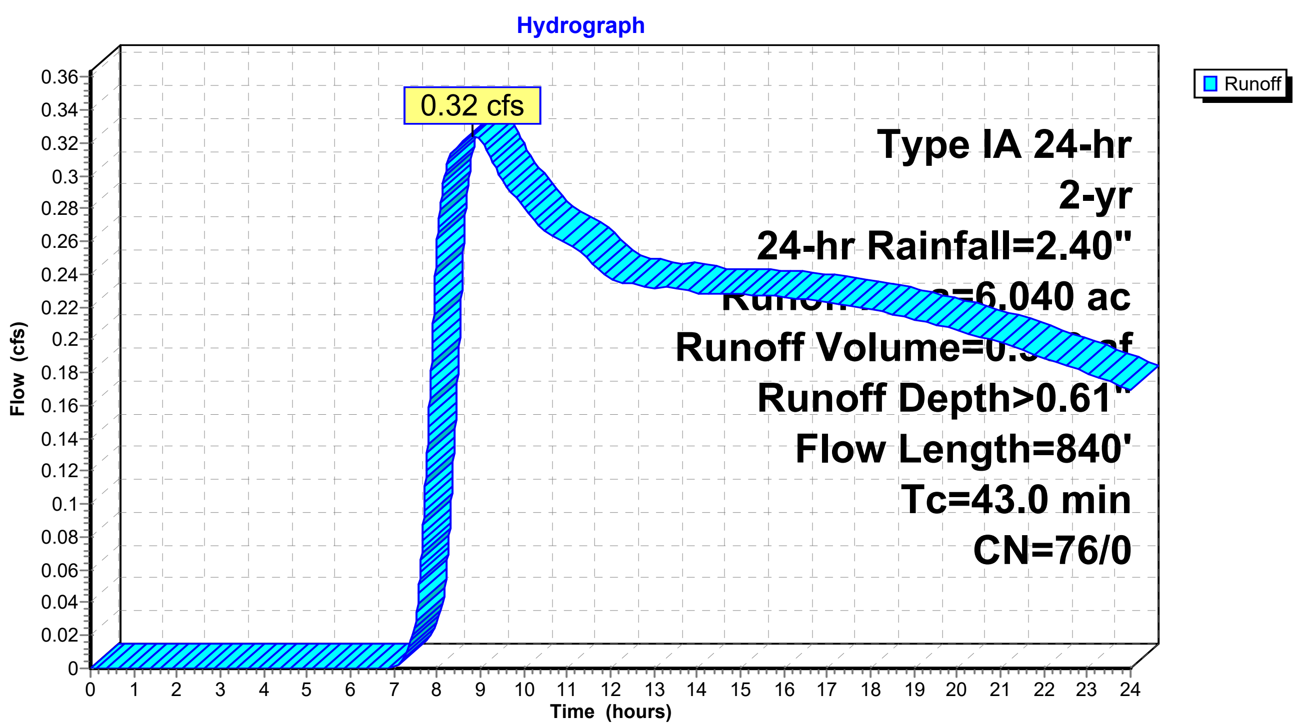
Runoff = 0.32 cfs @ 8.80 hrs, Volume= 0.309 af, Depth> 0.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	6.040	76	
	6.040	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1	540	0.0021	0.32		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
43.0	840	Total			

Subcatchment OS1: Off-Site Subcatchment #1



Summary for Subcatchment OS2: Off-Site Subcatchment #2

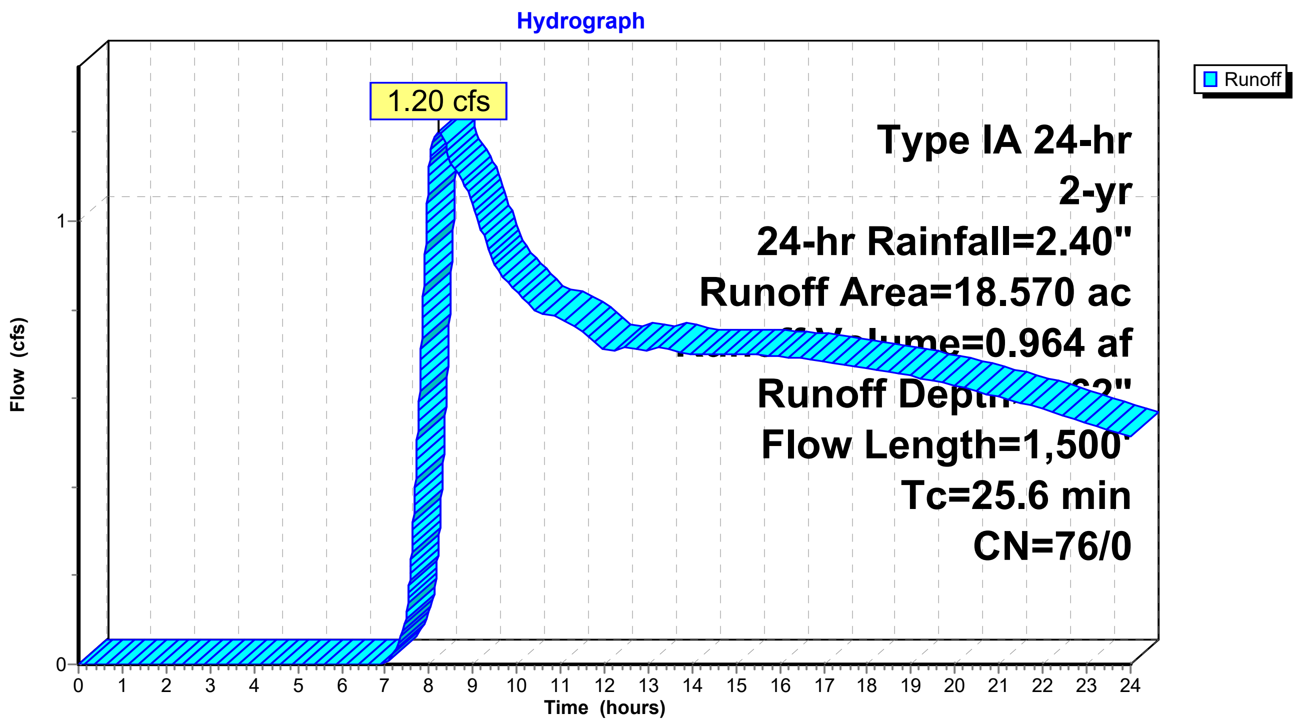
Runoff = 1.20 cfs @ 8.21 hrs, Volume= 0.964 af, Depth> 0.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	18.570	76	
	18.570	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment OS2: Off-Site Subcatchment #2



Summary for Subcatchment OS3: Off-Site Subcatchment #3

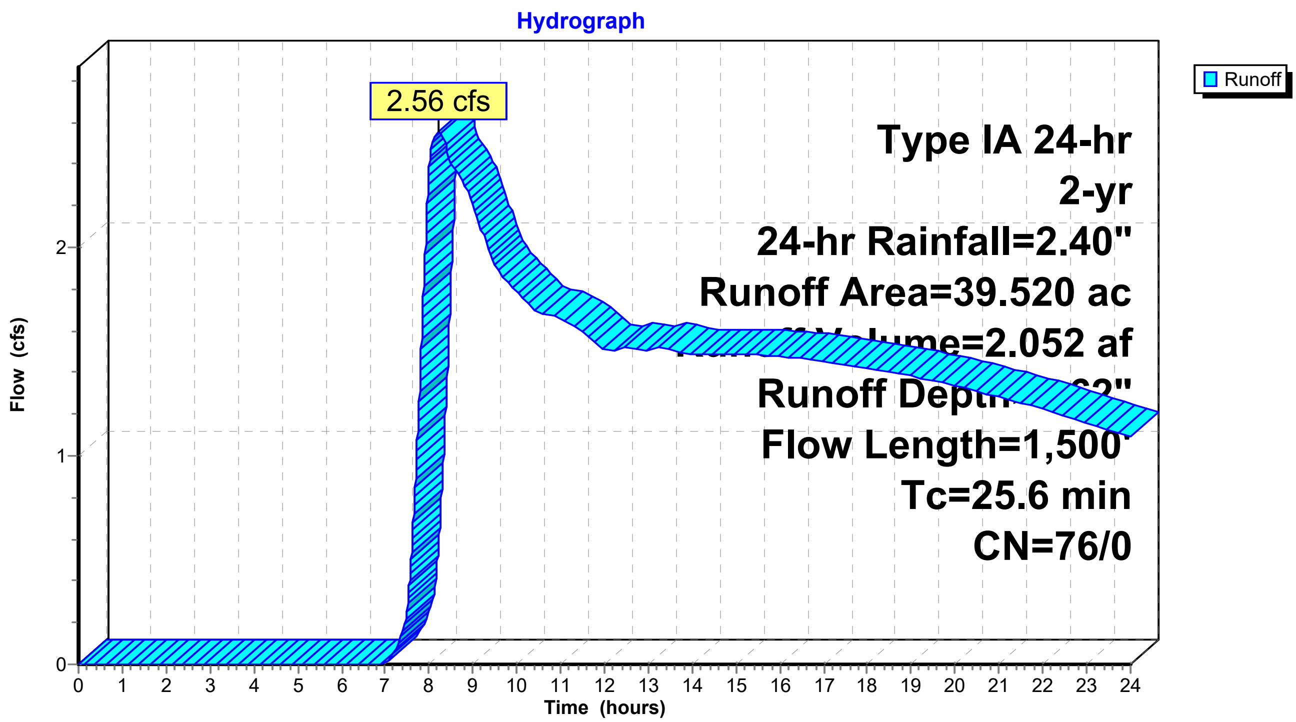
Runoff = 2.56 cfs @ 8.21 hrs, Volume= 2.052 af, Depth> 0.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	39.520	76	
	39.520	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment OS3: Off-Site Subcatchment #3



Summary for Subcatchment OS4: Off-Site Subcatchment #4

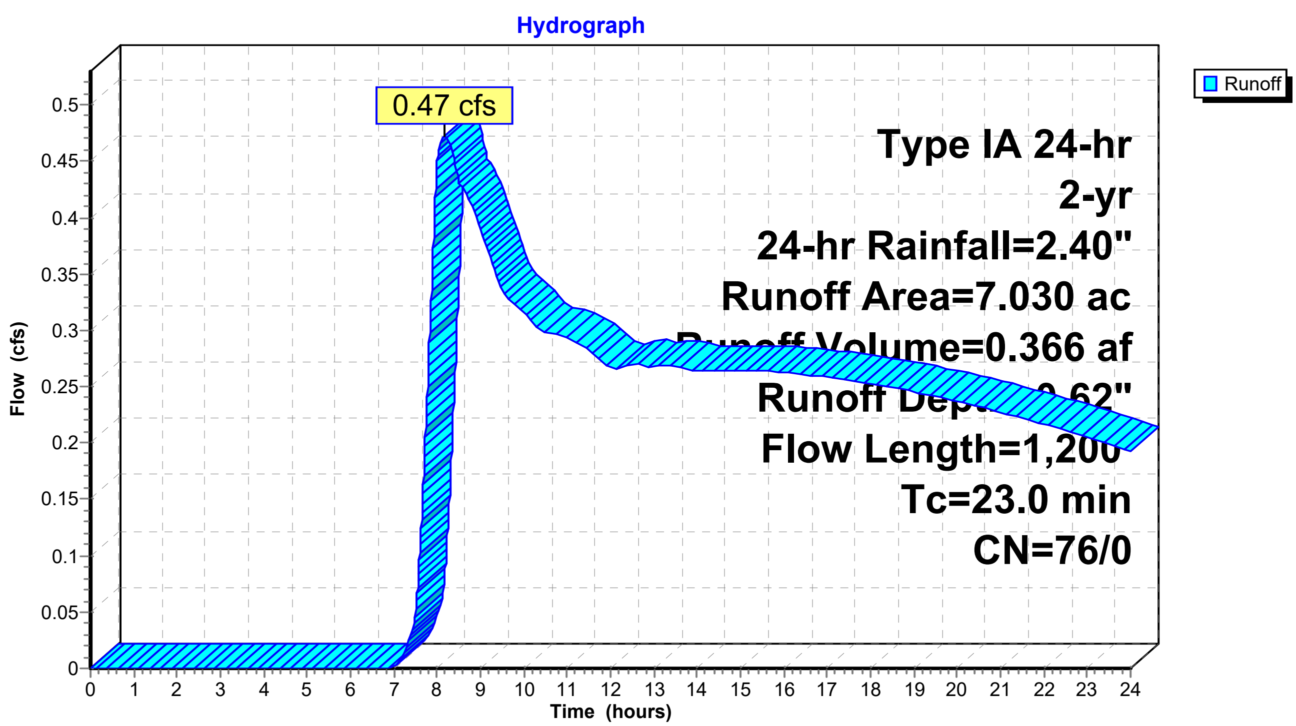
Runoff = 0.47 cfs @ 8.17 hrs, Volume= 0.366 af, Depth> 0.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	7.030	76	
	7.030	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	900	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
23.0	1,200	Total			

Subcatchment OS4: Off-Site Subcatchment #4



Summary for Subcatchment OS5: Off-Site Subcatchment #5

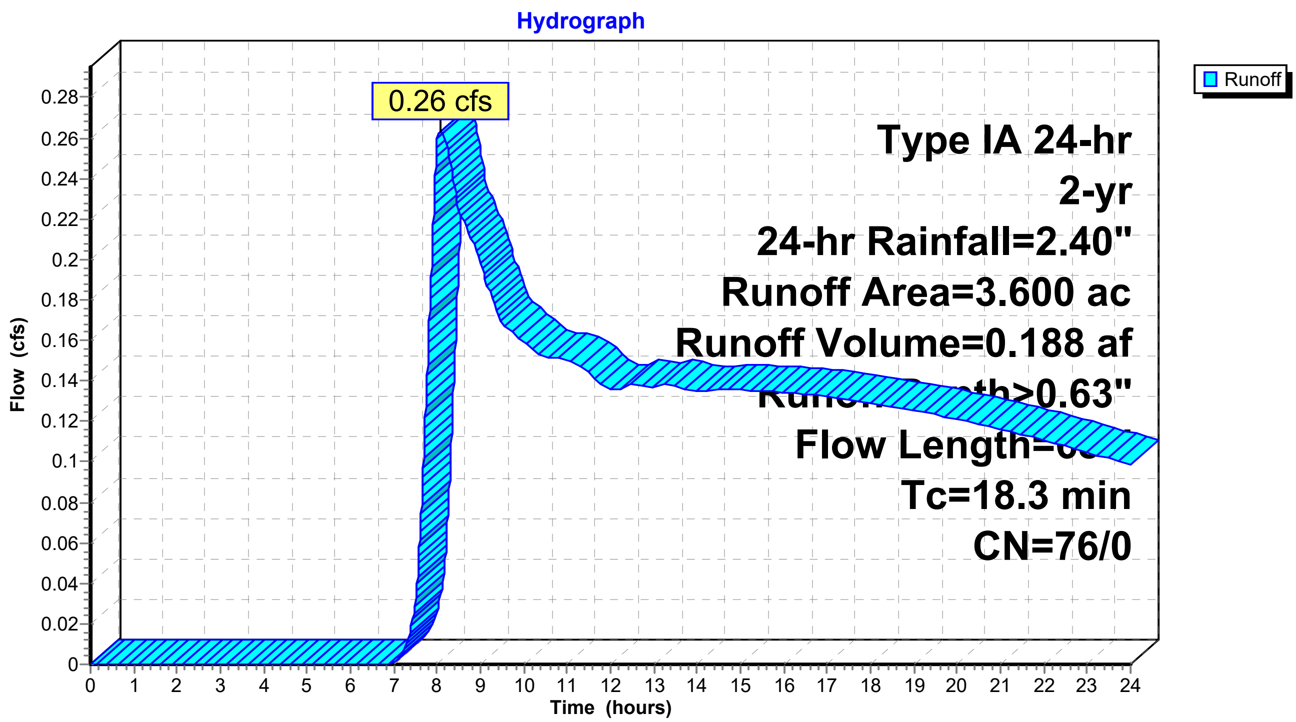
Runoff = 0.26 cfs @ 8.08 hrs, Volume= 0.188 af, Depth> 0.63"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-yr, 24-hr Rainfall=2.40"

	Area (ac)	CN	Description
*	3.600	76	
	3.600	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	380	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
18.3	680	Total			

Subcatchment OS5: Off-Site Subcatchment #5



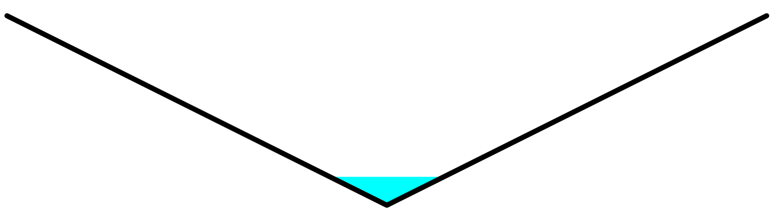
Summary for Reach 11R: Ditch 1

Inflow Area = 6.040 ac, 0.00% Impervious, Inflow Depth > 0.61" for 2-yr, 24-hr event
Inflow = 0.32 cfs @ 8.80 hrs, Volume= 0.309 af
Outflow = 0.32 cfs @ 9.10 hrs, Volume= 0.304 af, Atten= 2%, Lag= 18.3 min

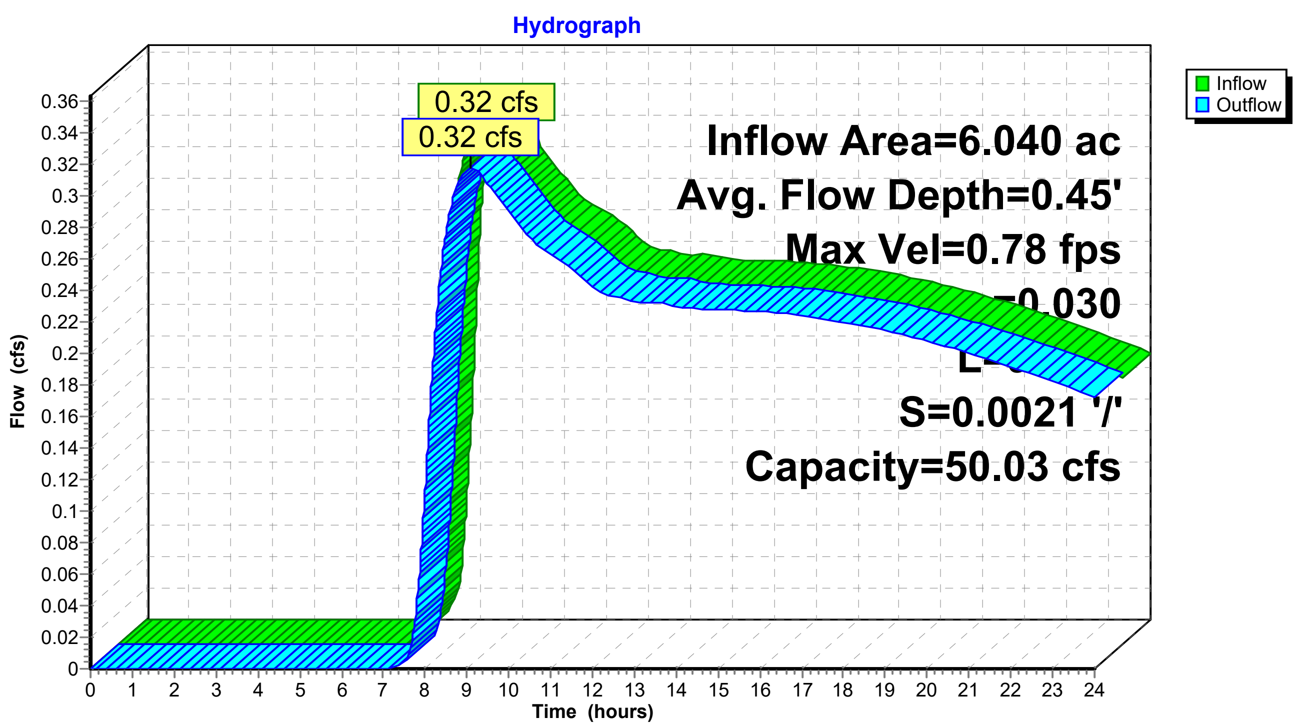
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.78 fps, Min. Travel Time= 20.0 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 22.4 min

Peak Storage= 380 cf @ 9.10 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 50.03 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 940.0' Slope= 0.0021 '/'
Inlet Invert= 149.00', Outlet Invert= 147.00'



Reach 11R: Ditch 1



Summary for Reach 15R: Ditch 2

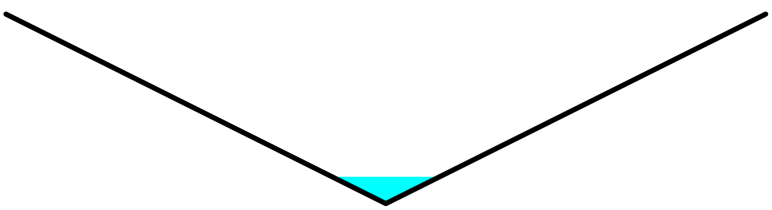
[62] Hint: Exceeded Reach 11R OUTLET depth by 0.12' @ 7.76 hrs

Inflow Area = 24.610 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2-yr, 24-hr event
Inflow = 1.42 cfs @ 8.33 hrs, Volume= 1.268 af
Outflow = 1.42 cfs @ 8.34 hrs, Volume= 1.268 af, Atten= 0%, Lag= 0.3 min

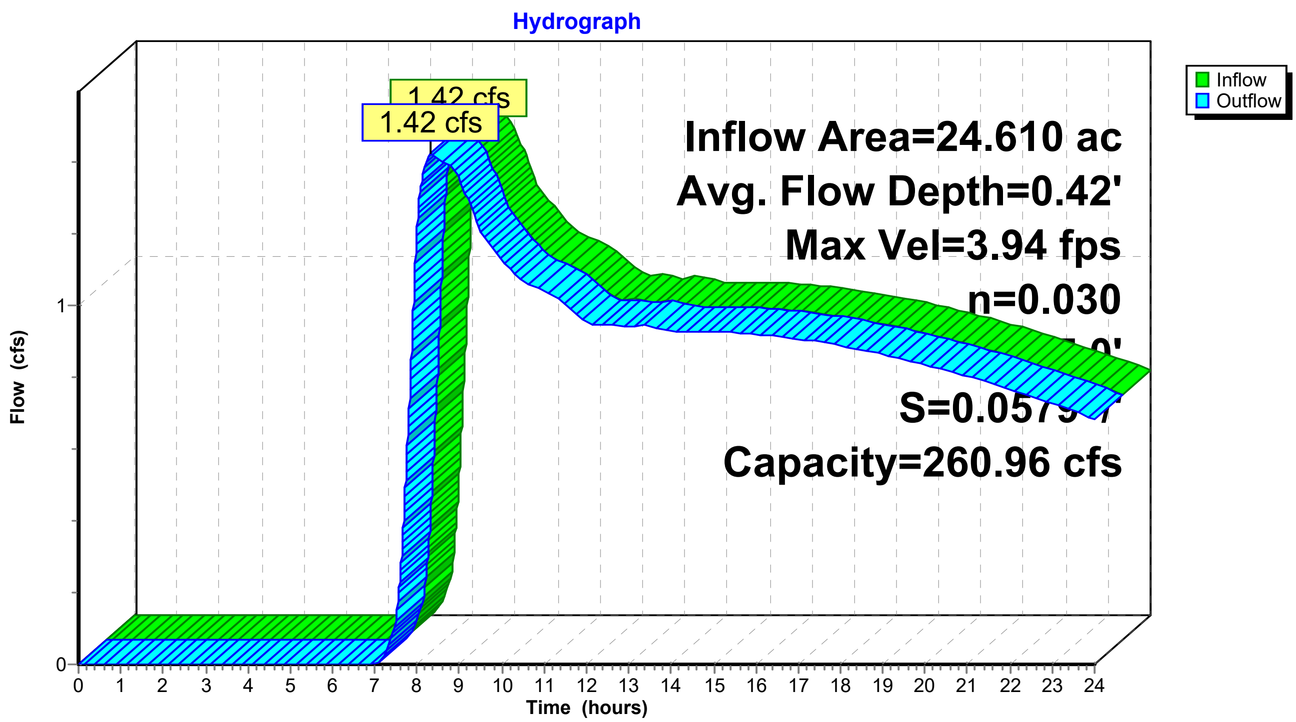
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.94 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.46 fps, Avg. Travel Time= 0.5 min

Peak Storage= 34 cf @ 8.34 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 260.96 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 95.0' Slope= 0.0579 '/'
Inlet Invert= 147.00', Outlet Invert= 141.50'



Reach 15R: Ditch 2



Summary for Reach 20R: Bypass Ditch

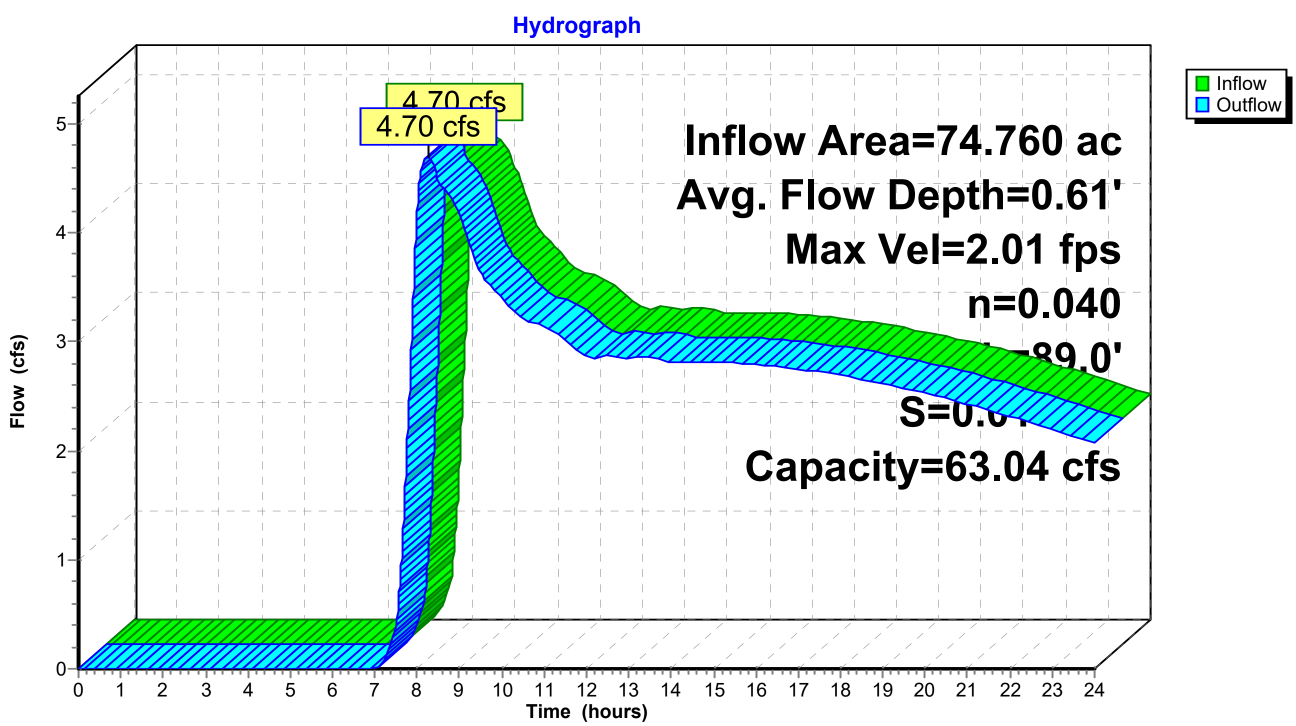
Inflow Area = 74.760 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2-yr, 24-hr event
Inflow = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af
Outflow = 4.70 cfs @ 8.25 hrs, Volume= 3.870 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 0.9 min

Peak Storage= 208 cf @ 8.25 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 63.04 cfs

2.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 89.0' Slope= 0.0100 '/'
Inlet Invert= 138.56', Outlet Invert= 137.67'

Reach 20R: Bypass Ditch



Summary for Reach 21R: Ditch 3

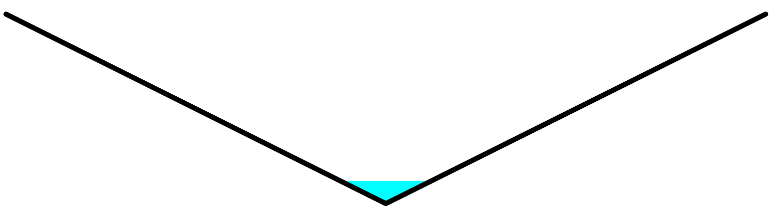
[62] Hint: Exceeded Reach 22R OUTLET depth by 0.06' @ 8.66 hrs

Inflow Area =	10.630 ac,	0.00% Impervious,	Inflow Depth > 0.62"	for 2-yr, 24-hr event	
Inflow =	0.73 cfs @	8.16 hrs,	Volume=	0.553 af	
Outflow =	0.73 cfs @	8.18 hrs,	Volume=	0.553 af,	Atten= 0%, Lag= 0.9 min

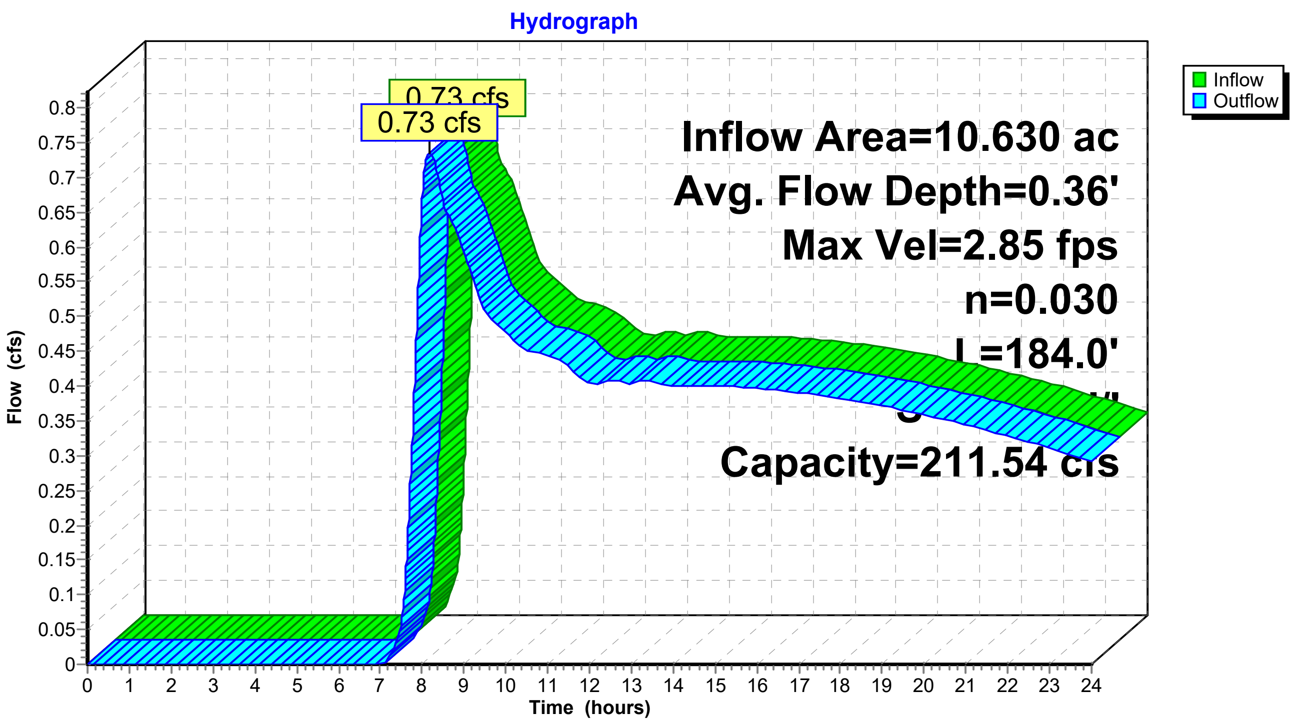
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.85 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 2.41 fps, Avg. Travel Time= 1.3 min

Peak Storage= 47 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 211.54 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 184.0' Slope= 0.0380 '/'
Inlet Invert= 148.50', Outlet Invert= 141.50'



Reach 21R: Ditch 3



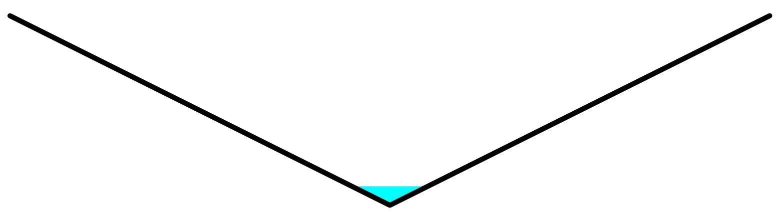
Summary for Reach 22R: Ditch 4

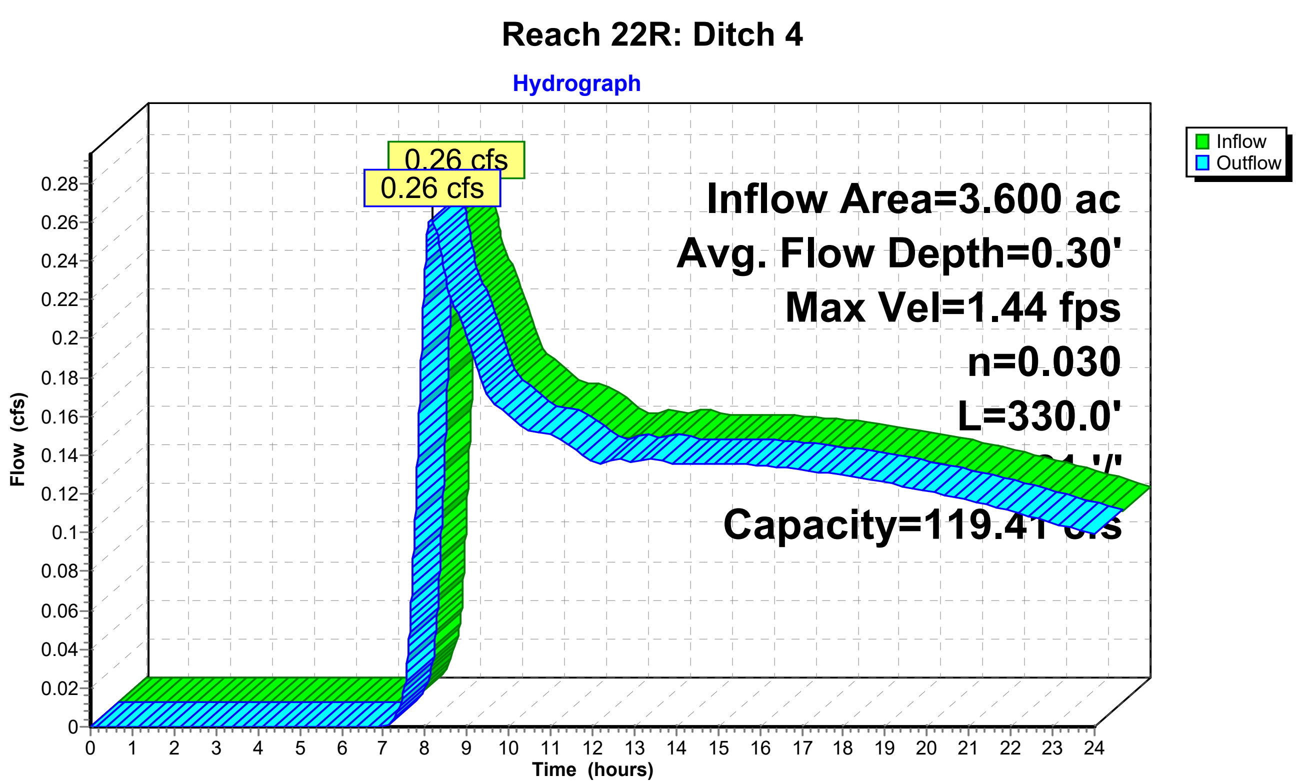
Inflow Area = 3.600 ac, 0.00% Impervious, Inflow Depth > 0.63" for 2-yr, 24-hr event
Inflow = 0.26 cfs @ 8.08 hrs, Volume= 0.188 af
Outflow = 0.26 cfs @ 8.15 hrs, Volume= 0.187 af, Atten= 1%, Lag= 4.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.44 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 1.20 fps, Avg. Travel Time= 4.6 min

Peak Storage= 60 cf @ 8.15 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 119.41 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 330.0' Slope= 0.0121 '/'
Inlet Invert= 152.50', Outlet Invert= 148.50'





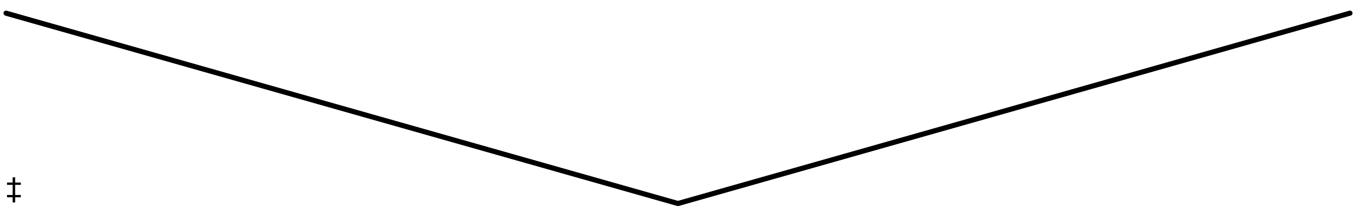
Summary for Reach 29R: Wetland Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.40' Flow Area= 5.4 sf, Capacity= 13.70 cfs

0.00' x 0.40' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 33.5 '/' Top Width= 26.80'
Length= 187.0' Slope= 0.0310 '/'
Inlet Invert= 139.80', Outlet Invert= 134.00'



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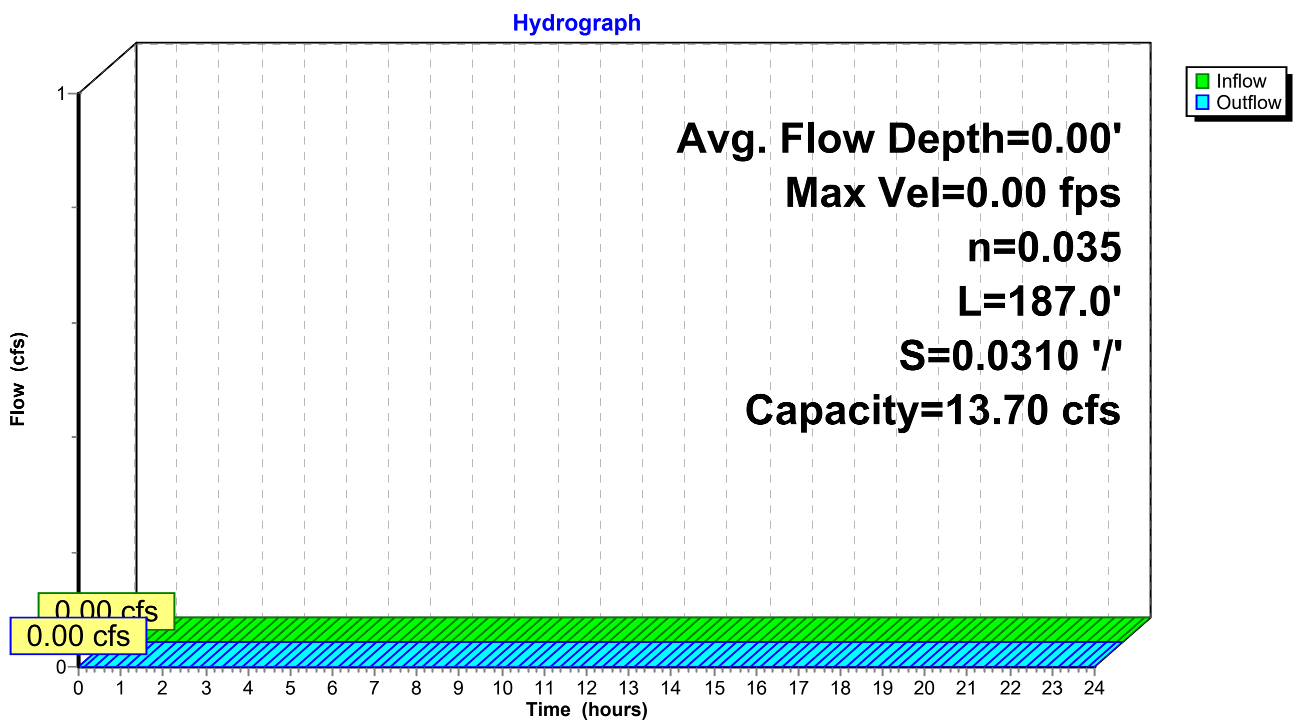
Reach 29R: Wetland Ditch



Summary for Pond 18R: 240 LF Bypass Culvert

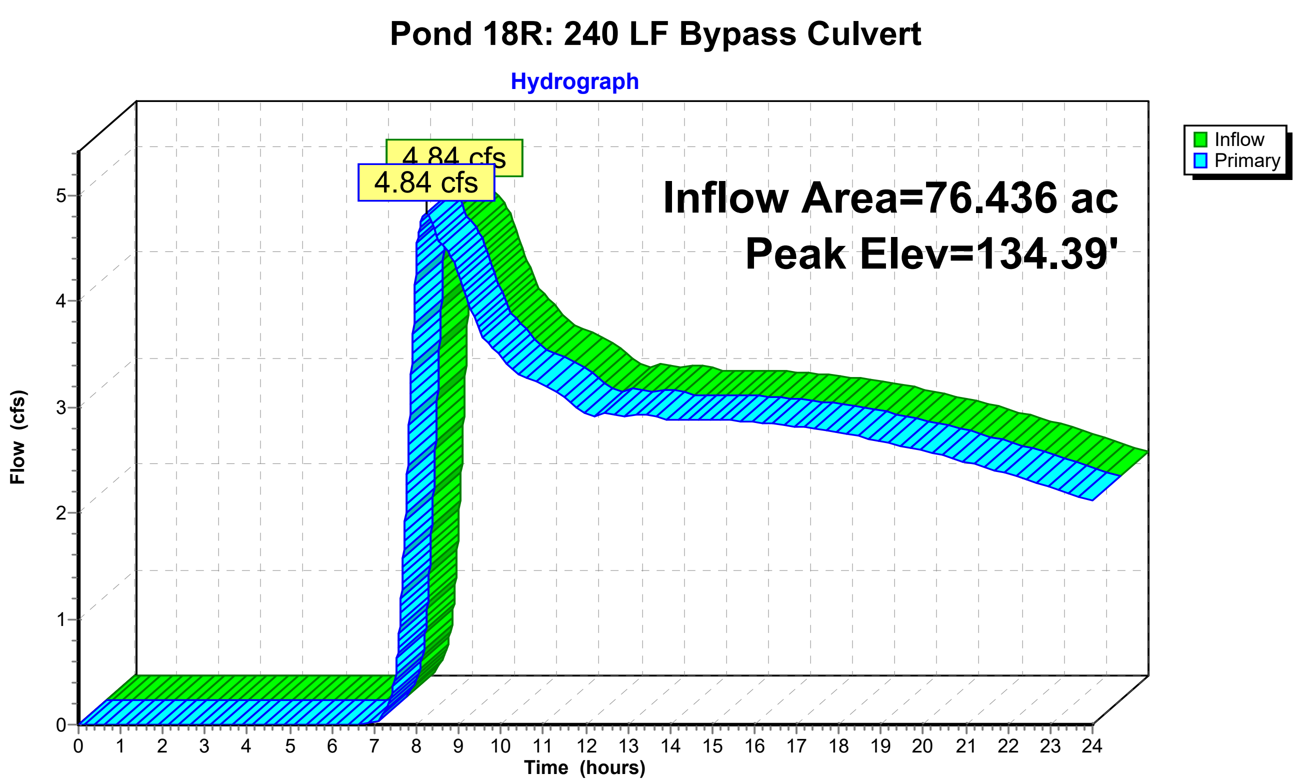
[57] Hint: Peaked at 134.39' (Flood elevation advised)
[62] Hint: Exceeded Reach 29R OUTLET depth by 0.39' @ 8.23 hrs

Inflow Area =	76.436 ac,	0.07% Impervious,	Inflow Depth > 0.62"	for 2-yr, 24-hr event
Inflow =	4.84 cfs @	8.23 hrs, Volume=	3.972 af	
Outflow =	4.84 cfs @	8.23 hrs, Volume=	3.972 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.84 cfs @	8.23 hrs, Volume=	3.972 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 134.39' @ 8.23 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=4.84 cfs @ 8.23 hrs HW=134.39' TW=128.04' (Dynamic Tailwater)
└1=**Culvert** (Passes 4.84 cfs of 17.92 cfs potential flow)
　└2=**Sharp-Crested Rectangular Weir** (Weir Controls 4.84 cfs @ 2.09 fps)



Summary for Pond 23P: Lockwood Creek Road

[57] Hint: Peaked at 142.43' (Flood elevation advised)
[62] Hint: Exceeded Reach 15R OUTLET depth by 0.51' @ 8.20 hrs
[62] Hint: Exceeded Reach 21R OUTLET depth by 0.57' @ 8.27 hrs

Inflow Area = 74.760 ac, 0.00% Impervious, Inflow Depth > 0.62" for 2-yr, 24-hr event
Inflow = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af
Outflow = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af, Atten= 0%, Lag= 0.0 min
Primary = 4.70 cfs @ 8.24 hrs, Volume= 3.873 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

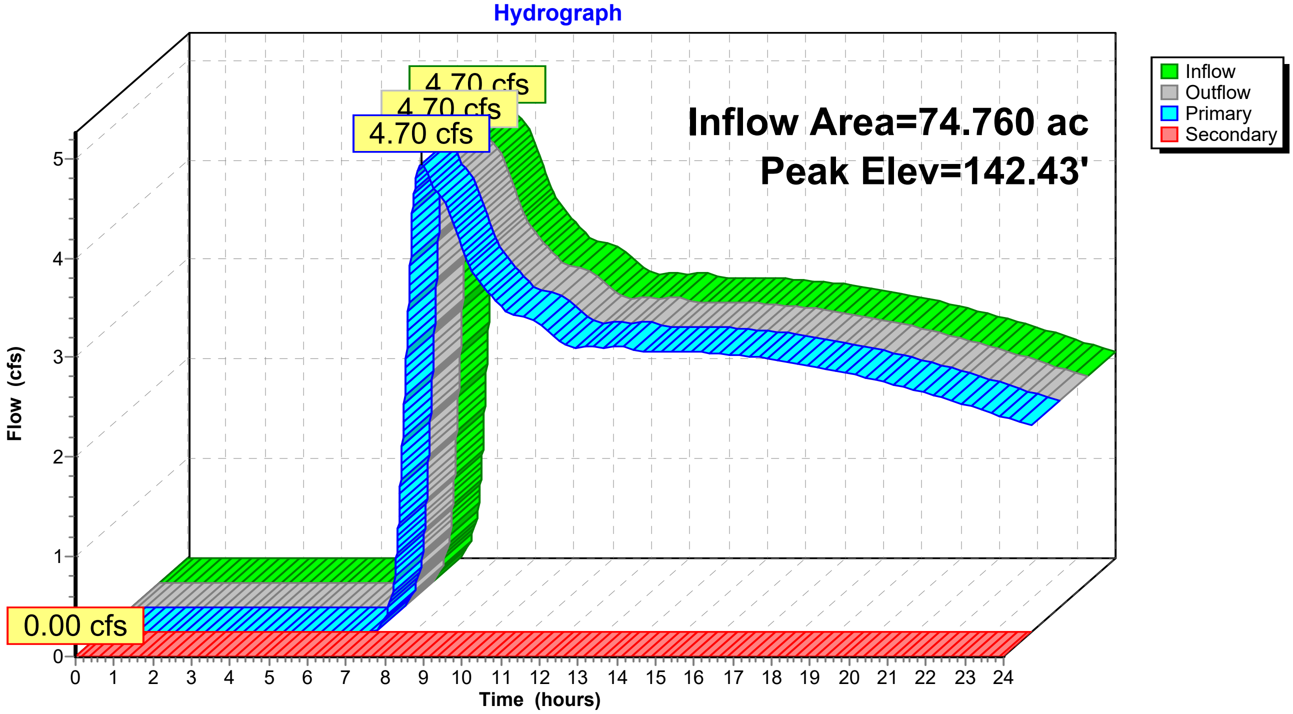
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 142.43' @ 8.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	**24.0" Round Culvert** L= 52.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 141.50' / 139.00' S= 0.0481 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 3.14 sf
#2	Secondary	145.60'	**210.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Secondary	142.60'	**8.0" Round Culvert** L= 82.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 142.60' / 138.14' S= 0.0544 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=4.70 cfs @ 8.24 hrs HW=142.43' TW=140.21' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.70 cfs @ 3.28 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=141.50' TW=139.80' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Culvert** (Controls 0.00 cfs)

Pond 23P: Lockwood Creek Road



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 128.04' (Flood elevation advised)

Inflow Area =	76.436 ac,	0.07% Impervious, Inflow Depth > 0.62"	for 2-yr, 24-hr event	
Inflow =	4.84 cfs @	8.23 hrs, Volume=	3.972 af	
Outflow =	4.84 cfs @	8.23 hrs, Volume=	3.972 af,	Atten= 0%, Lag= 0.0 min
Primary =	2.09 cfs @	8.23 hrs, Volume=	2.566 af	
Secondary =	2.75 cfs @	8.23 hrs, Volume=	1.406 af	

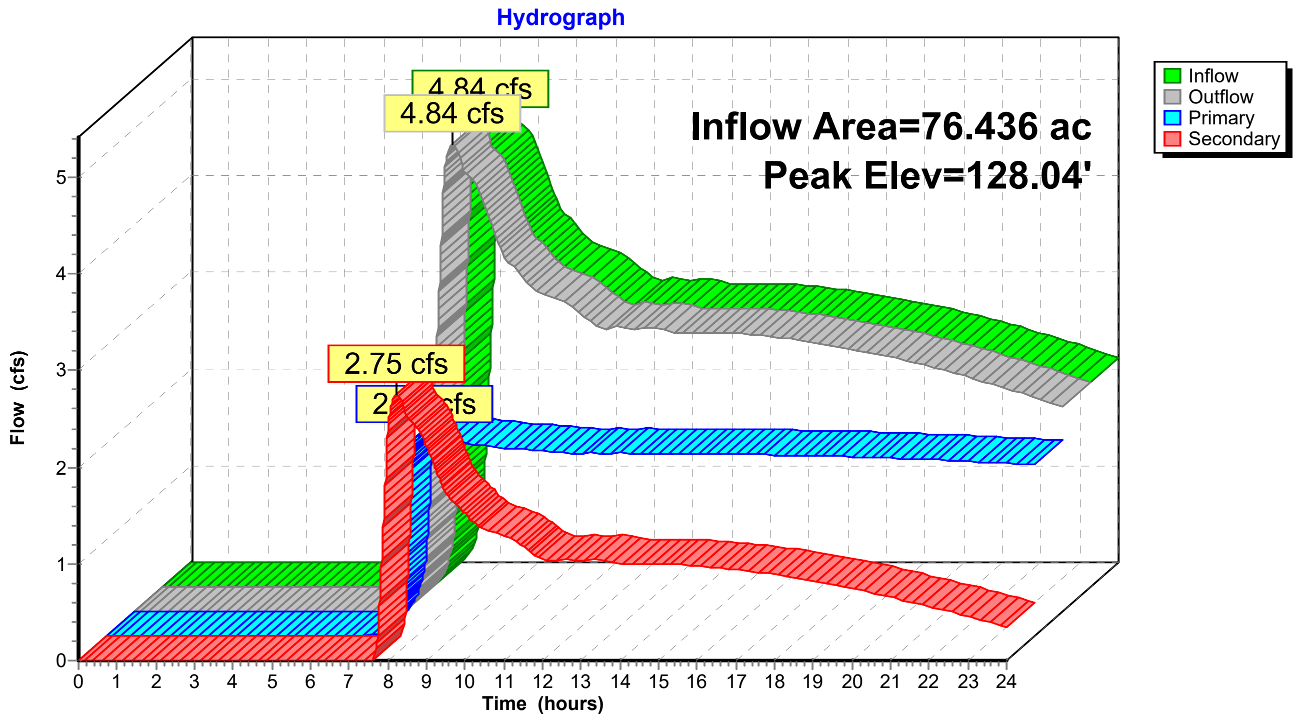
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.04' @ 8.23 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=2.09 cfs @ 8.23 hrs HW=128.04' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.09 cfs @ 3.83 fps)

Secondary OutFlow Max=2.75 cfs @ 8.23 hrs HW=128.04' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.75 cfs @ 1.16 fps)

Pond 25P: TDA 1 Outflow



Summary for Pond 28R: 42 LF Extension

[57] Hint: Peaked at 140.21' (Flood elevation advised)

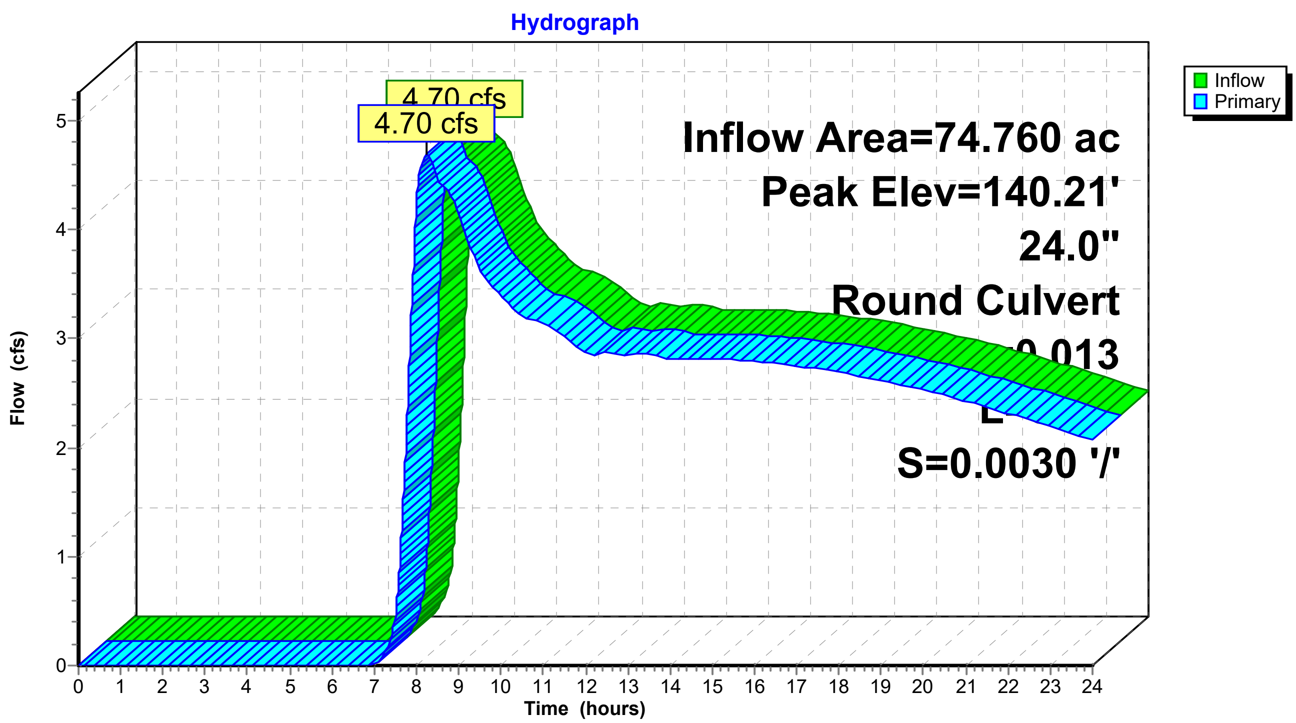
Inflow Area =	74.760 ac,	0.00% Impervious, Inflow Depth > 0.62"	for 2-yr, 24-hr event	
Inflow =	4.70 cfs @	8.24 hrs, Volume=	3.873 af	
Outflow =	4.70 cfs @	8.24 hrs, Volume=	3.873 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.70 cfs @	8.24 hrs, Volume=	3.873 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 140.21' @ 8.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	139.00'	**24.0" Round Culvert** L= 33.2' Ke= 0.800 Inlet / Outlet Invert= 139.00' / 138.90' S= 0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=4.70 cfs @ 8.24 hrs HW=140.21' TW=139.17' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 4.70 cfs @ 3.39 fps)

Pond 28R: 42 LF Extension



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A4: North Wetland Runoff Area=1.676 ac 3.22% Impervious Runoff Depth>2.28"
Flow Length=300' Slope=0.0240 '/' Tc=4.6 min CN=77/100 Runoff=0.89 cfs 0.318 af

Subcatchment OS1: Off-Site Subcatchment Runoff Area=6.040 ac 0.00% Impervious Runoff Depth>2.08"
Flow Length=840' Tc=43.0 min CN=76/0 Runoff=1.70 cfs 1.046 af

Subcatchment OS2: Off-Site Subcatchment Runoff Area=18.570 ac 0.00% Impervious Runoff Depth>2.10"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=6.54 cfs 3.250 af

Subcatchment OS3: Off-Site Subcatchment Runoff Area=39.520 ac 0.00% Impervious Runoff Depth>2.10"
Flow Length=1,500' Tc=25.6 min CN=76/0 Runoff=13.91 cfs 6.916 af

Subcatchment OS4: Off-Site Subcatchment Runoff Area=7.030 ac 0.00% Impervious Runoff Depth>2.10"
Flow Length=1,200' Tc=23.0 min CN=76/0 Runoff=2.58 cfs 1.232 af

Subcatchment OS5: Off-Site Subcatchment Runoff Area=3.600 ac 0.00% Impervious Runoff Depth>2.11"
Flow Length=680' Tc=18.3 min CN=76/0 Runoff=1.43 cfs 0.633 af

Reach 11R: Ditch 1 Avg. Flow Depth=0.83' Max Vel=1.18 fps Inflow=1.70 cfs 1.046 af
n=0.030 L=940.0' S=0.0021 '/' Capacity=50.03 cfs Outflow=1.64 cfs 1.035 af

Reach 15R: Ditch 2 Avg. Flow Depth=0.81' Max Vel=6.05 fps Inflow=7.89 cfs 4.285 af
n=0.030 L=95.0' S=0.0579 '/' Capacity=260.96 cfs Outflow=7.89 cfs 4.284 af

Reach 20R: Bypass Ditch Avg. Flow Depth=1.29' Max Vel=3.05 fps Inflow=23.20 cfs 12.699 af
n=0.040 L=89.0' S=0.0100 '/' Capacity=63.04 cfs Outflow=22.95 cfs 12.694 af

Reach 21R: Ditch 3 Avg. Flow Depth=0.68' Max Vel=4.36 fps Inflow=3.99 cfs 1.863 af
n=0.030 L=184.0' S=0.0380 '/' Capacity=211.54 cfs Outflow=3.99 cfs 1.862 af

Reach 22R: Ditch 4 Avg. Flow Depth=0.57' Max Vel=2.19 fps Inflow=1.43 cfs 0.633 af
n=0.030 L=330.0' S=0.0121 '/' Capacity=119.41 cfs Outflow=1.41 cfs 0.631 af

Reach 29R: Wetland Ditch Avg. Flow Depth=0.22' Max Vel=1.71 fps Inflow=3.02 cfs 0.364 af
n=0.035 L=187.0' S=0.0310 '/' Capacity=13.70 cfs Outflow=2.75 cfs 0.364 af

Pond 18R: 240 LF Bypass Culvert Peak Elev=135.20' Inflow=26.43 cfs 13.376 af
Outflow=26.43 cfs 13.376 af

Pond 23P: Lockwood Creek Road Peak Elev=145.61' Inflow=25.72 cfs 13.063 af
Primary=23.20 cfs 12.699 af Secondary=3.02 cfs 0.364 af Outflow=25.72 cfs 13.063 af

Pond 25P: TDA 1 Outflow Peak Elev=128.71' Inflow=26.43 cfs 13.376 af
Primary=3.00 cfs 3.541 af Secondary=23.43 cfs 9.835 af Outflow=26.43 cfs 13.376 af

Pond 28R: 42 LF Extension Peak Elev=143.39' Inflow=23.20 cfs 12.699 af
24.0" Round Culvert n=0.013 L=33.2' S=0.0030 '/' Outflow=23.20 cfs 12.699 af

Total Runoff Area = 76.436 ac Runoff Volume = 13.396 af Average Runoff Depth = 2.10"
99.93% Pervious = 76.382 ac 0.07% Impervious = 0.054 ac

Summary for Subcatchment A4: North Wetland

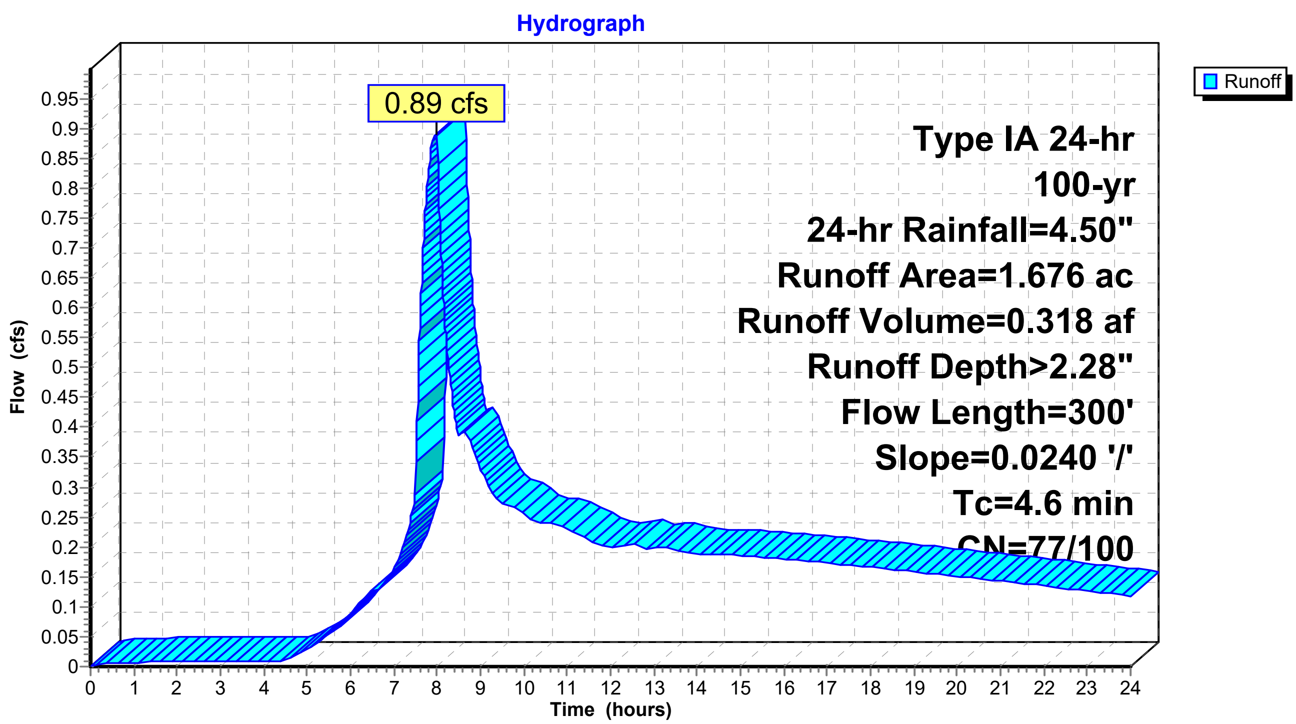
Runoff = 0.89 cfs @ 7.96 hrs, Volume= 0.318 af, Depth> 2.28"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	1.504	76	Undisturbed Buffer
*	0.054	100	Wetland
*	0.118	86	Landscaping/Fill Slope
	1.676	77	Weighted Average
	1.622	77	96.78% Pervious Area
	0.054	100	3.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	300	0.0240	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps

Subcatchment A4: North Wetland



Summary for Subcatchment OS1: Off-Site Subcatchment #1

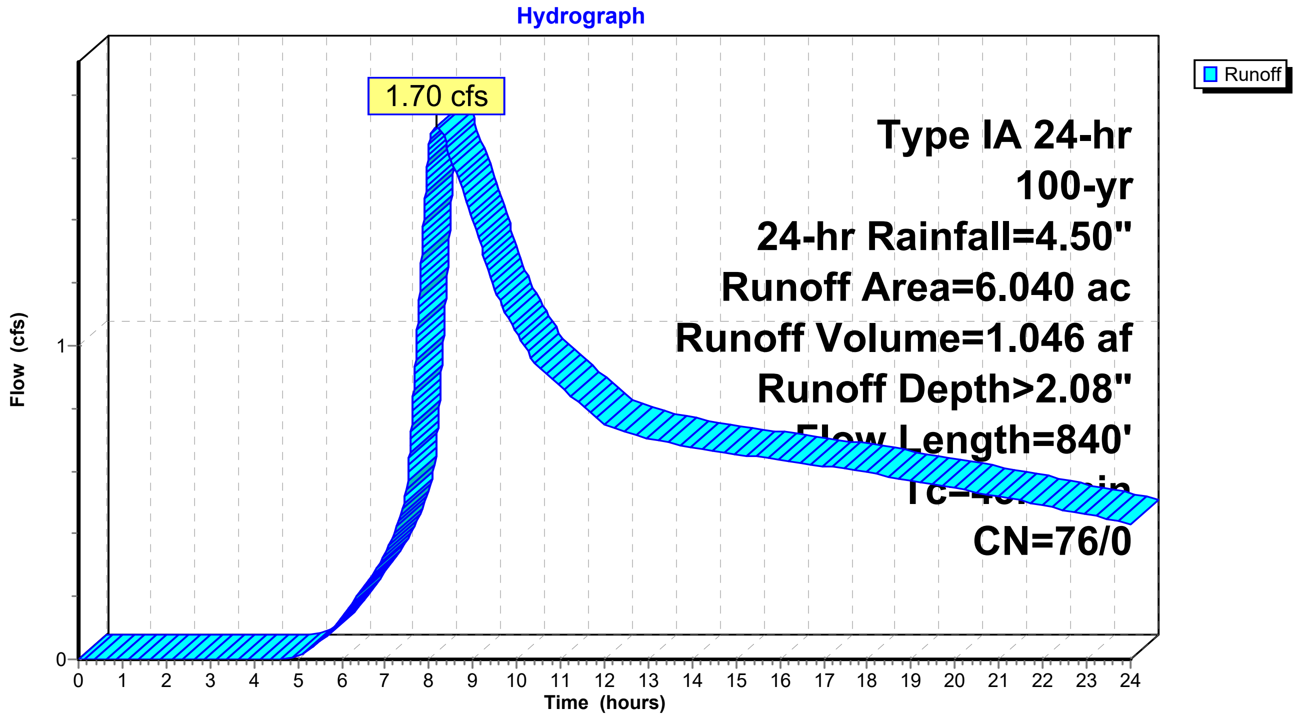
Runoff = 1.70 cfs @ 8.17 hrs, Volume= 1.046 af, Depth> 2.08"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	6.040	76	
	6.040	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1	540	0.0021	0.32		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
43.0	840	Total			

Subcatchment OS1: Off-Site Subcatchment #1



Summary for Subcatchment OS2: Off-Site Subcatchment #2

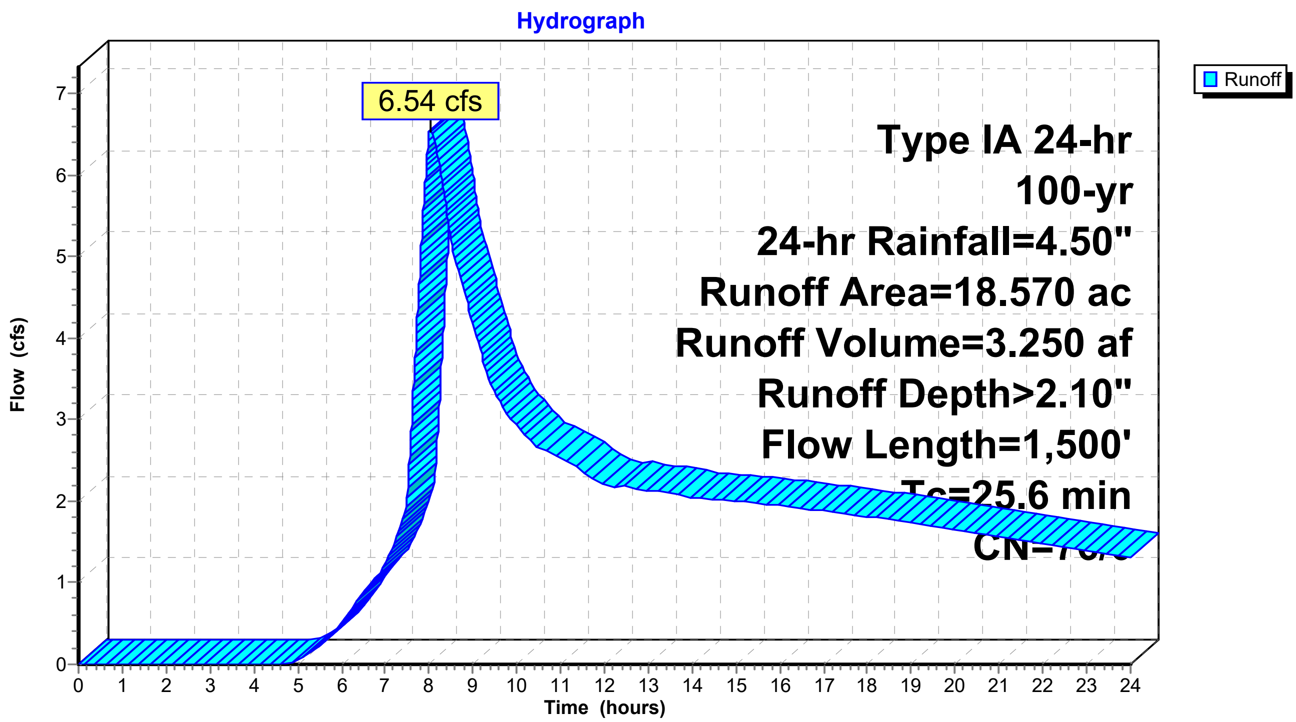
Runoff = 6.54 cfs @ 8.01 hrs, Volume= 3.250 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	18.570	76	
	18.570	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment OS2: Off-Site Subcatchment #2



Summary for Subcatchment OS3: Off-Site Subcatchment #3

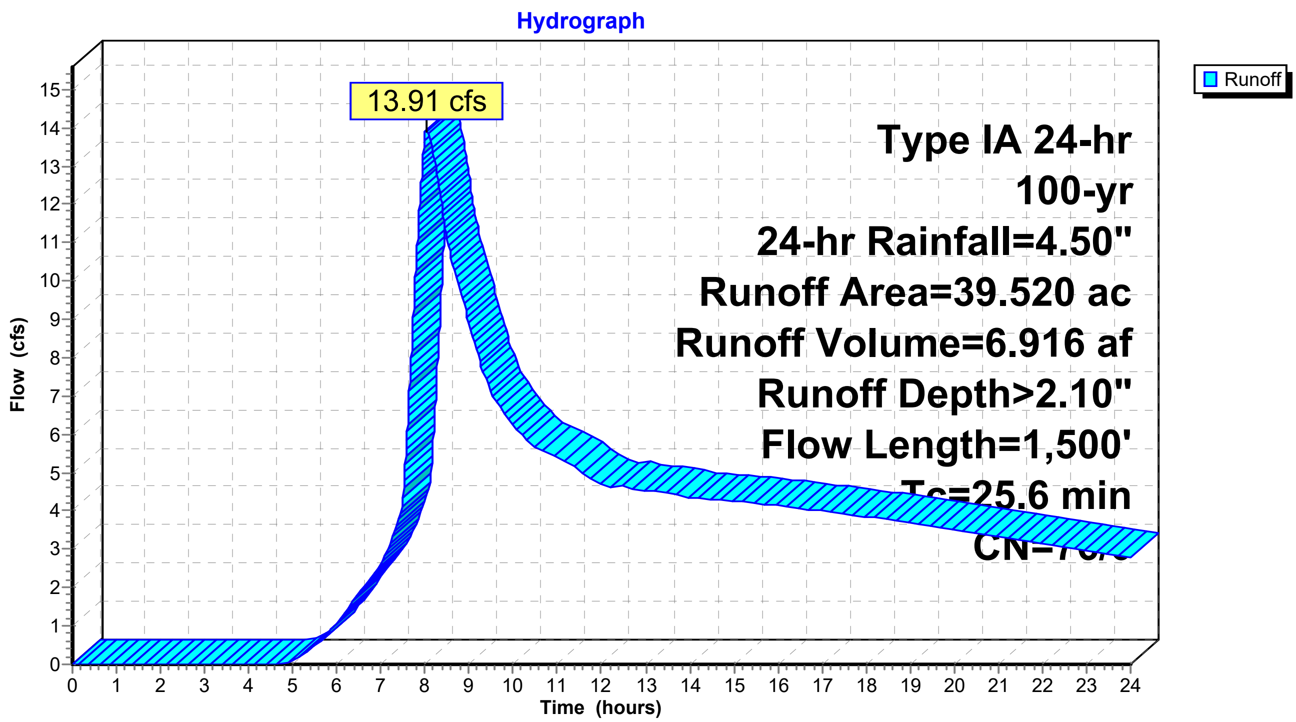
Runoff = 13.91 cfs @ 8.01 hrs, Volume= 6.916 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	39.520	76	
	39.520	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	1,200	0.0710	1.87		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
25.6	1,500	Total			

Subcatchment OS3: Off-Site Subcatchment #3



Summary for Subcatchment OS4: Off-Site Subcatchment #4

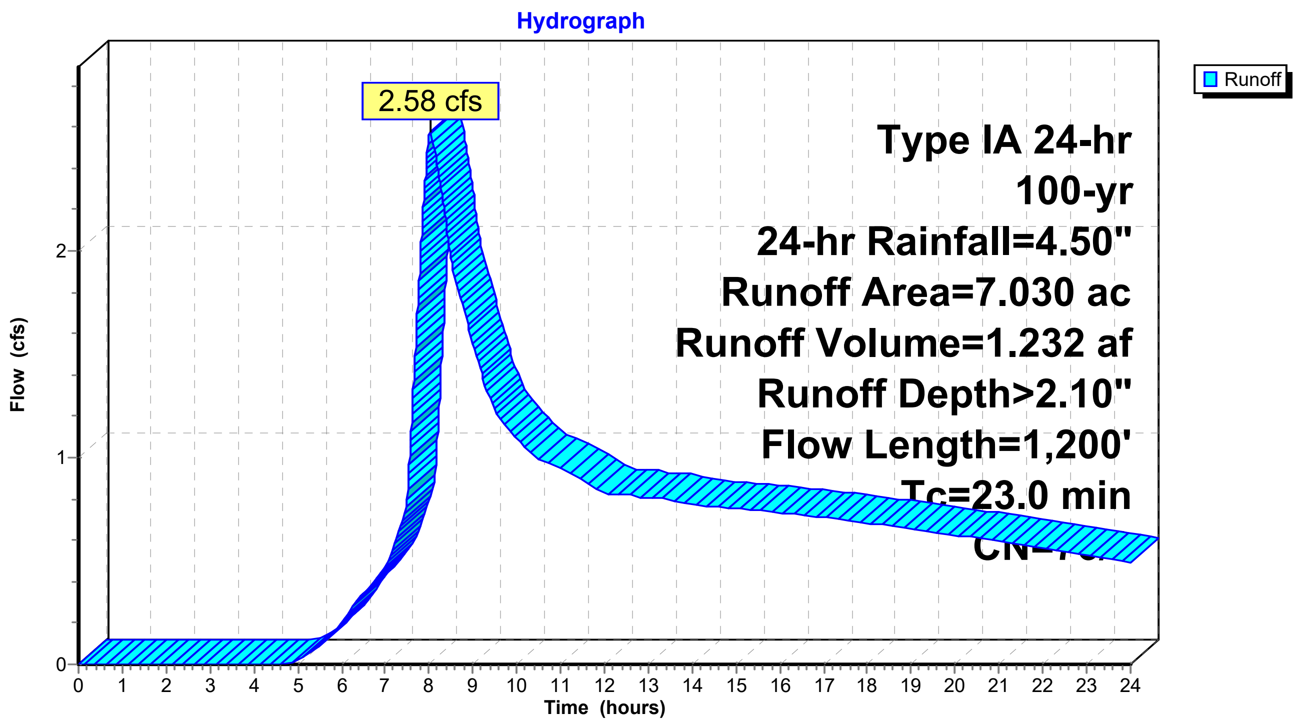
Runoff = 2.58 cfs @ 8.01 hrs, Volume= 1.232 af, Depth> 2.10"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	7.030	76	
	7.030	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	900	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
23.0	1,200	Total			

Subcatchment OS4: Off-Site Subcatchment #4



Summary for Subcatchment OS5: Off-Site Subcatchment #5

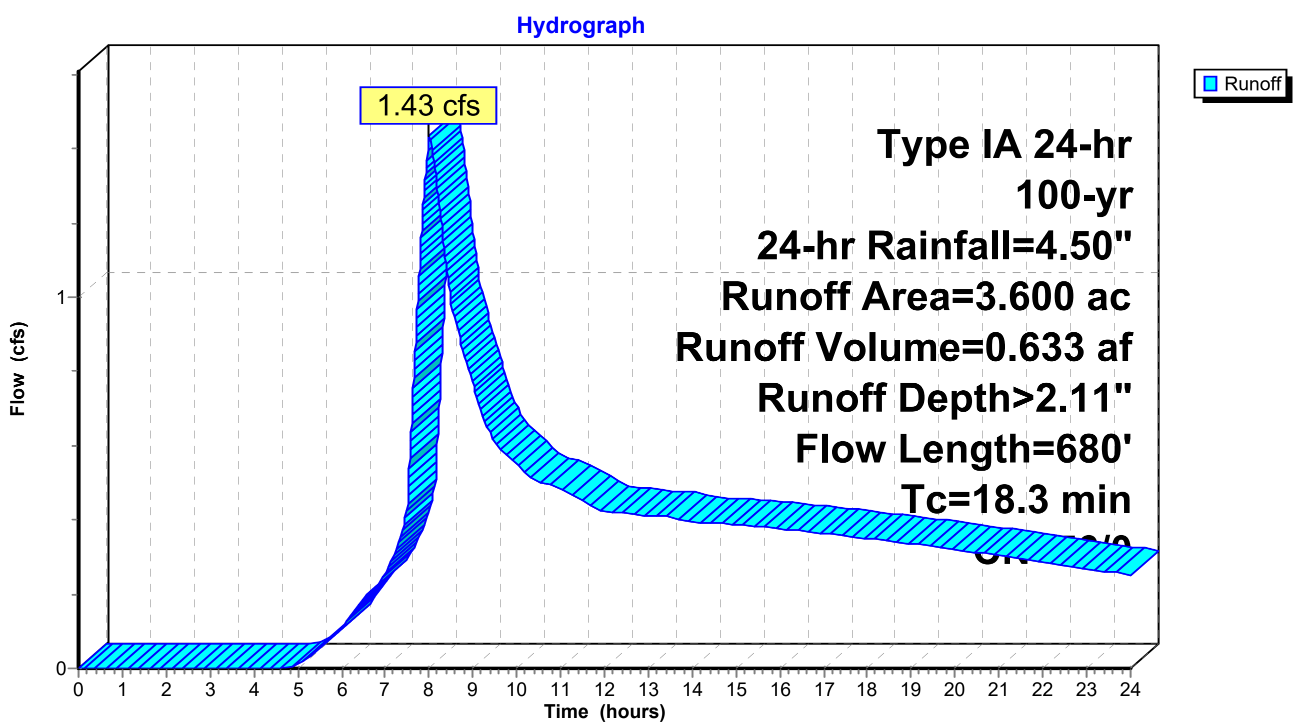
Runoff = 1.43 cfs @ 8.01 hrs, Volume= 0.633 af, Depth> 2.11"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-yr, 24-hr Rainfall=4.50"

	Area (ac)	CN	Description
*	3.600	76	
	3.600	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	380	0.0700	1.85		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
14.9	300	0.1000	0.33		**Sheet Flow, Overland Sheet** Grass: Short n= 0.150 P2= 2.20"
18.3	680	Total			

Subcatchment OS5: Off-Site Subcatchment #5



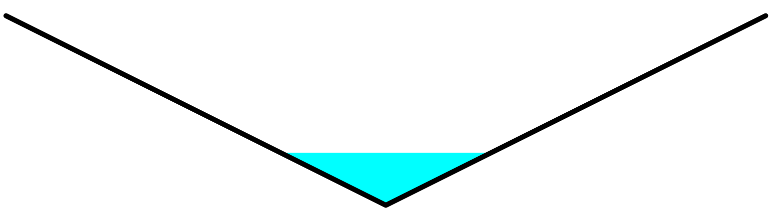
Summary for Reach 11R: Ditch 1

Inflow Area = 6.040 ac, 0.00% Impervious, Inflow Depth > 2.08" for 100-yr, 24-hr event
Inflow = 1.70 cfs @ 8.17 hrs, Volume= 1.046 af
Outflow = 1.64 cfs @ 8.41 hrs, Volume= 1.035 af, Atten= 4%, Lag= 14.2 min

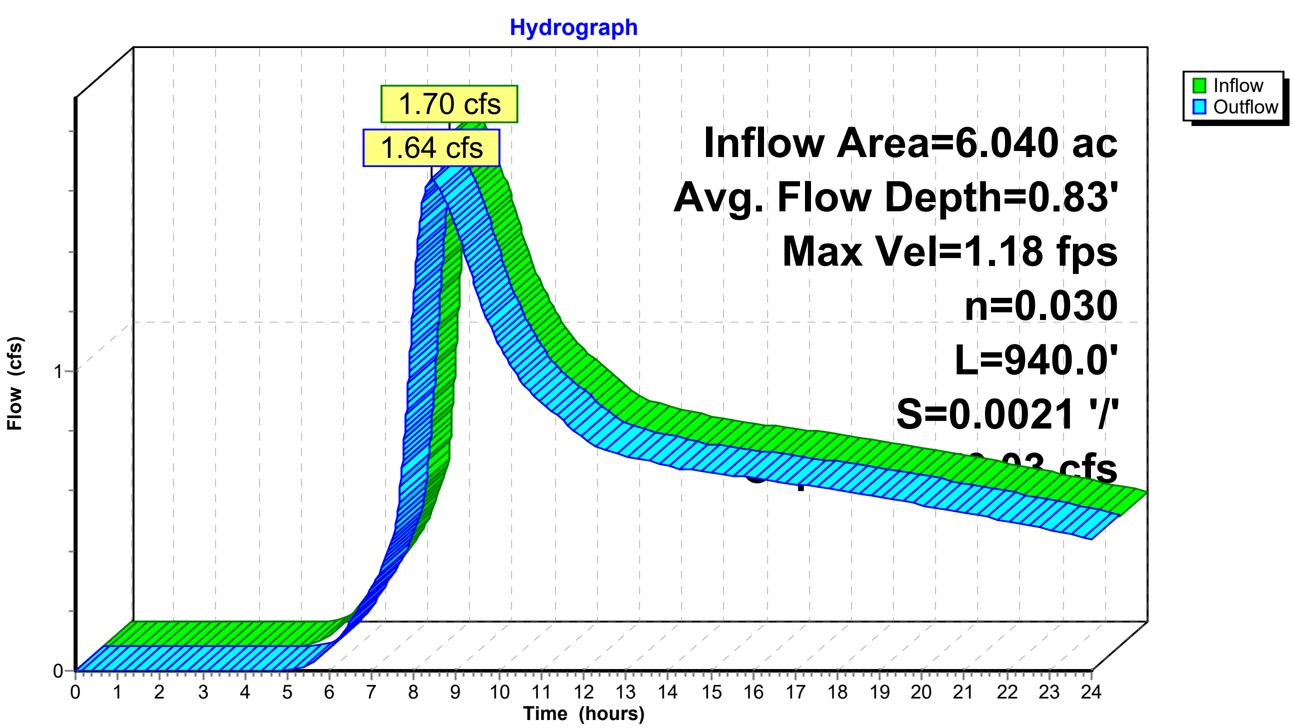
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.18 fps, Min. Travel Time= 13.3 min
Avg. Velocity = 0.90 fps, Avg. Travel Time= 17.5 min

Peak Storage= 1,302 cf @ 8.41 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 50.03 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 940.0' Slope= 0.0021 '/'
Inlet Invert= 149.00', Outlet Invert= 147.00'



Reach 11R: Ditch 1



Summary for Reach 15R: Ditch 2

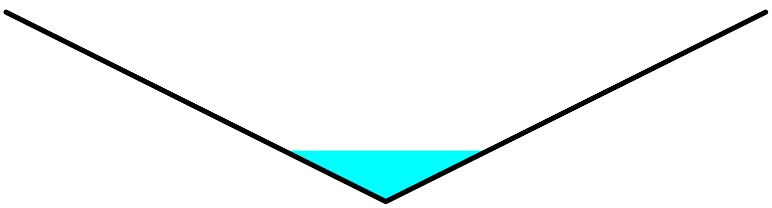
[62] Hint: Exceeded Reach 11R OUTLET depth by 0.08' @ 5.13 hrs

Inflow Area = 24.610 ac, 0.00% Impervious, Inflow Depth > 2.09" for 100-yr, 24-hr event
Inflow = 7.89 cfs @ 8.09 hrs, Volume= 4.285 af
Outflow = 7.89 cfs @ 8.09 hrs, Volume= 4.284 af, Atten= 0%, Lag= 0.2 min

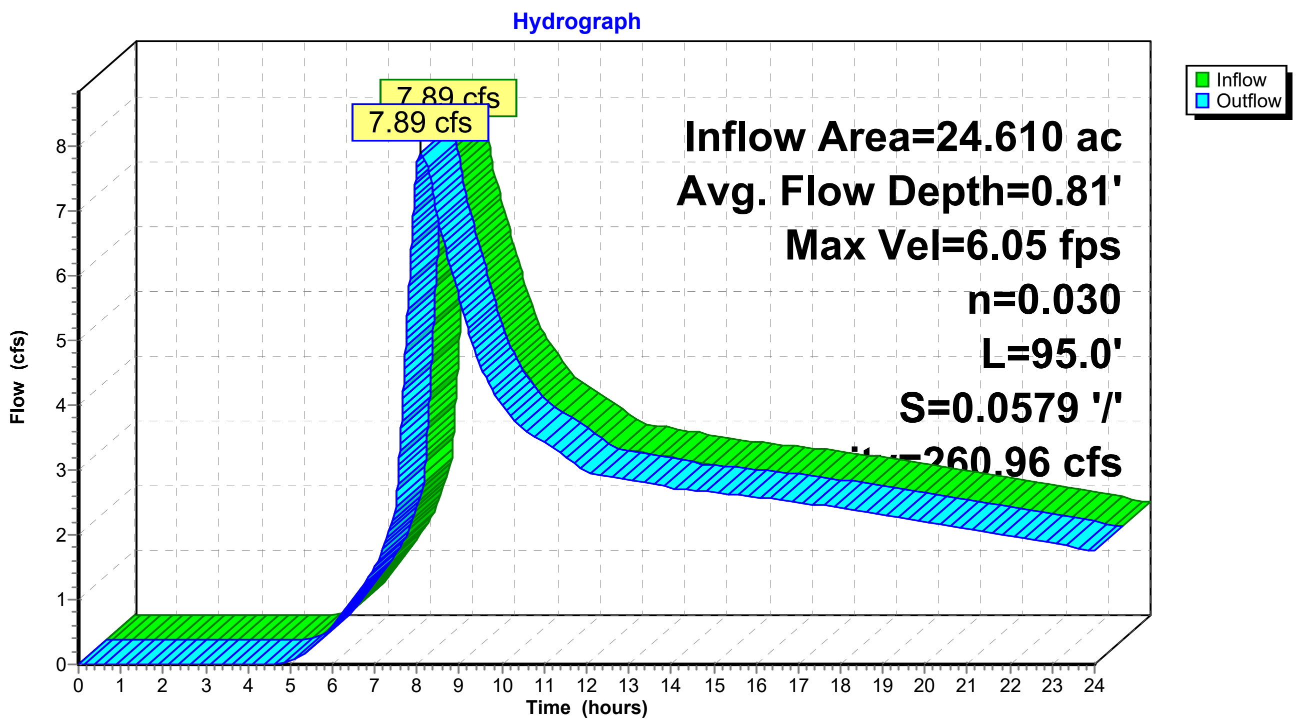
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.05 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 4.45 fps, Avg. Travel Time= 0.4 min

Peak Storage= 124 cf @ 8.09 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 260.96 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 95.0' Slope= 0.0579 '/'
Inlet Invert= 147.00', Outlet Invert= 141.50'



Reach 15R: Ditch 2



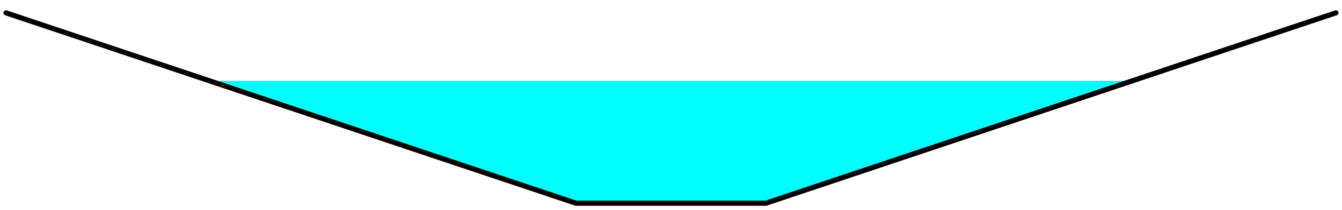
Summary for Reach 20R: Bypass Ditch

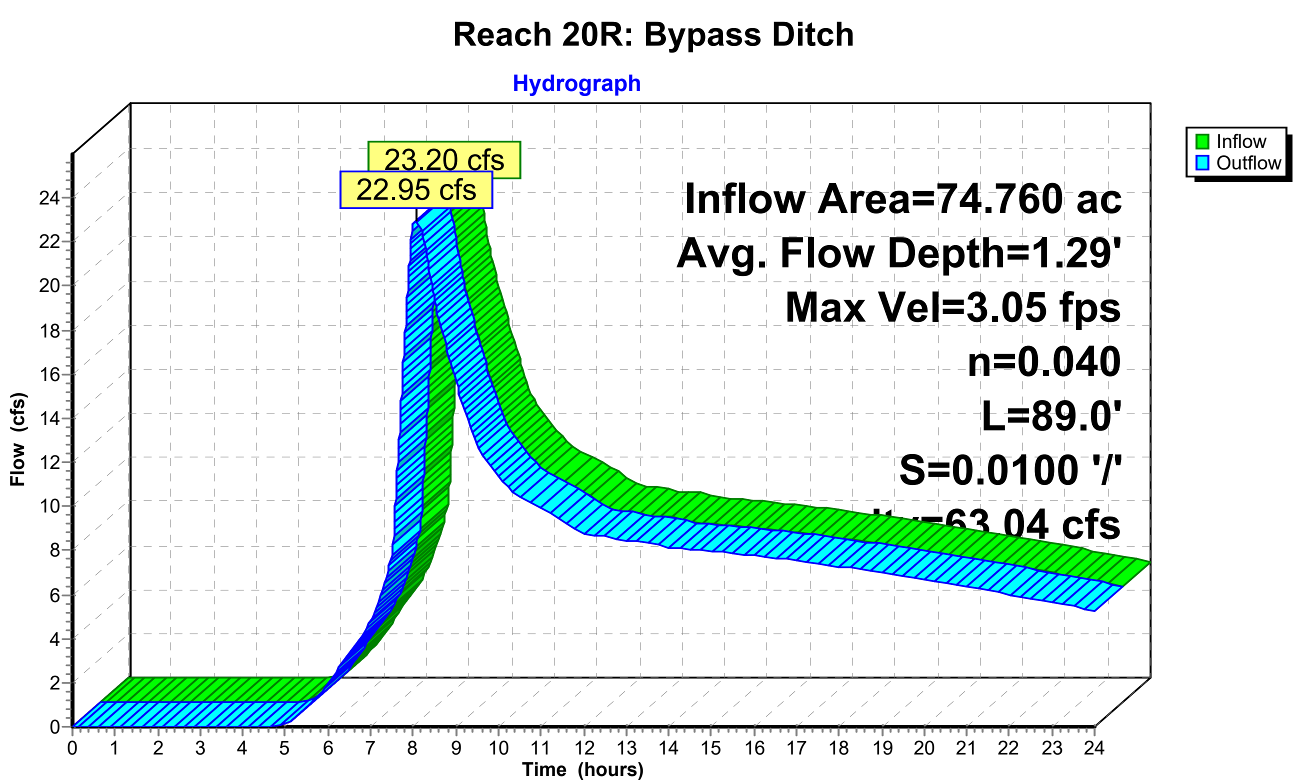
Inflow Area = 74.760 ac, 0.00% Impervious, Inflow Depth > 2.04" for 100-yr, 24-hr event
Inflow = 23.20 cfs @ 8.08 hrs, Volume= 12.699 af
Outflow = 22.95 cfs @ 8.06 hrs, Volume= 12.694 af, Atten= 1%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.05 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 0.7 min

Peak Storage= 670 cf @ 8.06 hrs
Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 63.04 cfs

2.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 89.0' Slope= 0.0100 '/'
Inlet Invert= 138.56', Outlet Invert= 137.67'





Summary for Reach 21R: Ditch 3

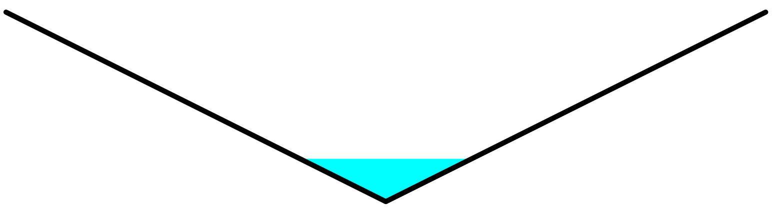
[62] Hint: Exceeded Reach 22R OUTLET depth by 0.11' @ 8.20 hrs

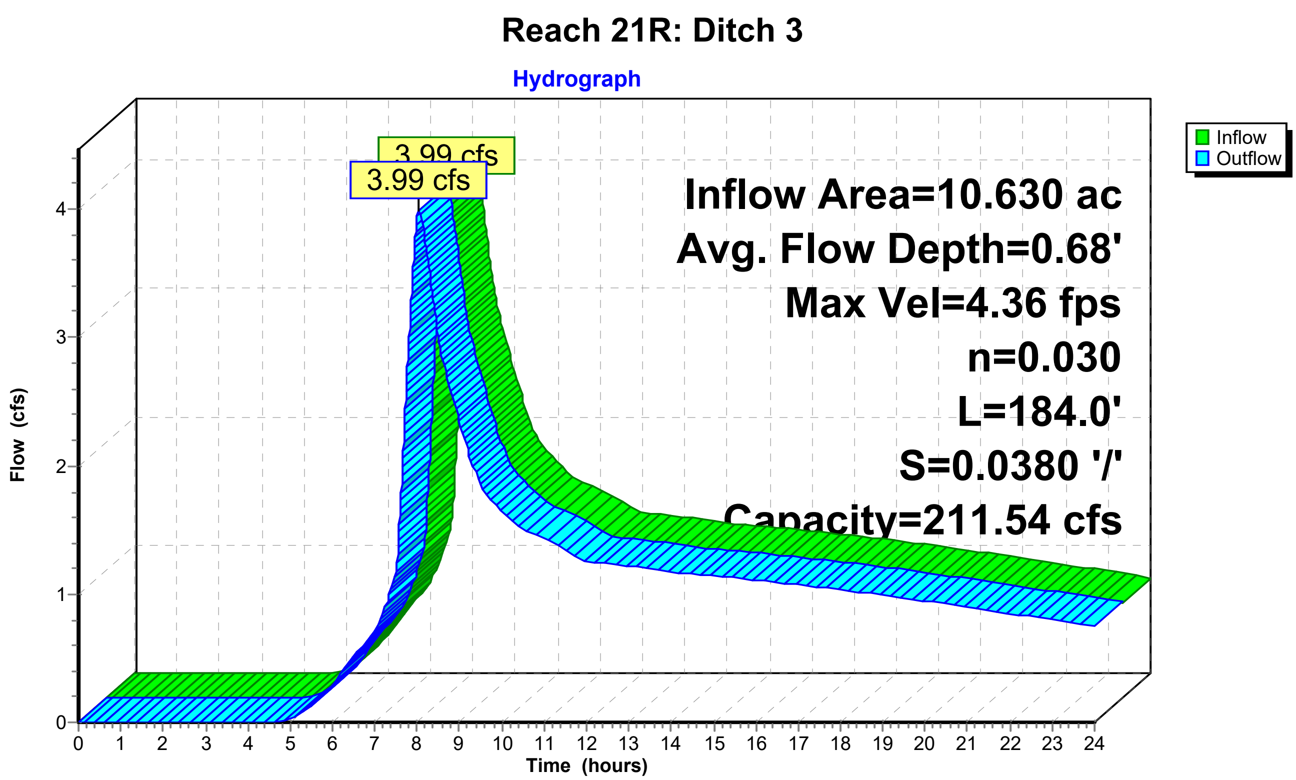
Inflow Area = 10.630 ac, 0.00% Impervious, Inflow Depth > 2.10" for 100-yr, 24-hr event
Inflow = 3.99 cfs @ 8.02 hrs, Volume= 1.863 af
Outflow = 3.99 cfs @ 8.03 hrs, Volume= 1.862 af, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.36 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.09 fps, Avg. Travel Time= 1.0 min

Peak Storage= 168 cf @ 8.03 hrs
Average Depth at Peak Storage= 0.68'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 211.54 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 184.0' Slope= 0.0380 '/'
Inlet Invert= 148.50', Outlet Invert= 141.50'





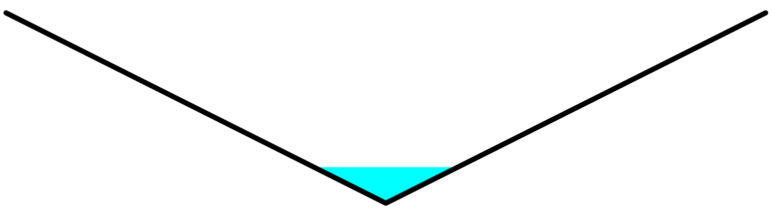
Summary for Reach 22R: Ditch 4

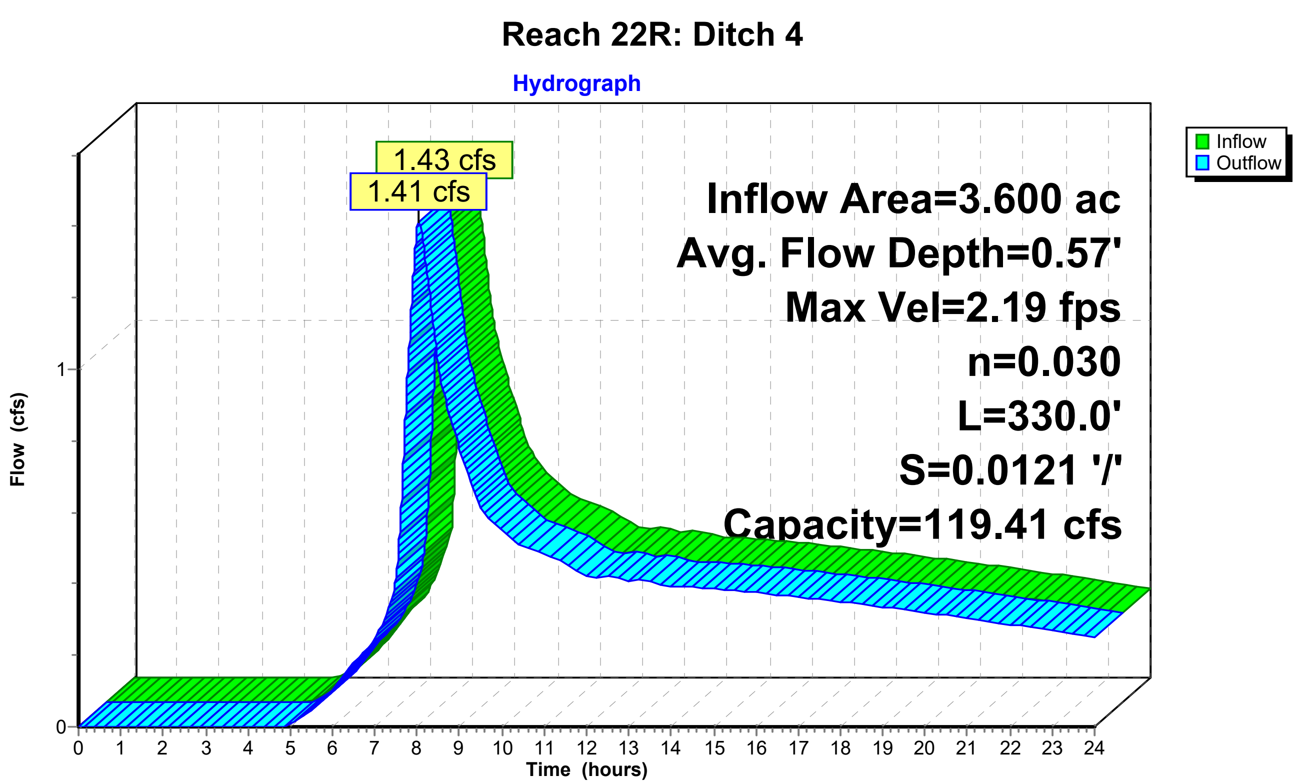
Inflow Area = 3.600 ac, 0.00% Impervious, Inflow Depth > 2.11" for 100-yr, 24-hr event
Inflow = 1.43 cfs @ 8.01 hrs, Volume= 0.633 af
Outflow = 1.41 cfs @ 8.04 hrs, Volume= 0.631 af, Atten= 1%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.19 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 3.6 min

Peak Storage= 213 cf @ 8.04 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 119.41 cfs

0.00' x 3.00' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 330.0' Slope= 0.0121 '/'
Inlet Invert= 152.50', Outlet Invert= 148.50'





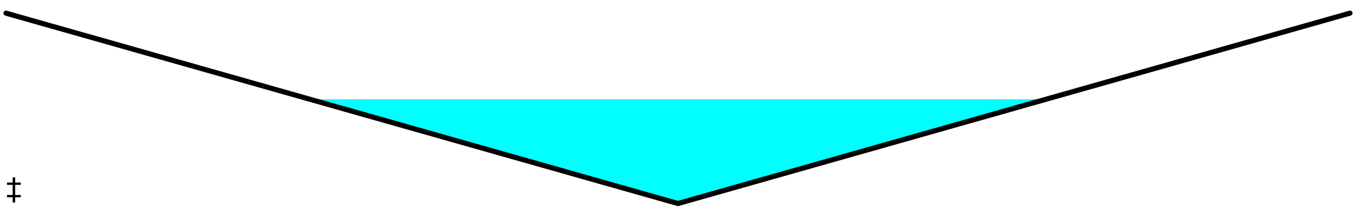
Summary for Reach 29R: Wetland Ditch

Inflow	=	3.02 cfs @	8.09 hrs, Volume=	0.364 af
Outflow	=	2.75 cfs @	8.07 hrs, Volume=	0.364 af, Atten= 9%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.71 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 0.74 fps, Avg. Travel Time= 4.2 min

Peak Storage= 300 cf @ 8.07 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 0.40' Flow Area= 5.4 sf, Capacity= 13.70 cfs

0.00' x 0.40' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 33.5 '/' Top Width= 26.80'
Length= 187.0' Slope= 0.0310 '/'
Inlet Invert= 139.80', Outlet Invert= 134.00'



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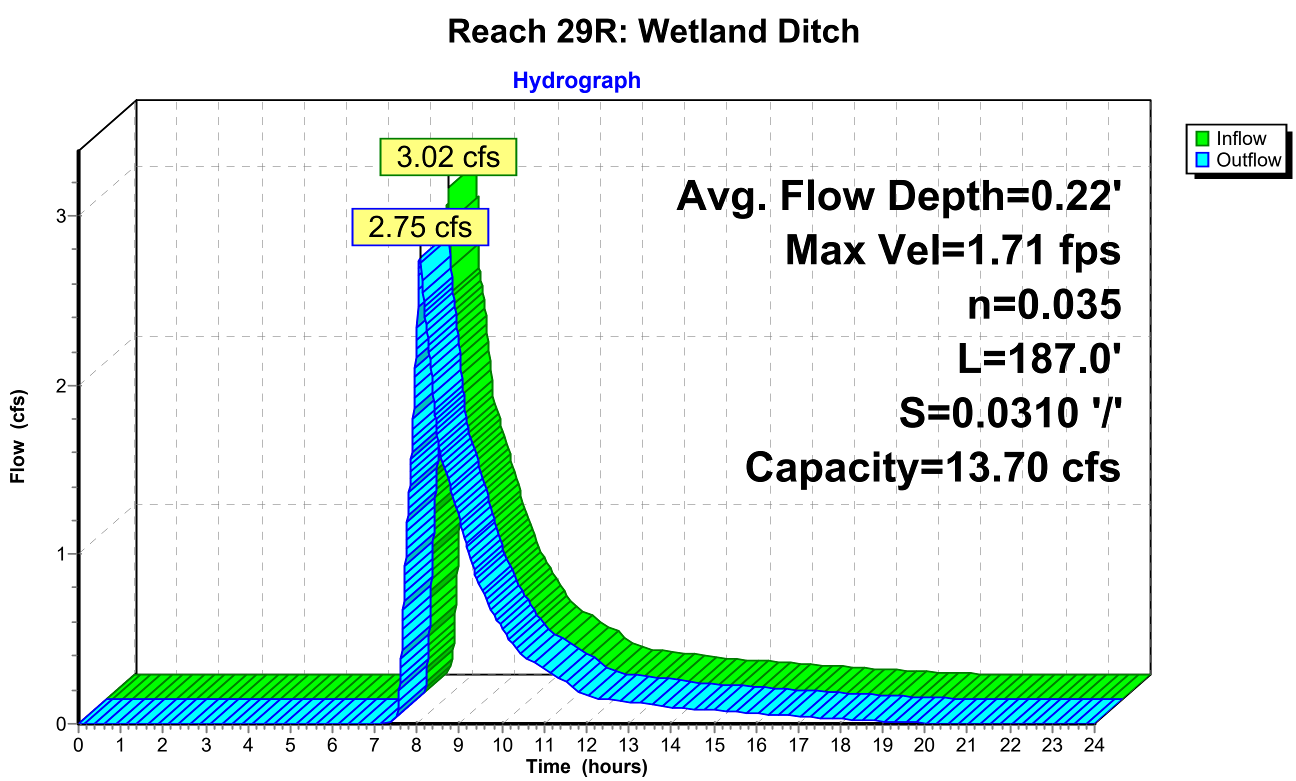


Summary for Pond 18R: 240 LF Bypass Culvert

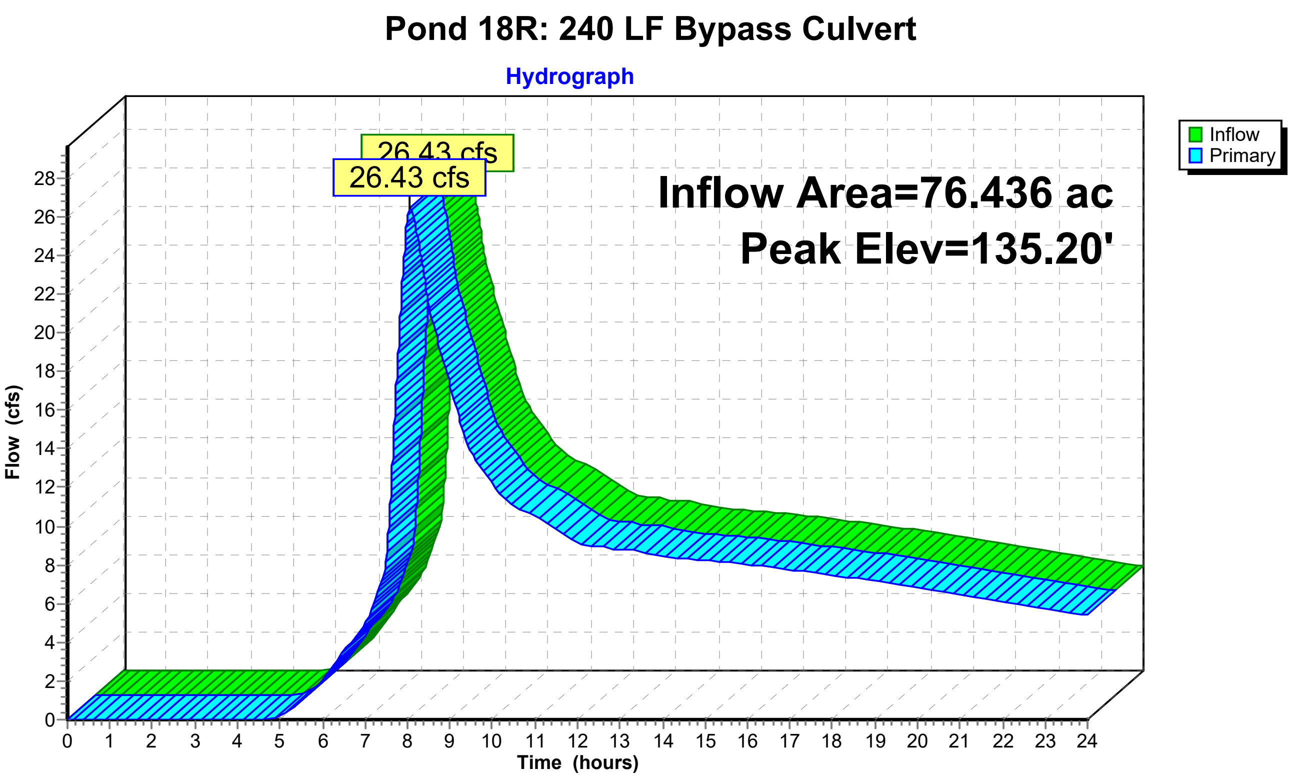
[57] Hint: Peaked at 135.20' (Flood elevation advised)
[62] Hint: Exceeded Reach 29R OUTLET depth by 0.98' @ 8.00 hrs

Inflow Area =	76.436 ac,	0.07% Impervious, Inflow Depth > 2.10"	for 100-yr, 24-hr event	
Inflow =	26.43 cfs @	8.06 hrs, Volume=	13.376 af	
Outflow =	26.43 cfs @	8.06 hrs, Volume=	13.376 af,	Atten= 0%, Lag= 0.0 min
Primary =	26.43 cfs @	8.06 hrs, Volume=	13.376 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 135.20' @ 8.06 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	132.50'	**36.0" Round Culvert** L= 240.0' Ke= 0.200 Inlet / Outlet Invert= 132.50' / 131.70' S= 0.0033 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf
#2	Device 1	134.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 2.0' Crest Height

Primary OutFlow Max=26.42 cfs @ 8.06 hrs HW=135.20' TW=128.71' (Dynamic Tailwater)
└─**1=Culvert** (Passes 26.42 cfs of 31.83 cfs potential flow)
  └─**2=Sharp-Crested Rectangular Weir** (Weir Controls 26.42 cfs @ 3.84 fps)



Summary for Pond 23P: Lockwood Creek Road

[57] Hint: Peaked at 145.61' (Flood elevation advised)
[62] Hint: Exceeded Reach 15R OUTLET depth by 3.30' @ 8.01 hrs
[62] Hint: Exceeded Reach 21R OUTLET depth by 3.44' @ 8.09 hrs

Inflow Area = 74.760 ac, 0.00% Impervious, Inflow Depth > 2.10" for 100-yr, 24-hr event
Inflow = 25.72 cfs @ 8.03 hrs, Volume= 13.063 af
Outflow = 25.72 cfs @ 8.03 hrs, Volume= 13.063 af, Atten= 0%, Lag= 0.0 min
Primary = 23.20 cfs @ 8.08 hrs, Volume= 12.699 af
Secondary = 3.02 cfs @ 8.09 hrs, Volume= 0.364 af

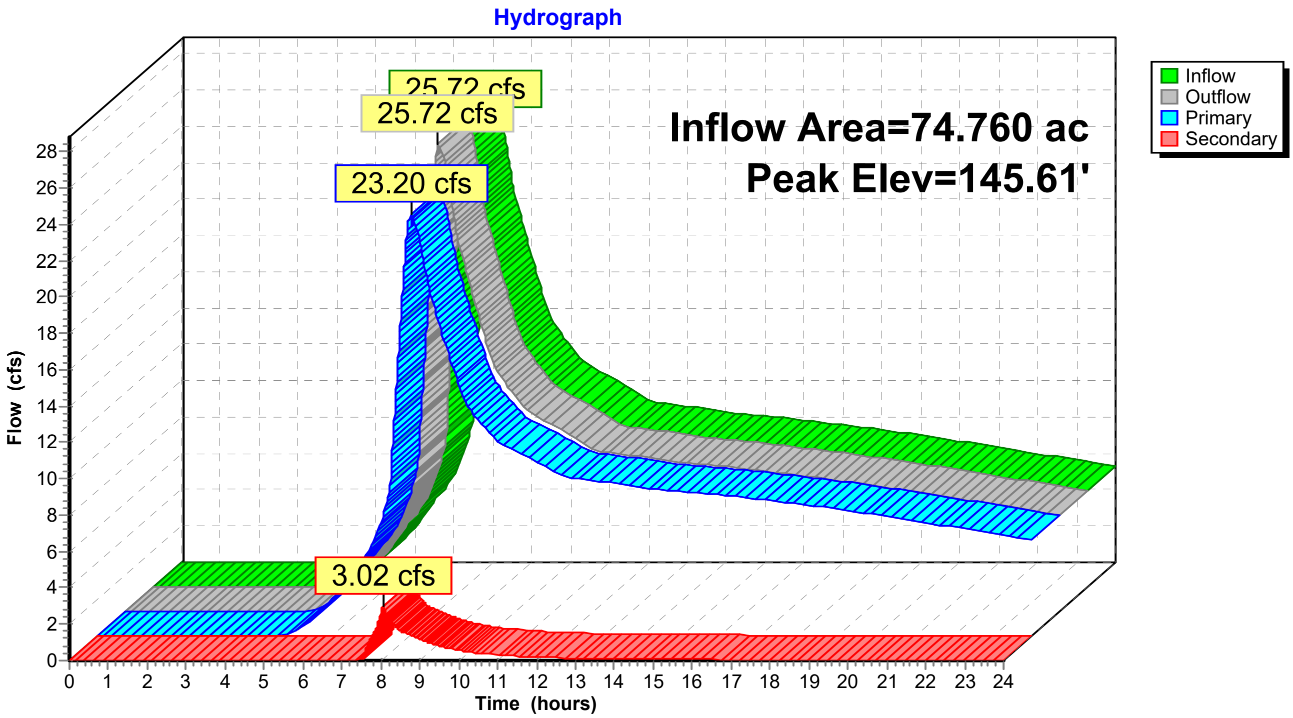
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 145.61' @ 8.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	**24.0" Round Culvert** L= 52.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 141.50' / 139.00' S= 0.0481 '/' Cc= 0.900 n= 0.013 Cast iron, coated, Flow Area= 3.14 sf
#2	Secondary	145.60'	**210.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#3	Secondary	142.60'	**8.0" Round Culvert** L= 82.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 142.60' / 138.14' S= 0.0544 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Primary OutFlow Max=22.48 cfs @ 8.08 hrs HW=145.59' TW=143.38' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.48 cfs @ 7.16 fps)

Secondary OutFlow Max=3.00 cfs @ 8.09 hrs HW=145.61' TW=140.02' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.58 cfs @ 0.27 fps)
└─**3=Culvert** (Inlet Controls 2.43 cfs @ 6.95 fps)

Pond 23P: Lockwood Creek Road



Summary for Pond 25P: TDA 1 Outflow

Culvert and Overland flow outlet calibrated to 2-dimensional HEC-RAS grid model to accurately reflect flow patterns to the west.

[57] Hint: Peaked at 128.71' (Flood elevation advised)

Inflow Area = 76.436 ac, 0.07% Impervious, Inflow Depth > 2.10" for 100-yr, 24-hr event
Inflow = 26.43 cfs @ 8.06 hrs, Volume= 13.376 af
Outflow = 26.43 cfs @ 8.06 hrs, Volume= 13.376 af, Atten= 0%, Lag= 0.0 min
Primary = 3.00 cfs @ 8.06 hrs, Volume= 3.541 af
Secondary = 23.43 cfs @ 8.06 hrs, Volume= 9.835 af

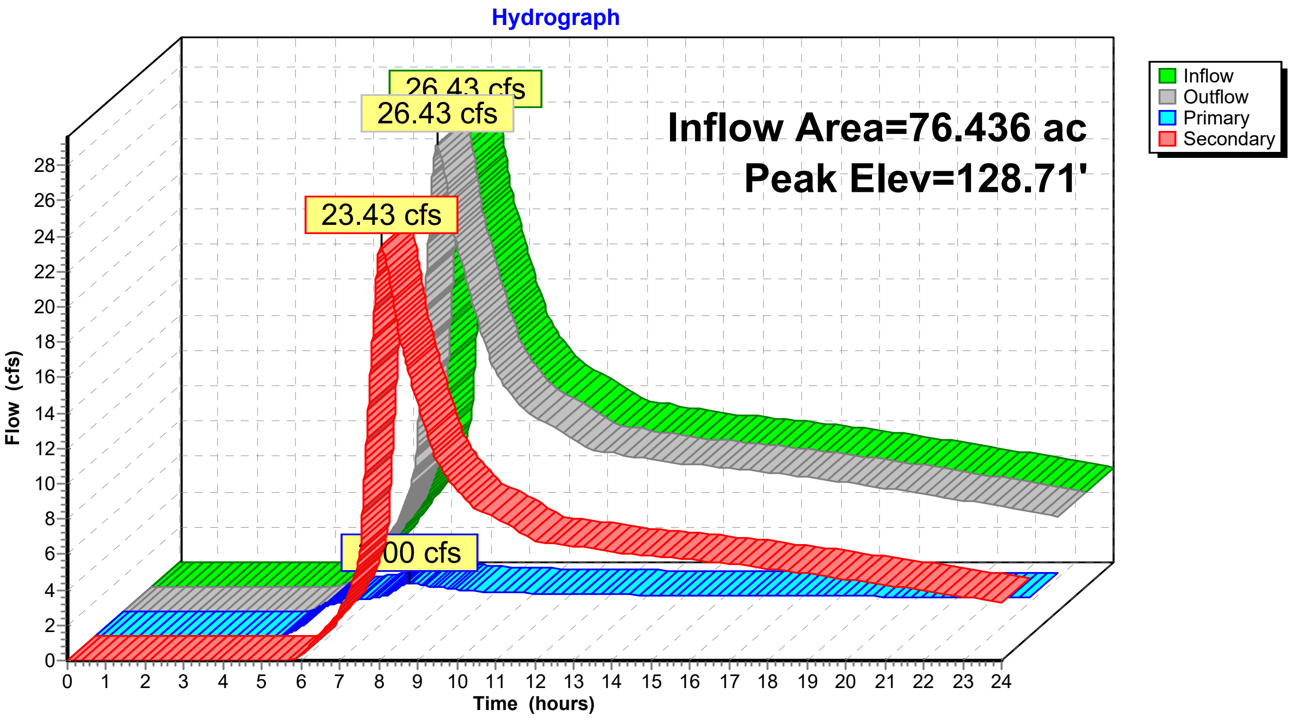
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 128.71' @ 8.06 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	126.99'	**10.0" Round Culvert** L= 247.0' Ke= 0.500 Inlet / Outlet Invert= 126.99' / 120.35' S= 0.0269 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.55 sf
#2	Secondary	127.80'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.00 cfs @ 8.06 hrs HW=128.71' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.00 cfs @ 5.51 fps)

Secondary OutFlow Max=23.42 cfs @ 8.06 hrs HW=128.71' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 23.42 cfs @ 2.56 fps)

Pond 25P: TDA 1 Outflow



Summary for Pond 28R: 42 LF Extension

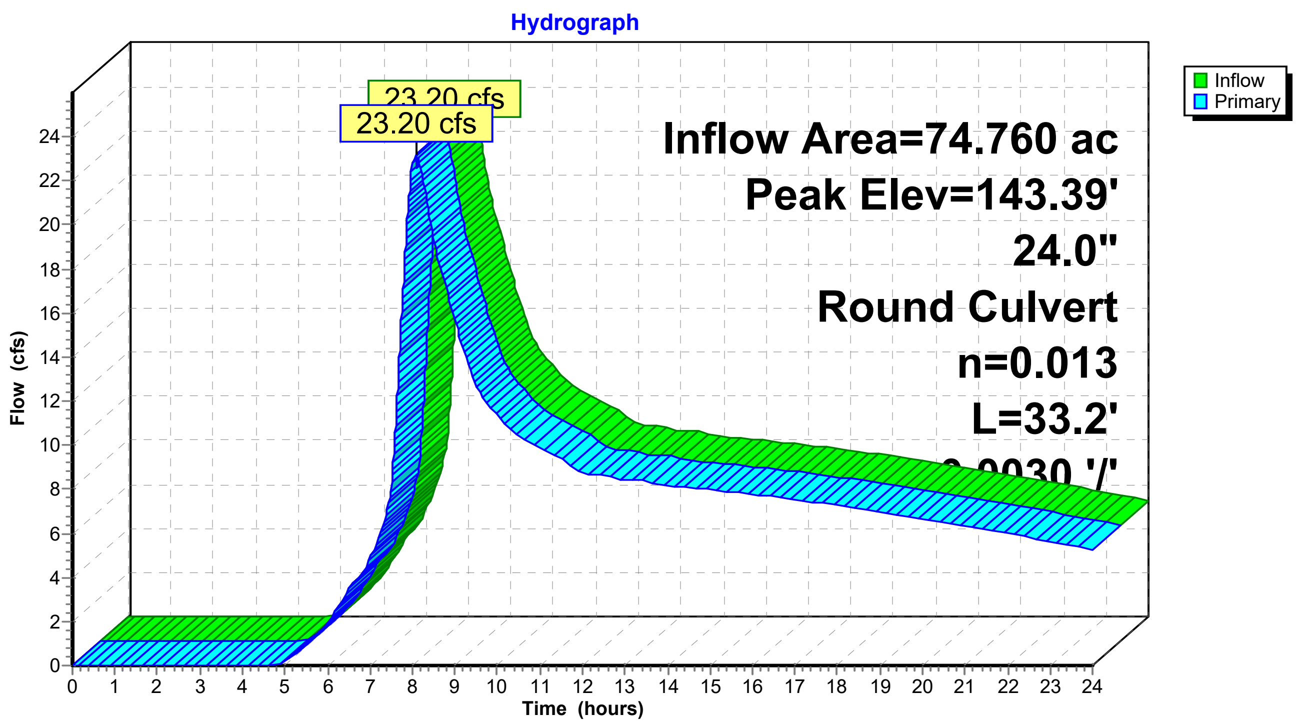
[57] Hint: Peaked at 143.39' (Flood elevation advised)

Inflow Area =	74.760 ac,	0.00% Impervious, Inflow Depth > 2.04"	for 100-yr, 24-hr event	
Inflow =	23.20 cfs @	8.08 hrs, Volume=	12.699 af	
Outflow =	23.20 cfs @	8.08 hrs, Volume=	12.699 af,	Atten= 0%, Lag= 0.0 min
Primary =	23.20 cfs @	8.08 hrs, Volume=	12.699 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 143.39' @ 8.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	139.00'	**24.0" Round Culvert** L= 33.2' Ke= 0.800 Inlet / Outlet Invert= 139.00' / 138.90' S= 0.0030 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=23.17 cfs @ 8.08 hrs HW=143.38' TW=139.85' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 23.17 cfs @ 7.38 fps)



WWHM2012

PROJECT REPORT

NOT FOR QUANTITY
CONTROL PURPOSES
(PAGE 27 THROUGH 72
OMITTED)

General Model Information

Project Name:	Preliminary Water Quality Sizing
Site Name:	La Center MS
Site Address:	
City:	
Report Date:	10/1/2018
Gage:	Ridgefield
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	1.110
Version Date:	2018/03/08
Version:	4.2.14

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year
Low Flow Threshold for POC3:	50 Percent of the 2 Year
High Flow Threshold for POC3:	50 Year

Landuse Basin Data
Predeveloped Land Use

Road Pre-Developed

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Flat	0.352
Pervious Total	0.352
Impervious Land Use	acre
ROADS FLAT	0.3702
Impervious Total	0.3702
Basin Total	0.7222

Element Flows To:

Surface	Interflow	Groundwater

West Lot Pre-Developed

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Flat	1.3362
Pervious Total	1.3362
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.3362

Element Flows To:

Surface	Interflow	Groundwater

East Lot Pre-Developed

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Flat	1.8515
Pervious Total	1.8515
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.8515

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Lockwood Post-Developed

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.6056
SIDEWALKS FLAT	0.1166
Impervious Total	0.7222
Basin Total	0.7222

Element Flows To:

Surface	Interflow	Groundwater
Surface Lockwood Bio	Surface Lockwood Bio	Surface Lockwood Bio

West Lot

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Lawn, Flat	0.066
Pervious Total	0.066
Impervious Land Use	acre
DRIVEWAYS FLAT	0.5287
SIDEWALKS FLAT	0.0818
Impervious Total	0.6105
Basin Total	0.6765

Element Flows To:

Surface	Interflow	Groundwater
Surface West Lot Bio	Surface West Lot Bio	Surface West Lot Bio

East Lot

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG4, Lawn, Flat	0.1653
SG4, Field, Flat	0.7755
Pervious Total	0.9408

Impervious Land Use	acre
DRIVEWAYS FLAT	0.8482
SIDEWALKS FLAT	0.0625
Impervious Total	0.9107
Basin Total	1.8515

Element Flows To:

Surface	Interflow	Groundwater
Surface East Lot Bio	Surface East Lot Bio	Surface East Lot Bio

West Lot 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Lawn, Flat	0.0426
Pervious Total	0.0426
Impervious Land Use	acre
DRIVEWAYS FLAT	0.5345
SIDEWALKS FLAT	0.0826
Impervious Total	0.6171
Basin Total	0.6597

Element Flows To:

Surface	Interflow	Groundwater
Surface st Lot Bio 2	Surface st Lot Bio 2	

Routing Elements
Predeveloped Routing

Mitigated Routing

Lockwood Bio

Bottom Length:	30.00 ft.
Bottom Width:	10.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	6
Orifice Diameter (in.):	2.7
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	118.258
Total Outflow (ac-ft.):	119.853
Percent Through Underdrain:	98.67

Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 24 in.
Element Flows To:
Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0258	0.0000	0.0000	0.0000
0.0385	0.0258	0.0001	0.0000	0.0000
0.0769	0.0255	0.0002	0.0000	0.0000
0.1154	0.0251	0.0004	0.0000	0.0000
0.1538	0.0247	0.0005	0.0001	0.0000
0.1923	0.0244	0.0007	0.0002	0.0000
0.2308	0.0240	0.0008	0.0003	0.0000
0.2692	0.0236	0.0009	0.0005	0.0000
0.3077	0.0233	0.0011	0.0008	0.0000
0.3462	0.0229	0.0012	0.0012	0.0000
0.3846	0.0226	0.0014	0.0017	0.0000
0.4231	0.0222	0.0016	0.0022	0.0000
0.4615	0.0219	0.0017	0.0029	0.0000
0.5000	0.0216	0.0019	0.0036	0.0000
0.5385	0.0212	0.0021	0.0045	0.0000
0.5769	0.0209	0.0023	0.0054	0.0000
0.6154	0.0205	0.0024	0.0065	0.0000
0.6538	0.0202	0.0026	0.0078	0.0000
0.6923	0.0199	0.0028	0.0091	0.0000
0.7308	0.0195	0.0030	0.0096	0.0000
0.7692	0.0192	0.0032	0.0106	0.0000
0.8077	0.0189	0.0034	0.0122	0.0000
0.8462	0.0186	0.0036	0.0139	0.0000
0.8846	0.0183	0.0039	0.0158	0.0000
0.9231	0.0179	0.0041	0.0179	0.0000
0.9615	0.0176	0.0043	0.0201	0.0000
1.0000	0.0173	0.0045	0.0224	0.0000
1.0385	0.0170	0.0048	0.0226	0.0000
1.0769	0.0167	0.0050	0.0249	0.0000

1.1154	0.0164	0.0053	0.0276	0.0000
1.1538	0.0161	0.0055	0.0304	0.0000
1.1923	0.0158	0.0058	0.0334	0.0000
1.2308	0.0155	0.0060	0.0365	0.0000
1.2692	0.0152	0.0063	0.0399	0.0000
1.3077	0.0149	0.0066	0.0423	0.0000
1.3462	0.0146	0.0068	0.0434	0.0000
1.3846	0.0143	0.0071	0.0471	0.0000
1.4231	0.0141	0.0074	0.0510	0.0000
1.4615	0.0138	0.0077	0.0550	0.0000
1.5000	0.0135	0.0080	0.0593	0.0000
1.5385	0.0132	0.0082	0.0637	0.0000
1.5769	0.0129	0.0085	0.0683	0.0000
1.6154	0.0127	0.0088	0.0699	0.0000
1.6538	0.0124	0.0091	0.0732	0.0000
1.6923	0.0121	0.0094	0.0782	0.0000
1.7308	0.0119	0.0097	0.0833	0.0000
1.7692	0.0116	0.0100	0.0833	0.0000
1.8077	0.0114	0.0103	0.0833	0.0000
1.8462	0.0111	0.0106	0.0833	0.0000
1.8846	0.0108	0.0109	0.0833	0.0000
1.9231	0.0106	0.0112	0.0833	0.0000
1.9615	0.0103	0.0116	0.0833	0.0000
2.0000	0.0101	0.0119	0.0833	0.0000
2.0385	0.0098	0.0123	0.0833	0.0000
2.0769	0.0096	0.0126	0.0833	0.0000
2.1154	0.0094	0.0130	0.0833	0.0000
2.1538	0.0091	0.0133	0.0833	0.0000
2.1923	0.0089	0.0137	0.0833	0.0000
2.2308	0.0087	0.0140	0.0833	0.0000
2.2692	0.0084	0.0144	0.0833	0.0000
2.3077	0.0082	0.0148	0.0833	0.0000
2.3462	0.0080	0.0152	0.0833	0.0000
2.3846	0.0078	0.0156	0.0833	0.0000
2.4231	0.0075	0.0160	0.0833	0.0000
2.4615	0.0073	0.0164	0.0833	0.0000
2.5000	0.0071	0.0168	0.0833	0.0000
2.5000	0.0069	0.0168	0.0833	0.0000

Bioretention Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**To Amended(cfs)**	**Infilt(cfs)**
2.5000	0.0258	0.0168	0.0000	0.0855	0.0000
2.5385	0.0262	0.0178	0.0000	0.0855	0.0000
2.5769	0.0266	0.0188	0.0000	0.0876	0.0000
2.6154	0.0269	0.0198	0.0000	0.0897	0.0000
2.6538	0.0273	0.0209	0.0000	0.0919	0.0000
2.6923	0.0277	0.0219	0.0000	0.0940	0.0000
2.7308	0.0281	0.0230	0.0000	0.0962	0.0000
2.7692	0.0285	0.0241	0.0000	0.0983	0.0000
2.8077	0.0289	0.0252	0.0000	0.1004	0.0000
2.8462	0.0293	0.0263	0.0000	0.1026	0.0000
2.8846	0.0297	0.0275	0.0000	0.1047	0.0000
2.9231	0.0301	0.0286	0.0000	0.1068	0.0000
2.9615	0.0305	0.0298	0.0000	0.1090	0.0000
3.0000	0.0309	0.0309	0.0000	0.1111	0.0000
3.0385	0.0313	0.0321	0.1601	0.1132	0.0000
3.0769	0.0317	0.0333	0.4524	0.1154	0.0000
3.1154	0.0321	0.0346	0.8304	0.1175	0.0000

3.1538	0.0325	0.0358	1.2766	0.1197	0.0000
3.1923	0.0329	0.0371	1.7799	0.1218	0.0000
3.2308	0.0333	0.0383	2.3316	0.1239	0.0000
3.2692	0.0337	0.0396	2.9237	0.1261	0.0000
3.3077	0.0342	0.0409	3.5484	0.1282	0.0000
3.3462	0.0346	0.0423	4.1981	0.1303	0.0000
3.3846	0.0350	0.0436	4.8649	0.1325	0.0000
3.4231	0.0354	0.0450	5.5408	0.1346	0.0000
3.4615	0.0359	0.0463	6.2177	0.1368	0.0000
3.5000	0.0363	0.0477	6.8875	0.1389	0.0000

Surface Lockwood Bio

Element Flows To:

Outlet 1	Outlet 2
	Lockwood Bio

West Lot Bio

Bottom Length:	28.00 ft.
Bottom Width:	10.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	6
Orifice Diameter (in.):	2.2
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	107.387
Total Outflow (ac-ft.):	108.634
Percent Through Underdrain:	98.85

Discharge Structure

Riser Height: 0.5 ft.

Riser Diameter: 24 in.

Element Flows To:

Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0247	0.0000	0.0000	0.0000
0.0385	0.0247	0.0001	0.0000	0.0000
0.0769	0.0243	0.0001	0.0000	0.0000
0.1154	0.0240	0.0002	0.0000	0.0000
0.1538	0.0236	0.0002	0.0001	0.0000
0.1923	0.0233	0.0003	0.0002	0.0000
0.2308	0.0229	0.0004	0.0003	0.0000
0.2692	0.0226	0.0004	0.0005	0.0000
0.3077	0.0222	0.0005	0.0008	0.0000
0.3462	0.0219	0.0006	0.0011	0.0000
0.3846	0.0215	0.0007	0.0015	0.0000
0.4231	0.0212	0.0007	0.0021	0.0000
0.4615	0.0209	0.0008	0.0027	0.0000
0.5000	0.0205	0.0009	0.0034	0.0000
0.5385	0.0202	0.0010	0.0042	0.0000
0.5769	0.0199	0.0011	0.0051	0.0000
0.6154	0.0195	0.0013	0.0061	0.0000
0.6538	0.0192	0.0015	0.0072	0.0000
0.6923	0.0189	0.0017	0.0085	0.0000
0.7308	0.0186	0.0019	0.0090	0.0000
0.7692	0.0183	0.0021	0.0099	0.0000
0.8077	0.0180	0.0022	0.0114	0.0000
0.8462	0.0177	0.0024	0.0130	0.0000
0.8846	0.0173	0.0026	0.0148	0.0000
0.9231	0.0170	0.0029	0.0167	0.0000
0.9615	0.0167	0.0031	0.0187	0.0000
1.0000	0.0164	0.0033	0.0209	0.0000
1.0385	0.0161	0.0035	0.0210	0.0000
1.0769	0.0158	0.0037	0.0232	0.0000
1.1154	0.0156	0.0040	0.0257	0.0000
1.1538	0.0153	0.0042	0.0284	0.0000

1.1923	0.0150	0.0044	0.0312	0.0000
1.2308	0.0147	0.0047	0.0341	0.0000
1.2692	0.0144	0.0049	0.0372	0.0000
1.3077	0.0141	0.0052	0.0395	0.0000
1.3462	0.0138	0.0055	0.0405	0.0000
1.3846	0.0136	0.0057	0.0440	0.0000
1.4231	0.0133	0.0060	0.0476	0.0000
1.4615	0.0130	0.0063	0.0498	0.0000
1.5000	0.0128	0.0065	0.0531	0.0000
1.5385	0.0125	0.0068	0.0563	0.0000
1.5769	0.0122	0.0071	0.0592	0.0000
1.6154	0.0120	0.0073	0.0616	0.0000
1.6538	0.0117	0.0076	0.0620	0.0000
1.6923	0.0114	0.0079	0.0647	0.0000
1.7308	0.0112	0.0082	0.0673	0.0000
1.7692	0.0109	0.0084	0.0698	0.0000
1.8077	0.0107	0.0087	0.0721	0.0000
1.8462	0.0104	0.0090	0.0744	0.0000
1.8846	0.0102	0.0093	0.0778	0.0000
1.9231	0.0100	0.0097	0.0778	0.0000
1.9615	0.0097	0.0100	0.0778	0.0000
2.0000	0.0095	0.0103	0.0778	0.0000
2.0385	0.0093	0.0106	0.0778	0.0000
2.0769	0.0090	0.0109	0.0778	0.0000
2.1154	0.0088	0.0113	0.0778	0.0000
2.1538	0.0086	0.0116	0.0778	0.0000
2.1923	0.0083	0.0120	0.0778	0.0000
2.2308	0.0081	0.0123	0.0778	0.0000
2.2692	0.0079	0.0127	0.0778	0.0000
2.3077	0.0077	0.0130	0.0778	0.0000
2.3462	0.0075	0.0134	0.0778	0.0000
2.3846	0.0073	0.0138	0.0778	0.0000
2.4231	0.0070	0.0142	0.0778	0.0000
2.4615	0.0068	0.0145	0.0778	0.0000
2.5000	0.0066	0.0149	0.0778	0.0000
2.5000	0.0064	0.0149	0.0778	0.0000

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.0247	0.0149	0.0000	0.0798	0.0000
2.5385	0.0250	0.0159	0.0000	0.0798	0.0000
2.5769	0.0254	0.0169	0.0000	0.0818	0.0000
2.6154	0.0258	0.0178	0.0000	0.0838	0.0000
2.6538	0.0261	0.0188	0.0000	0.0858	0.0000
2.6923	0.0265	0.0199	0.0000	0.0877	0.0000
2.7308	0.0269	0.0209	0.0000	0.0897	0.0000
2.7692	0.0273	0.0219	0.0000	0.0917	0.0000
2.8077	0.0276	0.0230	0.0000	0.0937	0.0000
2.8462	0.0280	0.0241	0.0000	0.0957	0.0000
2.8846	0.0284	0.0251	0.0000	0.0977	0.0000
2.9231	0.0288	0.0262	0.0000	0.0997	0.0000
2.9615	0.0292	0.0274	0.0000	0.1017	0.0000
3.0000	0.0296	0.0285	0.0000	0.1037	0.0000
3.0385	0.0300	0.0296	0.1601	0.1057	0.0000
3.0769	0.0304	0.0308	0.4524	0.1077	0.0000
3.1154	0.0308	0.0320	0.8304	0.1097	0.0000
3.1538	0.0312	0.0332	1.2766	0.1117	0.0000
3.1923	0.0316	0.0344	1.7799	0.1137	0.0000

3.2308	0.0320	0.0356	2.3316	0.1157	0.0000
3.2692	0.0324	0.0368	2.9237	0.1177	0.0000
3.3077	0.0328	0.0381	3.5484	0.1197	0.0000
3.3462	0.0332	0.0393	4.1981	0.1217	0.0000
3.3846	0.0336	0.0406	4.8649	0.1236	0.0000
3.4231	0.0340	0.0419	5.5408	0.1256	0.0000
3.4615	0.0344	0.0432	6.2177	0.1276	0.0000
3.5000	0.0349	0.0446	6.8875	0.1296	0.0000

Surface West Lot Bio

Element Flows To:

Outlet 1	Outlet 2
	West Lot Bio

East Lot Bio

Bottom Length:	20.00 ft.
Bottom Width:	20.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	6
Orifice Diameter (in.):	6
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	233.247
Total Outflow (ac-ft.):	241.742
Percent Through Underdrain:	96.49

Discharge Structure

Riser Height: 0.5 ft.

Riser Diameter: 24 in.

Element Flows To:

Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.0281	0.0000	0.0000	0.0000
0.0385	0.0281	0.0001	0.0000	0.0000
0.0769	0.0278	0.0002	0.0000	0.0000
0.1154	0.0274	0.0003	0.0000	0.0000
0.1538	0.0270	0.0003	0.0001	0.0000
0.1923	0.0267	0.0004	0.0002	0.0000
0.2308	0.0263	0.0005	0.0004	0.0000
0.2692	0.0259	0.0006	0.0007	0.0000
0.3077	0.0256	0.0007	0.0011	0.0000
0.3462	0.0252	0.0008	0.0016	0.0000
0.3846	0.0249	0.0009	0.0022	0.0000
0.4231	0.0245	0.0011	0.0029	0.0000
0.4615	0.0242	0.0013	0.0038	0.0000
0.5000	0.0238	0.0015	0.0048	0.0000
0.5385	0.0235	0.0017	0.0060	0.0000
0.5769	0.0232	0.0020	0.0073	0.0000
0.6154	0.0228	0.0022	0.0087	0.0000
0.6538	0.0225	0.0024	0.0103	0.0000
0.6923	0.0222	0.0026	0.0121	0.0000
0.7308	0.0218	0.0029	0.0129	0.0000
0.7692	0.0215	0.0031	0.0141	0.0000
0.8077	0.0212	0.0034	0.0162	0.0000
0.8462	0.0209	0.0036	0.0186	0.0000
0.8846	0.0206	0.0039	0.0211	0.0000
0.9231	0.0202	0.0041	0.0238	0.0000
0.9615	0.0199	0.0044	0.0267	0.0000
1.0000	0.0196	0.0047	0.0299	0.0000
1.0385	0.0193	0.0050	0.0301	0.0000
1.0769	0.0190	0.0052	0.0332	0.0000
1.1154	0.0187	0.0055	0.0368	0.0000
1.1538	0.0184	0.0058	0.0405	0.0000

1.1923	0.0181	0.0061	0.0445	0.0000
1.2308	0.0178	0.0064	0.0487	0.0000
1.2692	0.0175	0.0067	0.0532	0.0000
1.3077	0.0172	0.0070	0.0565	0.0000
1.3462	0.0169	0.0073	0.0579	0.0000
1.3846	0.0166	0.0077	0.0628	0.0000
1.4231	0.0164	0.0080	0.0680	0.0000
1.4615	0.0161	0.0083	0.0734	0.0000
1.5000	0.0158	0.0086	0.0790	0.0000
1.5385	0.0155	0.0089	0.0850	0.0000
1.5769	0.0152	0.0092	0.0911	0.0000
1.6154	0.0150	0.0096	0.0932	0.0000
1.6538	0.0147	0.0099	0.0976	0.0000
1.6923	0.0144	0.0102	0.1042	0.0000
1.7308	0.0142	0.0106	0.1111	0.0000
1.7692	0.0139	0.0109	0.1111	0.0000
1.8077	0.0137	0.0112	0.1111	0.0000
1.8462	0.0134	0.0116	0.1111	0.0000
1.8846	0.0131	0.0120	0.1111	0.0000
1.9231	0.0129	0.0123	0.1111	0.0000
1.9615	0.0126	0.0127	0.1111	0.0000
2.0000	0.0124	0.0131	0.1111	0.0000
2.0385	0.0121	0.0134	0.1111	0.0000
2.0769	0.0119	0.0138	0.1111	0.0000
2.1154	0.0117	0.0142	0.1111	0.0000
2.1538	0.0114	0.0146	0.1111	0.0000
2.1923	0.0112	0.0150	0.1111	0.0000
2.2308	0.0110	0.0154	0.1111	0.0000
2.2692	0.0107	0.0158	0.1111	0.0000
2.3077	0.0105	0.0162	0.1111	0.0000
2.3462	0.0103	0.0167	0.1111	0.0000
2.3846	0.0100	0.0171	0.1111	0.0000
2.4231	0.0098	0.0175	0.1111	0.0000
2.4615	0.0096	0.0180	0.1111	0.0000
2.5000	0.0094	0.0184	0.1111	0.0000
2.5000	0.0092	0.0184	0.1111	0.0000

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.0281	0.0184	0.0000	0.1140	0.0000
2.5385	0.0285	0.0195	0.0000	0.1140	0.0000
2.5769	0.0289	0.0206	0.0000	0.1168	0.0000
2.6154	0.0292	0.0217	0.0000	0.1197	0.0000
2.6538	0.0296	0.0228	0.0000	0.1225	0.0000
2.6923	0.0300	0.0240	0.0000	0.1254	0.0000
2.7308	0.0304	0.0252	0.0000	0.1282	0.0000
2.7692	0.0308	0.0263	0.0000	0.1311	0.0000
2.8077	0.0312	0.0275	0.0000	0.1339	0.0000
2.8462	0.0316	0.0287	0.0000	0.1368	0.0000
2.8846	0.0320	0.0300	0.0000	0.1396	0.0000
2.9231	0.0323	0.0312	0.0000	0.1425	0.0000
2.9615	0.0327	0.0324	0.0000	0.1453	0.0000
3.0000	0.0331	0.0337	0.0000	0.1481	0.0000
3.0385	0.0336	0.0350	0.1601	0.1510	0.0000
3.0769	0.0340	0.0363	0.4524	0.1538	0.0000
3.1154	0.0344	0.0376	0.8304	0.1567	0.0000
3.1538	0.0348	0.0389	1.2766	0.1595	0.0000
3.1923	0.0352	0.0403	1.7799	0.1624	0.0000

3.2308	0.0356	0.0416	2.3316	0.1652	0.0000
3.2692	0.0360	0.0430	2.9237	0.1681	0.0000
3.3077	0.0364	0.0444	3.5484	0.1709	0.0000
3.3462	0.0369	0.0458	4.1981	0.1738	0.0000
3.3846	0.0373	0.0472	4.8649	0.1766	0.0000
3.4231	0.0377	0.0487	5.5408	0.1795	0.0000
3.4615	0.0382	0.0502	6.2177	0.1823	0.0000
3.5000	0.0386	0.0516	6.8875	0.1852	0.0000

Surface East Lot Bio

Element Flows To:

Outlet 1	Outlet 2
	East Lot Bio

West Lot Bio 2

Bottom Length:	15.30 ft.
Bottom Width:	10.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	6
Orifice Diameter (in.):	2.2
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	100.139
Total Outflow (ac-ft.):	106.251
Percent Through Underdrain:	94.25

Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 24 in.
Element Flows To:
Outlet 1 Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0174	0.0000	0.0000	0.0000
0.0385	0.0174	0.0000	0.0000	0.0000
0.0769	0.0171	0.0001	0.0000	0.0000
0.1154	0.0168	0.0001	0.0000	0.0000
0.1538	0.0165	0.0001	0.0000	0.0000
0.1923	0.0162	0.0002	0.0001	0.0000
0.2308	0.0160	0.0002	0.0002	0.0000
0.2692	0.0157	0.0002	0.0003	0.0000
0.3077	0.0154	0.0003	0.0004	0.0000
0.3462	0.0151	0.0004	0.0006	0.0000
0.3846	0.0149	0.0005	0.0008	0.0000
0.4231	0.0146	0.0006	0.0011	0.0000
0.4615	0.0143	0.0007	0.0015	0.0000
0.5000	0.0141	0.0008	0.0018	0.0000
0.5385	0.0138	0.0009	0.0023	0.0000
0.5769	0.0135	0.0010	0.0028	0.0000
0.6154	0.0133	0.0011	0.0033	0.0000
0.6538	0.0130	0.0012	0.0040	0.0000
0.6923	0.0128	0.0013	0.0046	0.0000
0.7308	0.0125	0.0014	0.0049	0.0000
0.7692	0.0123	0.0015	0.0054	0.0000
0.8077	0.0120	0.0016	0.0062	0.0000
0.8462	0.0118	0.0018	0.0071	0.0000
0.8846	0.0115	0.0019	0.0081	0.0000
0.9231	0.0113	0.0020	0.0091	0.0000
0.9615	0.0111	0.0021	0.0102	0.0000
1.0000	0.0108	0.0023	0.0114	0.0000
1.0385	0.0106	0.0024	0.0115	0.0000
1.0769	0.0104	0.0026	0.0127	0.0000
1.1154	0.0101	0.0027	0.0141	0.0000
1.1538	0.0099	0.0029	0.0155	0.0000

1.1923	0.0097	0.0030	0.0170	0.0000
1.2308	0.0095	0.0032	0.0186	0.0000
1.2692	0.0093	0.0033	0.0203	0.0000
1.3077	0.0091	0.0035	0.0216	0.0000
1.3462	0.0088	0.0037	0.0221	0.0000
1.3846	0.0086	0.0038	0.0240	0.0000
1.4231	0.0084	0.0040	0.0260	0.0000
1.4615	0.0082	0.0042	0.0281	0.0000
1.5000	0.0080	0.0044	0.0302	0.0000
1.5385	0.0078	0.0045	0.0325	0.0000
1.5769	0.0076	0.0047	0.0349	0.0000
1.6154	0.0074	0.0049	0.0357	0.0000
1.6538	0.0072	0.0051	0.0373	0.0000
1.6923	0.0071	0.0053	0.0399	0.0000
1.7308	0.0069	0.0054	0.0425	0.0000
1.7692	0.0067	0.0056	0.0425	0.0000
1.8077	0.0065	0.0058	0.0425	0.0000
1.8462	0.0063	0.0060	0.0425	0.0000
1.8846	0.0061	0.0062	0.0425	0.0000
1.9231	0.0060	0.0065	0.0425	0.0000
1.9615	0.0058	0.0067	0.0425	0.0000
2.0000	0.0056	0.0069	0.0425	0.0000
2.0385	0.0055	0.0071	0.0425	0.0000
2.0769	0.0053	0.0073	0.0425	0.0000
2.1154	0.0051	0.0076	0.0425	0.0000
2.1538	0.0050	0.0078	0.0425	0.0000
2.1923	0.0048	0.0080	0.0425	0.0000
2.2308	0.0047	0.0083	0.0425	0.0000
2.2692	0.0045	0.0085	0.0425	0.0000
2.3077	0.0044	0.0088	0.0425	0.0000
2.3462	0.0042	0.0090	0.0425	0.0000
2.3846	0.0041	0.0093	0.0425	0.0000
2.4231	0.0039	0.0096	0.0425	0.0000
2.4615	0.0038	0.0098	0.0425	0.0000
2.5000	0.0036	0.0101	0.0425	0.0000
2.5000	0.0035	0.0101	0.0425	0.0000

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.0174	0.0101	0.0000	0.0436	0.0000
2.5385	0.0177	0.0108	0.0000	0.0436	0.0000
2.5769	0.0180	0.0115	0.0000	0.0447	0.0000
2.6154	0.0183	0.0122	0.0000	0.0458	0.0000
2.6538	0.0186	0.0129	0.0000	0.0469	0.0000
2.6923	0.0189	0.0136	0.0000	0.0479	0.0000
2.7308	0.0192	0.0143	0.0000	0.0490	0.0000
2.7692	0.0195	0.0151	0.0000	0.0501	0.0000
2.8077	0.0198	0.0158	0.0000	0.0512	0.0000
2.8462	0.0201	0.0166	0.0000	0.0523	0.0000
2.8846	0.0204	0.0174	0.0000	0.0534	0.0000
2.9231	0.0208	0.0182	0.0000	0.0545	0.0000
2.9615	0.0211	0.0190	0.0000	0.0556	0.0000
3.0000	0.0214	0.0198	0.0000	0.0567	0.0000
3.0385	0.0217	0.0206	0.1601	0.0578	0.0000
3.0769	0.0221	0.0215	0.4524	0.0588	0.0000
3.1154	0.0224	0.0223	0.8304	0.0599	0.0000
3.1538	0.0227	0.0232	1.2766	0.0610	0.0000
3.1923	0.0231	0.0241	1.7799	0.0621	0.0000

3.2308	0.0234	0.0250	2.3316	0.0632	0.0000
3.2692	0.0237	0.0259	2.9237	0.0643	0.0000
3.3077	0.0241	0.0268	3.5484	0.0654	0.0000
3.3462	0.0244	0.0277	4.1981	0.0665	0.0000
3.3846	0.0248	0.0287	4.8649	0.0676	0.0000
3.4231	0.0251	0.0296	5.5408	0.0687	0.0000
3.4615	0.0255	0.0306	6.2177	0.0697	0.0000
3.5000	0.0258	0.0316	6.8875	0.0708	0.0000

Surface st Lot Bio 2

Element Flows To:

Outlet 1	Outlet 2
	West Lot Bio 2

Disclaimer

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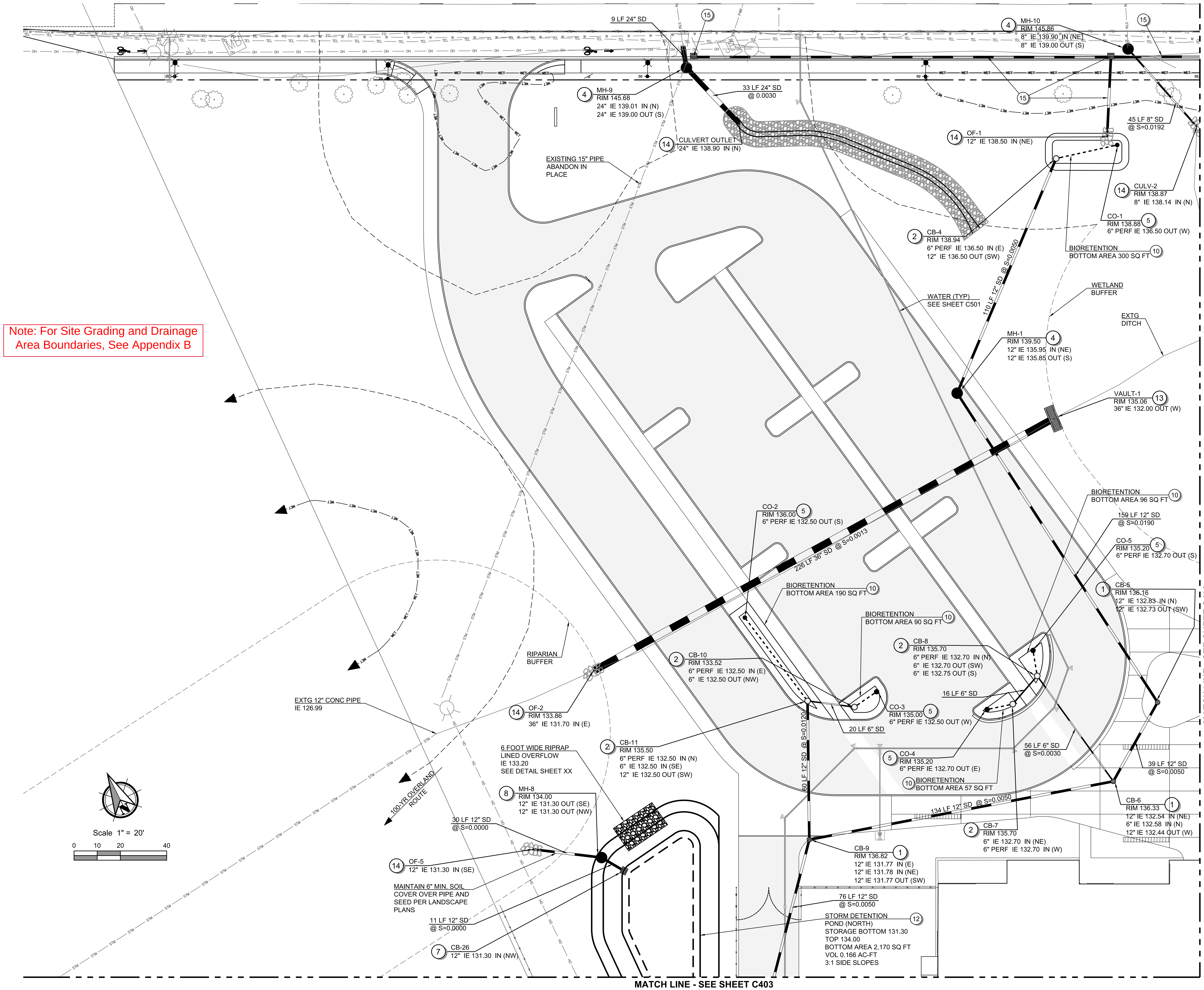
Appendix D
Stormwater Plans



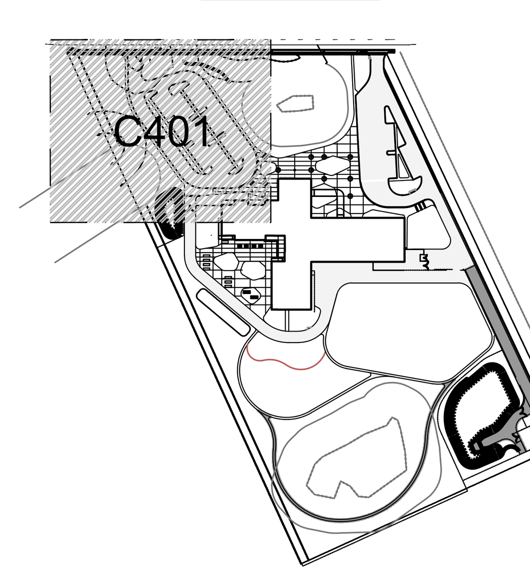
GENERAL NOTES

1. SEE SHEET xxxxx FOR ABBRREVIATIONS AND MASTER LEGEND. SEE SHEET xxxxx FOR GENERAL NOTES.
2. CONTRACTOR TO COORDINATE ROOF DRAIN CONNECTIONS TO CONNECT TO STORM SYSTEM AT A MINIMUM 2% SLOPE.

STORM SEWER NOTES:

1. INSTALL 18" PVC CATCH BASIN WITH 18" DROP-IN GRATE, SEE DETAIL SHEET xxxxx.
2. INSTALL18" PVC CATCH BASIN WITH 18" DOME GRATE, SEE SHEET xxxxxx FOR STRUCTURE AND DOME DETAILS.
3. INSTALL 24" PVC CATCH BASIN WITH 24" NON-SLIP SOLID LID, SEE DETAIL SHEET xxxxxx.
4. INSTALL 48-IN STORM SEWER MANHOLE, SEE DETAIL SHEET xxxxx.
5. INSTALL STORM SEWER CLEANOUT, SEE DETAIL SHEET xxxx.
6. INSTALL CATCH BASIN TYPE 1 WITH RECTANGULAR HERRINGBONE GRATE, SEE DETAIL SHEET xxxx.
7. INSTALL DITCH INLET, SEE DETAIL SHEET xxxxx.
8. INSTALL FLOW CONTROL STRUCTURE, SEE DETAIL SHEET xxxxx.
9. CONSTRUCT GRAVEL OVERFLOW SPILLWAY, SEE POND DETAIL SHEET xxxxx FOR DETAILS.
10. INSTALL BIORETENTION FACILITY, SEE DETAIL SHEET xxxx.
11. DEPRESSED LANDSCAPE AREA (SEE LANDSCAPE PLANS).
12. STORMWATER DETENTION POND. SEE TYPICAL SECTION SHEET XX.
13. INSTALL SLOPED BYPASS INTAKE. SEE DETAIL SHEET xxxx.
14. OUTFALL PROTECTION, SEE DETAIL SHEET xxxx.
15. SEE FRONTAGE IMPROVEMENTS SHEETS C701 - C703.
16. ROOF DRAIN CONNECTION.
17. FRENCH DRAIN, SEE DETAIL SHEET xxxx.

KEYMAP



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CHECKED	EAP
DATE	10-9-2018

STORMWATER PLANS

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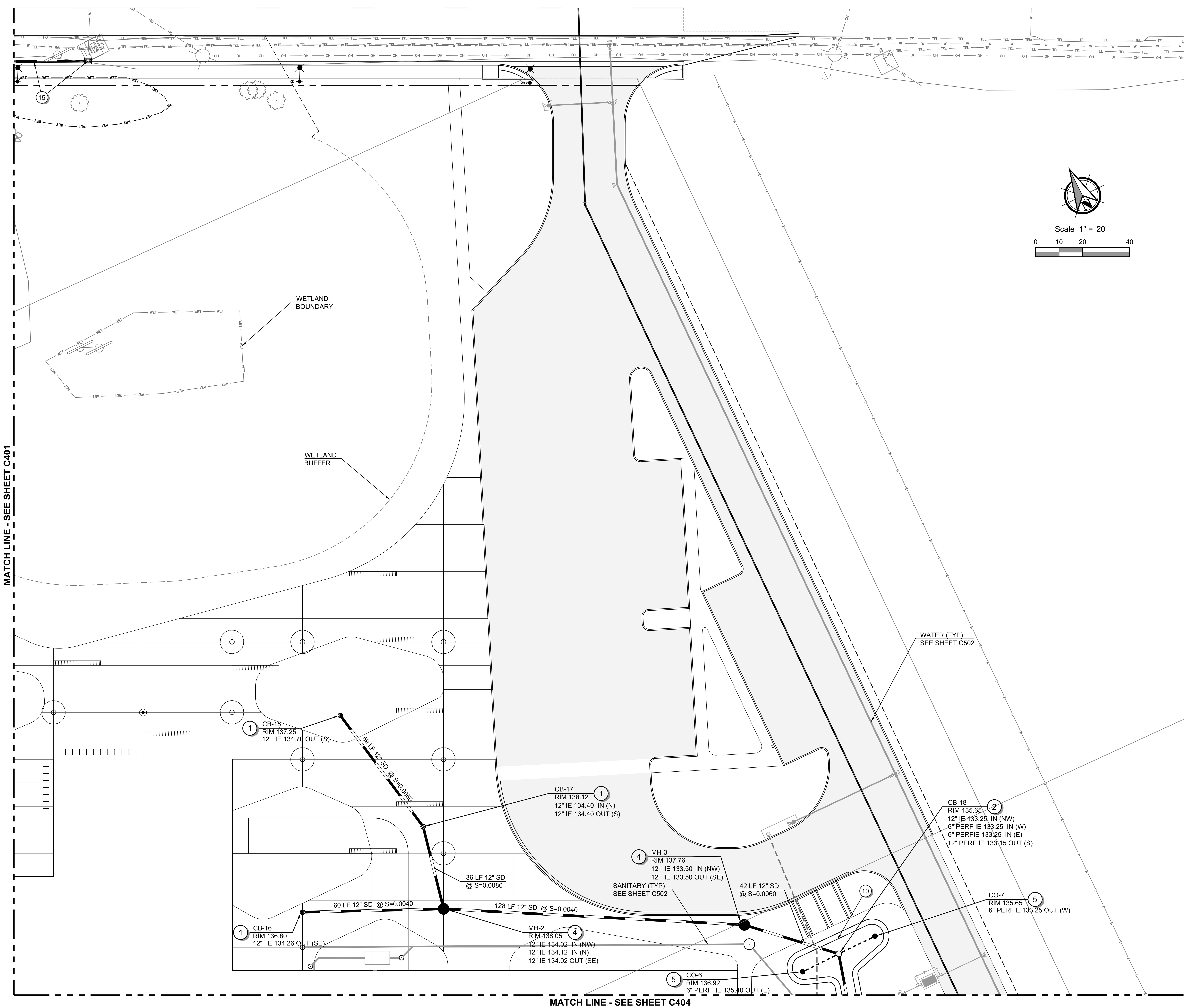
C401



GENERAL NOTES

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STORM SEWER NOTES:

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5. INSTALL STORM SEWER CLEANOUT, SEE DETAIL SHEET xxxx.
6. INSTALL CATCH BASIN TYPE 1 WITH RECTANGULAR HERRINGBONE GRATE, SEE DETAIL SHEET xxxx.
7. INSTALL DITCH INLET, SEE DETAIL SHEET xxxxx.
8. INSTALL FLOW CONTROL STRUCTURE, SEE DETAIL SHEET xxxxx.
9. CONSTRUCT GRAVEL OVERFLOW SPILLWAY, SEE POND DETAIL SHEET xxxxx FOR DETAILS.
10. INSTALL BIORETENTION FACILITY, SEE DETAIL SHEET xxxx.
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12. STORMWATER DETENTION POND. SEE TYPICAL SECTION SHEET XX.
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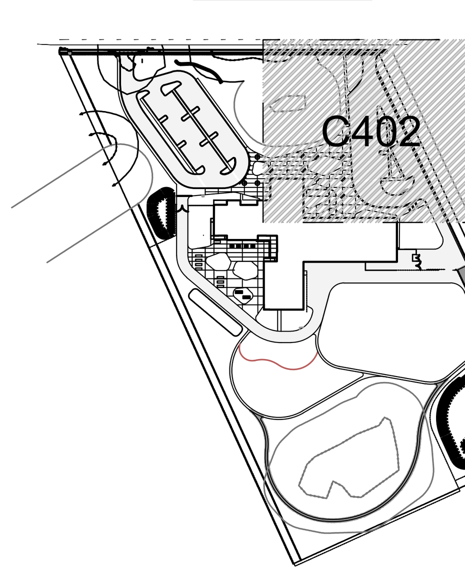
14. OUTFALL PROTECTION, SEE DETAIL SHEET xxxx.
15. SEE FRONTAGE IMPROVEMENTS SHEETS C701 - C703.
16. ROOF DRAIN CONNECTION.
17. FRENCH DRAIN, SEE DETAIL SHEET xxxx.

KEYMAP



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STORMWATER PLANS

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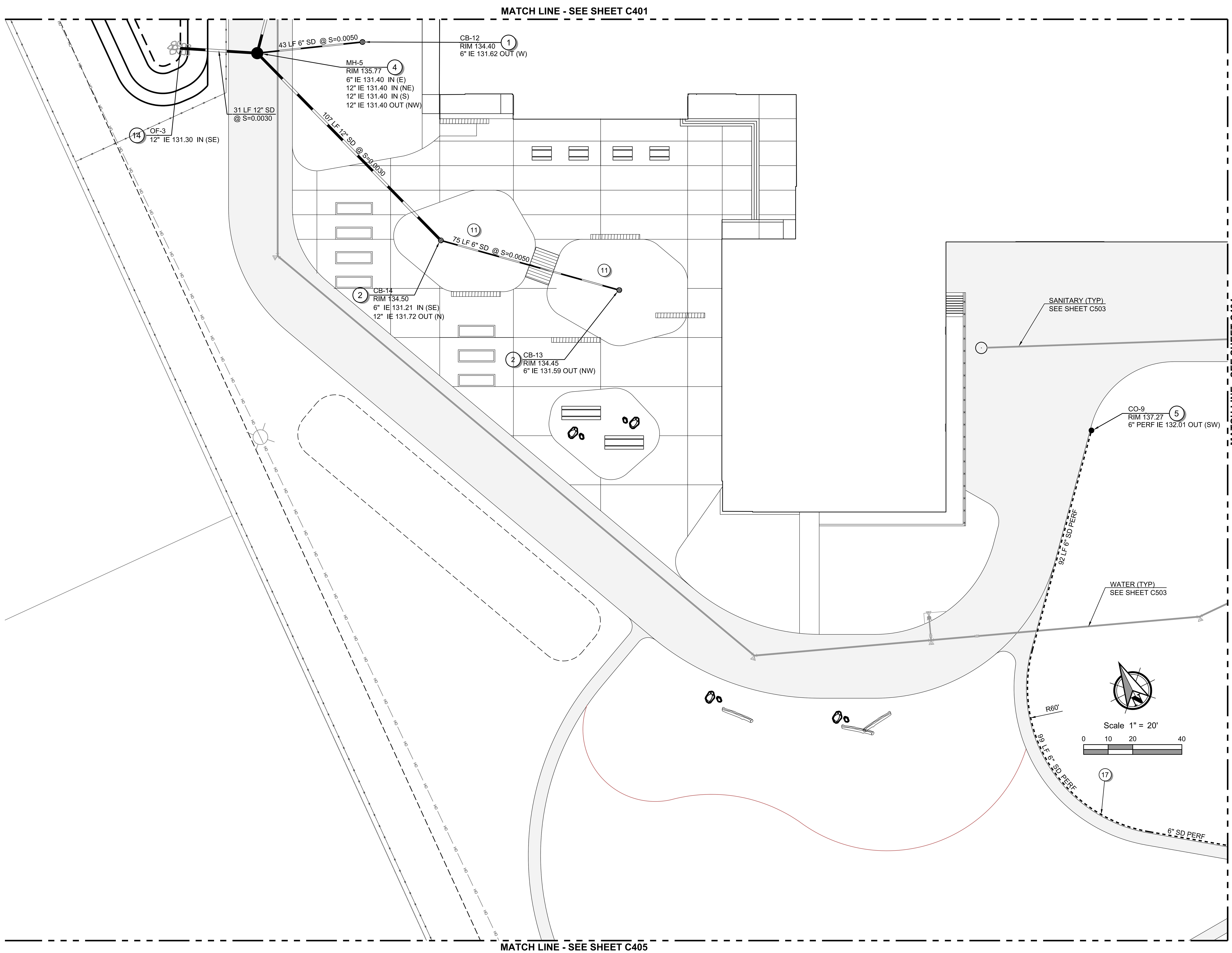

GENERAL NOTES

1. SEE SHEET xxxxx FOR ABBRREVIATIONS AND MASTER LEGEND. SEE SHEET xxxxx FOR GENERAL NOTES.
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STORM SEWER NOTES:

1. INSTALL 18" PVC CATCH BASIN WITH 18" DROP-IN GRATE, SEE DETAIL SHEET xxxxx.
2. INSTALL18" PVC CATCH BASIN WITH 18" DOME GRATE, SEE SHEET xxxxxx FOR STRUCTURE AND DOME DETAILS.
3. INSTALL 24" PVC CATCH BASIN WITH 24" NON-SLIP SOLID LID, SEE DETAIL SHEET xxxxxx.
4. INSTALL 48-IN STORM SEWER MANHOLE, SEE DETAIL SHEET xxxxx.
5. INSTALL STORM SEWER CLEANOUT, SEE DETAIL SHEET xxxx.
6. INSTALL CATCH BASIN TYPE 1 WITH RECTANGULAR HERRINGBONE GRATE, SEE DETAIL SHEET xxxx.
7. INSTALL DITCH INLET, SEE DETAIL SHEET xxxxx.
8. INSTALL FLOW CONTROL STRUCTURE, SEE DETAIL SHEET xxxxx.
9. CONSTRUCT GRAVEL OVERFLOW SPILLWAY, SEE POND DETAIL SHEET xxxxx FOR DETAILS.
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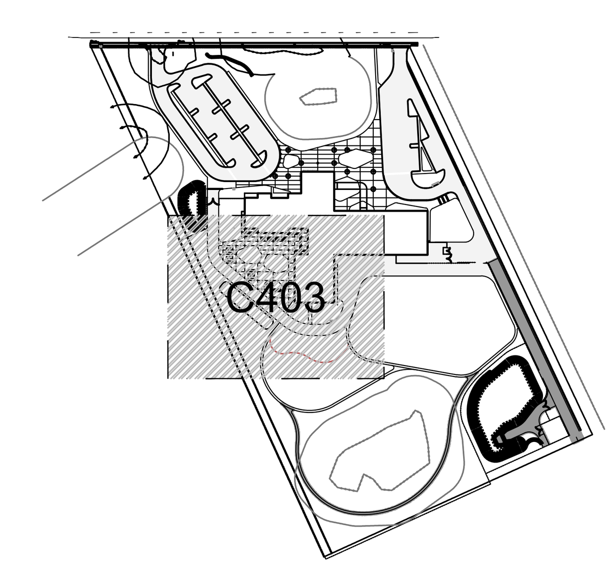
17. FRENCH DRAIN, SEE DETAIL SHEET xxxx.

KEYMAP



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STORMWATER PLANS

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REVISIONS

GENERAL NOTES

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2. CONTRACTOR TO COORDINATE ROOF DRAIN CONNECTIONS TO CONNECT TO STORM SYSTEM AT A MINIMUM 2% SLOPE.

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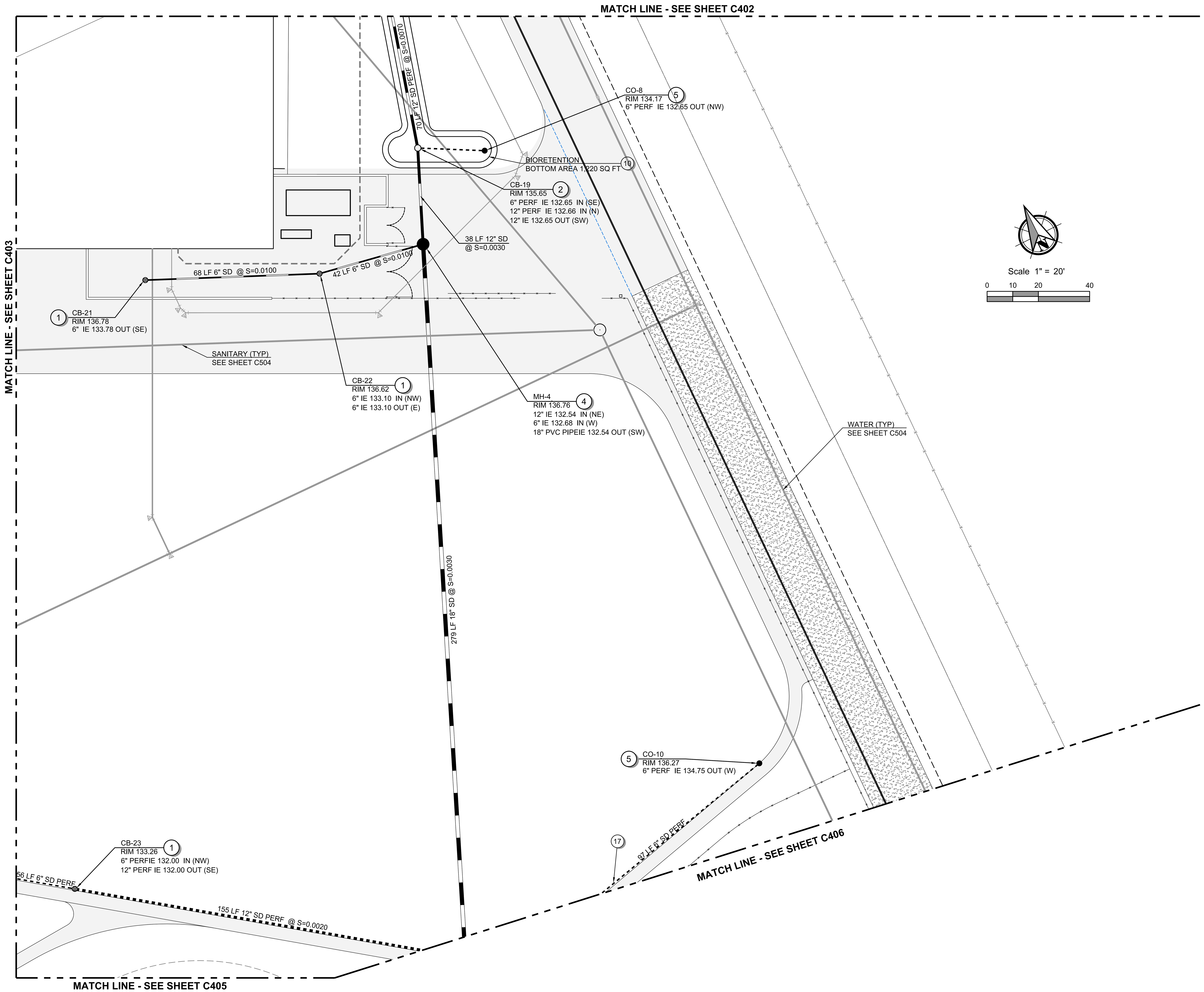

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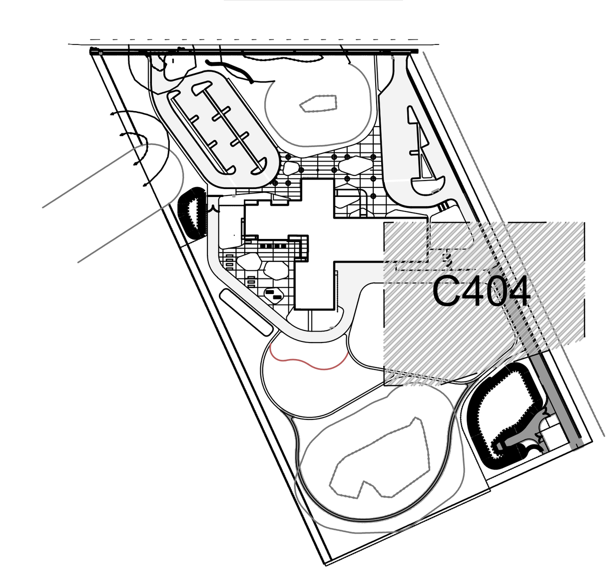

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ELISSA AKI PETERS
STATE OF WASHINGTON
45380
REGISTERED PROFESSIONAL ENGINEER
PRELIMINARY

LA CENTER SCHOOL DISTRICT
LA CENTER NEW MIDDLE SCHOOL
725 HIGHLAND ROAD, LA CENTER, WA 98629

LA CENTER School District

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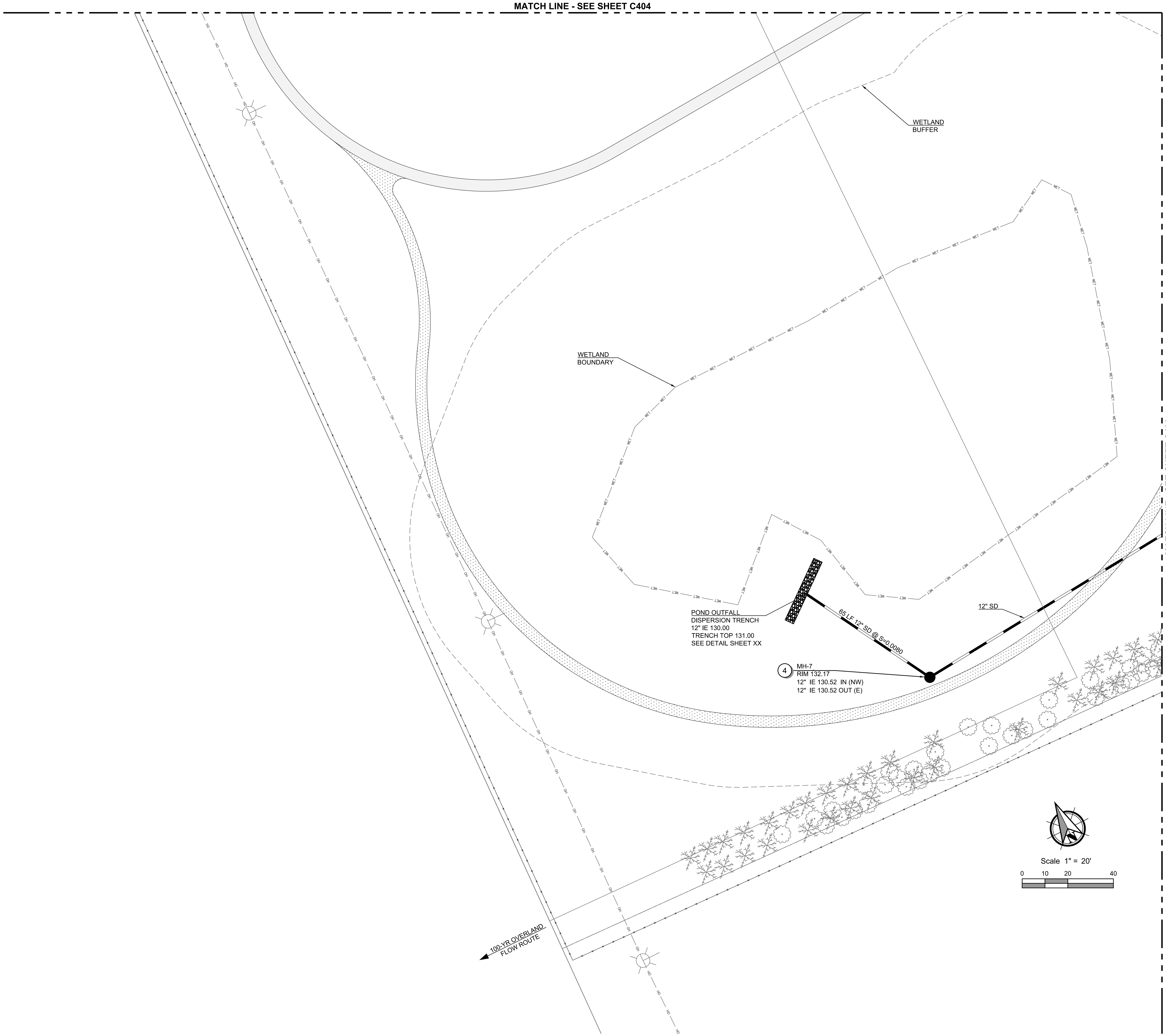
NAC NO	121-18009
DRAWN	JAB/JRM
CHECKED	EAP
DATE	10-9-2018

STORMWATER PLANS

DD SUBMITTAL

C404



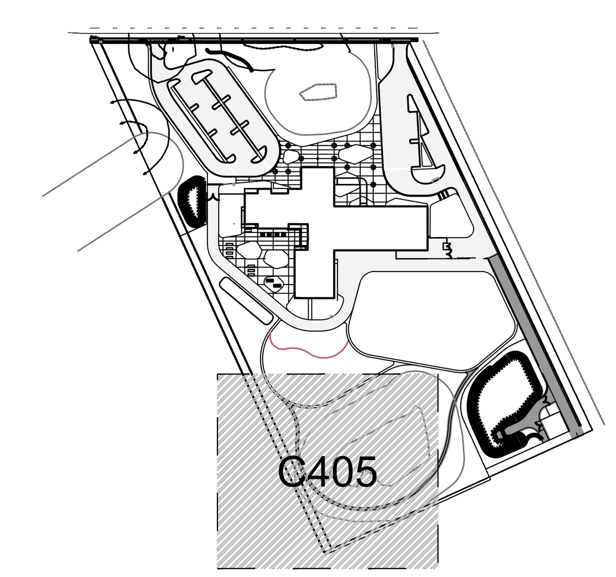
GENERAL NOTES

1. SEE SHEET xxxxx FOR ABBRREVIATIONS AND MASTER LEGEND. SEE SHEET xxxxx FOR GENERAL NOTES.
2. CONTRACTOR TO COORDINATE ROOF DRAIN CONNECTIONS TO CONNECT TO STORM SYSTEM AT A MINIMUM 2% SLOPE.

STORM SEWER NOTES:

1. INSTALL 18" PVC CATCH BASIN WITH 18" DROP-IN GRATE, SEE DETAIL SHEET xxxxx.
2. INSTALL18" PVC CATCH BASIN WITH 18" DOME GRATE, SEE SHEET xxxxxx FOR STRUCTURE AND DOME DETAILS.
3. INSTALL 24" PVC CATCH BASIN WITH 24" NON-SLIP SOLID LID, SEE DETAIL SHEET xxxxxx.
4. INSTALL 48-IN STORM SEWER MANHOLE, SEE DETAIL SHEET xxxxx.
5. INSTALL STORM SEWER CLEANOUT, SEE DETAIL SHEET xxxx.
6. INSTALL CATCH BASIN TYPE 1 WITH RECTANGULAR HERRINGBONE GRATE, SEE DETAIL SHEET xxxx.
7. INSTALL DITCH INLET, SEE DETAIL SHEET xxxxx.
8. INSTALL FLOW CONTROL STRUCTURE, SEE DETAIL SHEET xxxxx.
9. CONSTRUCT GRAVEL OVERFLOW SPILLWAY, SEE POND DETAIL SHEET xxxxx FOR DETAILS.
10. INSTALL BIORETENTION FACILITY, SEE DETAIL SHEET xxxx.
11. DEPRESSED LANDSCAPE AREA (SEE LANDSCAPE PLANS).
12. STORMWATER DETENTION POND. SEE TYPICAL SECTION SHEET XX.
13. INSTALL SLOPED BYPASS INTAKE. SEE DETAIL SHEET xxxx.
14. OUTFALL PROTECTION, SEE DETAIL SHEET xxxx.
15. SEE FRONTAGE IMPROVEMENTS SHEETS C701 - C703.
16. ROOF DRAIN CONNECTION.
17. FRENCH DRAIN, SEE DETAIL SHEET xxxx.

KEYMAP



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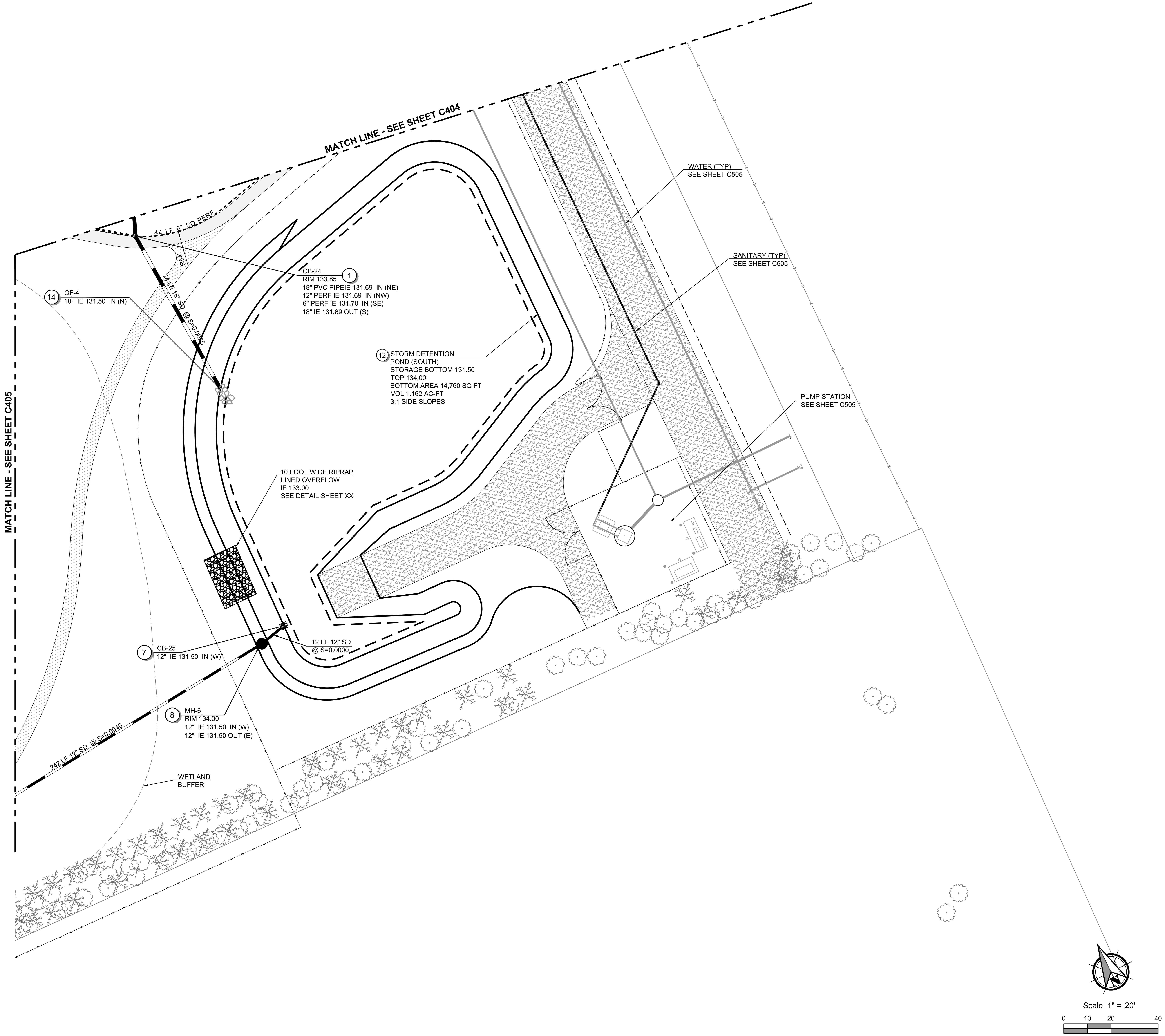

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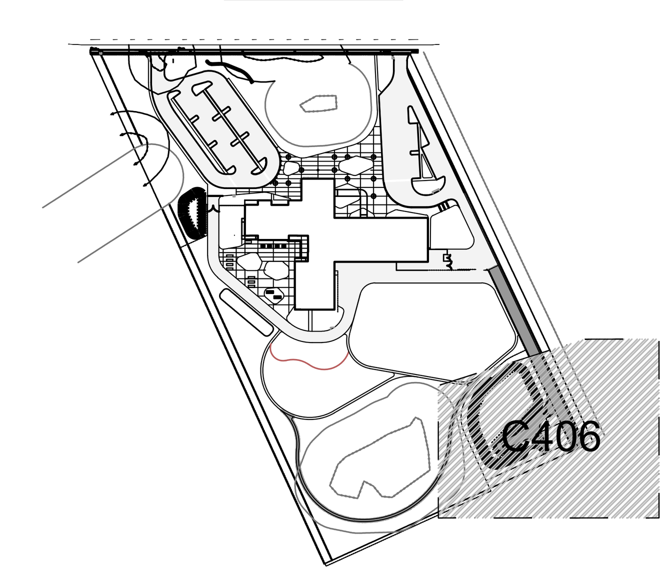
KEYMAP



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STORMWATER PLANS

DD SUBMITTAL

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Appendix E
Special Site Studies and Reports

N.E. Lockwood Creek Road
Wetland Delineation and Assessment
La Center, Washington

Prepared for:
La Center School District
725 Highland Road
La Center, WA 98629

Prepared by:
Olson Environmental, LLC
222 E. Evergreen Blvd.
Vancouver, WA 98660
(360) 693-4555

November 22, 2017

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION

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WETLAND DELINEATION AND ASSESSMENT

Project:	**NE Lockwood Creek Road Properties**
Applicant:	**La Center School District**
Location:	**South of NE Lockwood Creek Road, La Center, Washington**
Legal Description:	**NE & SE ¼s of Sec. 02, T04N, R01E, W. M., Clark County**
Serial Number(s):	**209118-000 (5.58 ac.), 209119-000 (7.91 ac.) & 209120-000 (9.78 ac.)**
Study Area Size:	**23.27 acres**
Jurisdiction:	**Currently Clark County/Soon Annexed to City of La Center**
Watershed:	**East Fork of the Lewis River**
Zoning:	**R1-75**
ComPlan:	**UL**
Assessment by:	**Kevin Grosz, PWS**
Site Visit(s):	**November 20, 2017**
Report Date:	**November 22, 2017**

1.0 INTRODUCTION

This report details the results of a wetland delineation and assessment conducted by Olson Environmental, LLC (OE) for the La Center School District. The study area is located south of NE Lockwood Creek Road on the east edge of La Center, Washington (Fig. 1). This report identifies the extent of any wetlands and associated buffers found within the study area as defined and regulated by the US Army Corps of Engineers (USACE) and the Washington Department of Ecology (Ecology) under sections 401 and 404 of the Clean Water Act, and locally by the City of La Center under the City's Critical Areas Ordinance (18.300.090(6) – Wetlands).

Currently, the approximately 23 acre study area is vacant land. The northern two parcels appear to be used for domestic livestock grazing and/or hayland. The southern tax lot appears to have been used as a chicken farm that has since been abandoned. The majority of this area southern parcel contains impervious surfaces. Generally, the site is relatively flat and gently slopes from north to south (Fig. 2).

2.0 WETLAND DELINEATION AND ASSESSMENT METHODS

The wetland delineation was conducted according to the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region (USACE, 2010.) hereafter, referred to as the manual. According to the manual, jurisdictional wetlands are defined as:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal*

circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Prior to the on-site investigations, a review of existing information related to determination of wetland boundaries was conducted. This review included the Clark County LiDAR topographic data (Fig. 2), National Wetland Inventory (NWI) data and Clark County Wetland Inventory (LWI) data (Fig. 3), NRCS Clark County Soil Survey data (Fig. 4), and aerial photographs.

The manual uses three parameters in making wetland determinations: hydrophytic vegetation, hydric soils, and wetland hydrology. Except in certain situations defined in the manual, evidence of a minimum of one positive indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland determination.

Hydrophytic vegetation are plants that due to morphological, physiological, and/or reproductive adaptations, have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions. Hydrophytic vegetation is present when more than 50 percent of the dominant species have an indicator status of OBL, FACW, and/or FAC. Wetland indicator status ratings and their ordinal rating categories, based on ecological descriptions:

Indicator Status (abbreviation) Ecological Description*
Obligate (OBL) Almost always is a hydrophyte, rarely in uplands
Facultative Wetland (FACW) Usually is a hydrophyte but occasionally found in uplands
Facultative (FAC) Commonly occurs as either a hydrophyte or nonhydrophyte
Facultative Upland (FACU) Occasionally is a hydrophyte, but usually occurs in uplands
Upland (UPL) Rarely is a hydrophyte, almost always in uplands.
*Source: Lichvar and Minkin (2008)

Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. The presence or absence of hydric soils is determined in the field by digging soil pits to a depth of a minimum of 16 inches and examining the soil for hydric soil indicators. Organic soils such as peats and mucks are considered hydric soils. Mineral hydric soils are generally either gleyed or have redox concentrations and/or low matrix chroma immediately below the A-horizon or 10 inches (whichever is shallower). Soil colors are determined using the Munsell Soil Color Chart (Munsell Color System 2009).

Wetland hydrology is present when an area is inundated or saturated to the surface for at least 5 percent of the growing season. The growing season is defined as the portion of the year when soil temperature at 19.7 inches below the soil surface is greater than biological zero (5 degrees C). The site was examined for standing water and/or saturated soils, which serve as primary indicators of wetland hydrology. The area was also checked for other wetland hydrologic characteristics such as watermarks, drift lines, wetland drainage patterns, and morphological plant adaptations.

3.0 SITE SPECIFIC METHODS

TRC conducted the onsite wetland delineation and assessment on November 20, 2017, using the methodology found in the Regional Supplement to the Manual (USACE 2010). In addition, applicable guidance and any supporting technical guidance documents issued by the USACE, Ecology, and Clark County GIS were also utilized.

The entire site was first traversed by foot to observe any visible wetland conditions. Once the general location of the wetland boundaries were identified, paired data plots were taken in areas that represented the conditions of the uplands and wetlands, respectively. One and ten meter radius plots were chosen in a uniform topographic position that was representative of a single plant community. The paired plots were located approximately 5 - 10 feet apart to minimize the margin of error. Soils at each sample plot were typically inspected to a depth of 16 inches (or more) to determine the presence or absence of hydric soil characteristics and/or wetland hydrology. Data sheets for the sample plots are attached in Appendix A.

The wetland boundaries were determined based on the presence of hydric soils, the presence of wetland hydrology (i.e. oxidized rhizospheres along living roots, soil saturation), and a dominance of hydrophytic vegetation. It should be noted that only paired plots were recorded in the field, however, numerous unrecorded plots were dug to confirm wetland boundaries. The on-site wetlands were classified according the USFWS classification system (Cowardin et al. 1979) and the Hydrogeomorphic (HGM) Classification system (Adamus et al. 2001).

4.0 RESULTS AND DISCUSSION

According to the NWI/LWI wetlands map (Fig. 3) wetlands potentially occur in the southeast corner of the property. It should be noted that these maps are created through aerial photograph and topographic map interpretation and are not intended to represent the extent of jurisdictional wetlands. There may be unmapped wetland and waters subject to regulation and all wetlands and waters boundary mapping is approximate. In all cases, actual field conditions determine the presence, absence and boundaries of wetlands and waters.

Two soil types are mapped on the site (Fig. 4):

> ***Gee Silt Loam, 0 to 8 percent slopes (GeB).*** Gee soils are deep, moderately well drained soils formed in the old alluvium deposited by the Columbia River. They are moderately permeable in the surface layer and very slow in the subsurface, surface runoff is slow and the erosion hazard is slight. In a typical profile, these soils are a very dark grayish brown (10YR 3/2) silt loam in the upper nine inches. Below this to a depth of 14 inches they are a dark

grayish brown (10YR 4/2) silt loam with yellowish brown (10YR 5/6) concentrations. It is listed as a **non-hydric** soil.

Odne silt loam, 0 to 5 percent slopes (OdB). This soil generally occurs in concave areas in drainageways or depressions within areas of Gee soils. In most places the slope is 1 to 2 percent. In a typical profile, the surface layer is about 10 inches thick. It is mottled, dark-gray heavy silt loam in the upper part. The subsurface layer is firm, mottled, gray silt loam about nine inches thick. The next eight inches is very firm, mottled, dark-gray silty clay loam that overlies six inches of firm, mottled, dark-gray clay loam. This soil is poorly drained and very slowly permeable. A high water table is common in winter. It is classified as a **hydric soil** according to the Clark County hydric soils list.

4.1 WETLANDS (FIG. 5)

Two wetlands were identified and delineated within the study area as shown in Figure 5. A description of each of these wetlands follows:

<u>Wetland A</u> – occurs in the southwestern portion of the study area (Fig. 5). The wetland is an open grassland plant community that was more than likely seeded with a pasture/hay mixture. The wetland plant community is predominantly colonial bent grass (*Agrostis capillaris* - FAC), spreading bentgrass (*A. stolonifera* – FAC), velvet grass (*Holcus lanatus* – FAC), reed canarygrass (*Phalaris arundinacea* – FACW), tall false rye grass (*Schedonorus arundinaceus* - FAC), and sweet vernal grass (*Anthoxanthum odoratum* – FACU). Soils from 0 to 5 inches area a very dark grayish brown (10YR 3/2) silt loam. Below this to a depth of >16 inches the soil is a very dark gray (10YR 3/1) silty clay loam with dark reddish brown (5YR 3/3) concentrations. Wetland hydrology was indicated by the presence of surface water (1" depth) and soil saturation to the surface. The wetland is a depressional HGM class wetland. Table 1 outlines the functional assessment for this wetland.

<u>Wetland B</u> – is located in the northern portion of the property (Fig 5). Vegetation in Wetland B consists of reed canarygrass, spreading bent grass, colonial bent grass, velvet grass, and soft rush (*Juncus effusus* – FACW). Soils are a dark gray (10YR 4/1) silt loam with dark reddish brown (10YR 3/3) concentrations to a depth of >16 inches. Wetland hydrology was indicated by water and soil saturation at the surface. It appears that portions of this part of the study area may contain drain tile that are artificially draining the area. This is a slope HGM class wetland. Table 1 outlines the functional assessment for this wetland.

4.2 WETLAND FUNCTIONAL ASSESSMENT

The delineated wetlands have been assessed using the Washington State Wetland Rating System for Western Washington (Hruby Update 2014). The system was designed to differentiate between wetlands based on their sensitivity to disturbance, their significance, their rarity, our ability to replace them, and the functions they provide. Through a series of questions, the wetland rating system generates a number for water quality functions, hydrologic functions, and habitat function, which creates as overall wetland function score. Based on the total score, the wetland is categorized as a Category I, II, III, or IV wetland. Table 1 below summarizes the wetland type, total score for functions, and category of wetlands identified within the study area.

Table 1. Wetland Function Rating

Wetland	Wetland Type	Water Quality Functions	Hydrologic Functions	Habitat Functions	Total Score	Wetland Category
A	Depressional	6	5	5	16	III
B	Slope	6	5	5	16	III

4.3 NON-WETLANDS

The non-wetland portions of the property on the northern two parcels are primarily open grassland that appears to be used primarily as hayland and may also be used to graze domestic livestock. Vegetation in the upland areas is similar to the wetland vegetation and is more than likely a pasture seed mixture that has been sown for the pasture/hay uses. A tree row separates the northern two parcels from the southern parcel. Vegetation in the tree row consists primarily of Douglas-fir (*Pseudotsugi menziesii* – FAC) and black cottonwood (*Populus balsamifera* – FAC). A shrub row runs along the west property line. Vegetation in this area is primarily hazelnut (*Corylus cornuta* – FACU) and willow (*Salix* spp. – FAC or better). The southern parcel consists primarily as impervious surfaces covered with tall false rye grass, blackberry, black cottonwood saplings, reed canary grass, and tarweed (*Madia gracilis* – UPL). The area is significantly disturbed due to past uses. No wetland hydrology indicators were observed in this portion of the property.

Photographs of the study area and wetlands are provided in Photo-Sheet 1.

5.0 REGULATORY ISSUES

Through the course of the wetland delineation and assessment two wetlands were identified on the property as shown in Figures 5 and 6. Although the study area is currently under the jurisdiction of Clark County, the La Center School District plans to have the area annexed into La Center’s Urban Growth Boundary (UGB). Therefore, wetland buffers are based on the guidelines of LMC 18.300.090(6). This section of the LMC provides for the protection of wetlands within the City’s jurisdiction. The ordinance establishes protective buffers associated with wetlands and specifies that certain permits or approvals be obtained for projects containing wetlands or their respective buffers.

As shown in Table 1, Wetland A is a HGM Category III depressional wetland with a low habitat score and Wetland B is a HGM Category III HGM slope wetland with a low habitat score. According to LMC Table 18.300.090(h)(i)-1 wetlands in a proposed high intensity land use with a low habitat score are protected by an 80-foot buffer (Fig. 6).

In addition to LMC 18.300.090(6), jurisdictional wetlands are also regulated at the federal and state levels by the USACE and Ecology under Sections 404 and 401 of the Clean Water Act, respectively. Any impacts to the wetlands will require notification and approval from the USACE and Ecology. It is recommended that the USACE and Ecology be contacted regarding current permit requirements before proceeding with any development activities that would impact wetlands on this site.

The wetland boundaries and classifications shown in this report have been determined using the most appropriate field techniques and best professional judgment of the environmental scientist. It should be noted that USACE and City of La Center have the final authority in determining the wetland boundaries and categories under their respective jurisdictions. It is recommended that this delineation report be submitted to these agencies for concurrence prior to starting any development or planning activities that would affect wetlands or buffers on this site.

6.0 LITERATURE CITED

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FIGURES

FIGURE 1 – PROJECT LOCATION

FIGURE 2 – CLARK COUNTY LIDAR TOPOGRAPHIC MAP

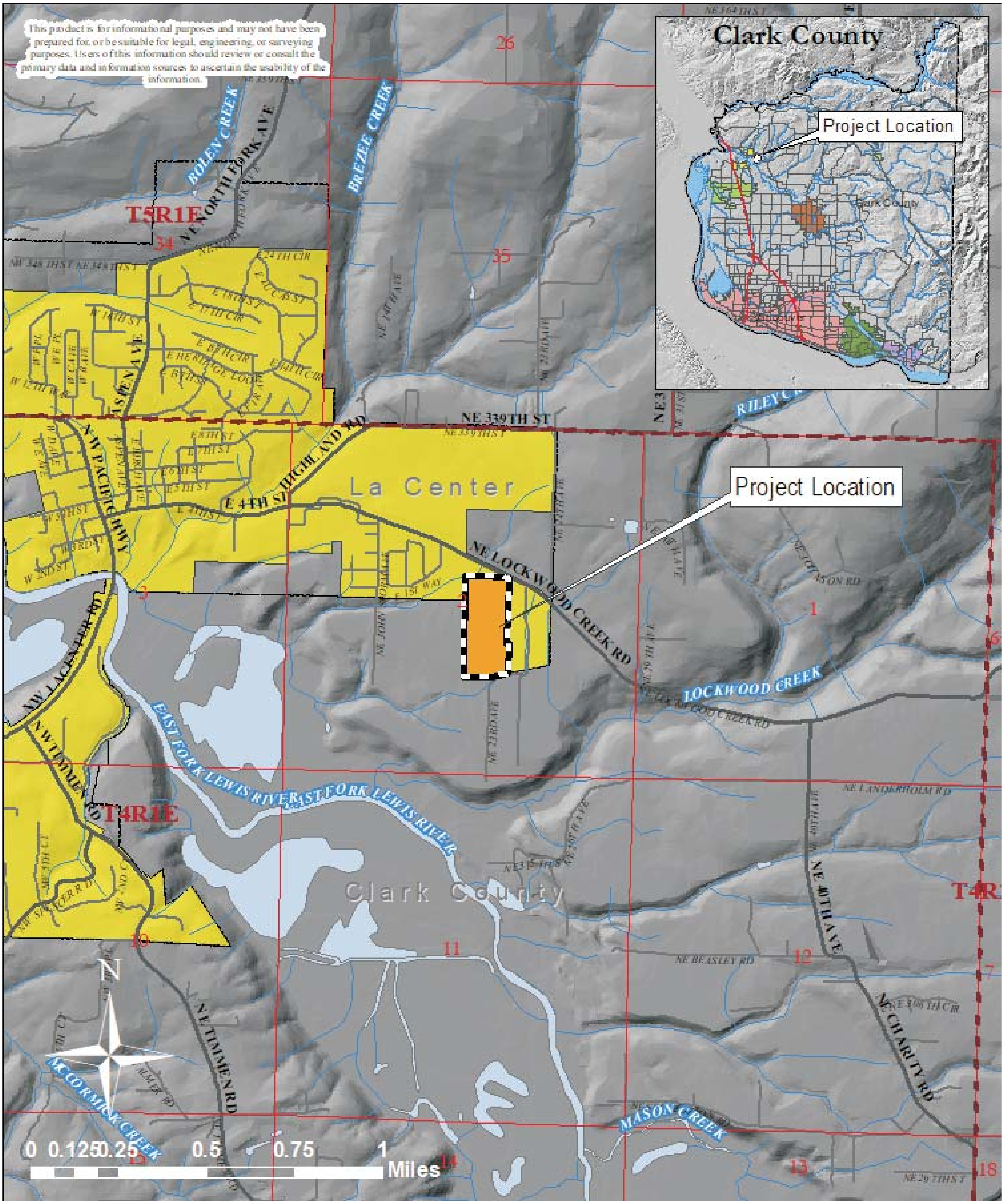
FIGURE 3 – LOCAL & NATIONAL WETLAND INVENTORY MAP

FIGURE 4 – CLARK COUNTY WEB SOIL SURVEY

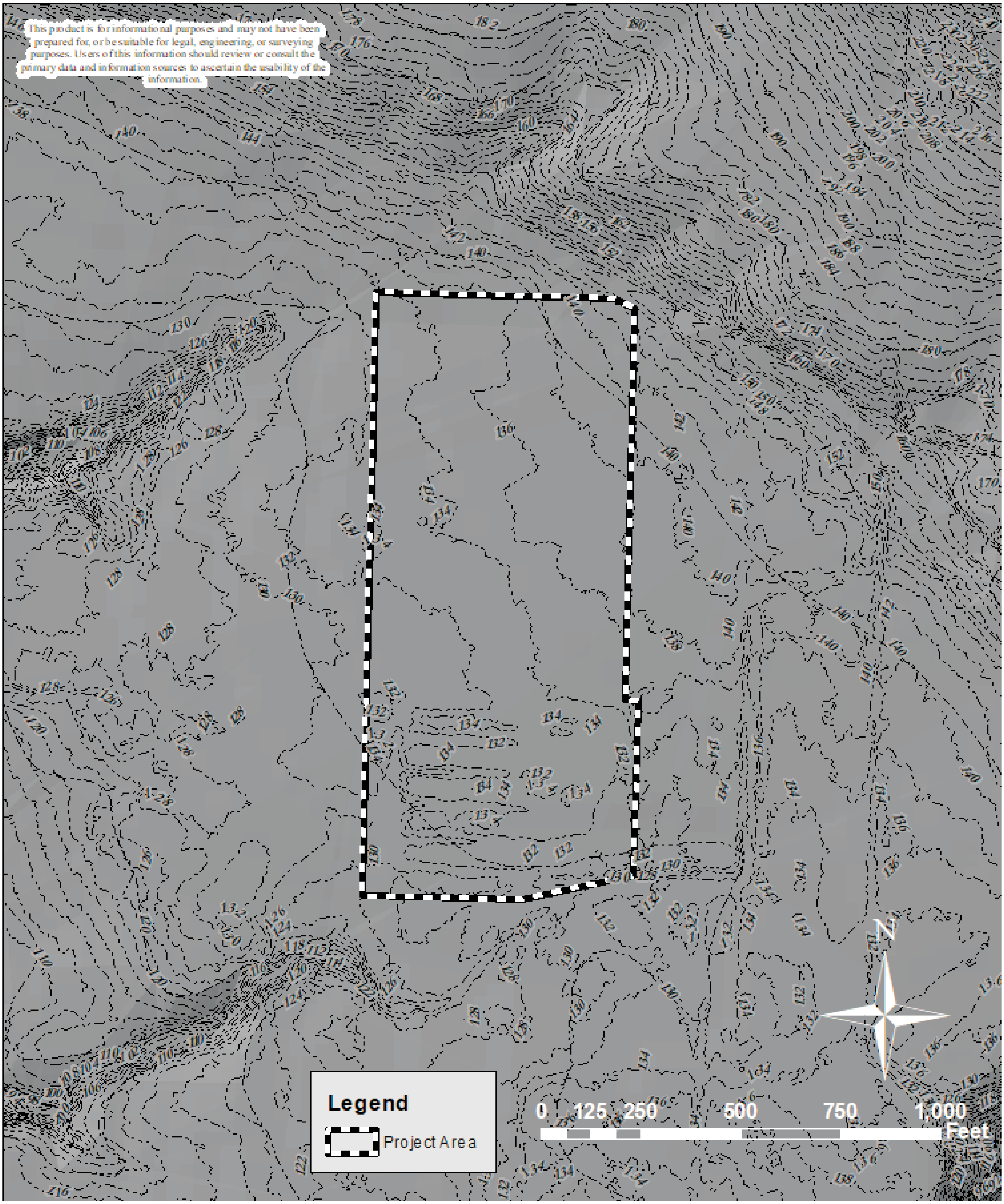
FIGURE 5 – WETLAND BOUNDARIES & SAMPLE PLOTS

FIGURE 6 – WETLAND BOUNDARIES & BUFFERS

PHOTO-SHEET 1 – PROJECT AREA PHOTOGRAPHS



APPLICANT:	Project Location Map	PROPOSED ACTIVITIES IN:
La Center School District 725 Northeast Highland Avenue La Center, WA 98629 **PURPOSE:** Wetland Delineation & Assessment	**N.E. Lockwood Creek Road** **La Center, Washington** OLSON ENVIRONMENTAL LLC 222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242	East Fork of the Lewis River **LEGAL:** SE & NE ¼s of Section 02, T4N, R1E, W. M. **NEAR:** La Center, Washington **COUNTY:** Clark County **DATE:** November 22, 2017 **Figure 1**



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La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

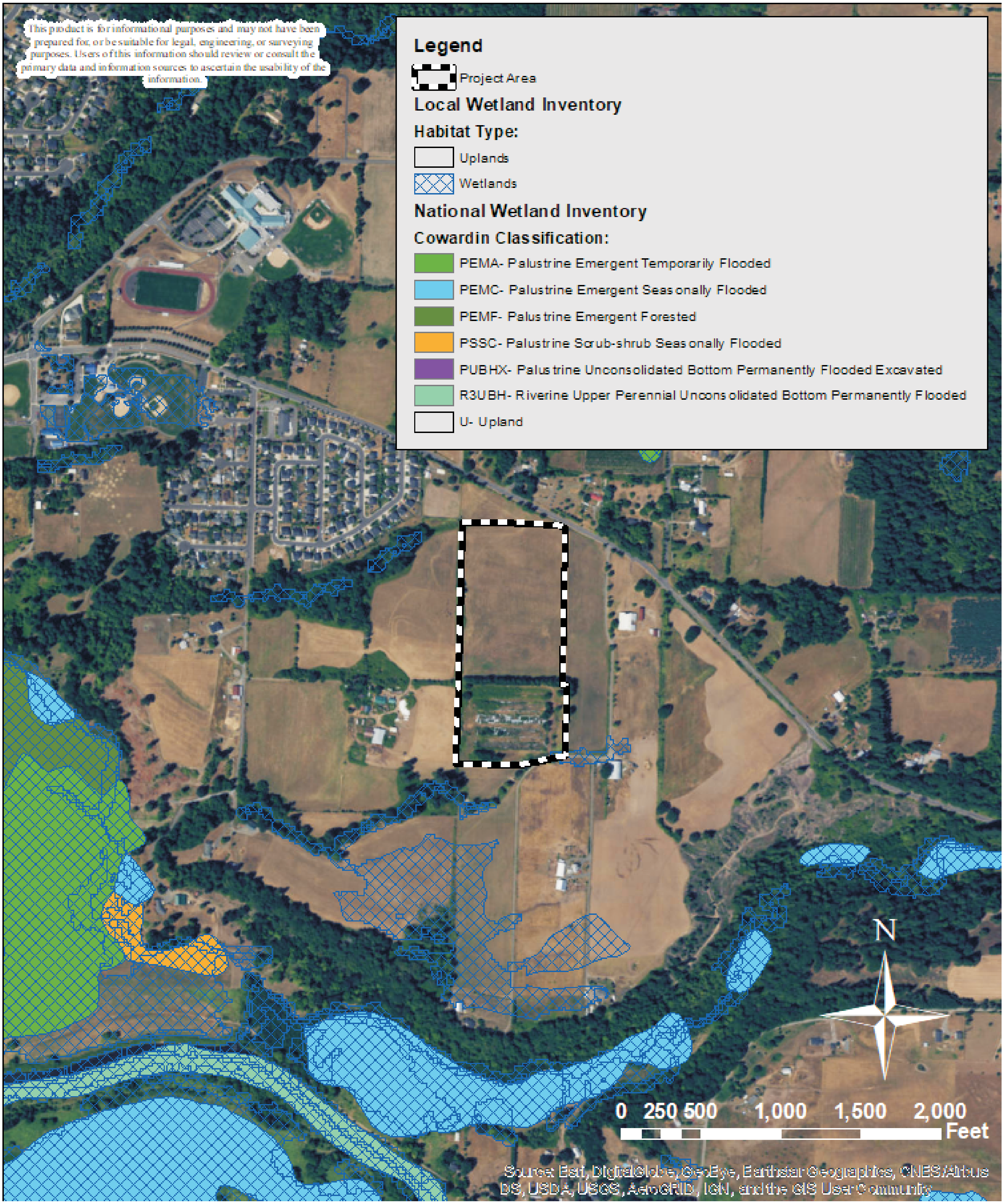
PURPOSE: Wetland Delineation & Assessment

Clark County LiDAR Topographic Map
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

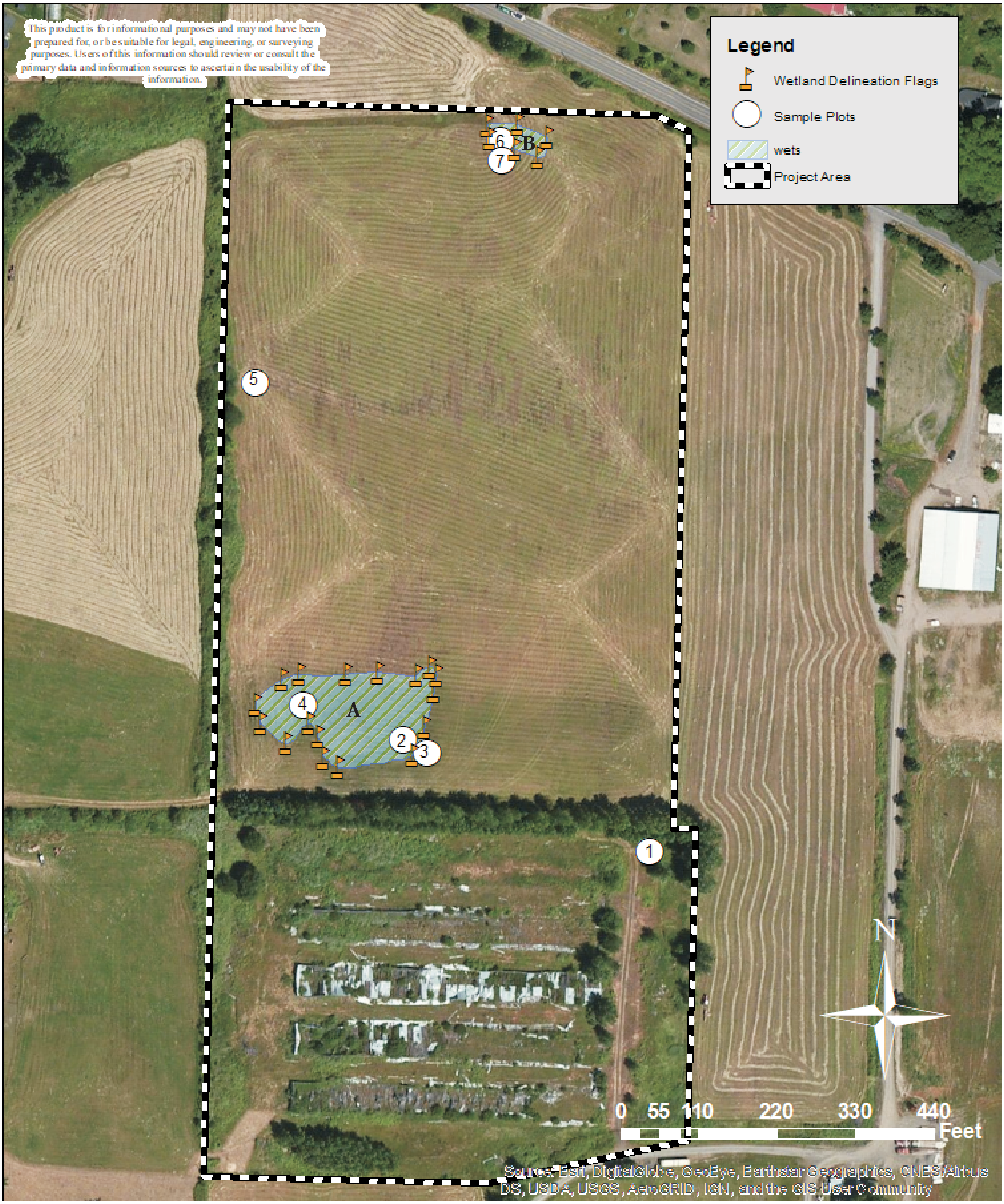
PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure 2



APPLICANT: La Center School District 725 Northeast Highland Avenue La Center, WA 98629 **PURPOSE:** Wetland Delineation & Assessment	**Clark County GIS Wetland Map** **N.E. Lockwood Creek Road** **La Center, Washington** OLSON ENVIRONMENTAL LLC 222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242	**PROPOSED ACTIVITIES IN:** East Fork of the Lewis River **LEGAL:** SE & NE ¼s of Section 02, T4N, R1E, W. M. **NEAR:** La Center, Washington **COUNTY:** Clark County **DATE:** November 22, 2017 **Figure 3**

APPLICANT: La Center School District 725 Northeast Highland Avenue La Center, WA 98629 PURPOSE: Wetland Delineation & Assessment	NRCS Clark County Soil Survey Map N.E. Lockwood Creek Road La Center, Washington OLSON ENVIRONMENTAL LLC 222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242	PROPOSED ACTIVITIES IN: East Fork of the Lewis River LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M. NEAR: La Center, Washington COUNTY: Clark County DATE: November 22, 2017 Figure 4



APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

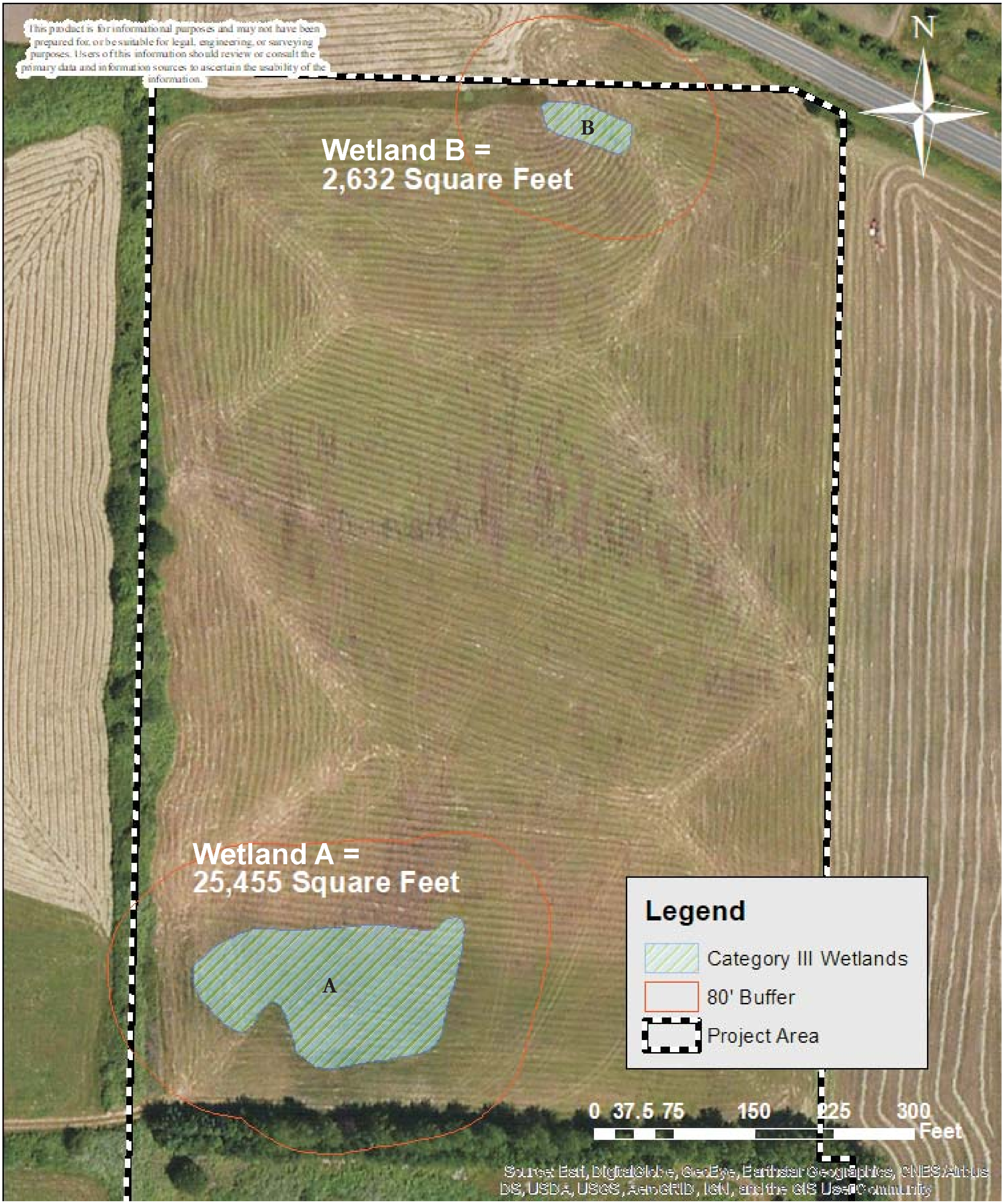
PURPOSE: Wetland Delineation & Assessment

Delineated Wetland Boundary/Sample Plots
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure 5



APPLICANT: La Center School District 725 Northeast Highland Avenue La Center, WA 98629 **PURPOSE:** Wetland Delineation & Assessment	**Delineated Wetland Boundary/Buffer** **N.E. Lockwood Creek Road** **La Center, Washington** OLSON ENVIRONMENTAL LLC 222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242	**PROPOSED ACTIVITIES IN:** East Fork of the Lewis River **LEGAL:** SE & NE ¼s of Section 02, T4N, R1E, W. M. **NEAR:** La Center, Washington **COUNTY:** Clark County **DATE:** November 22, 2017 **Figure 6**






APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Study Area Photographs
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Photo-Sheet 1

APPENDIX A – WETLAND DATA SHEETS

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Road Property   City/County: Clark   Sampling Date: 11/20/2017
Applicant/Owner: La Center School District   State: WA   Sampling Point: 1
Investigator(s): Kevin Grosz   Section, Township, Range: 02, 4N, 1E
Landform (hillslope, terrace, etc.): plain   Local relief (concave, convex, none): _ Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A)   Lat: 45.85718180   Long: -122.64880980   Datum: WGS84
Soil Map Unit Name: Gee Silt Loam (GeB)   NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed?   Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic?   (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 5 m)			
1. Schedonorus arundinaceus	80	Yes	FAC
2. Agrostis capillaris	5	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =80			
Woody Vine Stratum (Plot size: 0)			
1. Rubus armeniacus	15	No	FAC
2.			
Total Cover =15			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/2	0		0				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Creek Road City/County: La Center/Clark Sampling Date: 11/20/2017
Applicant/Owner: La Center School District State: WA Sampling Point: 2
Investigator(s): Kevin Grosz Section, Township, Range: 02/4N/1E
Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): None Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.85758670 Long: -122.65018650 Datum: WGS84
Soil Map Unit Name: Odne Silt Loam (OdB) NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? Yes Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** Yes
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 5M)			
1. Agrostis stolonifera	60	Yes	FAC
2. Agrostis capillaris	10	No	FAC
3. Phalaris arundinacea	5	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =75			
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:
___ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
___ 3 - Prevalence Index is ≤ 3.0[1]
___ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 – Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL

Sampling Point: New Point 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

	Matrix		Redox Features					
Depth (inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100		0				
5-16	10YR 3/1	80	5YR 3/3	20	C	M	Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
_X_ Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

_X_ Surface Water (A1)
___High Water Table (A2)
_X_ Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? Yes — Depth (inches): 1
Water Table Present? Yes — Depth (inches): 3
Saturation Present? (includes capillary fringe) Yes — Depth (inches): 0

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Creek Road City/County: La Center/Clark Sampling Date: 11/20/2017
Applicant/Owner: La Center School District State: WA Sampling Point: 3
Investigator(s): Kevin Grosz Section, Township, Range: 02/4N1E
Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): None Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.85753780 Long: -122.65004960 Datum: WGS84
Soil Map Unit Name: Odne Silt Loam (OdB) NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? No Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 0)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover = 0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover = 0			
Herb Stratum (Plot size: 5M)			
1. Agrostis capillaris	50	Yes	FAC
2. Schedonorus arundinaceus	15	No	FAC
3. Ranunculus repens	10	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover = 75			
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
Total Cover = 0			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:

___ 1 – Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
___ 3 - Prevalence Index is ≤ 3.0[1]
___ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	0		0				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
____Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
_X_Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? Yes Depth (inches): 0
Water Table Present? Yes Depth (inches):
Saturation Present? Yes Depth (inches): 4
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Creek Road City/County: La Center/Clark Sampling Date: 11/20/2017
Applicant/Owner: La Center School District State: WA Sampling Point: 4
Investigator(s): Kevin Grosz Section, Township, Range: 02/4N/1E
Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): None Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.85770970 Long: -122.65074040 Datum: WGS84
Soil Map Unit Name: Odne Silt Loam (OdB) NWI classification:None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? Yes Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** Yes
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 5M)			
1. Holcus lanatus	20	Yes	FAC
2. Agrostis stolonifera	50	Yes	FAC
3. Phalaris arundinacea	15	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =85			
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:
___ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
___ 3 - Prevalence Index is ≤ 3.0[1]
___ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL

Sampling Point: New Point 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/1	70	5YR 3/3	30	C	M	Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
_X__Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
____Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
_X_High Water Table (A2)
_X_Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? No Depth (inches):
Water Table Present? Yes Depth (inches): 4
Saturation Present? Yes Depth (inches): 0
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Creek Road City/County: La Center/Clark Sampling Date: 11/20/2017
Applicant/Owner: La Center School District State: WA Sampling Point: 5
Investigator(s): Kevin Grosz Section, Township, Range: 02/4N/1E
Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): concave Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.85894820 Long: -122.65105130 Datum: WGS84
Soil Map Unit Name: Odne Silt Loam NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 5M)			
1. Phalaris arundinacea	10	No	FACW
2. Agrostis stolonifera	40	Yes	FAC
3. Lolium perenne	40	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =90			
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix: Color (moist)	Matrix: %	Redox Features: Color (moist)	Redox Features: %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	0		0			Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
_X_High Water Table (A2)
_X_Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? No Depth (inches):
Water Table Present? Yes Depth (inches): 0
Saturation Present? Yes Depth (inches): 0
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Creek Road City/County: La Center/Clark Sampling Date: 11/20/2017
Applicant/Owner: La Center School District State: WA Sampling Point: 6
Investigator(s): Kevin Grosz Section, Township, Range: 02/4N/1E
Landform (hillslope, terrace, etc.): plain Local relief (concave, convex, none): None Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.85990740 Long: -122.64974100 Datum: WGS84
Soil Map Unit Name: Odne Silt Loam NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? Yes Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** No

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 5M)			
1. Phalaris arundinacea	20	Yes	FACW
2. Agrostis stolonifera	50	Yes	FAC
3. Holcus lanatus	6	No	FAC
4. Juncus effusus	10	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =86			
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	00
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 2.65

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix: Color (moist)	Matrix: %	Redox Features: Color (moist)	Redox Features: %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 4/1	80	5YR 3/3	20	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
_X_ Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
_X_ High Water Table (A2)
_X_ Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? No — Depth (inches):
Water Table Present? Yes — Depth (inches): 0
Saturation Present? Yes — Depth (inches): 0
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: NE Lockwood Creek Road City/County: La Center/Clark Sampling Date: 11/20/2017
Applicant/Owner: La Center School District State: WA Sampling Point: 7
Investigator(s): Kevin Grosz Section, Township, Range: 02/4N/1E
Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): None Slope (%): 3
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.85982750 Long: -122.64972910 Datum: WGS84
Soil Map Unit Name: Odne Silt Loam (OdB) NWI classification: None
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? No Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 0)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 5M)			
1. Agrostis stolonifera	70	Yes	FAC
2. Phalaris arundinacea	5	No	FACW
3. Ranunculus repens	5	No	FAC
4. Holcus lanatus	5	No	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =85			
Woody Vine Stratum (Plot size: 0)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 0			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = 0

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL

Sampling Point: New Point 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	0		0				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
____Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX B – UPDATED WESTERN WASHINGTON WETLAND RATING FORMS

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Lockwood Cr. Rd. - A Date of site visit: 11/20/17

Rated by Kevin Grosz Trained by Ecology? X Yes ___No Date of training 12/22/15

HGM Class used for rating Depressional Wetland has multiple HGM classes? ___Y X N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map ________________________________

OVERALL WETLAND CATEGORY III (based on functions X or special characteristics ___)

1. Category of wetland based on FUNCTIONS

_______**Category I** – Total score = 23 - 27

_______**Category II** – Total score = 20 - 22

X **Category III** – Total score = 16 - 19

_______**Category IV** – Total score = 9 - 15

FUNCTION	**Improving Water Quality**	**Hydrologic**	**Habitat**	
			Circle the appropriate ratings	
Site Potential	H M **L**	H M **L**	H M **L**	
Landscape Potential	H **M** L	H **M** L	**H** M L	
Value	**H** M L	H **M** L	H M **L**	**TOTAL**
Score Based on Ratings	6	5	5	16

Score for each function based on three ratings
(order of ratings is not important)

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	**CATEGORY**
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

   NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

   1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   NO – go to 3 **YES** – The wetland class is **Flats**

   *If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   ___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ___At least 30% of the open water area is deeper than 6.6 ft (2 m).

   NO – go to 4 **YES** – The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
   ____The wetland is on a slope (*slope can be very gradual*),
   ____The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   ____The water leaves the wetland **without being impounded**.

   NO – go to 5 **YES** – The wetland class is **Slope**

   NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
   ____The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ____The overbank flooding occurs at least once every 2 years.

NO – go to 6 **YES – The wetland class is Riverine**
NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*
   NO – go to 7 **YES** – The wetland class is **Depressional**
7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.
   NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.
   NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have ***more than 2 HGM classes*** *within a wetland boundary, classify the wetland as Depressional for the rating.*

Wetland name or number __A__

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	2
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*. Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^{1}/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^{1}/_{10}$ of area points = 0	0
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	2
Total for D 1 Add the points in the boxes above	4

Rating of Site Potential If score is: ___**12-16 = H** ___**6-11 = M** _X_**0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_grazing________ Yes = 1 No = 0	1
Total for D 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is: ___**3 or 4 = H** _X_**1 or 2 = M** ___**0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	0
Total for D 3 Add the points in the boxes above	2

Rating of Value If score is: _X_**2-4 = H** ___**1 = M** ___**0 = L** *Record the rating on the first page*

Wetland name or number A

DEPRESSIONAL AND FLATS WETLANDS **Hydrologic Functions** - Indicators that the site functions to reduce flooding and stream degradation	
D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. <u>Characteristics of surface water outflows from the wetland</u>: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outletpoints = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	2
D 4.2. <u>Depth of storage during wet periods:</u> *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	1
D 4.3. <u>Contribution of the wetland to storage in the watershed</u>: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	3

Rating of Site Potential If score is:___**12-16 = H** ___**6-11 = M** _X__**0-5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	1
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	0
Total for D 5 Add the points in the boxes above	1

Rating of Landscape Potential If score is:___**3 = H** _X__**1 or 2 = M** ___**0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. <u>The unit is in a landscape that has flooding problems</u>. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. <u>Choose the highest score if more than one condition is met</u>.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* ______________ points = 0 There are no problems with flooding downstream of the wetland. points = 0	1
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	1

Rating of Value If score is:___**2-4 = H** _x__**1 = M** ___**0 = L** *Record the rating on the first page*

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed	4 structures or more: points = 4
X Emergent	3 structures: points = 2
____Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
____Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

0

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated	4 or more types present: points = 3
X Seasonally flooded or inundated	3 types present: points = 2
X Occasionally flooded or inundated	2 types present: points = 1
____Saturated only	1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland	
____Seasonally flowing stream in, or adjacent to, the wetland	
____**Lake Fringe wetland**	**2 points**
____**Freshwater tidal wetland**	**2 points**

1

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

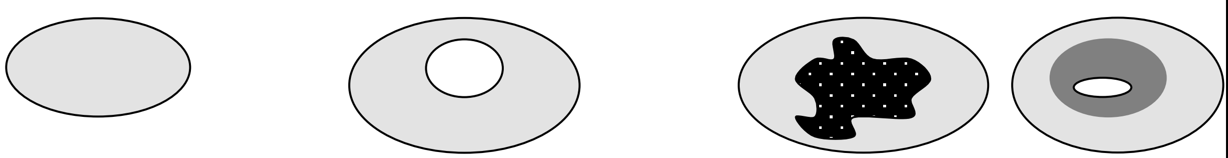
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

1

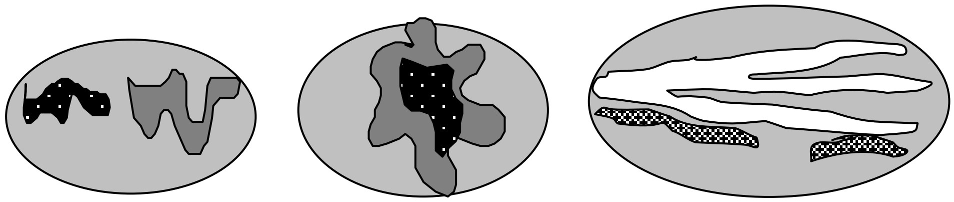
H 1.4. Interspersion of habitats

Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points **Low** = 1 point **Moderate** = 2 points

All three diagrams in this row are **HIGH** = 3points



0

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	0
Total for H 1 — Add the points in the boxes above	2

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** _X__**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat_0__ **+** [(% moderate and low intensity land uses)/2] 13 **=** ____13% If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	1
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 26_ **+** [(% moderate and low intensity land uses)/2] 32 **=** ___58_% Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	3
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	4

Rating of Landscape Potential If score is:_X_**4-6 = H** **1-3 = M** ___**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:___**2 = H** ___**1 = M** _X_**0 = L** *Record the rating on the first page*

Wetland name or number A

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number A

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** No **–** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I** No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** No **= Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No **= Is not a bog**	**Cat. I**

SC 4.0. Forested Wetlands Does the wetland have at least <u>1 contiguous acre</u> of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** No **= Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* Yes – Go to **SC 5.1** No = **Not a wetland in a coastal lagoon** SC 5.1. Does the wetland meet all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than $^1/_{10}$ ac (4350 ft^2) Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: — Long Beach Peninsula: Lands west of SR 103 — Grayland-Westport: Lands west of SR 105 — Ocean Shores-Copalis: Lands west of SR 115 and SR 109 Yes – Go to **SC 6.1** No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? Yes = **Category II** No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? Yes = **Category III** No = **Category IV**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	

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RATING SUMMARY – Western Washington

Name of wetland (or ID #): Lockwood Cr. Rd - B Date of site visit: 11/20/17

Rated by Kevin Grosz Trained by Ecology? X Yes ___No Date of training 12/22/17

HGM Class used for rating Slope Wetland has multiple HGM classes?___Y X N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.

Source of base aerial photo/map ______________________

OVERALL WETLAND CATEGORY IV (based on functions X or special characteristics___)

1. Category of wetland based on FUNCTIONS

_______**Category I** – Total score = 23 - 27

_______**Category II** – Total score = 20 - 22

_______**Category III** – Total score = 16 - 19

X **Category IV** – Total score = 9 - 15

FUNCTION	**Improving Water Quality**	**Hydrologic**	**Habitat**	
Circle the appropriate ratings				
Site Potential	H M L	H M L	H M L	
Landscape Potential	H M L	H M L	H M L	
Value	H M L	H M L	H M L	**TOTAL**
Score Based on Ratings	6	5	5	16

Score for each function based on three ratings
(order of ratings is not important)

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	**CATEGORY**
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	

Wetland name or number __B__

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

   NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

   1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   NO – go to 3 **YES** – The wetland class is **Flats**

   *If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   ___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ___At least 30% of the open water area is deeper than 6.6 ft (2 m).

   NO – go to 4 **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
   _X_The wetland is on a slope (*slope can be very gradual*),
   _X_The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   _X_The water leaves the wetland **without being impounded**.

   NO – go to 5 **YES** – The wetland class is **Slope**

   NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
   ____The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ____The overbank flooding occurs at least once every 2 years.

NO – go to 6 **YES –** The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

   NO – go to 7 **YES –** The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

   NO – go to 8 **YES –** The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

   NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

*If you are still unable to determine which of the above criteria apply to your wetland, or if you have **more than 2 HGM classes** within a wetland boundary, classify the wetland as Depressional for the rating.*

Wetland name or number __B__

SLOPE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)* Slope is 1% or less — points = 3 Slope is > 1%-2% — points = 2 Slope is > 2%-5% — points = 1 Slope is greater than 5% — points = 0	1
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area — points = 6 Dense, uncut, herbaceous plants > ½ of area — points = 3 Dense, woody, plants > ½ of area — points = 2 Dense, uncut, herbaceous plants > ¼ of area — points = 1 Does not meet any of the criteria above for plants — points = 0	0
Total for S 1 — Add the points in the boxes above	1

Rating of Site Potential If score is:___**12 = H** ___**6-11 = M** _X_**0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources _grazing_________ Yes = 1 No = 0	1
Total for S 2 — Add the points in the boxes above	2

Rating of Landscape Potential If score is:_X_**1-2 = M** ___**0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list.* Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	0
Total for S 3 — Add the points in the boxes above	2

Rating of Value If score is:_X_**2-4 = H** ___**1 = M** ___**0 = L** *Record the rating on the first page*

Wetland name or number __B__

SLOPE WETLANDS **Hydrologic Functions** - Indicators that the site functions to reduce flooding and stream erosion	
S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. *Stems of plants should be thick enough (usually > $^1/_8$ in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland — points = 1 All other conditions — points = 0	0

Rating of Site Potential If score is:___**1 = M** _X__**0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	1

Rating of Landscape Potential If score is:_X_**1 = M** ___**0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) — points = 2 Surface flooding problems are in a sub-basin farther down-gradient — points = 1 No flooding problems anywhere downstream — points = 0	1
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 — Add the points in the boxes above	1

Rating of Value If score is:___**2-4 = H** _X__**1 = M** ___**0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed — 4 structures or more: points = 4
_X_Emergent — 3 structures: points = 2
____Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1
____Forested (areas where trees have > 30% cover) — 1 structure: points = 0

If the unit has a Forested class, check if:

____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

0

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated — 4 or more types present: points = 3
____Seasonally flooded or inundated — 3 types present: points = 2
_X_Occasionally flooded or inundated — 2 types present: points = 1
____Saturated only — 1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland
____Seasonally flowing stream in, or adjacent to, the wetland
____**Lake Fringe wetland** — **2 points**
____**Freshwater tidal wetland** — **2 points**

0

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

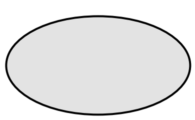
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

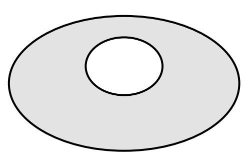
1

H 1.4. Interspersion of habitats

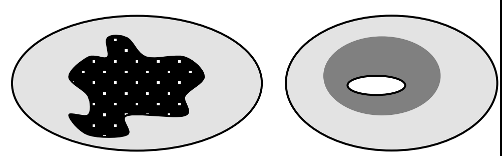
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points

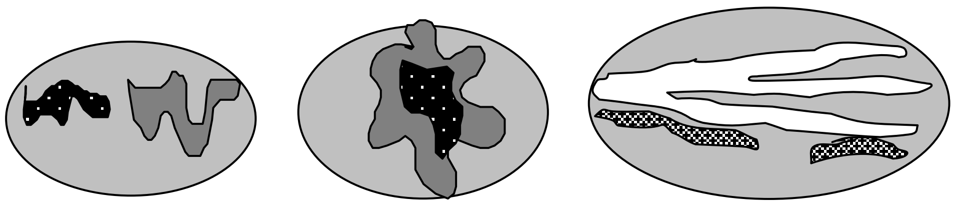


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3points



0

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	0
Total for H 1 — Add the points in the boxes above	1

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** _X_**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat_0_ **+** [(% moderate and low intensity land uses)/2]_30_ **=** ___30_% If total accessible habitat is: > $^{1}/_{3}$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	2
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat_27_ **+** [(% moderate and low intensity land uses)/2]_30_ **=** ___57_% Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	3
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	5

Rating of Landscape Potential If score is:_X_**4-6 = H** ___**1-3 = M** ___**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:___**2 = H** ___**1 = M** _X_**0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number B

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** **No= Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** **No –** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I** **No = Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** **No = Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** **No = Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** **No** = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** **No = Is not a bog**	**Cat. I**

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** **No = Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* Yes – Go to **SC 5.1** **No** = **Not a wetland in a coastal lagoon** SC 5.1. Does the wetland meet all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2) Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: — Long Beach Peninsula: Lands west of SR 103 — Grayland-Westport: Lands west of SR 105 — Ocean Shores-Copalis: Lands west of SR 115 and SR 109 Yes – Go to **SC 6.1** **No** = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? Yes = **Category II** No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? Yes = **Category III** No = **Category IV**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	

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APPENDIX B1. WETLAND RATING FORM FIGURES.

B1 - COWARDIN VEGETATION MAP
B2 - HYDROPERIOD MAP
B3 - WETLAND A – LAND USE INTENSITY MAP
B4 - WETLAND B – LAND USE INTENSITY MAP
B5 - WATER QUALITY ASSESSMENT MAP
B6 - LIST OF TMDLS FOR PROJECT WATERSHED

APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Cowardin Vegetation Map
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure B1

APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

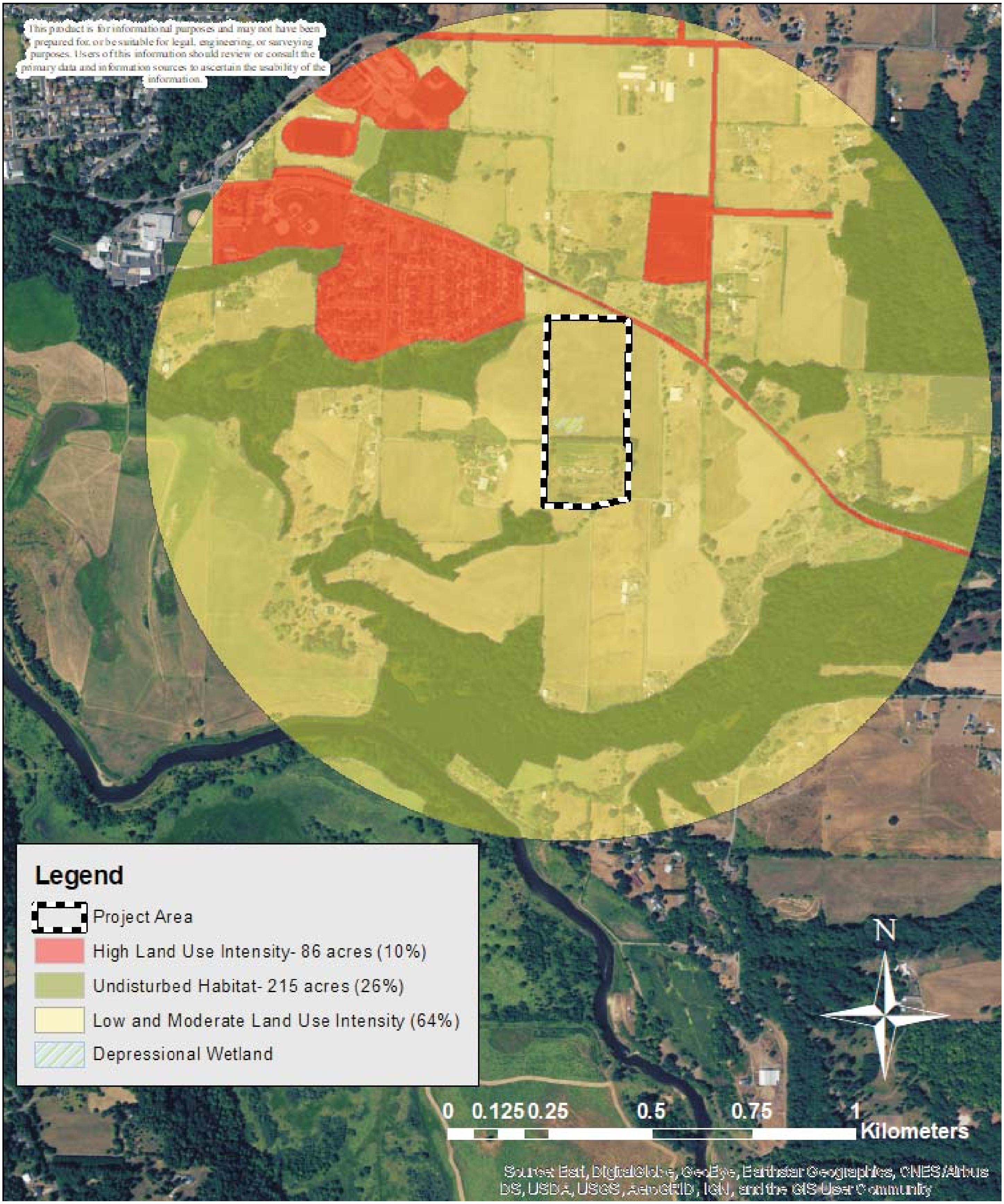
PURPOSE: Wetland Delineation & Assessment

Hydroperiod Map
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure B2



APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

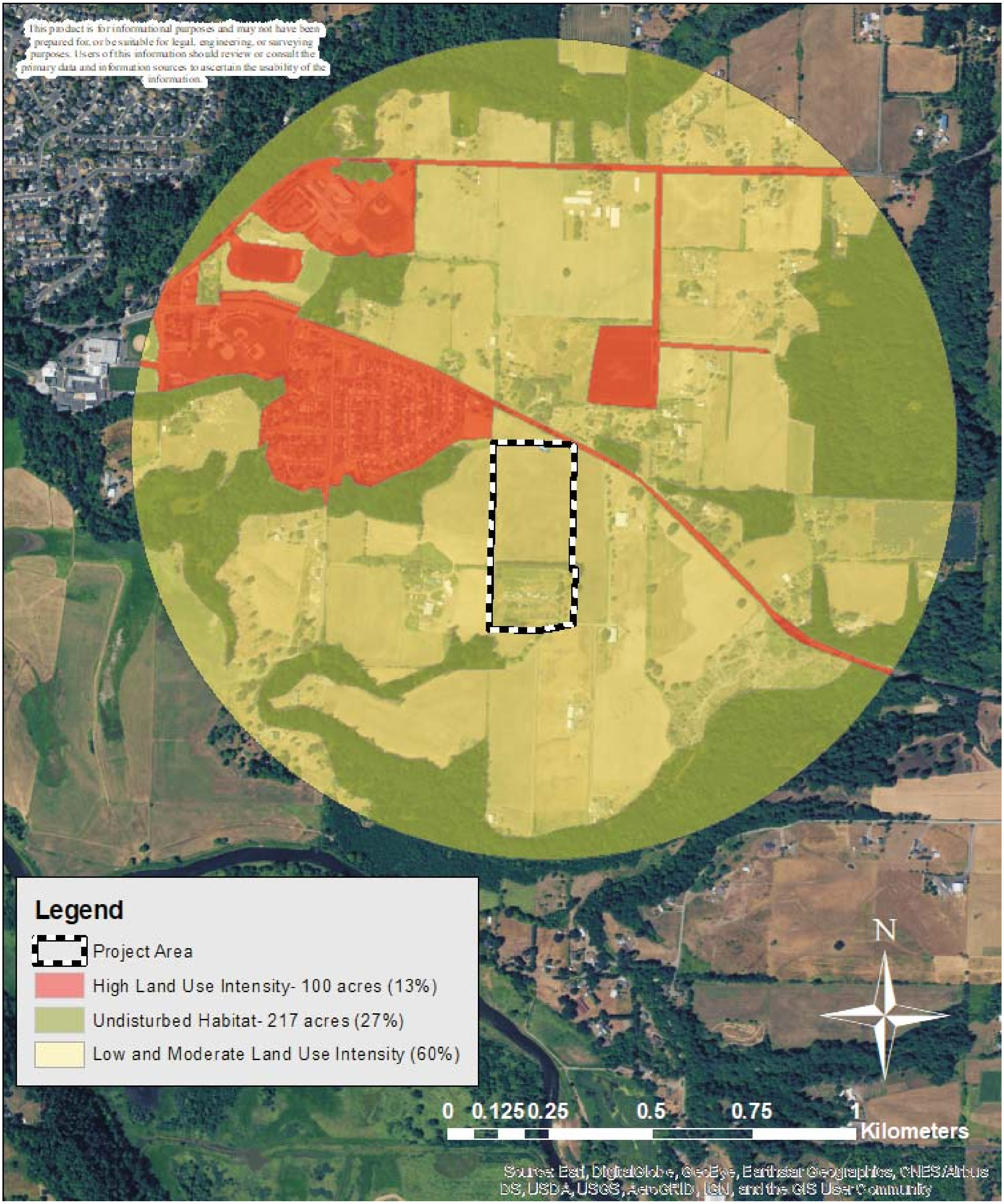
PURPOSE: Wetland Delineation & Assessment

Wetland A - Land Use Intensity Map
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure B3



APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

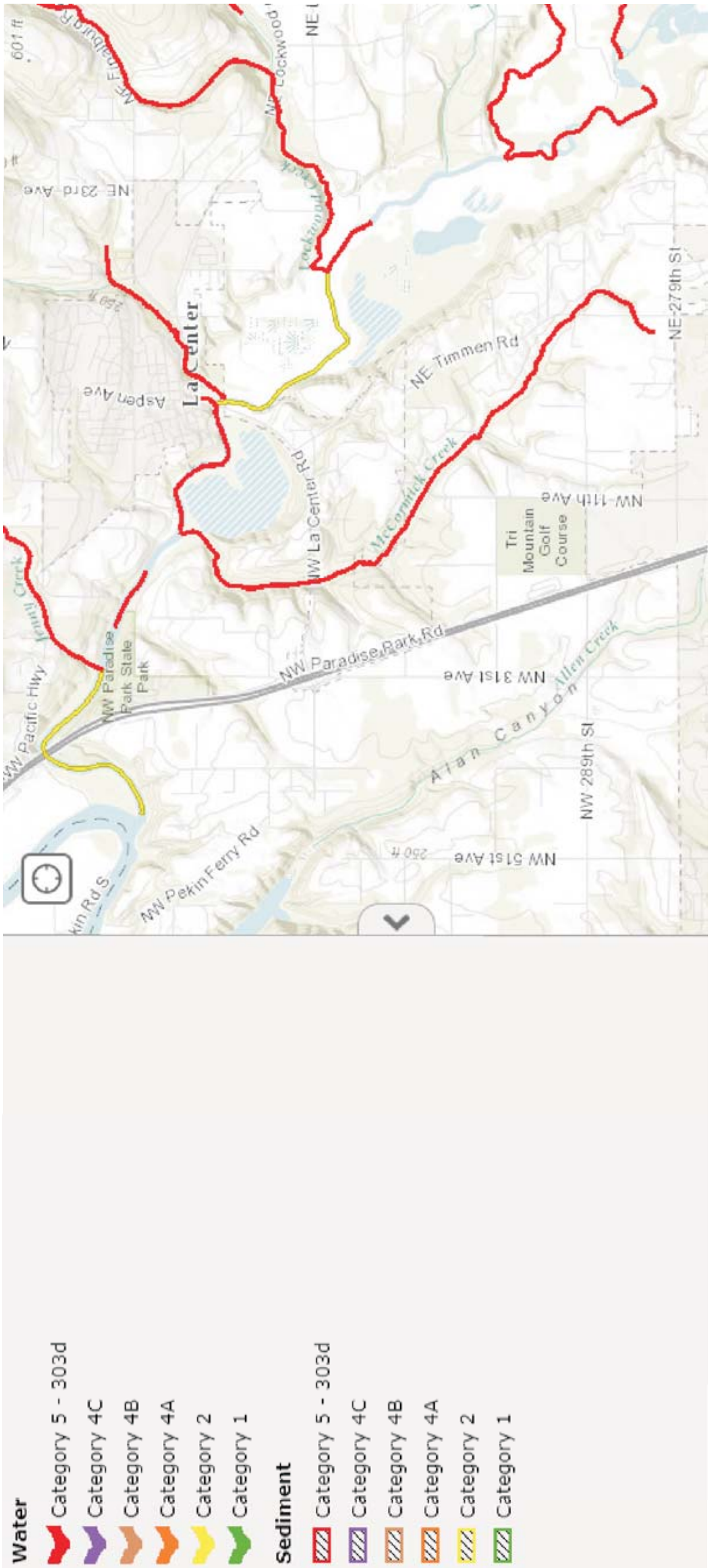
PURPOSE: Wetland Delineation & Assessment

Wetland B - Land Use Intensity Map
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure B4



APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Ecology 303(d) Listed Waters
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure B5

Washington State Water Quality Assessment
303(d)/305(b) List

Assessment WQ Search Tool | Contact Us | WQ Atlas

New Search | Refine Search | Export to File

4 Matched Listings

The 303(d) List contains only Category 5 Listings.

View	ListingID	Assessssment Unit ID	Medium	Parameter	Current Category	Waterbody Name	WRIA	WQ Improvement Project	WQ Atlas Map Link
View	7819	17080002000336	Water	Bacteria	5	LOCKWOOD CREEK	27 - Lewis		7819
View	7820	17080002000336	Water	Temperature	5	LOCKWOOD CREEK	27 - Lewis		7820
View	46224	17080002000338	Water	Bacteria	5	LOCKWOOD CREEK	27 - Lewis		46224
View	70061	17080002000336	Other	Bioassessment	5	LOCKWOOD CREEK	27 - Lewis		70061

New Search | Refine Search | Export to File

Ecology Home Page| Disclaimer| Privacy Notice| Accessibility| Release Notes
Approved WQA Version: 1.0.7

APPLICANT:
La Center School District
725 Northeast Highland Avenue
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

TMDLs for the Project Watershed
N.E. Lockwood Creek Road
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
East Fork of the Lewis River
LEGAL: SE & NE ¼s of Section 02, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: November 22, 2017

Figure B6

N.E. Lockwood Creek Road – North Parcel

WETLAND DELINEATION & ASSESSMENT
CRITICAL AREAS REPORT

Prepared for:
La Center School District
725 Highland Road
La Center, WA 98629

Prepared by:
Olson Environmental, LLC
222 E. Evergreen Blvd.
Vancouver, WA 98660
(360) 693-4555

September 28, 2018

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION

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FIGURE B3 – PLANT COVER MAP

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FIGURE B7 – LIST OF TMDLS IN PROJECT WATERSHED

FIGURE B8 – 303(d) WATER QUALITY ASSESSMENT MAP

WETLAND DELINEATION AND ASSESSMENT

Project: NE Lockwood Creek Road Properties – North Parcel
Applicant: La Center School District
Location: South of NE Lockwood Creek Road, La Center, Washington
Legal Description: NE ¼ of Sec. 02, T04N, R01E, W. M., Clark County
Serial Number(s): 209064-000
Study Area Size: 1.9 acres
Jurisdiction: City of La Center, WA
Watershed: East Fork of the Lewis River
Zoning: LDR-7.5
ComPlan: UL
Assessment by: Kevin Grosz, PWS; Ryan Thiele
Site Visit(s): September 20, 2018
Report Date: September 28, 2018

1.0 INTRODUCTION

This report details the results of a wetland delineation and assessment conducted by Olson Environmental, LLC (OE) for the La Center School District. The study area is located immediately adjacent and south of NE Lockwood Creek Road on the east edge of La Center, Washington (Fig. 1). This report identifies the extent of any wetlands and associated buffers found within the study area as defined and regulated by the US Army Corps of Engineers (USACE) and the Washington Department of Ecology (Ecology) under sections 401 and 404 of the Clean Water Act, and locally by the City of La Center under the City's Critical Areas Ordinance (18.300.090(6) – Wetlands).

Currently, the 1.9-acre study area is vacant land that appears to be used for domestic livestock grazing and/or hay land. A narrow strip of shrubs interspersed with trees separates the grassland portion of the site from NE Lockwood Creek Road to the north. Generally, the site is gently sloped from north to south (Fig. 2). Photographs of the study area and wetlands are provided in Photo-Sheet 1.

2.0 WETLAND DELINEATION AND ASSESSMENT METHODS

The wetland delineation was conducted according to the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys and Coast Region (USACE, 2010.) hereafter, referred to as the manual. According to the manual, jurisdictional wetlands are defined as:

> *Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life*

in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Prior to the on-site investigations, a review of existing information related to determination of wetland boundaries was conducted. This review included the Clark County LiDAR topographic data (Fig. 2), National Wetland Inventory (NWI) data and Clark County Wetland Inventory (LWI) data (Fig. 3), NRCS Clark County Soil Survey data (Fig. 4), and aerial photographs.

The manual uses three parameters in making wetland determinations: hydrophytic vegetation, hydric soils, and wetland hydrology. Except in certain situations defined in the manual, evidence of a minimum of one positive indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland determination.

<u>Hydrophytic vegetation</u> are plants that due to morphological, physiological, and/or reproductive adaptations, have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions. Hydrophytic vegetation is present when more than 50 percent of the dominant species have an indicator status of OBL, FACW, and/or FAC. Wetland indicator status ratings and their ordinal rating categories, based on ecological descriptions:

Indicator Status (abbreviation) Ecological Description*
Obligate (OBL) Almost always is a hydrophyte, rarely in uplands
Facultative Wetland (FACW) Usually is a hydrophyte but occasionally found in uplands
Facultative (FAC) Commonly occurs as either a hydrophyte or nonhydrophyte
Facultative Upland (FACU) Occasionally is a hydrophyte, but usually occurs in uplands
Upland (UPL) Rarely is a hydrophyte, almost always in uplands.
*Source: Lichvar and Minkin (2008)

<u>Hydric soils</u> are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation. The presence or absence of hydric soils is determined in the field by digging soil pits to a depth of a minimum of 16 inches and examining the soil for hydric soil indicators. Organic soils such as peats and mucks are considered hydric soils. Mineral hydric soils are generally either gleyed or have redox concentrations and/or low matrix chroma immediately below the A-horizon or 10 inches (whichever is shallower). Soil colors are determined using the Munsell Soil Color Chart (Munsell Color System 2009).

<u>Wetland hydrology</u> is present when an area is inundated or saturated to the surface for at least 5 percent of the growing season. The growing season is defined as the portion of the year when soil temperature at 19.7 inches below the soil surface is greater than biological zero (5 degrees C). The site was examined for standing water and/or saturated soils, which serve as primary indicators of wetland hydrology. The area was also checked for

other wetland hydrologic characteristics such as watermarks, wetland drainage patterns, and morphological plant adaptations.

3.0 SITE SPECIFIC METHODS

OE conducted the onsite wetland delineation and assessment on September 20, 2018, using the methodology found in the Regional Supplement to the Manual (USACE 2010). In addition, applicable guidance and any supporting technical guidance documents issued by the USACE, Ecology, and Clark County GIS were also utilized.

The entire site was first traversed by foot to observe any visible wetland conditions. Once the general locations of the wetland boundaries were identified, paired data plots were taken in areas that represented the conditions of the uplands and wetlands, respectively. One (1) and ten (10) meter radius plots were chosen in a uniform topographic position that was representative of a single plant community. The paired plots were located approximately 5 - 10 feet apart to minimize the margin of error. Soils at each sample plot are typically inspected to a depth of 16 inches (or more) to determine the presence or absence of hydric soil characteristics and/or wetland hydrology. Data sheets for the sample plots are attached in Appendix A.

The wetland boundaries were determined based on the presence of hydric soils (i.e. redox concentrations in the soil matrix), the presence of wetland hydrology (i.e. oxidized rhizospheres along living roots, soil saturation), and a dominance of hydrophytic vegetation. It should be noted that only paired plots were recorded in the field, however, numerous unrecorded plots were dug to confirm wetland boundaries. The on-site wetlands were classified according the USFWS classification system (Cowardin et al. 1979) and the Hydrogeomorphic (HGM) classification system (Adamus et al. 2001).

4.0 RESULTS AND DISCUSSION

According to the NWI/LWI wetlands map (Fig. 3), wetlands are not projected or modeled within the project area. It should be noted that these maps are created through aerial photograph and topographic map interpretation and are not intended to represent the extent of jurisdictional wetlands. There may be unmapped wetland and waters subject to regulation and all wetlands and waters boundary mapping is approximate. In all cases, actual field conditions determine the presence, absence and boundaries of wetlands and waters.

Four soil types are mapped on the site (Fig. 4):

Gee Silt Loam, 0 to 8 percent slopes (GeB). Gee soils are deep, moderately well drained soils formed in the old alluvium deposited by the Columbia River. They are moderately permeable in the surface layer and very slow in the subsurface. Surface runoff is slow and the erosion hazard is slight. In a typical profile, these soils are a very dark grayish brown (10YR 3/2) silt loam in the upper 9 inches. Below this to a depth of 14 inches they are a dark grayish brown (10YR 4/2) silt loam with yellowish brown (10YR 5/6) redox concentrations. It is listed as a **non-hydric** soil.

Gee silt loam, 8 to 20 percent slopes (GeD). This soil is similar to Gee silt loam, 0 to 8 percent slopes, except that the surface layer is 1 to 3 inches thinner. Sidehill seeps are common on these slopes in winter and spring. Surface runoff is medium, and the erosion hazard is moderate. It is listed as a **non-hydric** soil.

Hillsboro silt loam, 8 to 15 percent slopes (HoC). This soil was formed in mixed, silty and loamy old alluvium. It is well drained, has moderate permeability, surface runoff is slow to medium, and the erosion hazard is moderate. In a typical profile, soils are dark brown (10YR 3/3) loam or silt loam to a depth of 15 inches. It is listed as a **non-hydric** soil.

Odne silt loam, 0 to 5 percent slopes (OdB). This soil generally occurs in concave areas in drainageways or depressions within areas of Gee soils. In most places the slope is 1 to 2 percent. In a typical profile, the surface layer is about 10 inches thick. It is mottled, dark-gray heavy silt loam in the upper part. The subsurface layer is firm, mottled, gray silt loam about nine inches thick. The next eight inches is very firm, mottled, dark-gray silty clay loam that overlies six inches of firm, mottled, dark-gray clay loam. This soil is poorly drained and very slowly permeable. A high water-table is common in winter. It is classified as a **hydric soil** according to the Clark County hydric soils list.

4.1 WETLANDS (FIG. 5)

Three (3) wetlands were identified and delineated within the study area as shown in Figure 5. A description of each of these wetlands are as follows:

<u>Wetland D</u> (1541 sq. ft.)
Wetland D is characterized as a palustrine, emergent wetland and is located in the southwestern portion of the study area along the western property boundary (Fig. 5). It appears this wetland is predominately sustained by runoff from a ditch along the western property boundary. This wetland is classified as a slope HGM class. Table 1 outlines the functional assessment for this wetland.

The vegetation is predominantly colonial bent grass (*Agrostis capillaris* – FAC), reed canary grass (*Phalaris arundinacea* – FACW) and Himalayan blackberry (*Rubus armeniacus* – FAC). Hydric soil indicators included a reduced matrix. Soils from 0 to 12 inches are a very dark grayish brown (10YR 3/2) silt loam with brown (7.5YR 4/4) redox concentrations and turn very dark gray (10YR 3/1) from 12 to 16 inches with similar redox concentrations. Wetland hydrology was indicated by drainage patterns and geomorphic position.

<u>Wetland E</u> (1048 sq. ft.)
Wetland E is characterized as a palustrine, scrub-shrub wetland and is located in the northern portion of the property adjacent to NE Lockwood Creek Road (Fig 5). It appears

that the wetland is predominately sustained by a culvert from the road that drains into the scrub/shrub portion of the study area along the roadside. This wetland is classified as a slope HGM class wetland. Table 1 outlines the functional assessment for this wetland.

Vegetation in Wetland E consists of snowberry (*Symphoricarpos albus* – FACU), Scouler's willow (*Salix scouleriana* – FAC), and meadowsweet (*Spiraea douglasii* – FACW) in the shrub layer. Reed canary grass dominates the herbaceous layer, with Himalayan blackberry interspersed. Hydric Soil indicators included a reduced matrix with. Soils from 0 to 5 inches are a very dark grayish brown (10YR 3/2) silt loam and turn very dark gray (10YR 3/1) from 5 to 16 inches with dark brown (7.5YR 3/4) redox concentrations. Wetland hydrology was indicated by oxidized rhizospheres along living roots, drainage patterns and geomorphic position.

<u>Wetland F</u> (2647 sq. ft.)
Wetland F is characterized as a palustrine, forested/scrub-shrub wetland and is located in the northeastern portion of the property adjacent to NE Lockwood Creek Road (Fig 5). This wetland appears to be predominately sustained by a road culvert that drains into this of the study area and may contain drain tile that is artificially draining this portion of the study area. This wetland is classified as a depressional HGM class wetland. Table 1 outlines the functional assessment for this wetland.

Vegetation in Wetland F is dominated by black cottonwood (*Populus balsamifera* – FAC) and Nootka rose (*Rosa nutkana* – FAC) in the tree and shrub canopies, with soft rush (*Juncus effusus* – FACW) and colonial bent grass in the herbaceous layer. Hydric soil indicators included a reduced matrix. Soils from 0 to 16 inches are a very dark grayish brown (10YR 3/2) clayey silt loam with brown (7.5YR 4/4) redox concentrations. Wetland hydrology was indicated by oxidized rhizospheres along living roots, drainage patterns and geomorphic position.

4.2 WETLAND FUNCTIONAL ASSESSMENT

The delineated wetlands have been assessed using the Washington State Wetland Rating System for Western Washington (Hruby Update 2014). The system was designed to differentiate between wetlands based on their sensitivity to disturbance, their significance, their rarity, our ability to replace them, and the functions they provide. Through a series of questions, the wetland rating system generates a number for water quality functions, hydrologic functions, and habitat function, which creates as overall wetland function score. Based on the total score, the wetland is categorized as a Category I, II, III, or IV wetland. Table 1 below summarizes the wetland type, total score for functions, and category of wetlands identified within the study area.

Table 1. Wetland Function Rating

Wetland	Wetland Type	Water Quality Functions	Hydrologic Functions	Habitat Functions	Total Score	Wetland Category
D	Slope	6	3	5	14	IV
E	Slope	6	3	4	13	IV
F	Slope	6	4	4	14	IV

4.3 NON-WETLANDS

The non-wetland portions in the project area are primarily open grassland that appears to be used primarily as hay land and may also be used to graze domestic livestock. In addition, there are two areas with mixed shrub and tree cover. Vegetation in the grassland area is more than likely a pasture seed mixture that has been sown for the pasture/hay uses. This area consists tall sweet vernal grass (*Anthoxanthum odoratum* – FACU), false rye grass (*Schedonorus arundinaceus* - FAC), colonial bent grass, and spreading bent grass (*A. stolonifera* – FAC), velvet grass (*Holcus lanatus* – FAC). Vegetation in the upland areas to the north along the roadside consists of black cottonwood, cascara (*Frangula pershiana* – FAC), Nootka rose, Himalayan blackberry, trailing blackberry (*R. ursinus* – FACU) and reed canary grass. A shrub patch in the southwest corner is primarily bitter cherry (*Prunus emarginata*) and Nootka rose. No wetland hydrology or soil indicators were observed in these ares of the study site.

5.0 REGULATORY ISSUES

Through the course of the wetland delineation and assessment, three wetlands were identified on the property as shown in Figures 5 and 6. The subsequent wetland buffers are based on the guidelines of LMC 18.300.090(6). This section of the LMC provides for the protection of wetlands within the City's jurisdiction. The ordinance establishes protective buffers associated with wetlands and specifies that certain permits or approvals be obtained for projects containing wetlands or their respective buffers.

As shown in Table 1, Wetland D, Wetland E, and Wetland F are HGM slope class Category IV wetlands with low habitat scores. According to LMC Table 18.300.090(h)(i)-1, wetlands in a proposed high intensity land use with a low habitat score are protected by a 50-foot buffer (Fig. 6) to maintain hydrologic functions. N.E. Lockwood Creek Road forms the northern portion of the study area. Buffers along the road are functionally isolated since the roadway provides no protection to the wetlands.

In addition, LMC 18.300.090(6), jurisdictional wetlands are also regulated at the federal and state levels by the USACE and Ecology under Sections 404 and 401 of the Clean Water Act, respectively. Any impacts to the wetlands will require notification and approval from the USACE and Ecology. It is recommended that the USACE and Ecology be contacted regarding current permit requirements before proceeding with any development activities that would impact wetlands on this site.

The wetland boundaries and classifications shown in this report have been determined using the most appropriate field techniques and best professional judgment of the environmental scientist. It should be noted that USACE and City of La Center have the final authority in determining the wetland boundaries and categories under their respective jurisdictions. It is recommended that this delineation report be submitted to these agencies for concurrence prior to starting any development or planning activities that would affect wetlands or buffers on this site.

6.0 LITERATURE CITED

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FIGURES

FIGURE 1 – PROJECT LOCATION

FIGURE 2 – CLARK COUNTY LIDAR TOPOGRAPHIC MAP

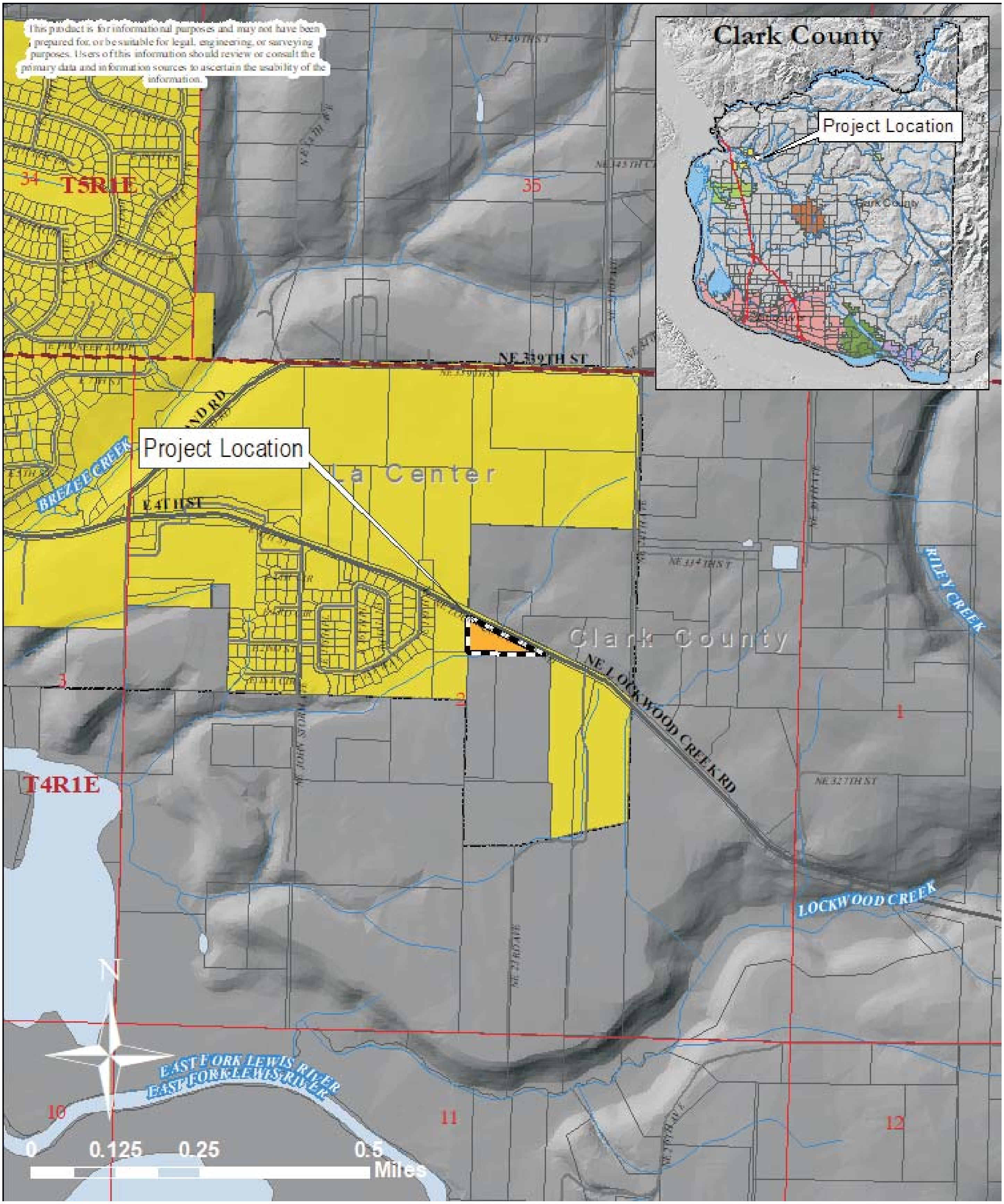
FIGURE 3 – LOCAL & NATIONAL WETLAND INVENTORY MAP

FIGURE 4 – CLARK COUNTY WEB SOIL SURVEY

FIGURE 5 – WETLAND BOUNDARY & SAMPLE PLOTS

FIGURE 6 – WETLAND BOUNDARIES & BUFFERS

PHOTO-SHEET 1 – PROJECT AREA PHOTOGRAPHS



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

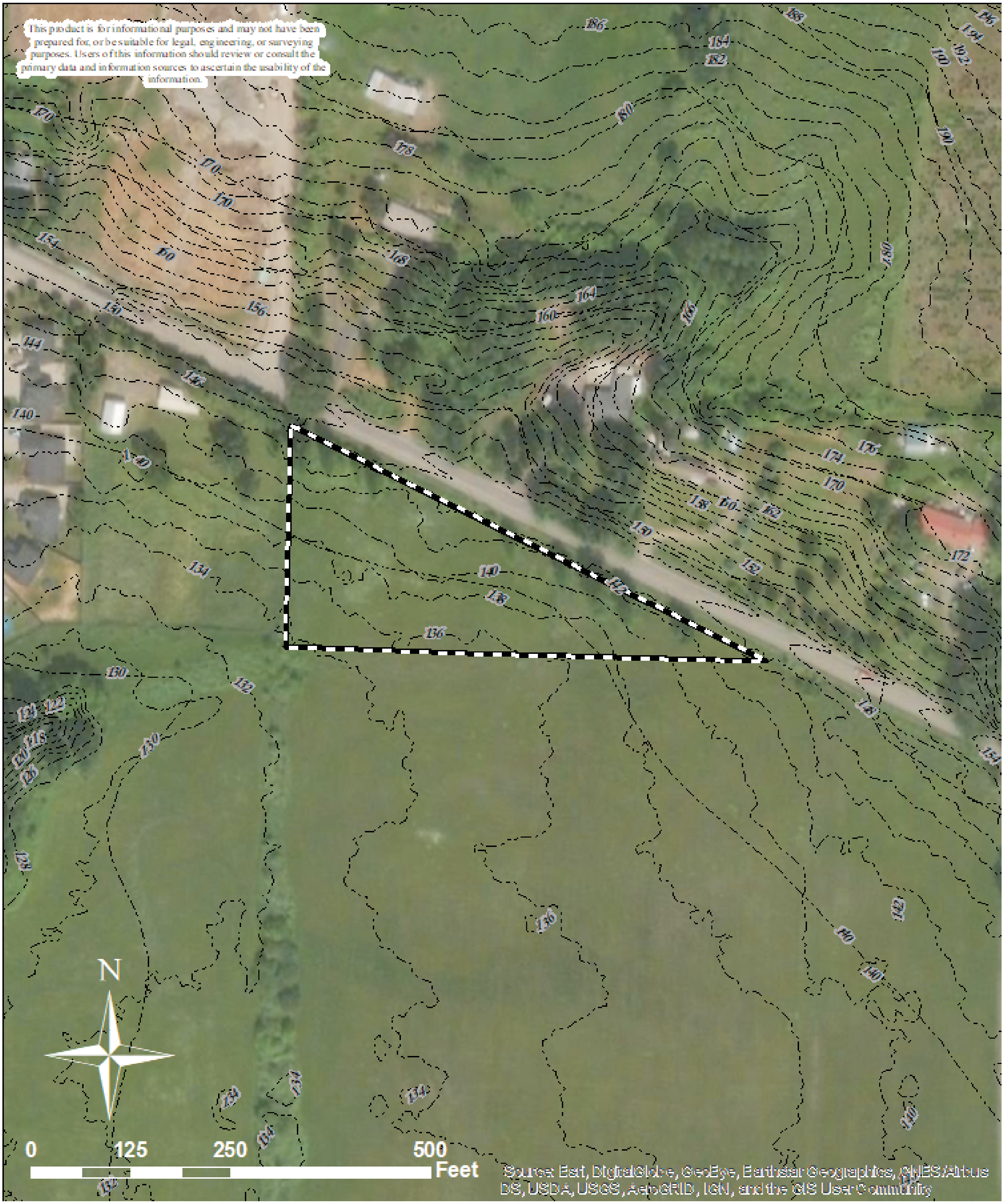
PURPOSE: Wetland Delineation & Assessment

Project Location Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

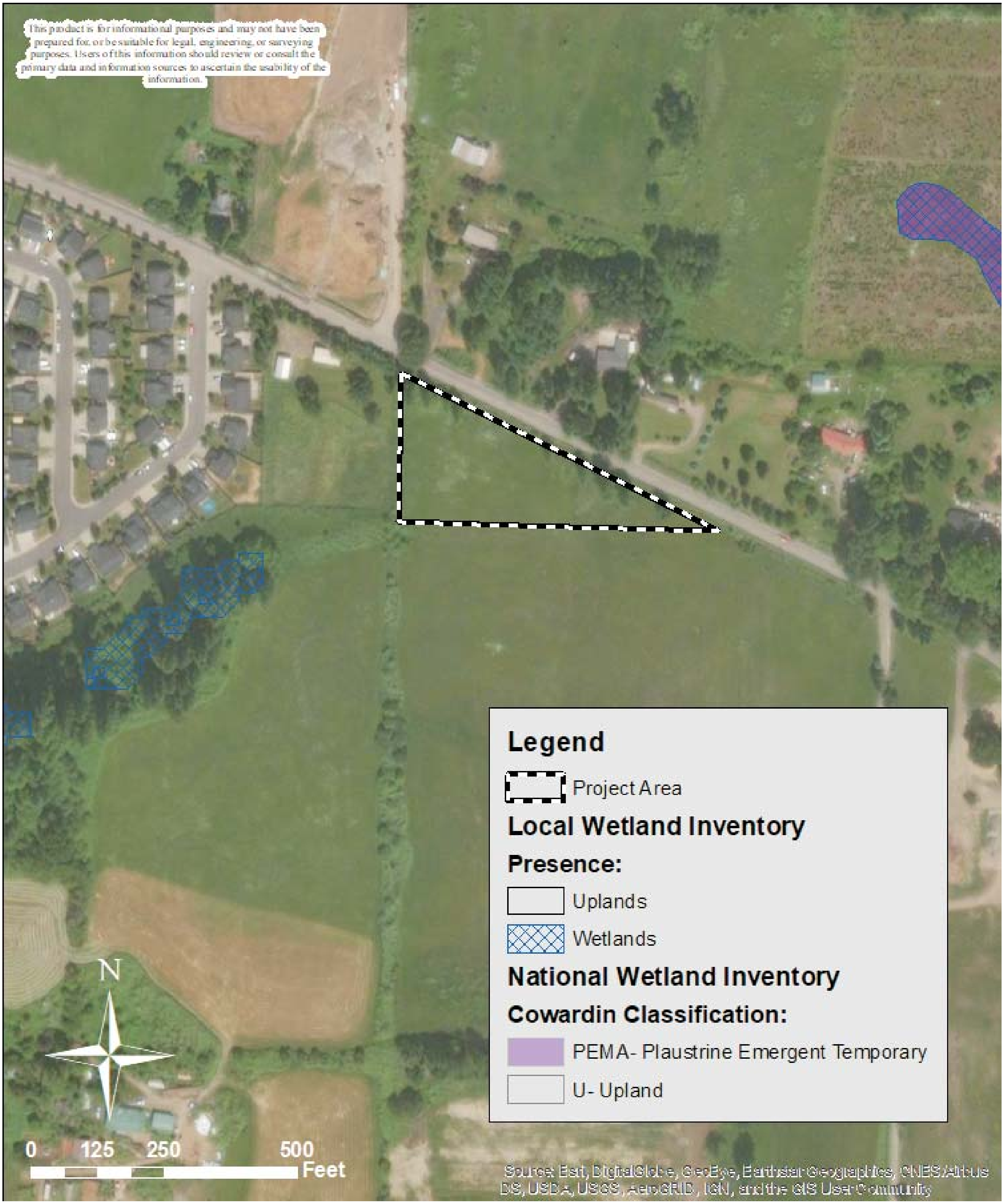
OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure 1



APPLICANT: La Center School District 725 NE Highland Ave La Center, WA 98629 **PURPOSE:** Wetland Delineation & Assessment	**Topography Map** **NE Lockwood Creek Road - North Parcel** **La Center, Washington** OLSON ENVIRONMENTAL LLC 222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242	**PROPOSED ACTIVITIES IN:** Lockwood Creek Watershed **LEGAL:** NE ¼ of S2, T4N, R1E, W. M. **NEAR:** La Center, Washington **COUNTY:** Clark County **DATE:** September 26, 2018 **Figure 2**



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

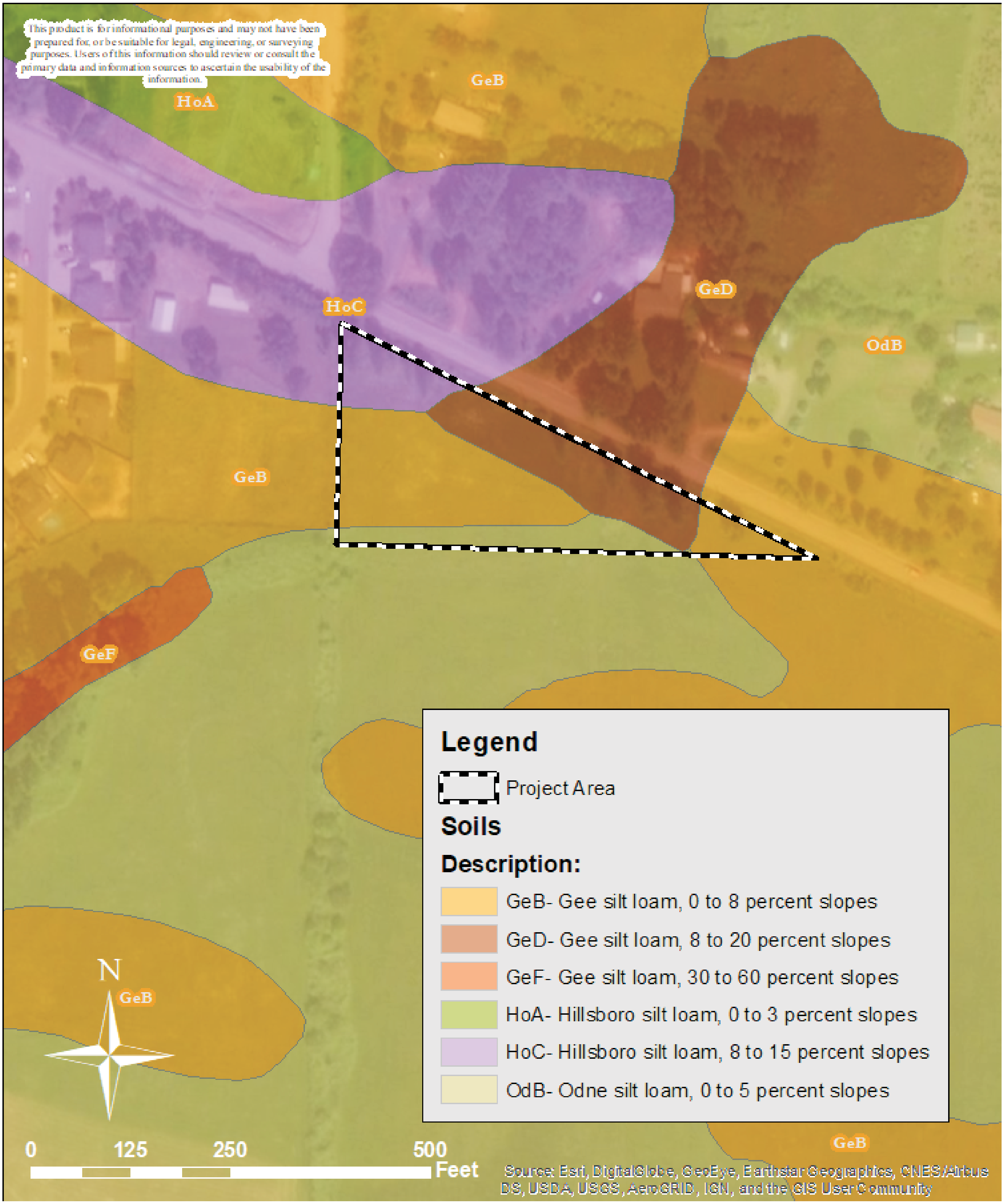
Local and National Wetland Inventories
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC

222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure 3



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

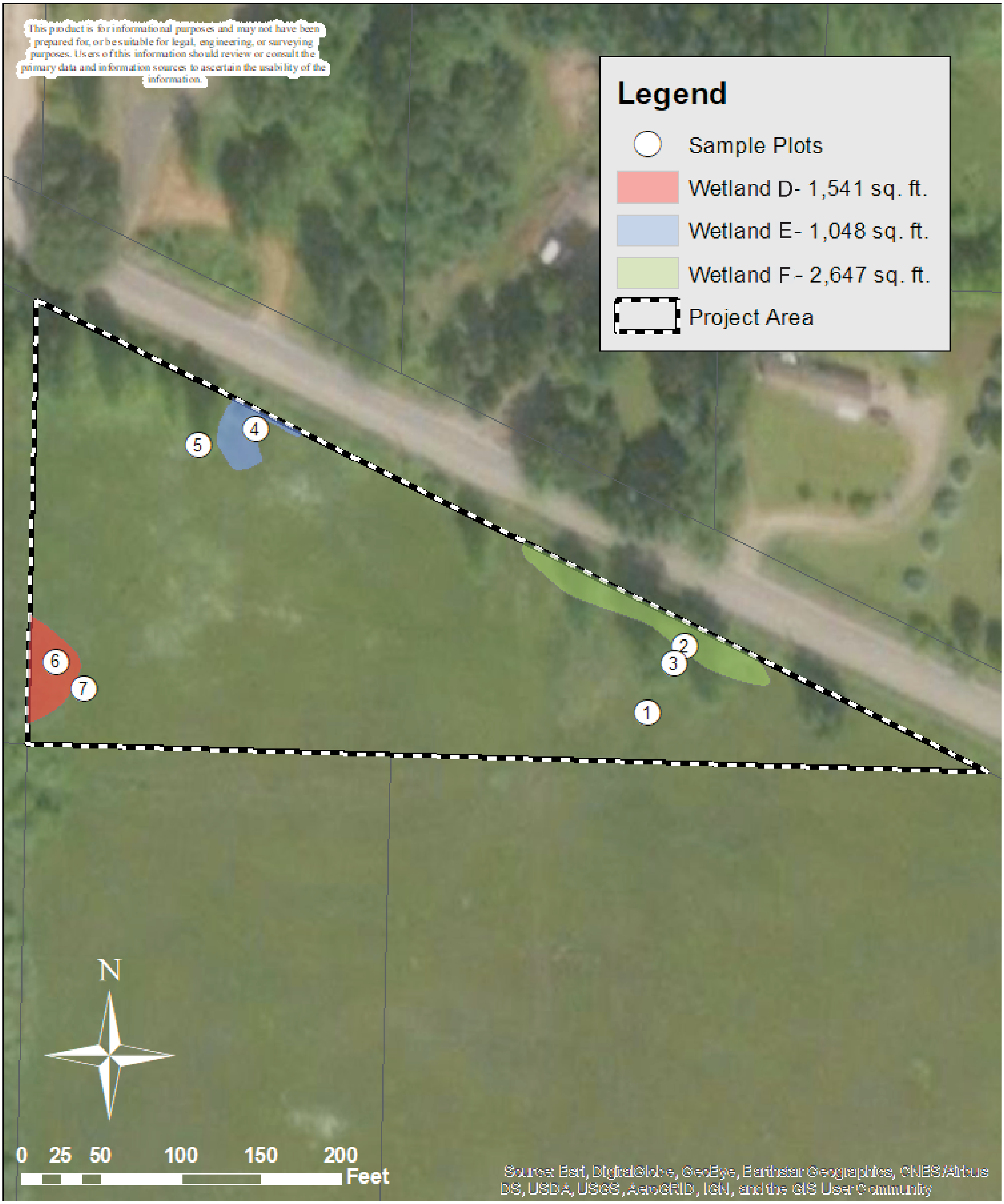
NRCS Clark County Soils Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC

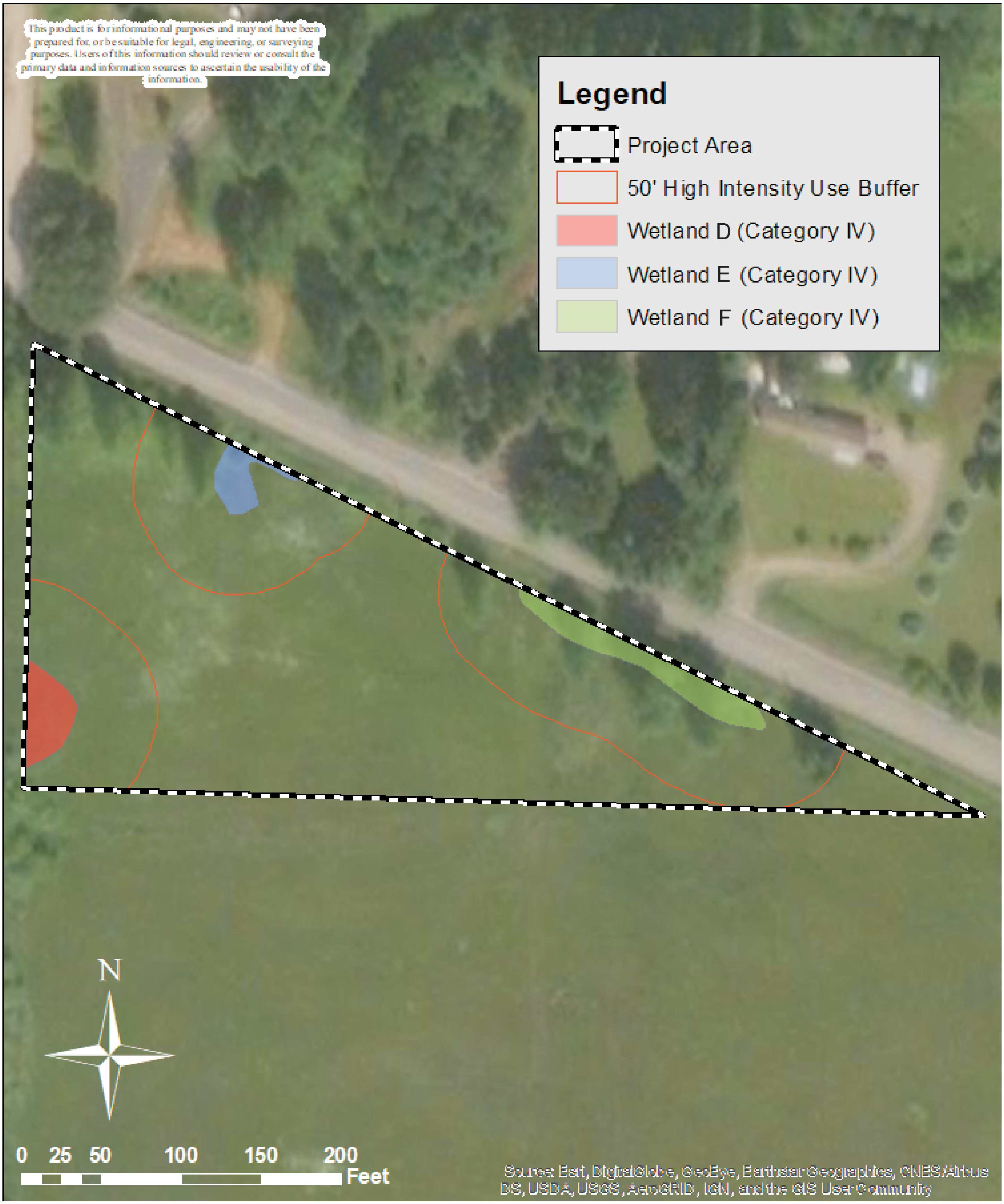
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure 4



APPLICANT: La Center School District 725 NE Highland Ave La Center, WA 98629 **PURPOSE:** Wetland Delineation & Assessment	**Wetland Boundary and Sample Plots** **NE Lockwood Creek Road - North Parcel** **La Center, Washington** OLSON ENVIRONMENTAL LLC 222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242	**PROPOSED ACTIVITIES IN:** Lockwood Creek Watershed **LEGAL:** NE ¼ of S2, T4N, R1E, W. M. **NEAR:** La Center, Washington **COUNTY:** Clark County **DATE:** September 26, 2018 **Figure 5**



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Wetland Categories and Buffers
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure 6

APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Study Area Photographs
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Photo-Sheet 1

APPENDIX A

WETLAND DETERMINATION DATA FORMS

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 1
Investigator(s): Kevin Grosz, Ryan Thiele Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 8-20%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86010680 Long: -122.64972330 Datum: WGS84
Soil Map Unit Name: Gee silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 1 meter)			
1. Schedonorus arundinaceus	60	Yes	FAC
2. Holcus lanatus	20	Yes	FAC
3. Anthoxanthum odoratum	10	No	FACU
4. Agrostis capillaris	5	No	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =95			
Woody Vine Stratum (Plot size: 10 meter)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 5			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	85	x 3 =	255
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	95 (A)		295 (B)

Prevalence Index = B/A = 3.11

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL Sampling Point: New Point 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	100		0			Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 2
Investigator(s): Kevin Grosz Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 8-20%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86022250 Long: -122.64963640 Datum: WGS84
Soil Map Unit Name: Gee silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? Yes Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** Yes
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 meter)	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus balsamifera	40	Yes	FAC
2.			
3.			
4.			
Total Cover =40			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1. Rosa nutkana	20	Yes	FAC
2. Corylus cornuta	2	No	FACU
3.			
4.			
5.			
Total Cover =22			
Herb Stratum (Plot size: 1 meter)			
1. Juncus effusus	20	Yes	FACW
2. Rubus ursinus	15	No	FACU
3. Phalaris arundinacea	15	No	FACW
4. Schedonorus arundinaceus	5	No	FAC
5. Anthoxanthum odoratum	2	No	FACU
6. Phleum pratense	5	No	FAC
7. Agrostis capillaris	20	Yes	FAC
8.			
9.			
10.			
11.			
Total Cover =82			
Woody Vine Stratum (Plot size: 1 meter)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 18			

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	35	x 2 =	70
FAC species	90	x 3 =	270
FACU species	19	x 4 =	76
UPL species	0	x 5 =	0
Column Totals:	144 (A)		416 (B)

Prevalence Index = B/A = 2.89

Hydrophytic Vegetation Indicators:
___ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
X 3 - Prevalence Index is ≤ 3.0[1]
___ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

SOIL

Sampling Point: New Point 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	80	7.5YR 4/4	20	C	M	Clayey Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
_X_Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
_X_Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
_X_Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
_X_Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 3
Investigator(s): Kevin Grosz, Ryan Thiele Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 8-20%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86019240 Long: -122.64966090 Datum: WGS84
Soil Map Unit Name: Gee silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? No Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 1 meter)			
1. Anthoxanthum odoratum	20	Yes	FACU
2. Agrostis capillaris	20	Yes	FAC
3. Schedonorus arundinaceus	15	Yes	FAC
5. Holcus lanatus	10	No	FAC
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =65			
Woody Vine Stratum (Plot size: 1 meter)			
1. Rubus ursinus	15	Yes	FACU
2.			
Total Cover =15			
% Bare Ground in Herb Stratum: 35			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	35	x 4 =	140
UPL species	0	x 5 =	0
Column Totals:	80 (A)		275 (B)

Prevalence Index = B/A = 3.44

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
___ 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
___ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? No

Remarks:

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	0		0			Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
____Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 4
Investigator(s): Kevin Grosz, Ryan Thiele Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 8-15%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86057640 Long: -122.65070310 Datum: WGS84
Soil Map Unit Name: Hillsboro silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? Yes Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** Yes
Remarks:	

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10 meter)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1. Symphoricarpos albus	10	Yes	FACU
2. Salix scouleriana	5	Yes	FAC
3. Spiraea douglasii	5	Yes	FACW
4.			
5.			
Total Cover =20			
Herb Stratum (Plot size: 1 meter)			
1. Phalaris arundinacea	75	Yes	FACW
2. Juncus effusus	10	No	FACW
3. Schedonorus arundinaceus	5	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =90			
Woody Vine Stratum (Plot size: 1 meter)			
1. Rubus armeniacus	15	Yes	FAC
2.			
Total Cover =15			
% Bare Ground in Herb Stratum: 10			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	90	x 2 =	180
FAC species	25	x 3 =	75
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	125 (A)		295 (B)

Prevalence Index = B/A = 2.36

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
X 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100		0			Silt Loam	
5-16	10YR 3/1	85	7.5YR 3/4	15	C	M	Clayey Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
_X_Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
____Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
_X_ Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
_X_Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
_X_Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 5
Investigator(s): Kevin Grosz, Ryan Thiele Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 8-15%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86019240 Long: -122.64966090 Datum: WGS84
Soil Map Unit Name: Hillsboro silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 1 meter)			
1. Agrostis capillaris	25	Yes	FAC
2. Schedonorus arundinaceus	20	Yes	FAC
3. Anthoxanthum odoratum	20	Yes	FACU
5. Holcus lanatus	10	No	FAC
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =75			
Woody Vine Stratum (Plot size: 1 meter)			
1.			
2.			
Total Cover =0			
% Bare Ground in Herb Stratum: 25			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	55	x 3 =	165
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	75 (A)		275 (B)

Prevalence Index = B/A = 3.26

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	0		0			Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 6
Investigator(s): Kevin Grosz, Ryan Thiele Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 0-8%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86016740 Long: -122.65118000 Datum: WGS84
Soil Map Unit Name: Gee silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes Hydric Soil Present? Yes Wetland Hydrology Present? Yes	**Is the Sampled Area within a Wetland?** Yes
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
Total Cover =0			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
5.			
Total Cover =0			
Herb Stratum (Plot size: 1 meter)			
1. Agrostis capillaris	60	Yes	FAC
2. Phalaris arundinacea	15	No	FACW
3. Lupinus polyphyllus	1	No	FAC
4. Holcus lanatus	5	No	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover =81			
Woody Vine Stratum (Plot size: 1 meter)			
1. Rubus armeniacus	2	Yes	FAC
2.			
Total Cover =2			
% Bare Ground in Herb Stratum: 19			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	15	x 2 =	30
FAC species	68	x 3 =	204
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	83 (A)		234 (B)

Prevalence Index = B/A = 2.82

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
X 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes

Remarks:

SOIL

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/2	90	7.5YR 4/4	10	C	M	Silt Loam	
12-16	10YR 3/1	80	7.5YR 4/4	20	C	M	Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
_X_Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:
Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
_X_Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
_X_Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? Yes

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: La Center School District/NE Lockwood Creek Rd City/County: La Center/Clark Sampling Date: 09/20/2018
Applicant/Owner: La Center School District State: WA Sampling Point: 7
Investigator(s): Kevin Grosz, Ryan Thiele Section, Township, Range: 02, T4N, R1E
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 0-8%
Subregion (LRR): Northwest Forests & Coast (LRR A) Lat: 45.86012280 Long: -122.65110680 Datum: WGS84
Soil Map Unit Name: Gee silt loam NWI classification: N/A
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (if no, explain in Remarks.)
Are Vegetation __, Soil __, or Hydrology __ significantly disturbed? Are "Normal Circumstances" present? Yes
Are Vegetation __, Soil __, or Hydrology __ naturally problematic? (if needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? No Hydric Soil Present? No Wetland Hydrology Present? No	**Is the Sampled Area within a Wetland?** No
Remarks:	

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
Total Cover = 0			
Sapling/Shrub Stratum (Plot size: 10 meter)			
1.			
2.			
3.			
4.			
5.			
Total Cover = 0			
Herb Stratum (Plot size: 1 meter)			
1. Phalaris arundinacea	10	No	FACW
2. Agrostis capillaris	40	Yes	FAC
3. Anthoxanthum odoratum	20	Yes	FACU
4. Schedonorus arundinaceus	20	Yes	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
Total Cover = 90			
Woody Vine Stratum (Plot size: 10 meter)			
1.			
2.			
Total Cover = 0			
% Bare Ground in Herb Stratum: 10			

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	60	x 3 =	180
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	90 (A)		280 (B)

Prevalence Index = B/A = 3.11

Hydrophytic Vegetation Indicators:
__ 1 –Rapid Test for Hydrophytic Vegetation
X 2 – Dominance Test >50%
__ 3 - Prevalence Index is ≤ 3.0[1]
__ 4 - Morphological Adaptions[1] (Provide supporting data in Remarks or on a separate sheet)
__ 5 – Wetland Non-Vascular Plants[1]
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? No

Remarks:

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/2	0		0			Silt Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___Histosol (A1)
___Histic Epipedon (A2)
___Black Histic (A3)
___Hydrogen Sulfide (A4)
___Depleted Below Dark Surface (A11)
___Thick Dark Surface (A12)
___Sandy Mucky Mineral (S1)
___Sandy Gleyed Matrix (S4)
___Sandy Redox (S5)
___Stripped Matrix (S6)
___Loamy Mucky Mineral (F1) (**except MLRA 1**)
___Loamy Gleyed Matrix (F2)
___Depleted Matrix (F3)
___Redox Dark Surface (F6)
___Depleted Dark Surface (F7)
___Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___2 cm Muck (A10)
___Red Parent Material (TF2)
___Very Shallow Dark Surface (TF12)
___Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type:
Depth (inches): 0

Hydric Soil Present? No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___Surface Water (A1)
___High Water Table (A2)
___Saturation (A3)
___Water Marks (B1)
___Sediment Deposits (B2)
___Drift Deposits (B3)
___Algal Mat or Crust (B4)
___Iron Deposits (B5)
___Surface Soil Cracks (B6)
___Inundation Visible on Aerial Imagery (B7)
___Sparsely Vegetated Concave Surface (B8)
___Water-Stained Leaves (B9) (**except MLRA 1,2,4A, and 4B**)
___Salt Crust (B11)
___Aquatic Invertebrates (B13)
___Hydrogen Sulfide Odor (C1)
___Oxidized Rhizospheres along Living Roots (C3)
___Presence of Reduced Iron (C4)
___Recent Iron Reduction in Tilled Soils (C6)
___Stunted or Stressed Plants (D1)(**LRR A**)
___Other (Explain in Remarks)

Secondary Indicators (two or more required)

___Water-Stained Leaves (B9)(**MLRA 1,2,4A,4B**)
___Drainage Patterns (B10)
___Dry-Season Water Table (C2)
___Saturation Visible on Aerial Imagery (C9)
___Geomorphic Position (D2)
___Shallow Aquitard (D3)
___FAC-Neutral Test (D5)
___Raised Ant Mounds (D6)(**LRR A**)
___Frost-Heave Hummocks (D7)

Field Observations:
Surface Water Present? No Depth (inches):
Water Table Present? No Depth (inches):
Saturation Present? No Depth (inches):
(includes capillary fringe)

Wetland Hydrology Present? No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX B

WETLAND RATING FORMS FOR WESTERN WASHINGTON & FIGURES

Wetland name or number D

RATING SUMMARY – Western Washington

Name of wetland (or ID #): NE Lockwood Creek Rd. - Wetland D Date of site visit: 9/20/18

Rated by Alex Sherman Trained by Ecology? x Yes ___No Date of training 9/18/17

HGM Class used for rating Slope Wetland has multiple HGM classes?___Y x N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map ArcGIS World Imagery Basemap

OVERALL WETLAND CATEGORY IV (based on functions X or special characteristics___)

1. Category of wetland based on FUNCTIONS

_______**Category I** – Total score = 23 - 27

_______**Category II** – Total score = 20 - 22

_______**Category III** – Total score = 16 - 19

X **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M **L**	H M **L**	H M **L**	
Landscape Potential	H **M** L	H M **L**	**H** M L	
Value	**H** M L	H M **L**	H M **L**	**TOTAL**
Score Based on Ratings	6	3	5	14

Score for each function based on three ratings
(order of ratings is not important)

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	Not Applicable

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	B1
Hydroperiods	H 1.2	B2
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	B3
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	B3
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	B2
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	B4
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	B8
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	B7

Wetland name or number __D__

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

   NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

   1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is an* ***Estuarine*** *wetland and is not scored. This method* ***cannot*** *be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   NO – go to 3 **YES** – The wetland class is **Flats**
   If your wetland can be classified as a Flats wetland, use the form for ***Depressional*** *wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   ___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ___At least 30% of the open water area is deeper than 6.6 ft (2 m).

   NO – go to 4 **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
   _x_The wetland is on a slope (*slope can be very gradual*),
   x___The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   _x_The water leaves the wetland **without being impounded**.

   NO – go to 5 **YES –** The wetland class is **Slope**

   NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
   ____The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ____The overbank flooding occurs at least once every 2 years.

SLOPE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	3
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	0
Total for S 1 Add the points in the boxes above	3

Rating of Site Potential If score is**:___12 = H ___6-11 = M x__0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources __________________ Yes = 1 No = 0	1
Total for S 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is**:_x_1-2 = M ___0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list*. Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	2
Total for S 3 Add the points in the boxes above	4

Rating of Value If score is:x___**2-4 = H ___1 = M ___0 = L** *Record the rating on the first page*

Wetland name or number _D __

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. *Stems of plants should be thick enough (usually > $^1/_8$ in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	0

Rating of Site Potential If score is**:**___**1 = M** _x__**0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	

Rating of Landscape Potential If score is:___**1 = M** _x__**0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	0
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 Add the points in the boxes above	0

Rating of Value If score is:___**2-4 = H** ___**1 = M** _x__**0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed — 4 structures or more: points = 4
_x__Emergent — 3 structures: points = 2
____Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1
____Forested (areas where trees have > 30% cover) — 1 structure: points = 0

If the unit has a Forested class, check if:

____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

0

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated — 4 or more types present: points = 3
_x__Seasonally flooded or inundated — 3 types present: points = 2
____Occasionally flooded or inundated — 2 types present: points = 1
____Saturated only — 1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland
____Seasonally flowing stream in, or adjacent to, the wetland
____**Lake Fringe wetland** — **2 points**
____**Freshwater tidal wetland** — **2 points**

0

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

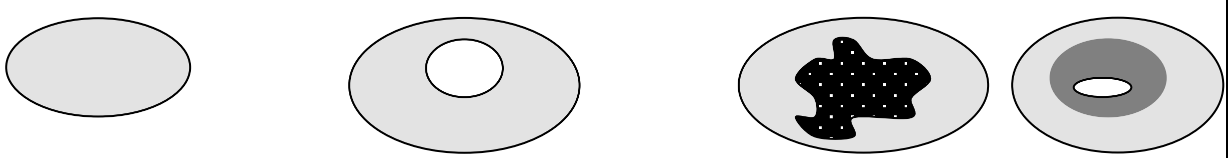
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

0

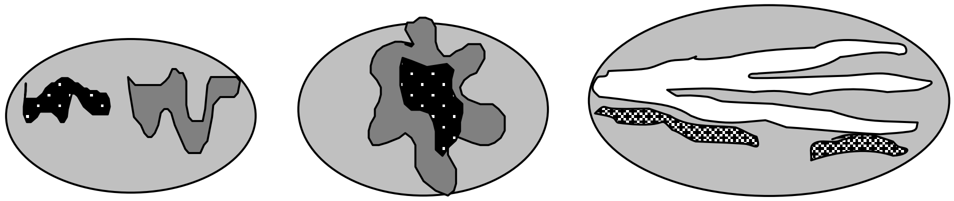
H 1.4. Interspersion of habitats

Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points　　**Low** = 1 point　　**Moderate** = 2 points

All three diagrams in this row are **HIGH** = 3points



0

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* _x__At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	1

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** _x__**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?

H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat_13_ + [(% moderate and low intensity land uses)/2]_13_ = __26__% If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	2
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat_27_ + [(% moderate and low intensity land uses)/2]_24_ = __51__% Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	3
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	5

Rating of Landscape Potential If score is:_x__**4-6 = H** ___**1-3 = M** ___**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?

H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:___**2 = H** ___**1 = M** _x__**0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number D

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	Category
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** No **–** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I** No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** No **= Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No **= Is not a bog**	**Cat. I**

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** No = **Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* Yes – Go to **SC 5.1** No = **Not a wetland in a coastal lagoon** SC 5.1. Does the wetland meet all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than $^{1}/_{10}$ ac (4350 ft^{2}) Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: — Long Beach Peninsula: Lands west of SR 103 — Grayland-Westport: Lands west of SR 105 — Ocean Shores-Copalis: Lands west of SR 115 and SR 109 Yes – Go to **SC 6.1** No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? Yes = **Category II** No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? Yes = **Category III** No = **Category IV**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

Wetland name or number E

RATING SUMMARY – Western Washington

Name of wetland (or ID #): NE Lockwood Creek Rd/North - Wetland E Date of site visit: 9/20/18

Rated by Alex Sherman Trained by Ecology? x Yes ___No Date of training 9/18/17

HGM Class used for rating Slope Wetland has multiple HGM classes?___Y x N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.

Source of base aerial photo/map ArcGIS World Imagery

OVERALL WETLAND CATEGORY IV (based on functions X or special characteristics___)

1. Category of wetland based on FUNCTIONS

_______**Category I** – Total score = 23 - 27

_______**Category II** – Total score = 20 - 22

_______**Category III** – Total score = 16 - 19

X **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M **L**	H M **L**	H M **L**	
Landscape Potential	H **M** L	H M **L**	H **M** L	
Value	**H** M L	H M **L**	H M **L**	**TOTAL**
Score Based on Ratings	6	3	4	13

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	Not Applicable

Wetland name or number _ E___

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	B1
Hydroperiods	H 1.2	B2
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	B3
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	B3
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	B1
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	B5
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	B8
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	B7

Wetland name or number __E__

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

   NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

   1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   NO – go to 3 **YES** – The wetland class is **Flats**
   *If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   __The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   __At least 30% of the open water area is deeper than 6.6 ft (2 m).

   NO – go to 4 **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
   _x_The wetland is on a slope (*slope can be very gradual*),
   _x_The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   _x_The water leaves the wetland **without being impounded**.

   NO – go to 5 **YES –** The wetland class is **Slope**

   NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
   ___The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ___The overbank flooding occurs at least once every 2 years.

SLOPE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	3
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	0
Total for S 1 Add the points in the boxes above	3

Rating of Site Potential If score is:**___12 = H ___6-11 = M _X_0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources oil, heavy metals Yes = 1 No = 0	1
Total for S 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is:**_X_1-2 = M ___0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list*. Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	2
Total for S 3 Add the points in the boxes above	4

Rating of Value If score is:**_X_2-4 = H ___1 = M ___0 = L** *Record the rating on the first page*

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. *Stems of plants should be thick enough (usually > $^1/_8$ in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	0

Rating of Site Potential If score is**:____1 = M _x__0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	1

Rating of Landscape Potential If score is:_x__**1 = M** ____**0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	0
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 Add the points in the boxes above	0

Rating of Value If score is:____**2-4 = H** ____**1 = M** _x__**0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed	4 structures or more: points = 4
_X_Emergent	3 structures: points = 2
_X_Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
____Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

1

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated	4 or more types present: points = 3
_X_Seasonally flooded or inundated	3 types present: points = 2
____Occasionally flooded or inundated	2 types present: points = 1
____Saturated only	1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland	
____Seasonally flowing stream in, or adjacent to, the wetland	
____**Lake Fringe wetland**	**2 points**
____**Freshwater tidal wetland**	**2 points**

0

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

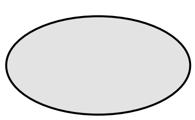
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

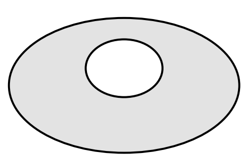
1

H 1.4. Interspersion of habitats

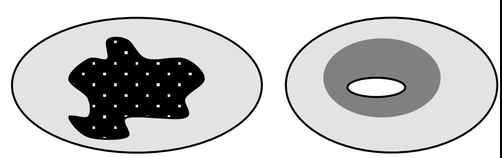
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points

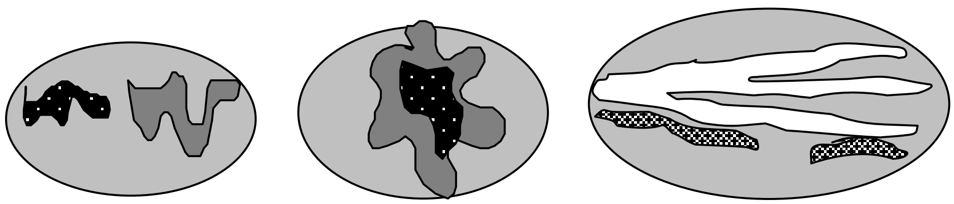


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3points



1

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* _x_Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 — Add the points in the boxes above	4

Rating of Site Potential If score is:____**15-18 = H** ____**7-14 = M** _x_**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat 12 **+** [(% moderate and low intensity land uses)/2] 13 **=** 25 % If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon — points = 3 20-33% of 1 km Polygon — points = 2 10-19% of 1 km Polygon — points = 1 < 10% of 1 km Polygon — points = 0	2
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat 25 **+** [(% moderate and low intensity land uses)/2] 25 **=** 50 % Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10-50% and in 1-3 patches — points = 2 Undisturbed habitat 10-50% and > 3 patches — points = 1 Undisturbed habitat < 10% of 1 km Polygon — points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use — points = (- 2) ≤ 50% of 1 km Polygon is high intensity — points = 0	0
Total for H 2 — Add the points in the boxes above	3

Rating of Landscape Potential If score is:____**4-6 = H** _x_**1-3 = M** ____**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1 Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:____**2 = H** ____**1 = M** _x_**0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	Category
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** No **–** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I**No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** No **= Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below. **If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No **= Is not a bog**	**Cat. I**

<table>
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SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

— **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.

— **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

Yes = **Category I** No = **Not a forested wetland for this section**

</td><td>

Cat. I

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SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

— The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks

— The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

Yes – Go to **SC 5.1** No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

— The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).

— At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

— The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

Yes = **Category I** No = **Category II**

</td><td>

Cat. I

Cat. II

</td></tr>
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SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

— Long Beach Peninsula: Lands west of SR 103

— Grayland-Westport: Lands west of SR 105

— Ocean Shores-Copalis: Lands west of SR 115 and SR 109

Yes – Go to **SC 6.1** No = **not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

Yes = **Category II** No – Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

Yes = **Category III** No = **Category IV**

</td><td>

Cat I

Cat. II

Cat. III

Cat. IV

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Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form

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NA

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</table>

RATING SUMMARY – Western Washington

Name of wetland (or ID #): NE Lockwood Creek Rd/North - Wetland F Date of site visit: 9/20/18

Rated by Alex Sherman Trained by Ecology? x Yes ___No Date of training 9/18/17

HGM Class used for rating Slope Wetland has multiple HGM classes?___Y x N

NOTE: Form is not complete without the figures requested *(figures can be combined)*.
Source of base aerial photo/map ArcMap World Imagery

OVERALL WETLAND CATEGORY IV (based on functions X or special characteristics___)

1. Category of wetland based on FUNCTIONS

________**Category I** – Total score = 23 - 27

________**Category II** – Total score = 20 - 22

________**Category III** – Total score = 16 - 19

___X___**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H M L	H M L	H M L	
Landscape Potential	H M L	H M L	H M L	
Value	H M L	H M L	H M L	**TOTAL**
Score Based on Ratings	6	4	4	14

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	Not Applicable

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	B1
Hydroperiods	H 1.2	B2
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	B3
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	B3
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	B1
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	B6
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	B8
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	B7

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

   NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

   1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is an* ***Estuarine*** *wetland and is not scored. This method* ***cannot*** *be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

   NO – go to 3 **YES** – The wetland class is **Flats**
   If your wetland can be classified as a Flats wetland, use the form for ***Depressional*** *wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   ___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ___At least 30% of the open water area is deeper than 6.6 ft (2 m).

   NO – go to 4 **YES** – The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
   _x_The wetland is on a slope (*slope can be very gradual*),
   _x_The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   _x_The water leaves the wetland **without being impounded**.

   NO – go to 5 **YES – The wetland class is Slope**

   NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
   ___The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ___The overbank flooding occurs at least once every 2 years.

SLOPE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance)* Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	3
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	1
Total for S 1 Add the points in the boxes above	4

Rating of Site Potential If score is:**___12 = H ___6-11 = M _X__0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources _oil, heavy metals_ Yes = 1 No = 0	1
Total for S 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is:**_X__1-2 = M ___0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list.* Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	2
Total for S 3 Add the points in the boxes above	4

Rating of Value If score is:**_X__2-4 = H ___1 = M ___0 = L** *Record the rating on the first page*

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. *Stems of plants should be thick enough (usually > $^1/_8$ in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland — points = 1 All other conditions — points = 0	0

Rating of Site Potential If score is**:**___**1 = M** _X__**0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	1

Rating of Landscape Potential If score is:_X__**1 = M** ___**0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) — points = 2 Surface flooding problems are in a sub-basin farther down-gradient — points = 1 No flooding problems anywhere downstream — points = 0	0
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 — Add the points in the boxes above	0

Rating of Value If score is:___**2-4 = H** ___**1 = M** _X__**0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number __F__

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed — 4 structures or more: points = 4
____Emergent — 3 structures: points = 2
_x__Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1
_x__Forested (areas where trees have > 30% cover) — 1 structure: points = 0

If the unit has a Forested class, check if:

____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

1

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated — 4 or more types present: points = 3
_x__Seasonally flooded or inundated — 3 types present: points = 2
____Occasionally flooded or inundated — 2 types present: points = 1
____Saturated only — 1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland
____Seasonally flowing stream in, or adjacent to, the wetland
____**Lake Fringe wetland** — **2 points**
____**Freshwater tidal wetland** — **2 points**

0

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

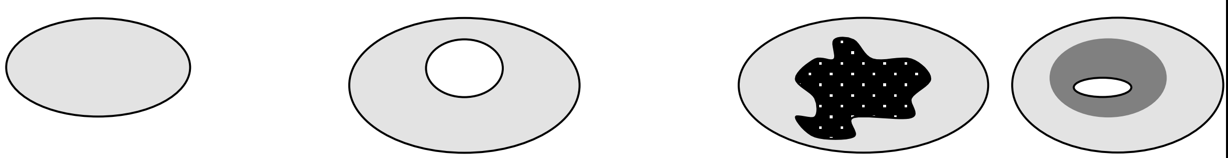
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

1

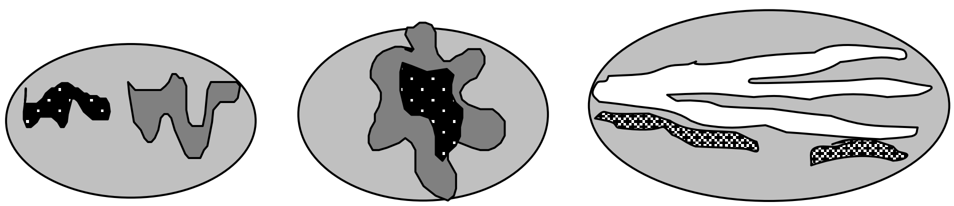
H 1.4. Interspersion of habitats

Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points   **Low** = 1 point   **Moderate** = 2 points

All three diagrams in this row are **HIGH** = 3points



1

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* ____Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). ____Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* __x__Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	1
Total for H 1 Add the points in the boxes above	4

Rating of Site Potential If score is:____**15-18 = H** ____**7-14 = M** __x__**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* % undisturbed habitat__13__ + [(% moderate and low intensity land uses)/2]__13__ = ___26___% If total accessible habitat is: > $^1/_3$ (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	2
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat__26__ + [(% moderate and low intensity land uses)/2]__24__ = ___50___% Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	0
Total for H 2 Add the points in the boxes above	3

Rating of Landscape Potential If score is:____**4-6 = H** __x__**1-3 = M** ____**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1 Site does not meet any of the criteria above points = 0	0

Rating of Value If score is:____**2 = H** ____**1 = M** __x__**0 = L** *Record the rating on the first page*

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number __F___

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes – Go to **SC 2.2** No – Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes = **Category I** No = **Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes – **Contact WNHP/WDNR and go to SC 2.4** No = **Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes = **Category I** No = **Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No = **Is not a bog**	**Cat. I**

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** No = **Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* Yes – Go to **SC 5.1** No = **Not a wetland in a coastal lagoon** SC 5.1. Does the wetland meet all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2) Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: — Long Beach Peninsula: Lands west of SR 103 — Grayland-Westport: Lands west of SR 105 — Ocean Shores-Copalis: Lands west of SR 115 and SR 109 Yes – Go to **SC 6.1** No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? Yes = **Category II** No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? Yes = **Category III** No = **Category IV**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	NA

APPENDIX B

WETLAND RATING FIGURES

FIGURE B1 – COWARDIN VEGETATION

FIGURE B2 – HYDROPERIODS MAP

FIGURE B3 – PLANT COVER MAP

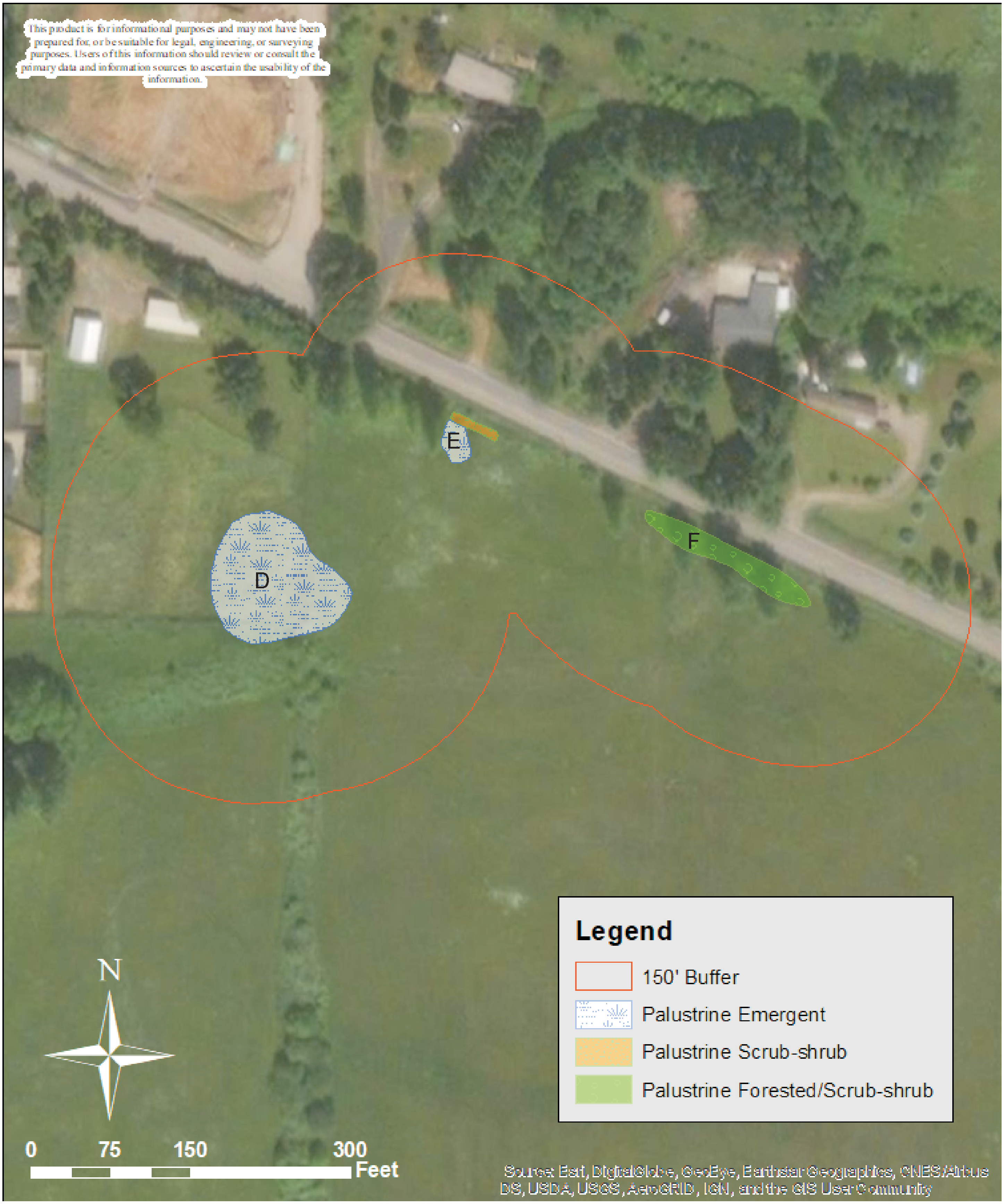
FIGURE B4 – LAND USE INTESITY MAP: WETLAND D

FIGURE B5 – LAND USE INTESITY MAP: WETLAND E

FIGURE B6 – LAND USE INTESITY MAP: WETLAND F

FIGURE B7 – LIST OF TMDLS IN PROJECT WATERSHED

FIGURE B8 – 303(d) WATER QUALITY ASSESSMENT MAP



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Cowardin Vegetation Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC

222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B1

APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Hydro-Period Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC

222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B2

APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

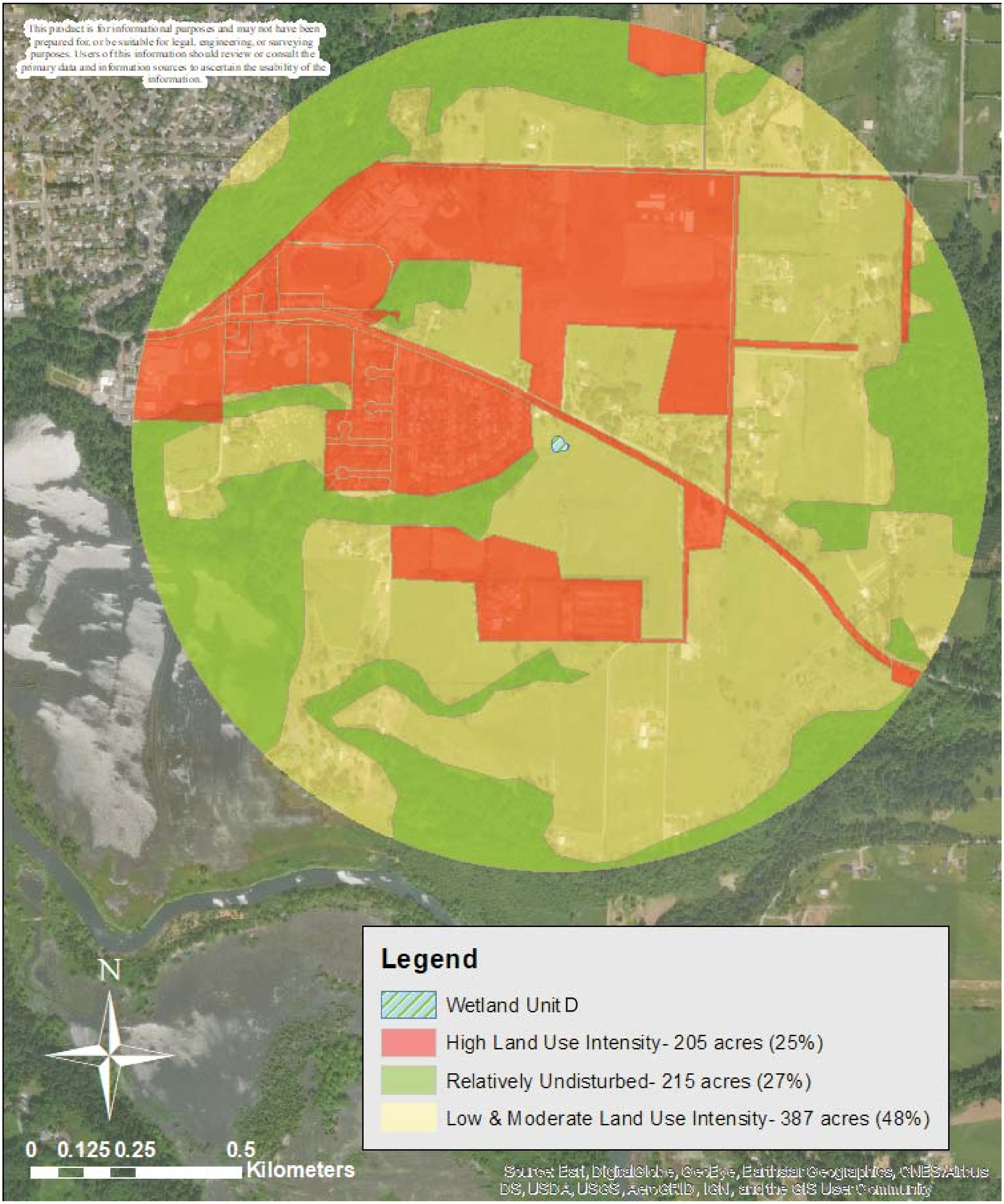
PURPOSE: Wetland Delineation & Assessment

Plant Cover Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B3



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

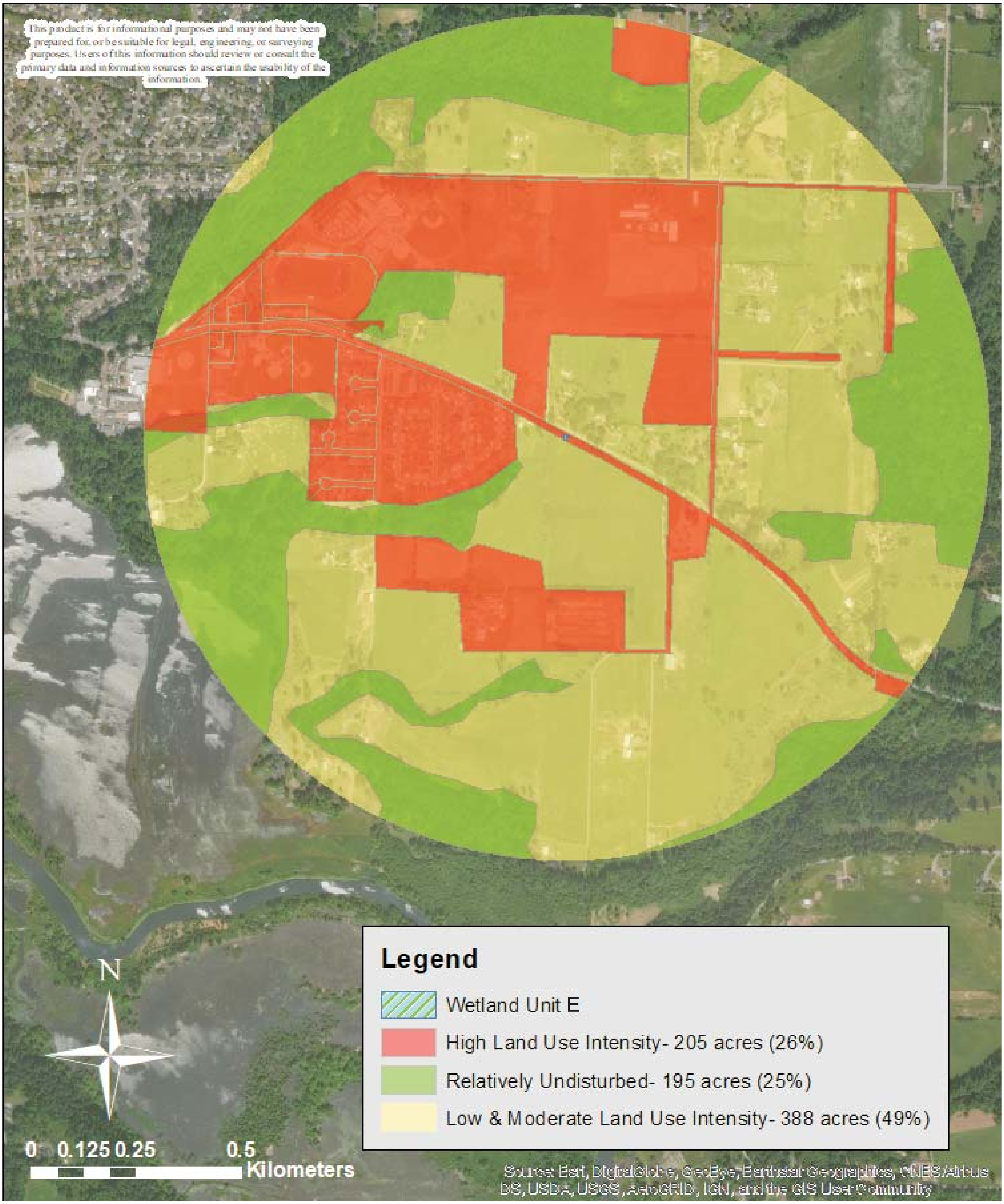
PURPOSE: Wetland Delineation & Assessment

Wetland D - Land Use Intensity Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B4



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

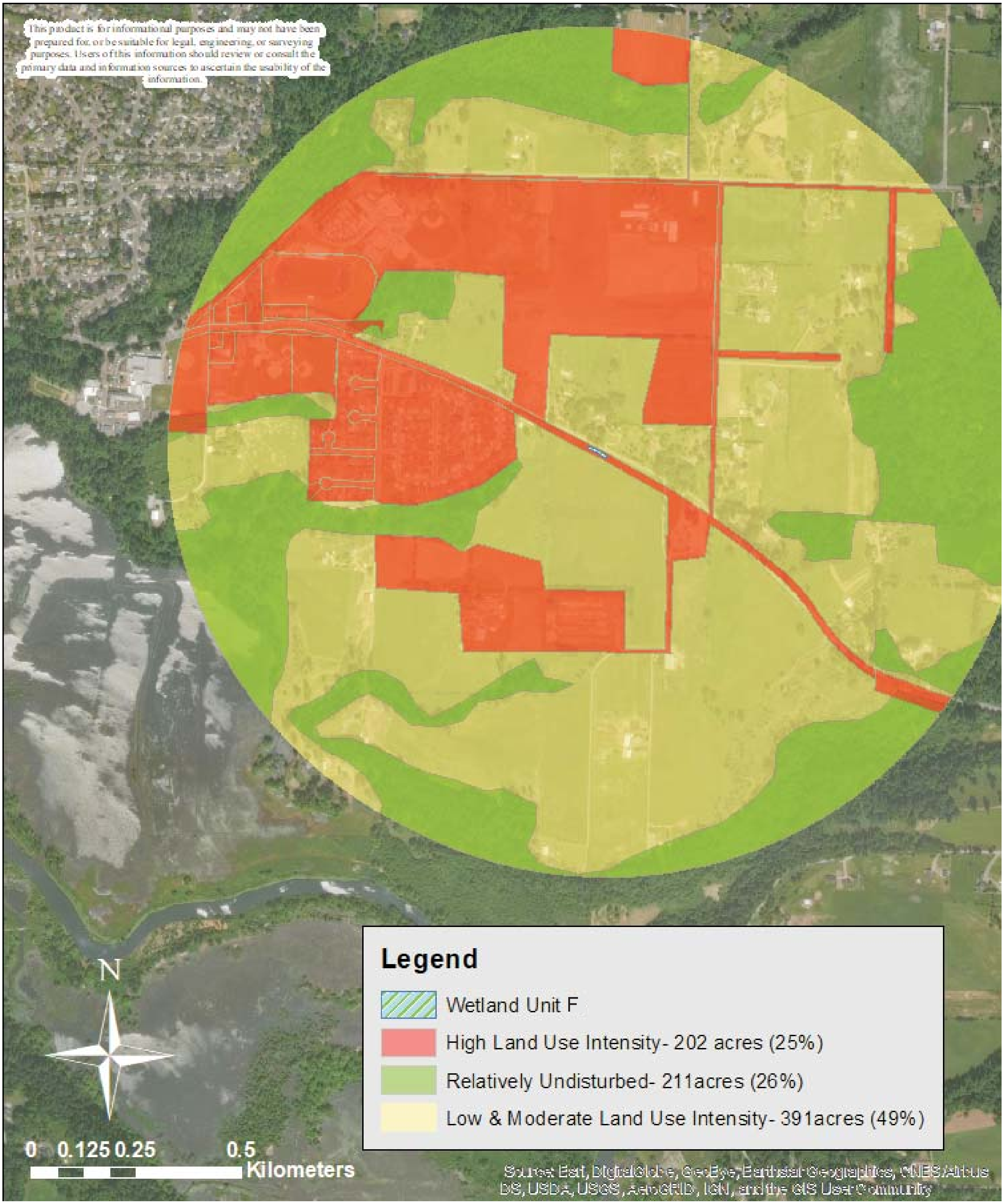
PURPOSE: Wetland Delineation & Assessment

Wetland E - Land Use Intensity Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B5



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Wetland F - Land Use Intensity Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B6

DEPARTMENT OF ECOLOGY State of Washington

Washington State Water Quality Assessment

303(d)/305(b) List

Assessment WQ Search Tool | Contact Us | WQ Atlas

New Search | Refine Search | Export to File

4 Matched Listings

The 303(d) List contains only Category 5 Listings.

View	ListingID	Assessment Unit ID	Medium	Parameter	Current Category	Waterbody Name	WRIA	WQ Improvement Project	WQ Atlas Map Link
View	7819	17080002000336	Water	Bacteria	5	LOCKWOOD CREEK	27 - Lewis		7819
View	7820	17080002000336	Water	Temperature	5	LOCKWOOD CREEK	27 - Lewis		7820
View	46224	17080002000338	Water	Bacteria	5	LOCKWOOD CREEK	27 - Lewis		46224
View	70061	17080002000336	Other	Bioassessment	5	LOCKWOOD CREEK	27 - Lewis		70061

New Search | Refine Search | Export to File

Ecology Home Page | Disclaimer | Privacy Notice | Accessibility | Release Notes

Approved WQA Version: 1.0.7

APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

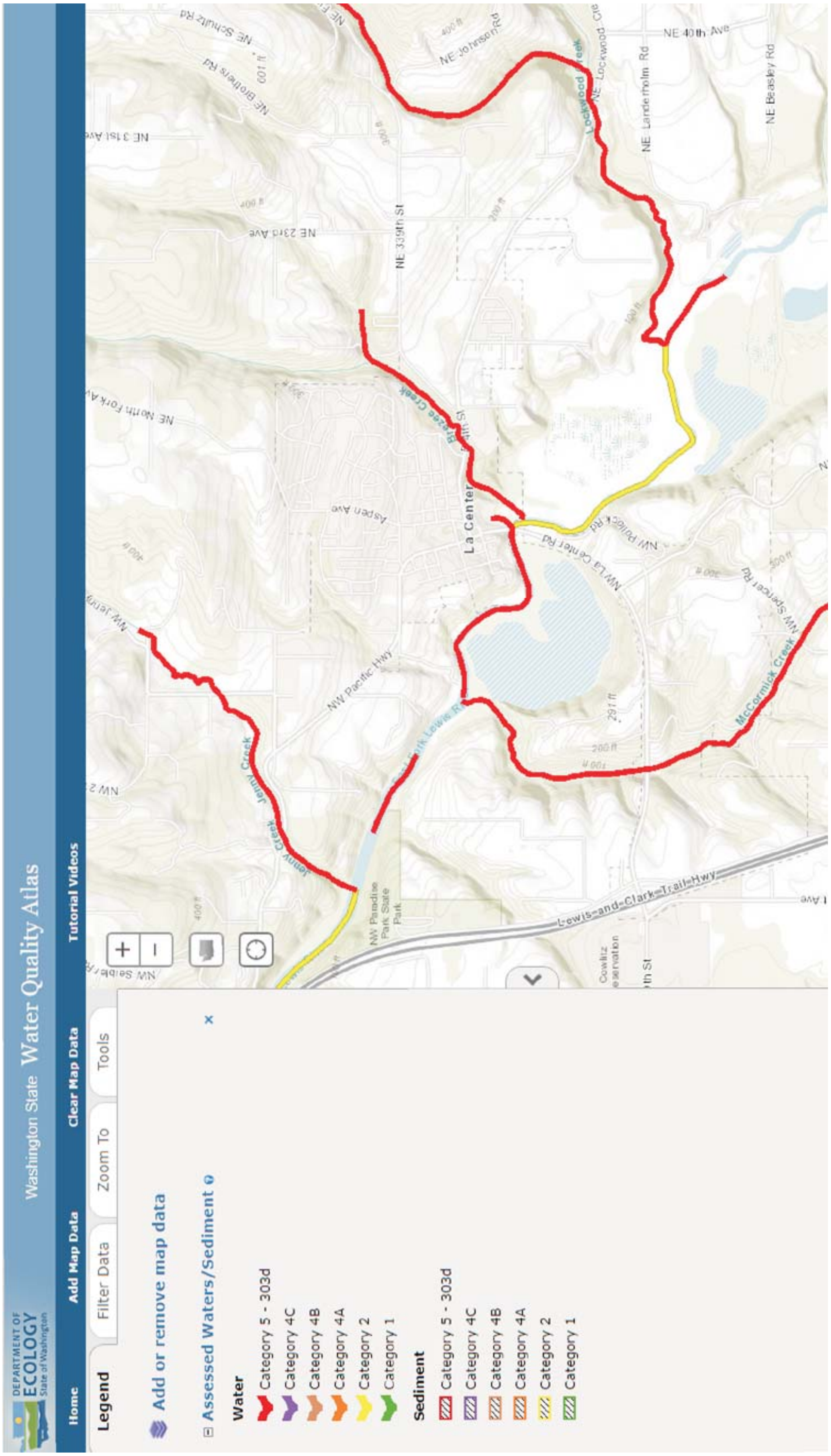
TMDL List
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC

222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B7



APPLICANT:
La Center School District
725 NE Highland Ave
La Center, WA 98629

PURPOSE: Wetland Delineation & Assessment

Watershed 303(d) Listing Map
NE Lockwood Creek Road - North Parcel
La Center, Washington

OLSON ENVIRONMENTAL LLC
ENVIRONMENTAL SERVICES • GIS • HABITAT RESTORATION
222 E. Evergreen Blvd., Vancouver, WA 98660 ph: 360-693-4555 fax: 360-699-6242

PROPOSED ACTIVITIES IN:
Lockwood Creek Watershed
LEGAL: NE ¼ of S2, T4N, R1E, W. M.
NEAR: La Center, Washington
COUNTY: Clark County
DATE: September 26, 2018

Figure B8

Appendix F
Stormwater Facility Operations and Maintenance

V-4.6 Maintenance Standards for Drainage Facilities

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants	Any evidence of oil,	No contaminants or pol-

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	and Pollution	gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	lutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure (s); e.g.,rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Ponds Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement	Dike is built back to the design elevation.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with	Piping eliminated. Erosion potential resolved.

Table V-4.5.2(1) Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	
Emergency Overflow/Spillway	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

Table V-4.5.2(2) Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate	Sediment is removed

Table V-4.5.2(3) Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See "Catch Basins" (No. 5)	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as

Table V-4.5.2(4) Maintenance Standards - Control Structure/Flow Restrictor (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		are not watertight and show signs of rust.	designed.
		Any holes - other than designed holes - in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).	See "Closed Detention Systems" (No. 3).
Catch Basin	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Table V-4.5.2(20) Maintenance Standards - Compost Amended Vegetated Filter Strip (CAVFS) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint				
Earthen side slopes and berms	B, S		Erosion (gullies/rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				depth), temporary erosion control measures should be put in place until permanent repairs can be made. • Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3	Restore to design height

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			inches (relative to undisturbed sections of berm)	
	A, S		Downstream face of berm wet, seeps or leaks evident	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm	• Eradicate rodents (see "Pest control") • Fill holes and compact (may require consultation with engineer, particularly for larger berms)
Concrete sidewalls	A		Cracks or failure of concrete sidewalls	• Repair/ seal cracks • Replace if repair is insufficient
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Facility area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		Accumulated sediment to extent that infiltration rate is	• Remove excess sediment • Replace any vegetation damaged or

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			reduced (see "Ponded water") or surface storage capacity significantly impacted	destroyed by sediment accumulation and removal • Mulch newly planted vegetation • Identify and control the sediment source (if feasible) • If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet
		During/after fall leaf drop	Accumulated leaves in facility	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded
Low permeability check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage
	A, S		Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	A		Grade board or top of weir damaged or not level	Restore to level position
Ponded water	B, S		Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Determine cause and resolve in the following order: 1. Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2. Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3. Check for other water inputs (e.g., groundwater, illicit connections). 4. Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem,

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.
Bioretention soil media	As needed		Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint	• Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. • Never drive equipment or apply heavy loads in facility footprint. • Because the risk of compaction is higher during saturated soil

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. â€¢ Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. â€¢ If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.
Inlets/Outlets/Pipes				
Splash block inlet	A		Water is not being directed properly to the facility and away from the inlet structure	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M during the wet season and before severe storm	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	is forecasted			
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		A	Maintain access for inspections	• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Erosion control at inlet	A		Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				cut or swale)
Trash rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	• Plant roots, sediment or debris reducing capacity of underdrain • Prolonged surface ponding (see "Ponded water"	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring		Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more	• Determine cause of poor vegetation growth and correct condition • Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jur-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			or less than 75% survival rate).	isdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound). • Confirm that plant selection is appropriate for site growing conditions • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Vegetation (general)	As needed		Presence of diseased plants and plant material	• Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • See Pacific North-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				west Plant Disease Management Handbook for information on disease recognition and for additional resources • Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".
Trees and shrubs		All pruning seasons (timing varies by species)	Pruning as needed	• Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques • All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				shrubs, if necessary.

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Fall and Spring		Standing dead vegetation is present	• Remove standing dead vegetation • Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season) • If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately. • Determine cause of dead vegetation and address issue, if possible • If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.
	Fall and		Planting	• When working

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Spring		beneath mature trees	around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.
	Fall and Spring		Presence of or need for stakes and guys (tree growth, maturation, and support needs)	• Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage • Monitor tree support systems: Repair and adjust as needed to

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				provide support and prevent damage to tree. • Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. • Backfill stake holes after removal.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		Vegetation causes some visibility (line of sight) or driver safety issues	• Maintain appropriate height for sight clearance • When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location. • Remove or transplant if continual safety hazard • Consultation with a landscape architect is recommended for removal, transplant, or substitution of

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				plants
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	Vegetation compromises conveyance	Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)		Winter and Spring	Dead material from previous year's growing cycle or dead collapsed foliage	• Leave dry foliage for winter interest • Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow
Ornamental grasses (evergreen)		Fall and Spring	Dead growth present in spring	• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				• Clean, rake, and comb grasses when they become too tall • Cut back to ground or thin every 2-3 years as needed
Noxious weeds		M (March - October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions • Apply mulch after weed removal (see "Mulch")
Weeds		M (March - October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)
Excessive vegetation		Once in early to mid- May and once in early- to mid-September	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	• Edge or trim groundcovers and shrubs at facility edge • Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks • While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging
	As needed		Excessive vegetation density inhibits stormwater flow beyond design ponding or	• Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
			becomes a hazard for pedestrian and vehicular circulation and safety	• Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow) • Remove plants that are weak, broken or not true to form; replace in-kind • Thin grass or plants impacting facility function without leaving visual holes or bare soil areas • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
	As needed		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	Remove vegetation and sediment buildup

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels) • Keep all mulch away from woody stems
Watering				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/located to properly water plants	Redirect sprinklers or move drip irrigation to desired areas
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		

				• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist
				• Use soaker hoses or spot water with a shower type wand when irrigation system is not present
				  ◦ Pulse water to enhance soil absorption, when feasible
				  ◦ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff
				• Add a tree bag or slow-release watering device (e.g.,

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present

Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree
				• 3 to 5 gallons per shrub
				• 2 gallons water per square foot for groundcover areas
				• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist
				• Use soaker hoses or spot water with a shower type wand when irrigation system is not present
				    ◦ Pulse water to enhance soil absorption, when feasible
				    ◦ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, fol-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				lowed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear • Water during drought conditions or more often if necessary to main-

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				tain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority. • Use of pesticides or *Bacillus thuringiensis israelensis* (Bti) may be considered only as a temporary measure while addressing the standing water cause. If overflow to

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				a surface water will occur within 2 weeks after pesticide use, apply for coverage under the Aquatic Mosquito Control NPDES General Permit.
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking

Table V-4.5.2(21) Maintenance Standards - Bioretention Facilities (continued)

Maintenance Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
				up pet waste.
Insect pests	Every site visit associated with vegetation management		Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	• Reduce hiding places for pests by removing diseased and dead plants • For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols)

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

IPM - Integrated Pest Management

ISA - International Society of Arboriculture

Table V-4.5.2(22) Maintenance Standards - Permeable Pavement

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course				
Permeable	A, S		Runoff from	• Clean deposited soil or

Appendix G
Geotechnical Report

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

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May 17, 2018

La Center School District
Mr. Dave Holmes, Superintendent
725 Highland Road
La Center, Washington 98629

Re: Geotechnical Feasibility Assessment
La Center Middle School
Parcel No. 209118000, 209119000, 209120000
La Center, Washington
CWE W.O. No. 18084

Mr. Holmes:

Columbia West Engineering, Inc. is pleased to submit this geotechnical feasibility assessment for the aforementioned parcels located in La Center, Washington. The primary purpose of this report is to address the feasibility of constructing a new middle school campus within these parcels. This is a feasibility-level assessment and does not provide specific design specifications, but rather general observations and recommendations. The specific scope of services was outlined in a proposal contract issued and authorized on April 9, 2018. The text herein summarizes the assessment and provides preliminary observations and recommendations. This report is subject to limitations expressed in Appendix E.

General Site Information

As indicated on Figures 1 and 2, the subject site is located southwest of the intersection of NE Lockwood Creek Road and NE 23rd Avenue in La Center, Washington and consists of tax parcels 209118000, 209119000, and 209120000. The approximately 22.79-acre area is zoned single family residential. The approximate latitude and longitude are N 45˚ 51' 26" and W 122˚ 38' 58" and the legal description are portions of the NE ¼ and SE ¼ of Section 02, T4N, R1E, Willamette Meridian. The regulatory jurisdictional agency is La Center, Washington.

Proposed Development

Based upon correspondence with the La Center School District (LCSD), Columbia West understands that a middle school building and associated infrastructure are proposed within the study area delineated in Figure 2. In addition, proposed development is likely to include essential utilities for structures, stormwater management facilities, as well as asphalt and concrete paving to provide vehicle and bus access to the school. Building type and size were unknown at the time of preparation of this Geotechnical Feasibility Assessment. Columbia West has not reviewed a preliminary grading or site plan but understands that cut and fill areas may be proposed.

Regional Geology and Soil Conditions

According to the *Geologic Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington* (*Russell C. Evarts, USGS Geological Survey Scientific Investigation Map 2844, 2004*), near-surface soils are expected to consist of Pleistocene-aged, unconsolidated, rhythmically bedded, periglacial clay, silt, and fine- to medium-textured sand deposits derived from catastrophic outburst floods of Glacial Lake Missoula (Qfs). The fine-textured flood deposits are underlain by Pleistocene to Pliocene, unconsolidated to cemented, deeply weathered, pebble to boulder sedimentary conglomerate (QTc).

The *Web Soil Survey* (*United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2014 Website*) identifies surface soils primarily as Gee silt loam and Odne silt loam. Gee and Odne series soils are generally fine-textured clays and silts with very low permeability, moderate to high water capacity, and low shear strength. Gee and Odne soils are generally moisture sensitive, somewhat compressible, and described as having moderate shrink-swell potential. The erosion hazard is slight primarily based upon slope grade.

Field Exploration and Observations

A geotechnical field investigation consisting of ten test pit explorations and two soil borings was performed at the site on April 18th through 20th, 2018. Piezometers were installed in both soil boring SB-1 and SB-2. Subsurface soil profiles were logged in accordance with the Unified Soil Classification System (USCS). Test pit and soil boring locations are indicated on Figure 2, laboratory results are presented in Appendix A, subsurface exploration logs are presented in Appendix B, soil classification information is presented in Appendix C, and a photo log of exploration activities is presented in Appendix D.

Field reconnaissance and review of topographic maps indicate the subject site is relatively flat with elevations ranging from approximately 130 to 140 feet amsl. Based on site research and conversations with neighbors, the site has been previously used for agriculture. The two northern parcels (209120000 and 209118000) appear to have been minimally disturbed with the installation of drainage tiles and seasonal tilling of the topsoil.

The southern parcel (209119000) has been occupied by several rows of chicken houses. The structures have been removed, however remnants of the structures' building materials were encountered both on the surface and subsurface in the areas observed. Test pits within the southern parcel indicate that significant grading has affected at least the upper five feet of soils, which would need to be replaced as structural fill to support proposed structures. Subsurface utilities are also anticipated to exist in the southern parcel, including an active waterline assumed to service at least one home to the south.

Soil Type Description

The field investigation indicated the presence of approximately 18 inches of till zone with sod and topsoil in the observed locations. Underlying the topsoil layer, subsurface soils resembling native USDA Gee and Odne soil series descriptions were encountered. Subsurface lithology was reasonably consistent at all explored locations in the two northern parcels and may generally be described by soil types identified in the following text.

Disturbed Clay Fill

Disturbed CLAY FILL soils were encountered in test pits TP-9 and TP-10 in the southern parcel to a depth of 4 and 5 feet, respectively. Remnant structure debris was also encountered. Disturbed soil depth may be greater or lesser in areas not explored on the southern parcel, due to previous use and structure demolition.

Soil Type 1 – Lean CLAY / Sandy Lean CLAY / Lean CLAY with Sand

Soil Type 1 was observed to primarily consist of orange-brown, moist to wet, soft to medium-stiff lean CLAY, lean CLAY with sand, and sandy learn CLAY. Soil Type 1 was observed below the topsoil layer in soil borings SB-1 and SB-2 and test pits TP-1 through TP-8, as well as below the disturbed clay fill in test pits TP-9 and TP-10. Soil Type 1 extended to depths between 5.5 and 9 feet where it was underlain by Soil Type 2.

Analytical laboratory testing conducted upon representative soil samples obtained from test pit TP-1 and soil borings SB-1 and SB-2 indicated approximately 66 to 89 percent by weight passing the No. 200 sieve and in situ moistures ranging from approximately 24 to 42 percent. Atterberg Limits analysis indicated liquid limits ranging from 30 to 46 percent and plasticity indices ranging from 8 to 22 percent. The laboratory tested samples of Soil Type 1 are classified CL according to USCS specifications and A-7-6(19), A-7-6(14), and A-4(5) according to AASHTO specifications.

Soil Type 2 – SILT / SILT with Sand / Silty SAND / Clayey SAND / Silty CLAY with Sand

Soil Type 2 was observed to primarily consist of brown or blue-gray, moist to wet, soft/loose to medium stiff/dense SILT, SILT with sand, silty CLAY with sand, silty SAND and clayey SAND. Soil Type 2 was observed below Soil Type 1 in all explorations. Soil Type 2 extended to a maximum depth of 33 feet bgs in soil borings SB-1 and SB-2.

Analytical laboratory testing conducted upon representative soil samples obtained from test pits TP-1, TP-4, and TP-5 and soil borings SB-1 and SB-2 indicated approximately 72 to 90 percent by weight passing the No. 200 sieve and in situ moistures ranging from approximately 23 to 30 percent. Atterberg Limits analysis indicated liquid limits ranging from 24 to 43 percent and plasticity indices ranging from 3 to 12 percent. Several samples exhibited nonplastic soil behavior. The laboratory tested samples of Soil Type 2 are classified SM, ML, CL-ML, and SC according to USCS specifications and A-4(2), A-4(5), A-4(0),and A-6(19) according to AASHTO specifications.

Soil Type 3 – Weathered Conglomerate

Semi-consolidated to unconsolidated conglomerate was encountered beneath Soil Types 1 and 2 at depths of 33 feet bgs in soil borings SB-1 and SB-2. Soil Type 3 was visually observed to consist of orange-brown to varicolored, moist, dense clayey gravel with sand and silt. Gravels, where present, were observed to be rounded to sub-rounded volcanic and sedimentary parent material. Analytical laboratory testing was not conducted upon soil samples obtained by SPT split-spoon samplers due to small quantities of recovery.

Groundwater and Drainage

Groundwater seeps were encountered in all test pits at depths ranging from 1 to 4 feet on April 18, 2018. Piezometers were installed in borings SB-1 and SB-2 to depths of 28 and 28.5 feet, respectively. Piezometers consist of 2-inch PVC pipe with 10 feet of screen at the bottom of the piezometer. Initial readings indicate groundwater as shallow as 3 feet below the piezometer lid elevation. Figure 2.1 presents piezometer locations and groundwater monitoring observations.

Groundwater levels are often subject to seasonal variance and may rise during extended periods of increased precipitation. Perched groundwater may also be present in localized areas. Seeps and springs may become evident during site grading, primarily along slopes or in areas cut below existing grade. Structures, roads, and drainage design should be planned accordingly.

Ponding water was observed at the ground surface throughout the site during the subsurface site investigation and surficial drainage appeared to be poor. Runoff and groundwater from higher elevations to the north and northeast of the site likely impact the shallow water table on the property. A drainage ditch follows NE 23rd Avenue on its north side along the south boundary of the study area and carries runoff to the south and west. The drainage ditch contained ponded water at the time of the investigation, indicating inadequate gradient or blockage downstream.

ENGINEERING RECOMMENDATIONS

Site Preparation and Grading

Vegetation, organic material, unsuitable fill, and deleterious material that may be encountered should be cleared from areas identified for structures and site grading. Vegetation, other organic material, and debris should be removed from the site. Stripped topsoil should also be removed or used only as landscape fill in nonstructural areas with slopes less than 25 percent. The stripping depth for sod and highly organic topsoil in the disturbed till zone is anticipated to vary from 12 to 18 inches. The required stripping depth may increase in areas of existing fill, heavy organics, or previously existing structures. Actual stripping depths should be determined based upon visual observations made during construction when soil conditions are exposed. The post-construction maximum depth of landscape fill placed or spread at any location onsite should not exceed one foot.

Previously disturbed soil, debris, or unconsolidated fill encountered during grading or construction activities should be removed completely and thoroughly from structural areas. Based on observations made during the field investigation, undocumented fill materials are present in the southern portion of the property previously used for chicken farming. Additional filled areas may be uncovered during construction operations. Further evaluation by Columbia West will be required to determine whether these materials are suitable for reuse as structural fill on the site.

Test pits excavated during site exploration were backfilled loosely with onsite soils. These test pits should be located and properly backfilled with structural fill during site improvements construction. Trees, stumps, and associated roots should also be removed from structural areas, individually and carefully. Resulting cavities and excavation areas should be backfilled with engineered structural fill.

Site grading activities should be performed in accordance with requirements specified in the 2015 *International Building Code* (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, and grading activities should be observed and documented by Columbia West.

Engineered Structural Fill

Areas proposed for fill placement should be appropriately prepared as described in the preceding text. Surface soils should then be scarified and compacted prior to additional fill placement. Engineered structural fill should be placed in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within two percentage points of optimum conditions. A field density at least equal to 95 percent of the maximum dry density, obtained from the standard Proctor moisture-density relationship test (ASTM D698), is recommended for structural fill placement. For engineered structural fill placed on sloped grades, the area should be benched to provide a horizontal surface for compaction.

Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. Field compaction testing should be performed for each vertical foot of engineered fill placed. Engineered fill placement should be observed by Columbia West.

Engineered structural fill placement activities should be performed during dry summer months if possible. Most clean native soils may be suitable for use as structural fill if adequately dried or moisture-conditioned to achieve recommended compaction specifications. Native soils may require addition of moisture during late summer months or after extended periods of warm, dry weather. Compacted fine-textured fill soils should be covered shortly after placement to maintain moisture conditions and minimize shrink swell potential.

Based upon laboratory analysis, near-surface soils contain as much as 92 percent by weight passing the No. 200 sieve and exhibit a plasticity index of up to 22 percent. This indicates some potential for soil shrinking or swelling and underscores the importance of proper moisture conditioning during fill placement. Medium to high plasticity soils proposed for use as structural fill should be evaluated and approved by Columbia West prior to use. These moisture-sensitive soils should be placed and compacted at a moisture content approximately two percent above optimum as determined by laboratory analysis.

If adequate compaction is not achievable with clean native soils, import structural fill consisting of granular fill meeting WSDOT specifications for *Gravel Borrow 9-03.14(1)* is recommended.

Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by Columbia West prior to placement. Laboratory analyses should include particle-size gradation and Proctor moisture-density analysis.

Foundations

Generally, site soils are anticipated to be compatible with standard building loads and construction types. Challenges to construction at the site include the presence of seasonally shallow groundwater and fine-textured, soft to medium stiff shallow soils that may reduce bearing capacity and increase settlement risk. Once foundation types, locations, and loads are known, Columbia West should be engaged to provide a second phase of geotechnical assessment targeting specific areas of the site.

Drainage, Stormwater, and Dewatering

Due to the presence of slowly permeable surficial clay soils and seasonal shallow groundwater, infiltration of stormwater is likely infeasible. At a minimum, site drainage should include surface water collection and conveyance to properly designed stormwater management structures and facilities. Drainage design in general should conform to the City of La Center's regulations. Finished site grading should be conducted with positive drainage away from structures. Depressions or shallow areas that may retain ponding water should be avoided.

Roof drains, low-point drains, and perimeter foundation drains are recommended for structures. Drains should consist of separate systems and gravity flow with a minimum two-percent slope away from foundations into the stormwater system or approved discharge location. Concentrated discharge of water should be prohibited across slopes and water should not be diverted, routed, or allowed to flow over or across slope faces.

Groundwater elevation and hydrostatic pressure should be carefully considered during design of utilities, retaining walls, or other structures that require below-grade excavation. As described previously, shallow groundwater was encountered throughout the site. Utility trenches in shallow groundwater areas or excavations and cuts that remain open for even short periods of time may undermine or collapse due to groundwater effects. Placement of layers of riprap or quarry spalls in localized areas on shallow excavation side slopes may be required to limit instability. Over-excavation and stabilization of pipe trenches or other excavations with imported crushed aggregate or gabion rock may also be necessary to provide adequate subgrade support.

Significant dewatering may be required to temporarily reduce the groundwater elevation to allow construction of proposed below-grade structures, installation of utilities, or placement of structural fills. Dewatering via a sump within excavation zones may be insufficient to control groundwater and provide excavation side slope stability. Fine textured sandy soils encountered during subsurface exploration may mobilize during trench excavation. Dewatering may be more feasibly conducted by installing a system of temporary well points and pumps around proposed excavation areas or utility trenches. Depending on proposed utility depths, a site-specific dewatering plan may be necessary. Well pumps should remain functioning at all times during the excavation and construction period. Suitable back-up pumps and power supply should be available to prevent unanticipated shut-down of dewatering equipment. Failure to operate pumps full-time may result in flooding of the excavation zones, resulting in damage to forms, slopes, or equipment.

Bituminous Asphalt and Portland Cement Concrete

Proposed development may include asphalt paved City right-of-way improvements, bus travel lanes, and automobile drive aisles and parking lots. Rigid Portland cement concrete pavements may also be planned in approach areas. Columbia West recommends adherence to City of Vancouver standards for street improvements in the public right-of-way.

For dry weather construction, pavement surface sections should bear upon competent subgrade consisting of scarified and compacted native soil or engineered structural fill. A full pavement design is recommended as part of future study to identify design section thicknesses.

Wet Weather Construction Methods and Techniques

Wet weather construction often results in significant shear strength reduction and soft areas that may rut or deflect. Installation of granular working layers may be necessary to provide a firm support base and sustain construction equipment. Granular layers should consist of all-weather gravel, 2x4-inch gabion, or other similar material (six-inch maximum size with less than five percent passing the No. 200 sieve).

Construction equipment traffic across exposed fine-textured soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for wet soils. Wet weather construction may also result in generation of significant excess quantities of soft wet soil. This material should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Over-excavation of subgrade soils or subgrade amendment with lime and/or cement may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric is also recommended. If soil amendment with lime or cement is considered, Columbia West should be contacted to provide appropriate recommendations based upon observed field conditions and desired performance criteria.

It should be understood that wet weather construction is risky and costly. Columbia West should observe and document wet weather construction activities. Proper construction methods and techniques are critical to overall project integrity

Limitations

Columbia West's observations and recommendations are based upon limited investigation as described above. This letter has not been prepared to meet the needs of design professionals, contractors, or any other parties, and use of this report by them may lead to erroneous assumptions, faulty conclusions, and other problems. This letter recommends additional geotechnical services prior to property development. Additional limitations and important information about this report are provided in Appendix E.

Columbia West appreciates this opportunity to provide geotechnical services. Please call 360-823-2900 if you have any questions or need additional information.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

Lance V. Lehto, PE, GE
President

Attachments:

Figure 1 – Site Location Map

Figure 2 – Soil Exploration Map

Figure 2.1 – Groundwater Monitoring

Appendix A – Laboratory Testing Results

Appendix B – Soil Exploration Logs

Appendix C – Soil Classification Information

Appendix D – Photo Log

Appendix E – Report Limitations and Important Information

References

Annual Book of ASTM Standards, Soil and Rock (I), v04.08, American Society for Testing and Materials, 1999.

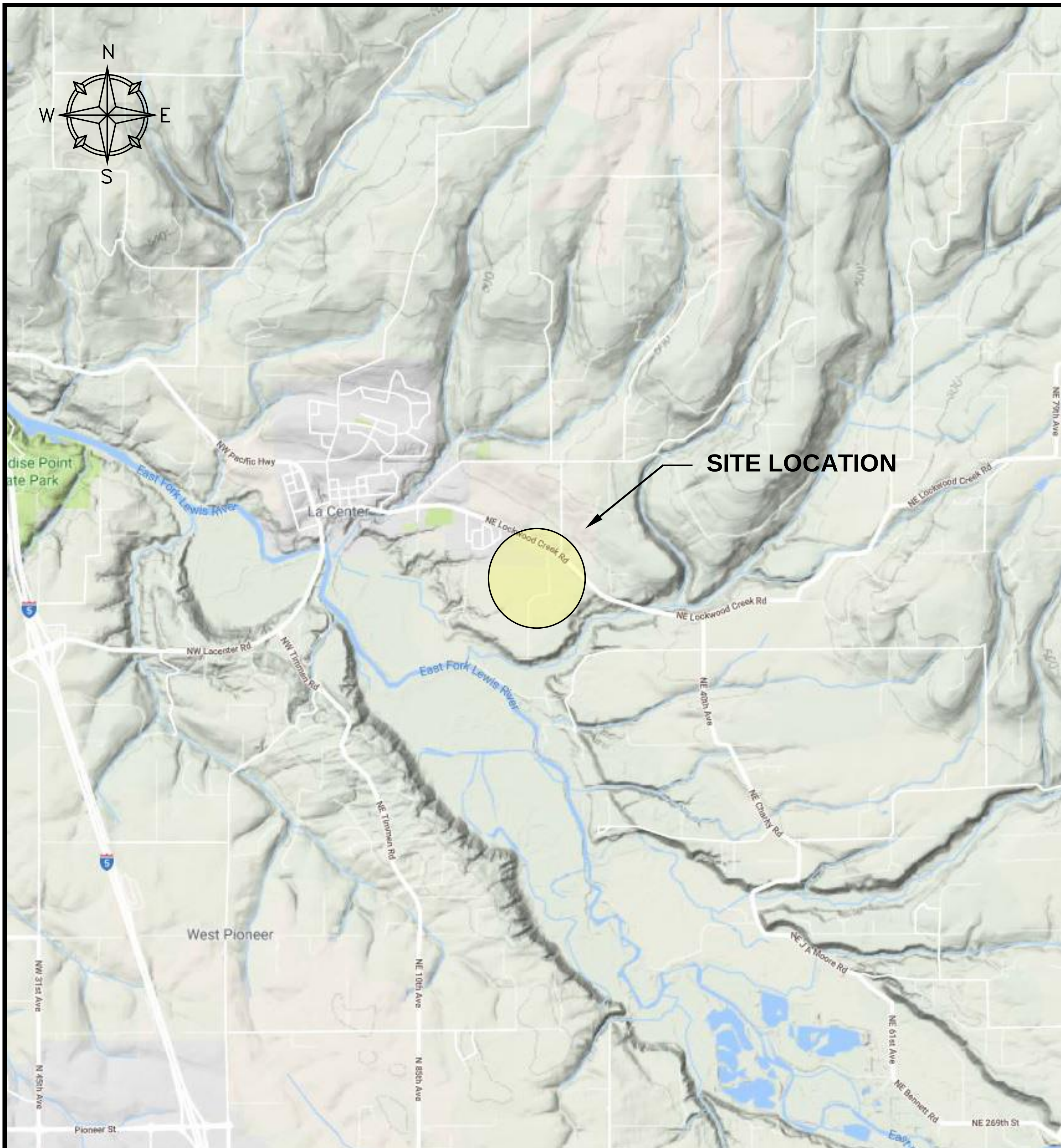
Evarts, Russell C., Geological Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington, Scientific Investigations Map 2844, US Geological Survey, 2004.

International Building Code: 2015 International Building Code, 2015 edition, International Code Council, 2015.

Clark County Maps Online (http://gis.clark.wa.gov/ccgis/mol/property.htm)

Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture *2014 website* (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.).

FIGURES



MAP SOURCE: Google Maps 2018

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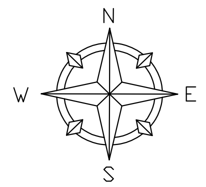
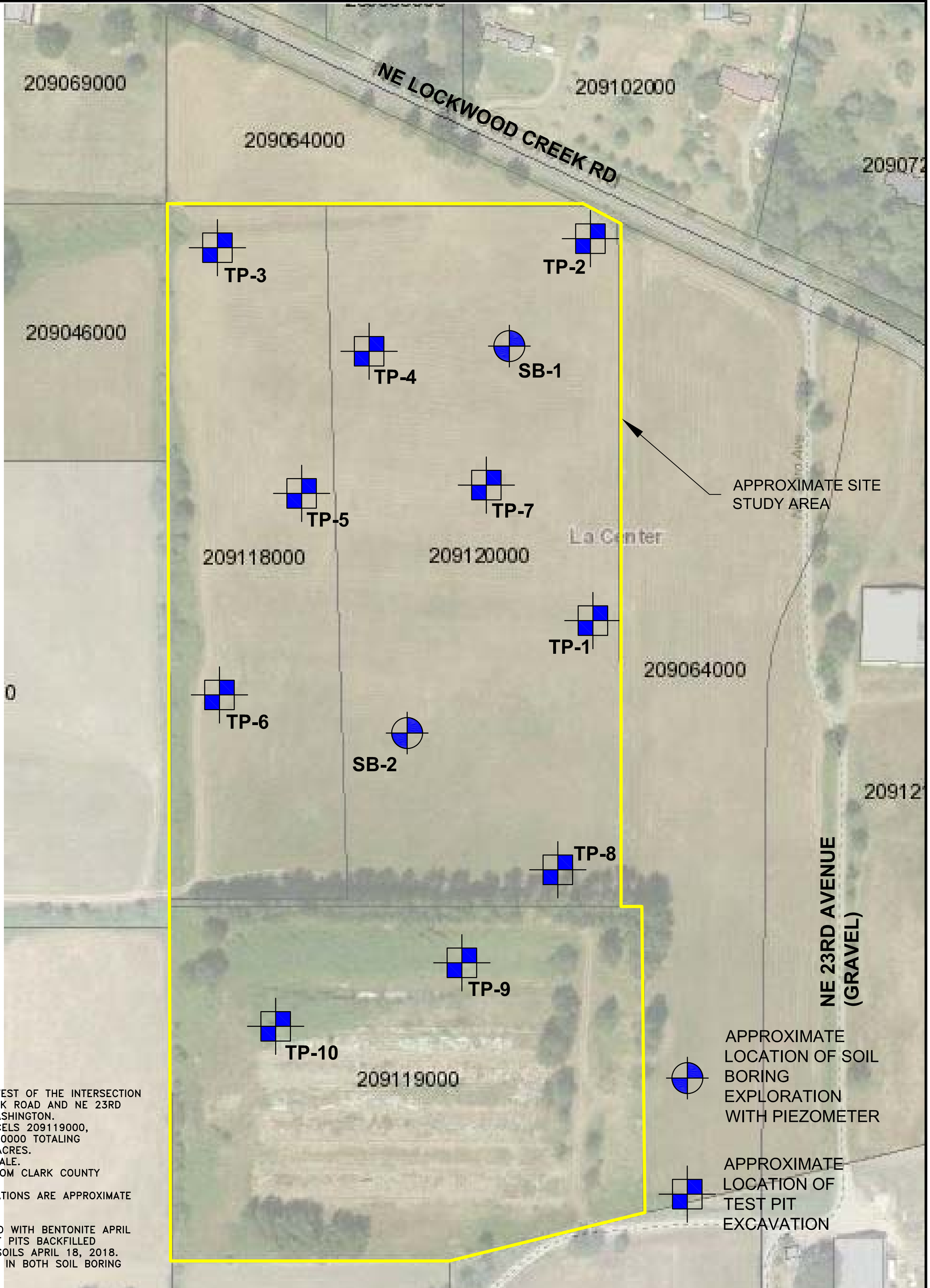
Design	Drawn: ASR			**SITE LOCATION MAP**	FIGURE 1
Checked: LVL	Date: 05/02/2018				
Client: LCSD	Rev	By	Date	LA CENTER MIDDLE SCHOOL	
Job No.: 18084				LA CENTER, WASHINGTON	
CAD File: FIGURE 1					
Scale: ~1:50,000					





NOTES:
1. SITE LOCATION: SOUTHWEST OF THE INTERSECTION OF NE LOCKWOOD CREEK ROAD AND NE 23RD AVENUE LA CENTER, WASHINGTON.
2. SITE CONSISTS OF PARCELS 209119000, 209118000, AND 209120000 TOTALING APPROXIMATELY 22.79 ACRES.
3. DRAWING IS NOT TO SCALE.
4. BASE MAP OBTAINED FROM CLARK COUNTY MAPSONLINE.
5. SOIL EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
6. SOIL BORING BACKFILLED WITH BENTONITE APRIL 19 AND 20, 2018. TEST PITS BACKFILLED LOOSELY WITH ONSITE SOILS APRIL 18, 2018.
7. PIEZOMETERS INSTALLED IN BOTH SOIL BORING SB-1 AND SB-2.

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Design:	Drawn: ASR	SUBSURFACE EXPLORATION LOCATION MAP	FIGURE 2
Checked: LVL	Date: 5/2/18		
Client: LCSD	Rev / By / Date	LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON	
Job No: 18084			
CAD File: FIGURE 2			
Scale: NONE			

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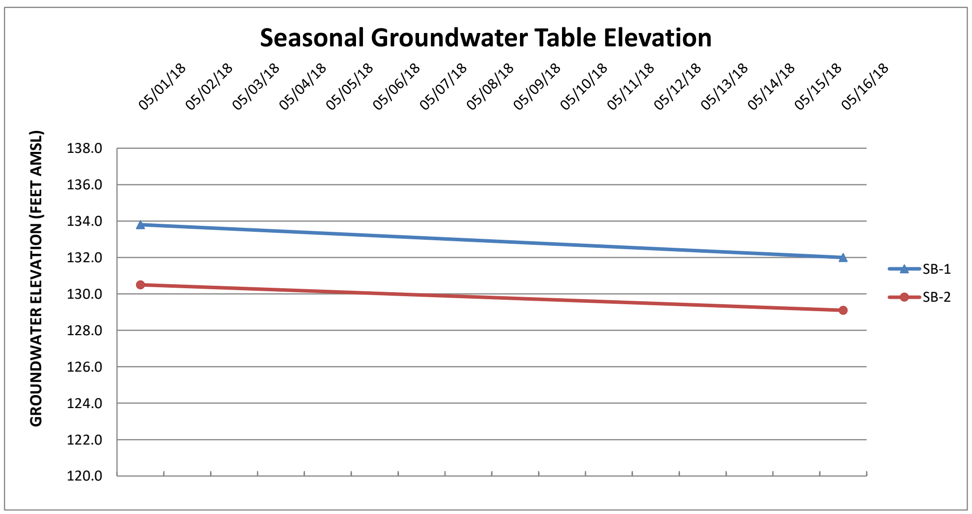
FIGURE 2.1

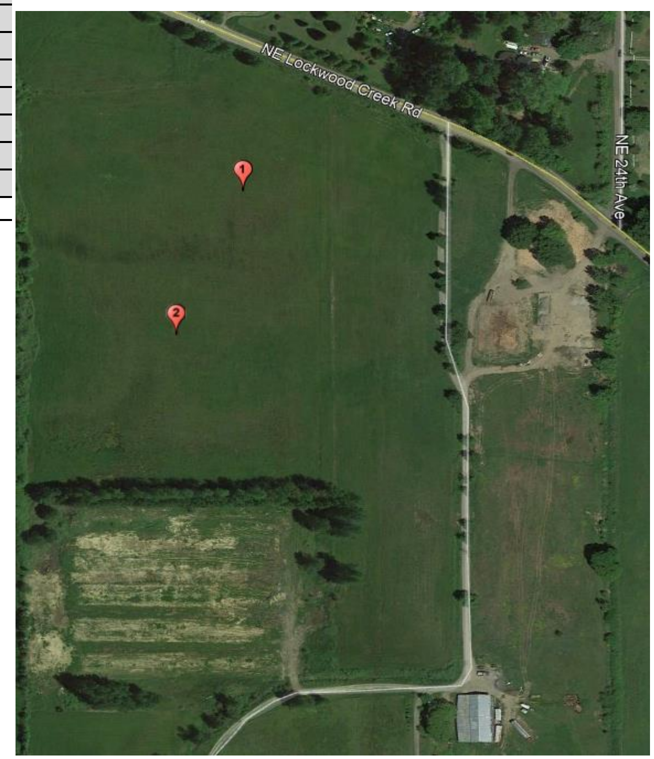
La Center Middle School
La Center School District
La Center, Washington
CWE W.O. #: 18084

- 2" PVC Piezometers installed on 4/19 and 4/20 2018.
- All elevations approximate based upon Clark County GIS topographic info.
- Lid Elevation = Ground Surface for depth measurements.

* Initial water level measurement taken during construction of wells. This value is not plotted on the chart below.

	SB-1				SB-2		
	Piezometer Depth (ft) =		28.5		Piezometer Depth (ft) =		28
	Apx. Lid Elevation (ft) =		138		Apx. Lid Elevation (ft) =		134
	Groundwater Level				Groundwater Level		
Date	depth (bgs)		feet (amsl)		depth (bgs)		feet (amsl)
4/20/2018	3.0	INITIAL*	135.0		3.0	INITIAL*	131.0
5/1/2018	4.2		133.8		3.5		130.5
5/16/2018	6.0		132.0		4.9		129.1





APPENDIX A
LABORATORY TEST RESULTS

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-346
		REPORT DATE: 04/27/18	FIELD ID: TP1.1
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY	Test Pit TP-01 depth = 2 feet	CL, Lean Clay

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-7-6(19)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

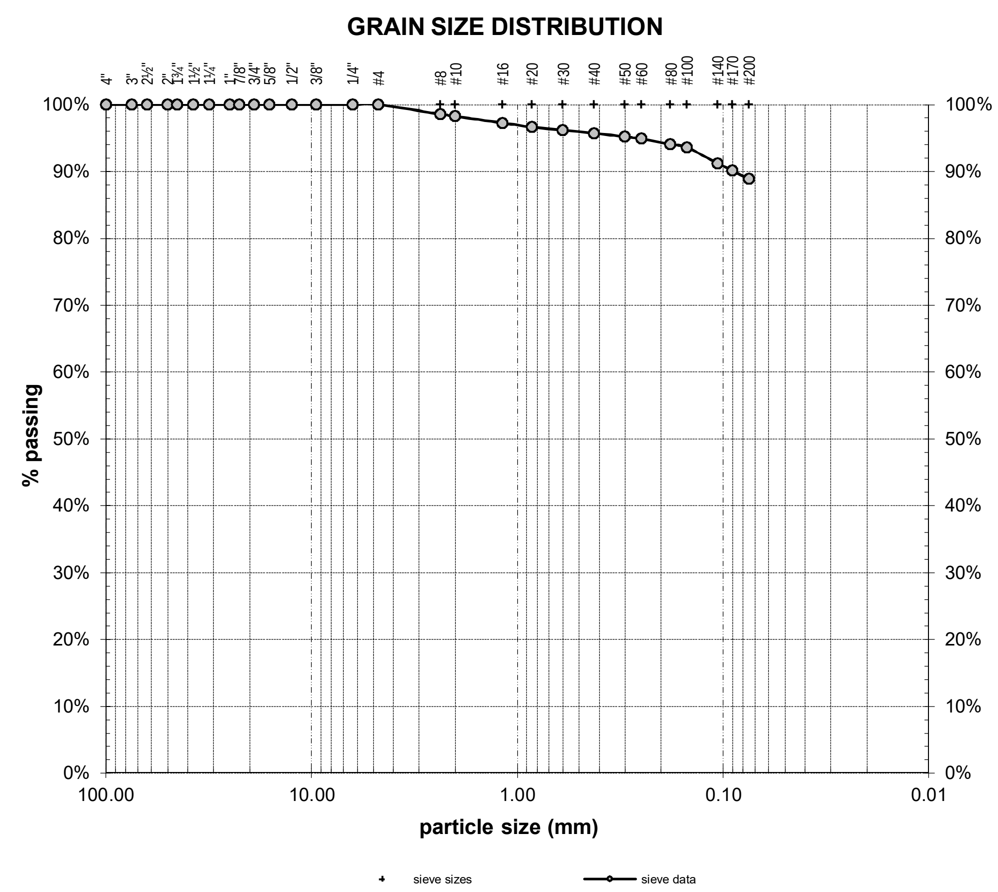
ADDITIONAL DATA

initial dry mass (g) =	113.49		
as-received moisture content =	38.3%	coefficient of curvature, C_C =	n/a
liquid limit =	44	coefficient of uniformity, C_U =	n/a
plastic limit =	25	effective size, $D_{(10)}$ =	n/a
plasticity index =	19	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 11.1%
% silt and clay = 88.9%

	SIEVE SIZE		PERCENT PASSING			
			SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		99%		
	#10	2.00	98%			
	#16	1.18		97%		
	#20	0.850	97%			
	#30	0.600		96%		
	#40	0.425	96%			
	#50	0.300		95%		
	#60	0.250	95%			
	#80	0.180		94%		
	#100	0.150	94%			
	#140	0.106		91%		
	#170	0.090		90%		
	#200	0.075	89%			



DATE TESTED	TESTED BY
04/20/18	RTT

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-346
		REPORT DATE: 04/27/18	FIELD ID: TP1.1
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY	Test Pit TP-01 depth = 2 feet	CL, Lean Clay

LABORATORY TEST DATA

LABORATORY EOUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

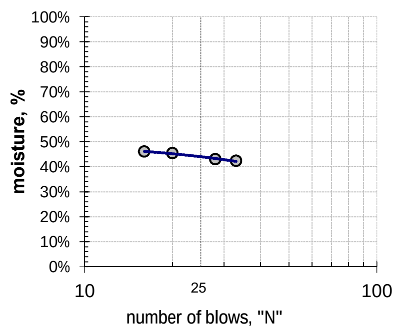
ATTERBERG LIMITS

liquid limit =	44
plastic limit =	25
plasticity index =	19

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	29.19	28.93	30.42	32.07
dry soil + pan weight, g =	26.68	26.53	27.43	28.46
pan weight, g =	20.75	20.94	20.85	20.62
N (blows) =	33	28	20	16
moisture, % =	42.3 %	42.9 %	45.4 %	46.1 %

LIQUID LIMIT



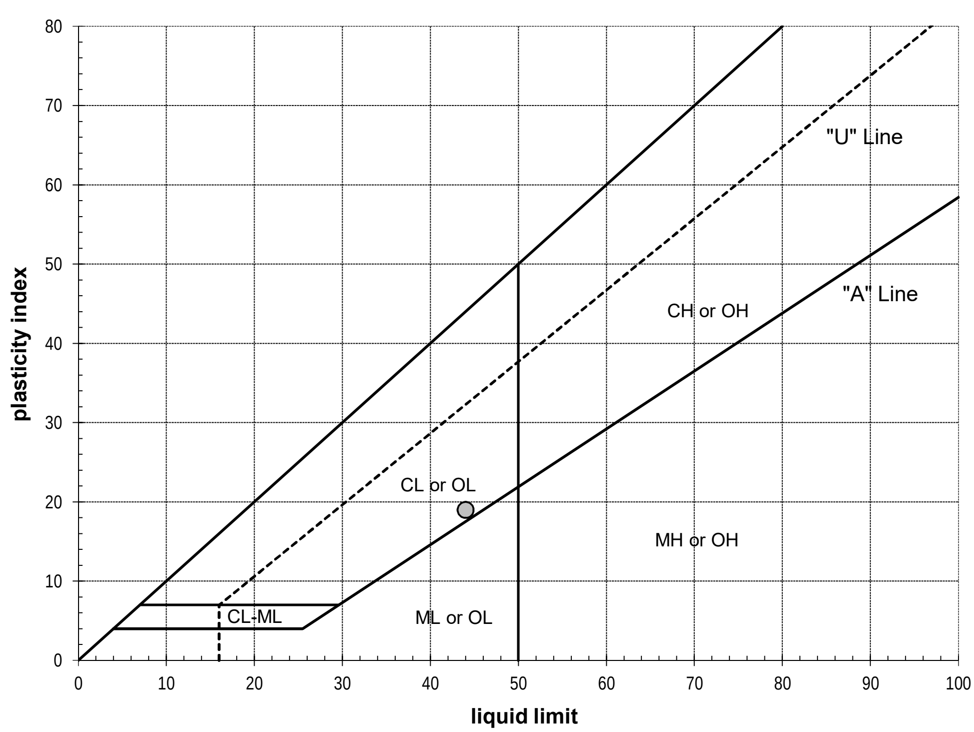
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.96	28.18		
dry soil + pan weight, g =	26.53	26.72		
pan weight, g =	20.83	20.86		
moisture, % =	25.1 %	24.9 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	11.1%
% silt and clay =	88.9%
% silt =	n/a
% clay =	n/a
moisture content =	38.3%

DATE TESTED	TESTED BY
04/24/18	JJC

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-347
		REPORT DATE: 04/27/18	FIELD ID: TP1.2
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT	Test Pit TP-01 depth = 6 feet	ML, Silt

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-4(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

ADDITIONAL DATA

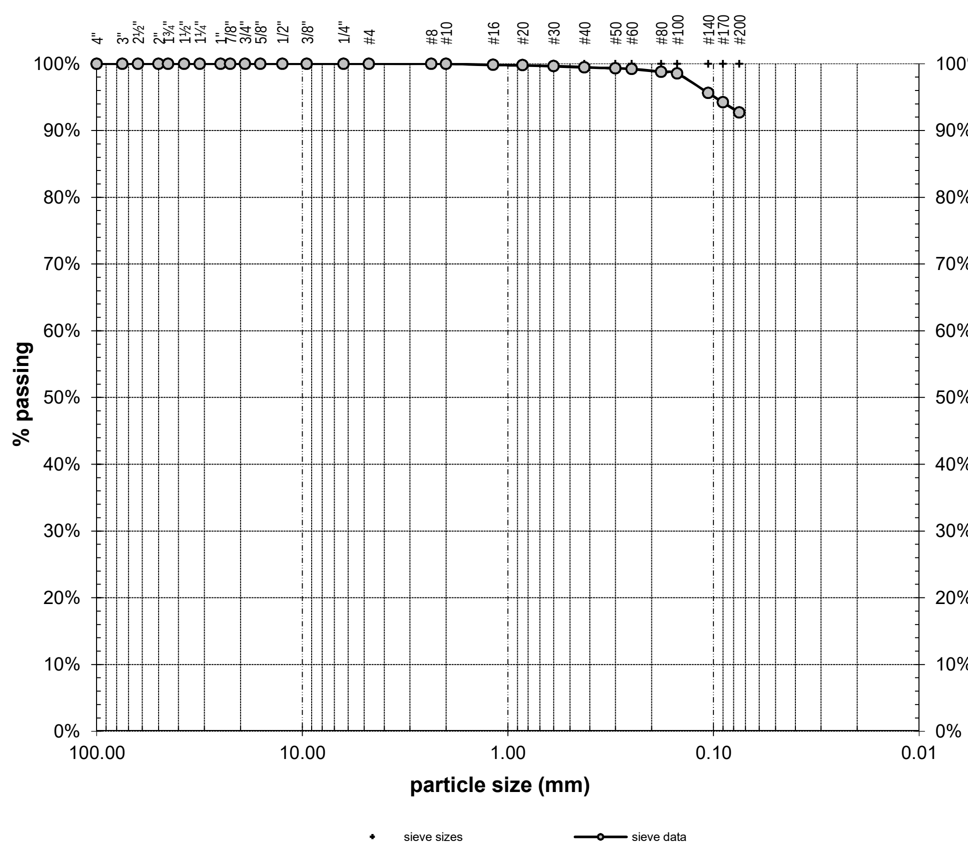
initial dry mass (g) =	120.14		
as-received moisture content =	39.1%	coefficient of curvature, C_C =	n/a
liquid limit =	-	coefficient of uniformity, C_U =	n/a
plastic limit =	-	effective size, $D_{(10)}$ =	n/a
plasticity index =	NP	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 7.3%
% silt and clay = 92.7%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		100%		
	#40	0.425	99%			
	#50	0.300		99%		
	#60	0.250	99%			
	#80	0.180		99%		
	#100	0.150	99%			
	#140	0.106		96%		
	#170	0.090		94%		
	#200	0.075	93%			

GRAIN SIZE DISTRIBUTION



DATE TESTED	TESTED BY
04/20/18	RTT

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-348
		REPORT DATE: 04/27/18	FIELD ID: TP1.3
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Sand	Test Pit TP-01 depth = 9 feet	ML, Silt with Sand
SPECIFICATIONS: none		AASHTO SOIL TYPE: A-4(5)

LABORATORY TEST DATA

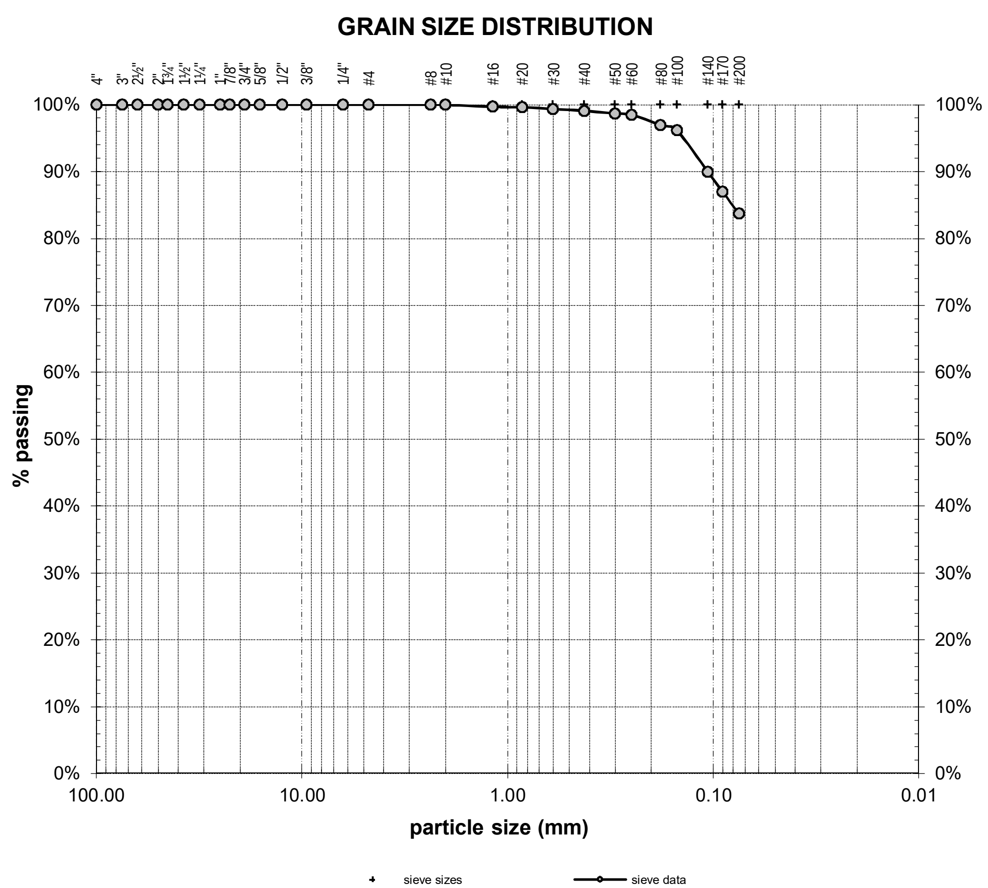
LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

ADDITIONAL DATA

initial dry mass (g) =	124.30		
as-received moisture content =	42.2%	coefficient of curvature, C_C =	n/a
liquid limit =	30	coefficient of uniformity, C_U =	n/a
plastic limit =	23	effective size, $D_{(10)}$ =	n/a
plasticity index =	7	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 16.3%
% silt and clay = 83.7%



	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		99%		
	#40	0.425	99%			
	#50	0.300		99%		
	#60	0.250	98%			
	#80	0.180		97%		
	#100	0.150	96%			
	#140	0.106		90%		
	#170	0.090		87%		
	#200	0.075	84%			

DATE TESTED	TESTED BY
04/20/18	RTT

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-348
		REPORT DATE: 04/27/18	FIELD ID: TP1.3
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Sand	Test Pit TP-01 depth = 9 feet	ML, Silt with Sand

LABORATORY TEST DATA

LABORATORY EOUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

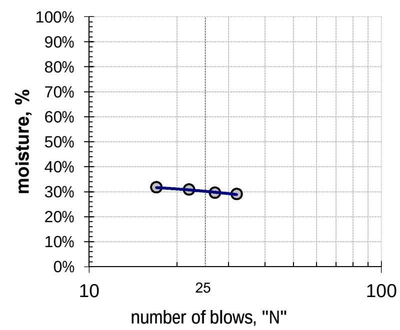
ATTERBERG LIMITS

liquid limit = 30
plastic limit = 23
plasticity index = 7

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	34.64	32.30	30.82	31.28
dry soil + pan weight, g =	31.52	29.71	28.42	28.77
pan weight, g =	20.76	20.94	20.63	20.85
N (blows) =	32	27	22	17
moisture, % =	29.0 %	29.5 %	30.8 %	31.7 %

LIQUID LIMIT



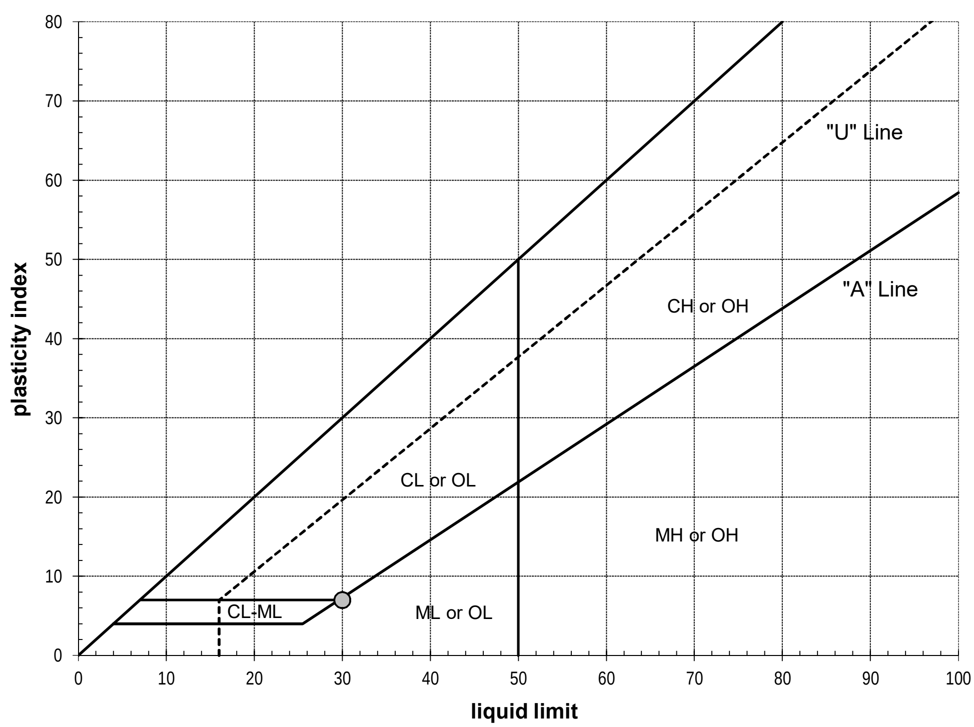
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	28.02	29.09		
dry soil + pan weight, g =	26.66	27.52		
pan weight, g =	20.72	20.85		
moisture, % =	22.9 %	23.5 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel = 0.0%
% sand = 16.3%
% silt and clay = 83.7%
% silt = n/a
% clay = n/a
moisture content = 42.2%

DATE TESTED	TESTED BY
04/25/18	RTT

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-349
		REPORT DATE: 04/27/18	FIELD ID: TP4.1
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT	Test Pit TP-04 depth = 4.5 feet	ML, Silt

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-4(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

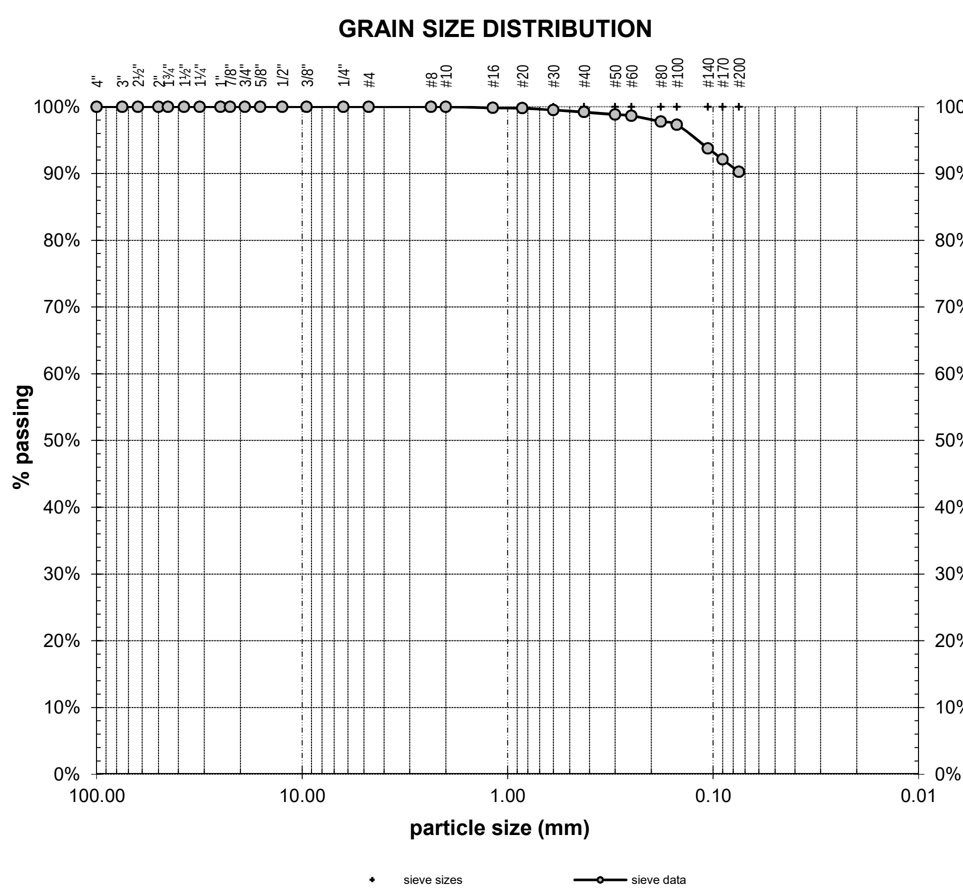
ADDITIONAL DATA

initial dry mass (g) =	108.10		
as-received moisture content =	39.8%	coefficient of curvature, C_C =	n/a
liquid limit =	-	coefficient of uniformity, C_U =	n/a
plastic limit =	-	effective size, $D_{(10)}$ =	n/a
plasticity index =	NP	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 9.8%
% silt and clay = 90.2%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		99%		
	#40	0.425	99%			
	#50	0.300		99%		
	#60	0.250	99%			
	#80	0.180		98%		
	#100	0.150	97%			
	#140	0.106		94%		
	#170	0.090		92%		
	#200	0.075	90%			



DATE TESTED	TESTED BY
04/20/18	RTT

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-350
		REPORT DATE: 04/27/18	FIELD ID: TP5.1
		DATE SAMPLED: 04/18/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Silty SAND	Test Pit TP-05 depth = 14 feet	SM, Silty Sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-4(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

ADDITIONAL DATA

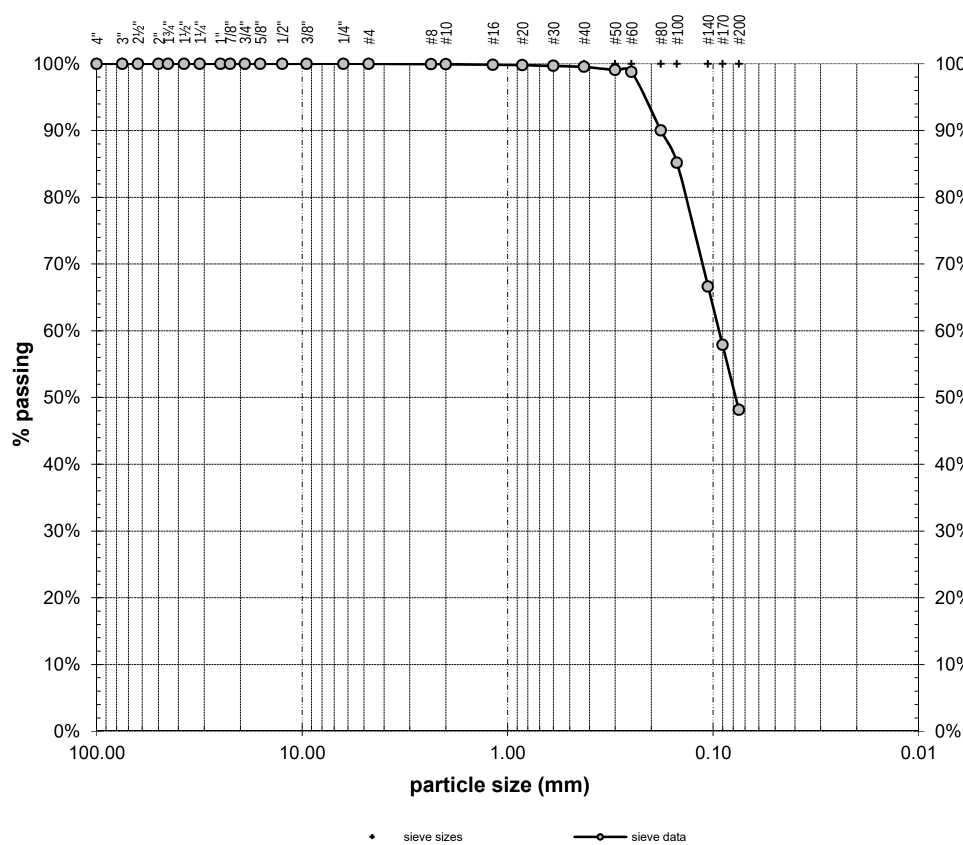
initial dry mass (g) =	172.53		
as-received moisture content =	35.4%	coefficient of curvature, C_C =	n/a
liquid limit =	-	coefficient of uniformity, C_U =	n/a
plastic limit =	-	effective size, $D_{(10)}$ =	n/a
plasticity index =	NP	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	0.094 mm

SIEVE DATA

% gravel = 0.0%
% sand = 51.8%
% silt and clay = 48.2%

	SIEVE SIZE		PERCENT PASSING SIEVE		SPECS	
	US	mm	act.	interp.	max	min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		100%		
	#40	0.425	100%			
	#50	0.300		99%		
	#60	0.250	99%			
	#80	0.180		90%		
	#100	0.150	85%			
	#140	0.106		67%		
	#170	0.090		58%		
	#200	0.075	48%			

GRAIN SIZE DISTRIBUTION



DATE TESTED	TESTED BY
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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-356
		REPORT DATE: 05/01/18	FIELD ID: SB1.1
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Lean CLAY	Soil Boring SB-01 depth = 2.5 feet	CL, Sandy Lean Clay

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-7-6(14)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

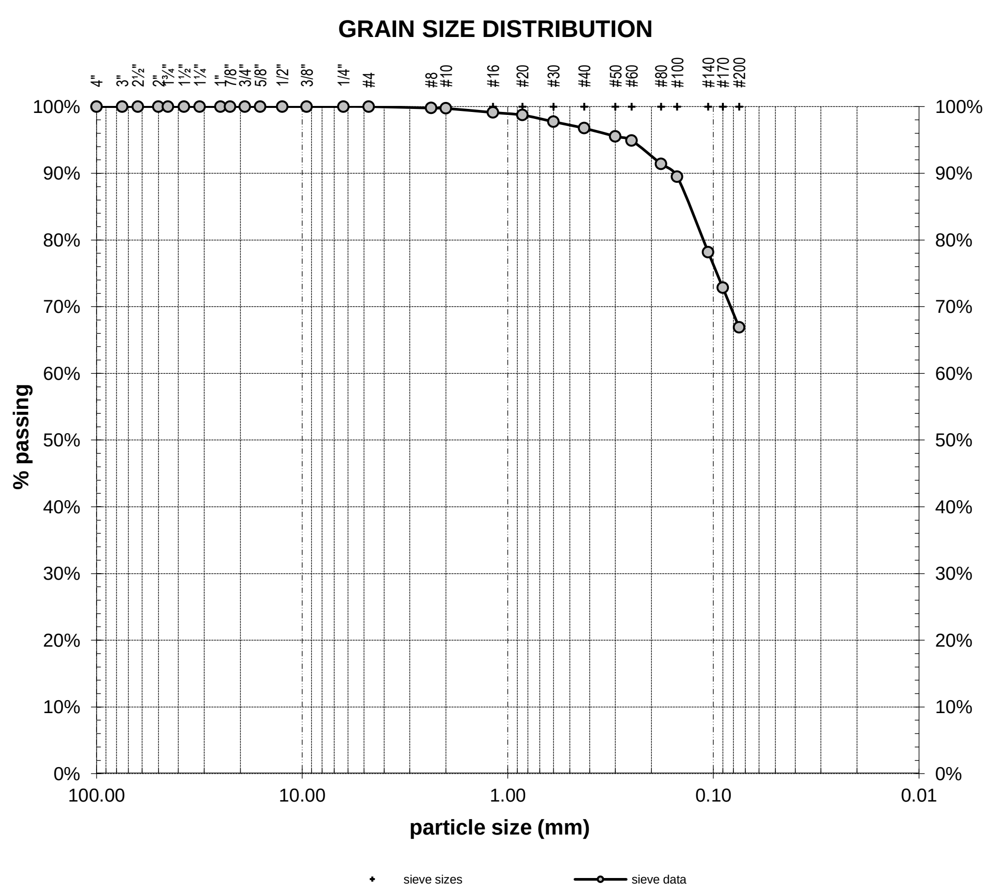
ADDITIONAL DATA

initial dry mass (g) =	144.37		
as-received moisture content =	37.7%	coefficient of curvature, C_C =	n/a
liquid limit =	46	coefficient of uniformity, C_U =	n/a
plastic limit =	24	effective size, $D_{(10)}$ =	n/a
plasticity index =	22	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 33.1%
% silt and clay = 66.9%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		99%		
	#20	0.850	99%			
	#30	0.600		98%		
	#40	0.425	97%			
	#50	0.300		96%		
	#60	0.250	95%			
	#80	0.180		91%		
	#100	0.150	89%			
	#140	0.106		78%		
	#170	0.090		73%		
	#200	0.075	67%			



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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-356
		REPORT DATE: 05/01/18	FIELD ID: SB1.1
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Sandy Lean CLAY	Soil Boring SB-01 depth = 2.5 feet	CL, Sandy Lean Clay

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

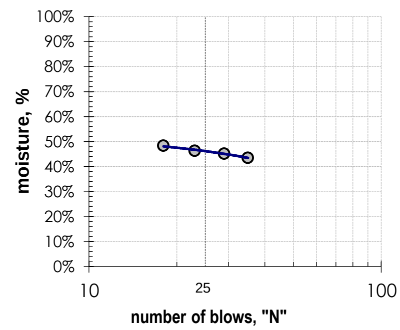
ATTERBERG LIMITS

liquid limit = 46
plastic limit = 24
plasticity index = 22

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	30.87	29.81	31.23	29.27
dry soil + pan weight, g =	27.80	27.05	27.87	26.53
pan weight, g =	20.75	20.94	20.62	20.86
N (blows) =	35	29	23	18
moisture, % =	43.6 %	45.2 %	46.3 %	48.3 %

LIQUID LIMIT



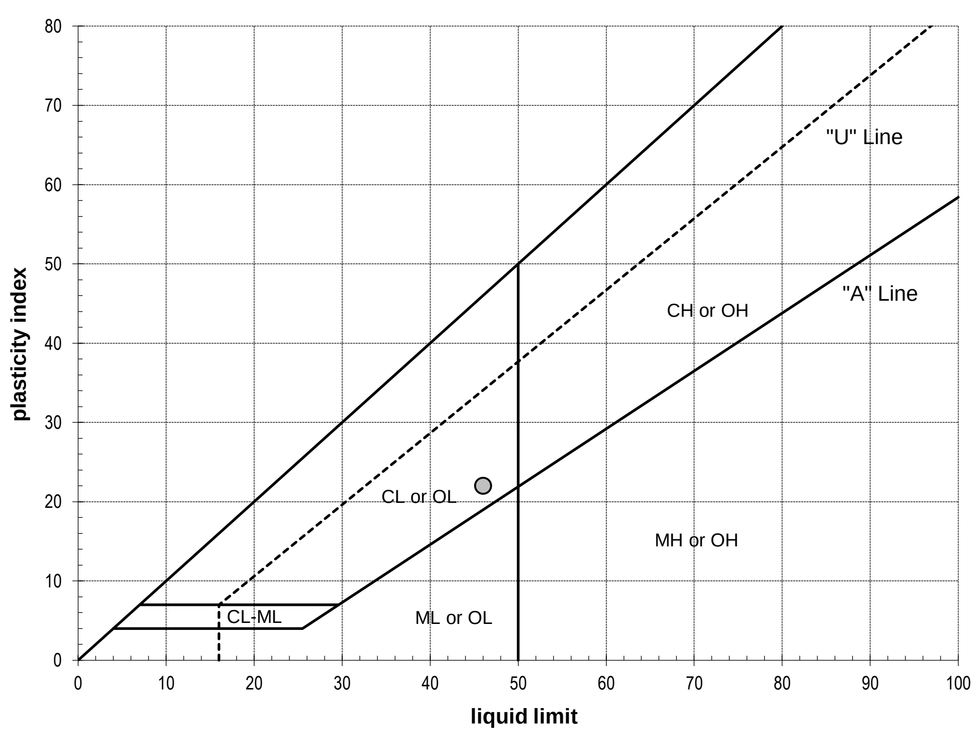
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.42	27.47		
dry soil + pan weight, g =	26.16	26.20		
pan weight, g =	20.83	20.88		
moisture, % =	23.6 %	23.9 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel = 0.0%
% sand = 33.1%
% silt and clay = 66.9%
% silt = n/a
% clay = n/a
moisture content = 37.7%

DATE TESTED	TESTED BY
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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-357
		REPORT DATE 05/01/18	FIELD ID SB1.4
		DATE SAMPLED 04/19/18	SAMPLED BY ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Sand	Soil Boring SB-01 depth = 9.5 feet	ML, Silt with Sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-4(2)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

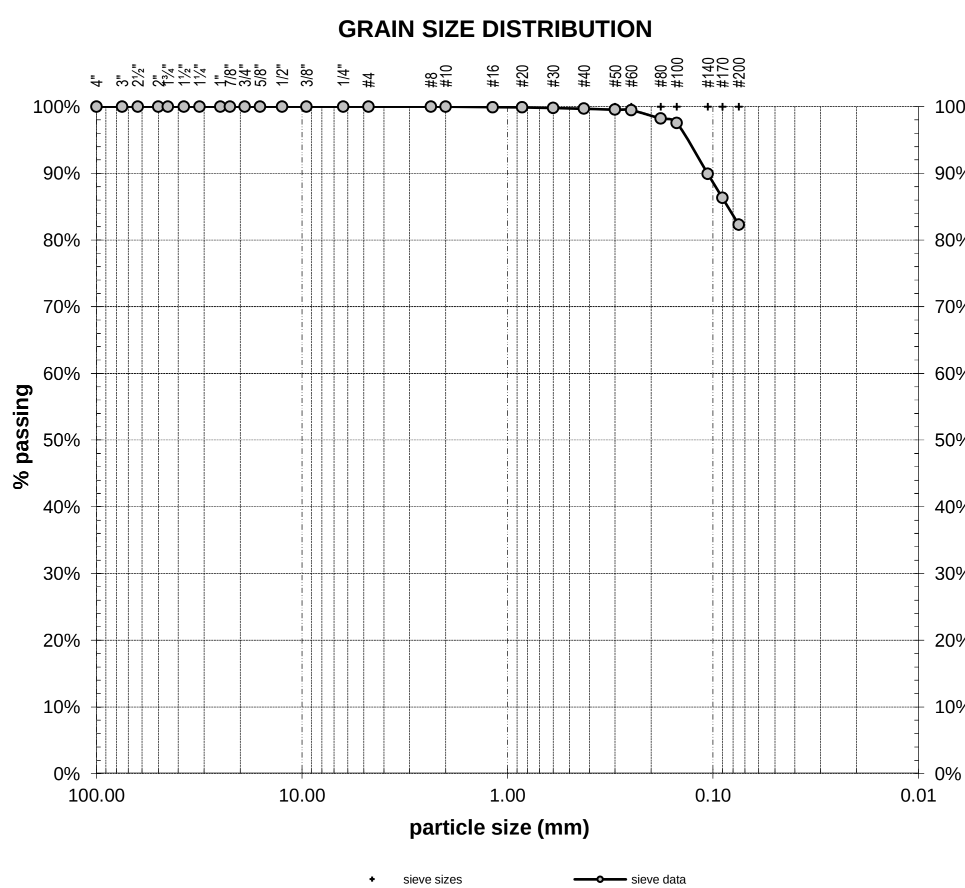
ADDITIONAL DATA

initial dry mass (g) =	138.12		
as-received moisture content =	36.5%	coefficient of curvature, C_C =	n/a
liquid limit =	27	coefficient of uniformity, C_U =	n/a
plastic limit =	24	effective size, $D_{(10)}$ =	n/a
plasticity index =	3	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 17.7%
% silt and clay = 82.3%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		100%		
	#40	0.425	100%			
	#50	0.300		100%		
	#60	0.250	99%			
	#80	0.180		98%		
	#100	0.150	98%			
	#140	0.106		90%		
	#170	0.090		86%		
	#200	0.075	82%			



DATE TESTED	TESTED BY
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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-357
		REPORT DATE: 05/01/18	FIELD ID: SB1.4
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Sand	Soil Boring SB-01 depth = 9.5 feet	ML, Silt with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

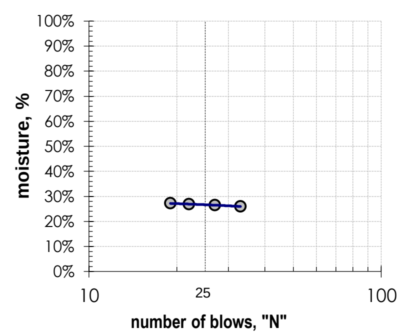
ATTERBERG LIMITS

liquid limit = 27
plastic limit = 24
plasticity index = 3

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	34.20	33.34	32.87	34.96
dry soil + pan weight, g =	31.43	30.74	30.28	31.94
pan weight, g =	20.76	20.94	20.63	20.85
N (blows) =	33	27	22	19
moisture, % =	26.0 %	26.5 %	26.8 %	27.2 %

LIQUID LIMIT



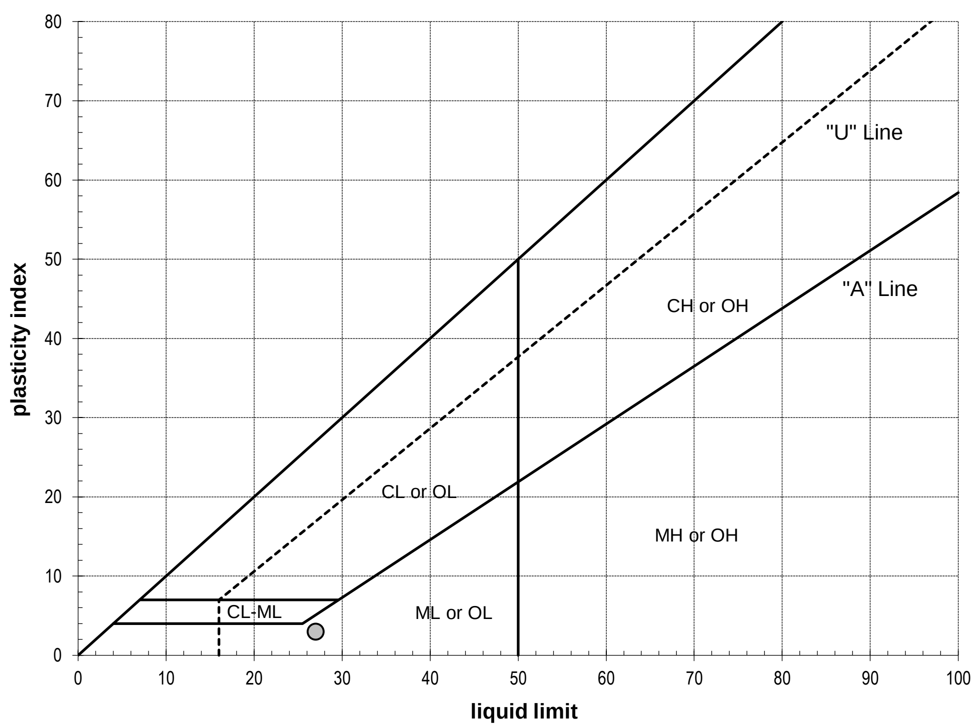
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.38	28.10		
dry soil + pan weight, g =	26.09	26.70		
pan weight, g =	20.72	20.85		
moisture, % =	24.0 %	23.9 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel = 0.0%
% sand = 17.7%
% silt and clay = 82.3%
% silt = n/a
% clay = n/a
moisture content = 36.5%

DATE TESTED	TESTED BY
04/27/18	RTT

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-358
		REPORT DATE: 05/01/18	FIELD ID: SB1.7
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Silty CLAY with Sand	Soil Boring SB-01 depth = 19.5 feet	CL-ML, Silty Clay with Sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-4(2)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

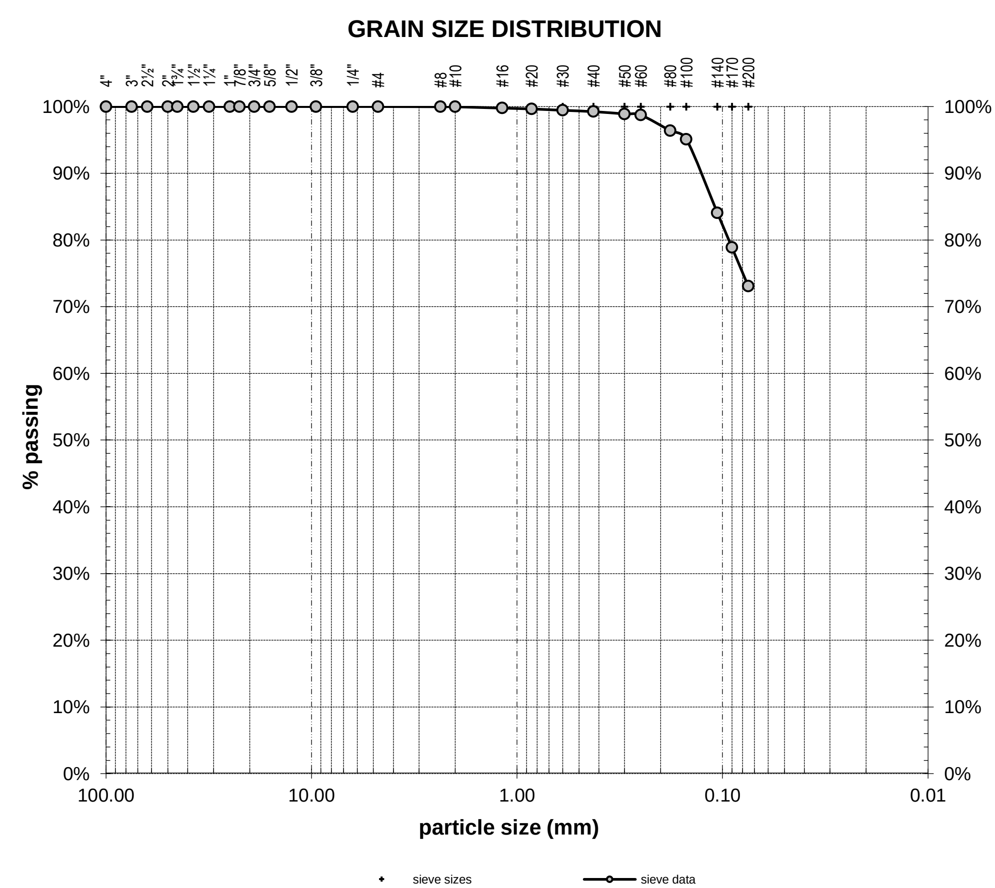
ADDITIONAL DATA

initial dry mass (g) =	151.73		
as-received moisture content =	29.6%	coefficient of curvature, C_C =	n/a
liquid limit =	26	coefficient of uniformity, C_U =	n/a
plastic limit =	21	effective size, $D_{(10)}$ =	n/a
plasticity index =	5	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 26.9%
% silt and clay = 73.1%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		100%		
	#10	2.00	100%			
	#16	1.18		100%		
	#20	0.850	100%			
	#30	0.600		99%		
	#40	0.425	99%			
	#50	0.300		99%		
	#60	0.250	99%			
	#80	0.180		96%		
	#100	0.150	95%			
	#140	0.106		84%		
	#170	0.090		79%		
	#200	0.075	73%			



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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-358
		REPORT DATE: 05/01/18	FIELD ID: SB1.7
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Silty CLAY with Sand	Soil Boring SB-01 depth = 19.5 feet	CL-ML, Silty Clay with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

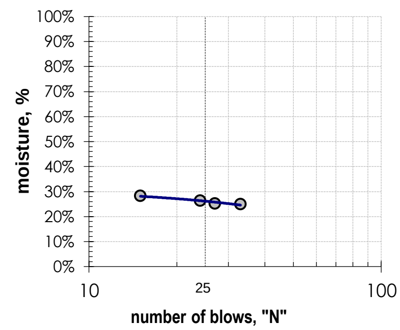
ATTERBERG LIMITS

liquid limit = 26
plastic limit = 21
plasticity index = 5

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	34.51	31.65	35.78	32.11
dry soil + pan weight, g =	31.80	29.43	32.68	29.61
pan weight, g =	20.94	20.64	20.90	20.78
N (blows) =	33	27	24	15
moisture, % =	25.0 %	25.3 %	26.3 %	28.3 %

LIQUID LIMIT



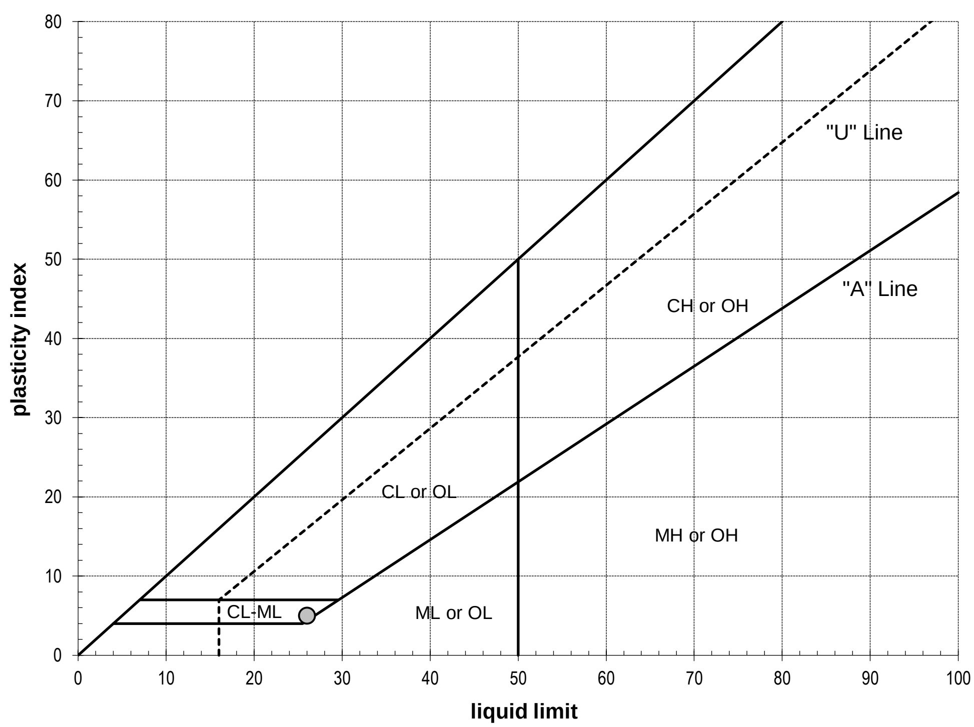
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	28.63	28.90		
dry soil + pan weight, g =	27.27	27.48		
pan weight, g =	20.84	20.87		
moisture, % =	21.2 %	21.5 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	26.9%
% silt and clay =	73.1%
% silt =	n/a
% clay =	n/a
moisture content =	29.6%

DATE TESTED	TESTED BY
04/30/18	RTT

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-359
		REPORT DATE: 05/01/18	FIELD ID: SB2.3
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY with Sand	Soil Boring SB-02 depth = 7.5 feet	CL, Lean Clay with Sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-4(5)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

ADDITIONAL DATA

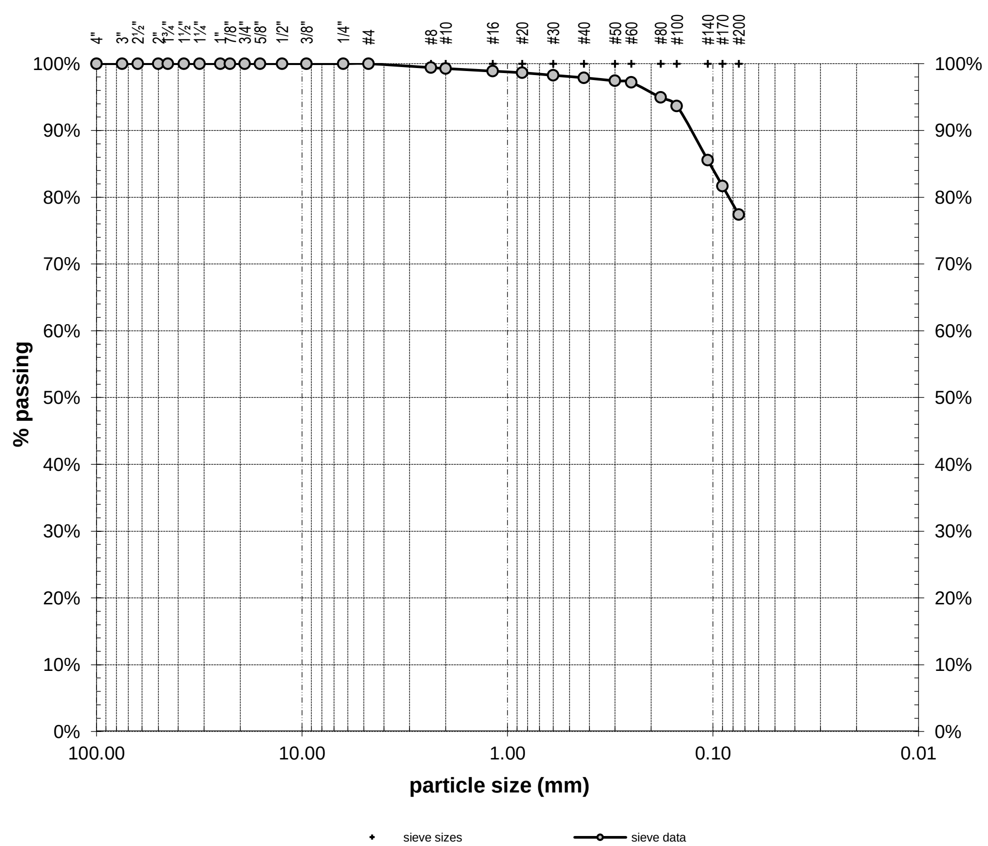
initial dry mass (g) =	133.16		
as-received moisture content =	41.8%	coefficient of curvature, C_C =	n/a
liquid limit =	30	coefficient of uniformity, C_U =	n/a
plastic limit =	22	effective size, $D_{(10)}$ =	n/a
plasticity index =	8	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	n/a

SIEVE DATA

% gravel = 0.0%
% sand = 22.6%
% silt and clay = 77.4%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		99%		
	#10	2.00	99%			
	#16	1.18		99%		
	#20	0.850	99%			
	#30	0.600		98%		
	#40	0.425	98%			
	#50	0.300		97%		
	#60	0.250	97%			
	#80	0.180		95%		
	#100	0.150	94%			
	#140	0.106		86%		
	#170	0.090		82%		
	#200	0.075	77%			

GRAIN SIZE DISTRIBUTION



DATE TESTED	TESTED BY
04/26/18	RTT

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-359
		REPORT DATE: 05/01/18	FIELD ID: SB2.3
		DATE SAMPLED: 04/19/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Lean CLAY with Sand	Soil Boring SB-02 depth = 7.5 feet	CL, Lean Clay with Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

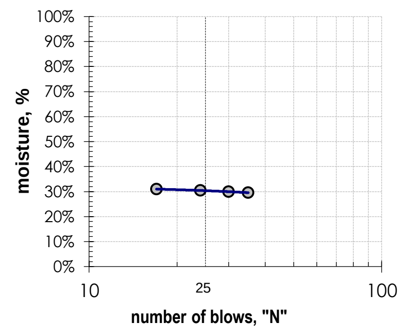
ATTERBERG LIMITS

liquid limit = 30
plastic limit = 22
plasticity index = 8

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	33.20	32.68	29.24	32.55
dry soil + pan weight, g =	30.39	29.95	27.26	29.75
pan weight, g =	20.88	20.84	20.76	20.71
N (blows) =	35	30	24	17
moisture, % =	29.6 %	30.0 %	30.5 %	31.0 %

LIQUID LIMIT



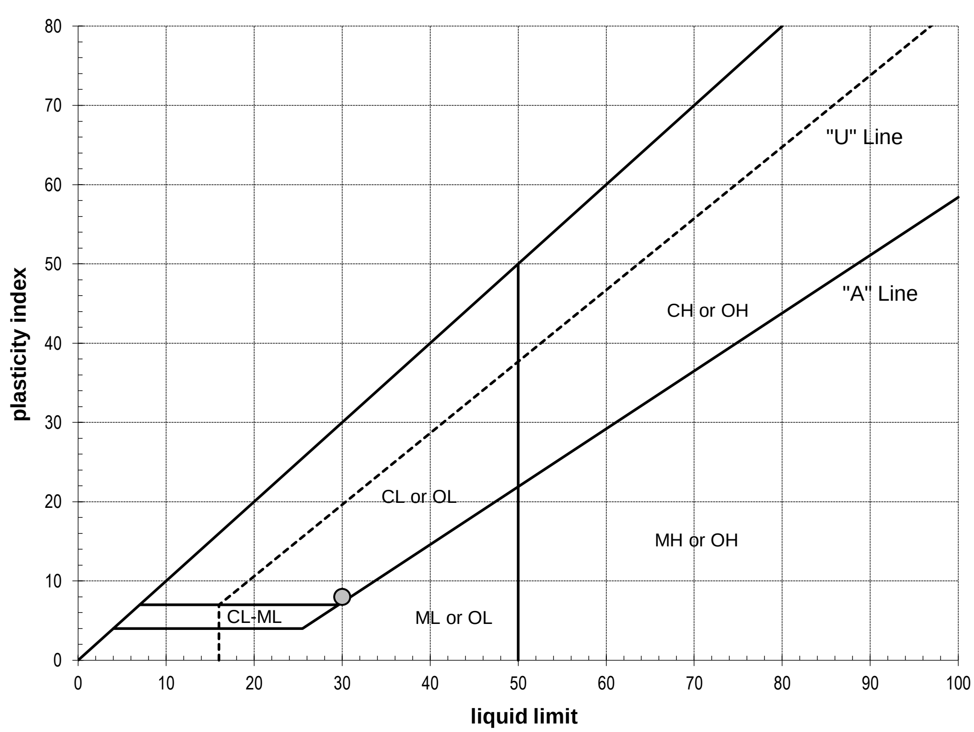
SHRINKAGE

shrinkage limit = n/a
shrinkage ratio = n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	28.15	28.51		
dry soil + pan weight, g =	26.80	27.14		
pan weight, g =	20.72	20.85		
moisture, % =	22.2 %	21.8 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel = 0.0%
% sand = 22.6%
% silt and clay = 77.4%
% silt = n/a
% clay = n/a
moisture content = 41.8%

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PARTICLE-SIZE ANALYSIS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-360
		REPORT DATE: 05/01/18	FIELD ID: SB2.8
		DATE SAMPLED: 04/20/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Clayey SAND	Soil Boring SB-02 depth = 30 feet	SC, Clayey Sand

SPECIFICATIONS	AASHTO SOIL TYPE
none	A-2-6(0)

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Rainhart "Mary Ann" Sifter 637	ASTM D6913

ADDITIONAL DATA

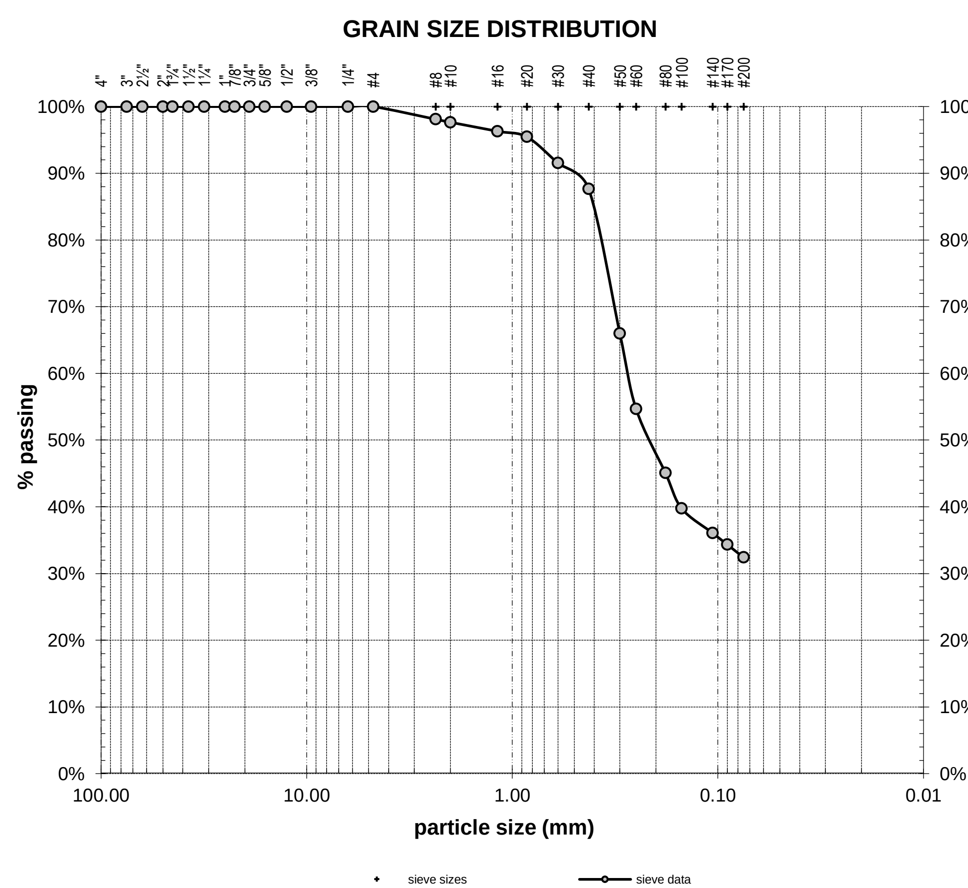
initial dry mass (g) =	148.33		
as-received moisture content =	24.9%	coefficient of curvature, C_C =	n/a
liquid limit =	27	coefficient of uniformity, C_U =	n/a
plastic limit =	15	effective size, $D_{(10)}$ =	n/a
plasticity index =	12	$D_{(30)}$ =	n/a
fineness modulus =	n/a	$D_{(60)}$ =	0.272 mm

SIEVE DATA

% gravel = 0.0%
% sand = 67.6%
% silt and clay = 32.4%

	SIEVE SIZE US	SIEVE SIZE mm	PERCENT PASSING SIEVE act.	PERCENT PASSING SIEVE interp.	SPECS max	SPECS min
GRAVEL	6.00"	150.0		100%		
	4.00"	100.0		100%		
	3.00"	75.0		100%		
	2.50"	63.0		100%		
	2.00"	50.0		100%		
	1.75"	45.0		100%		
	1.50"	37.5		100%		
	1.25"	31.5		100%		
	1.00"	25.0		100%		
	7/8"	22.4		100%		
	3/4"	19.0		100%		
	5/8"	16.0		100%		
	1/2"	12.5		100%		
	3/8"	9.50		100%		
	1/4"	6.30		100%		
	#4	4.75	100%			
SAND	#8	2.36		98%		
	#10	2.00	98%			
	#16	1.18		96%		
	#20	0.850	95%			
	#30	0.600		92%		
	#40	0.425	88%			
	#50	0.300		66%		
	#60	0.250	55%			
	#80	0.180		45%		
	#100	0.150	40%			
	#140	0.106		36%		
	#170	0.090		34%		
	#200	0.075	32%			

DATE TESTED	TESTED BY
04/26/18	RTT



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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	LAB ID
La Center Middle School La Center, Washington	Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue La Center, Washington 98629	18084	S18-360
		REPORT DATE: 05/01/18	FIELD ID: SB2.8
		DATE SAMPLED: 04/20/18	SAMPLED BY: ASR

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Clayey SAND	Soil Boring SB-02 depth = 30 feet	SC, Clayey Sand

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318

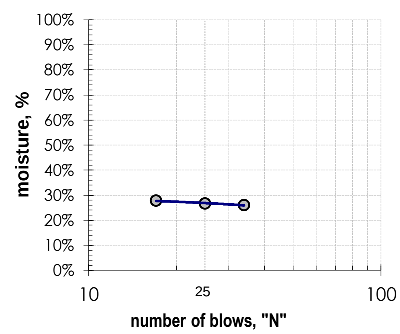
ATTERBERG LIMITS

liquid limit =	27
plastic limit =	15
plasticity index =	12

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	31.16	30.81	35.41	
dry soil + pan weight, g =	28.99	28.72	32.21	
pan weight, g =	20.65	20.85	20.70	
N (blows) =	34	25	17	
moisture, % =	26.0 %	26.6 %	27.8 %	

LIQUID LIMIT



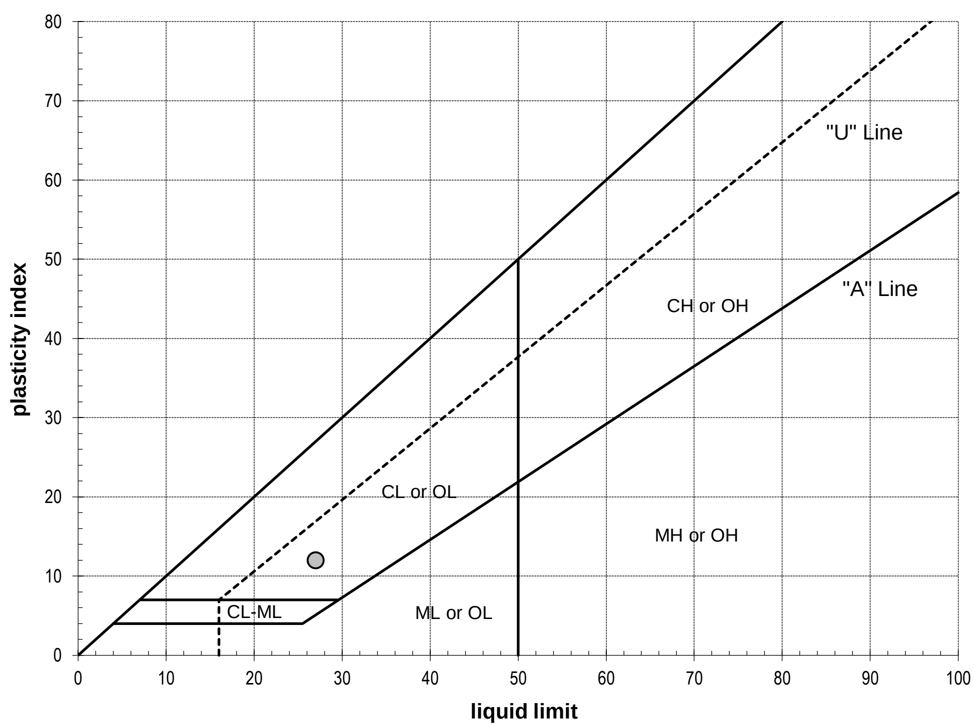
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.72	27.05		
dry soil + pan weight, g =	26.81	26.22		
pan weight, g =	20.74	20.59		
moisture, % =	15.0 %	14.7 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel =	0.0%
% sand =	67.6%
% silt and clay =	32.4%
% silt =	n/a
% clay =	n/a
moisture content =	24.9%

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APPENDIX B
SUBSURFACE EXPLORATION LOGS

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-1
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	138	Seeps at 1 feet bgs	0815	0850

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
	TP-1.1	Gee silt loam	A-7-6(19)	CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]	38.3	88.9	44	19	
5											
	TP1.2		A-4(0)	ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]	39.1	92.7	0	0	
	TP1.3		A-4(5)				42.2	83.7	30	7	
10											
15						Bottom of test pit at 14 feet bgs. Groundwater seeps encountered at 1 feet bgs. Heavy flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-2
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	142	Seeps at 3 feet bgs	0855	0915

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
15						Bottom of test pit at 15 feet bgs. Groundwater seeps encountered at 3 feet bgs. Moderate flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-3
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	136	Seeps at 3 feet bgs	0920	0950

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5											
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
15						Bottom of test pit at 14.5 feet bgs. Groundwater seeps encountered at 3 feet bgs. Moderate flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-4
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**GEOLOGIST/ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	137	Seeps at 3 feet bgs	1000	1050

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5	TP4.1		A-4(0)				39.8	90.2	0	0	
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
15						Bottom of test pit at 14 feet bgs. Groundwater seeps encountered at 3 feet bgs. Heavy flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-5
PROJECT LOCATION La Center, Washington	CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOGIST/ENGINEER ASR	DATE 4/18/18
APPROXIMATE TEST PIT LOCATION See Figure 2	APPROX. SURFACE ELEVATION 135	GROUNDWATER DEPTH Seeps at 3 feet bgs	START TIME 1100	FINISH TIME 1155

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5											
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
	TP5.1		A-4(0)	ML-CL		Blue-gray silty SAND, wet, loose, low plasticity to non-plastic, variable silt/clay content. [Soil Type 2]	35.4	48.2	0	0	
15						Bottom of test pit at 15 feet bgs. Groundwater seeps encountered at 3 feet bgs. Moderate flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-6
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	132	Seeps at 2 feet bgs	1200	1240

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5											
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
15						Bottom of test pit at 14 feet bgs. Groundwater seeps encountered at 2 feet bgs. Moderate flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-7
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	136	Seeps at 1 feet bgs	1245	1315

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5						Interbedded sand and silt lenses.					
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
						Bottom of test pit at 13 feet bgs. Groundwater seeps encountered at 1 feet bgs. Heavy flow.					
15											

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-8
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	134	Seeps at 2 feet bgs	1320	1345

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inches of grass and topsoil TILL ZONE.					
		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
5											
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
15						Bottom of test pit at 14 feet bgs. Groundwater seeps encountered at 2 feet bgs. Moderate flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-9
PROJECT LOCATION	**CONTRACTOR**	**EQUIPMENT**	**GEOLOGIST/ENGINEER**	**DATE**
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**START TIME**	**FINISH TIME**
See Figure 2	132	Seeps at 4 feet bgs	1350	1415

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0				CL		Minor topsoil, disturbed clay FILL, evidence of previous grading.					
5		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
10				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
15						Bottom of test pit at 14 feet bgs. Groundwater seeps encountered at 4 feet bgs. Moderate flow.					

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TEST PIT LOG

PROJECT NAME	CLIENT		PROJECT NO.	TEST PIT NO.
La Center Middle School	La Center School District		18084	TP-10
PROJECT LOCATION	CONTRACTOR	EQUIPMENT	GEOLOGIST/ENGINEER	DATE
La Center, Washington	L&S Contractors	CAT 307E	ASR	4/18/18
APPROXIMATE TEST PIT LOCATION	APPROX. SURFACE ELEVATION	GROUNDWATER DEPTH	START TIME	FINISH TIME
See Figure 2	132	Seeps at 4 feet bgs	1420	1500

Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0				CL		Minor topsoil, disturbed clay FILL, evidence of previous grading. Concrete debris encountered at 4 feet.					
5		Gee silt loam		CL		Orange-brown lean CLAY to lean CLAY with sand, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]					
				ML		Medium brown SILT to SILT with sand, wet to saturated, soft to medium stiff, low plasticity to non-plastic. Variable sand and clay content (fine texture). [Soil Type 2]					
10											
15						Bottom of test pit at 14 feet bgs. Groundwater seeps encountered at 4 feet bgs. Moderate flow.					

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SOIL BORING LOG

PROJECT NAME	CLIENT		PROJECT NO.	BORING NO.
La Center Middle School	La Center School District		18084	SB-1
PROJECT LOCATION	**DRILLING CONTRACTOR**	**DRILL RIG**	**ENGINEER/GEOLOGIST**	**PAGE NO.**
La Center, Washington	Western States	CME-55	ASR	1 of 1
BORING LOCATION	**DRILLING METHOD**	**SAMPLING METHOD**	**START DATE**	**START TIME**
See Figure 2	Mud-Rotary	SPT	4/19/2018	800
REMARKS	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**FINISH DATE**	**FINISH TIME**
none	138 ft amsl	3	4/19/2018	1400

Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	SPT N-value (uncorrected)	USCS Soil Type	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%) ✕	Passing No. 200 Sieve (%) ✚	Liquid Limit ●	Plasticity Index ○
0					Approximately 18 inches of grass and topsoil TILL ZONE.				
2	136	SB1.1	11	CL	Orange-brown sandy lean CLAY, moist to wet, medium dense, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]	37.7	66.9	46	22
6	132	SB1.2	6						
8		SB1.3		ML	Medium brown SILT with sand, wet to saturated, soft to medium stiff, low plasticity. Variable sand content (fine texture). [Soil Type 2]				
10	128	SB1.4	3			36.5	82.3	27	3
16		SB1.5	3						
18	120	SB1.6							
20		SB1.7	11			29.6	73.1	26	5
22	116			CL-ML	Blue-gray SILTY CLAY with sand, moist to wet, medium stiff to stiff, low to moderate plasticity. Varying amounts of fine sand. [Soil Type 2]				
26	112	SB1.8	24						
30	108	SB1.9	12						
34	104			Conglomerate	WEATHERED CONGLOMERATE - Orange-brown to varicolored CONGLOMERATE, partially to fully cemented sub-angular to sub-rounded pebbles and gravels in sand, silt, and clay matrix. Moist, very hard, moderate plasticity. [Soil Type 3]				
36		SB1.10	53						
46	92	SB1.11	50						

Soil boring terminated at 46 feet due to practical refusal.
Groundwater encountered at 3.0 feet.
Piezometer installed to 28 feet. Screened interval from 18 to 28 feet BGS.

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SOIL BORING LOG

PROJECT NAME	CLIENT		PROJECT NO.	BORING NO.
La Center Middle School	La Center School District		18084	SB-2
PROJECT LOCATION	**DRILLING CONTRACTOR**	**DRILL RIG**	**ENGINEER/GEOLOGIST**	**PAGE NO.**
La Center, Washington	Western States	CME-55	ASR	1 of 1
BORING LOCATION	**DRILLING METHOD**	**SAMPLING METHOD**	**START DATE**	**START TIME**
See Figure 2	Mud-Rotary	SPT	4/19/18	1445
REMARKS	**APPROX. SURFACE ELEVATION**	**GROUNDWATER DEPTH**	**FINISH DATE**	**FINISH TIME**
none	134 ft amsl	3	4/20/2018	1300

Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	SPT N-value (uncorrected)	USCS Soil Type	LITHOLOGIC DESCRIPTION AND REMARKS	Moisture Content (%) ✕	Passing No. 200 Sieve (%) ✚	Liquid Limit ●	Plasticity Index ○
0					Approximately 18 inches of grass and topsoil TILL ZONE.				
2	132			CL	Orange-brown LEAN CLAY with sand, moist to wet, medium dense, low to moderate plasticity. Gray mottles, blocky texture. [Soil Type 1]				
3		SB2.1	14						
6	128	SB2.2	5						
8		SB2.3	2			41.8	77.4	30	8
10	124			ML	Medium brown SILT with sand, wet to saturated, soft to medium stiff, low plasticity. Variable sand content (fine texture). [Soil Type 2]				
13		SB2.4	4						
14	120			CL-ML	Blue-gray SILTY CLAY with sand, moist to wet, medium stiff to stiff, low to moderate plasticity. Varying amounts of fine sand. [Soil Type 2]				
16		SB2.5	11						
18	116								
21		SB2.6	25						
22	112								
26	108	SB2.7	16						
28				SC	Blue-gray clayey SAND, moist to wet, medium dense, moderate plasticity. Medium-textured sand. [Soil Type 2]				
30	104	SB2.8	25			24.9	32.4	27	12
33				Conglomerate	WEATHERED CONGLOMERATE - Orange-brown to varicolored CONGLOMERATE, partially to fully cemented sub-angular to sub-rounded pebbles and gravels in sand, silt, and clay matrix. Moist, very hard, moderate plasticity. [Soil Type 3]				
34	100								
36		SB2.9	50						
38	96								
42	92								
46	88	SB2.10	50						
50	84								
54	80								
56		SB2.11	50		Soil boring terminated at 55.3 feet due to practical refusal. Groundwater encountered at 3.0 feet. Piezometer installed to 28.5 feet. Screened interval from 18.5 to 28.5 feet BGS.				
58	76								
60									
62	72								

APPENDIX C
SOIL CLASSIFICATION INFORMATION

SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

COMPONENT	ASTM/USCS		AASHTO	
	size range	sieve size range	size range	sieve size range
Cobbles	> 75 mm	greater than 3 inches	> 75 mm	greater than 3 inches
Gravel	75 mm – 4.75 mm	3 inches to No. 4 sieve	75 mm – 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm – 19.0 mm	3 inches to 3/4-inch sieve	-	-
Fine	19.0 mm – 4.75 mm	3/4-inch to No. 4 sieve	-	-
Sand	4.75 mm – 0.075 mm	No. 4 to No. 200 sieve	2.00 mm – 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm – 2.00 mm	No. 4 to No. 10 sieve	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve	-	-
Fine	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	< 0.075 mm	Passing No. 200 sieve	< 0.075 mm	Passing No. 200 sieve

Consistency for Cohesive Soil

CONSISTENCY	SPT N-VALUE (BLOWS PER FOOT)	POCKET PENETROMETER (UNCONFINED COMPRESSIVE STRENGTH, tsf)
Very Soft	2	less than 0.25
Soft	2 to 4	0.25 to 0.50
Medium Stiff	4 to 8	0.50 to 1.0
Stiff	8 to 15	1.0 to 2.0
Very Stiff	15 to 30	2.0 to 4.0
Hard	30 to 60	greater than 4.0
Very Hard	greater than 60	-

Relative Density for Granular Soil

RELATIVE DENSITY	SPT N-VALUE (BLOWS PER FOOT)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	more than 50

Moisture Designations

TERM	FIELD IDENTIFICATION
Dry	No moisture. Dusty or dry.
Damp	Some moisture. Cohesive soils are usually below plastic limit and are moldable.
Moist	Grains appear darkened, but no visible water is present. Cohesive soils will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grains. Sand and silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is much wetter than optimum moisture content and is above plastic limit.

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

General Classification	Granular Materials (35 Percent or Less Passing .075 mm)			Silt-Clay Materials (More than 35 Percent Passing 0.075)			
Group Classification	A-1	A-3	A-2	A-4	A-5	A-6	A-7
Sieve analysis, percent passing:							
2.00 mm (No. 10)	-	-	-				
0.425 mm (No. 40)	50 max	51 min	-	-	-	-	-
0.075 mm (No. 200)	25 max	10 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)							
Liquid limit				40 max	41 min	40 max	41 min
Plasticity index	6 max	N.P.		10 max	10 max	11 min	11 min
General rating as subgrade	Excellent to good			Fair to poor			

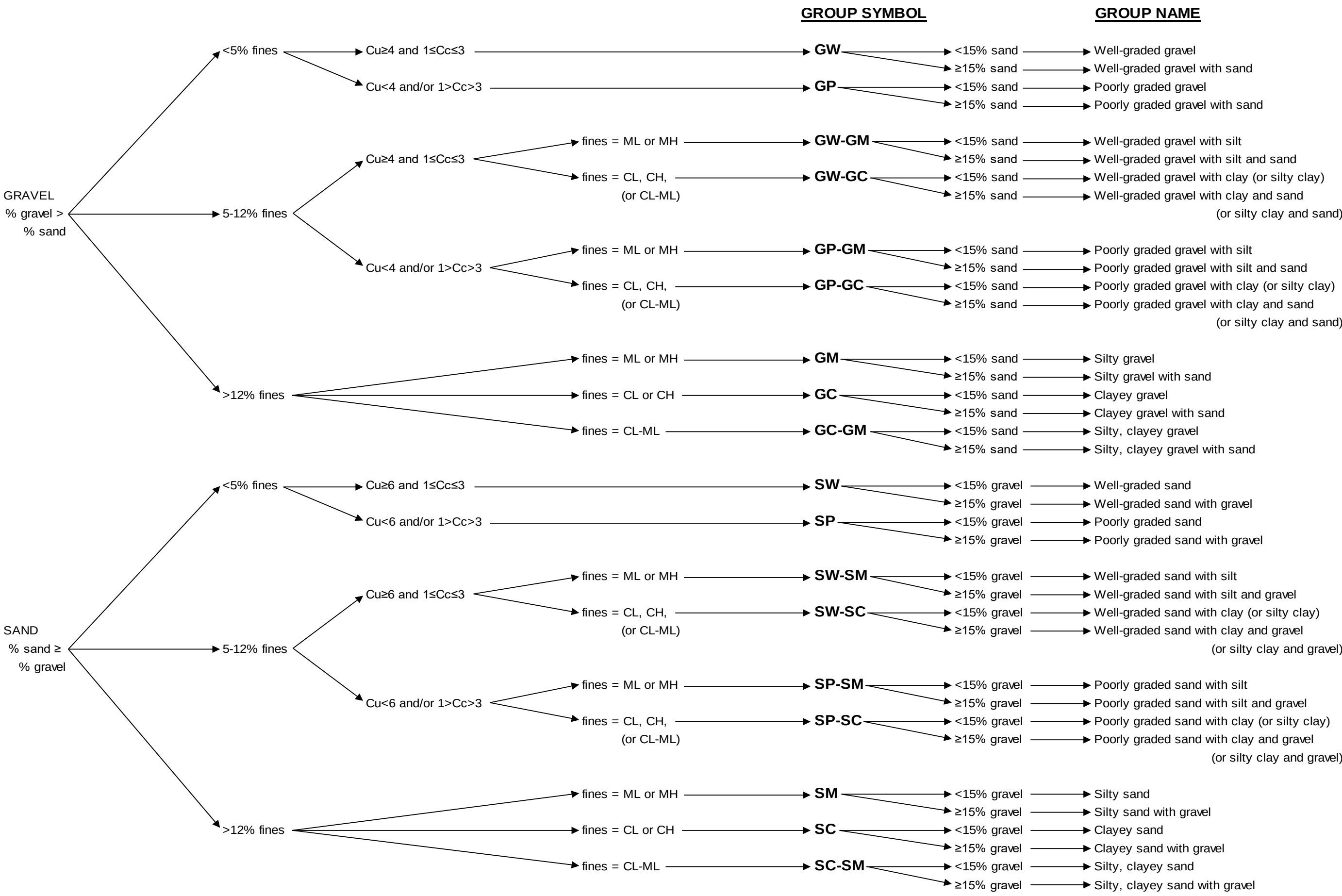
Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

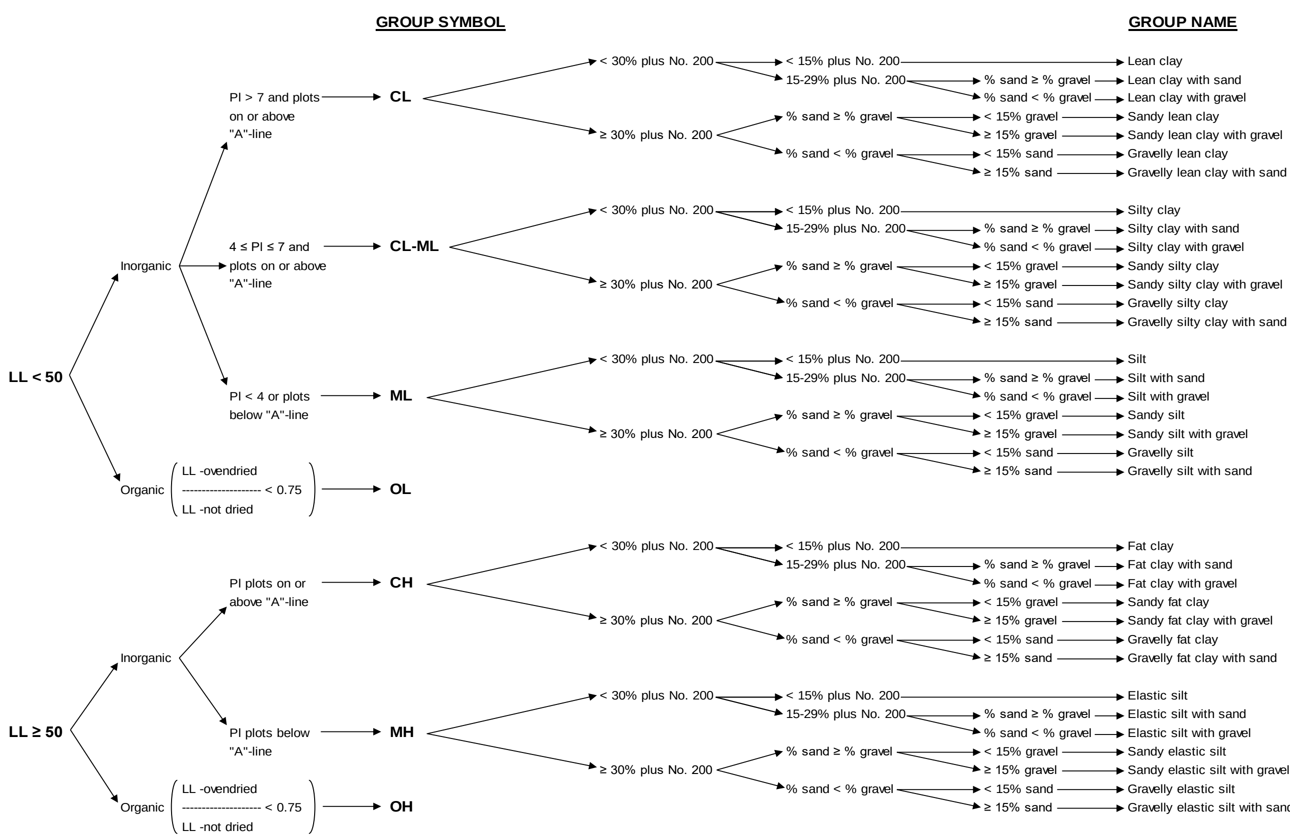
General Classification	Granular Materials (35 Percent or Less Passing 0.075 mm)							Silt-Clay Materials (More than 35 Percent Passing 0.075 mm)			
	A-1			A-2							A-7
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5, A-7-6
Sieve analysis, percent passing:											
2.00 mm (No. 10)	50 max	-	-	-	-	-	-	-	-	-	-
0.425 mm (No. 40)	30 max	50 max	51 min	-	-	-	-	-	-	-	-
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11min
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General ratings as subgrade	Excellent to Good							Fair to poor			

Note: Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30 (see Figure 2).

AASHTO = American Association of State Highway and Transportation Officials



Flow Chart for Classifying Coarse-Grained Soils (More Than 50% Retained on No. 200 Sieve)



Flow Chart for Classifying Fine-Grained Soil (50% or More Passes No. 200 Sieve)

APPENDIX D
PHOTO LOG

Aerial view of proposed parcels
Facing South

Aerial view of proposed parcels
Facing North

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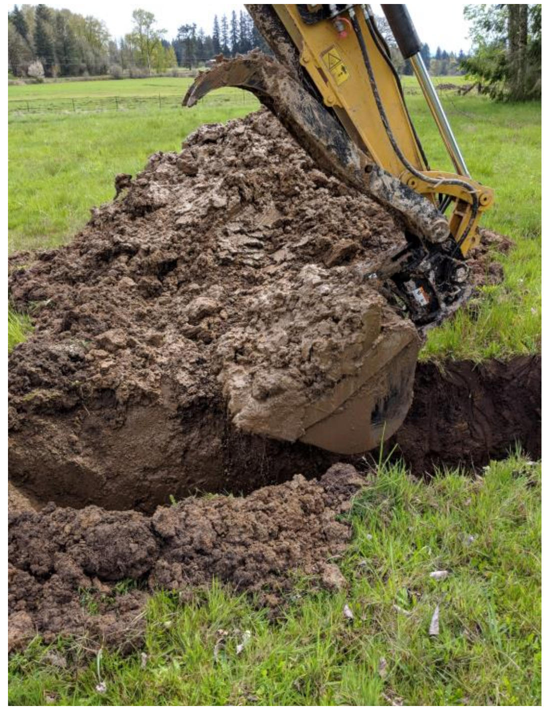
PHOTO LOG
La Center Middle School
La Center, Washington

Clay soils and ponding surface water at
Test Pit TP-7



Wet Silt and Clay from
Test Pit TP-8

Heavy groundwater seeps in
Test Pit TP-5

Topsoil and Till Zone Depth
approximately 18 inches

APPENDIX E
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Date: May 17, 2018
Project: La Center Middle School
La Center, Washington

Geotechnical and Environmental Report Limitations and Important Information

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction QA/QC

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled *Report Ownership*. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors

Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

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Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.