FRIENDSVIEW RCF PHASE 1

Exhibit G: Preliminary Storm Report

Friendsview
Residential Care Facility – Phase I
Newberg, Oregon

Preliminary Stormwater Report

Date: December 17, 2020

Client:
LRS Architects
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Portland, OR 97209

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AKS Job Number: 3199-01

REGISTERED PROFESSIONAL ENGINEER
50644PE
OREGON
SEPT. 14, 1999
CHARLES EDWARD GREGORY
RENEWS: JUNE 30, 2021

Preliminary

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ENGINEERING & FORESTRY

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Preliminary Stormwater Report

FRIENDSVIEW RESIDENTIAL CARE FACILITY – PHASE 1

NEWBERG, OREGON

1.0 Purpose of Report

The purpose of this report is to analyze the effects the proposed development will have on the existing stormwater conveyance system; document the criteria, methodology, and informational sources used to design the proposed stormwater system; and present the results of the preliminary hydraulic analysis.

2.0 Project Location/Description

The proposed development is located north of Fulton Street, and south of the Southern Pacific Railroad in Newberg, Oregon, encompassing 16.4 acres (Tax Lot 200, Yamhill County Tax Map 3S2W17).

The proposed project is a multi-phased development. The first phase will include the removal and relocation of existing duplex buildings and the construction of a residential care facility, reconstructed parking lot areas, drive aisles, curbs, sidewalks, landscaping, associated underground utilities, and stormwater facilities. The second phase will consist of an expansion to the existing Friendsview Manor Building, parking spaces, sidewalks, and accompanying utilities which will occur at a future date.

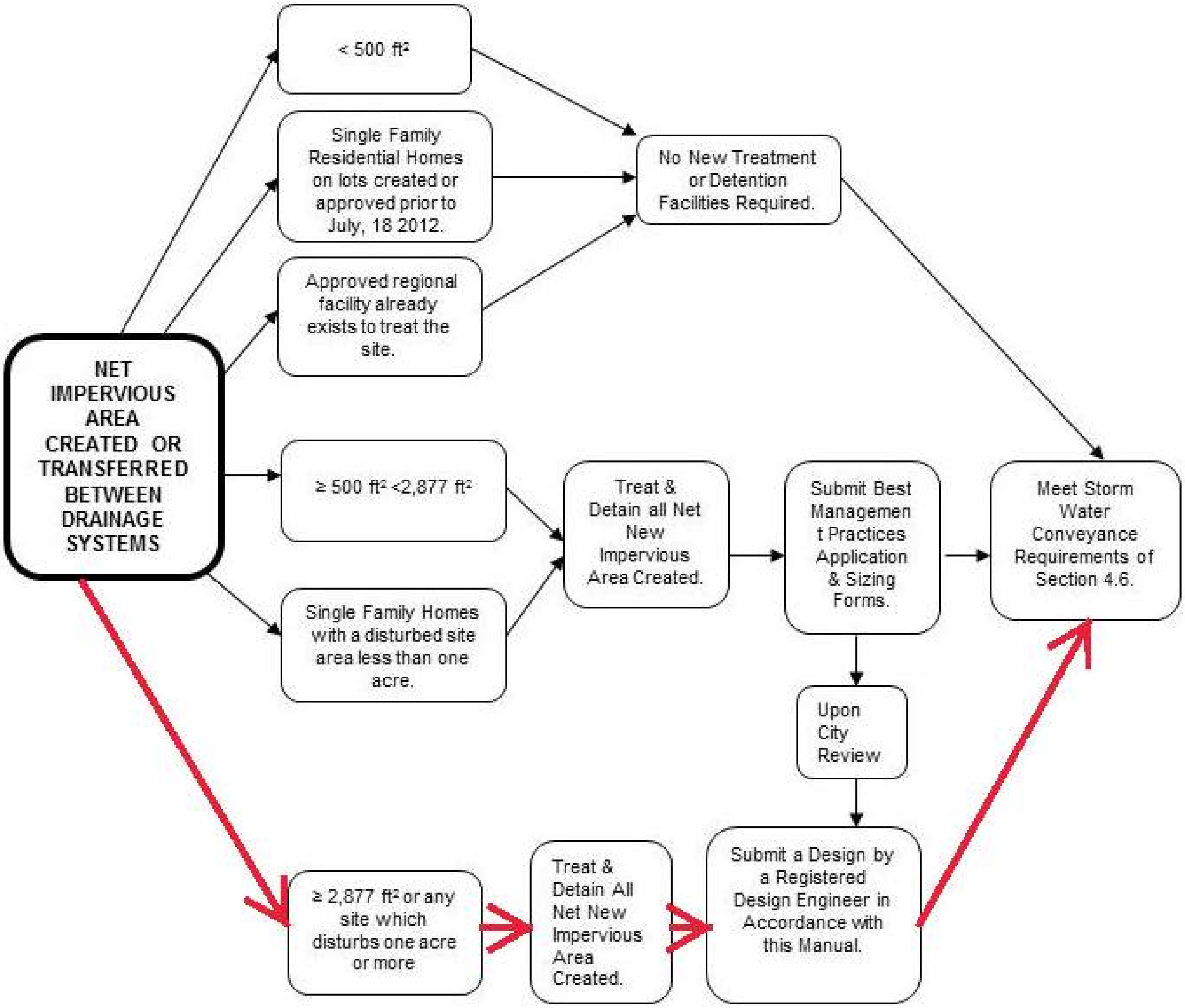
Stormwater management is provided through a combination of low impact development approach (LIDA) facilities and underground detention chambers. All stormwater detention facilities will be designed with outlet structures to release the post-developed site peak flow at or below pre-developed rates. Most of the existing upstream system will be treated using a StormFilter cartridge catch basin.

3.0 Regulatory Design Criteria

Stormwater design criteria is dictated by the City of Newberg *Public Works Design and Construction Standards (August 2015)*. Per Figure 4.4, the proposed development will create more than 2,877 square feet of impervious area and will therefore be required to provide treatment and detention for all net new impervious area.

4.6 Water Quantity and Quality Facilities

Figure 4.4 Storm water Quality & Quantity Design Flow Chart



3.1. Stormwater Quantity

Per City of Newberg's *Public Works Design and Construction Standards (August 2015),* it is required that the post-development runoff rates from the site do not exceed the pre-development runoff rates.

> *4.7.1.III Water Quantity Facility Design & Control Standards*
>
> *Stormwater quantity on-site detention facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development runoff rates from the site, based on 24-hour storm events ranging from ½ of the 2-year return storm to the 25-year return storm. Specifically, the ½ of the 2, 2, 10, and 25-year post-development runoff rates will not exceed their respective ½ of the 2, 2, 10, and 25-year pre-development runoff rates…*

Per City of Newberg standards, the proposed development will provide stormwater quantity management with LIDA facilities to the maximum extent practicable and underground detention chambers. The proposed conveyance system and stormwater management facilities will be designed to detain the post-developed runoff rates from the site, so that they do not exceed the pre-developed rates.

3.2. Stormwater Quality

Per City of Newberg's *Public Works Design and Construction Standards (August 2015),* it is required that stormwater quality facilities be designed based on the following:

> *4.8.5 Water Quality Storm*
>
> *The storm defines both volume and rate of runoff. The stormwater quality only facilities shall be designed for a dry weather storm event totaling 1.0 inches of precipitation falling in 24 hours with an average storm return period of 96 hours using Figure 4-3, rainfall distribution.*

Stormwater quality management for this project will be met using flow-through planter facilities to the maximum extent practicable and a StormFilter catch basin. All facilities have been designed per City of Newberg Standards and checked using the HydroCAD 10.0 computer software.

4.0 Design Methodology

The Santa Barbara Urban Hydrograph (SBUH) Method was used to analyze stormwater runoff from the site. This method utilizes the SCS Type 1A 24-hour design storm. HydroCAD 10.0 computer software was used to model the hydrology and stormwater facility hydraulics. Runoff Curve Numbers (CN), which are representative of existing and developed cover conditions and time of concentration (Tc) values were developed in accordance with the U.S. Department of Agriculture (USDA) – Natural Resource Conservation Service's (NRCS) Technical Release 55 and are included in Appendix D.

5.0 Design Parameters

5.1. Design Storms

Per City of Newberg requirements, Table 5-1 defines the rainfall intensities and durations that were utilized in the analysis of the existing and proposed stormwater facilities.

Table 5-1: Rainfall Intensities

Recurrence Interval (Years)	Total Precipitation Depth (Inches)
Water Quality	1.00
½ of 2	1.25
2	2.50
10	3.50
25	4.00

5.2. Pre-Developed Site Conditions

5.2.1. Site Topography

The subject site includes Hess Creek and the surrounding canyon to the east of the development. The canyon generally slopes at approximately a 2:1 slope, with a high point of approximately 180 feet and a low point of approximately 152 feet. Existing grades in the proposed development area generally vary from approximately 1 to 30 percent, with a high point of approximately 198 feet in the northwest corner of the site. The low point of the proposed development is approximately 175 feet near the west bank of the Hess Creek Canyon. The site generally slopes from northwest to southeast.

5.2.2. Land Use

The existing site is currently developed with existing buildings owned by Friendsview Retirement Community and is located within the City of Newberg's Institutional (I) zoning district.

5.3. Soil Type

The soil beneath the project site and associated drainage basins is classified as Aloha Silt Loam and Woodburn Silt Loam per the USDA Soil Survey for Yamhill County. Table 5-2 outlines the Hydrologic Soil Group rating for each soil type.

Table 5-2: Hydrologic Soil Groupings

NRCS Map Unit Identification	NRCS Soil Classification	Hydrologic Soil Group Rating
2300A	Aloha Silt Loam	C/D
2310C	Woodburn Silt Loam	C
2310F	Woodburn Silt Loam	C

Further information on this soil type is included in the NRCS Soil Resource Report located in Appendix C of this report.

5.4. Post-Developed Site Conditions

5.4.1. Site Topography

The on-site slopes will be modified with cuts and fills to accommodate the relocation of a portion of the private drive aisle and parking, the relocation of an existing duplex, the demolition of an existing duplex, and the construction of a multi-unit building and various stormwater facilities. The eastern portion of the site will remain unchanged and continue to drain to Hess Creek. The western and northern portions of the site will not be impacted by the proposed development.

5.4.2. Land Use

The post-developed site will consist of duplexes, a multi-unit building with associated streets, sidewalks, a concrete driveway, and underground utilities.

5.4.3. Post-Developed Site Parameters

Refer to Appendix A for HydroCAD reports that include each parameter (e.g. impervious/pervious areas, time of concentration, etc.) used to model and analyze the site hydrology.

5.4.4. Description of Off-Site Contributing Basins

There are no major off-site contributory basins draining onto the subject site.

6.0 Stormwater Analyses

6.1. Stormwater Conduit Sizing and Inlet Spacing

The proposed on-site catch basins and inlet structures will be spaced per City of Newberg requirements to properly convey stormwater runoff. The proposed storm pipes will be sized using Manning's equation to convey the peak flows from the 25-year storm event. All stormwater will be collected and conveyed to the existing private storm main located east of the Friendsview Manor building.

6.2. Existing Stormwater Facilities

The existing storm system is currently conveyed to a detention pond located approximately in the middle of the subject site (see Figure 2, Pre-Developed Basin Map for further detail). Following a topographic survey and visual inspections, AKS staff have determined that the existing pond does not meet current City of Newberg water quality standards for the following reasons:

A. Permanent Ponding Depth: The bottom of the existing pond currently sits level to or higher than the pond's outlet structure. Per City of Newberg standards, the minimum ponding depth for an extended dry basin is 0.4 feet. This lack of ponding depth prevents sediment from settling out of the stormwater conveyed to the pond.

B. Inlet and Outlet Locations: The existing pipe discharging into the pond is directly adjacent to the pond's outlet structure. This allows for direct flow between structures without treatment, thereby resulting in a short circuiting of the flow.

C. Non-standard Orifice: The existing outlet structure has a non-standard 6-inch turn-down pipe that conveys runoff to the overflow structure and out of the pond via a 15-inch storm line. A pond of this size and for a basin of this scale would typically utilize a 1-to-2-inch orifice to provide a drawdown time of 48 hours per City of Newberg standards. This would better allow for stormwater ponding which would allow sediment to settle out of the stormwater. A system with an orifice larger than approximately 1 to 2 inches would not provide the required draw down time.

While the pond does not meet current City standards for water quality, it does provide detention for the upstream system. However, due to the relocation of the existing access road, the pond will be decommissioned and filled as part of this project. As such, proposed facilities will need to provide capacity for detention to compensate for the removed pond facility. Because the existing pond does not currently treat the existing runoff, proposed facilities will not need to provide treatment due to the removal of the facility. The pond facility has been modeled in HydroCAD per survey data in order to analyze the pre-developed rates. Refer to Appendix A for calculations and contributing basins for the existing pond facility.

6.3. Proposed Stormwater Quality Control Facilities

6.3.1. Water Quality Treatment

Per Figure 4.4 of the City of Newberg Design standards, any site which disturbs more than 2,877 square feet or more than one acre must treat and detain all net new impervious area created. Table 6-1 details the existing, new, and net new impervious area created within the project limits. For additional information, refer to Figure 4 for basin maps detailing the impervious areas on site.

Table 6-1: Net New Impervious Area Summary

Pre-Development Impervious Area (square feet)	Post-Development Impervious Area (square feet)	Net New Impervious Area Requiring Treatment (square feet)	Total Treated Area (square feet)	Excess Treated Area (square feet)
146,000	172,640	26,640	34,960*	8,320

*Note: Approximately 14,175 square feet will be collected and treated by the StormFilter catch basin (see Table 6-2). The remaining area will be treated by LIDA flow-through planters.

6.3.2. Flow-Through Planter Facilities

LIDA flow-through planter facilities will be constructed on the west and east faces of the new building to collect and treat runoff from the roof of the new building and the surrounding plaza areas. The planters will be designed per City standards and analyzed in HydroCAD to provide water quality treatment for this new impervious area. Water quality flow will be routed through the growing medium and drain rock sections to the bottom of the facility. Also, the planters have been designed with outlet structures to maintain a minimum of 4-inches of freeboard during the 25-year storm event. Refer to Appendix A for the calculations for the water quality treatment through the planter.

6.3.3. Water Quality Structures

A portion of the proposed development's net new impervious area, as shown in the Post-Developed Basin Map, will be treated using a water quality catch basin. Flow will then be conveyed to the underground detention system. This area consists of the relocated drive aisle, new parking areas, and new sidewalks.

Refer to Figures 2 and 3 for basin maps detailing the contributing catchment area for the subject site. Refer to Table 6-2 and Appendix B for calculations and additional information regarding the sizing requirements of the water quality structure.

Table 6-2: Water Quality Structure Sizing

Structure ID	Collected Impervious Area (square feet)	Water Quality Flow (cfs)	Cartridge Flow Rate (27-inch Cartridge) (cfs)	Number of Cartridges Required
CB1	14,360	0.07	0.05	2

A portion of the project site will be situated at grades and elevations that will not allow stormwater runoff to be directed and discharged into the proposed water quality structure or LIDA facilities. Stormwater runoff from the proposed public improvements and repairs will continue to be collected and conveyed by the existing stormwater conveyance system in Fulton Street. If the net new impervious area created is less than 500 square feet, water quality treatment is not required. Additionally, a portion of the new improvements located south of the new building will be unable to be treated. This area is offset by the treatment that will be provided for existing impervious areas that were previously untreated by the existing pond.

6.4. Proposed Stormwater Quantity Control Facilities

Per Section 6.2 of this report, the existing pond to be removed currently provides detention for the upstream system. To offset the loss of the existing pond and to satisfy stormwater quantity requirements, a combination of an underground detention system and LIDA flow-through planters have been designed to release the post-developed peak flow at or below the pre-developed rate release from the existing pond. The detention facilities have been designed to collect and detain runoff from the existing upstream system that currently drains to the existing pond. Refer to Appendix A for calculations and contributing basins for the stormwater quantity control facility.

Table 6-3 outlines the pre-development and post-development flow rate comparisons.

Table 6-3: Water Quantity Flow Summary

Recurrence Interval	Peak Pre-Development Flow Exiting the Pond (cfs)	Peak Post-Development Flow (cfs)	Peak Flow Difference (cfs)
½ of 2	0.89	0.56	-0.33*
2	1.78	0.94	-0.84*
10	2.42	1.97	-0.45*
25	3.49	2.88	-0.61*

*Note: Additional detention capacity will be used by future development phases.

6.5. Downstream Analysis

The downstream system has been evaluated and it has been determined that this development will have no detrimental impacts to the downstream system. The onsite stormwater facility is designed so that post-development runoff rates will be less than or equal to the pre-development rates.

The conveyance system leaving the site has been analyzed from the proposed development site to the outfall at Hess Creek, approximately 250 feet downstream. It has been determined that the existing stormwater conveyance system meets the City’s capacity requirements (Design Standards Manual Section 4.5.7) to convey the detained flows from the proposed development.

AKS staff completed a visual investigation on 09/02/2020 of the existing conveyance system and outfall downstream of the proposed development. The existing outfall is in good condition with no signs of overflow or erosion.

Figure 1: Vicinity Map

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NOT FOR
CONSTRUCTION

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LRS PROJECT NUMBER:	*219081*
AKS PROJECT NUMBER:	*3199-01*

RESIDENTIAL CARE FACILITY- PHASE I

1301 Fulton St
Newberg,OR 97132

Friendsview
RETIREMENT COMMUNITY

SHEET TITLE:

VICINITY MAP

DRAWN BY:

SHEET:

FIG 1

90% DESIGN DEVELOPMENT
12/17/2020

Figure 2: Pre-Developed Basin Map

LRS ARCHITECTS
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SHEET TITLE:

PRE-DEVELOPED BASIN MAP

DRAWN BY:

SHEET:

FIG 2

100% DESIGN DEVELOPMENT
1/15/21

Figure 3: Post-Developed Basin Map

LEGEND:

▨ 1ES: EXISTING IMPERVIOUS AREA TO REMAIN UNDISTURBED (±106,000 SF)

NEW IMPERVIOUS AREA (±66,640 SF TOTAL)
- P1A: PHASE 1 ROOF – NORTH (±11,760 SF)
- P1B: PHASE 1 ROOF – SOUTHWEST (±7,030 SF)
- P1C: PHASE 1 ROOF – SOUTHEAST (±1,890 SF)
- P1D: PHASE 1 ENCLOSED YARD (±820 SF)
- P1E: PHASE 1 PARKING – NORTH (±14,360 SF)
- P1F: PHASE 1 PARKING – SOUTH (±16,170 SF)
- P1G: PHASE 1 RELOCATED DUPLEX ROOF (±4,970 SF)
- P1H: PHASE 1 PARKING – WEST (±3,790 SF)
- P1J: UN-DETAINED FLOWS (±500 SF)
- PH2: PHASE 2 ROOF (±5,350 SF)

⇨ PREDEVELOPMENT FLOW ARROW

➡ POST-DEVELOPMENT FLOW ARROW

→ STORMWATER PIPE FLOW DIRECTION

— — BASIN EXTENTS (±245,000 SF)

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SHEET TITLE:

POST-DEVELOPED BASIN MAP

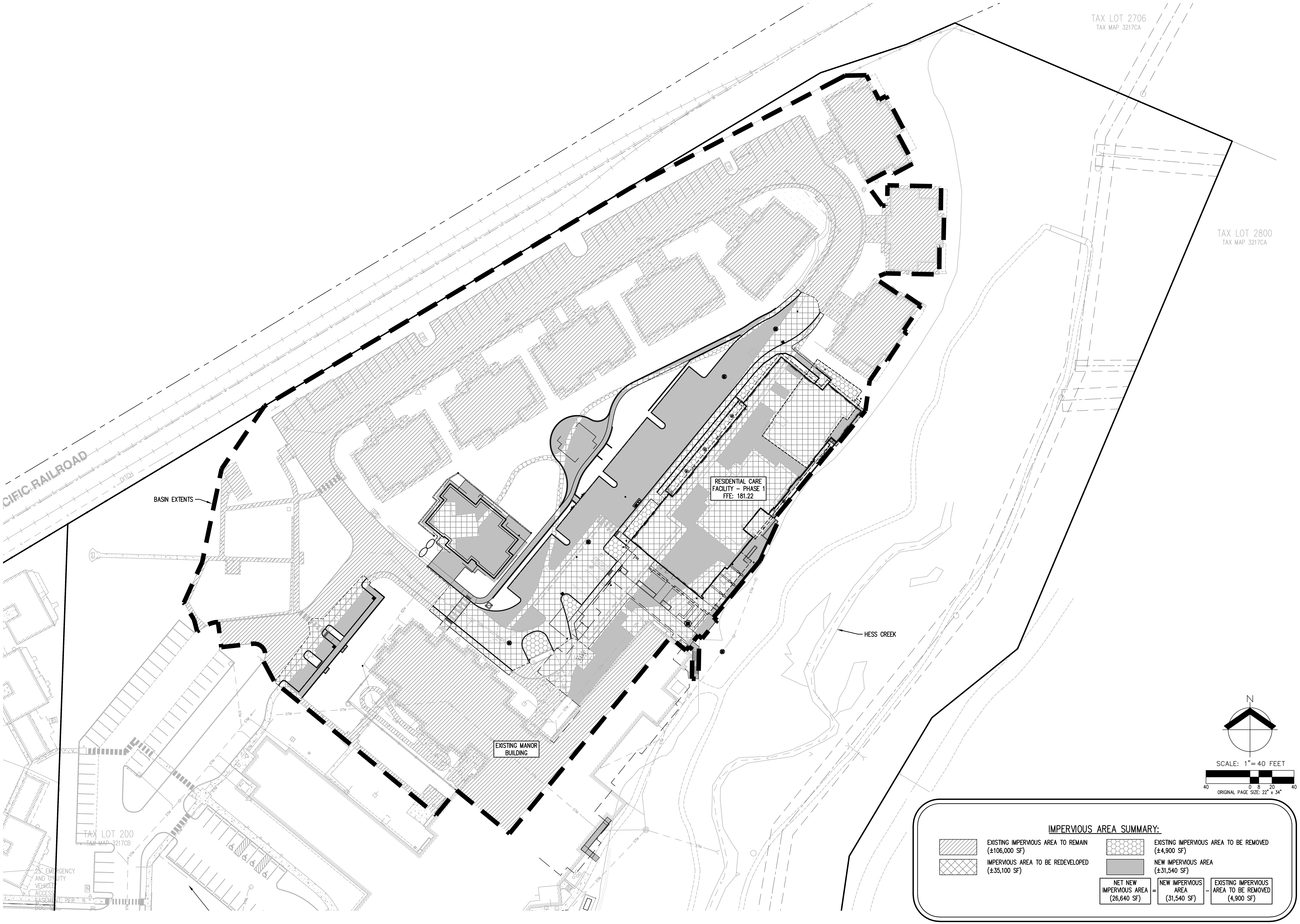
DRAWN BY:

SHEET:

FIG 3

100% DESIGN DEVELOPMENT
1/15/21

Figure 4: Impervious Area Basin Map



IMPERVIOUS AREA SUMMARY:

▨ EXISTING IMPERVIOUS AREA TO REMAIN (±106,000 SF)

▨ IMPERVIOUS AREA TO BE REDEVELOPED (±35,100 SF)

▨ EXISTING IMPERVIOUS AREA TO BE REMOVED (±4,900 SF)

▩ NEW IMPERVIOUS AREA (±31,540 SF)

NET NEW IMPERVIOUS AREA (26,640 SF) = NEW IMPERVIOUS AREA (31,540 SF) – EXISTING IMPERVIOUS AREA TO BE REMOVED (4,900 SF)

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SHEET TITLE:

IMPERVIOUS AREA BASIN MAP

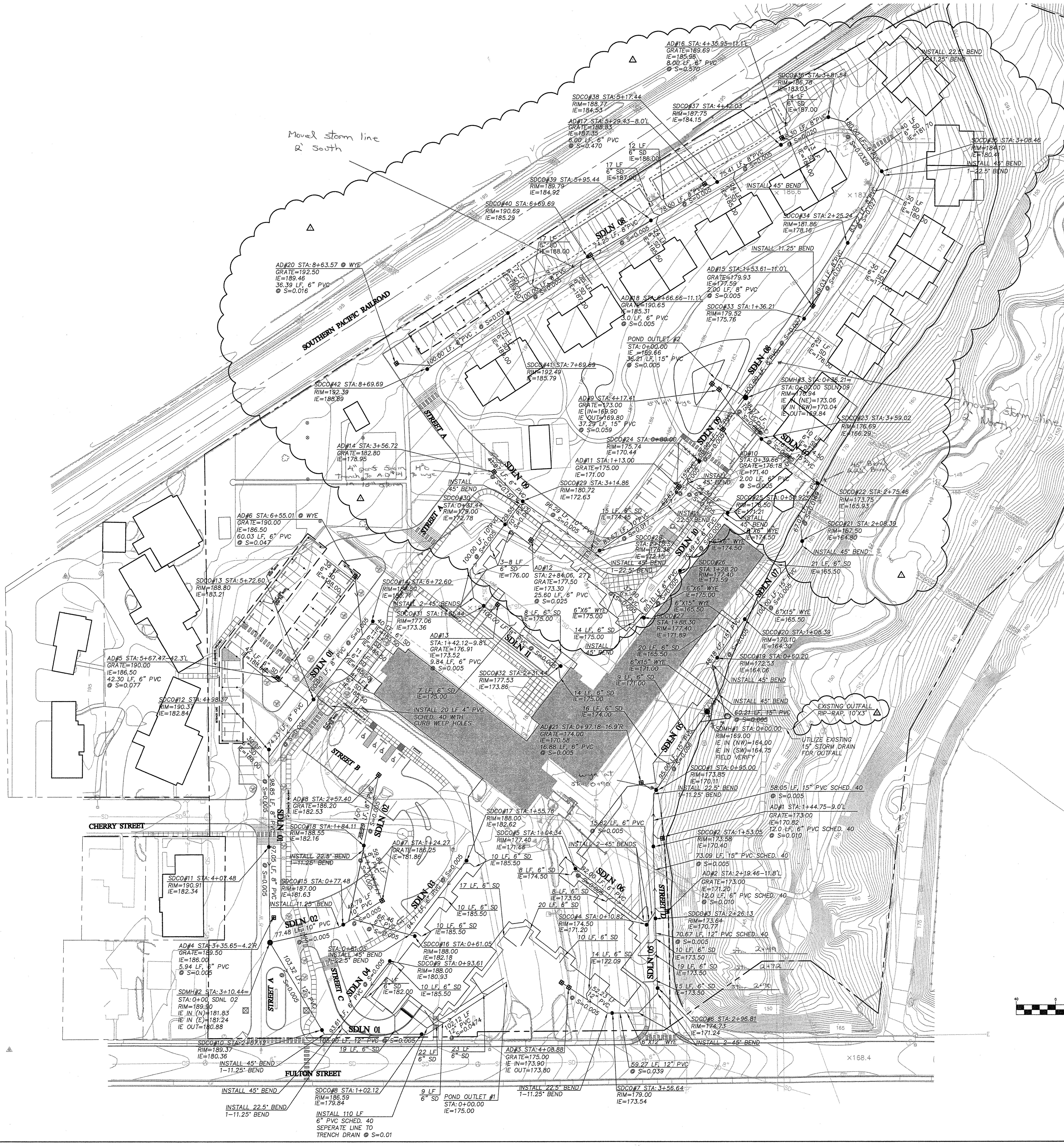
DRAWN BY:

SHEET:

FIG 4

100% DESIGN DEVELOPMENT
1/15/21

Figure 5: Stormwater As-Built Plan



NOTES:

1. ALL STORM DRAINAGE IS PRIVATE. PERMIT REQUIRED THROUGH BUILDING DEPARTMENT.
2. ENGINEER MUST CERTIFY IN WRITING THAT THAT THE DETENTION PONDS INCLUDING PIPING & STRUCTURES ARE CONSTRUCTED ACCORDING TO ENGINEER'S APPROVED DESIGN.
3. LAY STORM SEWER PIPE WITH LASER.
4. CONSTRUCTION BELOW CONTOUR ELEVATION 172 SHALL BE PERFORMED AND AREA DISTURBED BY CONSTRUCTION RESTORED TO CONDITION EQUAL TO OR BETTER THAN PRIOR TO CONSTRUCTION.
5. CONTRACTOR TO PREVENT ANY TRANSPORT OR MIGRATION OF SOILS OR DEBRIS INTO THE DRAINAGE CORRIDOR BY PLACING SEDIMENT FENCING, BIOBAGS OR OTHER MEANS AS MAY BE REQUIRED.

NORTH

GRAPHIC SCALE

0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

ALPHA ENGINEERING INC.
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OFFICE 503-452-8003 ▲ FAX 503-452-8043
PLAZA WEST ▲ SUITE 230 ▲ 9600 SW OAK ▲ PORTLAND, OR 97223

NO.	DATE	REVISION	BY
1	6/27/02	CLIENT/ARCH REVISIONS	JMJ
2	7/12/02	CITY REVISIONS	MVL

DESIGNED BY RAL DATE
DRAWN BY EJT DATE
REVIEWED BY MVL DATE
PROJECT NO. 626-002 REF. 6262BASE
SCALE HORZ: 1"=40'
VERT: 1"=4'
656ISTRM.DWG

REGISTERED PROFESSIONAL ENGINEER
13,280
OREGON
JULY 17, 1986
MICHAEL J. VAN LOO
VALID THROUGH 6-30-02

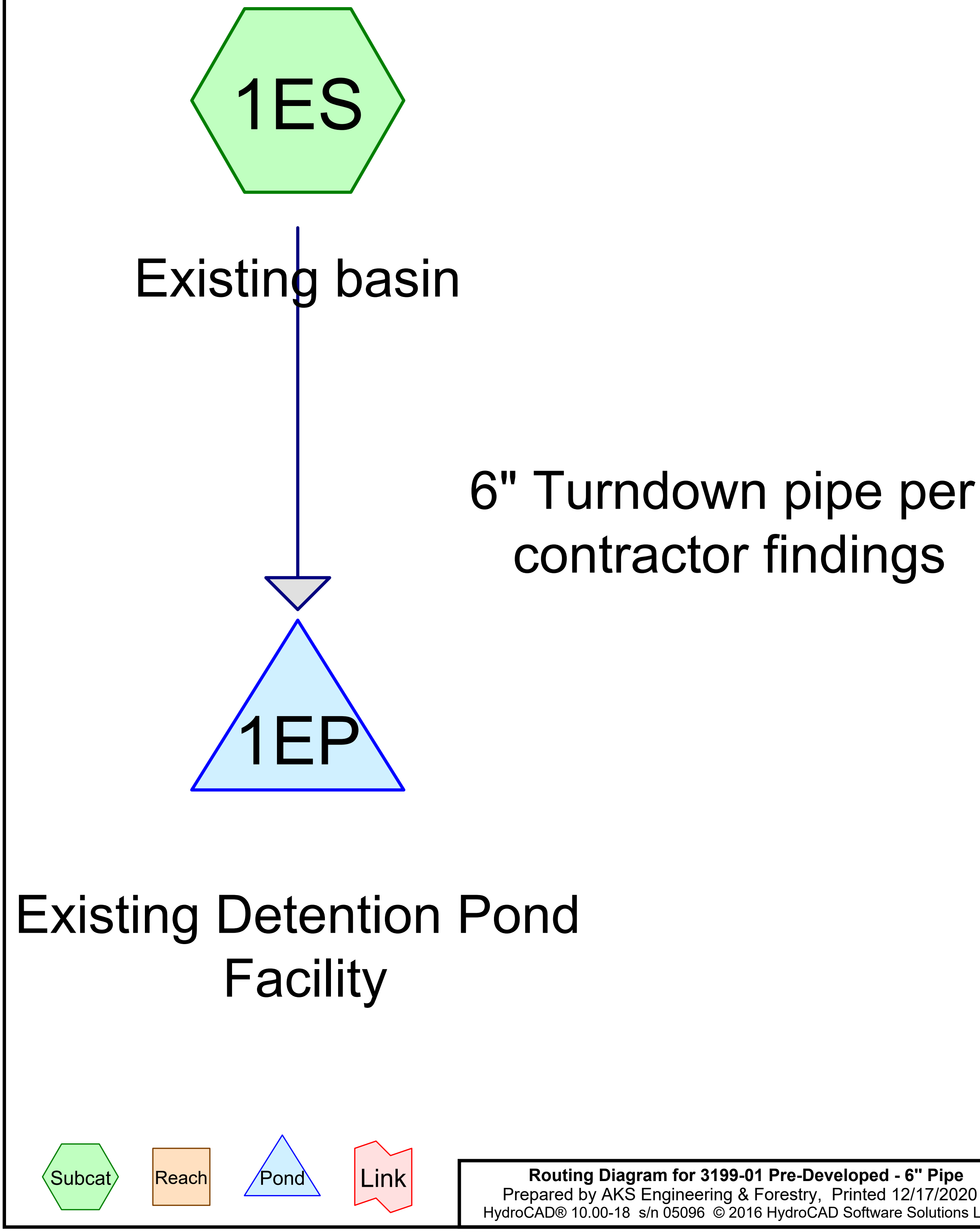
STORM DRAINAGE PLAN
FRIENDSVIEW MANOR

7/12/02
REVISED CONSTRUCTION SET
6/27/02
REVISED CONSTRUCTION SET
5/16/02
CONSTRUCTION SET

SHEET 3 OF 6

PROJECT FRIENDSVIEW MANOR
NO. 626-002
TYPE CONSTRUCTION

Appendix A: Pre-Developed and Post-Developed HydroCAD Analysis



Routing Diagram for 3199-01 Pre-Developed - 6" Pipe
Prepared by AKS Engineering & Forestry, Printed 12/17/2020
HydroCAD® 10.00-18 s/n 05096 © 2016 HydroCAD Software Solutions LLC

Summary for Subcatchment 1ES: Existing basin

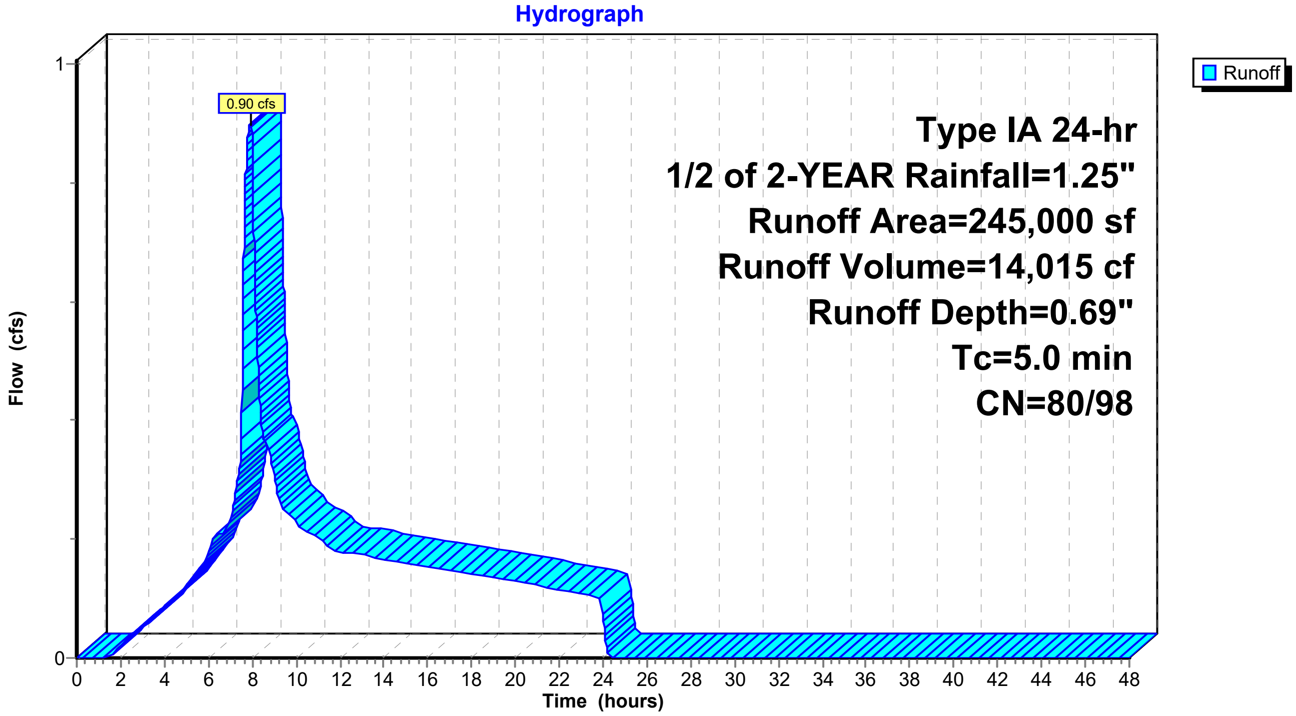
Runoff = 0.90 cfs @ 7.89 hrs, Volume= 14,015 cf, Depth= 0.69"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 of 2-YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	146,000	98	Existing Impervious Area
	99,000	80	>75% Grass cover, Good, HSG D
	245,000	91	Weighted Average
	99,000		40.41% Pervious Area
	146,000		59.59% Impervious Area

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

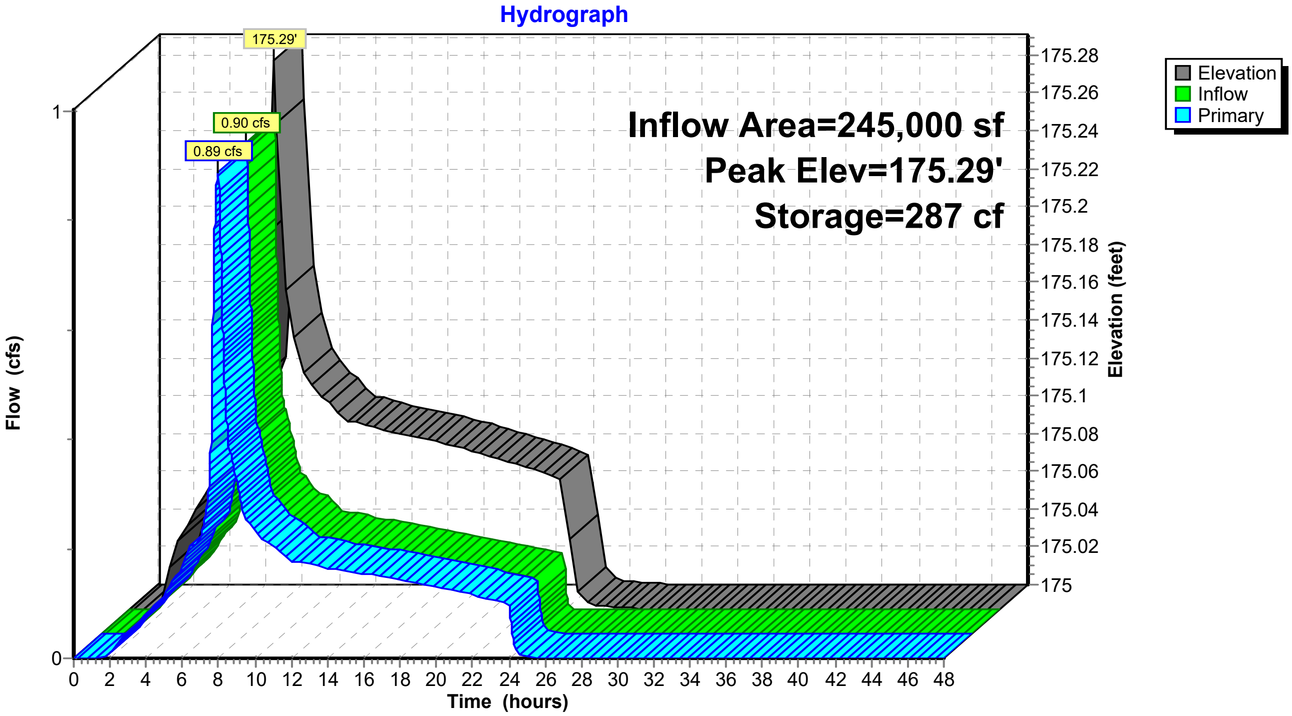
Subcatchment 1ES: Existing basin



Summary for Pond 1EP: Existing Detention Pond Facility

```
Inflow Area =        245,000 sf,  59.59% Impervious,  Inflow Depth =   0.69"    for  1/2 of 2-YEAR event
Inflow      =      0.90 cfs @    7.89 hrs,  Volume=           14,015 cf
Outflow     =      0.89 cfs @    7.97 hrs,  Volume=           14,015 cf,  Atten= 1%,  Lag= 4.6 min
Primary     =      0.89 cfs @    7.97 hrs,  Volume=           14,015 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 175.29' @ 7.97 hrs   Surf.Area= 1,051 sf   Storage= 287 cf

Plug-Flow detention time= 8.8 min calculated for 14,015 cf (100% of inflow)
Center-of-Mass det. time= 8.6 min ( 737.4 - 728.8 )

Volume        Invert    Avail.Storage   Storage Description
   #1        175.00'        10,377 cf   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation        Surf.Area   Voids         Inc.Store        Cum.Store
    (feet)          (sq-ft)     (%)     (cubic-feet)     (cubic-feet)
    175.00              931     0.0                0                0
    176.00            1,343   100.0            1,137            1,137
    177.00            1,778   100.0            1,561            2,698
    178.00            2,281   100.0            2,030            4,727
    179.00            2,808   100.0            2,545            7,272
    180.00            3,403   100.0            3,106           10,377

Device   Routing          Invert   Outlet Devices
   #1    Primary         172.25'   15.0"  Round Culvert  L= 142.8'   Ke= 0.500
                                   Inlet / Outlet Invert= 172.25' / 170.72'   S= 0.0107 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.23 sf
   #2    Device 1        177.00'   2.0' long  (Profile 17) Broad-Crested Rectangular Weir
                                   Head (feet)  0.49  0.98  1.48  1.97  2.46  2.95
                                   Coef. (English)  2.84  3.13  3.26  3.30  3.31  3.31
   #3    Device 1        172.47'   6.0" Horiz. WQV Orifice/Grate   C= 0.600
                                   Limited to weir flow at low heads
   #4    Device 3        175.00'   2.0' long  (Profile 17) Broad-Crested Rectangular Weir
                                   Head (feet)  0.49  0.98  1.48  1.97  2.46  2.95
                                   Coef. (English)  2.84  3.13  3.26  3.30  3.31  3.31

Primary OutFlow Max=0.89 cfs @ 7.97 hrs  HW=175.29'   (Free Discharge)
└─1=Culvert  (Passes 0.89 cfs of 8.16 cfs potential flow)
   ├─2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)
   └─3=WQV Orifice/Grate (Passes 0.89 cfs of 1.59 cfs potential flow)
      └─4=Broad-Crested Rectangular Weir(Weir Controls 0.89 cfs @ 1.53 fps)
```

Pond 1EP: Existing Detention Pond Facility



Summary for Subcatchment 1ES: Existing basin

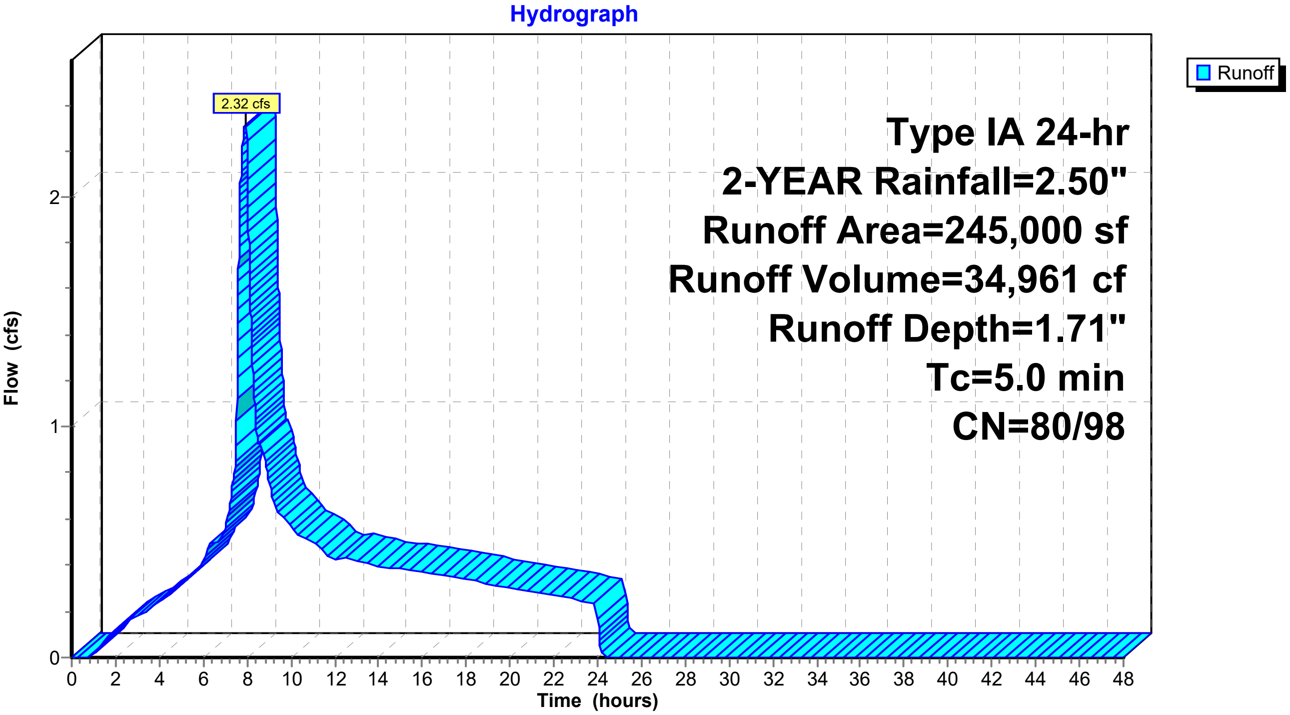
Runoff = 2.32 cfs @ 7.91 hrs, Volume= 34,961 cf, Depth= 1.71"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	146,000	98	Existing Impervious Area
	99,000	80	>75% Grass cover, Good, HSG D
	245,000	91	Weighted Average
	99,000		40.41% Pervious Area
	146,000		59.59% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Pond 1EP: Existing Detention Pond Facility

Inflow Area = 245,000 sf, 59.59% Impervious, Inflow Depth = 1.71" for 2-YEAR event
Inflow = 2.32 cfs @ 7.91 hrs, Volume= 34,961 cf
Outflow = 1.78 cfs @ 8.08 hrs, Volume= 34,961 cf, Atten= 23%, Lag= 10.4 min
Primary = 1.78 cfs @ 8.08 hrs, Volume= 34,961 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 176.01' @ 8.08 hrs Surf.Area= 1,347 sf Storage= 1,150 cf

Plug-Flow detention time= 7.2 min calculated for 34,961 cf (100% of inflow)
Center-of-Mass det. time= 7.1 min (717.0 - 709.9)

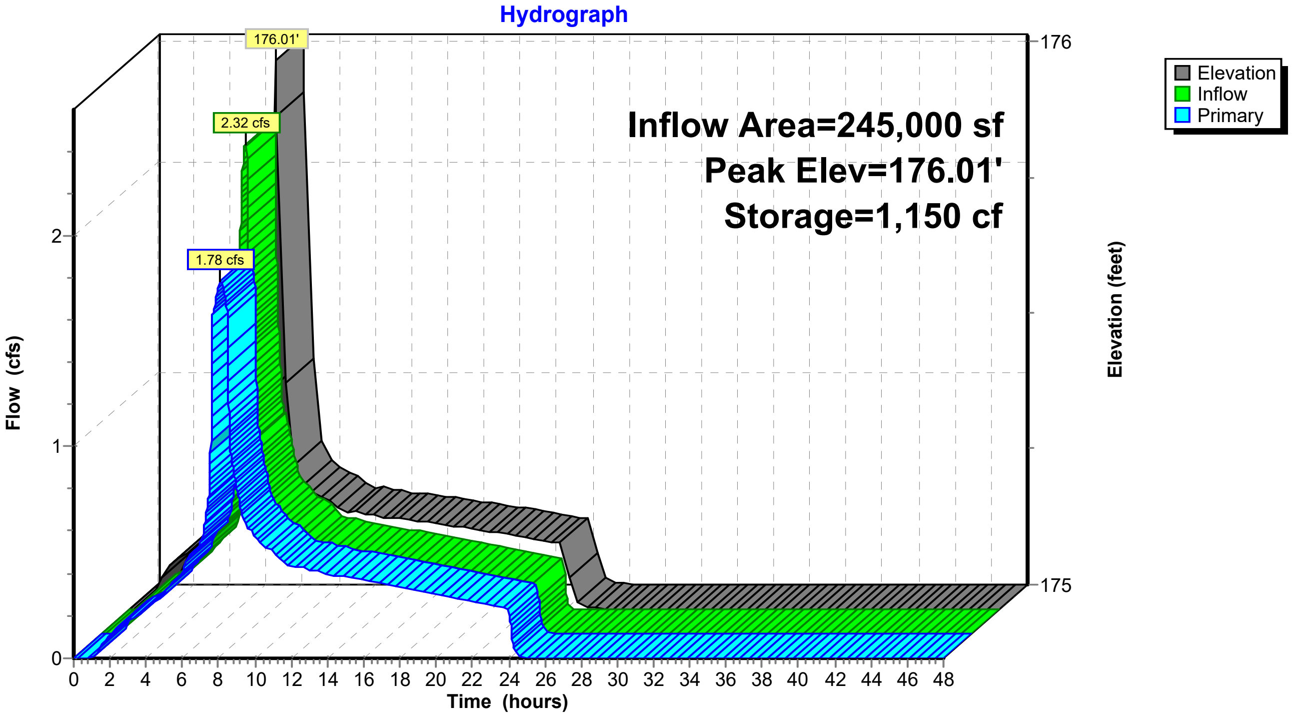
Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	10,377 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	931	0.0	0	0
176.00	1,343	100.0	1,137	1,137
177.00	1,778	100.0	1,561	2,698
178.00	2,281	100.0	2,030	4,727
179.00	2,808	100.0	2,545	7,272
180.00	3,403	100.0	3,106	10,377

Device	Routing	Invert	Outlet Devices
#1	Primary	172.25'	**15.0" Round Culvert** L= 142.8' Ke= 0.500 Inlet / Outlet Invert= 172.25' / 170.72' S= 0.0107 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	177.00'	**2.0' long (Profile 17) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#3	Device 1	172.47'	**6.0" Horiz. WQV Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 3	175.00'	**2.0' long (Profile 17) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31

Primary OutFlow Max=1.78 cfs @ 8.08 hrs HW=176.01' (Free Discharge)
- **1=Culvert** (Passes 1.78 cfs of 9.01 cfs potential flow)
  - **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  - **3=WQV Orifice/Grate** (Orifice Controls 1.78 cfs @ 9.06 fps)
    - **4=Broad-Crested Rectangular Weir** (Passes 1.78 cfs of 6.37 cfs potential flow)

Pond 1EP: Existing Detention Pond Facility



Summary for Subcatchment 1ES: Existing basin

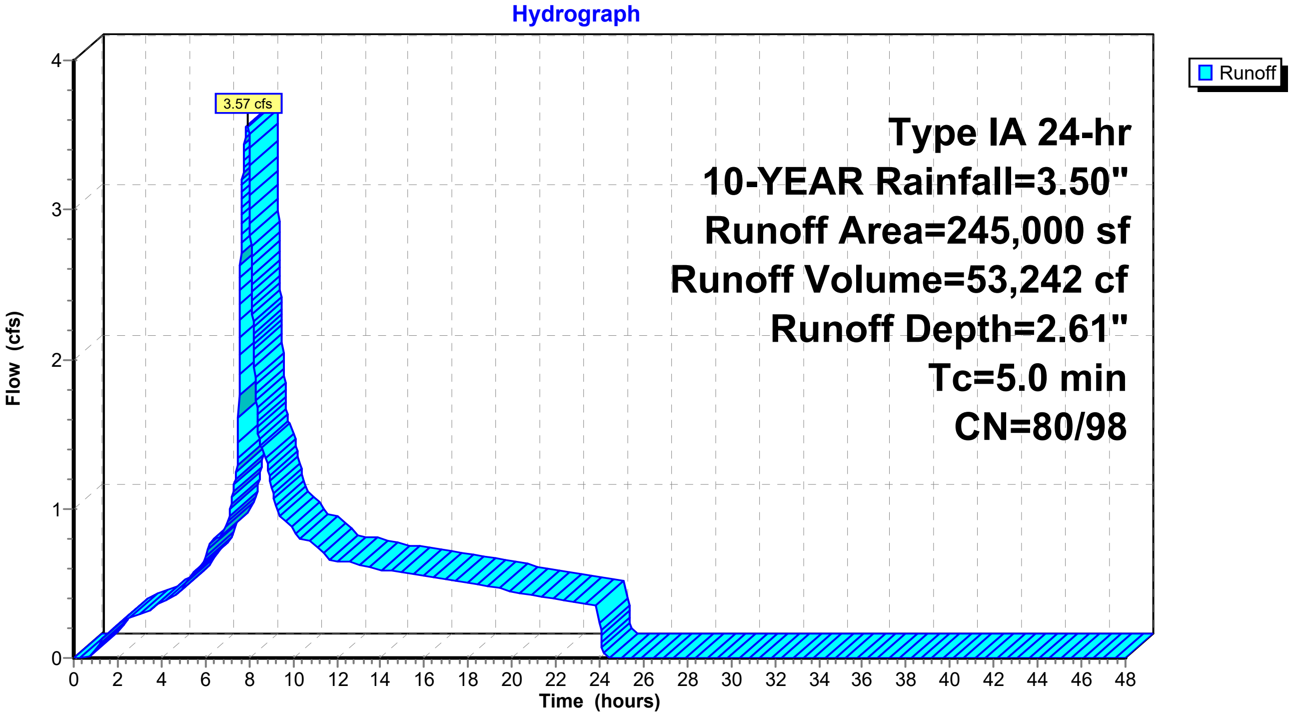
Runoff = 3.57 cfs @ 7.90 hrs, Volume= 53,242 cf, Depth= 2.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	146,000	98	Existing Impervious Area
	99,000	80	>75% Grass cover, Good, HSG D
	245,000	91	Weighted Average
	99,000		40.41% Pervious Area
	146,000		59.59% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Pond 1EP: Existing Detention Pond Facility

Inflow Area = 245,000 sf, 59.59% Impervious, Inflow Depth = 2.61" for 10-YEAR event
Inflow = 3.57 cfs @ 7.90 hrs, Volume= 53,242 cf
Outflow = 2.42 cfs @ 8.14 hrs, Volume= 53,242 cf, Atten= 32%, Lag= 13.9 min
Primary = 2.42 cfs @ 8.14 hrs, Volume= 53,242 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 177.16' @ 8.14 hrs Surf.Area= 1,860 sf Storage= 2,995 cf

Plug-Flow detention time= 8.6 min calculated for 53,231 cf (100% of inflow)
Center-of-Mass det. time= 8.6 min (709.1 - 700.4)

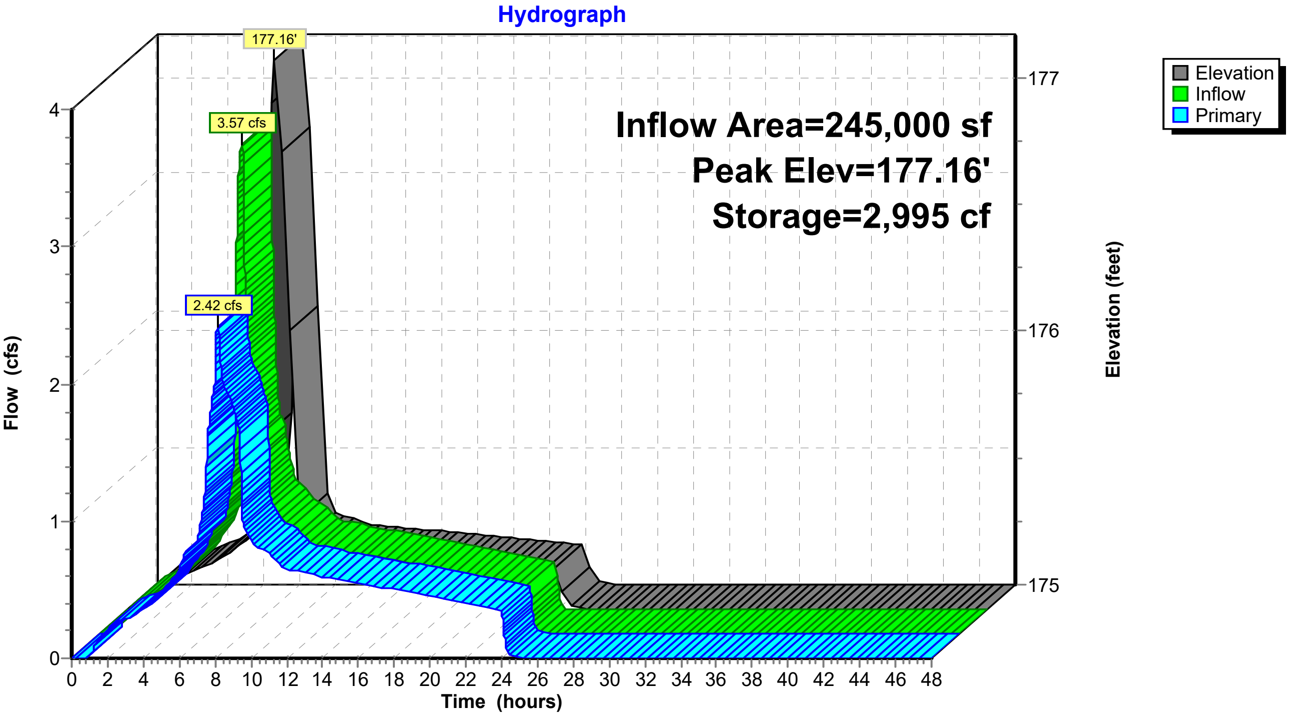
Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	10,377 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	931	0.0	0	0
176.00	1,343	100.0	1,137	1,137
177.00	1,778	100.0	1,561	2,698
178.00	2,281	100.0	2,030	4,727
179.00	2,808	100.0	2,545	7,272
180.00	3,403	100.0	3,106	10,377

Device	Routing	Invert	Outlet Devices
#1	Primary	172.25'	**15.0" Round Culvert** L= 142.8' Ke= 0.500 Inlet / Outlet Invert= 172.25' / 170.72' S= 0.0107 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	177.00'	**2.0' long (Profile 17) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#3	Device 1	172.47'	**6.0" Horiz. WQV Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 3	175.00'	**2.0' long (Profile 17) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31

Primary OutFlow Max=2.42 cfs @ 8.14 hrs HW=177.16' (Free Discharge)
- **1=Culvert** (Passes 2.42 cfs of 10.21 cfs potential flow)
  - **2=Broad-Crested Rectangular Weir** (Weir Controls 0.37 cfs @ 1.15 fps)
  - **3=WQV Orifice/Grate** (Orifice Controls 2.05 cfs @ 10.43 fps)
    - **4=Broad-Crested Rectangular Weir** (Passes 2.05 cfs of 21.03 cfs potential flow)

Pond 1EP: Existing Detention Pond Facility



Summary for Subcatchment 1ES: Existing basin

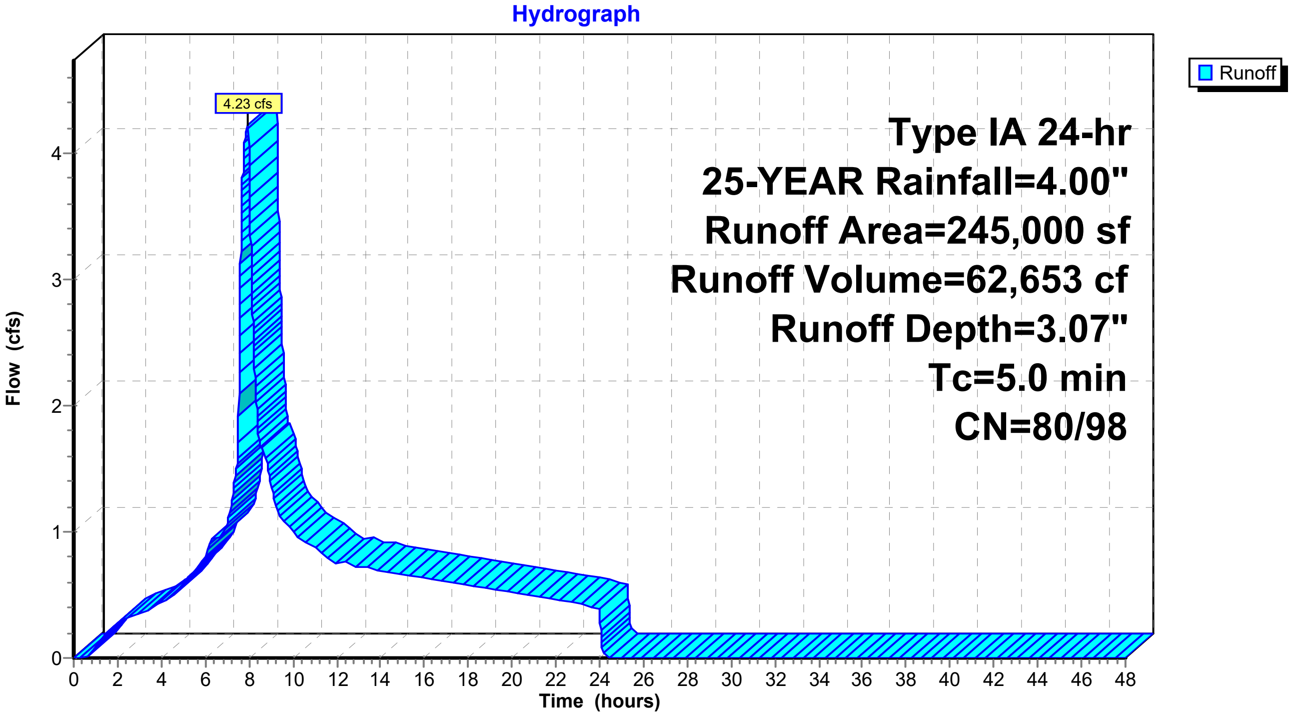
Runoff = 4.23 cfs @ 7.90 hrs, Volume= 62,653 cf, Depth= 3.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	146,000	98	Existing Impervious Area
	99,000	80	>75% Grass cover, Good, HSG D
	245,000	91	Weighted Average
	99,000		40.41% Pervious Area
	146,000		59.59% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Pond 1EP: Existing Detention Pond Facility

Inflow Area = 245,000 sf, 59.59% Impervious, Inflow Depth = 3.07" for 25-YEAR event
Inflow = 4.23 cfs @ 7.90 hrs, Volume= 62,653 cf
Outflow = 3.49 cfs @ 8.05 hrs, Volume= 62,653 cf, Atten= 17%, Lag= 9.2 min
Primary = 3.49 cfs @ 8.05 hrs, Volume= 62,653 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 177.39' @ 8.05 hrs Surf.Area= 1,975 sf Storage= 3,434 cf

Plug-Flow detention time= 8.9 min calculated for 62,653 cf (100% of inflow)
Center-of-Mass det. time= 8.7 min (705.3 - 696.6)

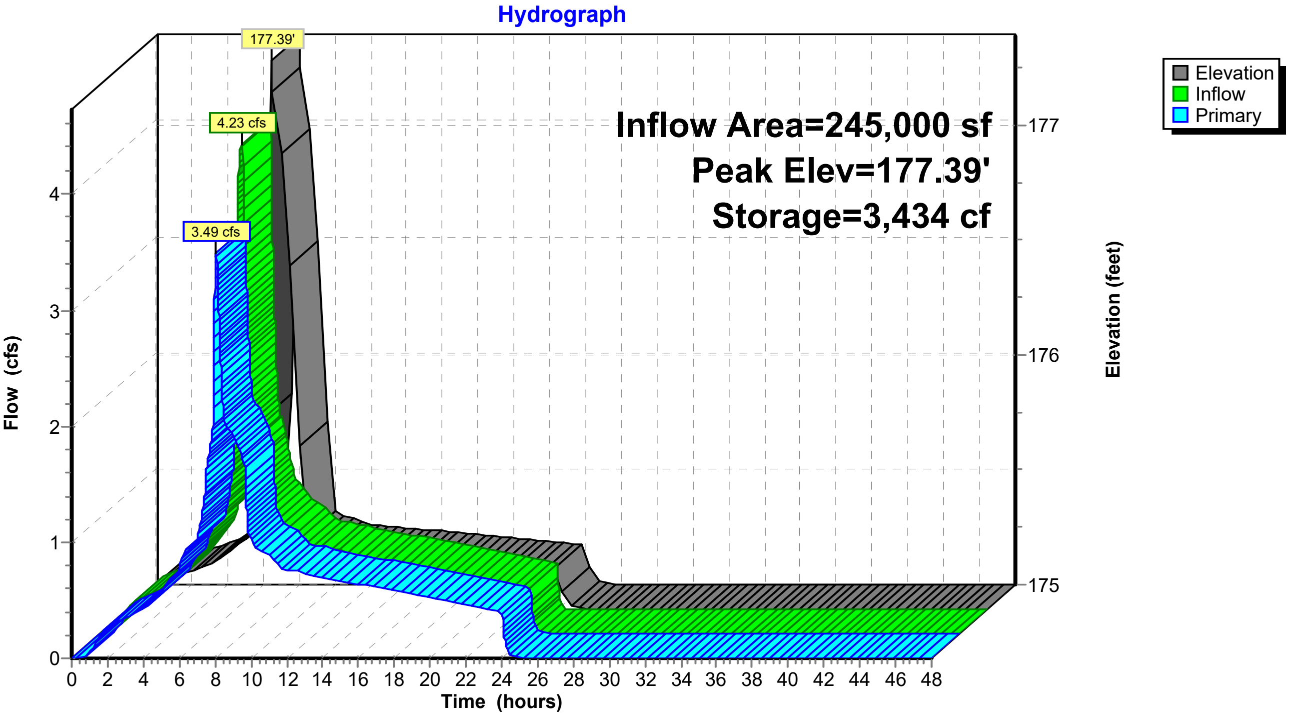
Volume	Invert	Avail.Storage	Storage Description
#1	175.00'	10,377 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

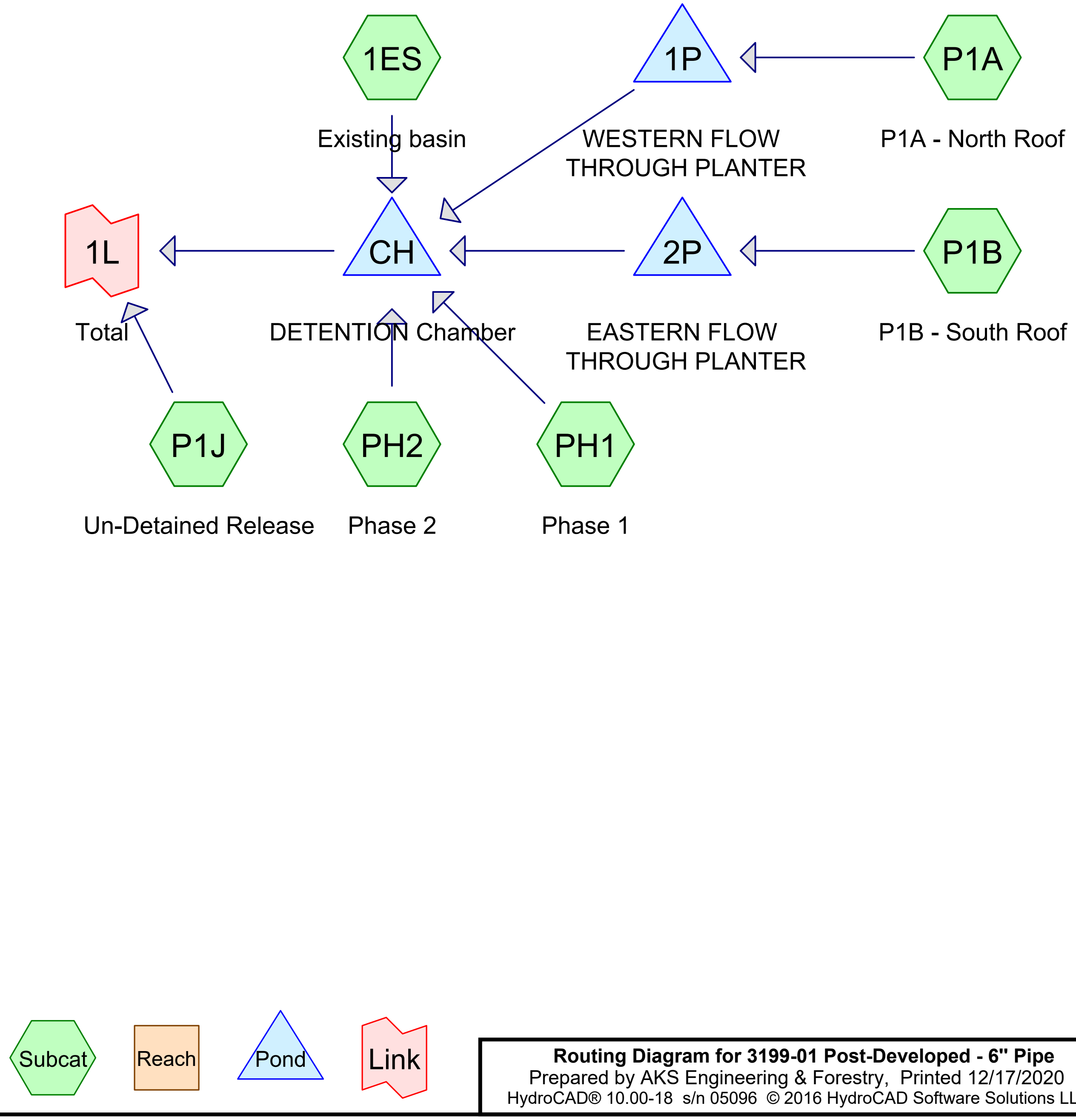
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
175.00	931	0.0	0	0
176.00	1,343	100.0	1,137	1,137
177.00	1,778	100.0	1,561	2,698
178.00	2,281	100.0	2,030	4,727
179.00	2,808	100.0	2,545	7,272
180.00	3,403	100.0	3,106	10,377

Device	Routing	Invert	Outlet Devices
#1	Primary	172.25'	**15.0" Round Culvert** L= 142.8' Ke= 0.500 Inlet / Outlet Invert= 172.25' / 170.72' S= 0.0107 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	177.00'	**2.0' long (Profile 17) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31
#3	Device 1	172.47'	**6.0" Horiz. WQV Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 3	175.00'	**2.0' long (Profile 17) Broad-Crested Rectangular Weir** Head (feet) 0.49 0.98 1.48 1.97 2.46 2.95 Coef. (English) 2.84 3.13 3.26 3.30 3.31 3.31

Primary OutFlow Max=3.49 cfs @ 8.05 hrs HW=177.39' (Free Discharge)
└─**1=Culvert** (Passes 3.49 cfs of 10.43 cfs potential flow)
  ├─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.39 cfs @ 1.78 fps)
  └─**3=WQV Orifice/Grate** (Orifice Controls 2.10 cfs @ 10.68 fps)
    └─**4=Broad-Crested Rectangular Weir** (Passes 2.10 cfs of 24.48 cfs potential flow)

Pond 1EP: Existing Detention Pond Facility





Routing Diagram for 3199-01 Post-Developed - 6" Pipe
Prepared by AKS Engineering & Forestry, Printed 12/17/2020
HydroCAD® 10.00-18 s/n 05096 © 2016 HydroCAD Software Solutions LLC

Summary for Subcatchment 1ES: Existing basin

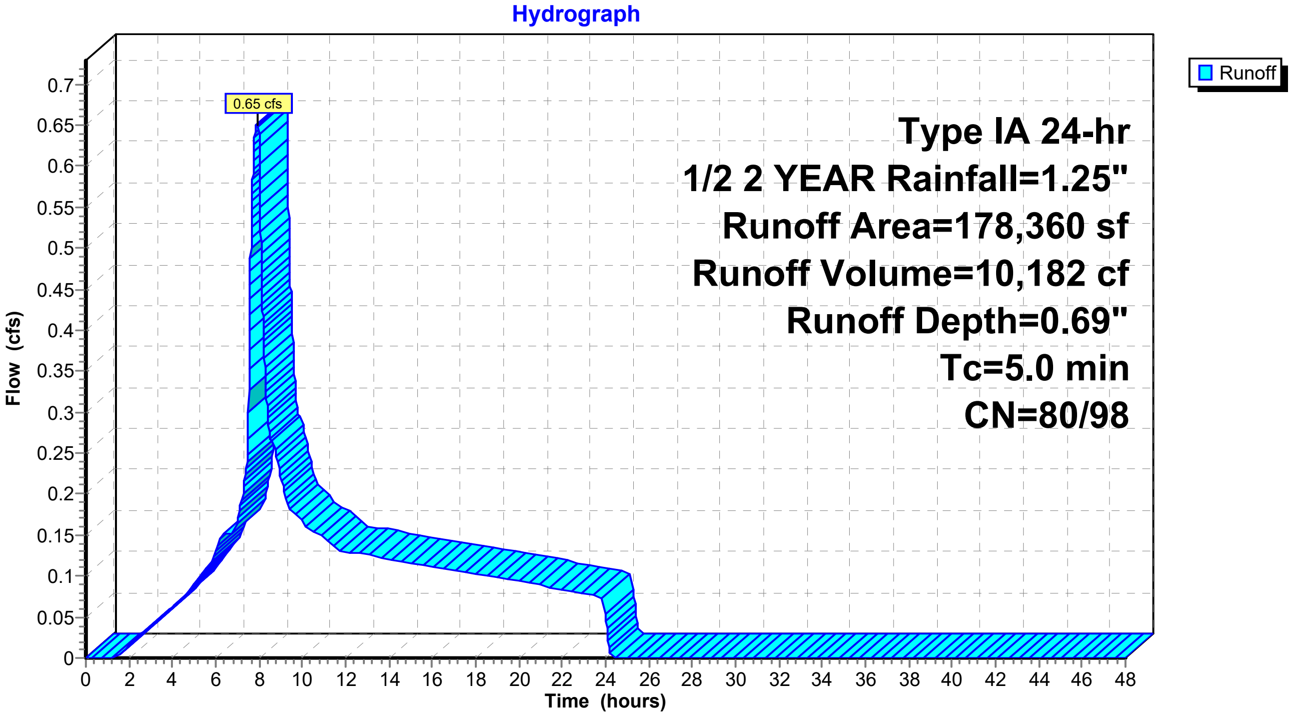
Runoff = 0.65 cfs @ 7.89 hrs, Volume= 10,182 cf, Depth= 0.69"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	106,000	98	Existing Impervious Area
	72,360	80	>75% Grass cover, Good, HSG D
	178,360	91	Weighted Average
	72,360		40.57% Pervious Area
	106,000		59.43% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Subcatchment P1A: P1A - North Roof

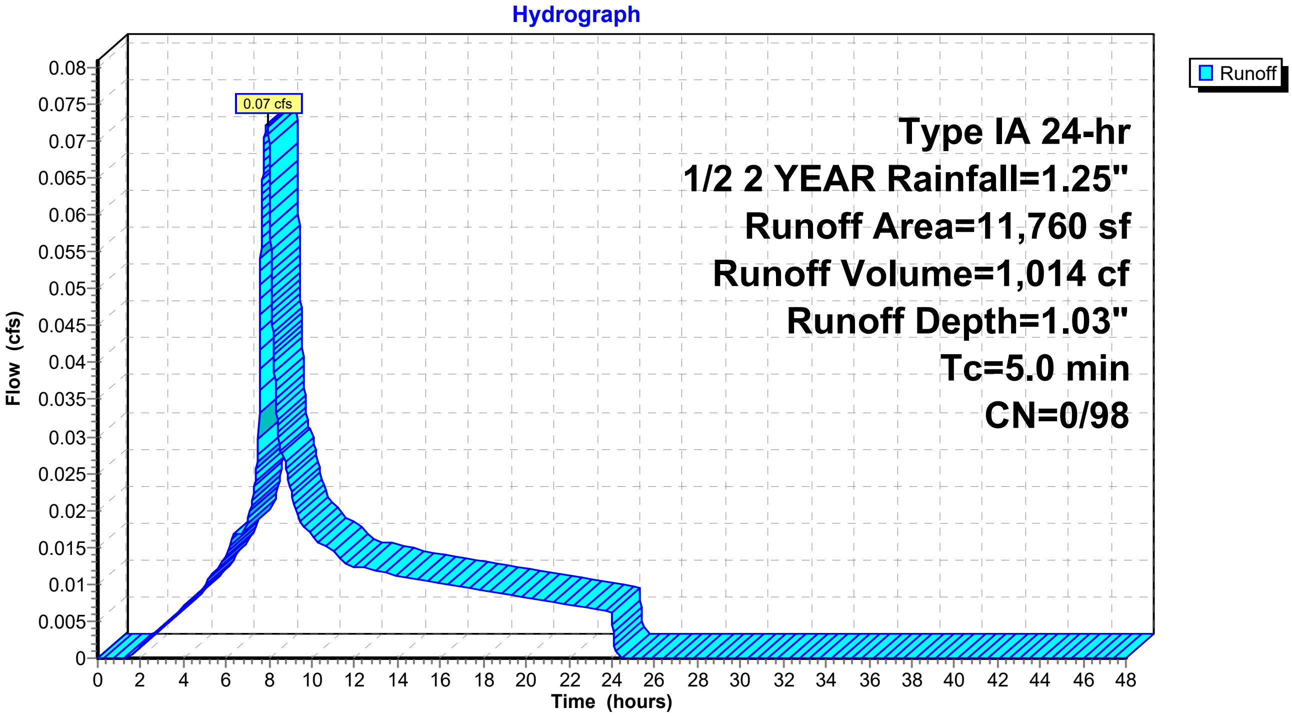
Runoff = 0.07 cfs @ 7.89 hrs, Volume= 1,014 cf, Depth= 1.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	11,760	98	Roof
	11,760		100.00% Impervious Area

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

Subcatchment P1A: P1A - North Roof



Summary for Subcatchment P1B: P1B - South Roof

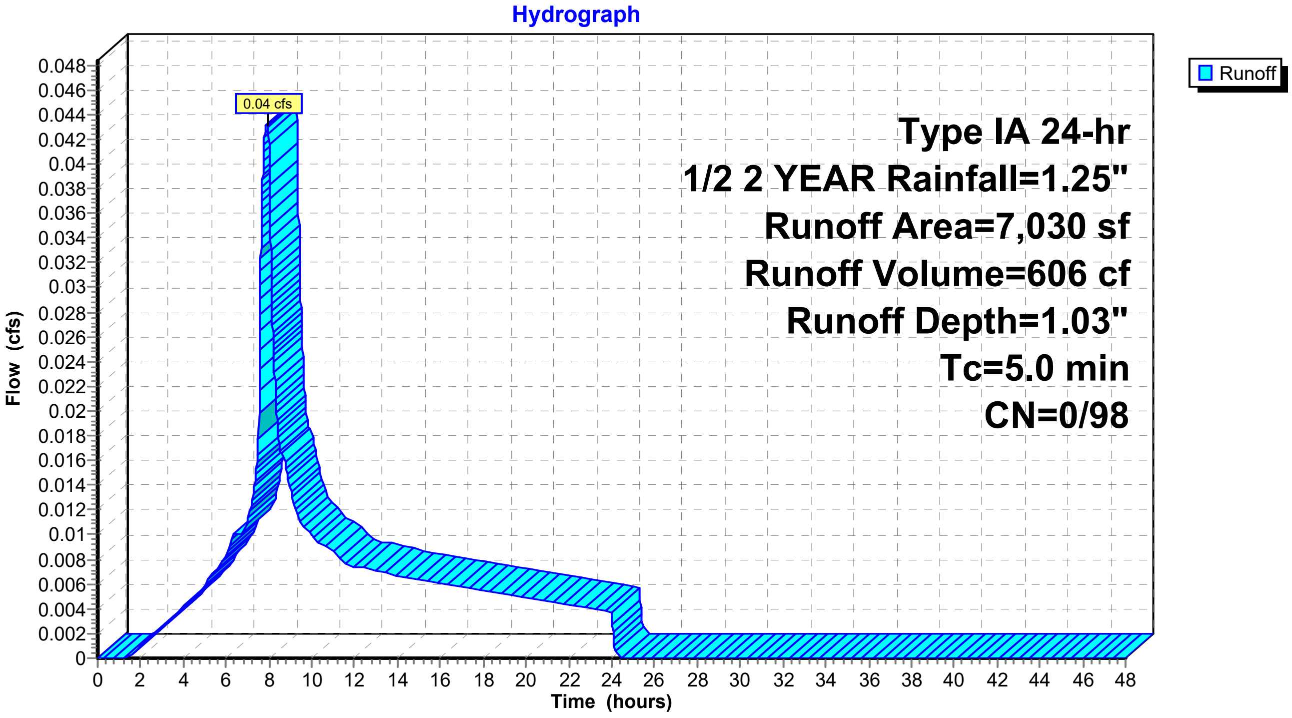
Runoff = 0.04 cfs @ 7.89 hrs, Volume= 606 cf, Depth= 1.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	7,030	98	Roof
	7,030		100.00% Impervious Area

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

Subcatchment P1B: P1B - South Roof



Summary for Subcatchment P1J: Un-Detained Release

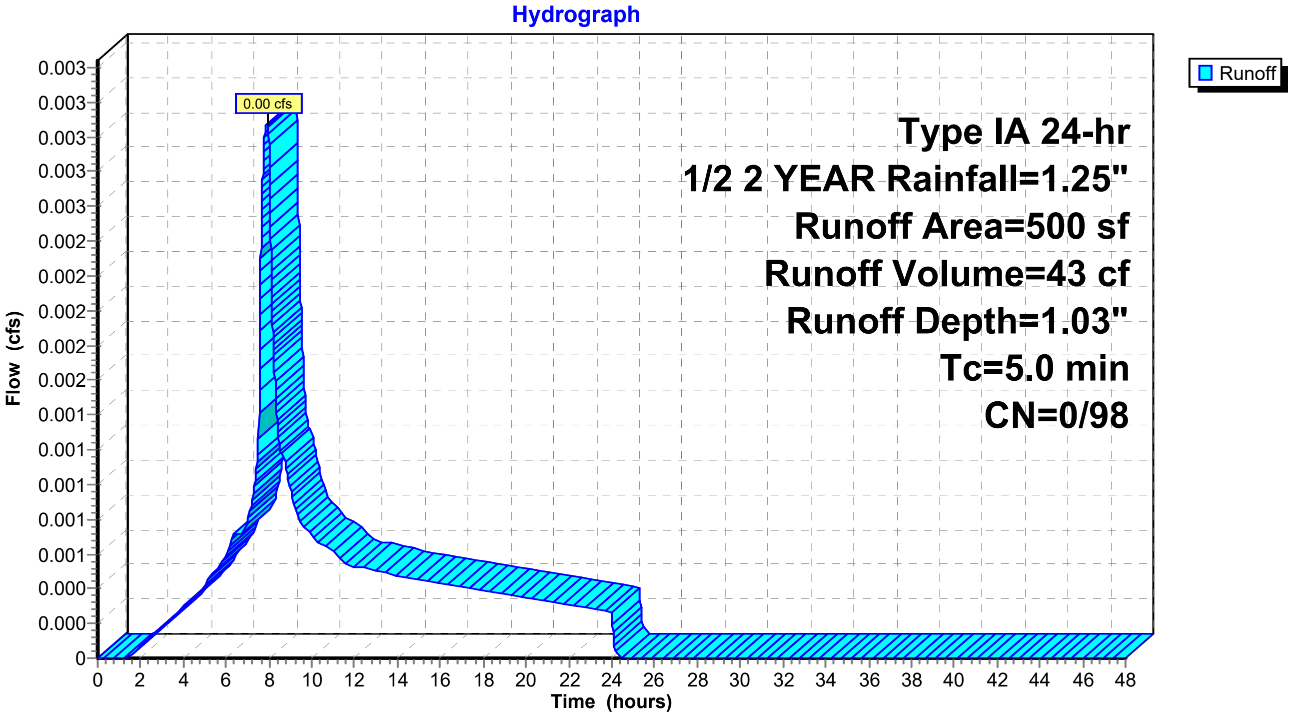
Runoff = 0.00 cfs @ 7.89 hrs, Volume= 43 cf, Depth= 1.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	500	98	Impervious
	500		100.00% Impervious Area

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

Subcatchment P1J: Un-Detained Release



Summary for Subcatchment PH1: Phase 1

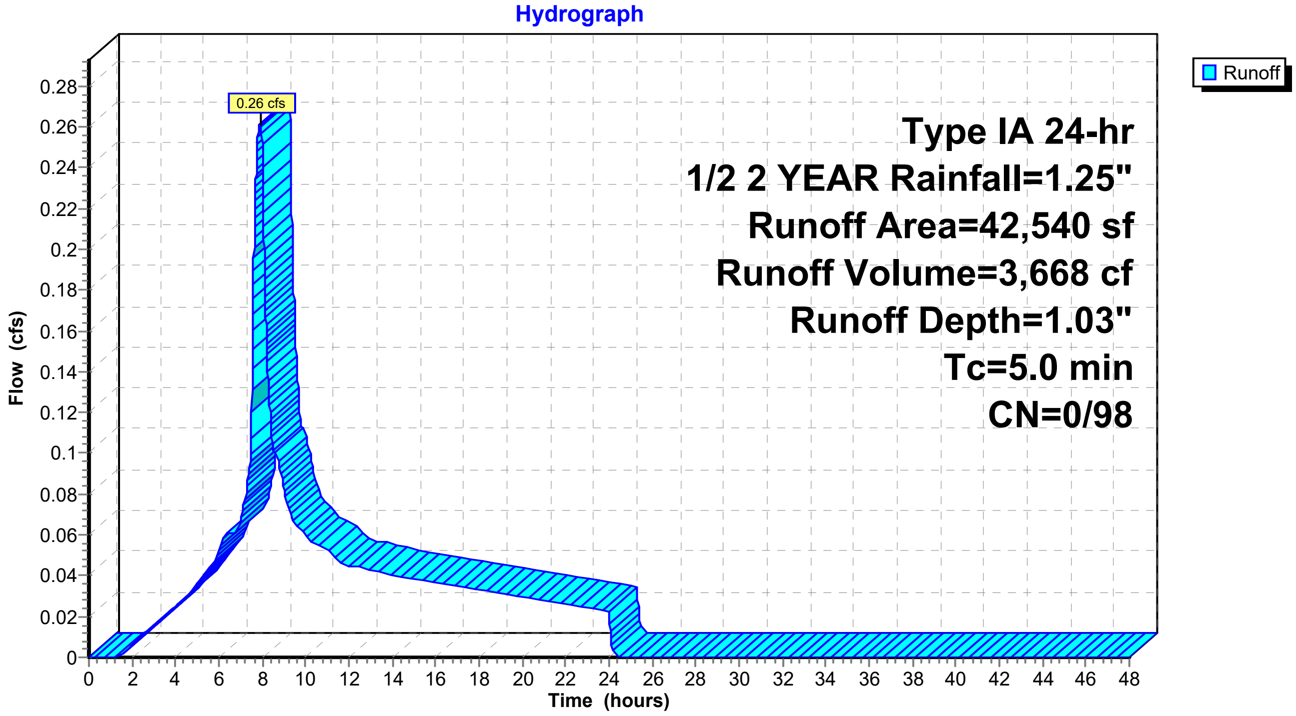
Runoff = 0.26 cfs @ 7.89 hrs, Volume= 3,668 cf, Depth= 1.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	1,890	98	P1C - Impervious
*	820	98	P1D - Impervious
*	14,360	98	P1E - Impervious
*	16,710	98	P1F - Impervious
*	4,970	98	P1G - Impervious
*	3,790	98	P1H - Impervious
	42,540	98	Weighted Average
	42,540		100.00% Impervious Area

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

Subcatchment PH1: Phase 1



Summary for Subcatchment PH2: Phase 2

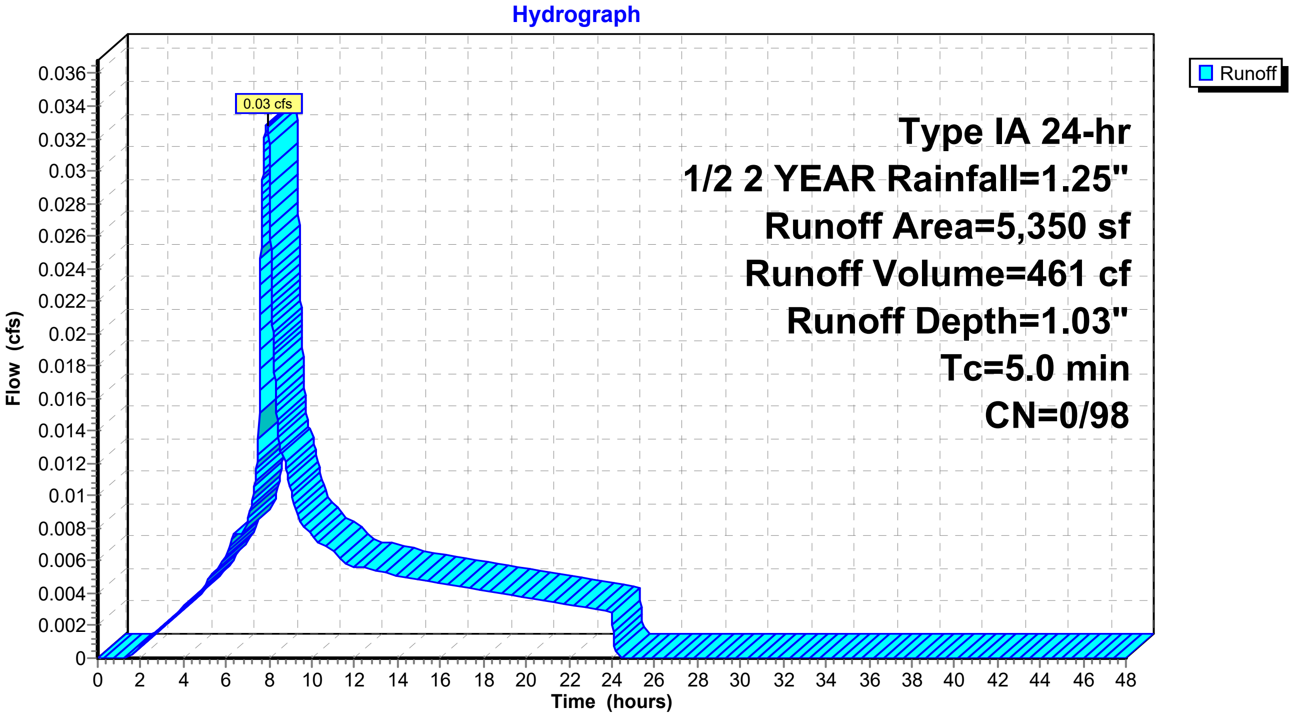
Runoff = 0.03 cfs @ 7.89 hrs, Volume= 461 cf, Depth= 1.03"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 YEAR Rainfall=1.25"

	Area (sf)	CN	Description
*	5,350	98	P2 - Impervious
	5,350		100.00% Impervious Area

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

Subcatchment PH2: Phase 2



Summary for Pond 1P: WESTERN FLOW THROUGH PLANTER

Inflow Area = 11,760 sf,100.00% Impervious, Inflow Depth = 1.03" for 1/2 2 YEAR event
Inflow = 0.07 cfs @ 7.89 hrs, Volume= 1,014 cf
Outflow = 0.04 cfs @ 7.76 hrs, Volume= 1,014 cf, Atten= 44%, Lag= 0.0 min
Primary = 0.04 cfs @ 7.76 hrs, Volume= 1,014 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.29' @ 8.23 hrs Surf.Area= 875 sf Storage= 58 cf
Flood Elev= 181.65' Surf.Area= 875 sf Storage= 726 cf

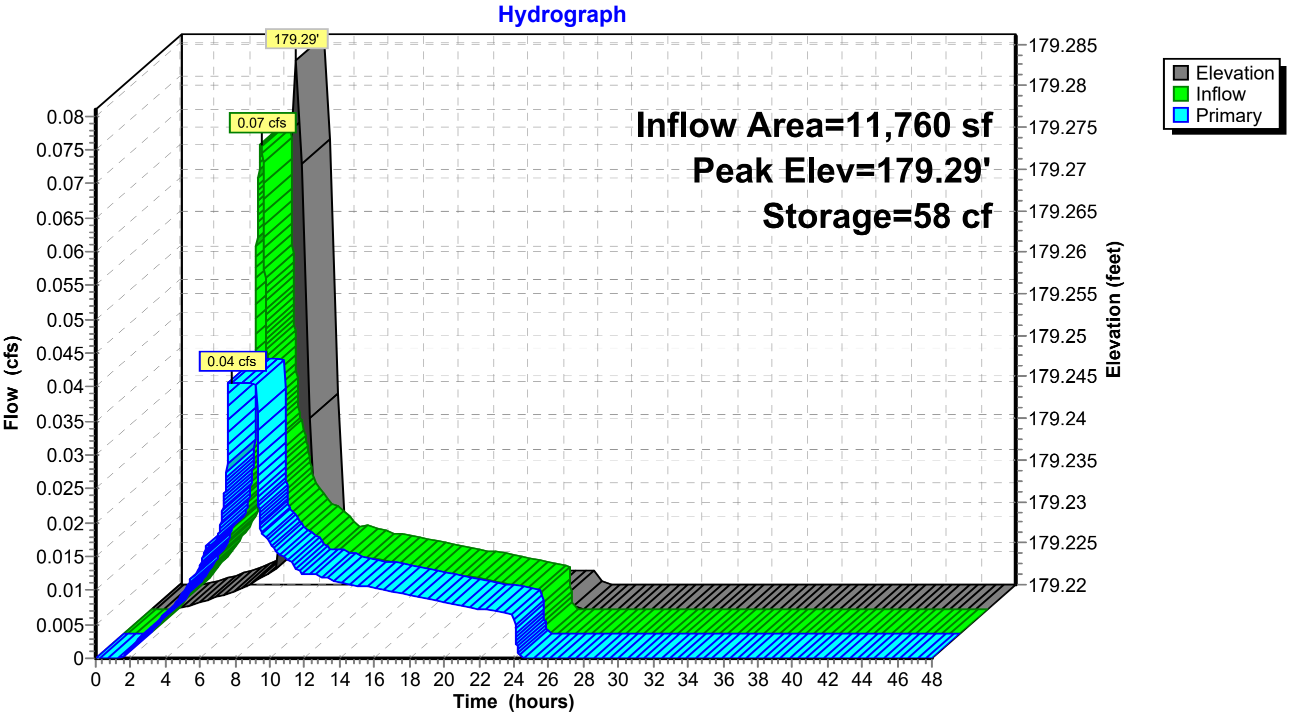
Plug-Flow detention time= 6.4 min calculated for 1,014 cf (100% of inflow)
Center-of-Mass det. time= 6.4 min (707.2 - 700.8)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	726 cf	**8.25'W x 106.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 7.76 hrs HW=179.24' TW=169.40' (Dynamic Tailwater)
1=Culvert (Passes 0.04 cfs of 1.43 cfs potential flow)
- **2=Exfiltration** (Exfiltration Controls 0.04 cfs)
- **3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: WESTERN FLOW THROUGH PLANTER



Summary for Pond 2P: EASTERN FLOW THROUGH PLANTER

Inflow Area = 7,030 sf,100.00% Impervious, Inflow Depth = 1.03" for 1/2 2 YEAR event
Inflow = 0.04 cfs @ 7.89 hrs, Volume= 606 cf
Outflow = 0.02 cfs @ 7.67 hrs, Volume= 606 cf, Atten= 49%, Lag= 0.0 min
Primary = 0.02 cfs @ 7.67 hrs, Volume= 606 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.30' @ 8.29 hrs Surf.Area= 474 sf Storage= 40 cf
Flood Elev= 181.00' Surf.Area= 474 sf Storage= 394 cf

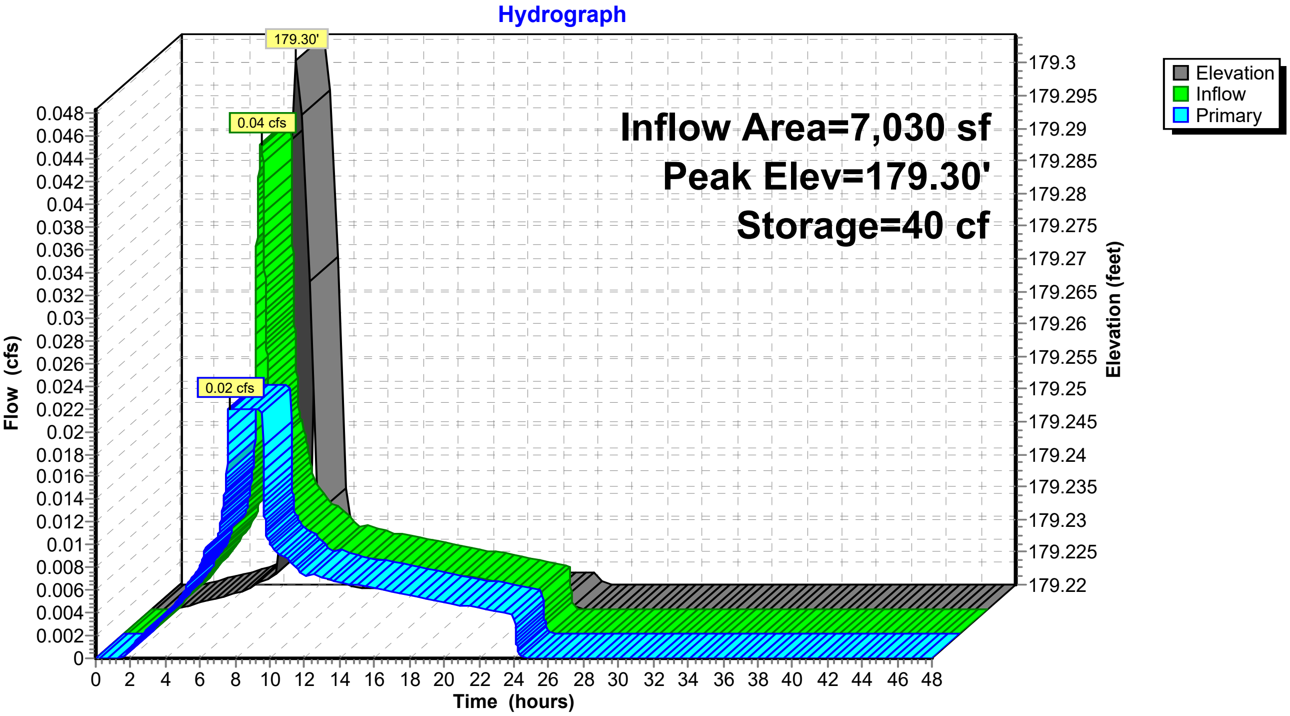
Plug-Flow detention time= 7.8 min calculated for 606 cf (100% of inflow)
Center-of-Mass det. time= 7.8 min (708.6 - 700.8)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	394 cf	**5.33'W x 89.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.02 cfs @ 7.67 hrs HW=179.24' TW=169.24' (Dynamic Tailwater)
1=Culvert (Passes 0.02 cfs of 1.42 cfs potential flow)
  2=Exfiltration (Exfiltration Controls 0.02 cfs)
  3=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: EASTERN FLOW THROUGH PLANTER



Summary for Pond CH: DETENTION Chamber

```
Inflow Area =          245,040 sf,  70.47% Impervious,  Inflow Depth =   0.78"    for  1/2 2 YEAR event
Inflow      =        1.01 cfs @    7.89 hrs,  Volume=           15,931 cf
Outflow     =        0.56 cfs @    8.28 hrs,  Volume=           15,931 cf,  Atten= 45%,  Lag= 23.3 min
Primary     =        0.56 cfs @    8.28 hrs,  Volume=           15,931 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 169.94' @ 8.28 hrs   Surf.Area= 0.056 ac   Storage= 0.022 af
Flood Elev= 175.85'   Surf.Area= 0.054 ac   Storage= 0.216 af

Plug-Flow detention time= 5.6 min calculated for 15,931 cf (100% of inflow)
Center-of-Mass det. time= 5.6 min ( 725.1 - 719.5 )

Volume      Invert    Avail.Storage   Storage Description
   #1A     169.10'         0.076 af   20.33'W x 115.79'L x 6.75'H Field A
                                      0.365 af Overall - 0.135 af Embedded = 0.230 af  x 33.0% Voids
   #2A     169.85'         0.135 af   ADS_StormTech MC-4500 +Cap x 54  Inside #1
                                      Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
                                      Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
                                      2 Rows of 27 Chambers
                                      Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
   #3      168.19'         0.005 af   15.0"  Round Pipe Storage
                                      L= 184.7'  S= 0.0050 '/'
                           0.216 af   Total Available Storage

   Storage Group A created with Chamber Wizard

Device   Routing          Invert   Outlet Devices
   #1    Primary         168.00'   15.0"  Round Outlet Pipe  L= 40.2'   Ke= 0.500
                                   Inlet / Outlet Invert= 168.00' / 167.79'   S= 0.0052 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 1.23 sf
   #2    Device 1        168.00'   4.0" Vert. 1/2 2 Year Overflow  C= 0.600
   #3    Device 1        171.90'   5.5" Horiz. 2 Year Overflow  C= 0.600
                                   Limited to weir flow at low heads
   #4    Device 1        174.50'   15.0" Horiz. Overflow   C= 0.600   Limited to weir flow at low heads

Primary OutFlow Max=0.56 cfs @ 8.28 hrs  HW=169.94'  TW=0.00'   (Dynamic Tailwater)
└─1=Outlet Pipe  (Passes 0.56 cfs of 5.97 cfs potential flow)
    ├─2=1/2 2 Year Overflow (Orifice Controls 0.56 cfs @ 6.41 fps)
    ├─3=2 Year Overflow ( Controls 0.00 cfs)
    └─4=Overflow  ( Controls 0.00 cfs)
```

Pond CH: DETENTION Chamber - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf

100.0" Wide + 20.0" Spacing = 120.0" C-C Row Spacing

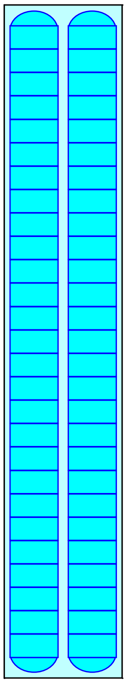
27 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 113.79' Row Length +12.0" End Stone x 2 = 115.79' Base Length
2 Rows x 100.0" Wide + 20.0" Spacing x 1 + 12.0" Side Stone x 2 = 20.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

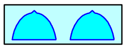
54 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 2 Rows = 5,893.3 cf Chamber Storage

15,892.4 cf Field - 5,893.3 cf Chambers = 9,999.1 cf Stone x 33.0% Voids = 3,299.7 cf Stone Storage

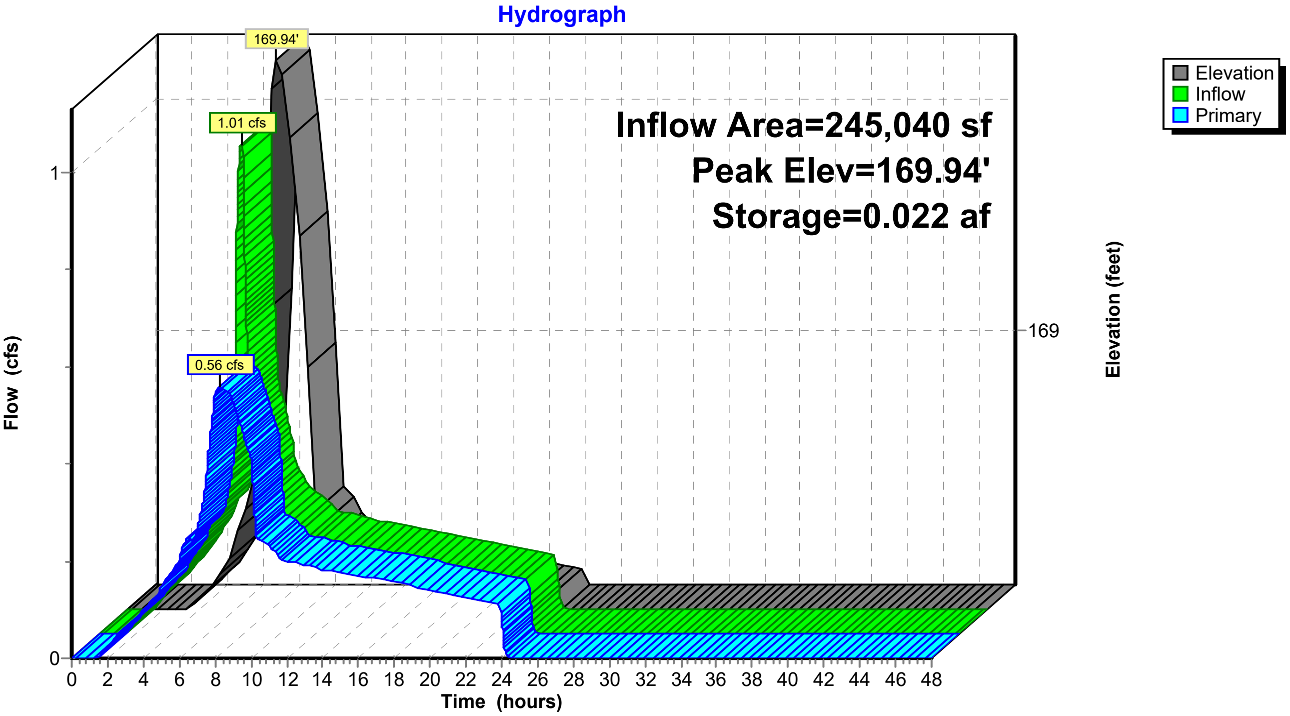
Chamber Storage + Stone Storage = 9,193.0 cf = 0.211 af
Overall Storage Efficiency = 57.8%
Overall System Size = 115.79' x 20.33' x 6.75'

54 Chambers
588.6 cy Field
370.3 cy Stone





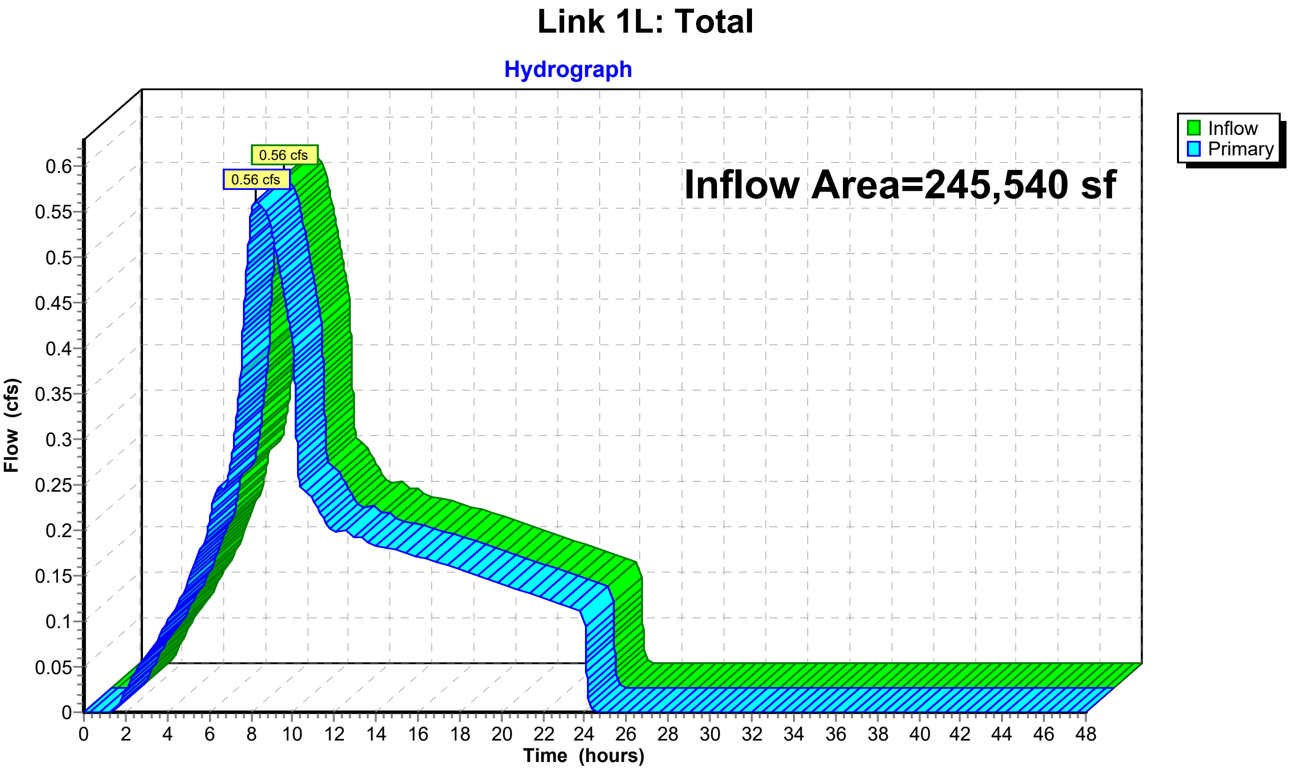
Pond CH: DETENTION Chamber



Summary for Link 1L: Total

Inflow Area = 245,540 sf, 70.53% Impervious, Inflow Depth = 0.78" for 1/2 2 YEAR event
Inflow = 0.56 cfs @ 8.27 hrs, Volume= 15,974 cf
Primary = 0.56 cfs @ 8.27 hrs, Volume= 15,974 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Summary for Subcatchment 1ES: Existing basin

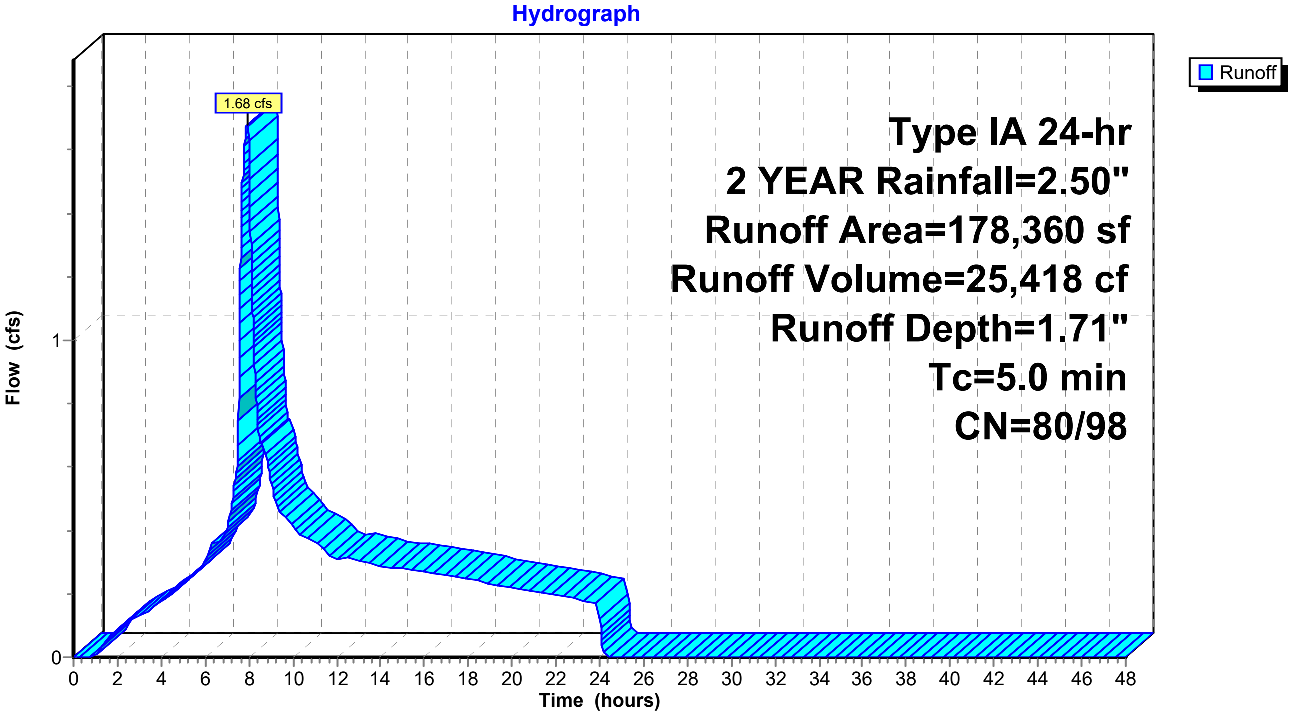
Runoff = 1.68 cfs @ 7.91 hrs, Volume= 25,418 cf, Depth= 1.71"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	106,000	98	Existing Impervious Area
	72,360	80	>75% Grass cover, Good, HSG D
	178,360	91	Weighted Average
	72,360		40.57% Pervious Area
	106,000		59.43% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Subcatchment P1A: P1A - North Roof

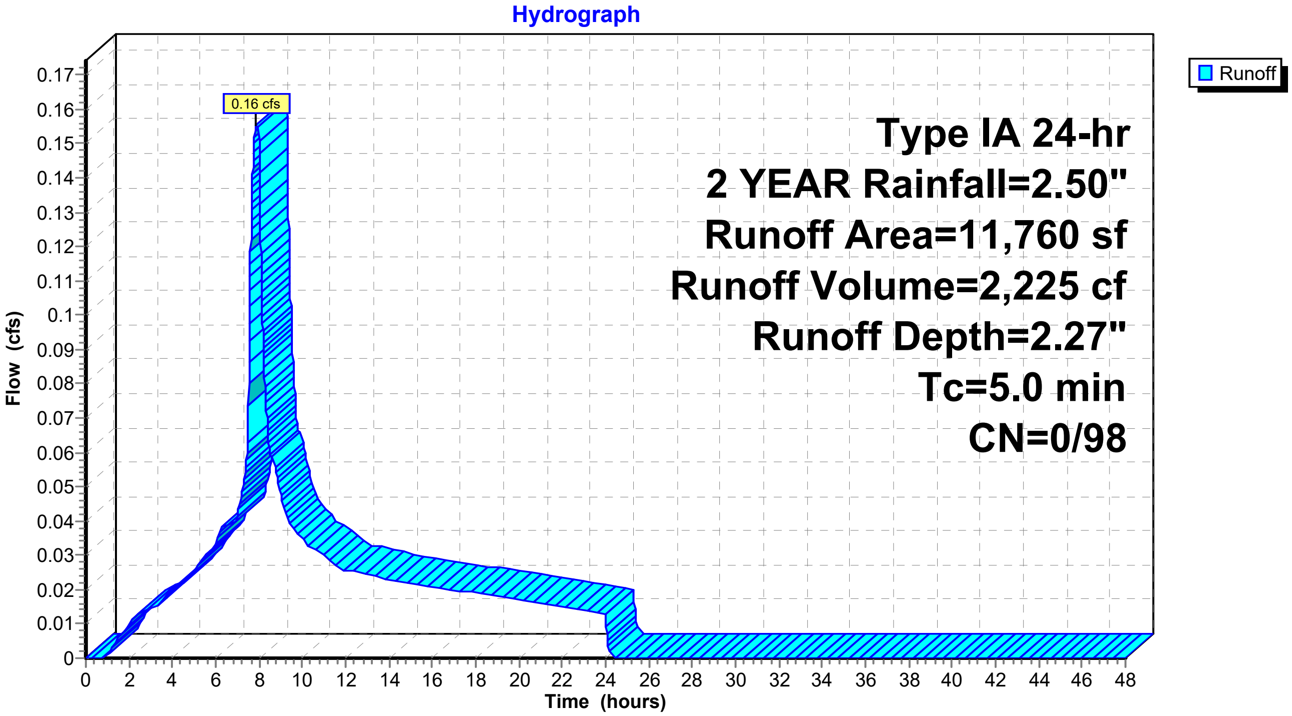
Runoff = 0.16 cfs @ 7.88 hrs, Volume= 2,225 cf, Depth= 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	11,760	98	Roof
	11,760		100.00% Impervious Area

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

Subcatchment P1A: P1A - North Roof



Summary for Subcatchment P1B: P1B - South Roof

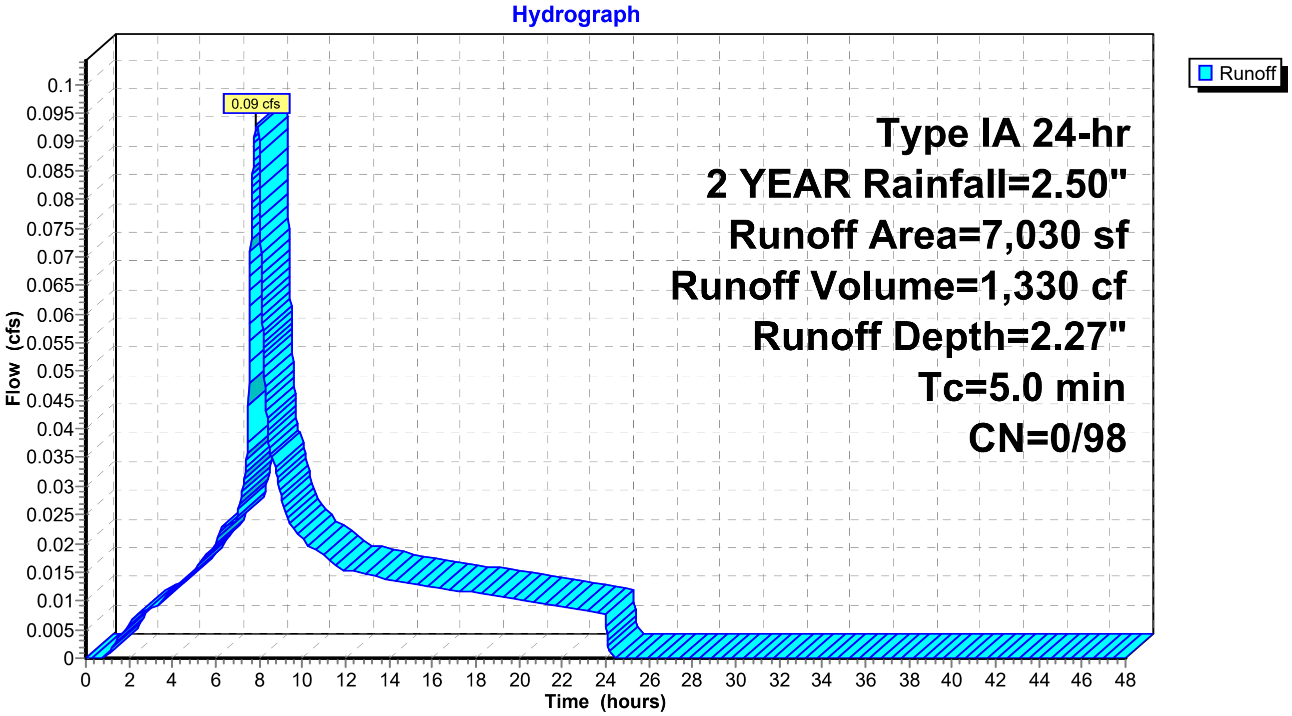
Runoff = 0.09 cfs @ 7.88 hrs, Volume= 1,330 cf, Depth= 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	7,030	98	Roof
	7,030		100.00% Impervious Area

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

Subcatchment P1B: P1B - South Roof



Summary for Subcatchment P1J: Un-Detained Release

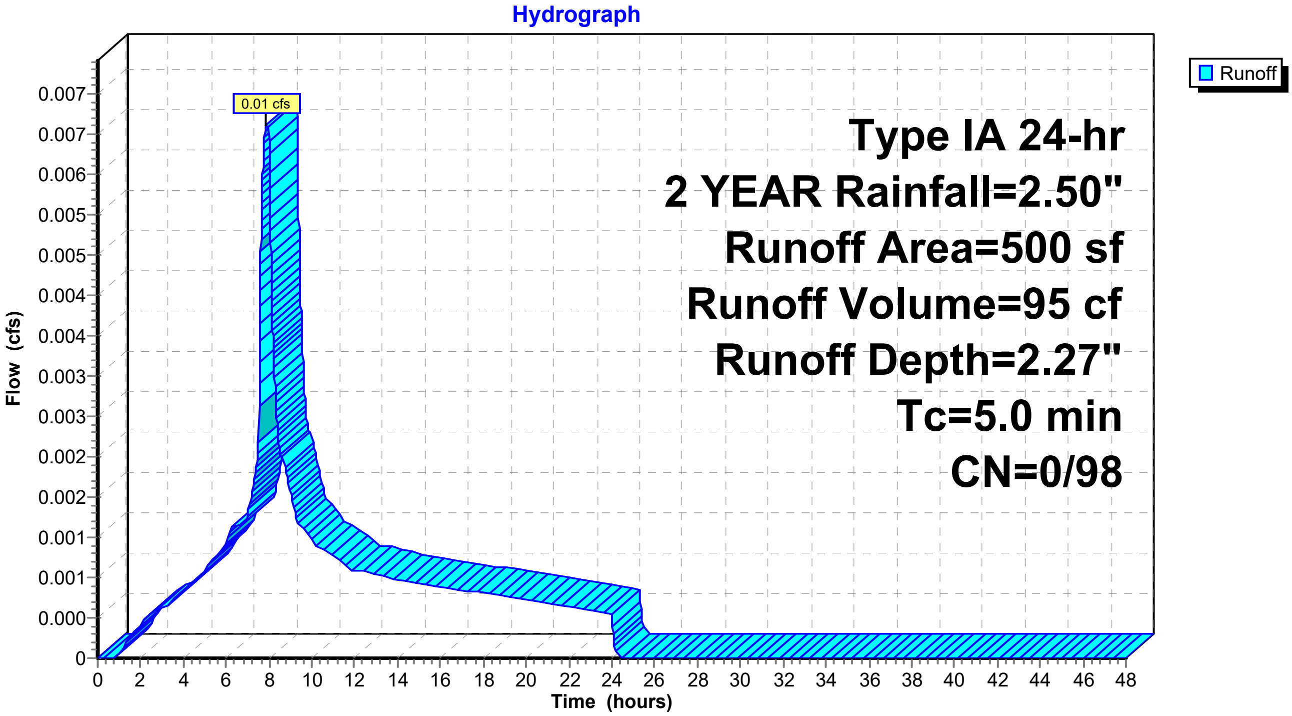
Runoff = 0.01 cfs @ 7.88 hrs, Volume= 95 cf, Depth= 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	500	98	Impervious
	500		100.00% Impervious Area

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

Subcatchment P1J: Un-Detained Release



Summary for Subcatchment PH1: Phase 1

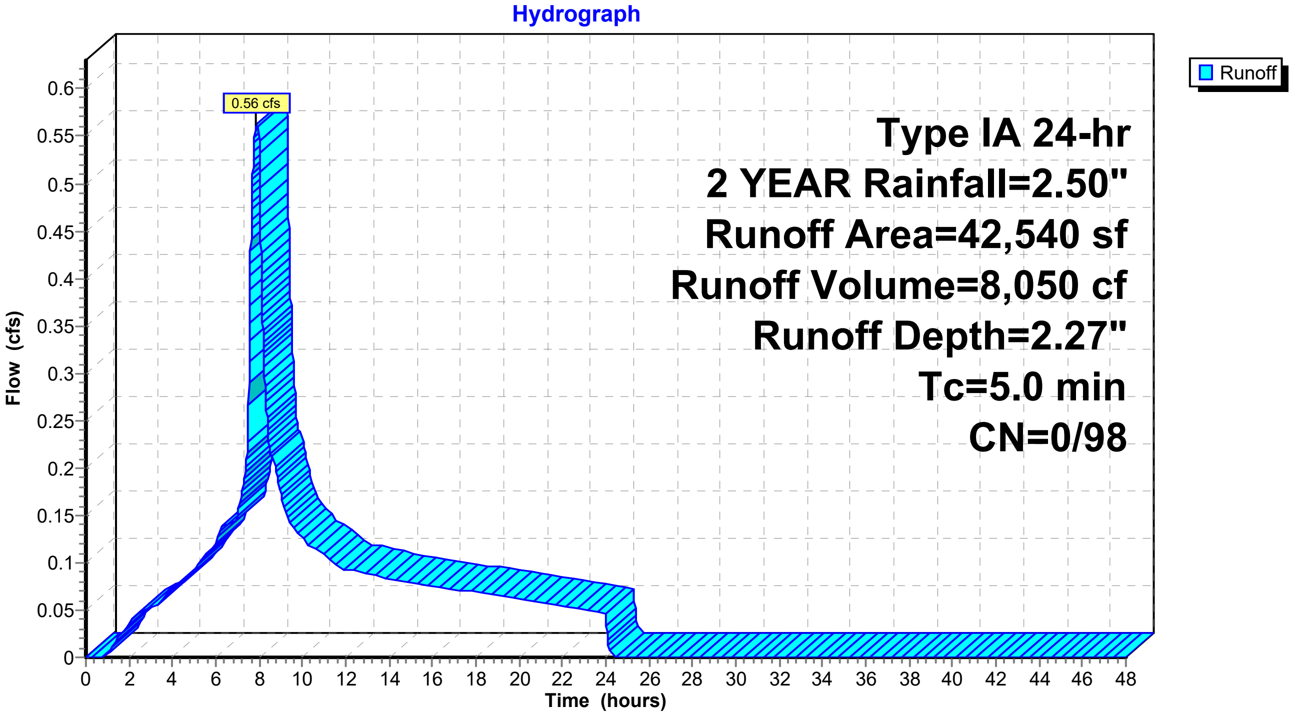
Runoff = 0.56 cfs @ 7.88 hrs, Volume= 8,050 cf, Depth= 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	1,890	98	P1C - Impervious
*	820	98	P1D - Impervious
*	14,360	98	P1E - Impervious
*	16,710	98	P1F - Impervious
*	4,970	98	P1G - Impervious
*	3,790	98	P1H - Impervious
	42,540	98	Weighted Average
	42,540		100.00% Impervious Area

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

Subcatchment PH1: Phase 1



Summary for Subcatchment PH2: Phase 2

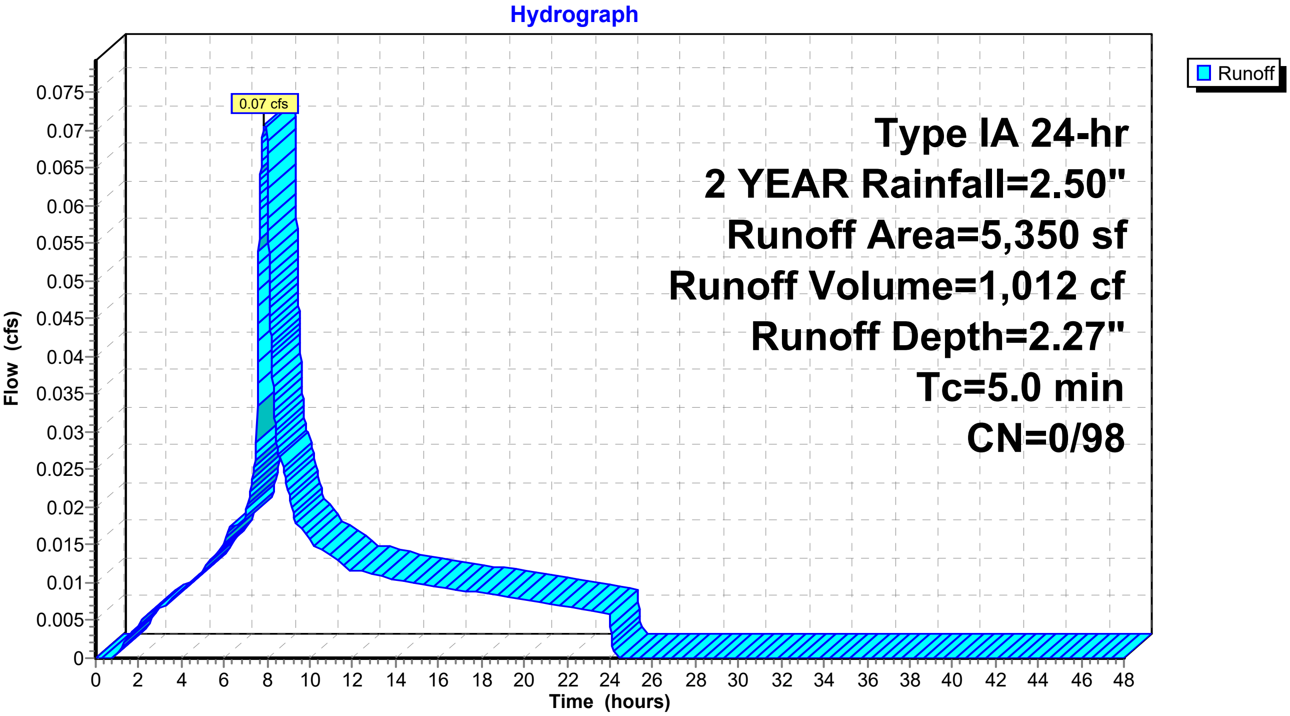
Runoff = 0.07 cfs @ 7.88 hrs, Volume= 1,012 cf, Depth= 2.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 YEAR Rainfall=2.50"

	Area (sf)	CN	Description
*	5,350	98	P2 - Impervious
	5,350		100.00% Impervious Area

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

Subcatchment PH2: Phase 2



Summary for Pond 1P: WESTERN FLOW THROUGH PLANTER

Inflow Area = 11,760 sf,100.00% Impervious, Inflow Depth = 2.27" for 2 YEAR event
Inflow = 0.16 cfs @ 7.88 hrs, Volume= 2,225 cf
Outflow = 0.04 cfs @ 7.42 hrs, Volume= 2,225 cf, Atten= 74%, Lag= 0.0 min
Primary = 0.04 cfs @ 7.42 hrs, Volume= 2,225 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.58' @ 9.30 hrs Surf.Area= 875 sf Storage= 316 cf
Flood Elev= 181.65' Surf.Area= 875 sf Storage= 726 cf

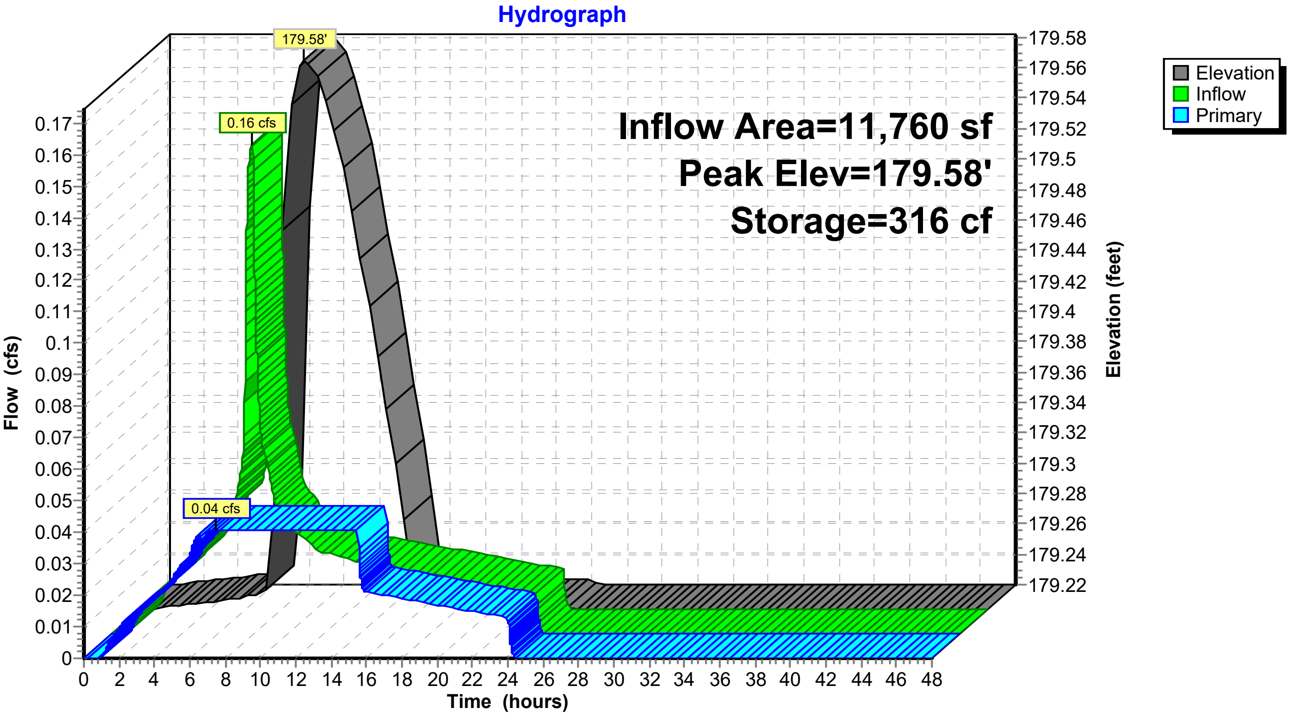
Plug-Flow detention time= 45.8 min calculated for 2,225 cf (100% of inflow)
Center-of-Mass det. time= 45.8 min (718.4 - 672.6)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	726 cf	**8.25'W x 106.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 7.42 hrs HW=179.24' TW=169.90' (Dynamic Tailwater)
1=Culvert (Passes 0.04 cfs of 1.43 cfs potential flow)
2=Exfiltration (Exfiltration Controls 0.04 cfs)
3=Orifice/Grate (Controls 0.00 cfs)

Pond 1P: WESTERN FLOW THROUGH PLANTER



Summary for Pond 2P: EASTERN FLOW THROUGH PLANTER

Inflow Area = 7,030 sf,100.00% Impervious, Inflow Depth = 2.27" for 2 YEAR event
Inflow = 0.09 cfs @ 7.88 hrs, Volume= 1,330 cf
Outflow = 0.02 cfs @ 7.00 hrs, Volume= 1,330 cf, Atten= 76%, Lag= 0.0 min
Primary = 0.02 cfs @ 7.00 hrs, Volume= 1,330 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.67' @ 9.75 hrs Surf.Area= 474 sf Storage= 212 cf
Flood Elev= 181.00' Surf.Area= 474 sf Storage= 394 cf

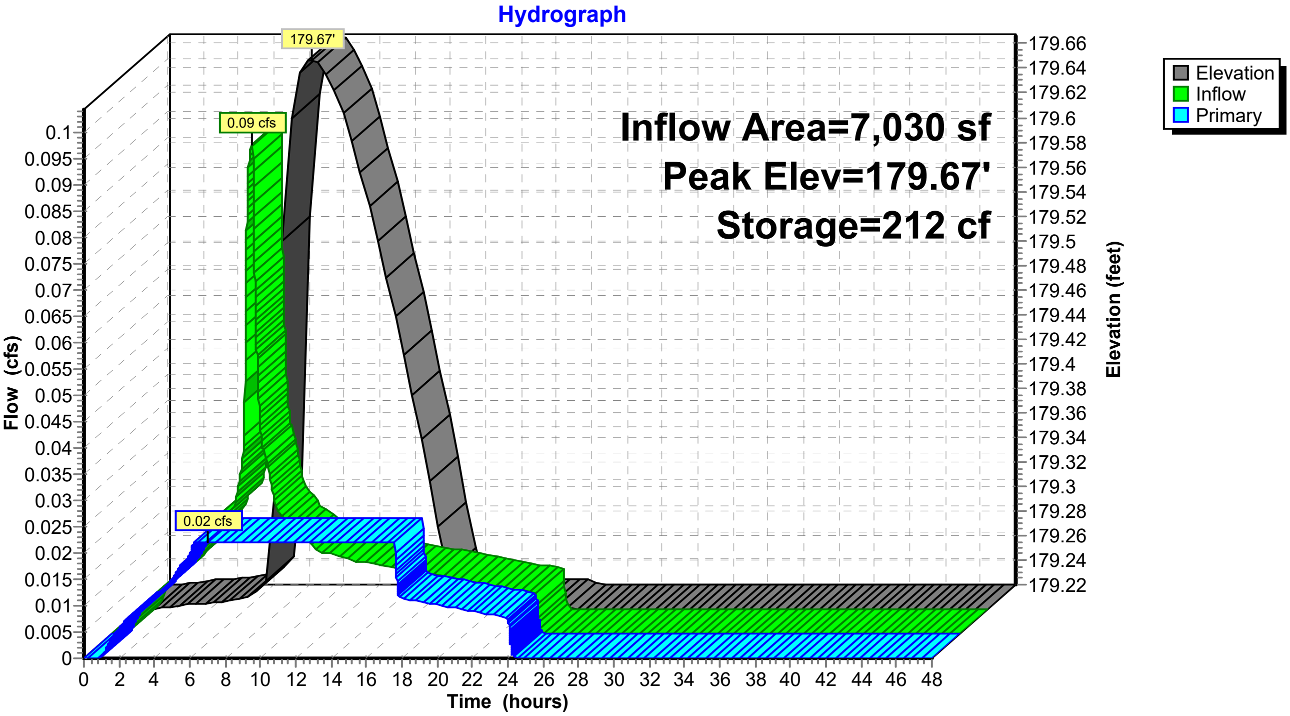
Plug-Flow detention time= 64.1 min calculated for 1,330 cf (100% of inflow)
Center-of-Mass det. time= 64.1 min (736.7 - 672.6)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	394 cf	**5.33'W x 89.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.02 cfs @ 7.00 hrs HW=179.24' TW=169.60' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.02 cfs of 1.42 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.02 cfs)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: EASTERN FLOW THROUGH PLANTER



Summary for Pond CH: DETENTION Chamber

```
Inflow Area =        245,040 sf,  70.47% Impervious,  Inflow Depth =   1.86"    for  2 YEAR event
Inflow      =       2.38 cfs @    7.90 hrs,  Volume=          38,036 cf
Outflow     =       0.93 cfs @    8.76 hrs,  Volume=          38,036 cf,  Atten= 61%,  Lag= 51.5 min
Primary     =       0.93 cfs @    8.76 hrs,  Volume=          38,036 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 171.98' @ 8.76 hrs   Surf.Area= 0.054 ac   Storage= 0.108 af
Flood Elev= 175.85'   Surf.Area= 0.054 ac   Storage= 0.216 af

Plug-Flow detention time= 38.9 min calculated for 38,028 cf (100% of inflow)
Center-of-Mass det. time= 38.9 min ( 741.5 - 702.6 )

Volume      Invert    Avail.Storage   Storage Description
  #1A      169.10'        0.076 af    20.33'W x 115.79'L x 6.75'H Field A
                                      0.365 af Overall - 0.135 af Embedded = 0.230 af  x 33.0% Voids
  #2A      169.85'        0.135 af    ADS_StormTech MC-4500 +Cap x 54  Inside #1
                                      Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
                                      Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
                                      2 Rows of 27 Chambers
                                      Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
  #3       168.19'        0.005 af    15.0"  Round Pipe Storage
                                      L= 184.7'  S= 0.0050 '/'
                          0.216 af    Total Available Storage

   Storage Group A created with Chamber Wizard

Device  Routing         Invert   Outlet Devices
  #1    Primary        168.00'   15.0"  Round Outlet Pipe  L= 40.2'   Ke= 0.500
                                 Inlet / Outlet Invert= 168.00' / 167.79'   S= 0.0052 '/'   Cc= 0.900
                                 n= 0.013,  Flow Area= 1.23 sf
  #2    Device 1       168.00'   4.0" Vert. 1/2 2 Year Overflow   C= 0.600
  #3    Device 1       171.90'   5.5" Horiz. 2 Year Overflow   C= 0.600
                                 Limited to weir flow at low heads
  #4    Device 1       174.50'   15.0" Horiz. Overflow   C= 0.600   Limited to weir flow at low heads

Primary OutFlow Max=0.93 cfs @ 8.76 hrs  HW=171.98'  TW=0.00'   (Dynamic Tailwater)
 └─1=Outlet Pipe  (Passes 0.93 cfs of 10.82 cfs potential flow)
     ├─2=1/2 2 Year Overflow (Orifice Controls 0.82 cfs @ 9.40 fps)
     ├─3=2 Year Overflow (Weir Controls 0.11 cfs @ 0.93 fps)
     └─4=Overflow  ( Controls 0.00 cfs)
```

Pond CH: DETENTION Chamber - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf

100.0" Wide + 20.0" Spacing = 120.0" C-C Row Spacing

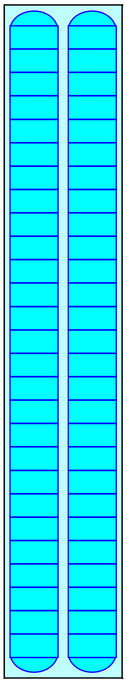
27 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 113.79' Row Length +12.0" End Stone x 2 = 115.79' Base Length
2 Rows x 100.0" Wide + 20.0" Spacing x 1 + 12.0" Side Stone x 2 = 20.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

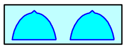
54 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 2 Rows = 5,893.3 cf Chamber Storage

15,892.4 cf Field - 5,893.3 cf Chambers = 9,999.1 cf Stone x 33.0% Voids = 3,299.7 cf Stone Storage

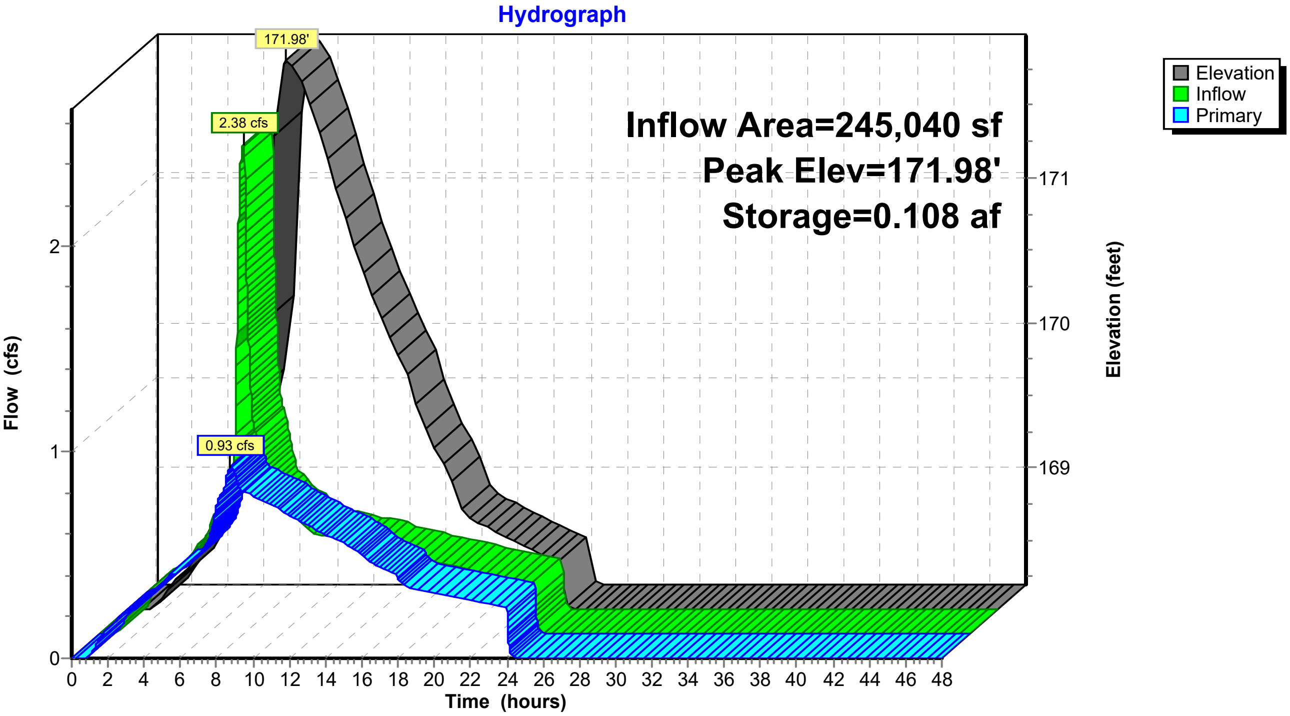
Chamber Storage + Stone Storage = 9,193.0 cf = 0.211 af
Overall Storage Efficiency = 57.8%
Overall System Size = 115.79' x 20.33' x 6.75'

54 Chambers
588.6 cy Field
370.3 cy Stone





Pond CH: DETENTION Chamber

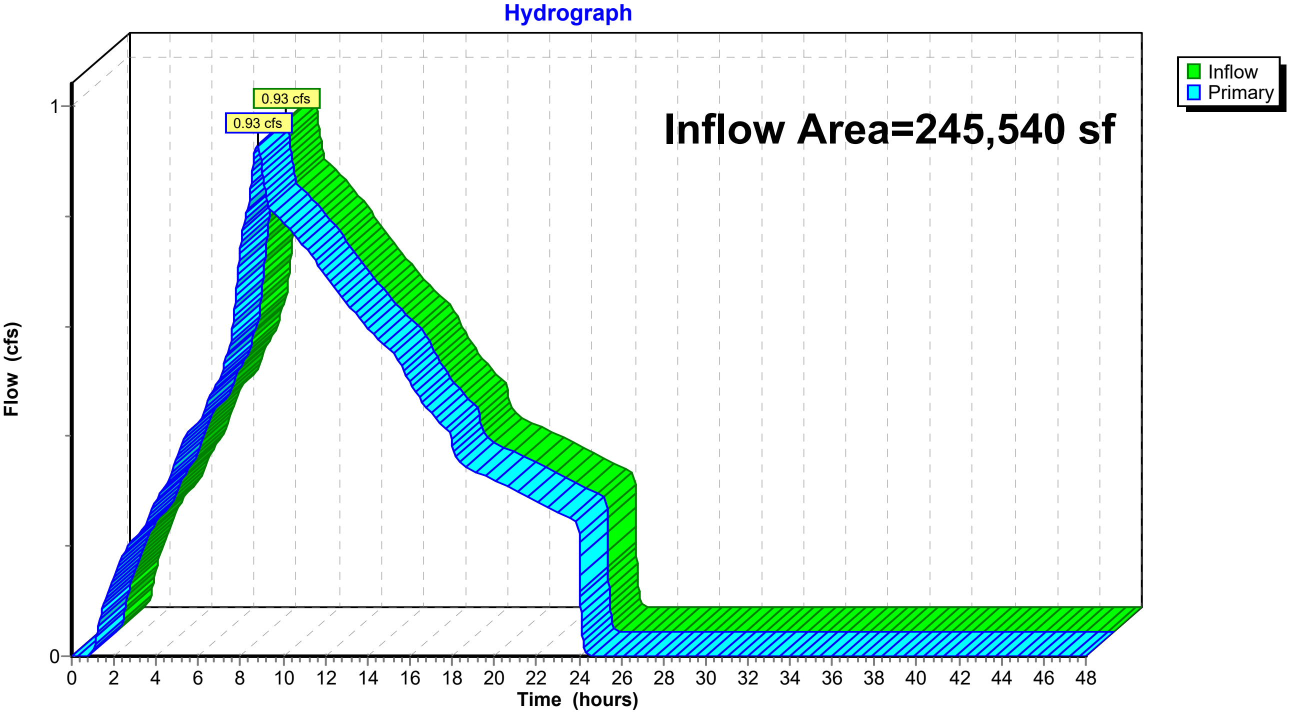


Summary for Link 1L: Total

Inflow Area = 245,540 sf, 70.53% Impervious, Inflow Depth = 1.86" for 2 YEAR event
Inflow = 0.93 cfs @ 8.76 hrs, Volume= 38,131 cf
Primary = 0.93 cfs @ 8.76 hrs, Volume= 38,131 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Summary for Subcatchment 1ES: Existing basin

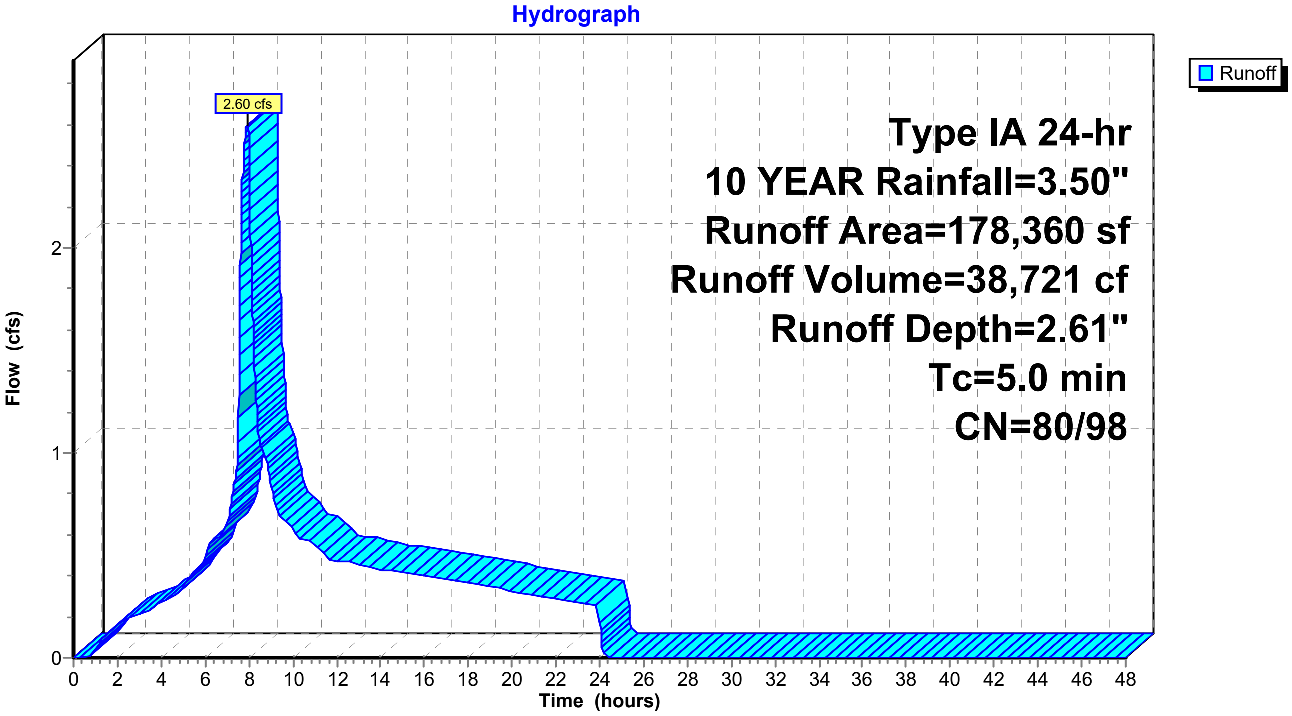
Runoff = 2.60 cfs @ 7.90 hrs, Volume= 38,721 cf, Depth= 2.61"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	106,000	98	Existing Impervious Area
	72,360	80	>75% Grass cover, Good, HSG D
	178,360	91	Weighted Average
	72,360		40.57% Pervious Area
	106,000		59.43% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Subcatchment P1A: P1A - North Roof

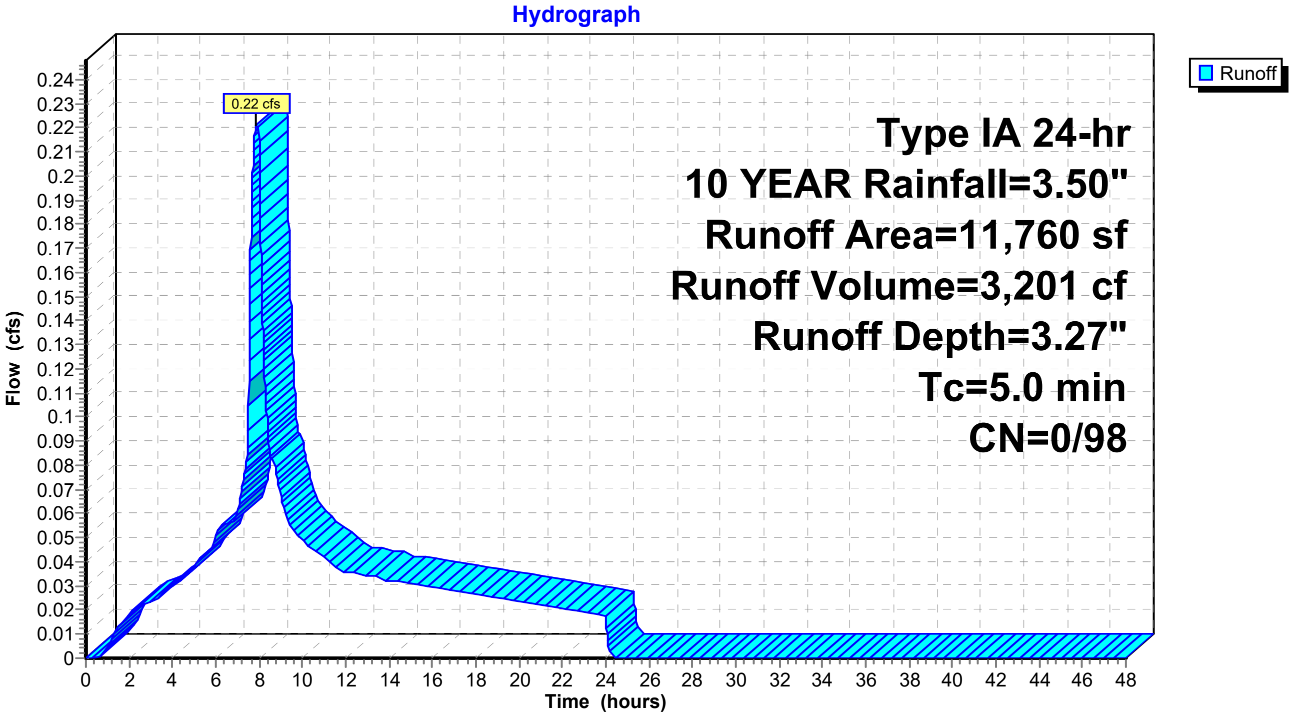
Runoff = 0.22 cfs @ 7.88 hrs, Volume= 3,201 cf, Depth= 3.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	11,760	98	Roof
	11,760		100.00% Impervious Area

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

Subcatchment P1A: P1A - North Roof



Summary for Subcatchment P1B: P1B - South Roof

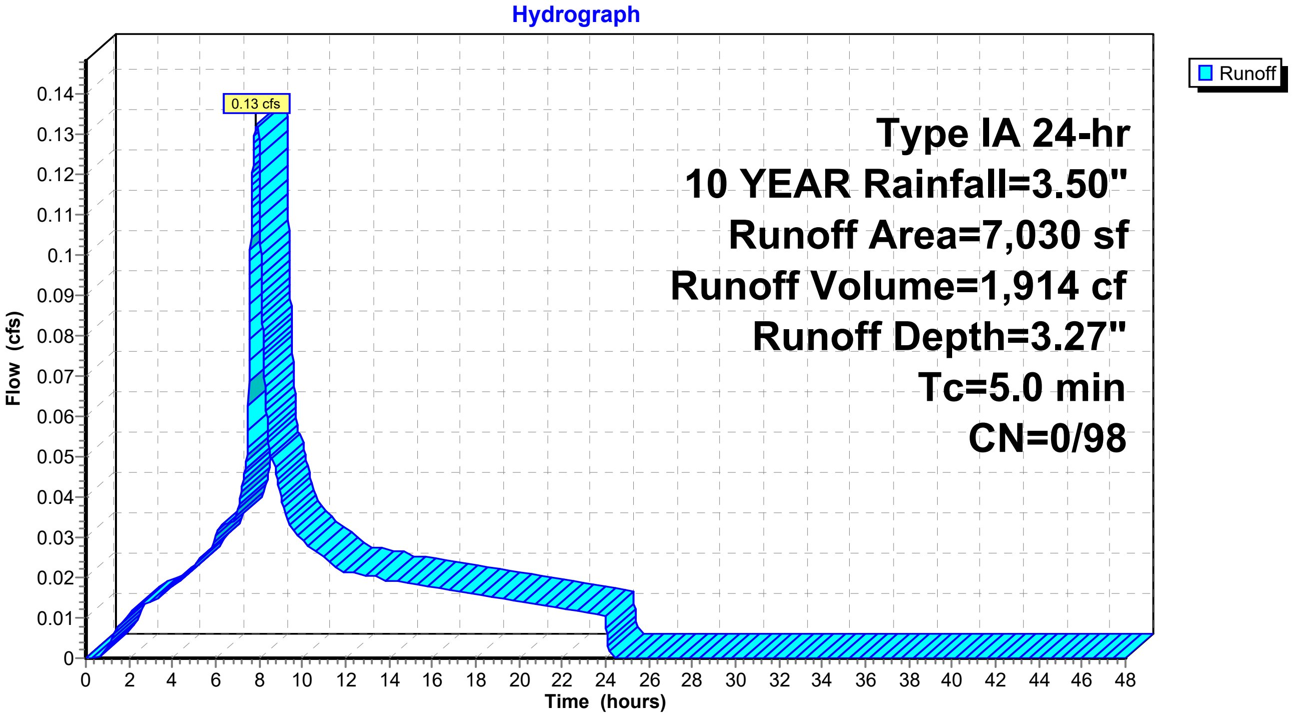
Runoff = 0.13 cfs @ 7.88 hrs, Volume= 1,914 cf, Depth= 3.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	7,030	98	Roof
	7,030		100.00% Impervious Area

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

Subcatchment P1B: P1B - South Roof



Summary for Subcatchment P1J: Un-Detained Release

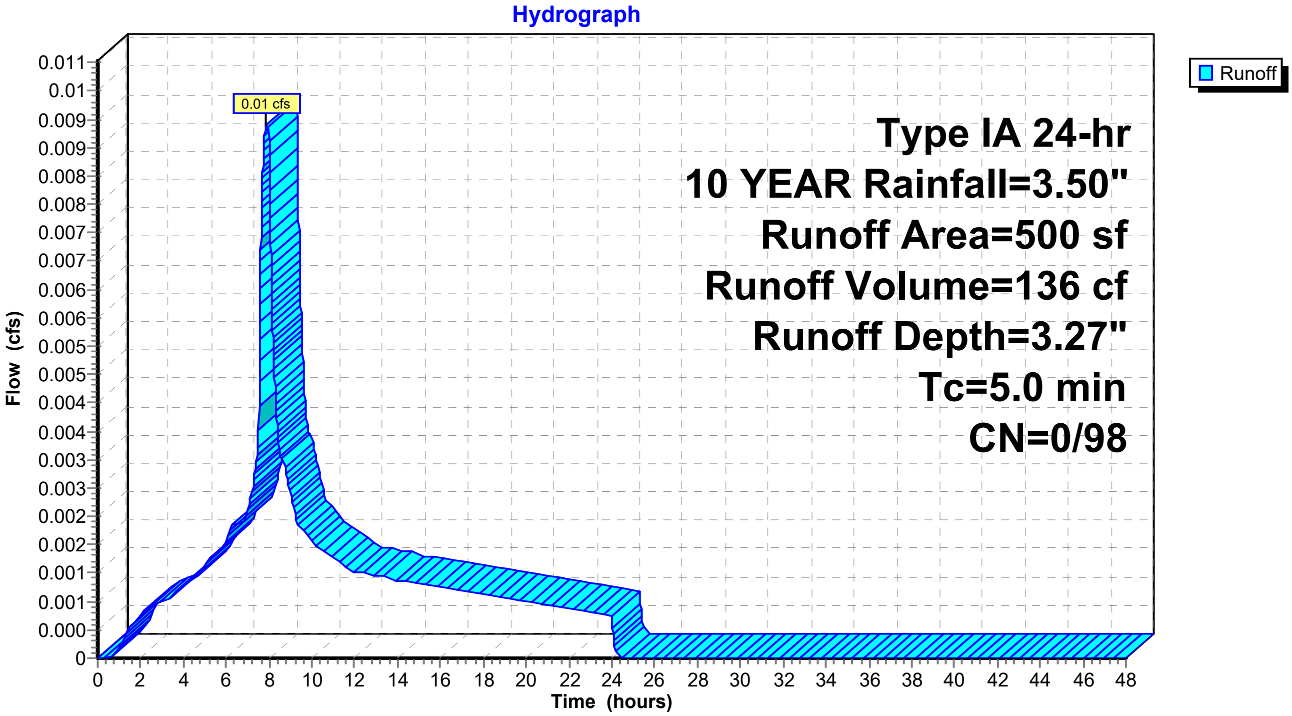
Runoff = 0.01 cfs @ 7.88 hrs, Volume= 136 cf, Depth= 3.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	500	98	Impervious
	500		100.00% Impervious Area

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

Subcatchment P1J: Un-Detained Release



Summary for Subcatchment PH1: Phase 1

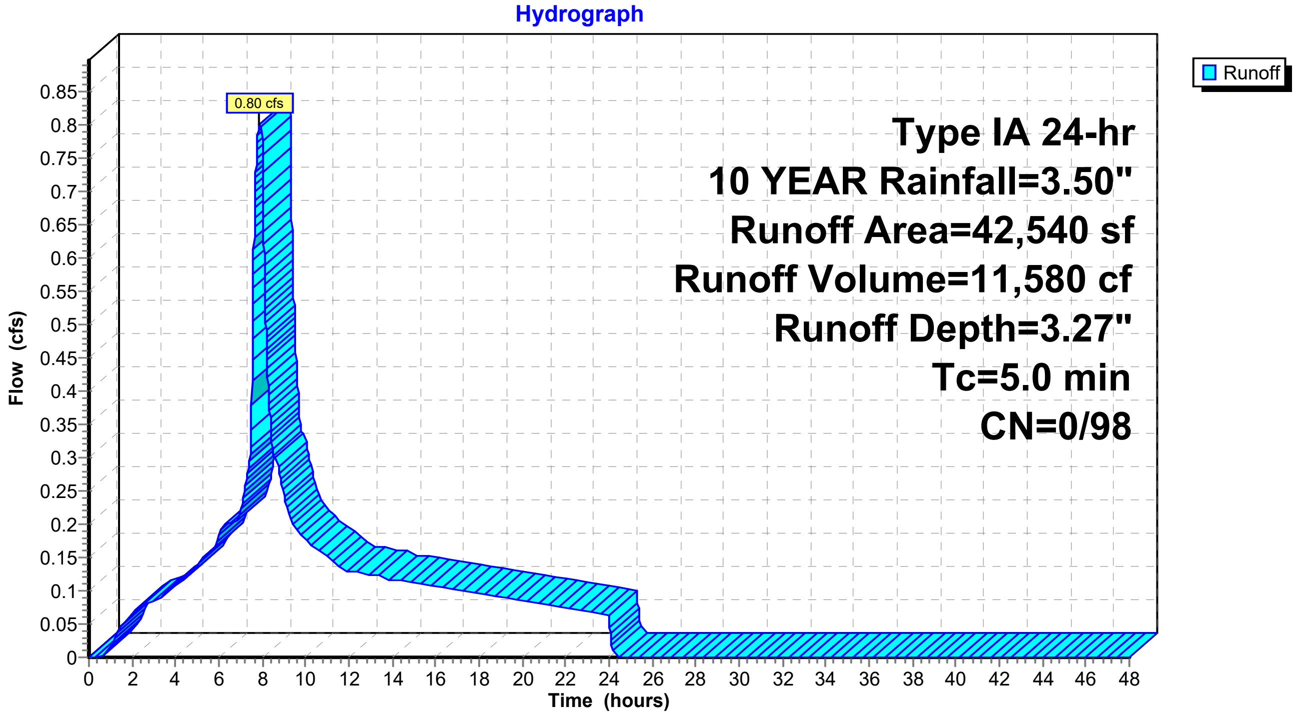
Runoff = 0.80 cfs @ 7.88 hrs, Volume= 11,580 cf, Depth= 3.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	1,890	98	P1C - Impervious
*	820	98	P1D - Impervious
*	14,360	98	P1E - Impervious
*	16,710	98	P1F - Impervious
*	4,970	98	P1G - Impervious
*	3,790	98	P1H - Impervious
	42,540	98	Weighted Average
	42,540		100.00% Impervious Area

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

Subcatchment PH1: Phase 1



Summary for Subcatchment PH2: Phase 2

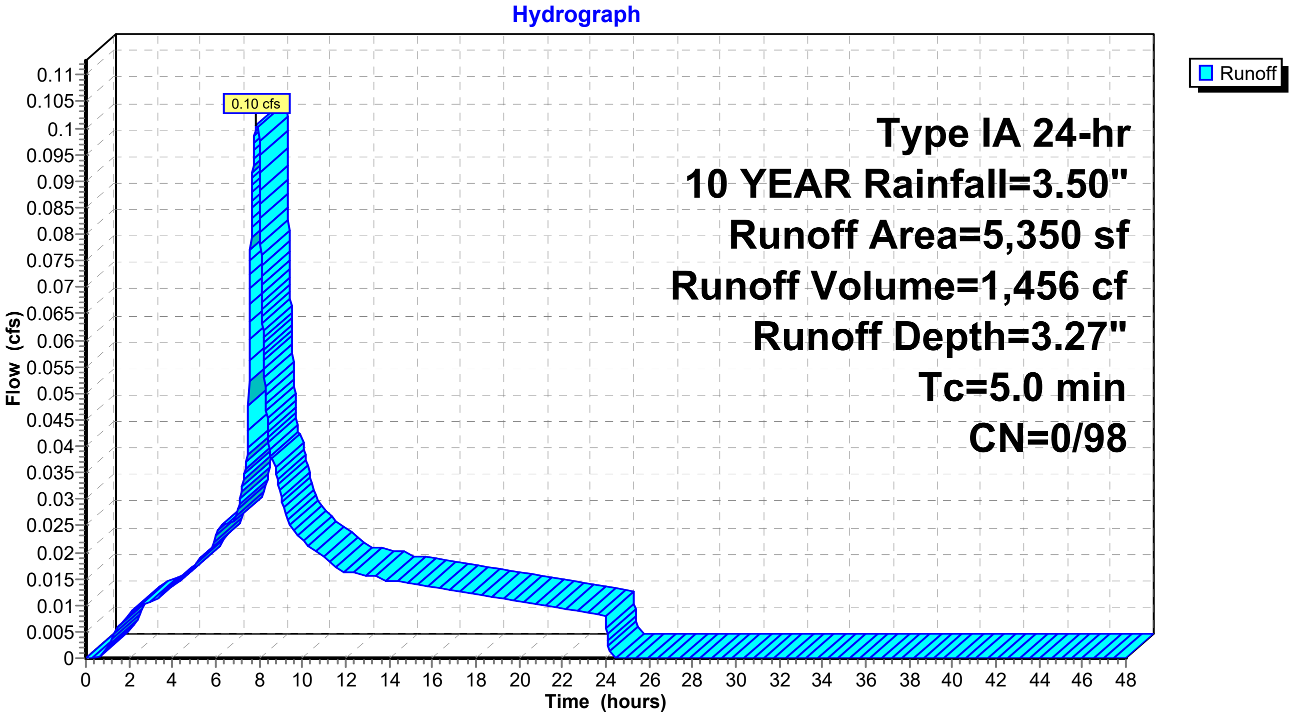
Runoff = 0.10 cfs @ 7.88 hrs, Volume= 1,456 cf, Depth= 3.27"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 YEAR Rainfall=3.50"

	Area (sf)	CN	Description
*	5,350	98	P2 - Impervious
	5,350		100.00% Impervious Area

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

Subcatchment PH2: Phase 2



Summary for Pond 1P: WESTERN FLOW THROUGH PLANTER

Inflow Area = 11,760 sf,100.00% Impervious, Inflow Depth = 3.27" for 10 YEAR event
Inflow = 0.22 cfs @ 7.88 hrs, Volume= 3,201 cf
Outflow = 0.11 cfs @ 8.31 hrs, Volume= 3,201 cf, Atten= 52%, Lag= 26.0 min
Primary = 0.11 cfs @ 8.31 hrs, Volume= 3,201 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.77' @ 8.31 hrs Surf.Area= 875 sf Storage= 485 cf
Flood Elev= 181.65' Surf.Area= 875 sf Storage= 726 cf

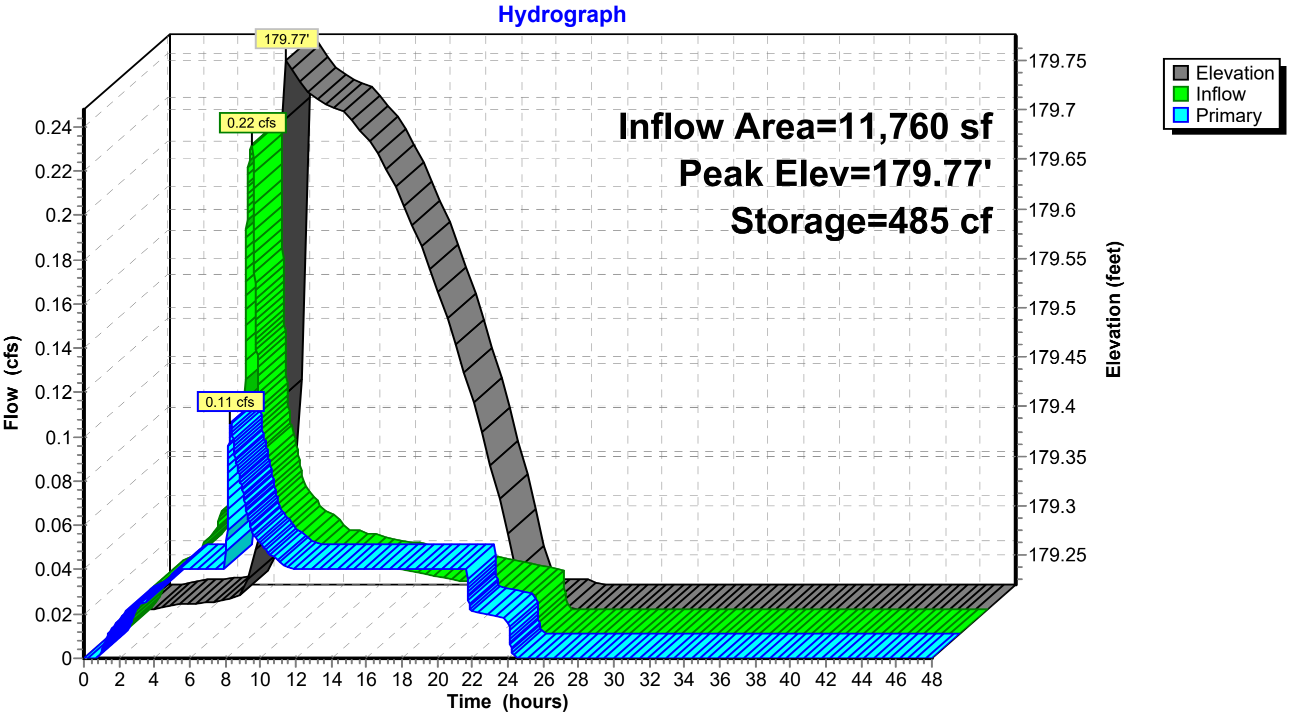
Plug-Flow detention time= 86.8 min calculated for 3,200 cf (100% of inflow)
Center-of-Mass det. time= 86.8 min (749.6 - 662.8)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	726 cf	**8.25'W x 106.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 8.31 hrs HW=179.77' TW=173.45' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.11 cfs of 1.58 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.04 cfs)
  └─**3=Orifice/Grate** (Weir Controls 0.07 cfs @ 0.76 fps)

Pond 1P: WESTERN FLOW THROUGH PLANTER



Summary for Pond 2P: EASTERN FLOW THROUGH PLANTER

Inflow Area = 7,030 sf,100.00% Impervious, Inflow Depth = 3.27" for 10 YEAR event
Inflow = 0.13 cfs @ 7.88 hrs, Volume= 1,914 cf
Outflow = 0.10 cfs @ 8.08 hrs, Volume= 1,914 cf, Atten= 25%, Lag= 12.5 min
Primary = 0.10 cfs @ 8.08 hrs, Volume= 1,914 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.78' @ 8.08 hrs Surf.Area= 474 sf Storage= 266 cf
Flood Elev= 181.00' Surf.Area= 474 sf Storage= 394 cf

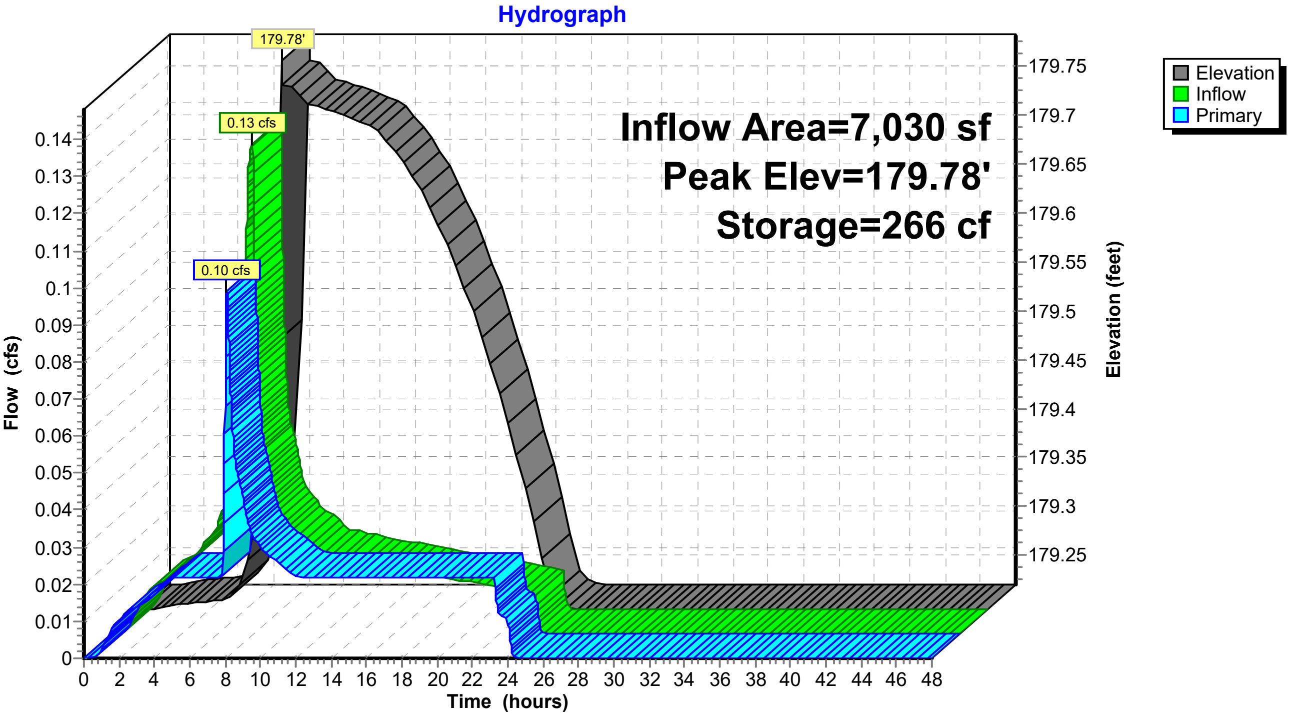
Plug-Flow detention time= 91.8 min calculated for 1,913 cf (100% of inflow)
Center-of-Mass det. time= 91.8 min (754.6 - 662.8)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	394 cf	**5.33'W x 89.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.10 cfs @ 8.08 hrs HW=179.78' TW=173.25' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.10 cfs of 1.59 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.02 cfs)
  └─**3=Orifice/Grate** (Weir Controls 0.08 cfs @ 0.81 fps)

Pond 2P: EASTERN FLOW THROUGH PLANTER



Summary for Pond CH: DETENTION Chamber

```
Inflow Area =        245,040 sf,  70.47% Impervious,  Inflow Depth =  2.79"    for  10 YEAR event
Inflow      =       3.56 cfs @   7.90 hrs,  Volume=          56,872 cf
Outflow     =       1.96 cfs @   8.29 hrs,  Volume=          56,872 cf,  Atten= 45%,  Lag= 23.7 min
Primary     =       1.96 cfs @   8.29 hrs,  Volume=          56,872 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 173.45' @ 8.29 hrs   Surf.Area= 0.054 ac   Storage= 0.162 af
Flood Elev= 175.85'   Surf.Area= 0.054 ac   Storage= 0.216 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 53.8 min ( 750.3 - 696.5 )

Volume     Invert   Avail.Storage   Storage Description
   #1A    169.10'        0.076 af   20.33'W x 115.79'L x 6.75'H Field A
                                    0.365 af Overall - 0.135 af Embedded = 0.230 af  x 33.0% Voids
   #2A    169.85'        0.135 af   ADS_StormTech MC-4500 +Cap x 54  Inside #1
                                    Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
                                    Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
                                    2 Rows of 27 Chambers
                                    Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
   #3     168.19'        0.005 af   15.0"  Round Pipe Storage
                                    L= 184.7'  S= 0.0050 '/'
                         0.216 af   Total Available Storage

   Storage Group A created with Chamber Wizard

Device   Routing        Invert   Outlet Devices
   #1    Primary       168.00'   15.0"  Round Outlet Pipe  L= 40.2'   Ke= 0.500
                                 Inlet / Outlet Invert= 168.00' / 167.79'   S= 0.0052 '/'   Cc= 0.900
                                 n= 0.013,  Flow Area= 1.23 sf
   #2    Device 1      168.00'   4.0" Vert. 1/2 2 Year Overflow  C= 0.600
   #3    Device 1      171.90'   5.5" Horiz. 2 Year Overflow  C= 0.600
                                 Limited to weir flow at low heads
   #4    Device 1      174.50'   15.0" Horiz. Overflow   C= 0.600   Limited to weir flow at low heads

Primary OutFlow Max=1.96 cfs @ 8.29 hrs  HW=173.45'  TW=0.00'   (Dynamic Tailwater)
└─1=Outlet Pipe (Passes 1.96 cfs of 12.99 cfs potential flow)
   ├─2=1/2 2 Year Overflow (Orifice Controls 0.97 cfs @ 11.07 fps)
   ├─3=2 Year Overflow (Orifice Controls 0.99 cfs @ 6.00 fps)
   └─4=Overflow  ( Controls 0.00 cfs)
```

Pond CH: DETENTION Chamber - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf

100.0" Wide + 20.0" Spacing = 120.0" C-C Row Spacing

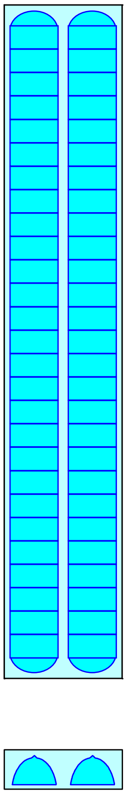
27 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 113.79' Row Length +12.0" End Stone x 2 = 115.79' Base Length
2 Rows x 100.0" Wide + 20.0" Spacing x 1 + 12.0" Side Stone x 2 = 20.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

54 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 2 Rows = 5,893.3 cf Chamber Storage

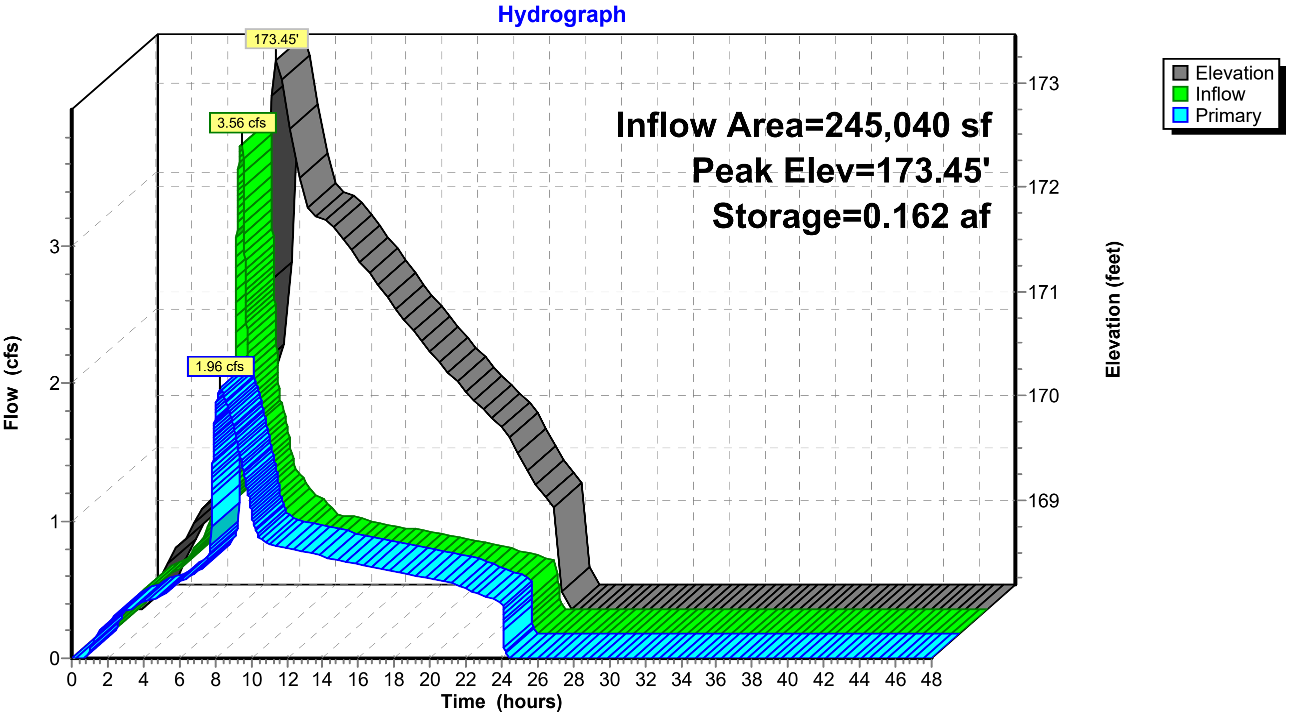
15,892.4 cf Field - 5,893.3 cf Chambers = 9,999.1 cf Stone x 33.0% Voids = 3,299.7 cf Stone Storage

Chamber Storage + Stone Storage = 9,193.0 cf = 0.211 af
Overall Storage Efficiency = 57.8%
Overall System Size = 115.79' x 20.33' x 6.75'

54 Chambers
588.6 cy Field
370.3 cy Stone



Pond CH: DETENTION Chamber

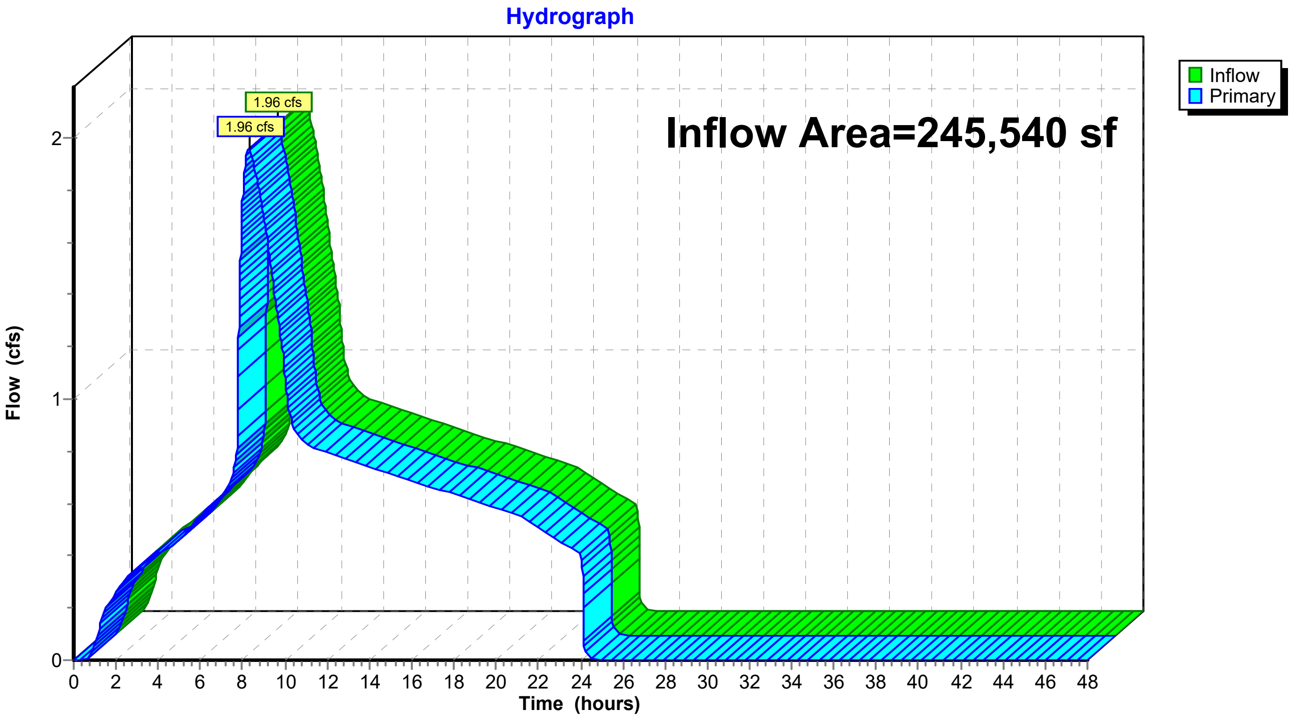


Summary for Link 1L: Total

Inflow Area = 245,540 sf, 70.53% Impervious, Inflow Depth = 2.79" for 10 YEAR event
Inflow = 1.96 cfs @ 8.29 hrs, Volume= 57,008 cf
Primary = 1.96 cfs @ 8.29 hrs, Volume= 57,008 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Summary for Subcatchment 1ES: Existing basin

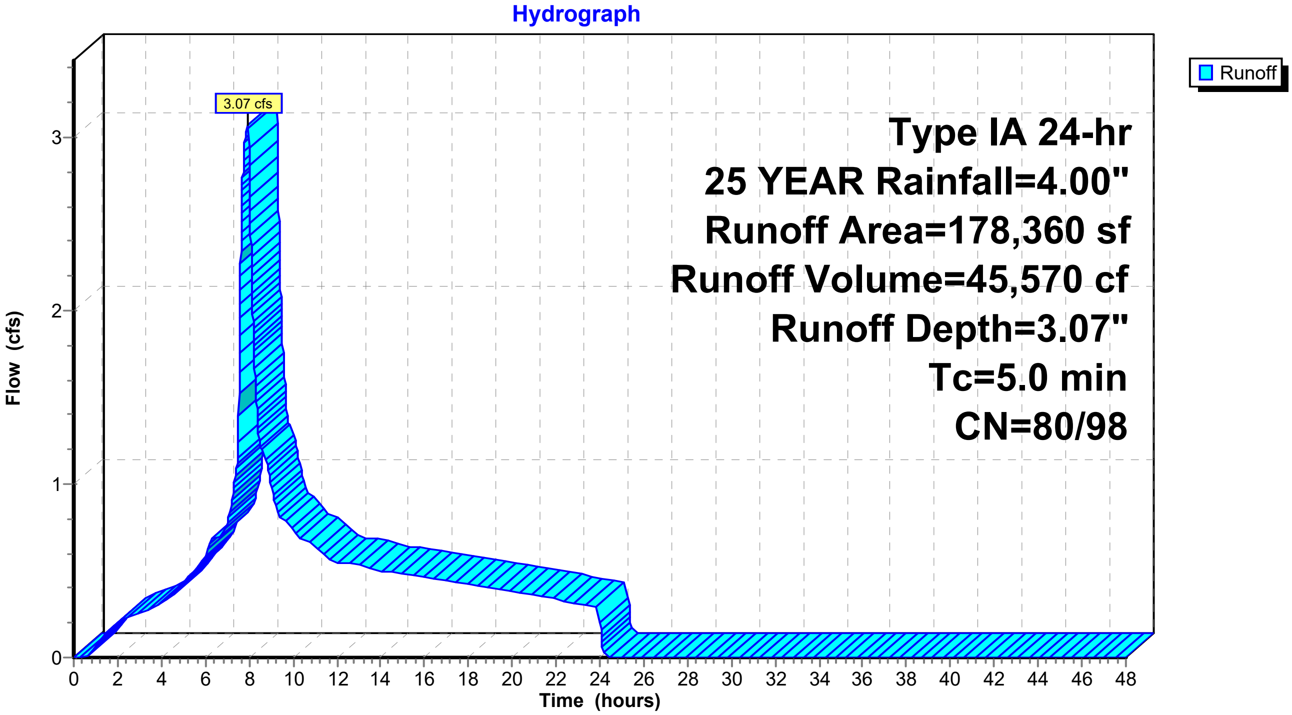
Runoff = 3.07 cfs @ 7.90 hrs, Volume= 45,570 cf, Depth= 3.07"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	106,000	98	Existing Impervious Area
	72,360	80	>75% Grass cover, Good, HSG D
	178,360	91	Weighted Average
	72,360		40.57% Pervious Area
	106,000		59.43% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Subcatchment P1A: P1A - North Roof

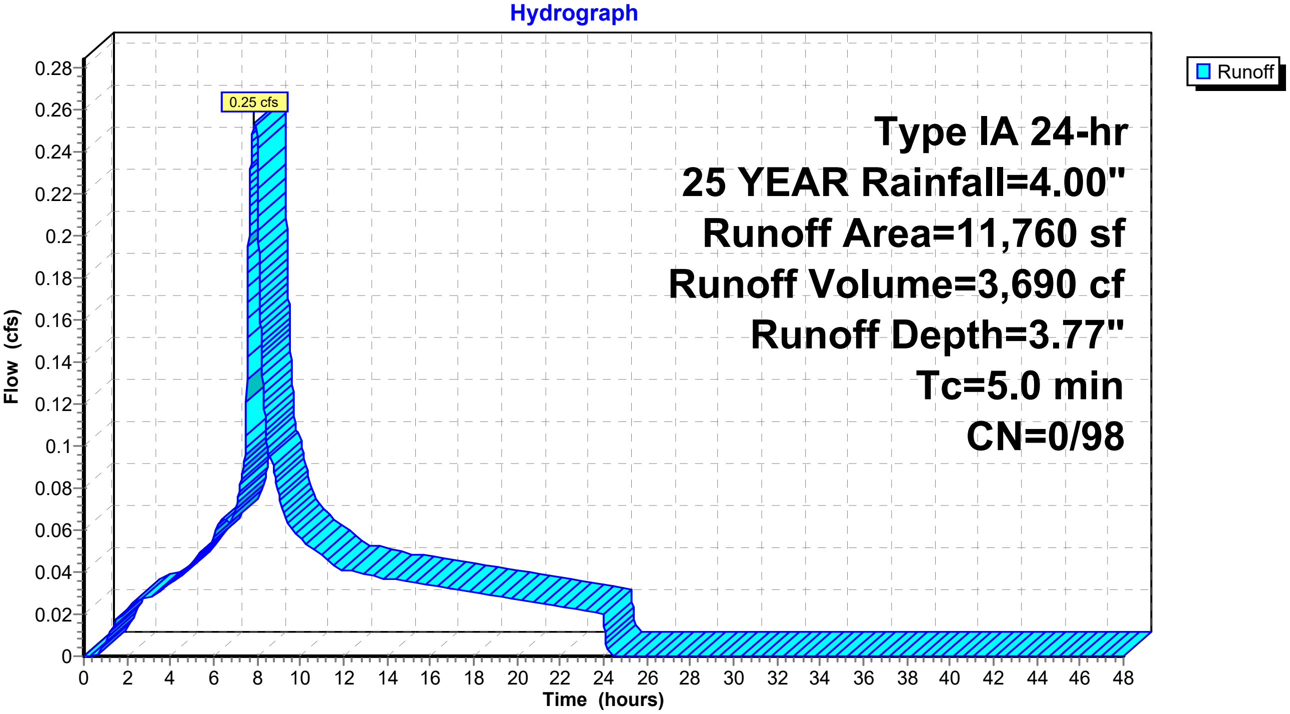
Runoff = 0.25 cfs @ 7.88 hrs, Volume= 3,690 cf, Depth= 3.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	11,760	98	Roof
	11,760		100.00% Impervious Area

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

Subcatchment P1A: P1A - North Roof



Summary for Subcatchment P1B: P1B - South Roof

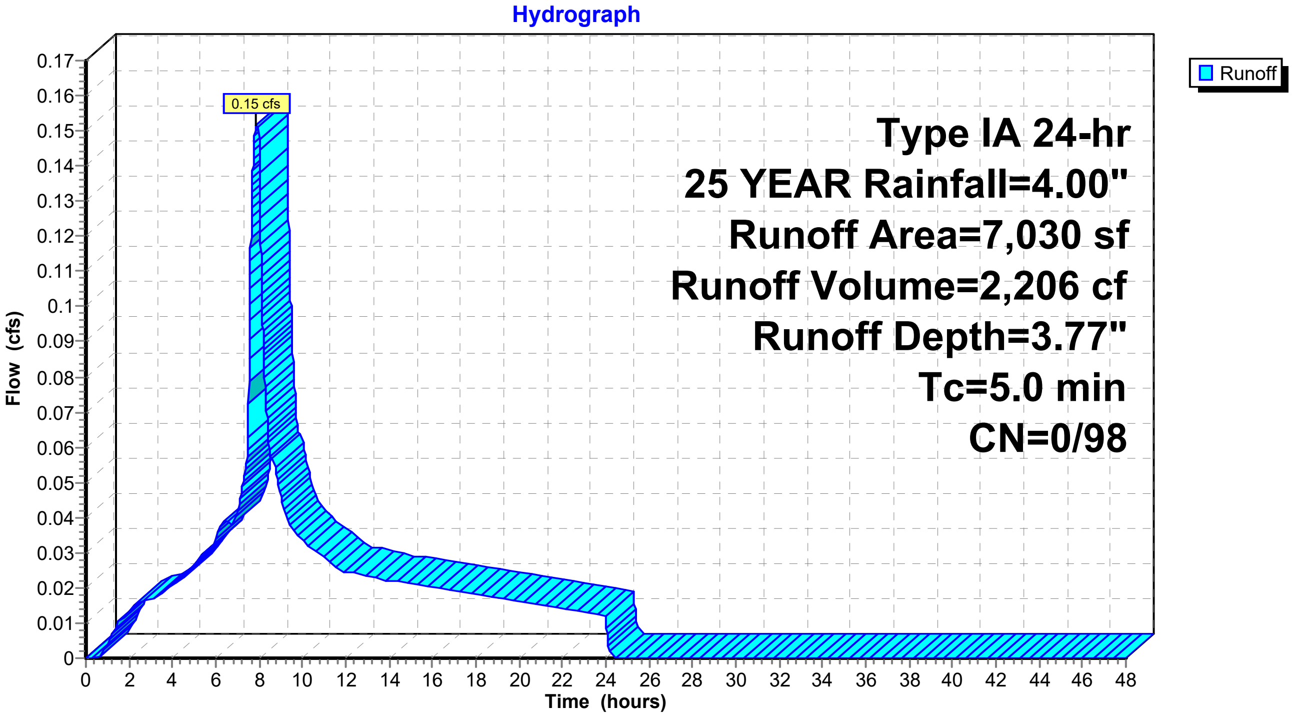
Runoff = 0.15 cfs @ 7.88 hrs, Volume= 2,206 cf, Depth= 3.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	7,030	98	Roof
	7,030		100.00% Impervious Area

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

Subcatchment P1B: P1B - South Roof



Summary for Subcatchment P1J: Un-Detained Release

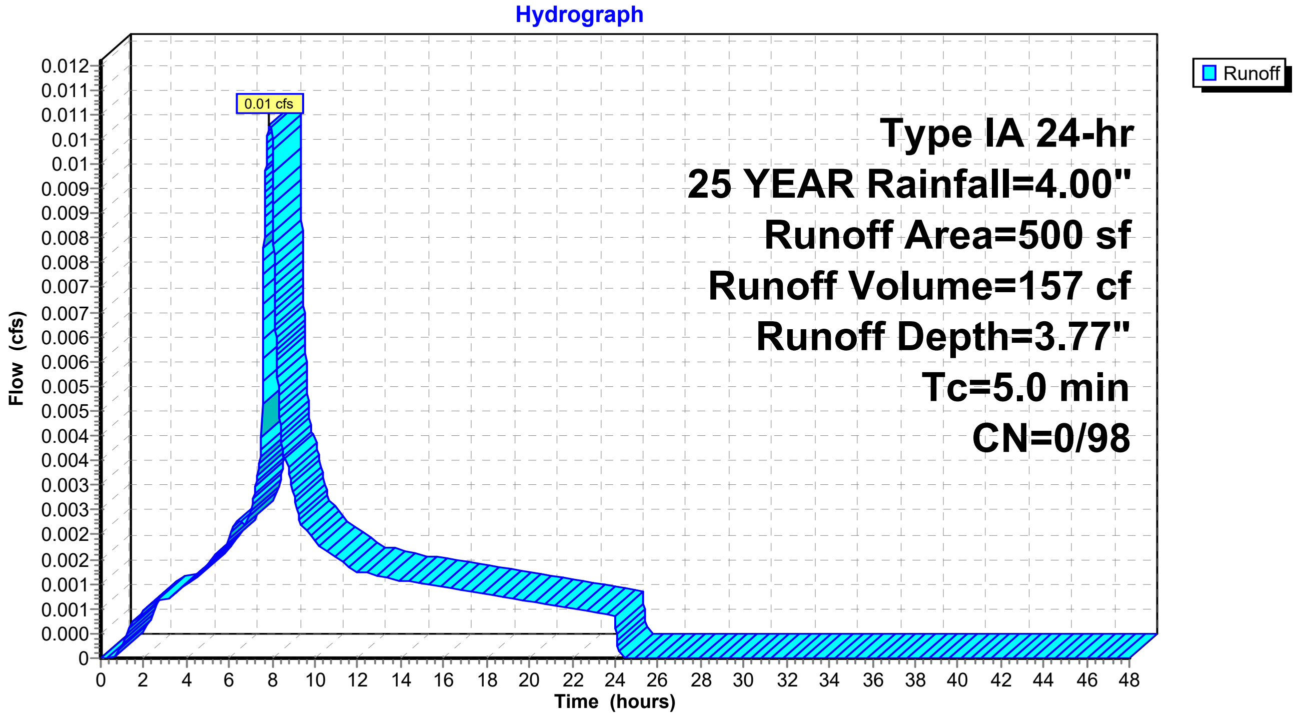
Runoff = 0.01 cfs @ 7.88 hrs, Volume= 157 cf, Depth= 3.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	500	98	Impervious
	500		100.00% Impervious Area

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

Subcatchment P1J: Un-Detained Release



Summary for Subcatchment PH1: Phase 1

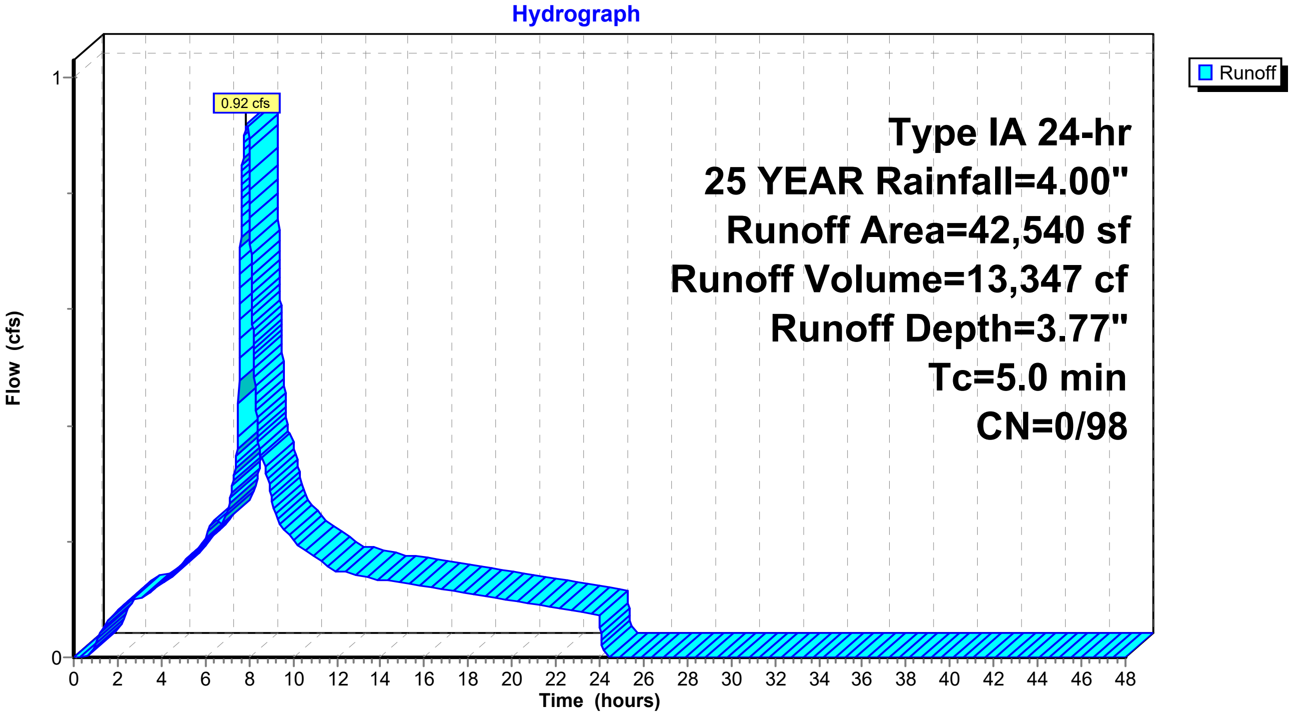
Runoff = 0.92 cfs @ 7.88 hrs, Volume= 13,347 cf, Depth= 3.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	1,890	98	P1C - Impervious
*	820	98	P1D - Impervious
*	14,360	98	P1E - Impervious
*	16,710	98	P1F - Impervious
*	4,970	98	P1G - Impervious
*	3,790	98	P1H - Impervious
	42,540	98	Weighted Average
	42,540		100.00% Impervious Area

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

Subcatchment PH1: Phase 1



Summary for Subcatchment PH2: Phase 2

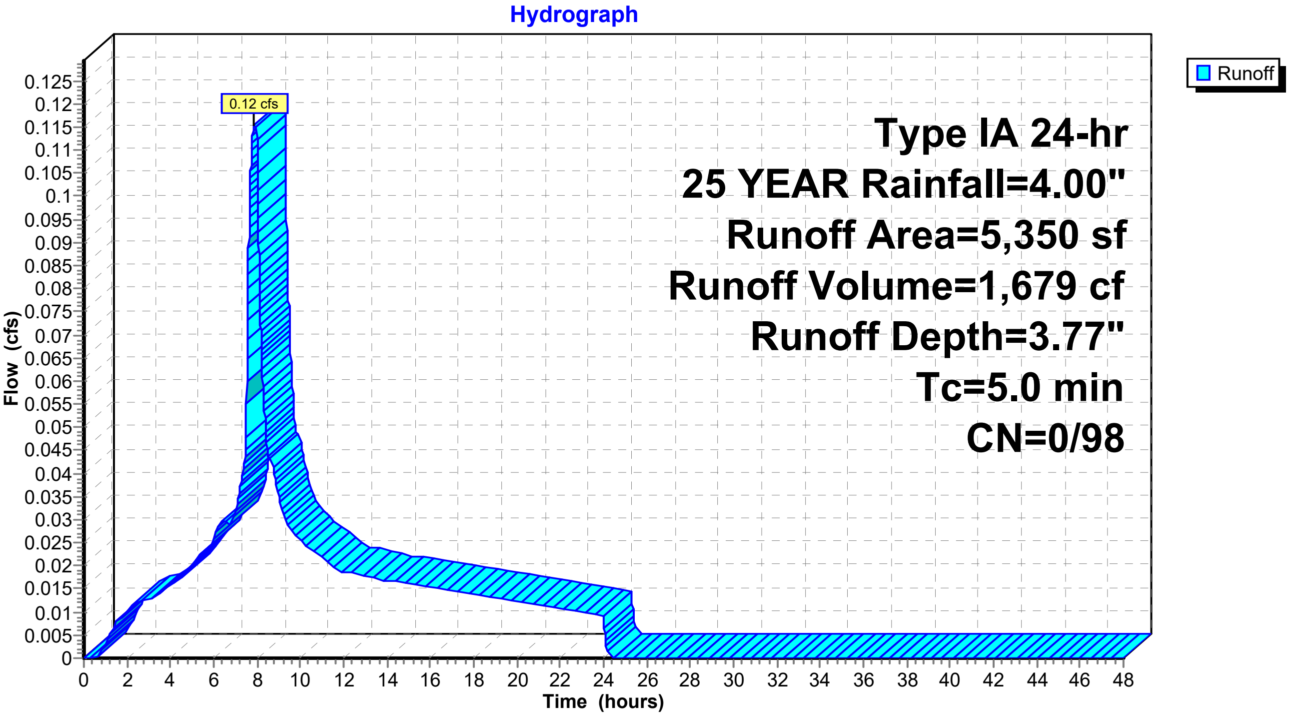
Runoff = 0.12 cfs @ 7.88 hrs, Volume= 1,679 cf, Depth= 3.77"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 YEAR Rainfall=4.00"

	Area (sf)	CN	Description
*	5,350	98	P2 - Impervious
	5,350		100.00% Impervious Area

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

Subcatchment PH2: Phase 2



Summary for Pond 1P: WESTERN FLOW THROUGH PLANTER

Inflow Area = 11,760 sf,100.00% Impervious, Inflow Depth = 3.77" for 25 YEAR event
Inflow = 0.25 cfs @ 7.88 hrs, Volume= 3,690 cf
Outflow = 0.19 cfs @ 8.09 hrs, Volume= 3,690 cf, Atten= 26%, Lag= 12.7 min
Primary = 0.19 cfs @ 8.09 hrs, Volume= 3,690 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.81' @ 8.09 hrs Surf.Area= 875 sf Storage= 519 cf
Flood Elev= 181.65' Surf.Area= 875 sf Storage= 726 cf

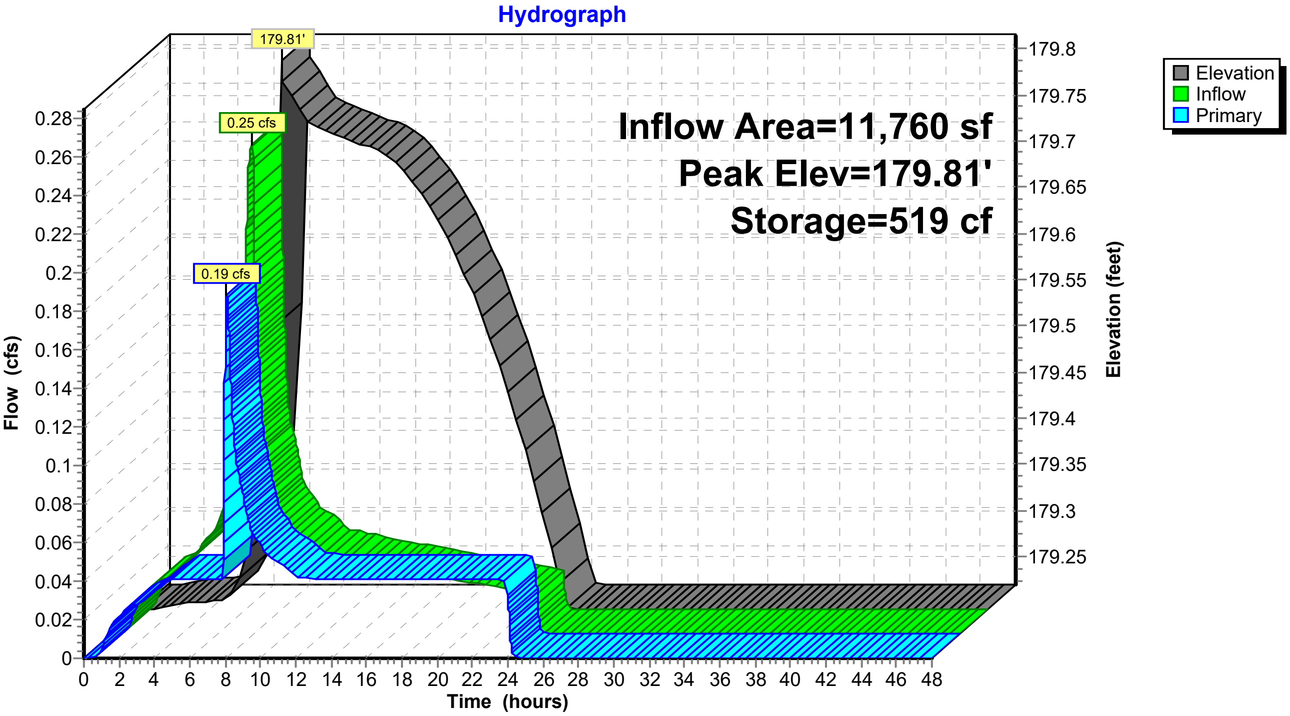
Plug-Flow detention time= 94.5 min calculated for 3,690 cf (100% of inflow)
Center-of-Mass det. time= 94.5 min (754.0 - 659.5)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	726 cf	**8.25'W x 106.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.19 cfs @ 8.09 hrs HW=179.81' TW=174.45' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.19 cfs of 1.59 cfs potential flow)
  ↑—**2=Exfiltration** (Exfiltration Controls 0.04 cfs)
  └—**3=Orifice/Grate** (Weir Controls 0.15 cfs @ 1.00 fps)

Pond 1P: WESTERN FLOW THROUGH PLANTER



Summary for Pond 2P: EASTERN FLOW THROUGH PLANTER

Inflow Area = 7,030 sf,100.00% Impervious, Inflow Depth = 3.77" for 25 YEAR event
Inflow = 0.15 cfs @ 7.88 hrs, Volume= 2,206 cf
Outflow = 0.14 cfs @ 8.00 hrs, Volume= 2,206 cf, Atten= 5%, Lag= 7.7 min
Primary = 0.14 cfs @ 8.00 hrs, Volume= 2,206 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.80' @ 8.00 hrs Surf.Area= 474 sf Storage= 277 cf
Flood Elev= 181.00' Surf.Area= 474 sf Storage= 394 cf

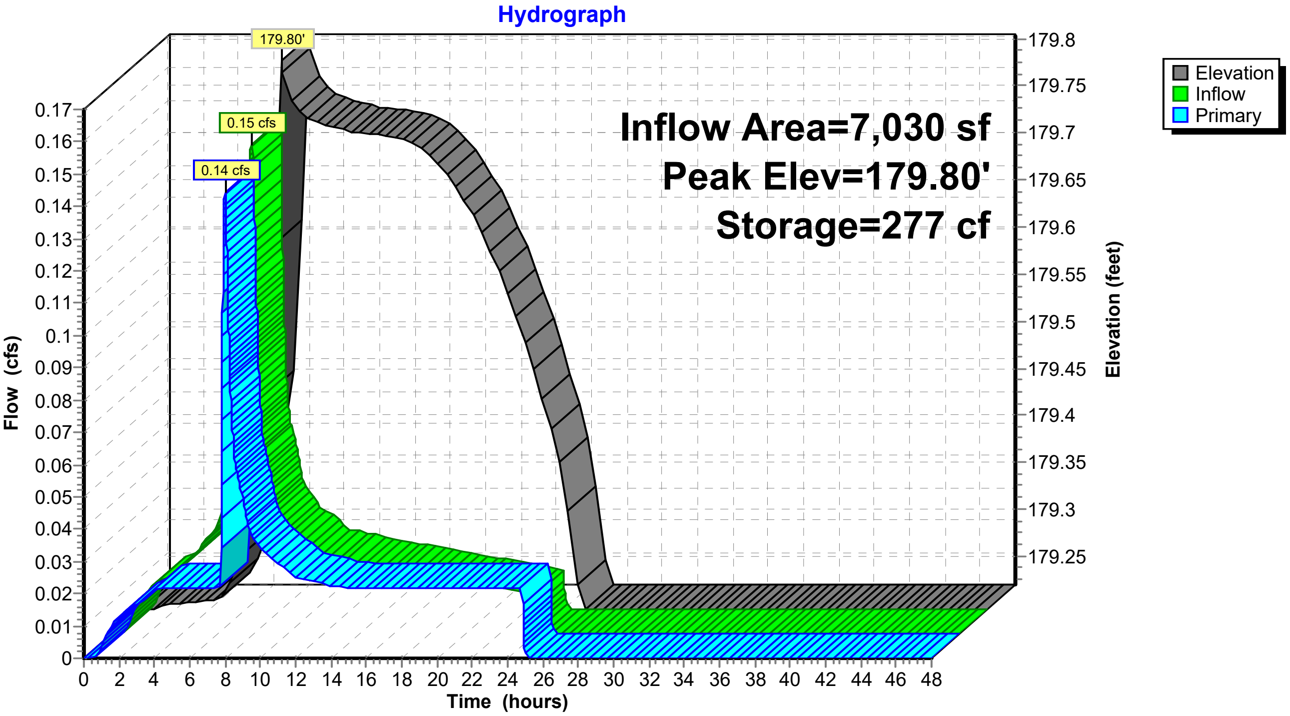
Plug-Flow detention time= 97.9 min calculated for 2,205 cf (100% of inflow)
Center-of-Mass det. time= 97.9 min (757.5 - 659.5)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	394 cf	**5.33'W x 89.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 8.00 hrs HW=179.80' TW=174.03' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.14 cfs of 1.59 cfs potential flow)
  ├─**2=Exfiltration** (Exfiltration Controls 0.02 cfs)
  └─**3=Orifice/Grate** (Weir Controls 0.12 cfs @ 0.94 fps)

Pond 2P: EASTERN FLOW THROUGH PLANTER



Summary for Pond CH: DETENTION Chamber

Inflow Area = 245,040 sf, 70.47% Impervious, Inflow Depth = 3.26" for 25 YEAR event
Inflow = 4.33 cfs @ 7.95 hrs, Volume= 66,491 cf
Outflow = 2.87 cfs @ 8.17 hrs, Volume= 66,493 cf, Atten= 34%, Lag= 12.9 min
Primary = 2.87 cfs @ 8.17 hrs, Volume= 66,493 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 174.61' @ 8.17 hrs Surf.Area= 0.054 ac Storage= 0.194 af
Flood Elev= 175.85' Surf.Area= 0.054 ac Storage= 0.216 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 60.2 min (753.7 - 693.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	169.10'	0.076 af	**20.33'W x 115.79'L x 6.75'H Field A** 0.365 af Overall - 0.135 af Embedded = 0.230 af x 33.0% Voids
#2A	169.85'	0.135 af	**ADS_StormTech MC-4500 +Cap** x 54 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 27 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
#3	168.19'	0.005 af	**15.0" Round Pipe Storage** L= 184.7' S= 0.0050 '/'
		0.216 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	168.00'	**15.0" Round Outlet Pipe** L= 40.2' Ke= 0.500 Inlet / Outlet Invert= 168.00' / 167.79' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	168.00'	**4.0" Vert. 1/2 2 Year Overflow** C= 0.600
#3	Device 1	171.90'	**5.5" Horiz. 2 Year Overflow** C= 0.600 Limited to weir flow at low heads
#4	Device 1	174.50'	**15.0" Horiz. Overflow** C= 0.600 Limited to weir flow at low heads

```
Primary OutFlow Max=2.87 cfs @ 8.17 hrs  HW=174.61'  TW=0.00'   (Dynamic Tailwater)
↑
└─1=Outlet Pipe  (Passes 2.87 cfs of 14.46 cfs potential flow)
    ↑
    ├─2=1/2 2 Year Overflow (Orifice Controls 1.07 cfs @ 12.23 fps)
    ├─3=2 Year Overflow (Orifice Controls 1.31 cfs @ 7.93 fps)
    └─4=Overflow  (Weir Controls 0.49 cfs @ 1.10 fps)
```

Pond CH: DETENTION Chamber - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf

100.0" Wide + 20.0" Spacing = 120.0" C-C Row Spacing

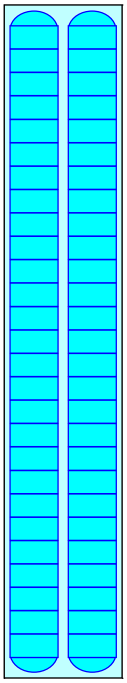
27 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 113.79' Row Length +12.0" End Stone x 2 = 115.79' Base Length
2 Rows x 100.0" Wide + 20.0" Spacing x 1 + 12.0" Side Stone x 2 = 20.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

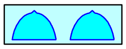
54 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 2 Rows = 5,893.3 cf Chamber Storage

15,892.4 cf Field - 5,893.3 cf Chambers = 9,999.1 cf Stone x 33.0% Voids = 3,299.7 cf Stone Storage

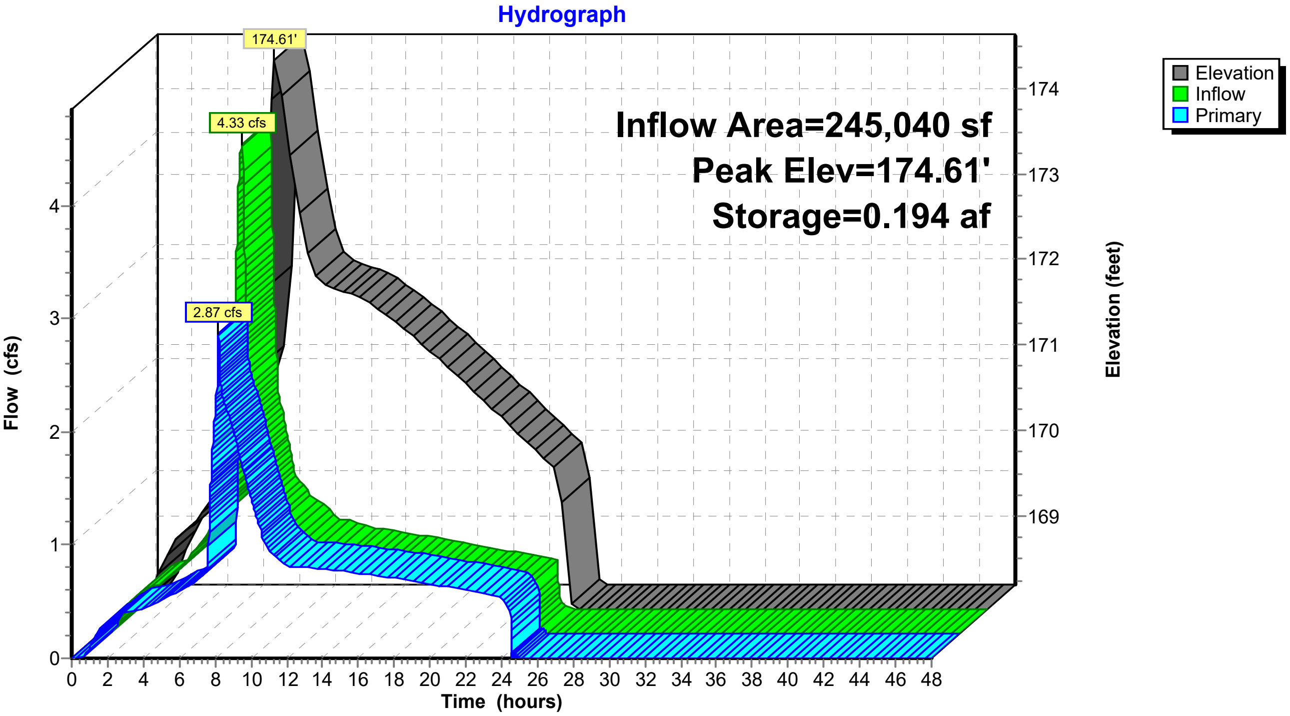
Chamber Storage + Stone Storage = 9,193.0 cf = 0.211 af
Overall Storage Efficiency = 57.8%
Overall System Size = 115.79' x 20.33' x 6.75'

54 Chambers
588.6 cy Field
370.3 cy Stone





Pond CH: DETENTION Chamber

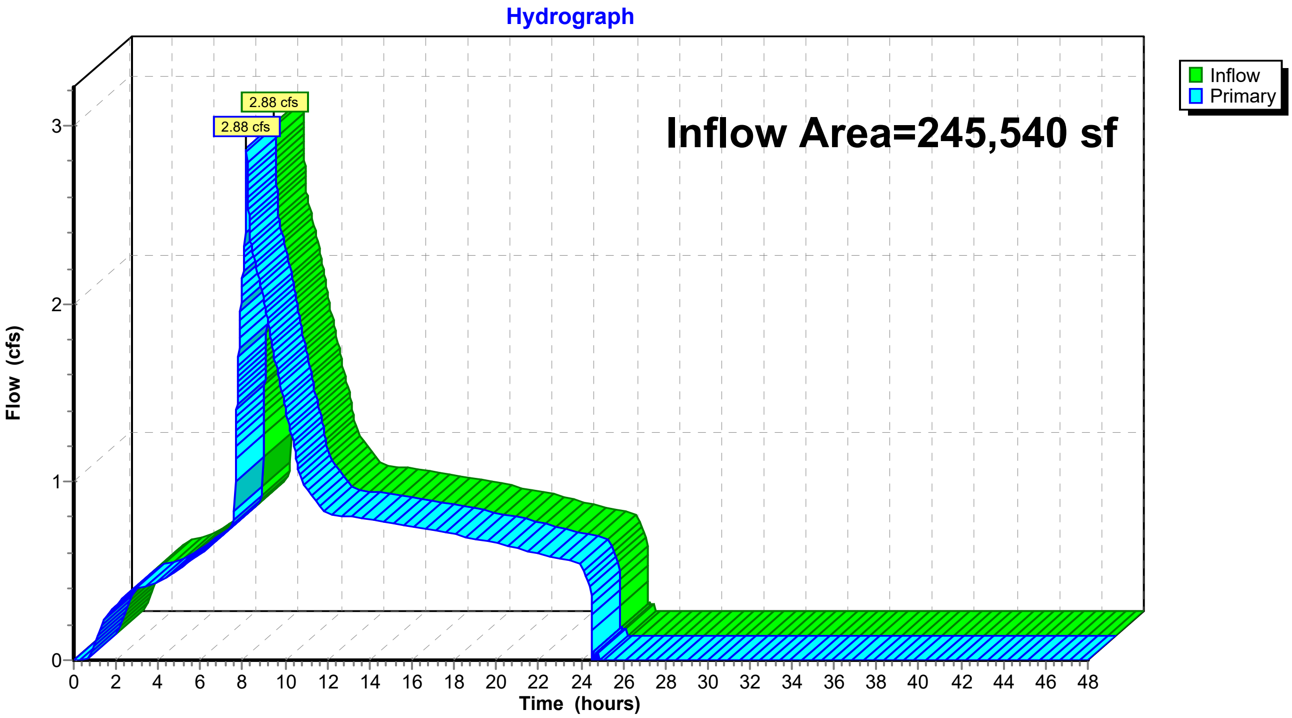


Summary for Link 1L: Total

Inflow Area = 245,540 sf, 70.53% Impervious, Inflow Depth = 3.26" for 25 YEAR event
Inflow = 2.88 cfs @ 8.17 hrs, Volume= 66,650 cf
Primary = 2.88 cfs @ 8.17 hrs, Volume= 66,650 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Summary for Subcatchment 1ES: Existing basin

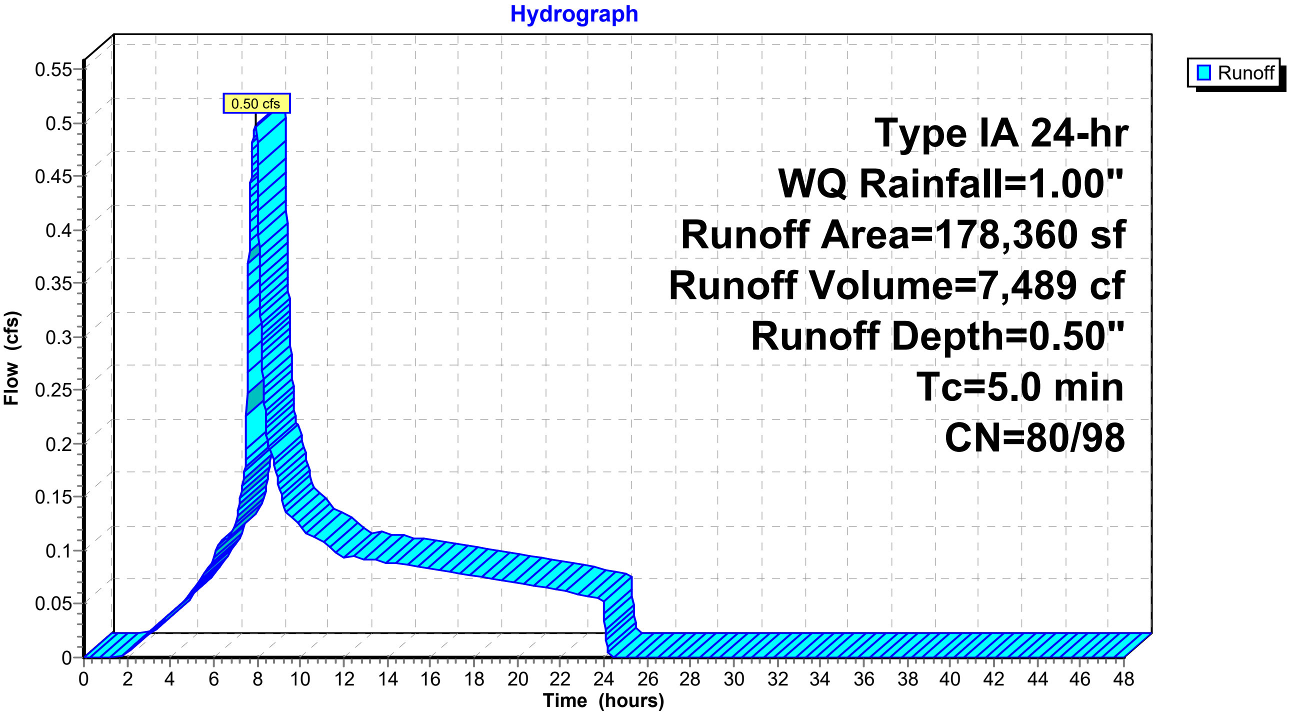
Runoff = 0.50 cfs @ 7.90 hrs, Volume= 7,489 cf, Depth= 0.50"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	106,000	98	Existing Impervious Area
	72,360	80	>75% Grass cover, Good, HSG D
	178,360	91	Weighted Average
	72,360		40.57% Pervious Area
	106,000		59.43% Impervious Area

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

Subcatchment 1ES: Existing basin



Summary for Subcatchment P1A: P1A - North Roof

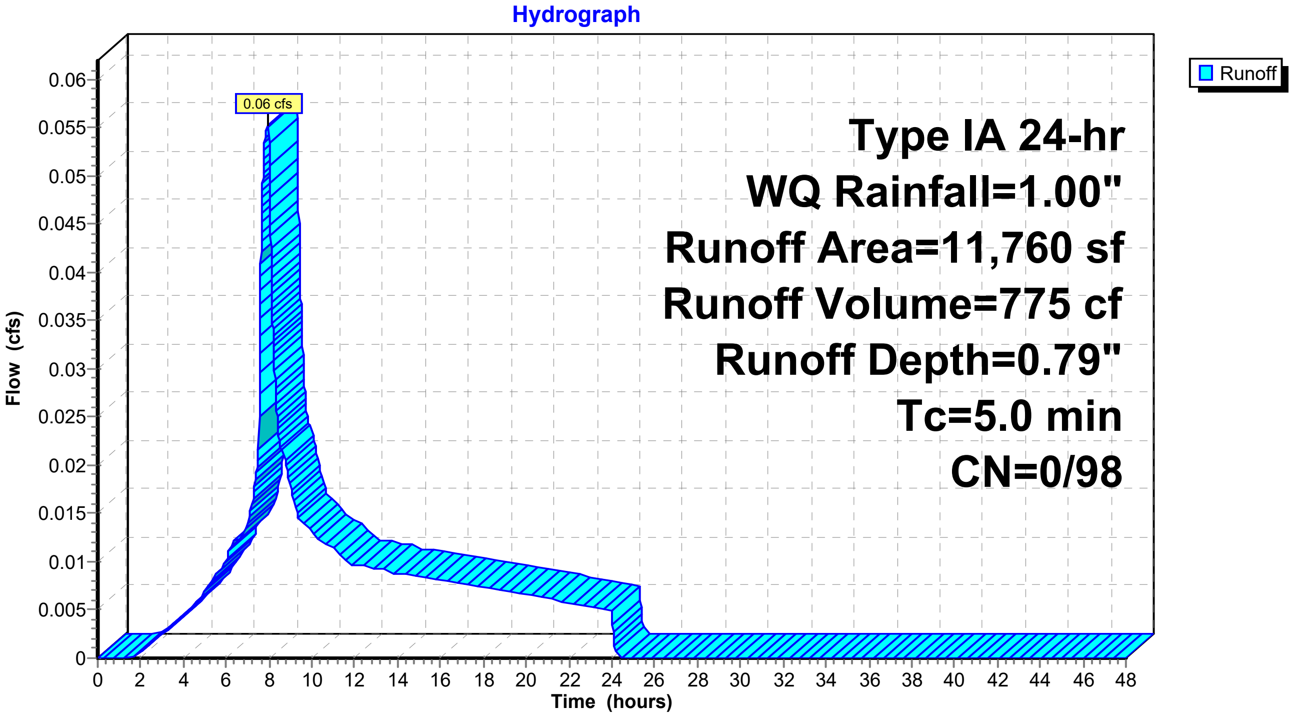
Runoff = 0.06 cfs @ 7.90 hrs, Volume= 775 cf, Depth= 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	11,760	98	Roof
	11,760		100.00% Impervious Area

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

Subcatchment P1A: P1A - North Roof



Summary for Subcatchment P1B: P1B - South Roof

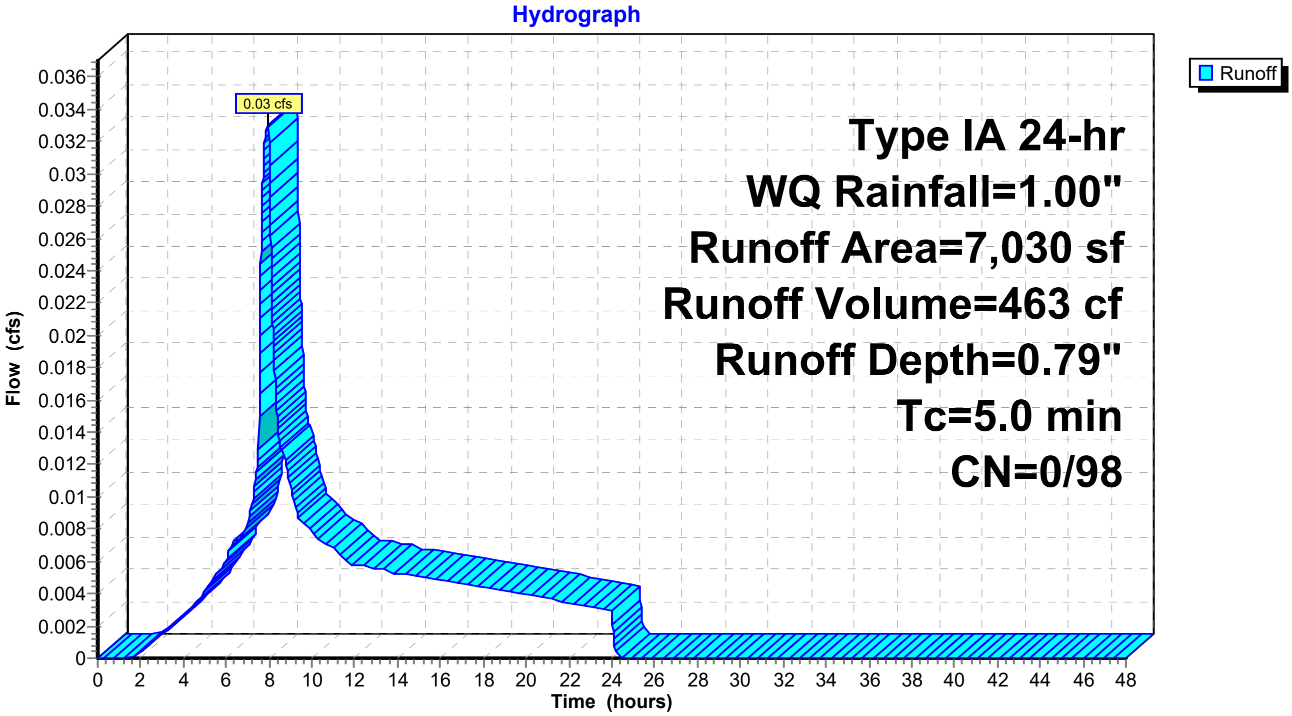
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 463 cf, Depth= 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	7,030	98	Roof
	7,030		100.00% Impervious Area

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

Subcatchment P1B: P1B - South Roof



Summary for Subcatchment P1J: Un-Detained Release

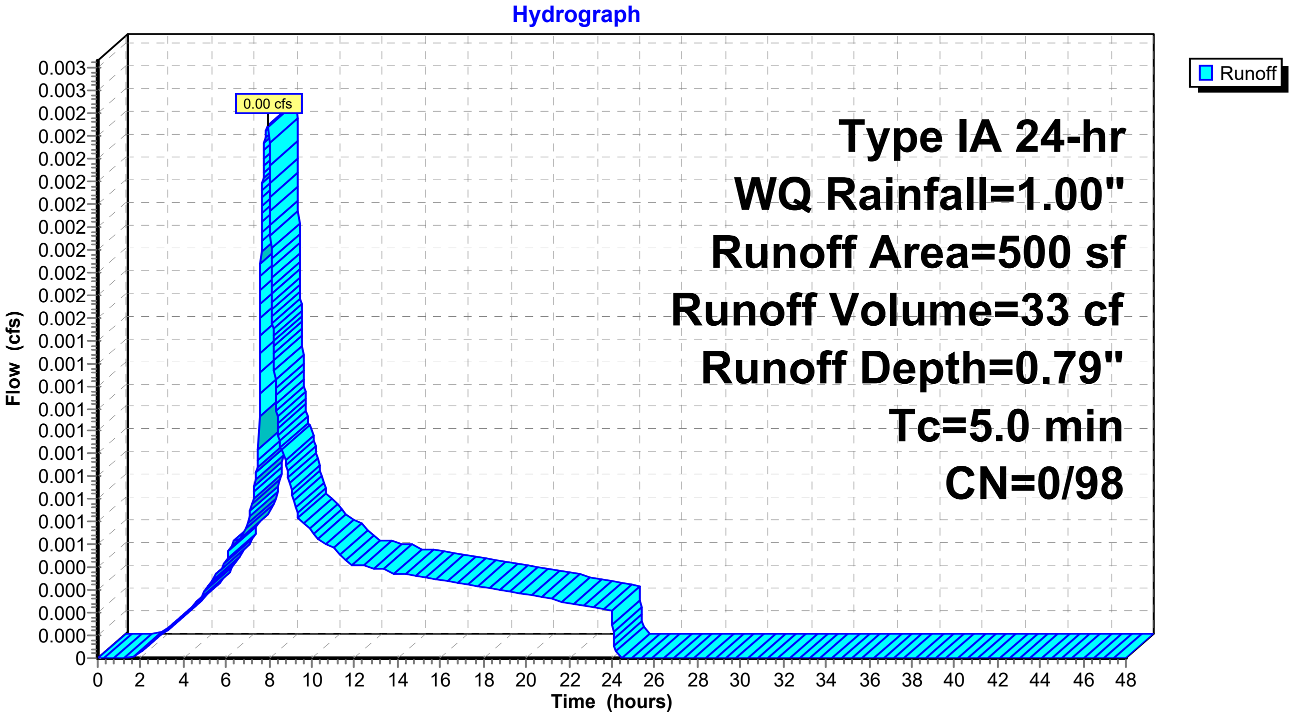
Runoff = 0.00 cfs @ 7.90 hrs, Volume= 33 cf, Depth= 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	500	98	Impervious
	500		100.00% Impervious Area

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

Subcatchment P1J: Un-Detained Release



Summary for Subcatchment PH1: Phase 1

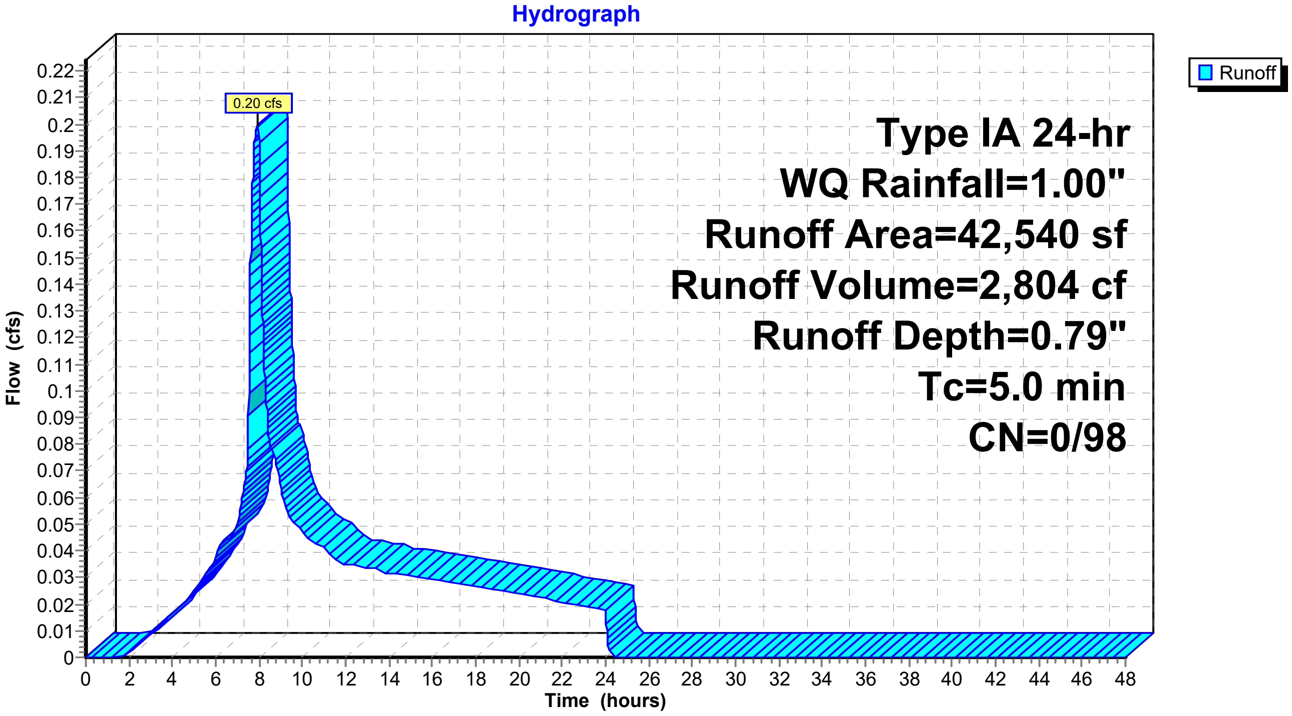
Runoff = 0.20 cfs @ 7.90 hrs, Volume= 2,804 cf, Depth= 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	1,890	98	P1C - Impervious
*	820	98	P1D - Impervious
*	14,360	98	P1E - Impervious
*	16,710	98	P1F - Impervious
*	4,970	98	P1G - Impervious
*	3,790	98	P1H - Impervious
	42,540	98	Weighted Average
	42,540		100.00% Impervious Area

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

Subcatchment PH1: Phase 1



Summary for Subcatchment PH2: Phase 2

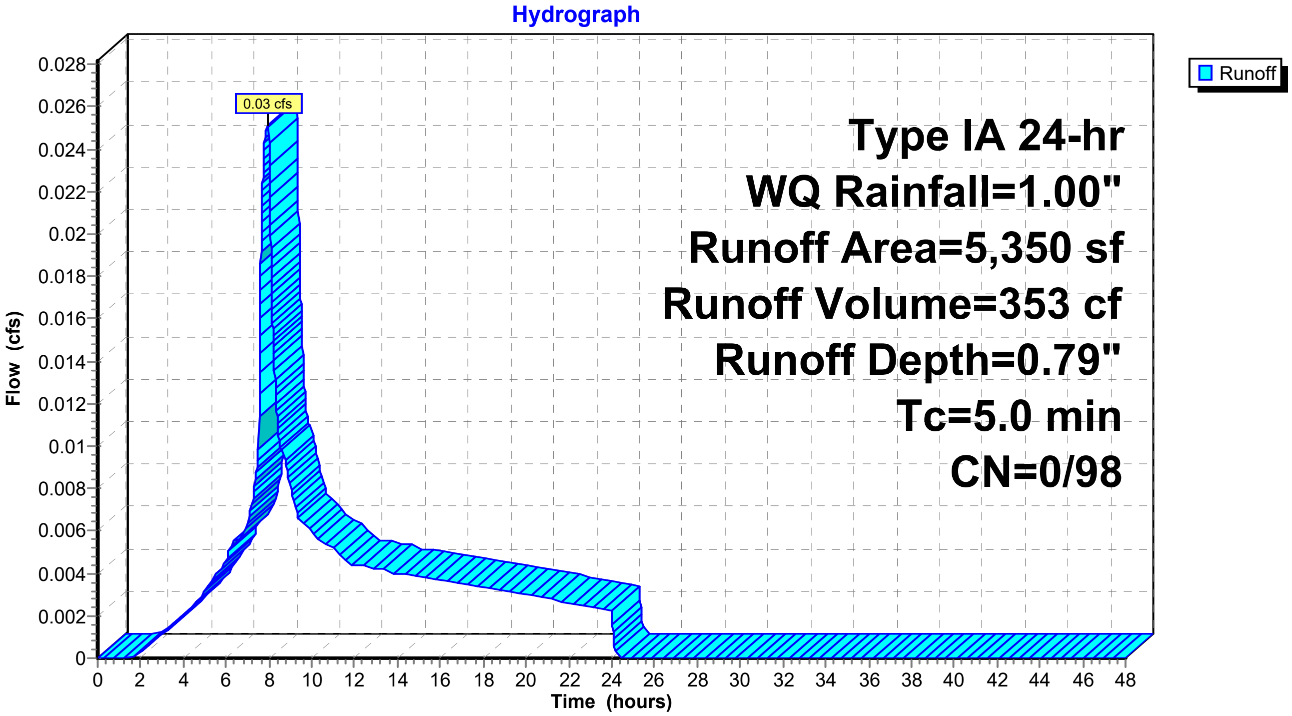
Runoff = 0.03 cfs @ 7.90 hrs, Volume= 353 cf, Depth= 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	5,350	98	P2 - Impervious
	5,350		100.00% Impervious Area

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

Subcatchment PH2: Phase 2



Summary for Pond 1P: WESTERN FLOW THROUGH PLANTER

```
Inflow Area =          11,760 sf,100.00% Impervious,  Inflow Depth =   0.79"    for  WQ event
Inflow      =      0.06 cfs @    7.90 hrs,  Volume=             775 cf
Outflow     =      0.04 cfs @    7.95 hrs,  Volume=             775 cf,  Atten= 27%,  Lag= 3.0 min
Primary     =      0.04 cfs @    7.95 hrs,  Volume=             775 cf
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.25' @ 8.10 hrs Surf.Area= 875 sf Storage= 26 cf
Flood Elev= 181.65' Surf.Area= 875 sf Storage= 726 cf

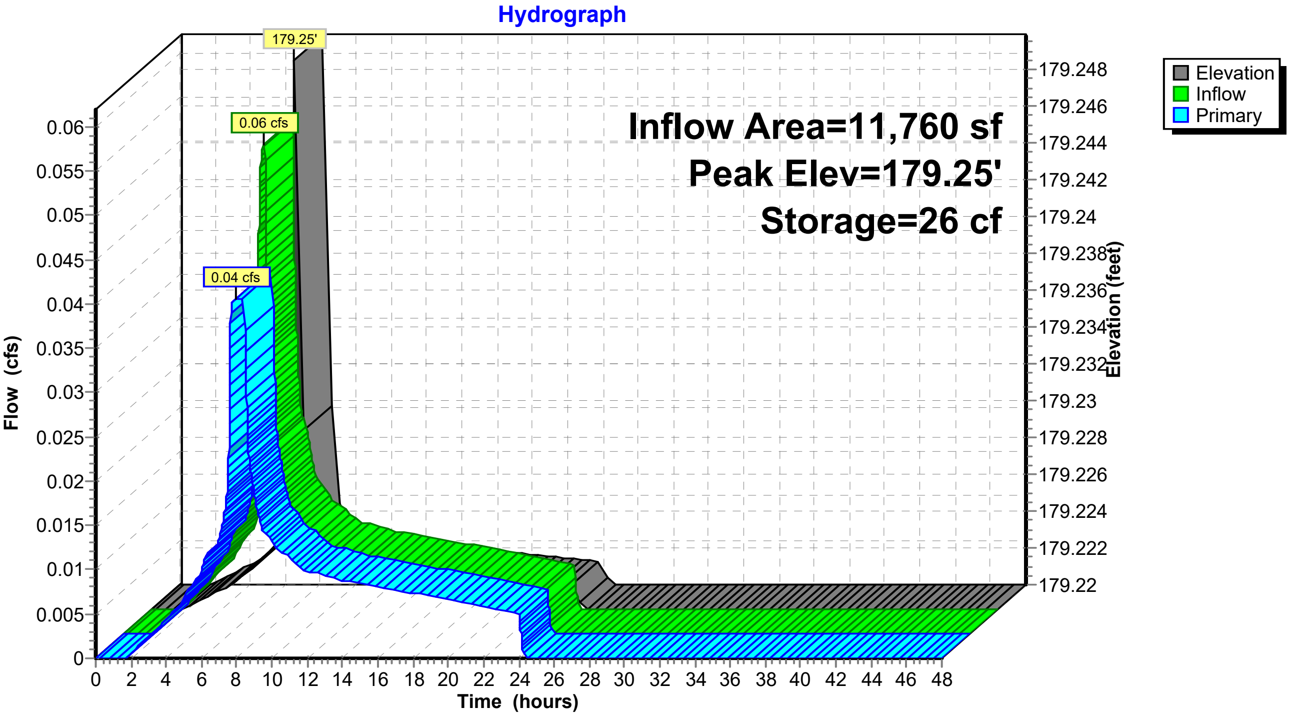
Plug-Flow detention time= 4.2 min calculated for 775 cf (100% of inflow)
Center-of-Mass det. time= 4.2 min (716.9 - 712.6)

Volume	Invert	Avail.Storage	Storage Description
#1	179.22'	726 cf	**8.25'W x 106.00'L x 0.83'H Prismatoid**

Device	Routing	Invert	Outlet Devices
#1	Primary	176.72'	**6.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 176.72' / 176.62' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf
#2	Device 1	179.22'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#3	Device 1	179.72'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

```
Primary OutFlow Max=0.04 cfs @ 7.95 hrs  HW=179.24'  TW=169.46'   (Dynamic Tailwater)
└─1=Culvert  (Passes 0.04 cfs of 1.43 cfs potential flow)
    ├─2=Exfiltration  (Exfiltration Controls 0.04 cfs)
    └─3=Orifice/Grate  ( Controls 0.00 cfs)
```

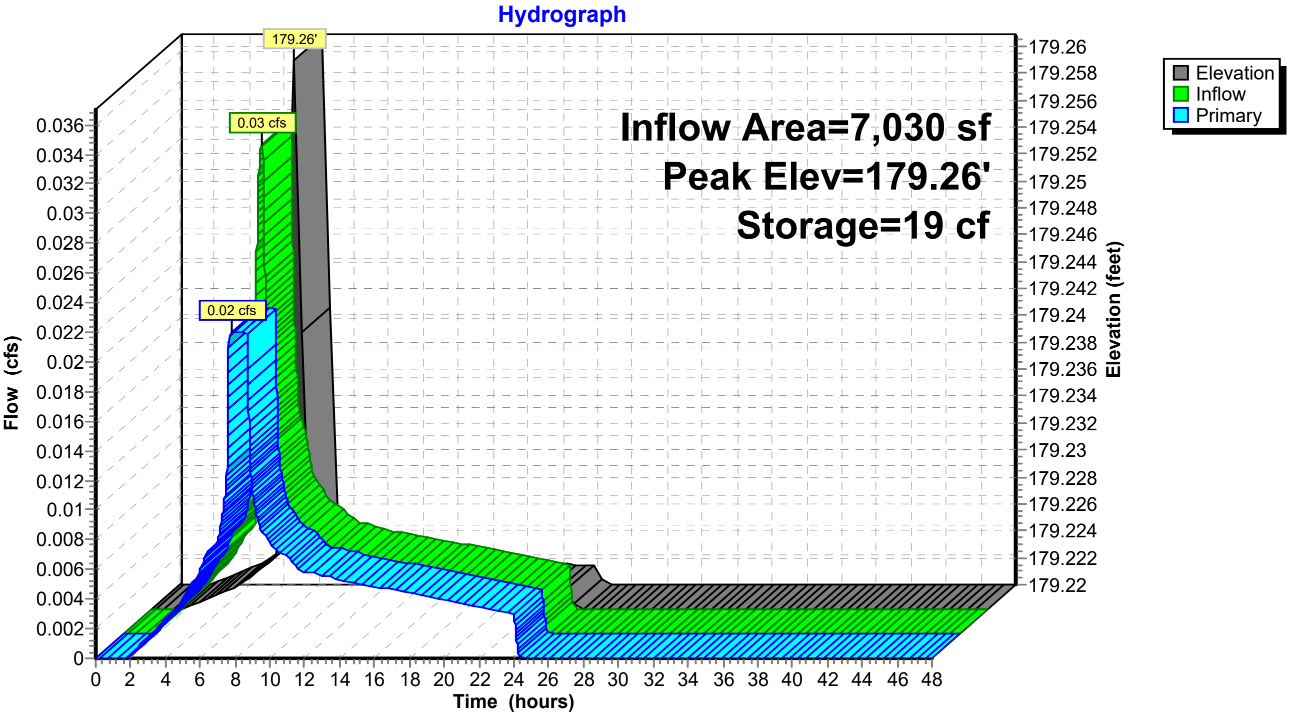
Pond 1P: WESTERN FLOW THROUGH PLANTER



Summary for Pond 2P: EASTERN FLOW THROUGH PLANTER

```
Inflow Area =          7,030 sf,100.00% Impervious,  Inflow Depth =   0.79"    for  WQ event
Inflow      =      0.03 cfs @    7.90 hrs,  Volume=              463 cf
Outflow     =      0.02 cfs @    7.78 hrs,  Volume=              463 cf,  Atten= 34%,  Lag= 0.0 min
Primary     =      0.02 cfs @    7.78 hrs,  Volume=              463 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 179.26' @ 8.14 hrs   Surf.Area= 474 sf   Storage= 19 cf
Flood Elev= 181.00'   Surf.Area= 474 sf   Storage= 394 cf

Plug-Flow detention time= 4.8 min calculated for 463 cf (100% of inflow)
Center-of-Mass det. time= 4.8 min ( 717.4 - 712.6 )

Volume      Invert   Avail.Storage   Storage Description
   #1      179.22'          394 cf   5.33'W x 89.00'L x 0.83'H Prismatoid

Device   Routing          Invert   Outlet Devices
   #1    Primary         176.72'   6.0"  Round Culvert  L= 10.0'   Ke= 0.500
                                   Inlet / Outlet Invert= 176.72' / 176.62'   S= 0.0100 '/'   Cc= 0.900
                                   n= 0.013,  Flow Area= 0.20 sf
   #2    Device 1        179.22'   2.000 in/hr Exfiltration over Surface area   Phase-In= 0.01'
   #3    Device 1        179.72'   6.0" Horiz. Orifice/Grate   C= 0.600   Limited to weir flow at low heads

Primary OutFlow Max=0.02 cfs @ 7.78 hrs  HW=179.24'  TW=169.26'   (Dynamic Tailwater)
↑
└─1=Culvert  (Passes 0.02 cfs of 1.42 cfs potential flow)
    ↑
    ├─2=Exfiltration  (Exfiltration Controls 0.02 cfs)
    └─3=Orifice/Grate  ( Controls 0.00 cfs)
```

Pond 2P: EASTERN FLOW THROUGH PLANTER



Summary for Pond CH: DETENTION Chamber

Inflow Area = 245,040 sf, 70.47% Impervious, Inflow Depth = 0.58" for WQ event
Inflow = 0.79 cfs @ 7.90 hrs, Volume= 11,884 cf
Outflow = 0.50 cfs @ 8.19 hrs, Volume= 11,884 cf, Atten= 36%, Lag= 17.3 min
Primary = 0.50 cfs @ 8.19 hrs, Volume= 11,884 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 169.59' @ 8.19 hrs Surf.Area= 0.058 ac Storage= 0.013 af
Flood Elev= 175.85' Surf.Area= 0.054 ac Storage= 0.216 af

Plug-Flow detention time= 2.9 min calculated for 11,884 cf (100% of inflow)
Center-of-Mass det. time= 2.9 min (729.9 - 727.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	169.10'	0.076 af	**20.33'W x 115.79'L x 6.75'H Field A** 0.365 af Overall - 0.135 af Embedded = 0.230 af x 33.0% Voids
#2A	169.85'	0.135 af	**ADS_StormTech MC-4500 +Cap** x 54 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 27 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
#3	168.19'	0.005 af	**15.0" Round Pipe Storage** L= 184.7' S= 0.0050 '/'
		0.216 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	168.00'	**15.0" Round Outlet Pipe** L= 40.2' Ke= 0.500 Inlet / Outlet Invert= 168.00' / 167.79' S= 0.0052 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	168.00'	**4.0" Vert. 1/2 2 Year Overflow** C= 0.600
#3	Device 1	171.90'	**5.5" Horiz. 2 Year Overflow** C= 0.600 Limited to weir flow at low heads
#4	Device 1	174.50'	**15.0" Horiz. Overflow** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.50 cfs @ 8.19 hrs HW=169.59' TW=0.00' (Dynamic Tailwater)
↑—**1=Outlet Pipe** (Passes 0.50 cfs of 5.00 cfs potential flow)
 ↑—**2=1/2 2 Year Overflow** (Orifice Controls 0.50 cfs @ 5.75 fps)
 —**3=2 Year Overflow** (Controls 0.00 cfs)
 —**4=Overflow** (Controls 0.00 cfs)

Pond CH: DETENTION Chamber - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf

100.0" Wide + 20.0" Spacing = 120.0" C-C Row Spacing

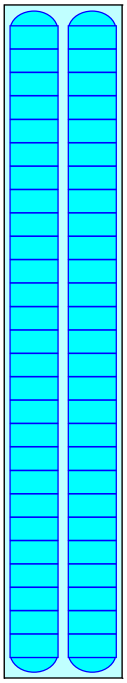
27 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 113.79' Row Length +12.0" End Stone x 2 = 115.79' Base Length
2 Rows x 100.0" Wide + 20.0" Spacing x 1 + 12.0" Side Stone x 2 = 20.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

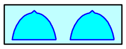
54 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 2 Rows = 5,893.3 cf Chamber Storage

15,892.4 cf Field - 5,893.3 cf Chambers = 9,999.1 cf Stone x 33.0% Voids = 3,299.7 cf Stone Storage

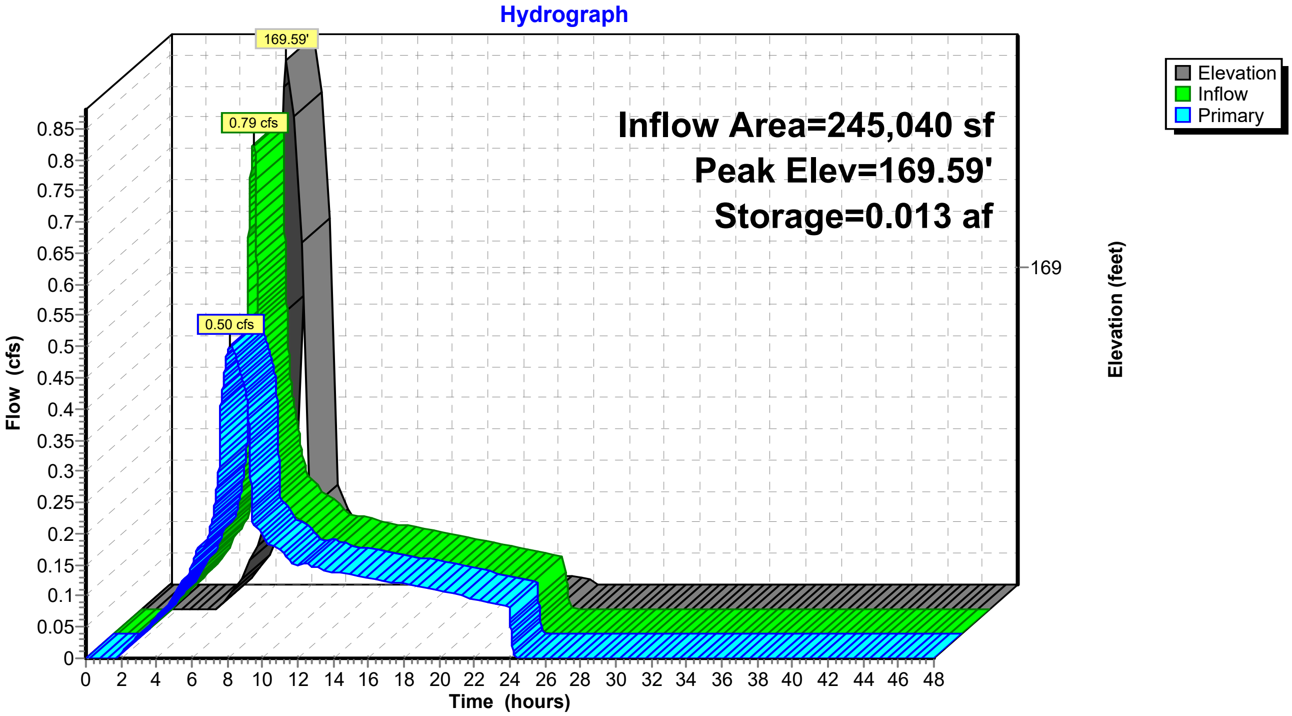
Chamber Storage + Stone Storage = 9,193.0 cf = 0.211 af
Overall Storage Efficiency = 57.8%
Overall System Size = 115.79' x 20.33' x 6.75'

54 Chambers
588.6 cy Field
370.3 cy Stone





Pond CH: DETENTION Chamber

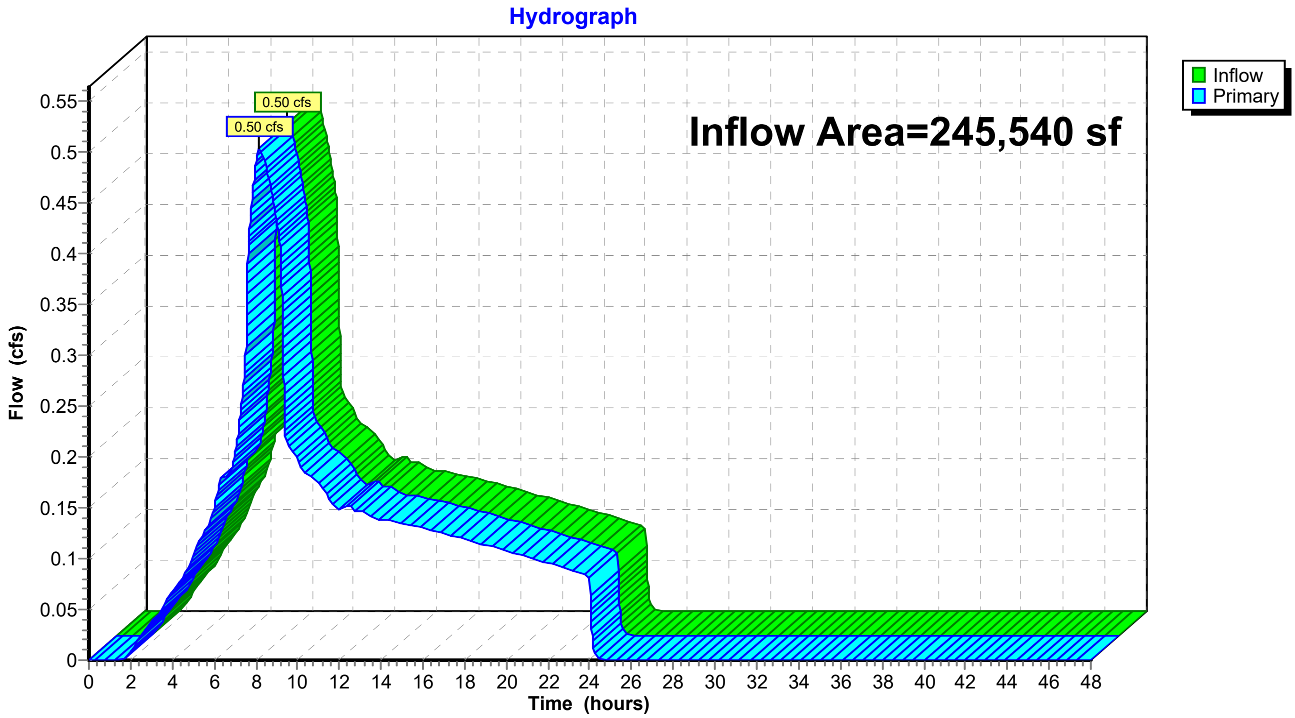


Summary for Link 1L: Total

Inflow Area = 245,540 sf, 70.53% Impervious, Inflow Depth = 0.58" for WQ event
Inflow = 0.50 cfs @ 8.18 hrs, Volume= 11,916 cf
Primary = 0.50 cfs @ 8.18 hrs, Volume= 11,916 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Appendix B: Water Quality Facility Calculations and Details

AKS ENGINEERING & FORESTRY, LLC.
12965 SW HERMAN ROAD, SUITE 100
TUALATIN, OR 97062
503-563-6151

Date: 12/17/2020
Designed by: AMC
Checked by: CEG

<u>Friendsview Residential Care Facility - Phase 1</u>

StormFilter Catch Basin Sizing

<u>STORMFILTER® DESIGN PARAMETERS</u>

Number of Cartridges Required:

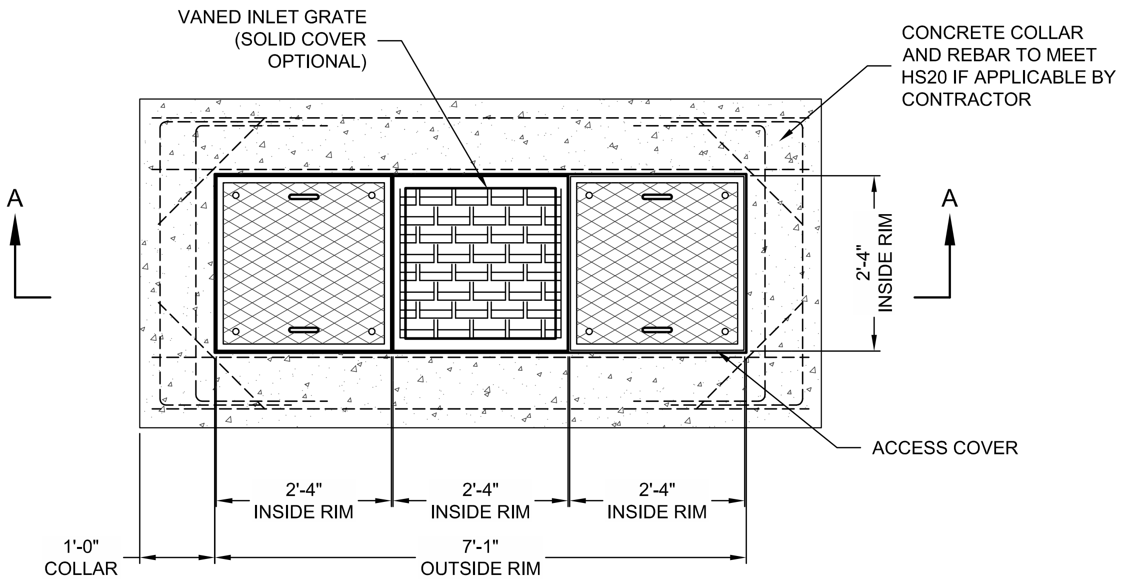
$N=Q_{treat}\,(449_{gpm/cfs}\ /\ Q_{cart\ gpm/cart})$

Q_{treat} = Water Quality Volume (WQV)

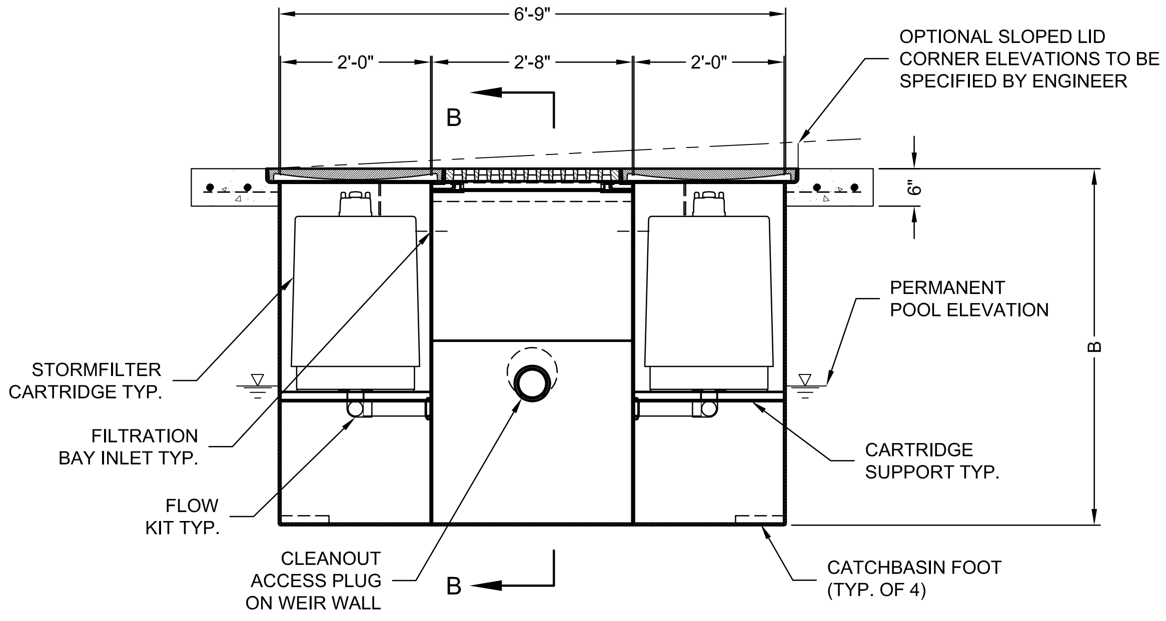
$Q_{cart\ gpm/cart}$ = Treatment per Cartridge = 22.5 $_{gpm/cart}$

StormFilter Catchbasin Sizing

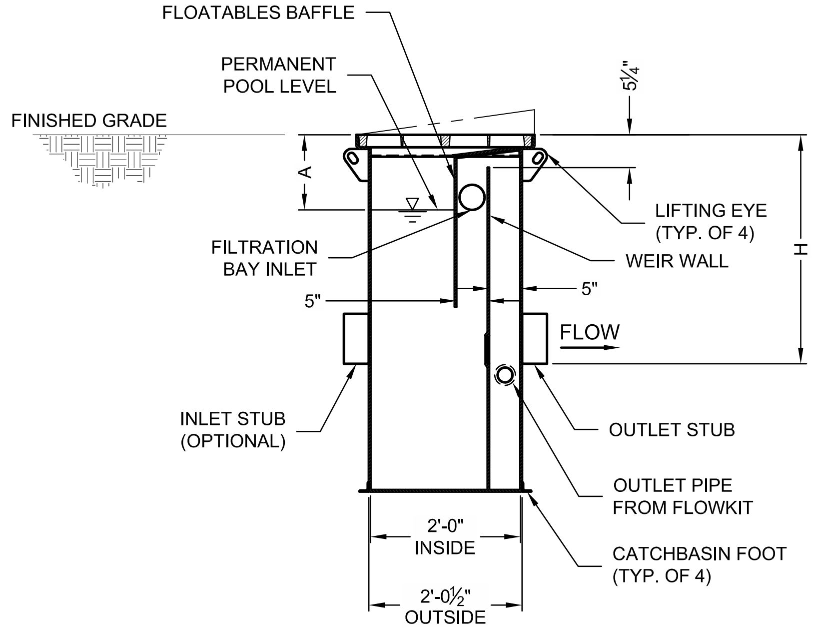
Area Requiring Treatment	14,360	SF	
WQV	945	FT^3	
WQF	0.070	CFS	
Cartridge Required	$N=Q_{treat}\,(449_{gpm/cfs}\ /\ Q_{cart\ gpm/cart})$		$N=Q_{treat}\,(449_{gpm/cfs}\ /\ 22.5_{cart\ gpm/cart})$
	N= 1.40	cart	2 SINGLE CARTRIDGE STORMFILTER



PLAN VIEW



SECTION A-A



SECTION B-B

The Stormwater Management StormFilter®

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,322,629; 5,524,576; 5,707,527; 5,985,157; 6,027,639; 6,649,048; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

STORMFILTER STEEL CATCHBASIN DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. 2 CARTRIDGE CATCHBASIN HAS A MAXIMUM OF TWO CARTRIDGES. SYSTEM IS SHOWN WITH A 27" CARTRIDGE, AND IS ALSO AVAILABLE WITH AN 18" CARTRIDGE. STORMFILTER CATCHBASIN CONFIGURATIONS ARE AVAILABLE WITH A DRY INLET BAY FOR VECTOR CONTROL.
PEAK HYDRAULIC CAPACITY PER TABLE BELOW. IF THE SITE CONDITIONS EXCEED PEAK HYDRAULIC CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			18" DEEP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			3.3'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	15	12.53	7.5
PEAK HYDRAULIC CAPACITY	1.0			1.0			1.8		
INLET PERMANENT POOL LEVEL (A)	1'-0"			1'-0"			2'-0"		
OVERALL STRUCTURE HEIGHT (B)	4'-9"			3'-9"			4'-9"		

* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STORMFILTER CATCHBASIN STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. WWW.CONTECHES.COM
3. STORMFILTER CATCHBASIN WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
4. INLET SHOULD NOT BE LOWER THAN OUTLET. INLET (IF APPLICABLE) AND OUTLET PIPING TO BE SPECIFIED BY ENGINEER AND PROVIDED BY CONTRACTOR.
5. MANUFACTURER TO APPLY A SURFACE BEAD WELD IN THE SHAPE OF THE LETTER "O" ABOVE THE OUTLET PIPE STUB ON THE EXTERIOR SURFACE OF THE STEEL SFCB.
6. STORMFILTER CATCHBASIN EQUIPPED WITH 4 INCH (APPROXIMATE) LONG STUBS FOR INLET (IF APPLICABLE) AND OUTLET PIPING. STANDARD OUTLET STUB IS 8 INCHES IN DIAMETER. MAXIMUM OUTLET STUB IS 15 INCHES IN DIAMETER. CONNECTION TO COLLECTION PIPING CAN BE MADE USING FLEXIBLE COUPLING BY CONTRACTOR.
7. STEEL STRUCTURE TO BE MANUFACTURED OF 1/4 INCH STEEL PLATE. CASTINGS SHALL MEET AASHTO M306 LOAD RATING. TO MEET HS20 LOAD RATING ON STRUCTURE, A CONCRETE COLLAR IS REQUIRED. WHEN REQUIRED, CONCRETE COLLAR WITH #4 REINFORCING BARS TO BE PROVIDED BY CONTRACTOR.
8. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
9. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

INSTALLATION NOTES

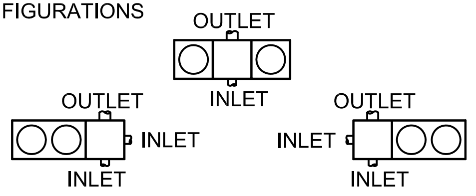
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CATCHBASIN (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

2-CARTRIDGE DEEP CATCHBASIN STORMFILTER DATA

STRUCTURE ID	XXX
WATER QUALITY FLOW RATE (cfs)	X.XX
PEAK FLOW RATE (<1.8 cfs)	X.XX
RETURN PERIOD OF PEAK FLOW (yrs)	XXX
CARTRIDGE FLOW RATE (gpm)	XX
MEDIA TYPE (PERLITE, ZPG, PSORB)	XXXXX
RIM ELEVATION	XXX.XX'

PIPE DATA:	I.E.	DIAMETER
INLET STUB	XXX.XX'	XX"
OUTLET STUB	XXX.XX'	XX"

CONFIGURATIONS



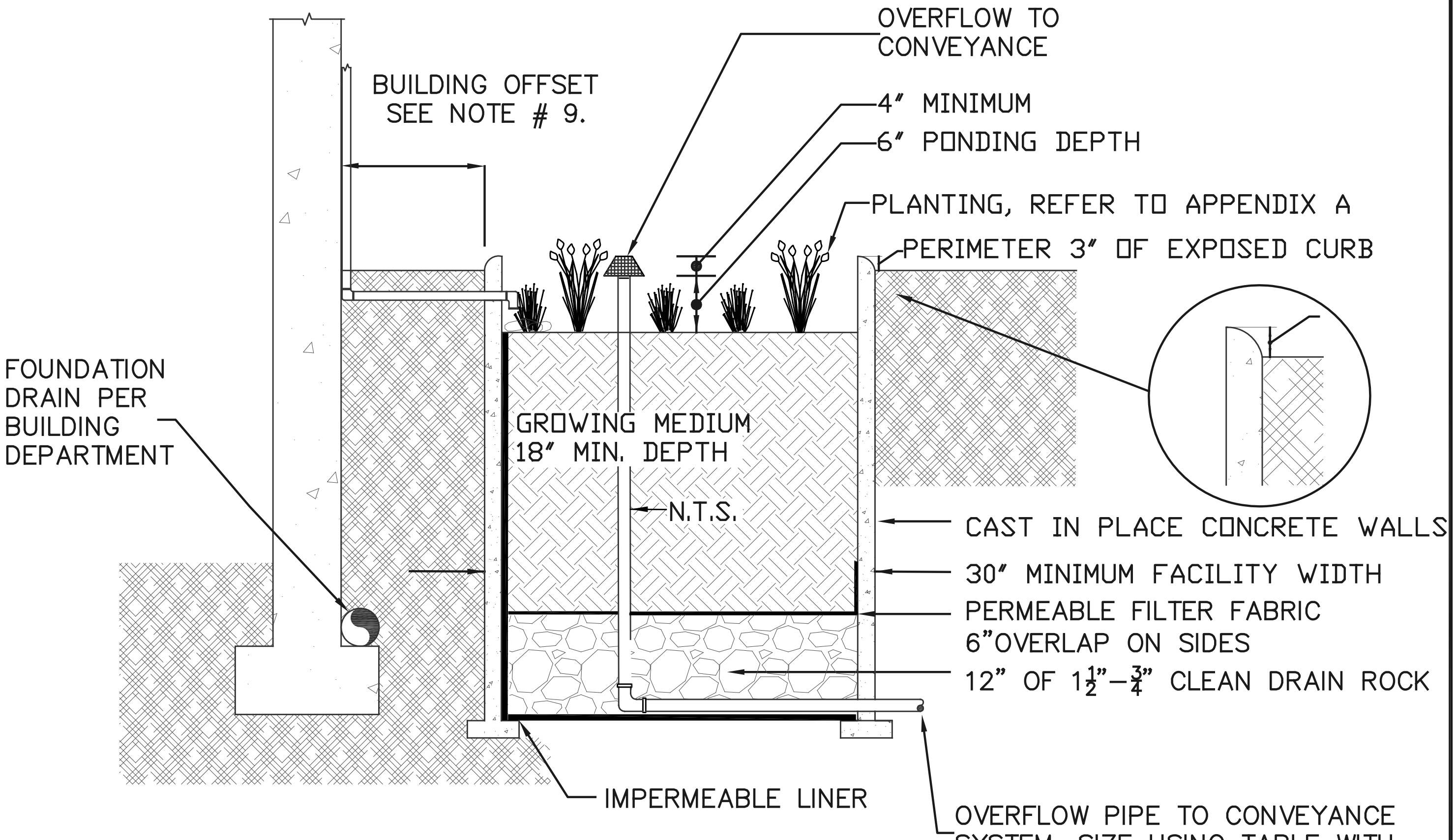
SLOPED LID	YES\NO
SOLID COVER	YES\NO

NOTES/SPECIAL REQUIREMENTS:

CONTECH®
ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-526-3999 513-645-7000 513-645-7993 FAX

2 CARTRIDGE CATCHBASIN
STORMFILTER
STANDARD DETAIL

PRIVATE/ PUBLIC WATER QUALITY & QUANTITY TREATMENT



NOTES:

1. MAXIMUM SLOPE OF PLANTER 0.5%.
2. NO TREES OR DEEP ROOTED VEGETATION OVER PIPING IS ALLOWED IN FACILITY.
3. STORM PIPING TO FACILITY THROUGH WALL CORE HOLES, MAINTAIN MAXIMUM DISTANCE FROM THE OVERFLOW PIPE AS POSSIBLE.
4. PRIVATE OVERFLOW PIPE TO BE MINIMUM SPECIFIED IN PLUMBING CODE, SEE TABLE. PUBLIC FACILITIES SHALL BE SIZED TO CONVEY THE 25 YEAR STORM.
5. ENERGY DISSIPATERS REQUIRED AT WATER ENTRANCES MINIMUM 18"X18"X6" OF 4 TO 6 INCH ANGULAR RIPRAP.
6. PERMEABLE FILTER FABRIC REQUIRED BETWEEN LAYERS
7. IMPERMEABLE LINER REQUIRED AT FACILITY BOTTOM AND ON WALLS ADJACENT TO STRUCTURES (AS SHOWN).
8. "PARTIAL" INFILTRATION FACILITIES ARE ENCOURAGED. IMPERMEABLE LINER LOCATED AT FACILITY BOTTOM, MAY BE REMOVED FOR "PARTIAL" INFILTRATION, APPROVAL BY DESIGN PROFESSIONAL AND BUILDING DEPARTMENT REQUIRED.
9. BUILDING OFFSET REQUIRED ONLY WHEN INFILTRATING, 10 FT MINIMUM.
10. MUST BE LOCATED A MINIMUM OF 3 FT FROM ADJACENT PROPERTY LINE.

OVERFLOW PIPE SIZE (1/8 in./ft. SLOPE)

MAX PROJECT ROOF AREA (ft.)	OVERFLOW PIPE SIZE (in.)
822	3
1,880	4
3,340	6

OVERFLOW PIPE SIZE (1/4 in./ft. SLOPE)

MAX PROJECT ROOF AREA (ft.)	OVERFLOW PIPE SIZE (in.)
1,160	3
2,650	4
4,720	6

City of Newberg

PUBLIC WORKS ENGINEERING DIVISION
414 E. FIRST STREET NEWBERG, OR 97132
PHONE: 503-537-1240
FAX: 503-537-1277

REVISIONS:

FLOW THROUGH PLANTER

SCALE: N.T.S.
DATE: MARCH 2014
APPROVED BY: JAY H.
STANDARD DRAWING 452

Appendix C: USDA/NRCS Soil Resource Report

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

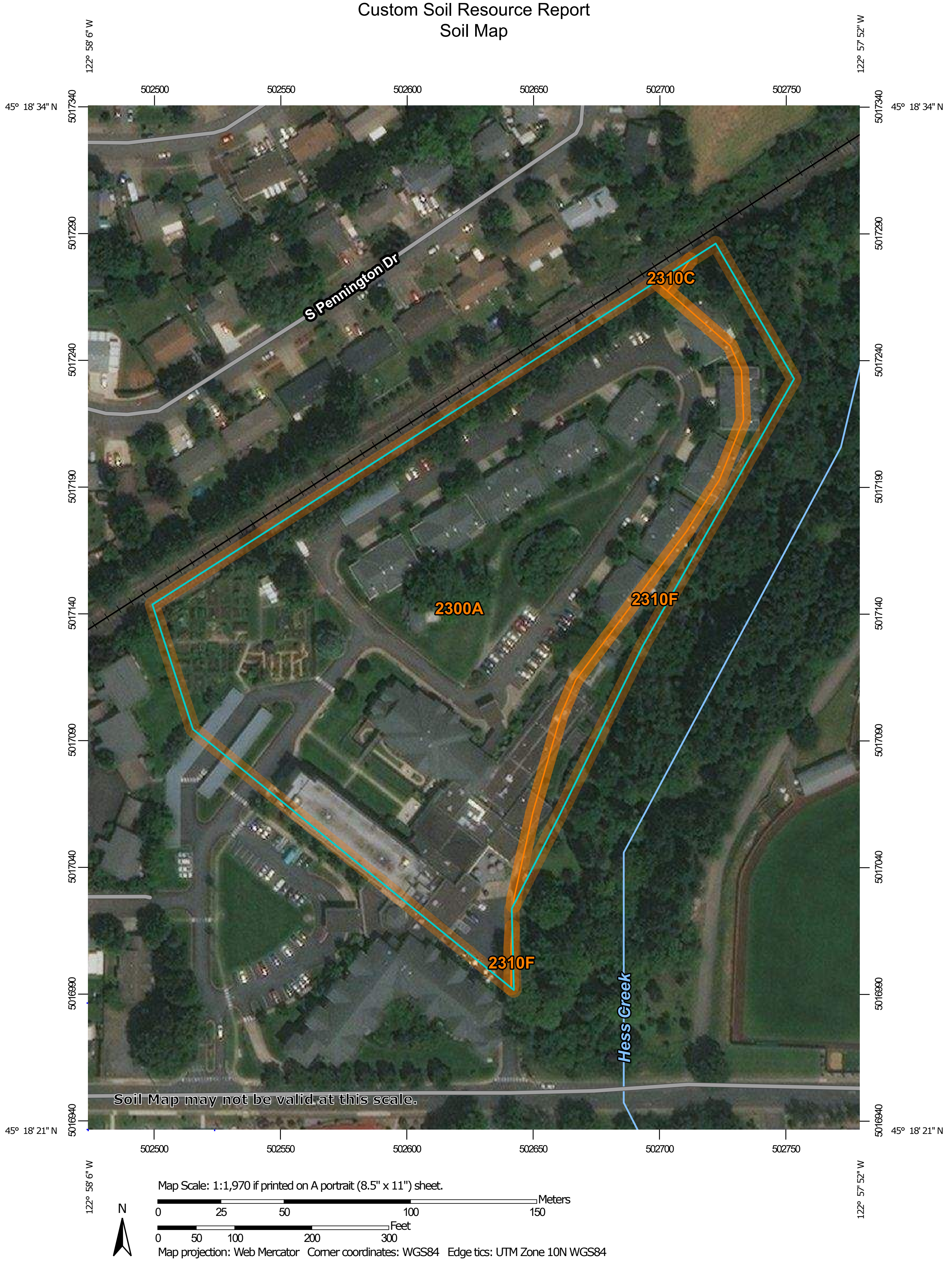
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Yamhill County, Oregon

September 18, 2020

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,970 if printed on A portrait (8.5" x 11") sheet.

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

Yamhill County, Oregon

2300A—Aloha silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1j8b0
Elevation: 100 to 350 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Aloha and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aloha

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy glaciolacustrine deposits

Typical profile

Ap - 0 to 8 inches: silt loam
BA - 8 to 15 inches: silt loam
Bt - 15 to 22 inches: silt loam
Bw1 - 22 to 31 inches: silt loam
Bw2 - 31 to 46 inches: silt loam
Bw3 - 46 to 60 inches: silt loam
C - 60 to 65 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 8 to 15 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Forage suitability group: Somewhat Poorly Drained (G002XY005OR)
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Willamette

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

2310C—Woodburn silt loam, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: 1j8b5
Elevation: 100 to 350 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodburn and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam

2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Amity

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Other vegetative classification: Somewhat Poorly Drained (G002XY005OR)
Hydric soil rating: No

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

2310F—Woodburn silt loam, 20 to 55 percent slopes

Map Unit Setting

National map unit symbol: 1j8b7
Elevation: 100 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days

Farmland classification: Not prime farmland

Map Unit Composition

Woodburn and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 20 to 55 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Yamhill County, Oregon

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
2300A—Aloha silt loam, 0 to 3 percent slopes														
Aloha	96	C/D	0-8	Silt loam	ML, CL, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	95-100-100	95-97-100	85-85-95	25-35-40	5-9 -15
			8-15	Loam, silt loam	ML, CL-ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	95-100-100	95-97-100	75-85-95	25-35-40	5-9 -15
			15-22	Silt loam, loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-97-100	75-85-95	30-36-40	10-13-15
			22-31	Silt loam, loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	75-82-95	30-36-40	10-13-15
			31-46	Loam, silt loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-98-100	65-82-95	30-36-40	10-13-15
			46-60	Silt loam, loam	CL-ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-98-100	65-80-95	25-30-40	5-10-15
			60-65	Silt loam, loam, very fine sandy loam	CL, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-97-100	60-64-95	25-28-40	5-8 -15

Engineering Properties–Yamhill County, Oregon

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
2310C—Woodburn silt loam, 3 to 12 percent slopes														
Woodburn	93	C	0-9	Silt loam	CL, ML	A-6, A-4	0- 0- 0	0- 0- 0	95-99-100	95-98-100	95-97-100	85-94-100	30-36-40	5-11-15
			9-17	Silt loam	ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	95-99-100	95-98-100	95-97-100	85-94-100	30-36-40	5-11-15
			17-25	Silty clay loam, silt loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-38-45	10-15-20
			25-32	Silty clay loam, silt loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-38-45	10-15-20
			32-39	Silt loam, silty clay loam	CL	A-7, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-36-45	10-14-20
			39-54	Silt loam, silty clay loam	CL	A-7, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-36-45	10-14-20
			54-68	Silt loam, silty clay loam	CL, CL-ML	A-6, A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	80-90-100	25-35-40	5-11-15
			68-80	Stratified fine sandy loam to silt loam	ML, SM	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	70-92-100	40-60-90	20-28-35	NP-5-10
			80-92	Stratified fine sandy loam to silt loam	ML, SM	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	70-92-100	40-51-90	20-28-35	NP-5-10

Engineering Properties–Yamhill County, Oregon															
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
2310F—Woodburn silt loam, 20 to 55 percent slopes														
Woodburn	100	C	0-9	Silt loam	ML, CL	A-4, A-6	0- 0- 0	0- 0- 0	95-99-100	95-98-100	95-97-100	85-94-100	30-36-40	5-11-15
			9-17	Silt loam	ML, CL	A-6, A-4	0- 0- 0	0- 0- 0	95-99-100	95-98-100	95-97-100	85-94-100	30-36-40	5-11-15
			17-25	Silt loam, silty clay loam	CL	A-7, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-38-45	10-15-20
			25-32	Silt loam, silty clay loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-38-45	10-15-20
			32-39	Silt loam, silty clay loam	CL	A-7, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-36-45	10-14-20
			39-54	Silt loam, silty clay loam	CL	A-7, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-99-100	90-97-100	30-36-45	10-14-20
			54-68	Silt loam, silty clay loam	CL-ML, CL	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	80-90-100	25-35-40	5-11-15
			68-80	Stratified fine sandy loam to silt loam	ML, SM	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	70-92-100	40-60-90	20-28-35	NP-5-10
			80-92	Stratified fine sandy loam to silt loam	SM, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	70-92-100	40-51-90	20-28-35	NP-5-10

Appendix D: TR-55 Runoff Curve Numbers

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

---

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Appendix E: Operations and Maintenance Plan

OPERATION AND MAINTENANCE

CatchBasin StormFilter™

Important: These guidelines should be used as a part of your site stormwater plan.

Overview

The CatchBasin StormFilter™ (CBSF) consists of a multi-chamber steel, concrete, or plastic catch basin unit that can contain up to four StormFilter cartridges. The steel CBSF is offered both as a standard and as a deep unit.

The CBSF is installed flush with the finished grade and is applicable for both constrained lot and retrofit applications. It can also be fitted with an inlet pipe for roof leaders or similar applications.

The CBSF unit treats peak water quality design flows up to 0.13 cfs, coupled with an internal weir overflow capacity of 1.0 cfs for the standard unit, and 1.8 cfs for the deep steel and concrete units. Plastic units have an internal weir overflow capacity of 0.5 cfs.

Design Operation

The CBSF is installed as the primary receiver of runoff, similar to a standard, grated catch basin. The steel and concrete CBSF units have an H-20 rated, traffic bearing lid that allows the filter to be installed in parking lots, and for all practical purposes, takes up no land area. Plastic units can be used in landscaped areas and for other non-traffic-bearing applications.

The CBSF consists of a sumped inlet chamber and a cartridge chamber(s). Runoff enters the sumped inlet chamber either by sheet flow from a paved surface or from an inlet pipe discharging directly to the unit vault. The inlet chamber is equipped with an internal baffle, which traps debris and floating oil and grease, and an overflow weir. While in the inlet chamber, heavier solids are allowed to settle into the deep sump, while lighter solids and soluble pollutants are directed under the baffle and into the cartridge chamber through a port between the baffle and the overflow weir.

Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in the cartridge's center tube from where it is directed by an under-drain manifold to the outlet pipe on the downstream side of the overflow weir and discharged.

When flows into the CBSF exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge bay, and discharges to the outlet pipe.

Applications

The CBSF is particularly useful where small flows are being treated or for sites that are flat and have little available hydraulic head to spare. The unit is ideal for applications in which standard catch basins are to be used. Both water quality and catchment issues can be resolved with the use of the CBSF.

Retro-Fit

The retrofit market has many possible applications for the CBSF. The CBSF can be installed by replacing an existing catch basin without having to "chase the grade," thus reducing the high cost of re piping the storm system.

OPERATION AND MAINTENANCE

CatchBasin StormFilter™

Maintenance Guidelines

Maintenance procedures for typical catch basins can be applied to the CatchBasin StormFilter (CBSF). The filter cartridges contained in the CBSF are easily removed and replaced during maintenance activities according to the following guidelines.

1. Establish a safe working area as per typical catch basin service activity.
2. Remove steel grate and diamond plate cover (weight 100 lbs. each).
3. Turn cartridge(s) counter-clockwise to disconnect from pipe manifold.
4. Remove 4″ center cap from cartridge and replace with lifting cap.
5. Remove cartridge(s) from catch basin by hand or with vactor truck boom.
6. Remove accumulated sediment via vactor truck (min. clearance 13″ x 24″).
7. Remove accumulated sediment from cartridge bay. (min. clearance 9.25″ x 11″).
8. Rinse interior of both bays and vactor remaining water and sediment.
9. Install fresh cartridge(s) threading clockwise to pipe manifold.
10. Replace cover and grate.
11. Return original cartridges to Contech for cleaning.

Media may be removed from the filter cartridges using the vactor truck before the cartridges are removed from the catch basin structure. Empty cartridges can be easily removed from the catch basin structure by hand. Empty cartridges should be reassembled and returned to Contech as appropriate.

Materials required include a lifting cap, vactor truck and fresh filter cartridges. Contact Contech for specifications and availability of the lifting cap. The vactor truck must be equipped with a hose capable of reaching areas of restricted clearance. the owner may refresh spent cartridges. Refreshed cartridges are also available from Contech on an exchange basis. Contact the maintenance department of Contech at 503-258-3157 for more information.

Maintenance is estimated at 26 minutes of site time. For units with more than one cartridge, add approximately 5 minutes for each additional cartridge. Add travel time as required.

Mosquito Abatement

In certain areas of the United States, mosquito abatement is desirable to reduce the incidence of vectors.

In BMPs with standing water, which could provide mosquito breeding habitat, certain abatement measures can be taken.

1. Periodic observation of the standing water to determine if the facility is harboring mosquito larvae.
2. Regular catch basin maintenance.
3. Use of larvicides containing Bacillus thuringiensis israelensis (BTI). BTI is a bacterium toxic to mosquito and black fly larvae.

In some cases, the presence of petroleum hydrocarbons may interrupt the mosquito growth cycle.

Using Larvicides in the CatchBasin StormFilter

Larvicides should be used according to manufacturer's recommendations.

Two widely available products are Mosquito Dunks and Summit B.t.i. Briquets. For more information, visit http://www.summitchemical.com/mos_ctrl/d efault.htm.

The larvicide must be in contact with the permanent pool. The larvicide should also be fastened to the CatchBasin StormFilter by string or wire to prevent displacement by high flows. A magnet can be used with a steel catch basin.

For more information on mosquito abatement in stormwater BMPs, refer to the following: http://www.ucmrp.ucdavis.edu/publications/managingmosquitoesstormwater8125.pdf

Appendix F: Geotechnical Engineering Report

GEODESIGN INC
AN NV5 COMPANY

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

Friendsview – RCF Phase 1
East Cherry Street and Fulton Street
Newberg, Oregon

For
Greystone
September 22, 2020

GeoDesign Project: Friends-4-01

GEODESIGN INC
AN NV5 COMPANY

September 22, 2020

Greystone
225 East John Carpenter Freeway
Irving, TX 75062

Attention: Dave Hampton

Report of Geotechnical Engineering Services
Friendsview – RCF Phase 1
East Cherry Street and Fulton Street
Newberg, Oregon
GeoDesign Project: Friends-4-01

GeoDesign, Inc. is pleased to present this report of geotechnical engineering services for Phase 1 of the residential care facility (RCF) remodel at the Friendsview University Village development in Newberg, Oregon. Our work was completed in general conformance with our revised proposal dated August 17, 2020.

We appreciate the opportunity to be of service to you. Please call if you have questions regarding this report.

Sincerely,

GeoDesign, Inc.

Nick Paveglio, P.E.
Senior Associate Engineer

George Saunders, P.E., G.E.
Principal Engineer

cc: Kelsy Laughnan, LRS Architects (via email only)
Chris Nelson, Froelich Engineers (via email only)

NNP:GPS:kt
Attachments
One copy submitted (via email only)
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EXECUTIVE SUMMARY

The primary geotechnical considerations for the project are summarized as follows:

- The building can be supported on conventional spread footings bearing on native soil, provided the exterior footings adjacent to the Hess Creek slope are continuous footings and all footings near slopes are embedded as described in the "Foundation Support" section.

- Analysis indicates post-construction slope stability of the proposed building and slope configuration near Hess Creek meets factors of safety requirements for static and seismic conditions. If the location of the building or foundation systems deviate from assumptions in this report, we should be contacted to revise our analysis.

- Undocumented fill (encountered in the east portion of proposed building footprint) should be removed from under footings and replaced with compacted crushed rock. We anticipate the foundation embedment requirements (see the "Foundation Embedment Recommendations" section) will remove a majority of the fill beneath the foundations adjacent to Hess Creek. Undocumented fill can be left beneath floor slab and pavement areas, provided the subgrades are evaluated as described in the report and minor risk of distress can be acceptable.

- Perched groundwater was observed at a depth of 7 feet BGS in recent explorations during the dry season. We anticipate perched groundwater could be less than 5 feet BGS in the wet season. Dewatering should be expected for excavations that extend more than a few feet below current grades. Static groundwater is expected to be 15 to 20 feet BGS during the year.

- Surface water should not be allowed to sheet flow onto the Hess Creek slope face. Stormwater should be collected and transferred away from the Hess Creek slopes.

- The near-surface soil is sensitive to disturbance when at a moisture content that is above optimum. Haul roads and staging areas will be necessary to prevent damage to subgrade and repair costs. A discussion of subgrade protection is included in the "Construction" section.

- Liquefaction and lateral spreading are not design considerations for the project.

- Based on the soil and groundwater conditions at the site, on-site infiltration systems are not recommended.

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ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
ACP	asphalt concrete pavement
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BGS	below ground surface
CPT	cone penetration test
CSZ	Cascadia subduction zone
g	gravitation acceleration (32.2 feet/second^2)
H:V	horizontal to vertical
km	kilometers
MCE	maximum considered earthquake
M_w	moment magnitude
OSHA	Occupational Safety and Health Administration
OSSC	Oregon Standard Specifications for Construction (2018)
pcf	pounds per cubic foot
pci	pounds per cubic inch
PG	performance grade
psf	pounds per square foot
psi	pounds per square inch
SOSSC	State of Oregon Structural Specialty Code
SPT	standard penetration test
USGS	U.S. Geological Survey

1.0 INTRODUCTION

GeoDesign, Inc. is pleased to submit this report of geotechnical engineering services for Phase 1 of the residential care facility remodel at the Friendsview University Village development in Newberg, Oregon. The site is shown relative to surrounding physical features on Figure 1. Locations of geotechnical explorations completed as part of this report are shown on Figure 2.

Development includes construction of a four-story, wood-frame, above-grade residential building with a footprint of approximately 18,000 square feet. Structural loads and grading plans were not available at the time of this report. The proposed development configuration is shown on Figure 2.

We understand the perimeter and most of the building will be supported by continuous spread footings with occasional isolated footings on the interior of the building. Foundation loads for the building were unknown at the time of this report; however, based on our experience with similar structures, we estimate maximum column and wall loads will be less than 150 kips and 6 kips per foot, respectively. We anticipate floor slab loads could be up to 150 psf. Cuts and fills are expected to be less than a few feet.

Acronyms and abbreviations used herein are defined above, immediately following the Table of Contents.

2.0 PURPOSE AND SCOPE

The purpose of our services was to complete geotechnical engineering services to support design and construction of the proposed project. The specific scope of our services included the following:

- Coordinated and managed the field investigation, including utility locates and scheduling subcontractors and GeoDesign staff.
- Completed the following explorations at the site:
  - Three drilled borings to depths between 26.5 and 51.5 feet BGS
  - One CPT to a depth of approximately 77.4 feet BGS
  - Two hand auger borings to depths between 5.5 and 10 feet BGS
- Collected soil samples from the borings for laboratory testing and maintained a log of encountered soil and groundwater conditions in the borings.
- Completed a laboratory testing program, including the following:
  - Fifteen moisture content determinations in general accordance with ASTM D2216
  - Three particle-size analyses in general accordance with ASTM D1140
  - Four Atterberg limits tests in general accordance with ASTM D4318
  - One consolidation test in general accordance with ASTM D2435
- Prepared this geotechnical report summarizing our explorations, laboratory testing, analyses, geotechnical design criteria, and construction recommendations, including information relating to the following:
  - Soil and groundwater conditions
  - Summary of liquefaction and lateral spreading potential at the site

- Slope stability analysis
- Recommendations for site preparation, grading and drainage, stripping depths, fill type for imported material, compaction criteria, trench excavation and backfill, use of on-site soil, and wet/dry weather earthwork
- Recommendations for foundation support of the building
- Recommendations for preparing floor slab subgrade
- Design criteria for retaining walls, including lateral earth pressures, backfill, compaction, and drainage, as well as temporary shoring recommendations
- Recommendations for managing identified groundwater conditions that may affect the performance of structures or pavements
- Recommendations for construction of AC pavement if needed for on-site access roads and parking areas, including subbase, base course, and AC paving thickness
- Seismic design parameters in accordance with the 2019 SOSSC.

3.0 SITE CONDITIONS

3.1 GEOLOGY

The site is located in the northwest portion of the Central Willamette Valley physiographic province. The coast range bounds the basin to the west with the Chehalem Mountains and Parrett Mountain to the north and east, respectively. The geologic profile in the site vicinity consists of 10 to 40 feet of catastrophic flood deposits comprised of silt with varying amounts of clay and fine sand, generally referred to as the Willamette Silt (Schlicker and Deacon, 1967). The catastrophic flood deposits are associated with Lake Missoula, a late Wisconsin glacial lake that formed when a lobe of the Cordilleran ice sheet impounded the Clark Fork River in western Montana. Periodic failure of the ice dam produced multiple flooding episodes with ponding into the Willamette Valley (Gannett and Caldwell, 1998).

The catastrophic flood deposits are underlain by Miocene to Pleistocene aged fluvial and lacustrine deposits. The fluvial and lacustrine deposits are up to 100 meters thick in the area and are underlain by Columbia River Basalt. The Columbia River Basalt is considered as the basement material (Gannett and Caldwell, 1998).

3.2 SURFACE CONDITIONS AND GEOLOGIC RECONNAISSANCE

The site is in the northeast portion of a residential care facility at the Friendsview University Village development in Newberg, Oregon. The proposed building footprint is occupied by two existing single-story residential structures, a wooden gazebo, and greenspace with a concrete slab. The remainder of the site is occupied by AC drive aisles and parking stalls, a driveway, and sidewalks. Vegetation at the site includes lawn grass with mature trees and landscape shrubs.

An engineering geologist from our office visited the site on September 1, 2020. Natural topography at the site is flat with the east edge of the proposed building at a slope break downward to the east towards Hess Creek. The slope is moderately steep and measured between 30 and 50 percent in the field. Moderately thick vegetation consisting of grass, shrubs, and a variety of trees are present on the slope. A paved path is located approximately halfway between the proposed structure and the creek.

Slopes near the existing residential structures appear uniform with fill likely placed as part of previous construction. No sign of recent sliding was observed during our visit. We did not observe any scarps or cracking in the paved path that may indicate signs of mass wasting events. However, conifer and deciduous trees did show signs of soil creep, with pistol-gripped trees from the edge of the slope to the creek. Water was observed in one area seeping from the ground on the paved trail directly below the gazebo area at the south end of the building footprint. It was unclear whether this was a naturally occurring spring or a possible irrigation leak during the time of our visit.

3.3 SUBSURFACE CONDITIONS

3.3.1 General

Subsurface conditions at the site were explored by drilling three borings (B-1 through B-3) to depths between 26.5 and 51.5 feet BGS, advancing one CPT (CPT-1) to a depth of approximately 77.4 feet BGS, and completing two hand auger borings (HA-1 and HA-2) to depths between 5.5 and 10 feet BGS. The approximate locations of our explorations are shown on Figure 2. The boring logs and laboratory test results are presented in Appendix A. The CPT results are presented in Appendix B.

3.3.2 Soil Conditions

3.3.2.1 Pavement Section

A pavement section consisting of 3 inches of AC over 16 inches of aggregate base was observed in boring B-2.

3.3.2.2 Fill

Fill was present in borings B-3, HA-1, and HA-2 in the east portion of the site near the Hess Creek slope. The fill consists of medium stiff to stiff, brown to gray clay with variable proportions of sand, gravel, and organics. The fill is moist and extends to depths between 4.5 and 5 feet BGS in HA-2 and B-3. Boring HA-1 was terminated at a depth of 5.5 feet BGS in fill. We anticipate maximum fill thickness could be up to 7 feet in the area. Laboratory testing indicates the moisture content of the fill was 25 to 26 percent at the time of our explorations.

3.3.2.3 Native Soil

Native soil below the fill consists medium stiff to very stiff silt and clay. The silt and clay are brown-gray-orange with trace to minor sand. Stiffness generally increases with depth and plasticity varies from low to high. The silt and clay extends to the maximum depth explored of 51.5 feet in the borings, and CPT-1 indicates the silt and clay are present to approximately 60 feet BGS. Medium dense, silty sand is present below the silt and clay and to the maximum depth explored of 77.5 feet BGS. Laboratory testing indicates the moisture content of the silt and clay was 31 to 45 percent at the time of our explorations.

3.3.3 Groundwater

Groundwater was observed at a depth of approximately 20 feet BGS in the explorations. Perched groundwater was also encountered in boring B-2 at a depth of 7 feet BGS. We anticipate static groundwater will vary between 15 and 20 feet BGS during year. We anticipate perched groundwater could be less than 5 feet BGS in the wet season.

3.4 GEOLOGIC HAZARDS

3.4.1 Seismicity

Three earthquake sources could affect the site. Two of the possible earthquake sources are associated with the CSZ, and the third source is a shallow, local crustal earthquake that could occur in the North American Plate.

The CSZ, which is the convergent boundary between the North America Plate and the Juan de Fuca Plate, lies offshore from northern California to southern British Columbia. The two plates are reportedly converging at a rate of approximately 3 to 4 centimeters (approximately 2 inches) per year. In addition, the northward-moving Pacific Plate is pushing the Juan de Fuca Plate north, causing complex seismic strains to accumulate. Earthquakes are caused by the abrupt release of this slowly accumulated strain. Evidence suggests that CSZ earthquakes can produce magnitudes up to approximately M_w 9.0 and are generally thought to occur on average every 500 years. The recurrence interval, however, has apparently been irregular, as short as approximately 100 years and as long as approximately 1,100 years. The last of these great earthquakes occurred in the Pacific Northwest in January 1700. Two types of subduction zone earthquakes are possible:

1. An interface event earthquake on the seismogenic part of the interface between the Juan de Fuca Plate and the North American Plate within the CSZ. This source can generate earthquakes with an M_w as large as 9+.
2. A deep intraplate earthquake on the seismogenic part of the subducting Juan de Fuca Plate. These events typically occur at depths between 30 and 60 km. This source can generate an event of up to M_w 7.5.

A significant earthquake could occur on a local fault near the site within the design life of the facility. Such an event would cause ground shaking at the site that could be more intense than the postulated CSZ events, although the duration would be shorter. The major local faults are the Newberg fault and Gales Creek fault zone.

3.4.2 Liquefaction

Liquefaction is caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles to near zero. Granular soil, which relies on interparticle friction for strength, is susceptible to liquefaction until the excess pore pressures can dissipate. In general, loose, saturated sand soil with low silt and clay content is the most susceptible to liquefaction. Silty soil with low plasticity is moderately susceptible to liquefaction under relatively higher levels of ground shaking.

Based on soil and groundwater conditions in the explorations, liquefaction will be negligible at the site.

3.4.3 Lateral Spreading

Lateral spreading is a liquefaction-related seismic hazard and occurs on gently sloping or flat sites underlain by liquefiable sediment adjacent to an open face, such as a riverbank. Liquefied soil adjacent to an open face can flow toward the open face, resulting in lateral ground displacement. Due to negligible liquefaction, lateral spreading is not a design consideration.

3.4.4 Fault Rupture

The nearest mapped faults are the Newberg fault (0.5 mile southwest) and the Gales Creek fault zone (7 miles northwest). Due to the distance from the site to the nearest faults, fault rupture is not considered a hazard at the site.

3.4.5 Landslides

3.4.5.1 Stability Analysis

The proposed building is planned at the top of the approximately 30-foot-tall slope leading to Hess Creek. The slope gradient ranges between 2H:1V and 3H:1V and is covered by trees and brush. A detailed description of the slope is discussed in the "Surface Conditions and Geologic Reconnaissance" section.

Due to proximity of the proposed building with respect to Hess Creek, a stability analysis was completed to determine slope setbacks and building foundation embedment (if necessary). Analysis was completed using Slope/W by Geo-Slope International, Ltd. Slope/W performs two-dimensional limiting equilibrium analysis to compute slope stability. The factor of safety against slope failure is simplistically defined as the ratio of the forces resisting slope movement (e.g., soil strength, soil mass, etc.) to the forces driving slope movement (e.g., soil weight, water pressure). The program predicts the location and geometry of "critical failures planes." Critical failure planes are the zones with the lowest factors of safety. A factor of safety less than 1.0 infers that the model is not in equilibrium and slope movement is likely to occur. Standard of care generally dictates that a minimum factor of safety for static and seismic conditions be 1.5 and 1.1, respectively.

Analysis was completed based on the topography and proposed building location provided by LRS Architects (shown on Figure 2). The steepest slope and closest distance from the building to the slope along the entire building footprint was used in analysis to model the "worst case" scenario. Analysis assumes the perimeter of the building is supported by continuous spread footings designed with allowable bearing pressures of 2,500 psf. A floor slab load of 150 psf was applied where footings were not present. A seismic coefficient of 0.197 g (one-half of the site peak ground acceleration of 0.394 g) was used for the seismic condition. The soil parameters, load, and results of the analysis are presented in Appendix C.

Analysis indicates factors of safety for the static and seismic conditions are above the minimum standard of care. The proposed building can be constructed, provided the exterior footings adjacent to the Hess Creek slope are continuous footings and all footings near slopes are embedded as described in the "Foundation Embedment Recommendations" section. Our analysis is based on the building location shown on Figure 2 and assumes the building perimeter will be supported by continuous spread footings (no isolated spread footings near the slope). If the location of the building or foundation systems deviate from these assumptions, we should be contacted to revise our analysis.

3.4.5.2 Foundation Embedment Recommendations

To reduce lateral loading on adjacent slopes, the base of all spread footings near slopes (continuous and isolated) should be embedded to maintain a minimum horizontal distance of 10 feet from the lowest outside edge of the footing to the face of adjacent slopes.

3.4.5.3 Stormwater System Recommendations on Steep Slopes

Surface water should not be allowed to sheet flow onto steep slope faces. Stormwater should be collected and transferred away from the Hess Creek slopes. If stormwater is directed to the bottom of Hess Creek, angular rock should be installed at the base of the outfall pipes to dissipate energy generated from the gradient.

Granular backfill for pipes on steep slopes will create preferential flow paths for water that can generate moderate velocities within the trenches and a potential for piping. Where stormwater pipes are installed in slopes that exceed 15 percent, we recommend including trench plugs in the design. We can provide recommendations with review of the drainage plans, if requested.

Stormwater infiltration systems are not recommended for the project. If stormwater detention ponds are required within 100 feet of the crest of the slope, they should be lined with an impermeable membrane or bentonite to prevent water from infiltrating into the subsurface soil.

4.0 DESIGN

4.1 FOUNDATION SUPPORT

4.1.1 Discussion

Structures associated with the project can be founded on spread footings bearing on native soil or structural fill on native soil. All spread footings near the Hess Creek slopes (continuous and isolated) should be embedded to maintain minimum depths as recommended in the "Foundation Embedment Recommendations" section.

4.1.2 Conventional Spread Footings

Footings bearing on native soil or structural fill overlying non-organic native soil should be proportioned on a maximum allowable bearing pressure of 2,500 psf. This value is a net bearing pressure; the weight of the footing and overlying backfill can be ignored in calculating footing sizes. The recommended allowable bearing pressure applies to the total of dead plus long-term live loads and can be increased by one-third for short-term loads resulting from wind or seismic forces.

Footings should not be supported on undocumented fill. Undocumented fill was encountered in explorations in the east portion of the proposed building near the Hess Creek slope. All undocumented fill should be removed from under footings and replaced with compacted crushed rock. Over-excavation should extend 6 inches beyond the margins of the footings for every foot excavated below the base grade of the footings. The crushed rock should consist of imported granular material, as defined in the "Structural Fill" section. The imported granular material should be compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D1557, or until well-keyed, as determined by one of our geotechnical staff. We recommend that a member of our geotechnical staff observe the prepared footing subgrade.

Continuous wall and isolated spread footings should be at least 18 and 24 inches wide, respectively. The bottom of exterior footings should be at least 18 inches below the lowest adjacent exterior grade. The bottom of interior footings should be established at least 12 inches below the base of the slab. If footings are excavated in the wet season, we recommend they are covered with 3 to 6 inches of crushed rock shortly after excavation to prevent softening of the subgrade soil.

Total post-construction consolidation settlement is expected to be less than 1 inch with differential settlement less than 0.5 inch over a 50-foot span.

Lateral loads on building and retaining wall footings can be resisted by passive earth pressure on the sides of the structures and by friction on the base of footings. Our analysis indicates that the allowable passive earth pressure for footings confined by the on-site soil or planned structural fill is 250 pcf. Adjacent floor slabs, pavement, or the upper 12-inch depth of adjacent, unpaved areas should not be considered when calculating passive resistance. An allowable coefficient of friction equal to 0.35 can be used for footings at the site.

All footing subgrades should be evaluated by a representative of GeoDesign to confirm suitable bearing conditions. Observations should also confirm that loose or soft material, organic material, unsuitable fill, prior topsoil zones, undocumented fill and softened subgrades (if present) have been removed. Localized deepening of footing excavations may be required to penetrate any deleterious material.

4.2 SEISMIC DESIGN CRITERIA

Seismic design criteria for this project will be based on the 2019 SOSSC and ASCE 7-16. Based on the soil conditions, a seismic Site Class D is appropriate. ASCE 7-16 Section 11.4.8 requires a ground motion hazard study in accordance with Section 21.2 for structures on Site Class D sites with S_1 greater than or equal to 0.2 g (S_1 at the site is 0.414 g).

Exception 2 of ASCE 7-16 Section 11.4.8 indicates a ground motion hazard study is not required for structures on Site Class D sites with S_1 greater to or equal 0.2 g, provided the value of the seismic response coefficient C_S is determined by Eq. (12.8-2) for values of $T \leq T_s$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq T > 1.5T_s$ or Eq. (12.8-4) for $T > T_L$.

Based on correspondence with Froelich Engineers, the proposed building meets the exception. The seismic design criteria in accordance with Exception 2 of ASCE 7-16 Section 11.4.8 are summarized in Table 1. If the exception is not applicable, we should be contacted to complete a ground motion hazard study for the site.

Table 1. Seismic Design Parameters (ASCE 7-16)

Parameter	Short Period (T_s = 0.2 second)	1 Second Period (T_1 = 1.0 second)
MCE Spectral Acceleration, S	S_s = 0.854 g	S_1 = 0.414 g
Site Class	D	
Site Coefficient, F	F_a = 1.158	F_v = 1.886
Adjusted Spectral Acceleration, S_M	S_{MS} = 0.989 g	S_{M1} = 0.781 g
Design Spectral Response Acceleration Parameters, S_D	S_{DS} = 0.660 g	S_{D1} = 0.521 g

4.3 FLOOR SLABS

Floor slabs on native soil or structural fill on native soil can support areal loads of up 150 psf, provided the subgrade is prepared in accordance with the "Site Preparation" section. A modulus of reaction of 120 pci should be used for slab design. Undocumented fill was encountered beneath the east portion of the proposed building. Where undocumented fill is present, the floor slab subgrade should be prepared as recommended in the "Undocumented Fill" section.

A minimum 6-inch-thick layer of imported granular material should be placed and compacted over the prepared subgrade to assist as a capillary break. The floor slab base rock should be crushed rock or crushed gravel and sand meeting the requirements outlined in the "Structural Fill" section. The imported granular material should be placed in one lift and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D1557. Floor slab base rock contaminated with excessive fines (greater than 5 percent by dry weight passing the U.S. Standard No. 200 sieve) should be replaced.

Flooring manufacturers often require vapor barriers to protect flooring and flooring adhesives. Many flooring manufacturers will warrant their product only if a vapor barrier is installed according to their recommendations. Selection and design of an appropriate vapor barrier, if needed, should be based on discussions among members of the design team. We can provide additional information to assist you with your decision.

All slab subgrades should be evaluated by appropriate personnel to confirm suitable bearing conditions. Observations should also confirm that loose or soft material, organic material, unsuitable fill, prior topsoil zones, and softened subgrades (if present) have been removed.

4.4 RETAINING STRUCTURES

4.4.1 Assumptions

Our retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls, (2) the walls are less than 8 feet in height, (3) the backfill is drained, and (4) the backfill has a slope flatter than 4H:1V. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

4.4.2 Wall Design Parameters

Unrestrained site walls that retain native soil should be designed to resist an active earth pressure of 35 pcf. For embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $7.5H^2$ pounds per linear foot of wall, where H is the height of the wall in feet, and applied at 0.6H from the base of the wall.

Where retaining walls are restrained from rotation prior to being backfilled, an equivalent fluid pressure of 55 pcf should be used for design. If other surcharges (e.g., slopes steeper than 4H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, additional pressures may need to be accounted for in the wall design. Our office should be contacted for appropriate wall surcharges based on the actual magnitude and configuration of the applied loads.

4.4.3 Wall Foundations

Wall foundations should be designed in accordance with the "Foundation Support" section.

4.4.4 Wall Drainage and Backfill

The above design parameters have been provided assuming that back-of-wall drains will be installed to prevent buildup of hydrostatic pressures behind all walls. If a drainage system is not installed, our office should be contacted for revised design forces. Backfill material placed behind walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of retaining wall select backfill placed and compacted in conformance with the "Structural Fill" section.

A minimum 6-inch-diameter, perforated collector pipe should be placed at the base of the walls. The pipe should be embedded in a minimum 2-foot-wide zone of angular drain rock that is wrapped in a drainage geotextile fabric and extends up the back of the wall to within 1 foot of the finished grade. The drain rock and drainage geotextile fabric should meet specifications provided in the "Structural Fill" section. The perforated collector pipes should discharge at an appropriate location away from the base of the wall. The discharge pipe(s) should not be tied directly into stormwater drain systems unless measures are taken to prevent backflow into the wall's drainage system.

Settlement of up to 1 percent of the wall height commonly occurs immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend that construction of flatwork adjacent to retaining walls be postponed at least four weeks after backfilling of the wall, unless survey data indicates that settlement is complete prior to that time.

4.5 PAVEMENT

4.5.1 AC Pavement

Pavement should be installed on subgrade prepared in conformance with the "Site Preparation" and "Structural Fill" sections. Note the discussions regarding undocumented fill in the "Undocumented Fill" section. Satisfactory subgrade support for pavement can be obtained, provided the subgrade is prepared as described in the "Undocumented Fill" section. Our pavement recommendations are based on the following assumptions:

- The top 12 inches of soil subgrade is prepared as recommended in the "Site Preparation" and "Structural Fill" sections or until proof rolling with heavy equipment indicates that is it firm and unyielding.
- Resilient moduli of 3,500 psi and 20,000 psi were assumed for the subgrade and base rock, respectively.
- Structural coefficient of 0.08 for cement-amended subgrade.
- The design manual provided for the project specifies pavement recommendations based on a design life of 20 years.
- Initial and terminal serviceability indices of 4.2 and 2.5, respectively.
- Reliability of 85 percent and standard deviation of 0.4.
- Traffic consists of passenger vehicles with the occasional garbage, fire, and moving trucks.

If any of these assumptions are incorrect, our office should be contacted with the appropriate information so that the pavement designs can be revised. Our recommendations are provided in Table 2 and alternative sections using cement-amended subgrade are provided in Table 3.

Table 2. Minimum Pavement Thicknesses with Compacted Soil Subgrade

Traffic Loading	**AC (inches)**	**Aggregate Base (inches)**
Parking Stalls	2.5	7.0
Roadways/Drive Aisles	3.0	9.0

Table 3. Alternative Minimum Pavement Sections with Cement-Amended Subgrade

Traffic Loading)	**AC (inches)**	**Aggregate Base (inches)**	**Cement-Amended Subgrade[1] (inches)**
Parking Stalls	2.5	4.0	12.0
Roadways/Drive Aisles	3.0	4.0	12.0

1. Assumes a minimum seven-day unconfined compressive strength of 100 psi.

All thicknesses are intended to be the minimum acceptable. Design of the recommended pavement section assumes that construction will be completed during an extended period of dry weather. Wet weather construction could require an increased thickness of aggregate base as discussed in the "Construction Considerations" section.

To prevent strength loss during curing, cement-amended soil should be allowed to cure for at least four days prior to construction traffic or placing the base rock. Lastly, the amended subgrade should be protected with a minimum of 4 inches of base rock prior to construction traffic access.

The AC, aggregate base, and cement amendment should meet the requirements outlined in the "Structural Fill" section.

4.5.2 Construction Traffic Considerations

The pavement sections recommend above are designed to support post-construction traffic. Construction traffic should not be allowed on new pavement. If construction traffic is to be allowed on newly constructed road sections, an allowance for this additional traffic will need to be made in the design pavement section.

The pavement sections recommended above are for support of post-construction design traffic. The aggregate (with or without cement-amended subgrade) is designed to support construction traffic. Increased aggregate thicknesses will likely be required to support construction traffic as discussed in the "Construction Considerations" section.

4.6 DRAINAGE

4.6.1 Temporary

During work at the site, the contractor should be made responsible for temporary drainage of surface water as necessary to prevent standing water and/or erosion at the working surface. During rough and finished grading of the site, the contractor should keep all pads and subgrades free of ponding water.

4.6.2 Surface

The ground surface at finished pads should be sloped away from their edges at a minimum 2 percent gradient for a distance of at least 5 feet. Roof drainage from the building should be directed into solid, smooth-walled drainage pipes that carry the collected water to the storm drain system. Surface water should not be allowed to sheet flow above or onto the Hess Creek slope face. If stormwater is discharged to the east of the building, it should be collected and transferred to the base of the slope in solid pipes and angular rock should be installed at the base of the outfall pipes to dissipate energy generated from the gradient.

4.6.3 Subsurface

Based on the anticipated depth to groundwater, perimeter footing drains are not required. If requested, perimeter drains should consist of a filter fabric-wrapped, drain rock-filled trench that extends at least 12 inches below the lowest adjacent grade (i.e., slab subgrade elevation). A perforated pipe should be placed at the base to collect water that gathers in the drain rock. The drain rock and filter fabric should meet specifications outlined in the "Structural Fill" section. Discharge for footing drains should not be tied directly into the stormwater drainage system unless mechanisms are installed to prevent backflow. Stormwater directed to the Hess Creek slope should adhere to the recommendations in the "Surface" section above.

4.6.4 Stormwater Infiltration Systems

Based on the subsurface and groundwater conditions at the site, on-site infiltration systems are not recommended for the development.

4.7 PERMANENT SLOPES

The Hess Creek slope should be meet the topography shown on Figure 2. If more than 2 feet of fill is planned near the slope, we should be contacted to review our recommendations.

All cut and fill slopes away from Hess Creek should not exceed 2H:1V. Upslope roads and pavement should be located at least 5 feet from the top of cut and fill slopes. The setback should be increased to 10 feet for buildings. The slopes should be planted with appropriate vegetation to provide protection against erosion as soon as possible after grading. Surface water runoff should be collected and directed away from slopes to prevent water from running down the face of the slope.

5.0 CONSTRUCTION

5.1 SITE PREPARATION

5.1.1 Demolition

Demolition should include complete removal of existing site features within 5 feet of areas to receive new pavement, buildings, retaining walls, or engineered fills. Underground utility lines, vaults, or tanks encountered in areas of new development should be completely removed or (with approval) grouted full if left in place.

Crawlspace areas or voids resulting from removal of improvements or loose soil in utility lines should be backfilled with compacted structural fill, as discussed in the "Structural Fill" section. The bottom of such excavations should be excavated to expose a firm subgrade before filling and their sides sloped at a minimum of 1H:1V and benched to allow for more uniform compaction at the edges of the excavations.

Materials generated during demolition should be transported off site for disposal or stockpiled in areas designated by the owner. In general, these materials will not be suitable for re-use as engineered fill. However, AC, concrete, and base rock materials may be recycled in accordance the "Structural Fill" section.

5.1.2 Stripping and Grubbing

Existing root zone and topsoil zones should be stripped and removed from all structural and fill areas. We anticipate the average depth of stripping will be approximately 3 to 6 inches, although greater stripping depths will be required to remove localized zones of loose or organic soil. Greater stripping depths (approaching 12 inches) are anticipated in areas with thicker vegetation and shrubs, in all forested areas, and along the base of draws. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported off site for disposal or used in landscaped areas.

Trees and shrubs should be removed from fill areas. In addition, root balls should be grubbed out to the depth of the roots, which could exceed 3 feet BGS. Depending on the methods used to remove root balls, considerable disturbance and loosening of the subgrade could occur during site grubbing. We recommend that soil disturbed during grubbing operations be removed to expose firm, undisturbed subgrade. The resulting excavations should be backfilled with structural fill.

5.1.3 Undocumented Fill

5.1.3.1 General

Undocumented fill was encountered in the east portion of the project area near the slope leading to Hess Creek. We assume the fill was placed during construction of the existing residences. Documentation on the placement and compaction of the fill is not available. Due to the variable composition of the fill and the unknown methods of placement and compaction, reliable strength properties for undocumented fill are extremely difficult to predict.

5.1.3.2 Foundation Areas

Undocumented fill should be removed from under new building foundations and footings supported on granular pads as discussed in the "Foundation Embedment Recommendations" and "Foundation Support" sections.

5.1.3.3 Floor Slab and Pavement Areas

There is a small risk for poor performance of floor slabs and pavement established directly over undocumented fill soil. If undocumented fill is present after site grading, removal and replacement of undocumented fill would eliminate all risk. Floor slabs and pavement can be constructed on fill, provided a small risk of distress is accepted (minor floor slab cracking and localized "bird baths" in pavement).

5.1.4 Subgrade Evaluation

Prior to the placement of fill, floor slabs, base rock, or pavement improvements, the exposed subgrade should be evaluated by proof rolling. The subgrade should be proof rolled with a fully loaded dump truck or similar heavy, rubber tire construction equipment to identify soft, loose, or unsuitable areas. A member of our geotechnical staff should observe proof rolling to evaluate yielding of the ground surface. During wet weather, subgrade evaluation should be performed by probing with a foundation probe rather than proof rolling. Areas that appear soft or loose should be removed and replaced with structural fill or improved by cement amending in accordance with subsequent sections of this report.

5.2 CONSTRUCTION CONSIDERATIONS

The fine-grained soil present on this site is easily disturbed. If not carefully executed, site preparation, utility trench work, and roadway excavation can create extensive soft areas and significant repair costs can result. Earthwork planning, regardless of the time of year, should include considerations for minimizing subgrade disturbance.

If construction occurs during or extends into the wet season, or if the moisture content of the surficial soil is more than a couple percentage points above optimum, site stripping and cutting may need to be accomplished using track-mounted equipment. Likewise, the use of granular haul roads and staging areas will be necessary for support of construction traffic during the rainy season or when the moisture content of the surficial soil is more than a few percentage points above optimum. The amount of staging and haul road areas, as well as the required thickness of granular material, will vary with the contractor's sequencing of a project and type/frequency of construction equipment. Based on our experience, between 12 and 18 inches of imported granular material is generally required in staging areas and between 18 and 24 inches in haul roads areas. Stabilization material may be used as a substitute, provided the top 4 inches of material consists of imported granular material. The actual thickness will depend on the contractor's means and methods and should be the contractor's responsibility. In addition, a geotextile fabric should be considered to assist in developing a barrier between the subgrade and imported granular material in areas of repeated construction traffic. The imported granular material, stabilization material, and geotextile fabric should meet the specifications in the "Structural Fill" section. If the site is filled above current grades, the subgrade can be cement amended as described in the "Structural Fill" section.

As an alternative to thickened crushed rock sections, haul roads and utility work zones may be constructed using cement-amended subgrades overlain by a crushed rock wearing surface. Due to the size of the project and presence of existing roadways, we anticipate that cement amending is not economically feasible. If cement amending is considered, GeoDesign should be contacted to provide recommendations.

5.3 EXCAVATION

5.3.1 General

The subsurface conditions at the site consist of up to 5.5 feet of medium stiff to stiff, fine-grained fill on top of medium stiff to very stiff, fine-grained native soil. Groundwater was observed at a depth of approximately 20 feet BGS; however, perched water was observed in boring B-2 at a depth of 7 feet BGS.

Trench cuts in the native silt soil will likely stay open to depths of up to 4 feet. The stiffness of the fill indicates it will likely stay open to depths of 4 feet; however, some caving and sloughing could be possible. Open excavation techniques may be used to excavate trenches with depths between 4 and 8 feet, provided the walls of the excavation are cut at a slope of 1H:1V and groundwater seepage is not present. Excavations should be flattened to 1½H:1V or 2H:1V if excessive sloughing or raveling occurs. If groundwater is present, caving and raveling could occur. Excavations near Hess Creek should not destabilize the slopes.

Approved temporary shoring may be used for excavation support in lieu of large and open cuts. A wide variety of shoring and dewatering systems are available. Consequently, we recommend that the contractor be responsible for selecting the appropriate shoring and dewatering systems.

If shoring is used, we recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation. All excavations should be made in accordance with applicable OSHA and state regulations.

5.3.2 Dewatering

Dewatering should be expected for excavations that extend more than 5 feet below existing grades. Pumping from a sump may be effective in dewatering localized sections of trenches. However, this method is unlikely to prove effective in dewatering long sections of trench or large excavations, particularly for excavations that extend into native gravel. In addition, the sidewalls of trench excavations will need to be flattened or shored if seepage is encountered.

Where groundwater seepage into shored excavations occurs, we recommend placing at least 1 foot to 2 feet of stabilization material at the base of the excavations. Trench stabilization material should meet the requirements provided in the "Structural Fill" section.

While not anticipated, dewatering for large, open excavations may require a series of wells around the perimeter of the excavation. Selection, design, and construction of the dewatering system should be the responsibility of the contractor who is in the best position to modify or adapt the system to changing groundwater conditions and construction sequencing and requirements. The construction dewatering system should be adaptable to varying flow conditions and capable of lowering the level of the groundwater to a minimum of 2 feet below the base of the excavation.

5.4 STRUCTURAL FILL

5.4.1 General

Fills should only be placed over subgrade that has been prepared in conformance with the "Site Preparation" section. A variety of material may be used as structural fill at the site. However, all material used as structural fill should be free of organic material or other unsuitable materials and should meet the specifications provided in OSSC 00330 (Earthwork), OSSC 00400 (Drainage and Sewers), and OSSC 02600 (Aggregates), depending on the application. A brief characterization of some of the acceptable materials and our recommendations for their use as structural fill are provided below.

5.4.2 On-Site Soil

The soil at the site that will likely be excavated and subsequently used as structural fill consists of medium stiff clay fill and native silt and clay with variable proportions of sand. Material greater than 4 inches in diameter should be removed from all new fill if encountered in the existing fill.

Laboratory testing indicates that the moisture content of the on-site soil is greater than the anticipated optimum moisture content required for adequate compaction, and drying will be required to achieve adequate compaction during most times of the year. We recommend using imported granular material for structural fill if the on-site material cannot be properly moisture conditioned. When used as structural fill, the on-site soil should be placed in lifts with a maximum uncompacted thickness of 8 inches. The soil should be compacted to not less than 92 percent of the maximum dry density, as determined by ASTM D1557.

5.4.3 Imported Granular Material

Imported granular material used as structural fill should be pit- or quarry-run rock, crushed rock, or crushed gravel and sand and should meet the specifications provided in OSSC 00330.14 (Selected Granular Backfill) or OSSC 00330.15 (Selected Stone Backfill). The imported granular material should also be angular, should be well graded between coarse and fine material, should have less than 5 percent by dry weight passing the U.S. Standard No. 200 sieve, and should have at least two mechanically fractured faces.

Imported granular material should be placed in lifts with a maximum uncompacted thickness of 12 inches and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D1557. During the wet season or when wet subgrade conditions exists, the initial lift should be approximately 18 inches in uncompacted thickness and should be compacted by rolling with a smooth-drum roller without using vibratory action.

5.4.4 Trench Backfill

Trench backfill placed beneath, adjacent to, and for at least 12 inches above utility lines (i.e., the pipe zone) should consist of well-graded granular material with a maximum particle size of 1½ inches and less than 7 percent by dry weight passing the U.S. Standard No. 200 sieve and should meet the specifications provided in OSSC 00405.13 (Pipe Zone Material). The pipe zone backfill should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D1557, or as required by the pipe manufacturer or local building department.

Within roadway alignments, the remainder of the trench backfill up to the subgrade elevation should consist of well-graded granular material with a maximum particle size of 2½ inches and less than 7 percent by dry weight passing the U.S. Standard No. 200 sieve and should meet the specifications provided in OSSC 00405.14 (Trench Backfill; Class B, C, or D). This material should be compacted to at least 92 percent of the maximum dry density, as determined by ASTM D1557, or as required by the pipe manufacturer or local building department. The upper 3 feet of the trench backfill should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D1557.

Outside of structural improvement areas (e.g., roadway alignments or building pads) trench backfill placed above the pipe zone may consist of general fill material that is free of organic material and material over 6 inches in diameter and meets the specifications provided in OSSC 00405.14 (Trench Backfill; Class A, B, C, or D). This general trench backfill should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D1557, or as required by the pipe manufacturer or local building department.

5.4.5 Stabilization Material

Stabilization material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel and should meet the specifications provided in OSSC 00330.16 (Stone Embankment Material). In addition, the material should have a maximum particle size of 6 inches, should have less than 5 percent by dry weight passing the U.S. Standard No. 4 sieve, and should have at least two mechanically fractured faces. The material should be free of organic material and other deleterious materials. Stabilization material should be placed in lifts between 12 and 18 inches thick and compacted to a firm condition.

Where the stabilization material is used to stabilize soft subgrade beneath pavement or construction haul roads, a geotextile should be placed as a barrier between the soil subgrade and the imported granular material. Placement of the imported granular fill should be done in conformance with the specifications provided in OSSC 00331 (Subgrade Stabilization). The geotextile fabric should meet the specifications provided below for subgrade geotextiles. Geotextile is not required where stabilization material is used at the base of utility trenches. Stabilization material should be placed in lifts between 12 and 18 inches thick and compacted to a firm condition with a smooth-drum roller without using vibratory action.

5.4.6 Drain Rock

Drain rock should consist of granular material that meets the specifications provided in OSSC 00430.11 (Granular Drain Backfill Material). In addition, the drain rock should be angular, should be well graded between coarse and fine material, should have less than 2 percent by dry weight passing the U.S. Standard No. 200 sieve, and should have at least two mechanically fractured faces. The drain rock should be wrapped in a drainage geotextile that meets the specifications provided below for drainage geotextiles.

5.4.7 Building Slab Base and Pavement Aggregate

Imported granular material used as base rock for building floor slabs and pavement should consist of ¾- or 1½-inch-minus material (depending on the application) and meet the requirements in OSSC 00641 (Aggregate Subbase, Base, and Shoulders). In addition, the aggregate should have less than 5 percent by dry weight passing the U.S. Standard No. 200 sieve. The aggregate base should be compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D1557.

5.4.8 Geotextile Fabric

5.4.8.1 Subgrade Geotextile

The subgrade geotextile should meet the specifications provided in OSSC Table 02320-4 – Geotextile Property Values for Subgrade Geotextile (Separation). The geotextile should be installed in conformance with OSSC 00350 (Geosynthetic Installation). A minimum initial aggregate base lift of 6 inches is required over geotextiles. All drainage aggregate and stabilization material should be underlain by a subgrade geotextile. Geotextile is not required where stabilization material is used at the base of utility trenches.

5.4.8.2 Drainage Geotextile

Drainage geotextile should meet the specifications provided in OSSC Table 02320-1 – Geotextile Property Values for Drainage Geotextile. The geotextile should be installed in conformance with OSSC 00350 (Geosynthetic Installation). A minimum initial aggregate base lift of 6 inches is required over geotextiles.

5.4.9 AC

5.4.9.1 ACP

The AC should be Level 2, ½-inch, dense ACP according to OSSC 00744 (Asphalt Concrete Pavement) and compacted to 91 percent of the theoretical maximum density of the mix, as determined by AASHTO T 209. The minimum and maximum lift thicknesses are 2.0 and 3.0 inches, respectively, for ½-inch ACP. Lift thicknesses desired outside these limits should be discussed with the design team prior to design or construction. Asphalt binder should be performance graded and conform to PG 64-22 or better.

5.4.9.2 Cold Weather Paving Considerations

In general, AC paving is not recommended during the cold weather (temperatures less than 40 degrees Fahrenheit). Compacting under these conditions can result in low compaction and premature pavement distress.

Each AC mix design has a recommended compaction temperature range that is specific for the particular AC binder used. In colder temperatures, it is more difficult to maintain the temperature of the AC mix as it can lose heat while stored in the delivery truck, as it is placed, and in the time between placement and compaction. In Oregon, the AC surface temperature during paving should be at least 40 degrees Fahrenheit for lift thickness greater than 2.5 inches and at least 50 degrees Fahrenheit for lift thickness between 2.0 and 2.5 inches.

If paving activities must take place during cold-weather construction as defined above, the project team should be consulted and a site meeting should be held to discuss ways to lessen low compaction risks.

5.5 EROSION CONTROL

In our opinion, earthwork is feasible during the rainy season, provided proper erosion control procedures are implemented and the "Construction Considerations" and "Structural Fill" sections are followed. The site soil is susceptible to erosion; therefore, erosion control measures should be carefully planned and in place before construction begins. Surface water runoff should be collected and directed away from slopes to prevent water from running down the slope face. Erosion control measures (such as straw bales, sediment fences, and temporary detention and settling basins) should be used in accordance with local and state ordinances.

6.0 OBSERVATION OF CONSTRUCTION

Satisfactory pavement, earthwork, and foundation performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. GeoDesign should be retained to observe subgrade preparation, fill placement, foundation excavations, drainage system installation, and pavement placement and to review laboratory compaction and field moisture-density information.

Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated.

7.0 LIMITATIONS

We have prepared this report for use by the Greystone and members of the design and construction teams for the proposed project. The data and report can be used for bidding or estimating purposes, but our report, conclusions, and interpretations should not be construed as warranty of the subsurface conditions and are not applicable to other sites. Exploration observations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect soil strata or water level variations that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, re-evaluation will be necessary.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in this report for consideration in design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty, express or implied, should be understood.

◆ ◆ ◆

We appreciate the opportunity to be of continued service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,

GeoDesign, Inc.

Nick Paveglio, P.E.
Senior Associate Engineer

George Saunders, P.E., G.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
86690
OREGON
May 8, 2012
NICHOLAS N. PAVEGLIO
EXPIRES: 12/31/20

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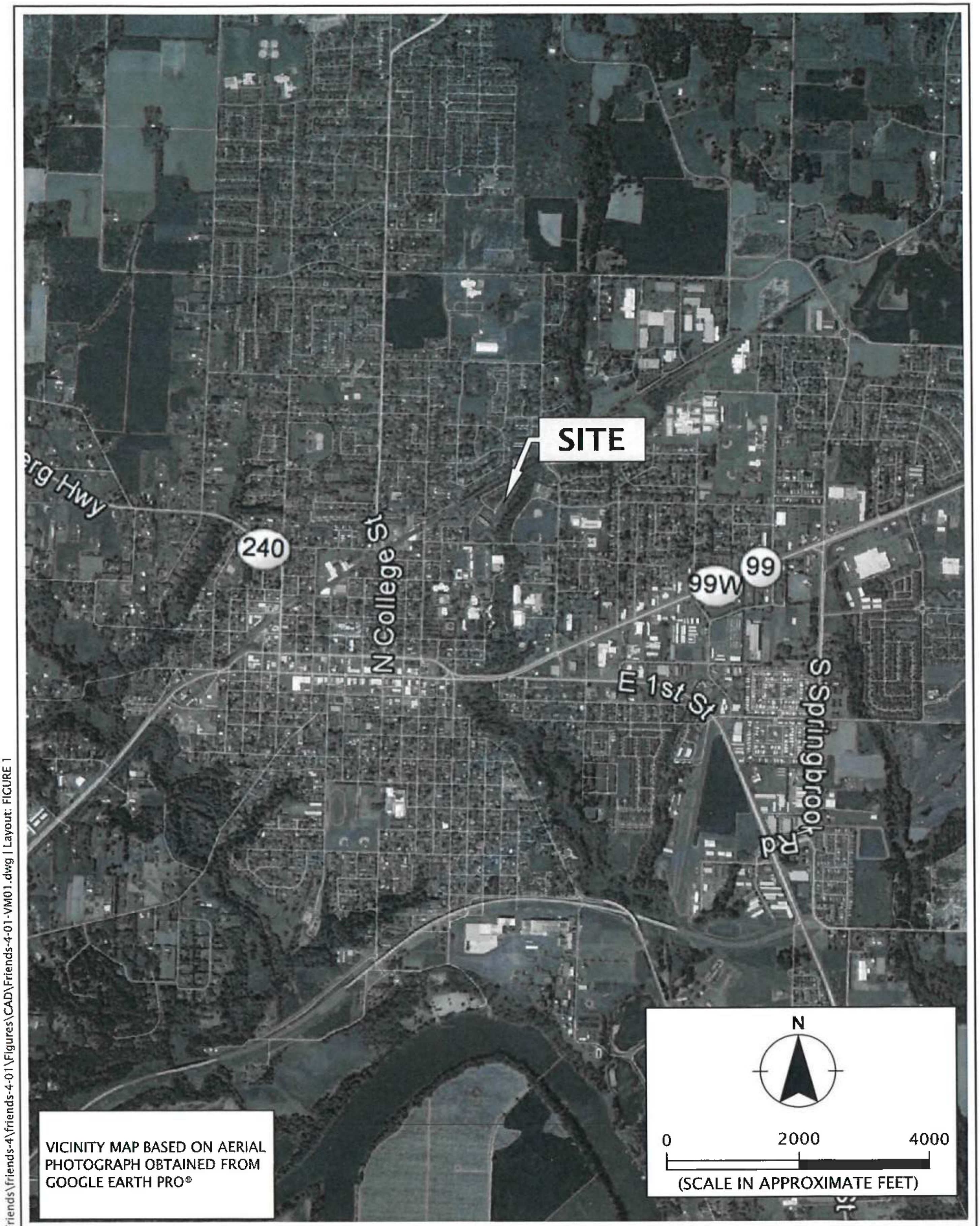
FIGURES



VICINITY MAP BASED ON AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH PRO®

GEODESIGN INC AN NV5 COMPANY	FRIENDS-4-01	**VICINITY MAP**	
	SEPTEMBER 2020	FRIENDSVIEW - RCF PHASE 1 NEWBERG, OR	**FIGURE 1**

Printed By: aday | Print Date: 9/21/2020 12:48:12 PM
File Name: J:\E-L\Friends\friends-4\friends-4-01\Figures\CAD\Friends-4-01-VM01.dwg | Layout: FIGURE 1

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File Name: J:\E-L\Friends\friends-4\friends-4-01\Figures\CAD\Friends-4-01-SP02.dwg | Layout: FIGURE 2

LEGEND:

▬ ▬ ▬	APPROXIMATE LOCATION OF PROPOSED BUILDING FOOTPRINT
B-1 ◉	BORING
HA-1 ◐	HAND AUGER BORING
CPT-1 △	CPT

N

0 50 100
(SCALE IN FEET)

NOTES:

1. SITE PLAN BASED ON DRAWING PROVIDED BY LRS ARCHITECTS SEPTEMBER 9, 2020.
2. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH PRO JUNE 1, 2020.

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FRIENDS-4-01

SEPTEMBER 2020

SITE PLAN

FRIENDSVIEW – RCF PHASE 1
NEWBERG, OR

FIGURE 2

APPENDIX A

APPENDIX A

FIELD EXPLORATIONS

GENERAL

Subsurface conditions at the site we explored by drilling three borings (B-1 through B-3) to depths between 26.5 and 51.5 feet BGS, advancing one CPT (CPT-1) to a depth of approximately 77.4 feet BGS, and completing two hand auger borings (HA-1 and HA-2) to depths between 5.5 and 10 feet BGS. Drilling services were conducted by Dan J. Fischer Excavating, Inc. using solid-stem auger techniques. The CPT was completed by Oregon Geotechnical Explorations of Kaiser, Oregon, and the hand augers were completed by a member of our geology staff. The exploration logs for the borings are presented in this appendix. The results of the CPT are presented in Appendix B.

The locations of the explorations were determined in the field by pacing or measuring from existing site features. This information should be considered accurate only to the degree implied by the methods used.

SOIL SAMPLING

We collected representative samples of the various soils encountered during drilling in the explorations for geotechnical laboratory testing. Samples were collected from the borings using 1½-inch-inside diameter, split-spoon SPT sampler in general accordance with ASTM D1586. The samplers were driven into the soil with a 140-pound automatic trip hammer free-falling 30 inches. The sampler was driven a total distance of 18 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the exploration logs, unless otherwise noted. Relatively undisturbed samples were collected using a standard Shelby tube in general accordance with ASTM D1587. Representative grab samples of the soil observed in the hand auger borings were collected from the tip of the hand auger. Sampling methods and intervals are shown on the exploration logs.

We understand that calibration of the SPT hammer used by Dan J. Fischer Excavating, Inc. has not been completed. The SPT blow counts completed by Dan J. Fischer Excavating, Inc. were conducted using two wraps around the cathead.

SOIL CLASSIFICATION

The soil samples were classified in the field in accordance with the "Exploration Key" (Table A-1) and "Soil Classification System" (Table A-2), which are presented in this appendix. The exploration logs indicate the depths at which the soil characteristics change, although the change actually could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications are shown on the exploration logs.

LABORATORY TESTING

We visually examined soil samples collected from the explorations to confirm field classifications. We also performed to following laboratory testing to evaluate the engineering properties of the soil.

ATTERBERG LIMITS

Atterberg limits (plastic and liquid limits) testing was performed on select soil samples in general accordance with ASTM D4318. The test results are presented in this appendix.

CONSOLIDATION TESTING

Consolidation testing was performed on a select soil sample in general accordance with ASTM D2435. This test determines the magnitude and rate of consolidation of soil when it is restrained laterally and drained axially while subjected to incrementally applied controlled-stress loading. The test results are used to estimate the magnitude and rate of settlement of the site soil under a specific increase in effective stress. The test results are presented in this appendix.

MOISTURE CONTENT

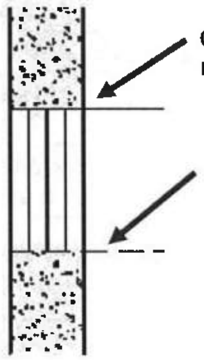
We tested the natural moisture content of select soil samples in general accordance with ASTM D2216. The test results are presented in this appendix.

PARTICLE-SIZE ANALYSIS

Particle-size analysis was completed on select soil samples in general accordance with ASTM D1140. The test results are presented in this appendix.

SYMBOL	SAMPLING DESCRIPTION
▯	Location of sample collected in general accordance with ASTM D1586 using Standard Penetration Test with recovery
▮	Location of sample collected using thin-wall Shelby tube or Geoprobe® sampler in general accordance with ASTM D1587 with recovery
▤	Location of sample collected using Dames & Moore sampler and 300-pound hammer or pushed with recovery
▥	Location of sample collected using Dames & Moore sampler and 140-pound hammer or pushed with recovery
◧	Location of sample collected using 3-inch-O.D. California split-spoon sampler and 140-pound hammer with recovery
⊠	Location of grab sample
▩	Rock coring interval
▽	Water level during drilling
▼	Water level taken on date shown

Graphic Log of Soil and Rock Types



Observed contact between soil or rock units (at depth indicated)

Inferred contact between soil or rock units (at approximate depths indicated)

GEOTECHNICAL TESTING EXPLANATIONS

ATT	Atterberg Limits	P	Pushed Sample
CBR	California Bearing Ratio	PP	Pocket Penetrometer
CON	Consolidation	P200	Percent Passing U.S. Standard No. 200 Sieve
DD	Dry Density		
DS	Direct Shear	RES	Resilient Modulus
HYD	Hydrometer Gradation	SIEV	Sieve Gradation
MC	Moisture Content	TOR	Torvane
MD	Moisture-Density Relationship	UC	Unconfined Compressive Strength
NP	Non-Plastic	VS	Vane Shear
OC	Organic Content	kPa	Kilopascal

ENVIRONMENTAL TESTING EXPLANATIONS

CA	Sample Submitted for Chemical Analysis	ND	Not Detected
P	Pushed Sample	NS	No Visible Sheen
PID	Photoionization Detector Headspace Analysis	SS	Slight Sheen
		MS	Moderate Sheen
ppm	Parts per Million	HS	Heavy Sheen

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EXPLORATION KEY

TABLE A-1

RELATIVE DENSITY - COARSE-GRAINED SOIL

Relative Density	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)
Very Loose	0 - 4	0 - 11	0 - 4
Loose	4 - 10	11 - 26	4 - 10
Medium Dense	10 - 30	26 - 74	10 - 30
Dense	30 - 50	74 - 120	30 - 47
Very Dense	More than 50	More than 120	More than 47

CONSISTENCY - FINE-GRAINED SOIL

Consistency	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)	Unconfined Compressive Strength (tsf)
Very Soft	Less than 2	Less than 3	Less than 2	Less than 0.25
Soft	2 - 4	3 - 6	2 - 5	0.25 - 0.50
Medium Stiff	4 - 8	6 - 12	5 - 9	0.50 - 1.0
Stiff	8 - 15	12 - 25	9 - 19	1.0 - 2.0
Very Stiff	15 - 30	25 - 65	19 - 31	2.0 - 4.0
Hard	More than 30	More than 65	More than 31	More than 4.0

PRIMARY SOIL DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOIL (more than 50% retained on No. 200 sieve)	GRAVEL (more than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (< 5% fines)	GW or GP	GRAVEL
		GRAVEL WITH FINES (≥ 5% and ≤ 12% fines)	GW-GM or GP-GM	GRAVEL with silt
			GW-GC or GP-GC	GRAVEL with clay
		GRAVEL WITH FINES (> 12% fines)	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND (50% or more of coarse fraction passing No. 4 sieve)	CLEAN SAND (<5% fines)	SW or SP	SAND
		SAND WITH FINES (≥ 5% and ≤ 12% fines)	SW-SM or SP-SM	SAND with silt
			SW-SC or SP-SC	SAND with clay
		SAND WITH FINES (> 12% fines)	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOIL (50% or more passing No. 200 sieve)	SILT AND CLAY	Liquid limit less than 50	ML	SILT
			CL	CLAY
			CL-ML	silty CLAY
			OL	ORGANIC SILT or ORGANIC CLAY
		Liquid limit 50 or greater	MH	SILT
			CH	CLAY
			OH	ORGANIC SILT or ORGANIC CLAY
HIGHLY ORGANIC SOIL			PT	PEAT

MOISTURE CLASSIFICATION

Term	Field Test
dry	very low moisture, dry to touch
moist	damp, without visible moisture
wet	visible free water, usually saturated

ADDITIONAL CONSTITUENTS

Secondary granular components or other materials such as organics, man-made debris, etc.

Percent	Silt and Clay In:		Percent	Sand and Gravel In:	
	Fine-Grained Soil	Coarse-Grained Soil		Fine-Grained Soil	Coarse-Grained Soil
< 5	trace	trace	< 5	trace	trace
5 - 12	minor	with	5 - 15	minor	minor
> 12	some	silty/clayey	15 - 30	with	with
			> 30	sandy/gravelly	Indicate %

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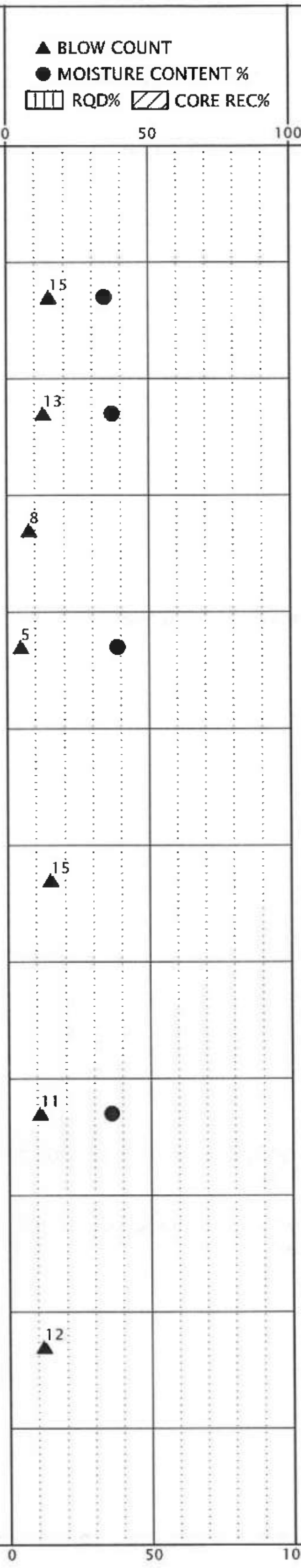
SOIL CLASSIFICATION SYSTEM

TABLE A-2

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	INSTALLATION AND COMMENTS
0.0		Stiff to very stiff, light gray with brown mottled SILT (ML/MH), trace sand; moist.				
2.5				PP		PP = 1.25 tsf
5.0		stiff, dark brown, sandy at 5.0 feet		ATT PP		PP = 2.25 tsf LL = 54% PL = 29%
7.5		medium stiff to stiff, gray with orange mottles, with sand at 7.5 feet		PP		PP = 2.25 tsf
10.0		medium stiff, gray at 10.0 feet		P200 PP		P200 = 96% PP = 1.0 tsf
12.5						
		Stiff to very stiff, gray CLAY (CH), trace sand and silt; moist.	13.5			
15.0				PP		PP = 3.5 tsf
17.5						
20.0		minor sand at 20.0 feet		ATT PP		PP = 0.75 tsf LL = 79% PL = 31%
22.5						
25.0		brown at 25.0 feet		PP		PP = 3.25 tsf
27.5						
30.0						



▽ 19.5 feet during drilling

DRILLED BY: Dan J. Fischer Excavating, Inc.

LOGGED BY: L. Gose

COMPLETED: 06/25/20

BORING METHOD: solid-stem auger (see document text)

BORING BIT DIAMETER: 4 inches

GEODESIGN INC
AN NV5 COMPANY

FRIENDS-4-01

SEPTEMBER 2020

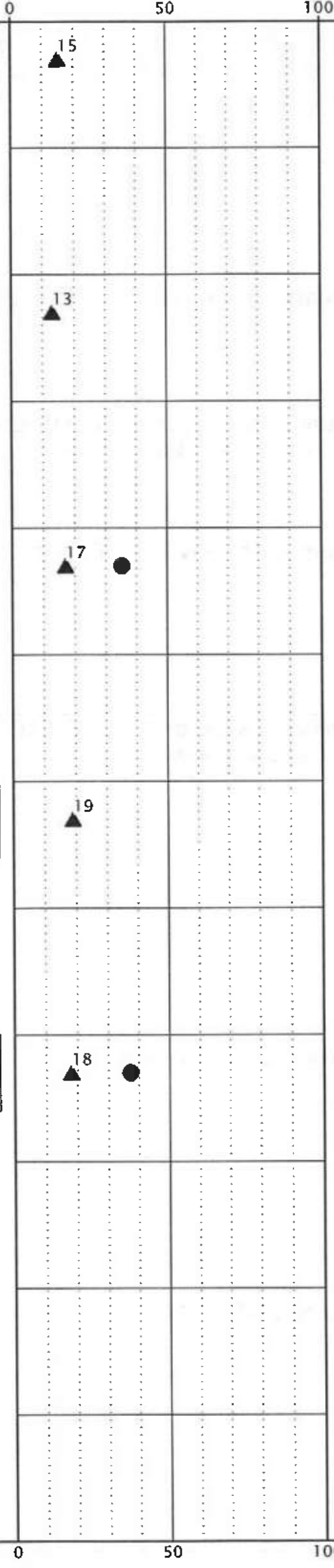
BORING B-1

FRIENDSVIEW - RCF PHASE 1
NEWBERG, OR

FIGURE A-1

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	INSTALLATION AND COMMENTS
30.0	with sand at 30.0 feet		PP	PP = 3.0 tsf
32.5				
35.0			PP	PP = 1.75 tsf
37.5				
40.0	red-brown at 40.0 feet		P200 PP	P200 = 93% PP = 1.25 tsf
42.5				
45.0			PP	PP = 1.25 tsf
47.5				
50.0			P200	P200 = 92%
	Exploration completed at a depth of 51.5 feet. SPT completed using two wraps with a cathead.	51.5		Surface elevation was not measured at the time of exploration.
52.5				
55.0				
57.5				
60.0				

▲ BLOW COUNT
● MOISTURE CONTENT %
▥ RQD%
▨ CORE REC%



DRILLED BY: Dan J. Fischer Excavating, Inc.
LOGGED BY: L. Gose
COMPLETED: 06/25/20

BORING METHOD: solid-stem auger (see document text)
BORING BIT DIAMETER: 4 inches

GEODESIGN INC
AN NV5 COMPANY

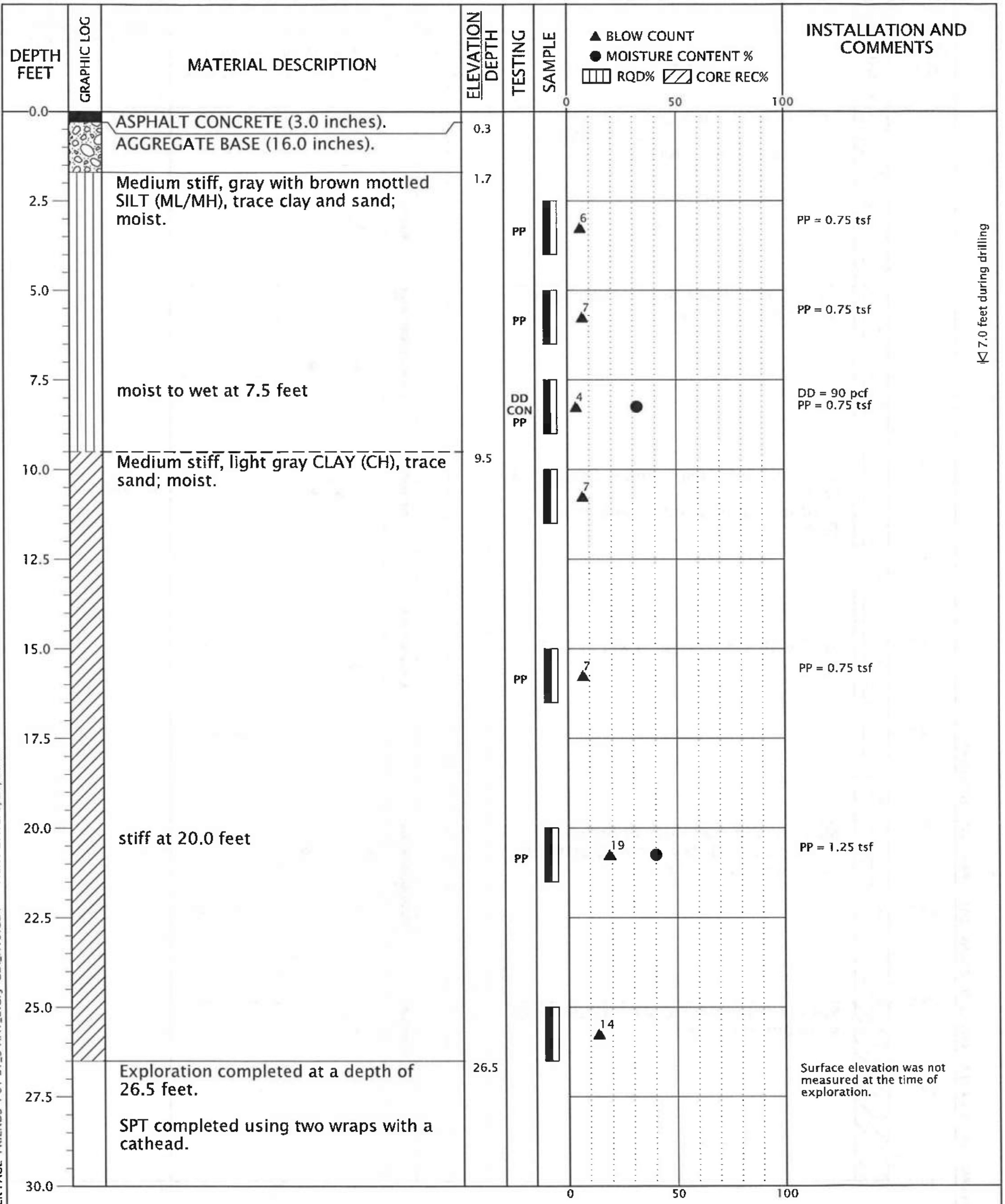
FRIENDS-4-01

SEPTEMBER 2020

BORING B-1
(continued)

FRIENDSVIEW - RCF PHASE 1
NEWBERG, OR

FIGURE A-1



DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	BLOW COUNT	MOISTURE CONTENT %	INSTALLATION AND COMMENTS
0.0	ASPHALT CONCRETE (3.0 inches).	0.3				
	AGGREGATE BASE (16.0 inches).	1.7				
2.5	Medium stiff, gray with brown mottled SILT (ML/MH), trace clay and sand; moist.		PP	6		PP = 0.75 tsf
5.0			PP	7		PP = 0.75 tsf
7.5	moist to wet at 7.5 feet		DD CON PP	4	●	DD = 90 pcf PP = 0.75 tsf
10.0	Medium stiff, light gray CLAY (CH), trace sand; moist.	9.5		7		
15.0			PP	7		PP = 0.75 tsf
20.0	stiff at 20.0 feet		PP	19	●	PP = 1.25 tsf
25.0				14		
26.5	Exploration completed at a depth of 26.5 feet. SPT completed using two wraps with a cathead.	26.5				Surface elevation was not measured at the time of exploration.

⊻ 7.0 feet during drilling

DRILLED BY: Dan J. Fischer Excavating, Inc.
LOGGED BY: L. Gose
COMPLETED: 06/25/20

BORING METHOD: solid-stem auger (see document text)
BORING BIT DIAMETER: 4 inches

GEODESIGN INC
AN NV5 COMPANY

FRIENDS-4-01

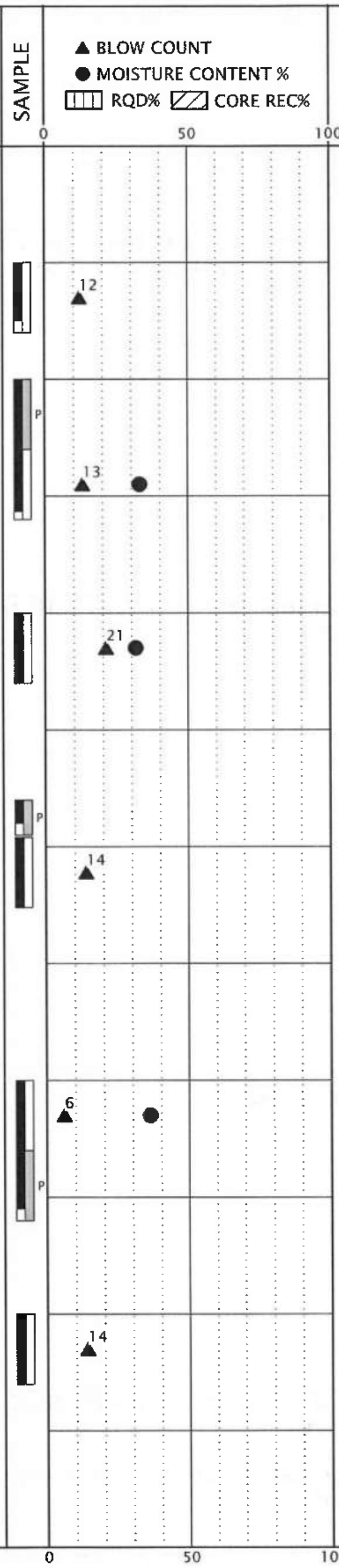
SEPTEMBER 2020

BORING B-2

FRIENDSVIEW – RCF PHASE 1
NEWBERG, OR

FIGURE A-2

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	INSTALLATION AND COMMENTS
0.0	Stiff, brown to gray CLAY (CL/CH), trace gravel and silt; moist (2.25-inch-thick root zone) - **FILL.**			
5.0	Stiff, light brown-orange to light gray SILT (ML), some clay; moist.	5.0		
10.0	very stiff, with sand; sand is fine at 10.0 feet light gray-orange, trace sand at 10.5 feet		ATT	LL = 41% PL = 27%
15.0	stiff, with sand; moist to wet at 14.8 feet			
19.6				▼ 19.6 feet, after drilling
20.0	Medium stiff, light gray to brown-orange SILT (ML/MH), some clay, trace sand; wet, sand is fine.	20.0		
25.0	Stiff, gray to brown CLAY (CL/CH), trace sand and silt; moist.	25.0		
30.0				

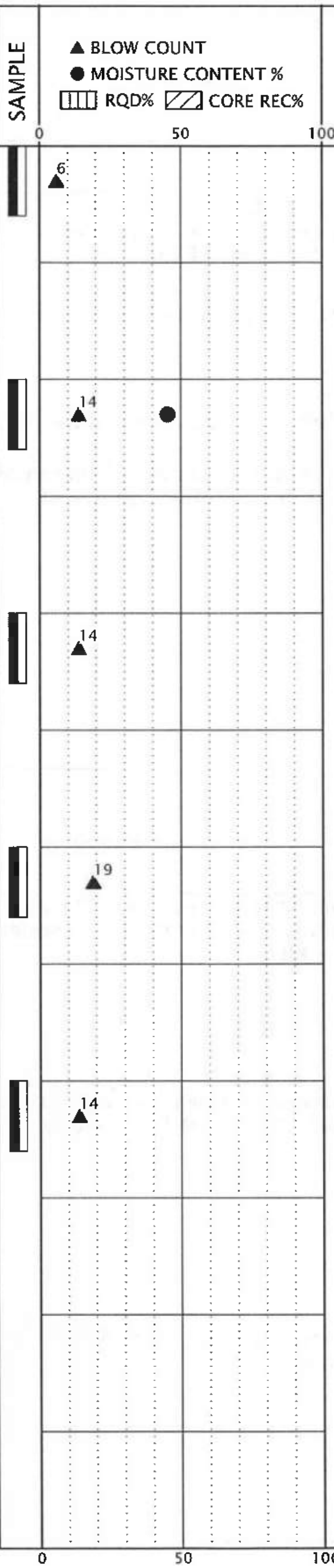


DRILLED BY: Dan J. Fischer Excavating, Inc.
LOGGED BY: J. Heidgerken
COMPLETED: 09/01/20

BORING METHOD: solid-stem auger (see document text)
BORING BIT DIAMETER: 4 inches

GEODESIGN INC AN NV5 COMPANY	FRIENDS-4-01	**BORING B-3**
	SEPTEMBER 2020	FRIENDSVIEW - RCF PHASE 1 NEWBERG, OR
		FIGURE A-3

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	INSTALLATION AND COMMENTS
30.0	brown-orange at 30.0 feet			
35.0	Stiff, dark brown-orange CLAY (CH), some silt, minor sand; moist.	35.0	ATT	LL = 88% PL = 29%
40.0	brown-orange to light gray, trace sand, without silt at 40.0 feet			
45.0	very stiff at 45.0 feet			
50.0	stiff at 50.0 feet			
51.5	Exploration completed at a depth of 51.5 feet. SPT completed using two wraps with a cathead.	51.5		Surface elevation was not measured at the time of exploration.



DEPTH FEET: 30.0, 32.5, 35.0, 37.5, 40.0, 42.5, 45.0, 47.5, 50.0, 52.5, 55.0, 57.5, 60.0

DRILLED BY: Dan J. Fischer Excavating, Inc.
LOGGED BY: J. Heidgerken
COMPLETED: 09/01/20

BORING METHOD: solid-stem auger (see document text)
BORING BIT DIAMETER: 4 inches

GEODESIGN INC
AN NV5 COMPANY

FRIENDS-4-01

SEPTEMBER 2020

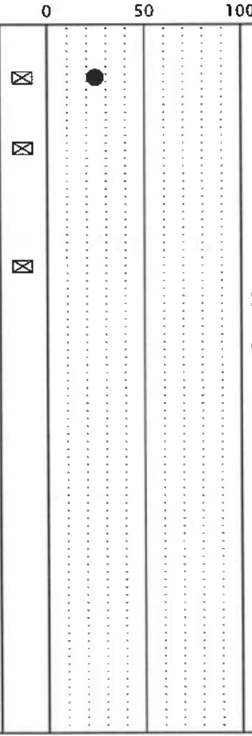
BORING B-3
(continued)

FRIENDSVIEW - RCF PHASE 1
NEWBERG, OR

FIGURE A-3

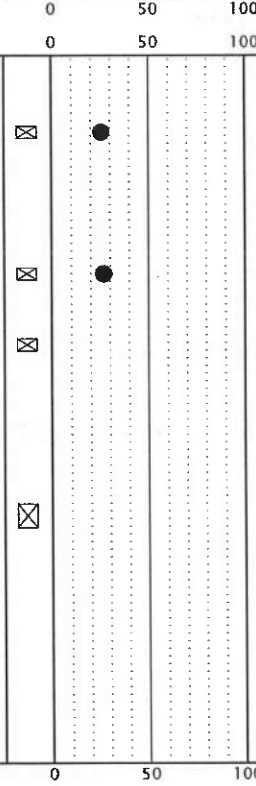
DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	▲ BLOW COUNT ● MOISTURE CONTENT %	COMMENTS

HA-1



Depth (feet)	Material description	Elevation depth	Comments
0.0	Medium stiff, gray-brown CLAY (CL), minor silt and sand, trace organics (rootlets); moist - **FILL.**		
2.5	with sand, trace gravel at 2.5 feet		
5.0	dark brown, sandy; moist to wet at 5.0 feet	5.5	Surface elevation was not measured at the time of exploration.
	Exploration terminated at a depth of 5.5 feet due to refusal on gravel.		

HA-2



Depth (feet)	Material description	Elevation depth	Comments
0.0	Medium stiff, brown CLAY (CL), minor silt and sand, trace organics (rootlets); moist - **FILL.**		
4.5	Medium stiff, brown-gray with orange mottled SILT (ML/MH), trace clay; moist.	4.5	
10.0	Exploration completed at a depth of 10.0 feet.	10.0	Surface elevation was not measured at the time of exploration.

DRILLED BY: GeoDesign, Inc. staff | LOGGED BY: L. Gose | COMPLETED: 06/25/20

BORING METHOD: hand auger (see document text) | BORING BIT DIAMETER: 3 inches

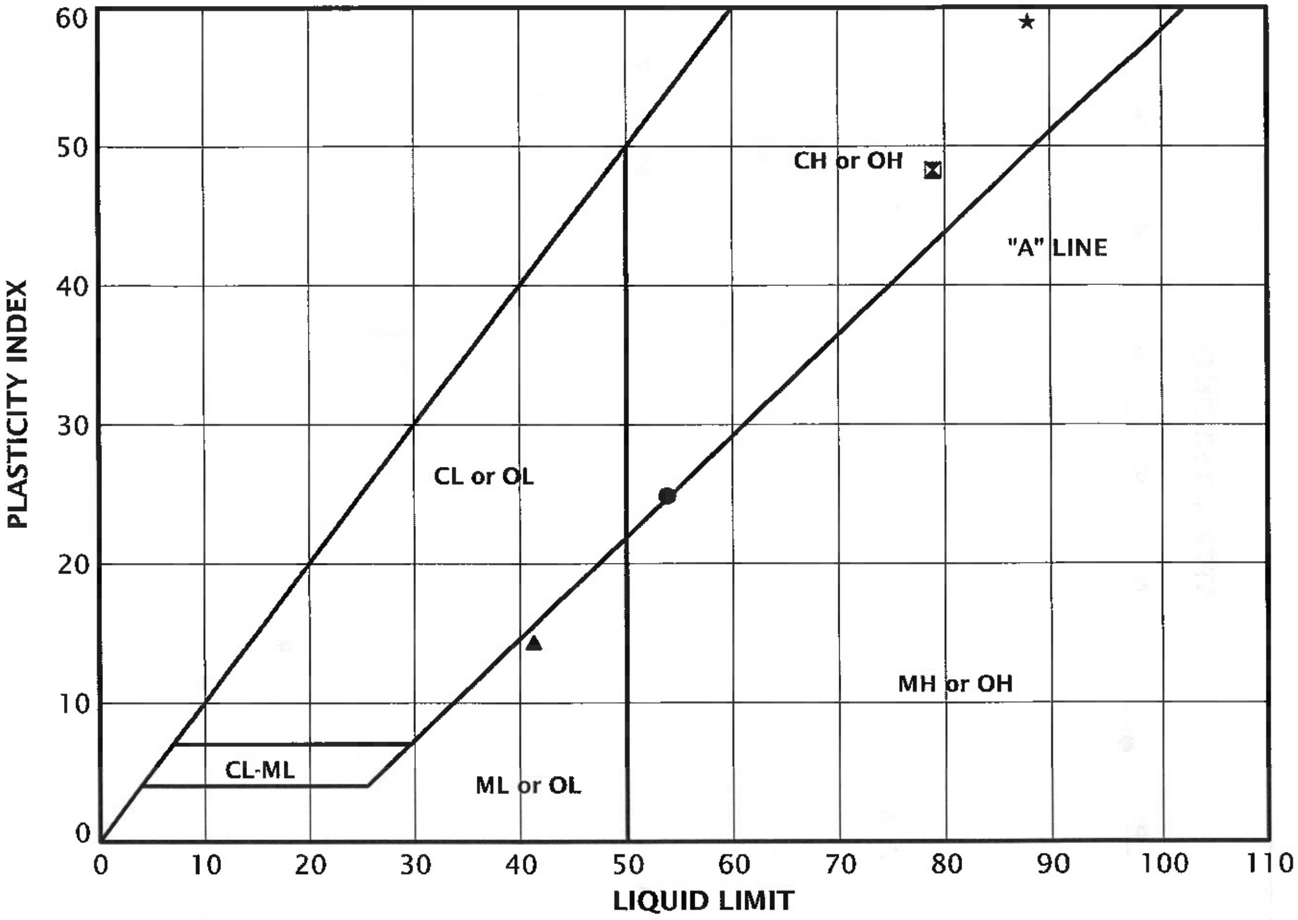
GEODESIGN INC
AN NV5 COMPANY

FRIENDS-4-01
SEPTEMBER 2020

BORING

FRIENDSVIEW - RCF PHASE 1
NEWBERG, OR

FIGURE A-4



KEY	EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	MOISTURE CONTENT (PERCENT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
●	B-1	5.0	37	54	29	25
☒	B-1	20.0	40	79	31	48
▲	B-3	10.0	31	41	27	14
★	B-3	35.0	45	88	29	59

ATTERBERG_LIMITS 7 FRIENDS-4-01-B1_3-HA1_2.GPJ GEODESIGN.GDT PRINT DATE: 9/17/20:KT

GEODESIGN INC
AN NV5 COMPANY

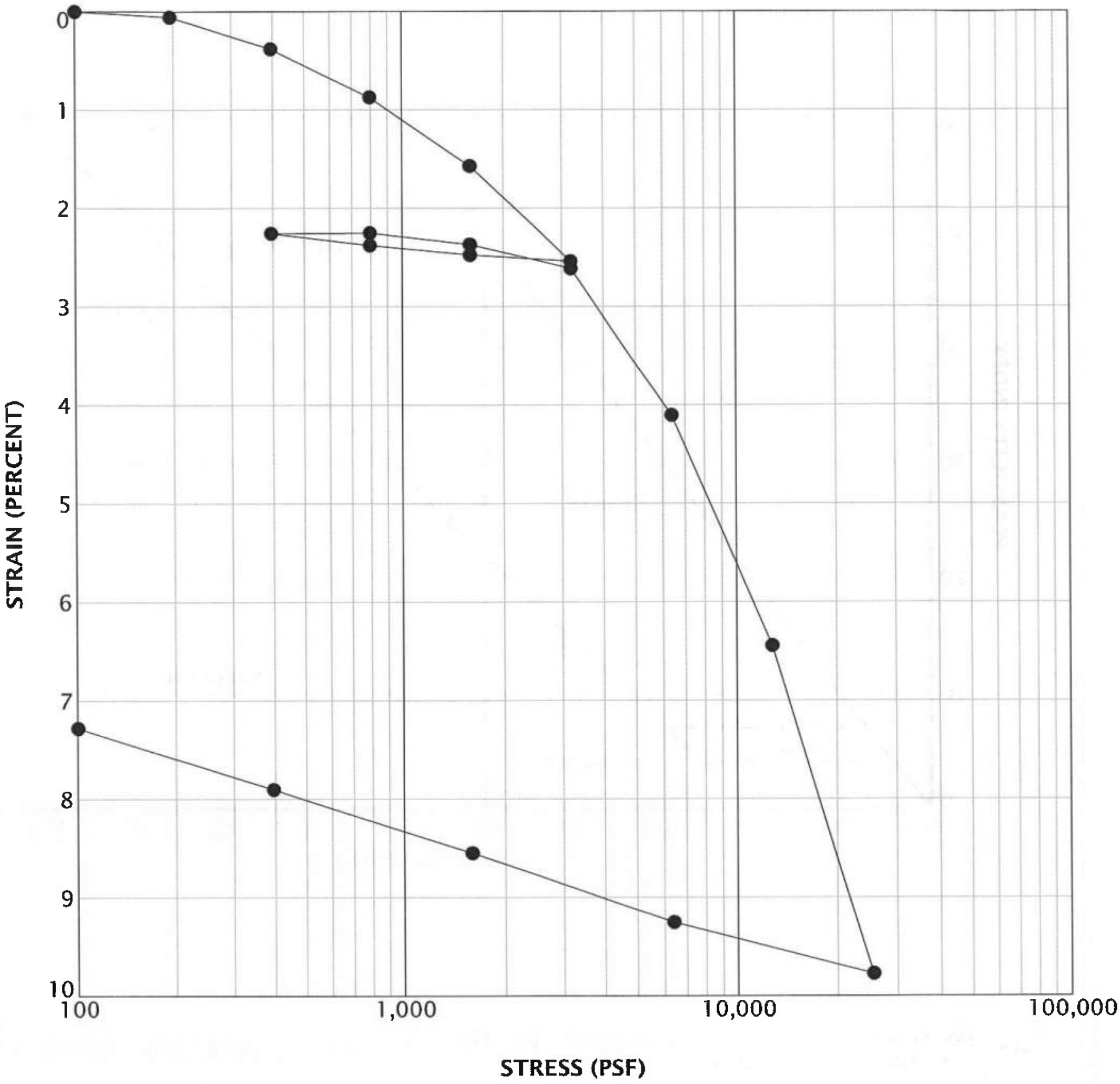
FRIENDS-4-01

SEPTEMBER 2020

ATTERBERG LIMITS TEST RESULTS

FRIENDSVIEW – RCF PHASE 1
NEWBERG, OR

FIGURE A-5



KEY	EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	MOISTURE CONTENT (PERCENT)	DRY DENSITY (PCF)
●	B-2	7.5	32	90

CONSOL_STRAIN_100K FRIENDS-4-01-B1_3-HA1_2.GPJ GEODESIGN.GDT PRINT DATE: 9/17/20:KT

GEODESIGN INC AN NV5 COMPANY	FRIENDS-4-01	**CONSOLIDATION TEST RESULTS**	
	SEPTEMBER 2020	FRIENDSVIEW - RCF PHASE 1 NEWBERG, OR	**FIGURE A-6**

SAMPLE INFORMATION			MOISTURE CONTENT (PERCENT)	DRY DENSITY (PCF)	SIEVE			ATTERBERG LIMITS		
EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	ELEVATION (FEET)			GRAVEL (PERCENT)	SAND (PERCENT)	P200 (PERCENT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
B-1	2.5		34							
B-1	5.0		37					54	29	25
B-1	10.0		39				96			
B-1	20.0		36					79	31	48
B-1	40.0		35				93			
B-1	50.0		37				92			
B-2	7.5		32	90						
B-2	20.0		40							
B-3	6.5		33							
B-3	10.0		31					41	27	14
B-3	20.0		36							
B-3	35.0		45					88	29	59
HA-1	1.0		25							
HA-2	1.5		26							
HA-2	4.5		27							

GEODESIGN INC
AN NV5 COMPANY

FRIENDS-4-01

SEPTEMBER 2020

SUMMARY OF LABORATORY DATA

FRIENDSVIEW – RCF PHASE 1
NEWBERG, OR

FIGURE A-7

APPENDIX B

APPENDIX B

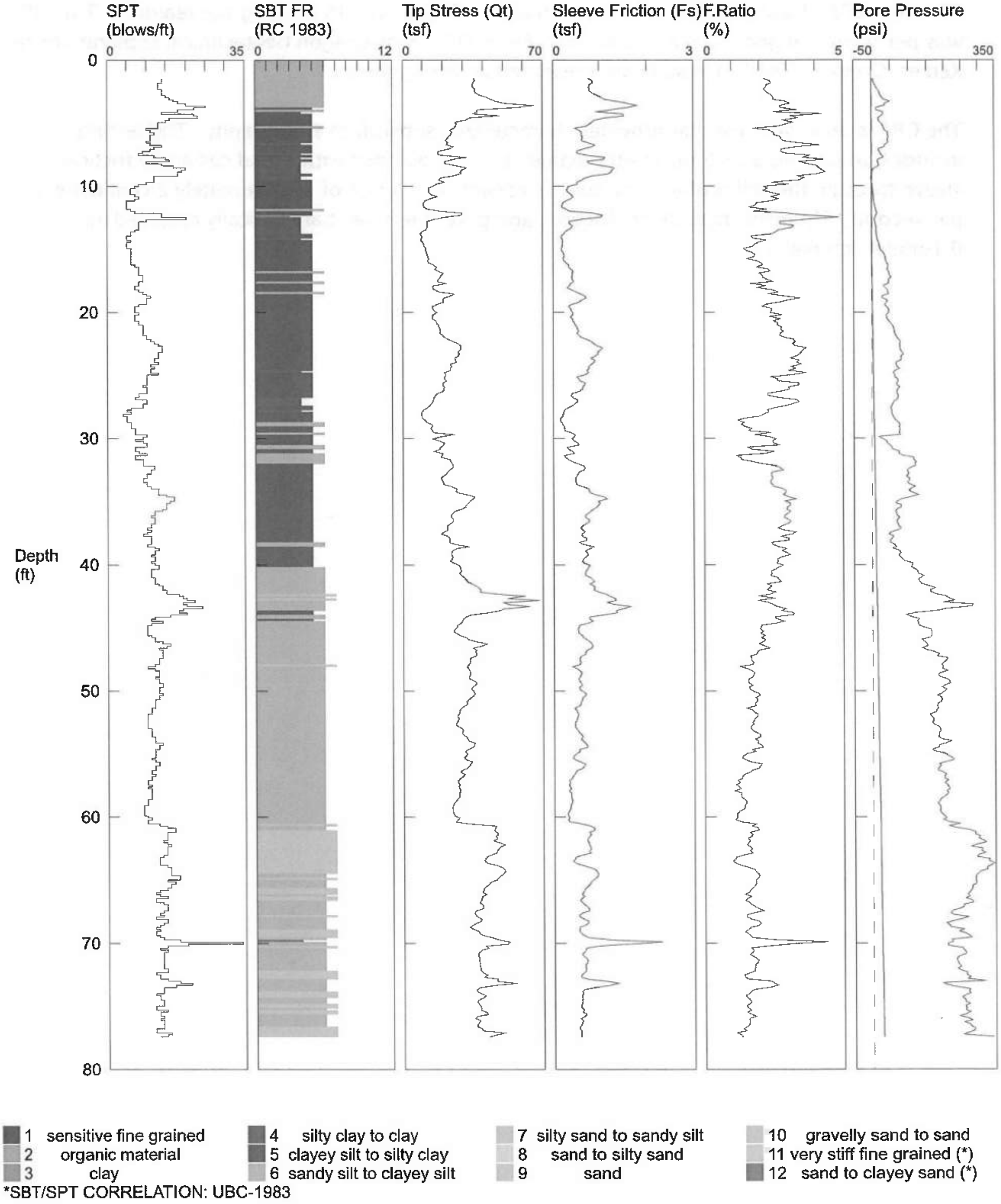
CONE PENETRATION TESTING

Our subsurface exploration program included one CPT (CPT-1) to a depth of approximately 77.4 feet BGS. Figure 2 shows the location of the CPT relative to existing site features. The CPT was performed in general accordance with ASTM D5778 by Oregon Geotechnical Explorations of Keizer, Oregon. The CPT results are presented in this appendix.

The CPT is an in-situ test that provides characterizes subsurface stratigraphy. The testing includes advancing a 35.6-millimeter-diameter cone equipped with a load cell and a friction sleeve through the soil profile. The cone is advanced at a rate of approximately 2 centimeters per second. Tip resistance, sleeve friction, and pore pressure at are typically recorded at 0.1-meter intervals.

GeoDesign / CPT-1 / 1301 Fulton St Newberg

OPERATOR: OGE BAK
CONE ID: DPG1211
HOLE NUMBER: CPT-1
TEST DATE: 6/25/2020 8:23:31 AM
TOTAL DEPTH: 77.428 ft



GeoDesign / CPT-1 / 1301 Fulton St Newberg

OPERATOR: OGE BAK
CONE ID: DPG1211
HOLE NUMBER: CPT-1
TEST DATE: 6/25/2020 8:23:31 AM
TOTAL DEPTH: 77.428 ft

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
1.476	35.28	0.7670	2.174	4.016	14	6	sandy silt to clayey silt
1.640	35.79	0.8548	2.388	4.664	14	6	sandy silt to clayey silt
1.804	34.99	0.8494	2.428	6.255	13	6	sandy silt to clayey silt
1.969	34.86	0.7959	2.283	8.496	13	6	sandy silt to clayey silt
2.133	34.73	0.7800	2.246	12.012	13	6	sandy silt to clayey silt
2.297	35.95	0.7830	2.178	15.155	14	6	sandy silt to clayey silt
2.461	35.69	0.7965	2.232	20.086	14	6	sandy silt to clayey silt
2.625	36.52	0.8526	2.335	21.598	14	6	sandy silt to clayey silt
2.789	38.43	0.9486	2.468	23.403	15	6	sandy silt to clayey silt
2.953	41.97	1.0500	2.502	27.197	16	6	sandy silt to clayey silt
3.117	43.92	1.1082	2.523	33.407	17	6	sandy silt to clayey silt
3.281	46.55	1.3794	2.963	49.753	18	6	sandy silt to clayey silt
3.445	51.25	1.5957	3.114	35.819	20	6	sandy silt to clayey silt
3.609	64.93	1.8015	2.775	34.706	25	6	sandy silt to clayey silt
3.773	57.41	1.5893	2.769	13.612	22	6	sandy silt to clayey silt
3.937	37.39	1.2493	3.341	11.351	18	5	clayey silt to silty clay
4.101	36.89	0.9375	2.542	29.353	14	6	sandy silt to clayey silt
4.265	34.97	1.4874	4.253	31.964	22	4	silty clay to clay
4.429	48.07	1.5151	3.152	25.674	23	5	clayey silt to silty clay
4.593	33.33	1.1300	3.390	17.776	16	5	clayey silt to silty clay
4.757	31.30	0.8980	2.869	18.842	15	5	clayey silt to silty clay
4.921	26.18	0.8445	3.226	22.327	13	5	clayey silt to silty clay
5.085	26.61	0.7881	2.962	28.348	13	5	clayey silt to silty clay
5.249	26.48	0.7115	2.687	30.595	13	5	clayey silt to silty clay
5.413	25.53	0.4638	1.816	33.125	10	6	sandy silt to clayey silt
5.577	23.66	0.5642	2.385	35.183	11	5	clayey silt to silty clay
5.741	24.46	0.6158	2.517	44.172	12	5	clayey silt to silty clay
5.906	23.83	0.6081	2.552	43.717	11	5	clayey silt to silty clay
6.070	22.95	0.6371	2.776	45.529	11	5	clayey silt to silty clay
6.234	22.29	0.6242	2.800	43.637	11	5	clayey silt to silty clay
6.398	21.57	0.6205	2.876	43.250	10	5	clayey silt to silty clay
6.562	22.48	0.7579	3.372	44.519	11	5	clayey silt to silty clay
6.726	21.87	0.9095	4.158	35.294	14	4	silty clay to clay
6.890	24.94	0.8435	3.382	34.917	12	5	clayey silt to silty clay
7.054	23.14	0.6546	2.829	18.085	11	5	clayey silt to silty clay
7.218	18.39	0.5139	2.794	19.819	9	5	clayey silt to silty clay
7.382	17.56	0.5124	2.917	23.591	8	5	clayey silt to silty clay
7.546	18.57	0.7093	3.819	26.664	12	4	silty clay to clay
7.710	31.22	1.1234	3.599	32.472	15	5	clayey silt to silty clay
7.874	25.16	1.0855	4.314	16.279	16	4	silty clay to clay
8.038	21.43	0.7407	3.456	15.907	10	5	clayey silt to silty clay
8.202	21.16	0.7835	3.704	17.965	14	4	silty clay to clay
8.366	25.92	1.0534	4.064	19.854	17	4	silty clay to clay
8.530	31.65	1.3153	4.156	9.758	20	4	silty clay to clay

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
8.694	29.90	1.2691	4.245	3.448	19	4	silty clay to clay
8.858	28.74	1.2594	4.382	0.890	18	4	silty clay to clay
9.022	28.98	1.1859	4.092	-0.025	18	4	silty clay to clay
9.186	25.20	0.8599	3.413	-0.885	12	5	clayey silt to silty clay
9.350	19.19	0.6965	3.629	-1.196	12	4	silty clay to clay
9.514	18.18	0.6266	3.446	-0.500	12	4	silty clay to clay
9.678	20.55	0.5181	2.521	0.088	10	5	clayey silt to silty clay
9.843	17.06	0.5195	3.045	0.596	8	5	clayey silt to silty clay
10.007	15.20	0.3303	2.173	1.372	7	5	clayey silt to silty clay
10.171	13.07	0.3012	2.305	1.935	6	5	clayey silt to silty clay
10.335	13.32	0.2858	2.146	2.669	6	5	clayey silt to silty clay
10.499	13.20	0.3211	2.432	3.430	6	5	clayey silt to silty clay
10.663	14.15	0.3870	2.734	4.307	7	5	clayey silt to silty clay
10.827	17.33	0.4247	2.450	4.933	8	5	clayey silt to silty clay
10.991	13.95	0.3750	2.689	5.428	7	5	clayey silt to silty clay
11.155	11.37	0.2816	2.477	5.870	5	5	clayey silt to silty clay
11.319	10.74	0.2052	1.911	6.649	5	5	clayey silt to silty clay
11.483	10.21	0.1911	1.872	7.627	5	5	clayey silt to silty clay
11.647	10.87	0.1802	1.658	8.921	5	5	clayey silt to silty clay
11.811	12.33	0.2765	2.243	10.135	6	5	clayey silt to silty clay
11.975	18.93	0.3490	1.844	12.024	7	6	sandy silt to clayey silt
12.139	29.46	0.8782	2.981	14.379	14	5	clayey silt to silty clay
12.303	29.09	1.0669	3.667	11.675	14	5	clayey silt to silty clay
12.467	21.09	1.0253	4.862	8.815	20	3	clay
12.631	15.48	0.5725	3.699	7.375	10	4	silty clay to clay
12.795	12.29	0.3392	2.761	8.011	8	4	silty clay to clay
12.959	12.42	0.3413	2.747	9.788	8	4	silty clay to clay
13.123	12.48	0.4061	3.255	11.301	8	4	silty clay to clay
13.287	12.38	0.3938	3.179	11.710	8	4	silty clay to clay
13.451	11.61	0.3139	2.705	12.090	7	4	silty clay to clay
13.615	9.69	0.2532	2.613	11.590	6	4	silty clay to clay
13.780	8.88	0.2176	2.451	12.273	6	4	silty clay to clay
13.944	9.49	0.1623	1.711	13.115	5	5	clayey silt to silty clay
14.108	9.60	0.1700	1.770	14.087	5	5	clayey silt to silty clay
14.272	9.00	0.2009	2.232	15.510	6	4	silty clay to clay
14.436	9.99	0.2005	2.006	17.437	5	5	clayey silt to silty clay
14.600	10.67	0.1946	1.823	19.146	5	5	clayey silt to silty clay
14.764	10.73	0.1910	1.780	20.608	5	5	clayey silt to silty clay
14.928	11.66	0.1661	1.425	22.287	6	5	clayey silt to silty clay
15.092	11.57	0.1754	1.516	23.840	6	5	clayey silt to silty clay
15.256	11.79	0.2041	1.731	31.215	6	5	clayey silt to silty clay
15.420	12.35	0.2269	1.837	33.477	6	5	clayey silt to silty clay
15.584	12.63	0.2278	1.804	36.070	6	5	clayey silt to silty clay
15.748	13.23	0.2065	1.562	36.673	6	5	clayey silt to silty clay
15.912	12.40	0.2356	1.900	37.528	6	5	clayey silt to silty clay
16.076	13.17	0.2711	2.058	40.433	6	5	clayey silt to silty clay
16.240	15.41	0.3280	2.128	43.448	7	5	clayey silt to silty clay
16.404	16.99	0.3247	1.911	43.224	8	5	clayey silt to silty clay
16.568	16.16	0.3769	2.332	40.498	8	5	clayey silt to silty clay
16.732	17.63	0.4235	2.402	45.009	8	5	clayey silt to silty clay
16.896	20.23	0.4047	2.001	46.964	8	6	sandy silt to clayey silt
17.060	19.28	0.4079	2.116	46.858	9	5	clayey silt to silty clay
17.224	18.75	0.3961	2.113	52.185	9	5	clayey silt to silty clay

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.388	17.79	0.4041	2.271	45.139	9	5	clayey silt to silty clay
17.552	17.48	0.4352	2.490	45.295	8	5	clayey silt to silty clay
17.717	21.34	0.3670	1.719	44.129	8	6	sandy silt to clayey silt
17.881	15.42	0.3415	2.215	29.544	7	5	clayey silt to silty clay
18.045	15.13	0.2897	1.914	35.166	7	5	clayey silt to silty clay
18.209	15.92	0.3869	2.430	41.036	8	5	clayey silt to silty clay
18.373	18.39	0.4910	2.669	43.574	9	5	clayey silt to silty clay
18.537	25.38	0.5950	2.344	44.617	10	6	sandy silt to clayey silt
18.701	23.50	0.6858	2.918	28.330	11	5	clayey silt to silty clay
18.865	20.56	0.7068	3.438	28.047	10	5	clayey silt to silty clay
19.029	19.93	0.6104	3.063	40.988	10	5	clayey silt to silty clay
19.193	20.39	0.5576	2.734	40.576	10	5	clayey silt to silty clay
19.357	17.35	0.3897	2.247	33.731	8	5	clayey silt to silty clay
19.521	14.93	0.3133	2.099	37.935	7	5	clayey silt to silty clay
19.685	15.04	0.3703	2.462	44.056	7	5	clayey silt to silty clay
19.849	15.59	0.3803	2.440	45.358	7	5	clayey silt to silty clay
20.013	17.19	0.4132	2.404	45.750	8	5	clayey silt to silty clay
20.177	15.10	0.4219	2.794	38.063	7	5	clayey silt to silty clay
20.341	15.01	0.3591	2.393	39.719	7	5	clayey silt to silty clay
20.505	14.77	0.4075	2.758	40.408	7	5	clayey silt to silty clay
20.669	16.73	0.4208	2.515	46.160	8	5	clayey silt to silty clay
20.833	16.92	0.4521	2.672	50.060	8	5	clayey silt to silty clay
20.997	17.81	0.4717	2.649	54.834	9	5	clayey silt to silty clay
21.161	18.04	0.5065	2.808	58.134	9	5	clayey silt to silty clay
21.325	18.80	0.5218	2.776	59.935	9	5	clayey silt to silty clay
21.490	18.83	0.5405	2.871	60.915	9	5	clayey silt to silty clay
21.654	18.54	0.5111	2.756	61.561	9	5	clayey silt to silty clay
21.818	19.92	0.5448	2.735	64.702	10	5	clayey silt to silty clay
21.982	20.84	0.6057	2.906	67.351	10	5	clayey silt to silty clay
22.146	22.59	0.7312	3.236	73.334	11	5	clayey silt to silty clay
22.310	25.10	0.8273	3.296	77.571	12	5	clayey silt to silty clay
22.474	27.52	0.8842	3.213	74.905	13	5	clayey silt to silty clay
22.638	28.61	0.9407	3.288	76.664	14	5	clayey silt to silty clay
22.802	28.88	1.0654	3.689	76.053	14	5	clayey silt to silty clay
22.966	28.51	1.0210	3.581	77.360	14	5	clayey silt to silty clay
23.130	27.29	0.9590	3.515	81.084	13	5	clayey silt to silty clay
23.294	27.92	0.9657	3.459	86.308	13	5	clayey silt to silty clay
23.458	27.31	0.9069	3.320	79.199	13	5	clayey silt to silty clay
23.622	25.95	0.8102	3.122	79.898	12	5	clayey silt to silty clay
23.786	26.02	0.8963	3.445	78.918	12	5	clayey silt to silty clay
23.950	26.47	0.8849	3.342	65.986	13	5	clayey silt to silty clay
24.114	23.58	0.8271	3.508	66.039	11	5	clayey silt to silty clay
24.278	24.07	0.7616	3.164	67.557	12	5	clayey silt to silty clay
24.442	23.48	0.7753	3.301	74.183	11	5	clayey silt to silty clay
24.606	23.64	0.7250	3.066	63.227	11	5	clayey silt to silty clay
24.770	20.76	0.7595	3.659	56.872	13	4	silty clay to clay
24.934	21.37	0.6949	3.252	62.074	10	5	clayey silt to silty clay
25.098	20.83	0.5004	2.403	62.255	10	5	clayey silt to silty clay
25.262	20.46	0.5429	2.654	69.115	10	5	clayey silt to silty clay
25.427	21.51	0.5732	2.665	71.771	10	5	clayey silt to silty clay
25.591	20.19	0.6935	3.435	67.235	10	5	clayey silt to silty clay
25.755	19.81	0.6753	3.409	67.577	9	5	clayey silt to silty clay
25.919	20.75	0.6360	3.065	74.696	10	5	clayey silt to silty clay

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.083	20.44	0.6309	3.087	69.419	10	5	clayey silt to silty clay
26.247	20.04	0.5541	2.765	67.733	10	5	clayey silt to silty clay
26.411	17.49	0.4021	2.299	67.426	8	5	clayey silt to silty clay
26.575	16.36	0.3761	2.298	71.464	8	5	clayey silt to silty clay
26.739	15.55	0.4135	2.659	70.766	7	5	clayey silt to silty clay
26.903	15.31	0.5115	3.341	66.813	10	4	silty clay to clay
27.067	15.19	0.5204	3.425	58.842	10	4	silty clay to clay
27.231	14.05	0.4499	3.202	56.030	9	4	silty clay to clay
27.395	13.50	0.3968	2.941	54.030	9	4	silty clay to clay
27.559	12.23	0.3111	2.544	49.871	6	5	clayey silt to silty clay
27.723	10.49	0.2393	2.282	53.329	5	5	clayey silt to silty clay
27.887	9.49	0.2222	2.342	53.467	6	4	silty clay to clay
28.051	9.38	0.2015	2.149	54.452	4	5	clayey silt to silty clay
28.215	9.52	0.1918	2.015	56.952	5	5	clayey silt to silty clay
28.379	9.83	0.1426	1.451	59.614	5	5	clayey silt to silty clay
28.543	11.20	0.1372	1.225	64.747	5	5	clayey silt to silty clay
28.707	11.79	0.1675	1.421	70.409	6	5	clayey silt to silty clay
28.871	14.37	0.1902	1.324	76.088	6	6	sandy silt to clayey silt
29.035	14.83	0.2181	1.471	73.716	6	6	sandy silt to clayey silt
29.199	13.96	0.2378	1.703	75.234	7	5	clayey silt to silty clay
29.364	14.87	0.2397	1.612	75.126	7	5	clayey silt to silty clay
29.528	15.49	0.3689	2.382	74.073	7	5	clayey silt to silty clay
29.692	25.25	0.4708	1.865	76.679	10	6	sandy silt to clayey silt
29.856	18.71	0.4401	2.353	16.781	9	5	clayey silt to silty clay
30.020	15.22	0.3935	2.584	28.288	7	5	clayey silt to silty clay
30.184	18.38	0.4542	2.470	39.234	9	5	clayey silt to silty clay
30.348	20.65	0.5186	2.511	40.264	10	5	clayey silt to silty clay
30.512	20.09	0.5428	2.702	47.011	10	5	clayey silt to silty clay
30.676	18.82	0.2945	1.565	53.417	7	6	sandy silt to clayey silt
30.840	18.33	0.3128	1.707	55.131	7	6	sandy silt to clayey silt
31.004	15.79	0.3963	2.510	73.746	8	5	clayey silt to silty clay
31.168	19.85	0.4386	2.210	72.442	10	5	clayey silt to silty clay
31.332	19.48	0.2279	1.170	82.081	7	6	sandy silt to clayey silt
31.496	19.36	0.2527	1.306	112.578	7	6	sandy silt to clayey silt
31.660	23.35	0.3134	1.342	112.829	9	6	sandy silt to clayey silt
31.824	23.74	0.4184	1.763	119.066	9	6	sandy silt to clayey silt
31.988	24.34	0.5062	2.080	116.609	9	6	sandy silt to clayey silt
32.152	25.03	0.6504	2.598	117.338	12	5	clayey silt to silty clay
32.316	24.59	0.6746	2.744	102.785	12	5	clayey silt to silty clay
32.480	23.05	0.6614	2.870	95.314	11	5	clayey silt to silty clay
32.644	22.07	0.5464	2.476	97.606	11	5	clayey silt to silty clay
32.808	21.68	0.5237	2.416	98.740	10	5	clayey silt to silty clay
32.972	20.02	0.4907	2.451	92.897	10	5	clayey silt to silty clay
33.136	19.16	0.4738	2.472	100.632	9	5	clayey silt to silty clay
33.301	19.42	0.4683	2.411	100.659	9	5	clayey silt to silty clay
33.465	20.10	0.4811	2.394	95.282	10	5	clayey silt to silty clay
33.629	20.39	0.4996	2.450	102.569	10	5	clayey silt to silty clay
33.793	23.70	0.5950	2.510	116.498	11	5	clayey silt to silty clay
33.957	26.67	0.7577	2.841	105.188	13	5	clayey silt to silty clay
34.121	26.24	0.7739	2.949	98.682	13	5	clayey silt to silty clay
34.285	26.84	0.7905	2.946	110.744	13	5	clayey silt to silty clay
34.449	31.92	0.9106	2.852	126.196	15	5	clayey silt to silty clay
34.613	35.59	1.0833	3.044	106.454	17	5	clayey silt to silty clay

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
34.777	34.50	1.1471	3.325	80.312	17	5	clayey silt to silty clay
34.941	33.29	0.9655	2.900	68.065	16	5	clayey silt to silty clay
35.105	32.23	0.9990	3.099	63.906	15	5	clayey silt to silty clay
35.269	31.19	0.9717	3.115	79.016	15	5	clayey silt to silty clay
35.433	30.73	0.9266	3.015	78.126	15	5	clayey silt to silty clay
35.597	28.92	0.8606	2.976	66.997	14	5	clayey silt to silty clay
35.761	25.66	0.7989	3.114	62.659	12	5	clayey silt to silty clay
35.925	24.47	0.7395	3.022	66.006	12	5	clayey silt to silty clay
36.089	23.72	0.6863	2.894	67.874	11	5	clayey silt to silty clay
36.253	24.08	0.6968	2.894	74.299	12	5	clayey silt to silty clay
36.417	24.93	0.7617	3.056	68.499	12	5	clayey silt to silty clay
36.581	24.68	0.7701	3.120	65.285	12	5	clayey silt to silty clay
36.745	23.20	0.6940	2.992	69.909	11	5	clayey silt to silty clay
36.909	22.02	0.6177	2.805	71.065	11	5	clayey silt to silty clay
37.073	21.84	0.5830	2.670	78.239	10	5	clayey silt to silty clay
37.238	22.02	0.6272	2.849	70.869	11	5	clayey silt to silty clay
37.402	20.53	0.6775	3.300	51.595	10	5	clayey silt to silty clay
37.566	19.04	0.6049	3.177	44.622	9	5	clayey silt to silty clay
37.730	22.21	0.6173	2.779	56.812	11	5	clayey silt to silty clay
37.894	23.08	0.7059	3.058	53.452	11	5	clayey silt to silty clay
38.058	23.09	0.7010	3.036	48.170	11	5	clayey silt to silty clay
38.222	22.92	0.5591	2.440	47.773	11	5	clayey silt to silty clay
38.386	25.98	0.6407	2.466	59.400	10	6	sandy silt to clayey silt
38.550	32.34	0.8603	2.660	64.582	12	6	sandy silt to clayey silt
38.714	26.35	0.7813	2.966	55.495	13	5	clayey silt to silty clay
38.878	24.52	0.6888	2.809	74.407	12	5	clayey silt to silty clay
39.042	24.09	0.7214	2.995	76.355	12	5	clayey silt to silty clay
39.206	23.94	0.7395	3.089	72.691	11	5	clayey silt to silty clay
39.370	24.44	0.6871	2.811	74.631	12	5	clayey silt to silty clay
39.534	24.30	0.6428	2.645	80.473	12	5	clayey silt to silty clay
39.698	23.38	0.6221	2.661	88.346	11	5	clayey silt to silty clay
39.862	25.10	0.6534	2.603	109.138	12	5	clayey silt to silty clay
40.026	27.60	0.7816	2.832	107.826	13	5	clayey silt to silty clay
40.190	28.18	0.7531	2.672	105.406	13	5	clayey silt to silty clay
40.354	28.43	0.7269	2.557	116.048	11	6	sandy silt to clayey silt
40.518	28.80	0.6940	2.410	122.265	11	6	sandy silt to clayey silt
40.682	27.78	0.6787	2.444	124.650	11	6	sandy silt to clayey silt
40.846	29.13	0.6930	2.379	138.531	11	6	sandy silt to clayey silt
41.011	30.24	0.7966	2.634	132.008	12	6	sandy silt to clayey silt
41.175	31.23	0.8379	2.683	124.555	12	6	sandy silt to clayey silt
41.339	31.84	0.8817	2.769	128.751	12	6	sandy silt to clayey silt
41.503	34.15	0.7776	2.277	134.239	13	6	sandy silt to clayey silt
41.667	36.13	0.8749	2.422	153.832	14	6	sandy silt to clayey silt
41.831	37.67	0.8855	2.351	173.147	14	6	sandy silt to clayey silt
41.995	38.53	0.8667	2.249	158.697	15	6	sandy silt to clayey silt
42.159	38.13	0.9750	2.557	160.260	15	6	sandy silt to clayey silt
42.323	46.81	1.1150	2.382	173.632	18	6	sandy silt to clayey silt
42.487	60.39	1.1914	1.973	202.925	19	7	silty sand to sandy silt
42.651	51.95	1.3140	2.529	212.494	20	6	sandy silt to clayey silt
42.815	67.90	1.3240	1.950	227.443	22	7	silty sand to sandy silt
42.979	49.72	1.1378	2.289	198.087	19	6	sandy silt to clayey silt
43.143	52.60	1.3036	2.478	282.699	20	6	sandy silt to clayey silt
43.307	63.01	1.6393	2.602	278.656	24	6	sandy silt to clayey silt

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
43.471	50.11	1.4758	2.945	205.696	19	6	sandy silt to clayey silt
43.635	48.08	1.3396	2.786	183.771	18	6	sandy silt to clayey silt
43.799	41.95	1.3506	3.219	116.398	20	5	clayey silt to silty clay
43.963	33.74	1.0835	3.212	91.487	16	5	clayey silt to silty clay
44.127	30.91	0.7853	2.541	104.012	12	6	sandy silt to clayey silt
44.291	29.58	0.7675	2.594	126.218	11	6	sandy silt to clayey silt
44.455	29.22	0.8464	2.897	122.494	14	5	clayey silt to silty clay
44.619	28.58	0.7423	2.597	124.836	11	6	sandy silt to clayey silt
44.783	26.96	0.5555	2.061	125.276	10	6	sandy silt to clayey silt
44.948	26.60	0.5371	2.020	137.162	10	6	sandy silt to clayey silt
45.112	25.51	0.5148	2.018	157.896	10	6	sandy silt to clayey silt
45.276	24.99	0.5282	2.114	162.547	10	6	sandy silt to clayey silt
45.440	26.43	0.5327	2.015	162.881	10	6	sandy silt to clayey silt
45.604	28.24	0.6142	2.175	162.062	11	6	sandy silt to clayey silt
45.768	31.16	0.6355	2.040	157.067	12	6	sandy silt to clayey silt
45.932	32.45	0.7116	2.193	134.280	12	6	sandy silt to clayey silt
46.096	36.41	0.7722	2.121	140.524	14	6	sandy silt to clayey silt
46.260	41.68	0.8187	1.964	146.208	16	6	sandy silt to clayey silt
46.424	39.00	0.8386	2.150	150.400	15	6	sandy silt to clayey silt
46.588	34.69	0.8157	2.352	135.104	13	6	sandy silt to clayey silt
46.752	36.23	0.7145	1.972	148.902	14	6	sandy silt to clayey silt
46.916	35.95	0.6849	1.905	170.418	14	6	sandy silt to clayey silt
47.080	36.44	0.6791	1.864	184.533	14	6	sandy silt to clayey silt
47.244	35.62	0.5844	1.641	178.122	14	6	sandy silt to clayey silt
47.408	33.10	0.5584	1.687	208.360	13	6	sandy silt to clayey silt
47.572	33.05	0.5577	1.687	204.834	13	6	sandy silt to clayey silt
47.736	32.97	0.5797	1.759	197.997	13	6	sandy silt to clayey silt
47.900	32.47	0.5593	1.723	191.797	12	6	sandy silt to clayey silt
48.064	31.54	0.3940	1.249	195.102	10	7	silty sand to sandy silt
48.228	32.02	0.4865	1.519	193.938	12	6	sandy silt to clayey silt
48.392	32.88	0.5569	1.694	208.312	13	6	sandy silt to clayey silt
48.556	33.21	0.5968	1.797	187.727	13	6	sandy silt to clayey silt
48.720	33.08	0.5786	1.749	181.273	13	6	sandy silt to clayey silt
48.885	32.45	0.5580	1.719	185.794	12	6	sandy silt to clayey silt
49.049	32.79	0.5194	1.584	206.405	13	6	sandy silt to clayey silt
49.213	35.18	0.5511	1.566	214.047	13	6	sandy silt to clayey silt
49.377	36.41	0.5812	1.596	215.735	14	6	sandy silt to clayey silt
49.541	35.43	0.6076	1.715	200.944	14	6	sandy silt to clayey silt
49.705	34.11	0.5448	1.597	192.074	13	6	sandy silt to clayey silt
49.869	33.83	0.5498	1.625	204.907	13	6	sandy silt to clayey silt
50.033	34.92	0.6117	1.752	198.658	13	6	sandy silt to clayey silt
50.197	35.48	0.6935	1.955	191.094	14	6	sandy silt to clayey silt
50.361	34.90	0.6865	1.967	178.982	13	6	sandy silt to clayey silt
50.525	33.45	0.6128	1.832	191.184	13	6	sandy silt to clayey silt
50.689	32.06	0.6109	1.906	191.606	12	6	sandy silt to clayey silt
50.853	31.26	0.5830	1.865	189.295	12	6	sandy silt to clayey silt
51.017	31.79	0.5723	1.801	179.816	12	6	sandy silt to clayey silt
51.181	30.23	0.5548	1.836	178.675	12	6	sandy silt to clayey silt
51.345	28.80	0.4322	1.501	180.690	11	6	sandy silt to clayey silt
51.509	28.03	0.4801	1.713	176.283	11	6	sandy silt to clayey silt
51.673	27.87	0.4979	1.786	174.556	11	6	sandy silt to clayey silt
51.837	27.24	0.5202	1.909	158.092	10	6	sandy silt to clayey silt
52.001	26.70	0.5064	1.896	159.705	10	6	sandy silt to clayey silt

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
52.165	27.40	0.4967	1.813	165.543	10	6	sandy silt to clayey silt
52.329	27.14	0.4816	1.775	167.656	10	6	sandy silt to clayey silt
52.493	26.34	0.4522	1.717	162.947	10	6	sandy silt to clayey silt
52.657	26.06	0.4551	1.747	167.885	10	6	sandy silt to clayey silt
52.822	27.22	0.4471	1.643	181.947	10	6	sandy silt to clayey silt
52.986	29.02	0.4810	1.658	186.380	11	6	sandy silt to clayey silt
53.150	29.50	0.5140	1.742	187.887	11	6	sandy silt to clayey silt
53.314	28.88	0.5455	1.889	183.774	11	6	sandy silt to clayey silt
53.478	29.80	0.5975	2.005	184.070	11	6	sandy silt to clayey silt
53.642	31.13	0.6181	1.986	181.706	12	6	sandy silt to clayey silt
53.806	31.70	0.5733	1.808	189.734	12	6	sandy silt to clayey silt
53.970	32.52	0.6253	1.923	219.718	12	6	sandy silt to clayey silt
54.134	35.49	0.6742	1.900	204.980	14	6	sandy silt to clayey silt
54.298	35.09	0.7167	2.043	183.080	13	6	sandy silt to clayey silt
54.462	34.09	0.7127	2.091	182.442	13	6	sandy silt to clayey silt
54.626	31.94	0.5410	1.694	163.849	12	6	sandy silt to clayey silt
54.790	30.43	0.5530	1.817	170.759	12	6	sandy silt to clayey silt
54.954	31.59	0.4839	1.532	199.577	12	6	sandy silt to clayey silt
55.118	30.98	0.4273	1.379	208.619	12	6	sandy silt to clayey silt
55.282	29.84	0.3989	1.337	220.286	11	6	sandy silt to clayey silt
55.446	31.23	0.4504	1.442	226.418	12	6	sandy silt to clayey silt
55.610	33.85	0.5598	1.654	204.842	13	6	sandy silt to clayey silt
55.774	33.22	0.6805	2.048	183.892	13	6	sandy silt to clayey silt
55.938	32.41	0.6476	1.998	188.355	12	6	sandy silt to clayey silt
56.102	31.45	0.6112	1.943	182.125	12	6	sandy silt to clayey silt
56.266	28.99	0.4950	1.708	177.886	11	6	sandy silt to clayey silt
56.430	28.17	0.4593	1.630	193.556	11	6	sandy silt to clayey silt
56.594	30.19	0.4302	1.425	203.065	12	6	sandy silt to clayey silt
56.759	29.42	0.3982	1.354	198.763	11	6	sandy silt to clayey silt
56.923	27.84	0.3706	1.331	199.753	11	6	sandy silt to clayey silt
57.087	27.13	0.3164	1.166	209.297	10	6	sandy silt to clayey silt
57.251	27.03	0.3383	1.251	198.768	10	6	sandy silt to clayey silt
57.415	27.61	0.3076	1.114	206.222	11	6	sandy silt to clayey silt
57.579	27.14	0.3287	1.211	209.330	10	6	sandy silt to clayey silt
57.743	27.78	0.3590	1.292	213.469	11	6	sandy silt to clayey silt
57.907	27.98	0.2987	1.067	205.852	11	6	sandy silt to clayey silt
58.071	27.64	0.3608	1.305	208.516	11	6	sandy silt to clayey silt
58.235	27.66	0.3617	1.307	203.967	11	6	sandy silt to clayey silt
58.399	27.56	0.3609	1.310	196.466	11	6	sandy silt to clayey silt
58.563	26.54	0.3714	1.399	187.757	10	6	sandy silt to clayey silt
58.727	25.86	0.3843	1.486	184.907	10	6	sandy silt to clayey silt
58.891	24.90	0.3708	1.490	177.816	10	6	sandy silt to clayey silt
59.055	24.45	0.3477	1.422	184.663	9	6	sandy silt to clayey silt
59.219	24.11	0.3485	1.446	186.988	9	6	sandy silt to clayey silt
59.383	24.21	0.3301	1.364	186.895	9	6	sandy silt to clayey silt
59.547	24.36	0.3007	1.234	185.603	9	6	sandy silt to clayey silt
59.711	24.56	0.2823	1.149	190.898	9	6	sandy silt to clayey silt
59.875	25.27	0.2918	1.154	198.085	10	6	sandy silt to clayey silt
60.039	27.49	0.3152	1.146	204.432	11	6	sandy silt to clayey silt
60.203	26.71	0.2896	1.084	194.805	10	6	sandy silt to clayey silt
60.367	25.87	0.3325	1.286	210.936	10	6	sandy silt to clayey silt
60.532	32.94	0.6043	1.835	241.538	13	6	sandy silt to clayey silt
60.696	45.95	0.7761	1.689	210.418	15	7	silty sand to sandy silt

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
60.860	45.40	0.8695	1.915	232.798	17	6	sandy silt to clayey silt
61.024	44.71	0.8604	1.925	272.989	17	6	sandy silt to clayey silt
61.188	46.17	0.7465	1.617	289.250	15	7	silty sand to sandy silt
61.352	46.91	0.7959	1.697	287.069	15	7	silty sand to sandy silt
61.516	45.52	0.7596	1.669	303.029	15	7	silty sand to sandy silt
61.680	46.45	0.7164	1.542	298.231	15	7	silty sand to sandy silt
61.844	44.38	0.7156	1.613	313.724	14	7	silty sand to sandy silt
62.008	47.36	0.7389	1.560	321.064	15	7	silty sand to sandy silt
62.172	50.10	0.7562	1.509	293.271	16	7	silty sand to sandy silt
62.336	48.07	0.7700	1.602	276.337	15	7	silty sand to sandy silt
62.500	46.84	0.7901	1.687	310.889	15	7	silty sand to sandy silt
62.664	46.43	0.7488	1.613	306.135	15	7	silty sand to sandy silt
62.828	45.82	0.7811	1.705	318.996	15	7	silty sand to sandy silt
62.992	42.93	0.5860	1.365	297.935	14	7	silty sand to sandy silt
63.156	41.00	0.4612	1.125	294.042	13	7	silty sand to sandy silt
63.320	40.43	0.4348	1.076	331.404	13	7	silty sand to sandy silt
63.484	40.09	0.3996	0.997	329.753	13	7	silty sand to sandy silt
63.648	41.72	0.4632	1.110	345.044	13	7	silty sand to sandy silt
63.812	46.29	0.5870	1.268	336.556	15	7	silty sand to sandy silt
63.976	48.81	0.7669	1.571	323.516	16	7	silty sand to sandy silt
64.140	50.09	0.8858	1.768	324.763	16	7	silty sand to sandy silt
64.304	50.19	0.9133	1.820	303.662	16	7	silty sand to sandy silt
64.469	49.48	0.9390	1.898	297.882	16	7	silty sand to sandy silt
64.633	48.13	0.9373	1.947	289.841	18	6	sandy silt to clayey silt
64.797	46.93	0.8968	1.911	290.479	18	6	sandy silt to clayey silt
64.961	46.05	0.8341	1.811	288.916	15	7	silty sand to sandy silt
65.125	43.22	0.7907	1.829	292.007	17	6	sandy silt to clayey silt
65.289	42.25	0.7678	1.817	290.376	16	6	sandy silt to clayey silt
65.453	40.95	0.7296	1.782	278.189	16	6	sandy silt to clayey silt
65.617	39.67	0.6711	1.692	279.656	15	6	sandy silt to clayey silt
65.781	39.64	0.6435	1.623	276.115	13	7	silty sand to sandy silt
65.945	38.90	0.6155	1.582	271.220	12	7	silty sand to sandy silt
66.109	40.85	0.5848	1.432	264.812	13	7	silty sand to sandy silt
66.273	39.09	0.6432	1.645	271.127	15	6	sandy silt to clayey silt
66.437	38.49	0.5824	1.513	258.442	12	7	silty sand to sandy silt
66.601	38.15	0.5477	1.436	277.467	12	7	silty sand to sandy silt
66.765	37.63	0.5993	1.593	282.312	14	6	sandy silt to clayey silt
66.929	38.92	0.6490	1.668	253.178	15	6	sandy silt to clayey silt
67.093	39.26	0.7070	1.801	254.406	15	6	sandy silt to clayey silt
67.257	38.78	0.7457	1.923	242.106	15	6	sandy silt to clayey silt
67.421	35.42	0.7457	2.105	219.919	14	6	sandy silt to clayey silt
67.585	35.04	0.6032	1.721	214.569	13	6	sandy silt to clayey silt
67.749	35.61	0.5225	1.467	222.957	14	6	sandy silt to clayey silt
67.913	36.71	0.5465	1.489	266.458	12	7	silty sand to sandy silt
68.077	38.32	0.6338	1.654	248.270	15	6	sandy silt to clayey silt
68.241	38.00	0.7272	1.913	224.171	15	6	sandy silt to clayey silt
68.406	35.82	0.7171	2.002	202.834	14	6	sandy silt to clayey silt
68.570	33.77	0.6466	1.915	212.258	13	6	sandy silt to clayey silt
68.734	32.40	0.5297	1.635	215.394	12	6	sandy silt to clayey silt
68.898	34.81	0.5412	1.555	253.286	13	6	sandy silt to clayey silt
69.062	37.07	0.5272	1.422	239.032	12	7	silty sand to sandy silt
69.226	37.34	0.5694	1.525	257.080	12	7	silty sand to sandy silt
69.390	39.63	0.6356	1.604	269.107	13	7	silty sand to sandy silt

Depth ft	Tip Stress (Qt) (tsf)	Sleeve Friction (Fs) (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
69.554	43.70	0.7342	1.680	276.020	14	7	silty sand to sandy silt
69.718	47.30	1.2249	2.590	217.092	18	6	sandy silt to clayey silt
69.882	52.62	2.3020	4.375	221.528	34	4	silty clay to clay
70.046	51.57	1.6050	3.112	205.093	20	6	sandy silt to clayey silt
70.210	40.40	0.9348	2.314	208.513	15	6	sandy silt to clayey silt
70.374	41.78	0.6877	1.646	248.549	13	7	silty sand to sandy silt
70.538	38.72	0.6658	1.719	252.886	15	6	sandy silt to clayey silt
70.702	37.16	0.6338	1.706	258.975	14	6	sandy silt to clayey silt
70.866	36.60	0.5780	1.580	258.045	14	6	sandy silt to clayey silt
71.030	36.89	0.6269	1.699	240.080	14	6	sandy silt to clayey silt
71.194	37.41	0.6840	1.828	232.557	14	6	sandy silt to clayey silt
71.358	37.27	0.7087	1.901	232.667	14	6	sandy silt to clayey silt
71.522	37.38	0.7003	1.874	235.442	14	6	sandy silt to clayey silt
71.686	37.32	0.6650	1.782	238.510	14	6	sandy silt to clayey silt
71.850	37.50	0.6693	1.785	244.666	14	6	sandy silt to clayey silt
72.014	37.93	0.6738	1.776	235.228	15	6	sandy silt to clayey silt
72.178	37.97	0.6733	1.773	245.395	15	6	sandy silt to clayey silt
72.343	39.16	0.6308	1.611	262.938	12	7	silty sand to sandy silt
72.507	41.12	0.5726	1.393	259.955	13	7	silty sand to sandy silt
72.671	39.79	0.5670	1.425	272.731	13	7	silty sand to sandy silt
72.835	46.44	0.7029	1.514	262.433	15	7	silty sand to sandy silt
72.999	45.96	1.0891	2.370	318.837	18	6	sandy silt to clayey silt
73.163	55.55	1.3717	2.469	192.456	21	6	sandy silt to clayey silt
73.327	45.23	1.1899	2.631	203.814	17	6	sandy silt to clayey silt
73.491	37.43	0.8623	2.304	236.231	14	6	sandy silt to clayey silt
73.655	35.97	0.6324	1.758	271.909	14	6	sandy silt to clayey silt
73.819	36.23	0.5877	1.622	267.315	14	6	sandy silt to clayey silt
73.983	38.17	0.6018	1.577	272.590	12	7	silty sand to sandy silt
74.147	40.35	0.5834	1.446	256.336	13	7	silty sand to sandy silt
74.311	39.25	0.5886	1.500	246.953	13	7	silty sand to sandy silt
74.475	36.81	0.5901	1.603	257.037	14	6	sandy silt to clayey silt
74.639	36.13	0.5905	1.635	256.919	14	6	sandy silt to clayey silt
74.803	37.03	0.5807	1.568	270.220	14	6	sandy silt to clayey silt
74.967	37.80	0.5585	1.477	256.402	12	7	silty sand to sandy silt
75.131	38.09	0.5800	1.522	261.030	12	7	silty sand to sandy silt
75.295	38.08	0.6257	1.643	257.007	15	6	sandy silt to clayey silt
75.459	40.43	0.6021	1.489	272.728	13	7	silty sand to sandy silt
75.623	41.46	0.6737	1.625	258.553	13	7	silty sand to sandy silt
75.787	36.05	0.6498	1.803	239.455	14	6	sandy silt to clayey silt
75.951	35.01	0.5500	1.571	265.021	13	6	sandy silt to clayey silt
76.115	37.68	0.5956	1.580	276.806	14	6	sandy silt to clayey silt
76.280	37.06	0.5883	1.588	254.416	14	6	sandy silt to clayey silt
76.444	36.41	0.5680	1.560	271.316	14	6	sandy silt to clayey silt
76.608	36.18	0.5405	1.494	275.608	14	6	sandy silt to clayey silt
76.772	38.50	0.5196	1.350	285.602	12	7	silty sand to sandy silt
76.936	38.94	0.5671	1.457	283.689	12	7	silty sand to sandy silt
77.100	50.15	0.5610	1.119	267.039	16	7	silty sand to sandy silt
77.264	45.49	0.5701	1.253	250.240	15	7	silty sand to sandy silt
77.428	41.88	0.5601	1.337	341.866	13	7	silty sand to sandy silt

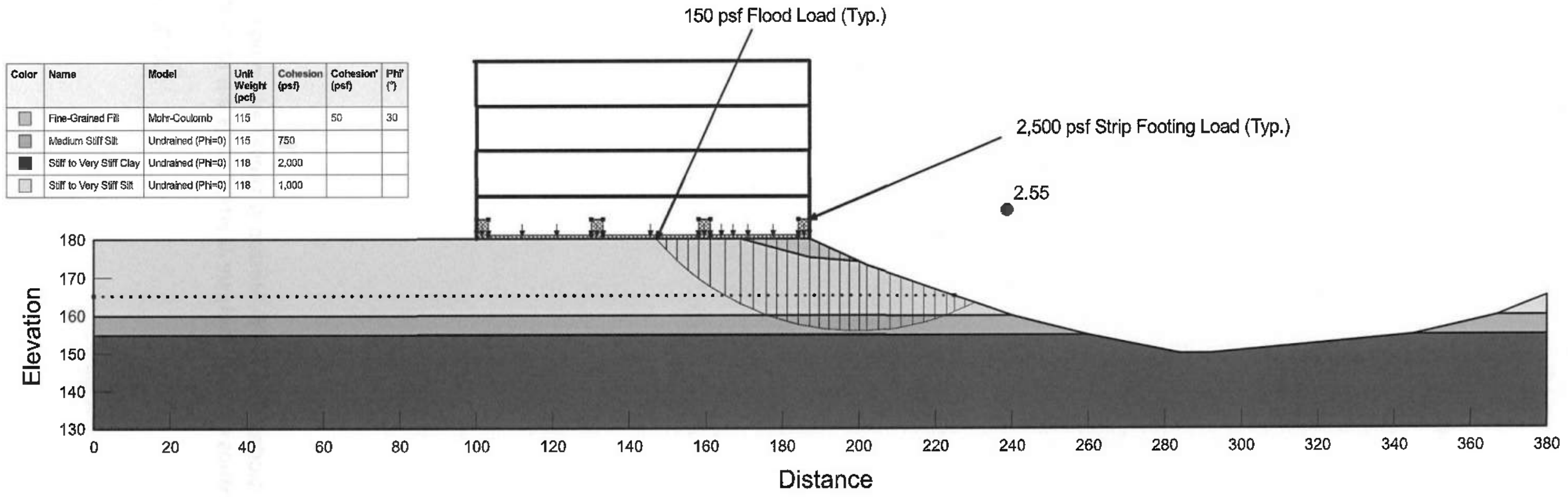
APPENDIX C

APPENDIX C

SLOPE STABILITY ANALYSIS RESULTS

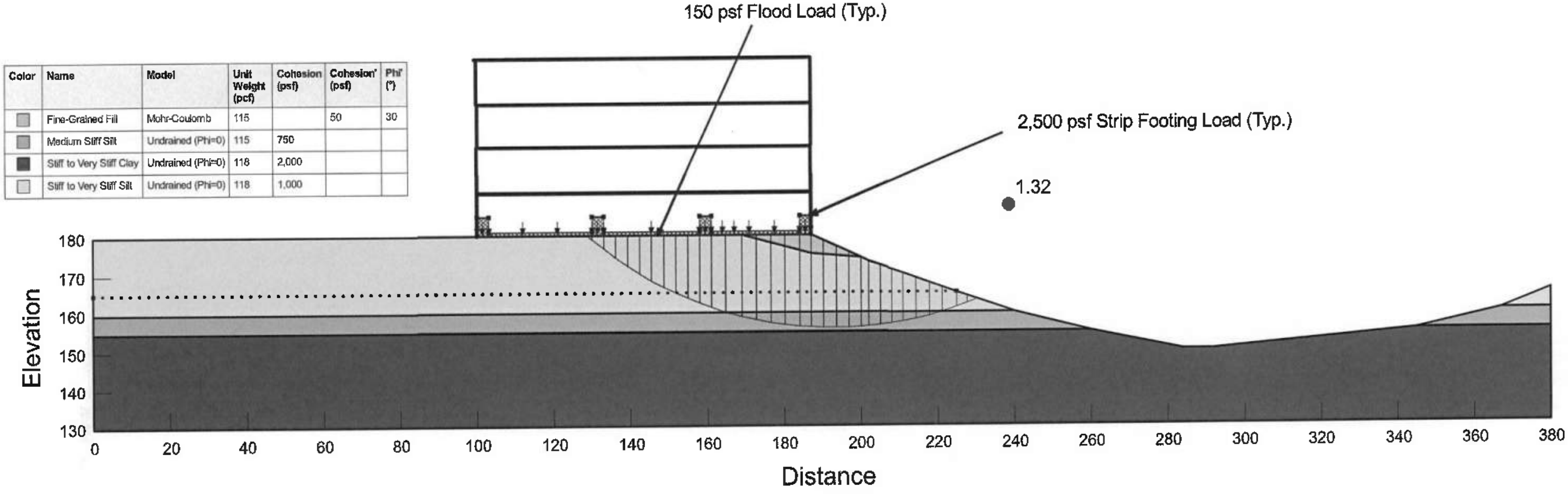
This appendix contains the outputs of the slope stability analysis from the software program Slope/W by GeoStudio. A discussion of the results is present in the main report.

Friends-4-01 - Stability Analysis
Static Conditions
Horz Seismic Coef.: 0



Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Cohesion' (psf)	Phi' (°)
▨	Fine-Grained Fill	Mohr-Coulomb	115		50	30
▨	Medium Stiff Silt	Undrained (Phi=0)	115	750		
■	Stiff to Very Stiff Clay	Undrained (Phi=0)	118	2,000		
□	Stiff to Very Stiff Silt	Undrained (Phi=0)	118	1,000		

Friends-4-01 - Stability Analysis
Seismic Conditions
Horz Seismic Coef.: 0.2375



Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Cohesion' (psf)	Phi' (°)
▨	Fine-Grained Fill	Mohr-Coulomb	115		50	30
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☐	Stiff to Very Stiff Silt	Undrained (Phi=0)	118	1,000		

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