STORMWATER MANAGEMENT PLAN

PROJECT SITE:

GOODWIN COLLEGE CONNECTICUT RIVER ACADEMY MANUFACTURING ANNEX

1 PENT ROAD

EAST HARTFORD, CONNECTICUT 06118

December 20, 2017

(Revised January 3, 2018)

PREPARED BY:

FREEMAN COMPANIES

FREEMAN COMPANIES, LLC

36 JOHN STREET

HARTFORD, CONNECTICUT 06106

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Introduction

The purpose of this report is to present the Town of East Hartford with sufficient technical information to review the potential impacts associated with the proposed school development located at 1 Pent Road, East Hartford, Connecticut. The proposed annex building is to be an auxiliary learning center for manufacturing for the High School students from the main campus.

All of the proposed site improvements are intended to be in compliance with Town and State codes while taking into account prevailing site conditions and practical needs. The proposed building and site improvements have been designed to be compatible with the surrounding neighborhood, improve overland stormwater runoff conditions, and not have any significant negative impacts on the existing infrastructure.

General Site Information

The subject property consists of approximately 8.8 acres. The site is bounded by Goodwin College to the north, Route 2 to the east, Pathways Magnet School to the south and Pratt & Whitney property to the west. The project site is presently occupied with two industrial/education buildings and surrounded by existing parking lots with sidewalks, drives/parking, and landscape area.

Per the FEMA Flood Insurance Rate Map Number 09003C0507G for Hartford County, Connecticut, map revised date: September 16, 2011, the site is located within the 500-year flood plain. A copy of the FEMA Firm Map is included in Appendix A.

No wetlands were identified on-site.

The soils within the project site consists of 21A – Ninigret and Tisbury soils, 36B – Windsor loamy sand, 306 – Udorthents, and 307 – Urban land. Refer to the USDA NRCS Soil Survey. Also, refer to the excerpt from the Geotechnical Report for the project, which has more detail and site specific information and is also included in Appendix A, which generally indicates fill over sand over clay. Depths are listed in the boring logs. Groundwater is generally around 6-ft down from existing grades.

Existing & Proposed Drainage Conditions

The subject property consists of existing drainage structures and storm drain piping systems that collect and direct the stormwater to existing drainage systems within the site and flow to the west, ultimately to a headwall at the Connecticut River.

The intent of the proposed site drainage is to mimic the existing drainage patterns as much as possible while taking into account the existing site features and the inverts of the existing drainage systems within the site. All of the existing drainage piping currently discharges to the outfall as discussed above. The existing drainage system will be used to the maximum extent practical and will be replaced where the new building is proposed. The replacement piping will go around the new building and convey flows down gradient into the same system and ultimate outfall as the remainder of the site.

The proposed site improvements will have an increase in impervious area by approximately 0.63 acres, with a slight increase in the subcatchment area will be directed to the storm drain system. The increase in drainage area to the design point, (existing pipe at the property line) is 0.13 acres. The post development conditions will have the same design point as the existing conditions. The quantity of pervious cover will decrease by approximately 0.5 acres. The proposed conditions with the new re-routed piping will enter an underground detention system to reduce the peak flow rates off site. The water quality will be increased from existing conditions by having a structural water quality unit by CDS systems near the end of the pipe run to treat runoff from paved areas before flowing down gradient. The attached

drainage area maps show the cover types and areas.

The proposed conditions also accommodate for the 500-year flood storage volume that has been displaced with the location of the new building. The proposed Flood Storage Management Plan, L-202 shows the new areas that account for the additional storage.

Erosion and Sedimentation Control Plan

The proposed development will make use of several erosion and sedimentation control measures as an element of the site design plan:

1. Installation of silt fence and straw/hay bales downgrade of disturbed areas as outlined and needed.
2. Installation of hay bale and/or silt sack inlet protection around each catch basins and yard drains within the project limits and as needed.
3. Installation of a double row of silt fence surrounding any temporary soil stockpile areas.
4. Installation of diversion swales around work areas and directing them into temporary sediment basins only if needed to control sedimentation.
5. Controlled and staged clearing to minimize soil erosion.
6. Dewatering outfalls will be controlled with appropriate devices to prevent erosion.
7. Reseeding and mulching disturbed areas during construction.
8. Installation of stabilized construction entrances as indicated on the drawings and as needed.
9. Maintenance of these measures.

Stormwater Quality

Measures to improve water quality in the runoff from the site have been integrated into the design of the site drainage system. All the new paved areas will flow to a water quality unit before the detention structure near the end of the discharge point into the existing storm drain system. The water quality unit will be a CDS model or equal and sized appropriately for the treated area.

A significant portion of the roof runoff from the existing buildings and the new building will be directed downgradient in a controlled manner.

Maintenance and Operation

It is important that the existing and proposed storm drain systems and their discharges to downstream water resource areas be protected during and after construction from sedimentation and pollutants to the maximum extent possible. All materials generated by demolition operations shall be removed off-site and disposed of in accordance with local and state regulations at approved disposal sites. No demolition debris will be allowed to enter any resource area or to be stored beyond the limits of work. All demolition debris shall be removed from the site as soon as possible, if not immediately. Cut and fill slopes will need to be stabilized by vegetation, riprap or erosion control geotextiles as soon as possible to minimize slope erosion. Work in high groundwater areas shall be scheduled, when possible, so it can be completed in a dry period and in the shortest time possible.

Drainage System Sizing

The storm drainage facilities proposed for the subject project has been designed in accordance with the Town of East Hartford's Manual of Technical Design, Revision November 9, 1999. Inlets and pipes were designed to pass flows associated with a 10-year storm. Times of concentration were computed using the T5-55 methodology as recommended by the Town of East Hartford. These times were converted to rainfall rates with Intensity, Duration, and Frequency of Rainfall amounts based on the NOAA Atlas 14 for East Hartford, CT. For small drainage areas, a

minimum time of concentration of 5 minutes was used. Weighted runoff coefficients ("C") ranging from 0.30 to 0.90 were used for each of the drainage areas as appropriate. A fixed runoff coefficient of 0.90 was used for drainage structures with only impervious areas.

Design of the drainage system uses pipe flow and hydraulic grade line analysis to determine the drainage system's hydraulic flow capacity. All pipes considered for the site drainage design in this analysis are RCP with a Manning's coefficient "n" of 0.013. Other existing pipes that are remaining are labeled on the plan sheets and modeled appropriately.

The rational method was used to compute peak discharge for the drainage systems with the Hydraflow Storm Sewers Extension in AutoCAD Civil 3D, version 10. Refer to Appendix B for the drainage system sizing calculations.

Peak Runoff

A hydrology study was completed for the proposed development area to quantify the change in peak rates of stormwater runoff versus existing conditions. To accurately compare the runoff rates, an analysis of all water runoff within the limit of disturbance for pre- and post-development conditions was determined as the 'control' limit of areas considered.

All drainage areas were plotted and measured with AutoCAD Civil 3D 2013. The HydroCAD Stormwater Modeling System computer program by Applied Microcomputer Systems was used to analyze the stormwater system. HydroCAD utilizes the National Resource Conservation Service's SCS Unit Hydrograph Method, commonly known as the SCS TR-20 runoff method, to estimate the runoff produced by each drainage area. The design storms analyzed were the 2, 5, 10, 25, and 100-year 24-hr duration storm, with Type III rainfall for Hartford County, Connecticut. Refer to Appendix B for the Existing and Proposed Drainage Area Map and for the Pre-and Post- Development Hydrologic Computations.

Detention

To accommodate for the increase in runoff from the increase in impervious surfaces within the watershed, a detention system with a size of 0.24 ac-ft or approximately 75,000 gallons has been proposed. The proposed detention system is modular precast concrete units (Storm Trap Double Trap Model 6-0) which will be installed underground to the west of the proposed building. The detention system was modeled using Hydrocad and the routing hydrographs along with detention summaries are shown in Appendix B.

The following table shows the pre- and post-development peak flows and associated with the regulated storm events analyzed as part of the hydrologic modeling: The post development flows account for the Storm Trap detention system which attenuates the peak flow rates.

Return Frequency (Year)	Peak Runoff (CFS)		
	Pre-Development	Post-Development	Difference
2	13.98	12.36	-1.62
5	20.95	19.25	-1.70
10	26.87	23.71	-3.16
25	34.98	29.95	-5.03
100	47.56	46.82	-0.74

Summary

As a result of this comparison, it is demonstrated that the proposed development will have a negligible effect on the overall peak flow rate offsite from this project for all storm events. Therefore, the proposed development should have no adverse impact on adjacent downstream properties related to stormwater flows.

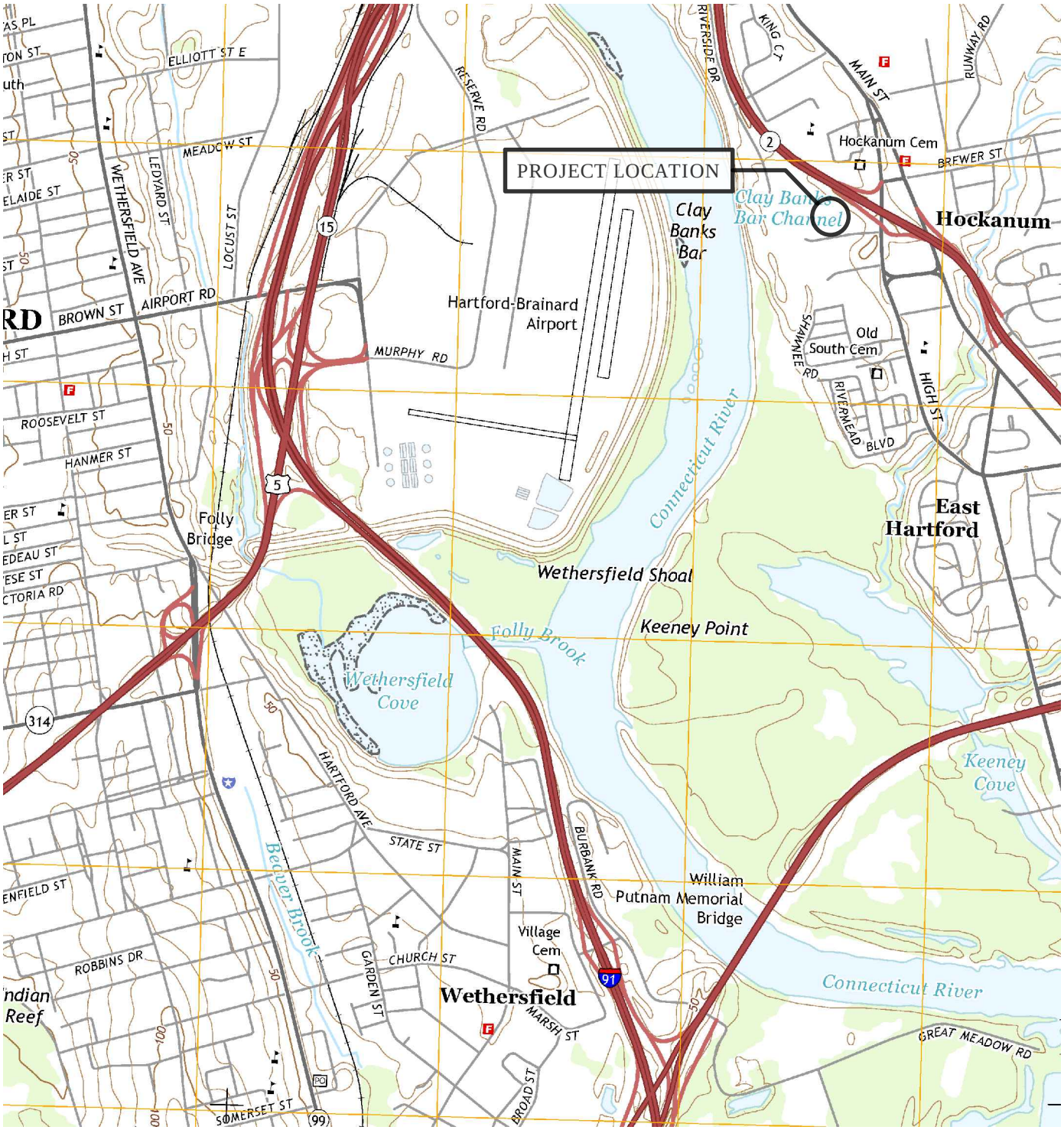
Appendix A

Site Location Map

FEMA Flood Insurance Map Number 09003C0507G

USDA NRCS Soil Survey

Excerpts from Geotechnical Report



USGS QUADRANGLE MAP
HARTFORD SOUTH, CONNECTICUT
DATE 2015

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ELEVATE YOUR EXPECTATIONS

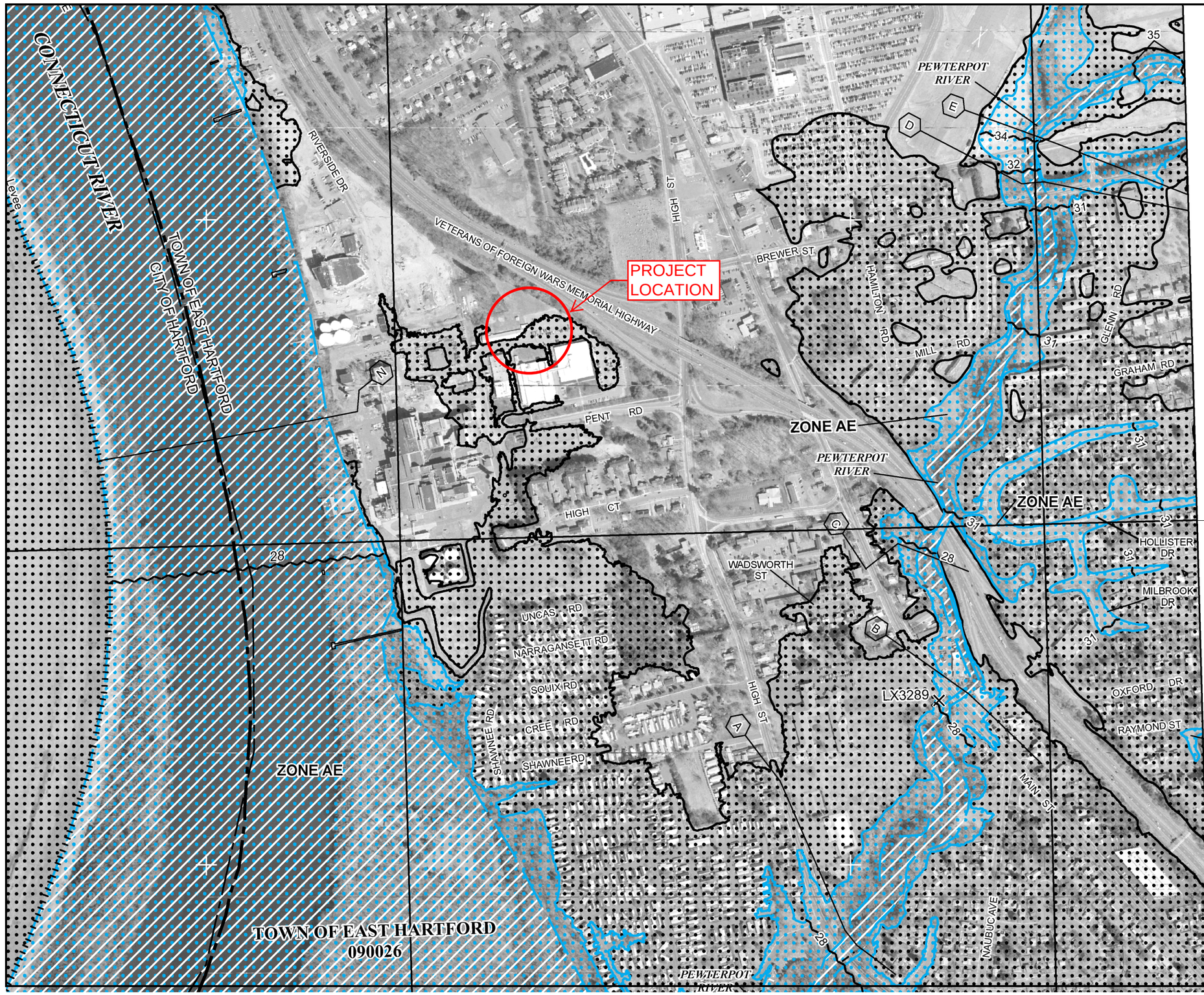
SITE LOCATION MAP
GOODWIN COLLEGE
CONNECTICUT RIVER MANUFACTURING ANNEX
1 PENT ROAD
EAST HARTFORD, CONNECTICUT

DRAFTED:	M.K.
CHECKED:	J.N.L.
APPROVED:	P.A.R.
SCALED:	1"=2000'
PROJECT NO.:	2016-0809
DATE:	12/18/2017

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2016\2016-0809 Goodwin College-CT River Academy - Adv. Man\DWG\Figures\Figure 1.dwg Dec 18, 2017-2:44pm Plotted By: Mkwok



flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas o average depths of less than 1 foot or with dr mile; and areas protected by levees from 1%

OTHER AREAS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0507G

FIRM

FLOOD INSURANCE RATE MAP

HARTFORD COUNTY, CONNECTICUT (ALL JURISDICTIONS)

PANEL 507 OF 675

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EAST HARTFORD, TOWN OF	090026	0507	G
GLASTONBURY, TOWN OF	090124	0507	G
HARTFORD, CITY OF	095080	0507	G
WETHERSFIELD, TOWN OF	090040	0507	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
09003C0507G

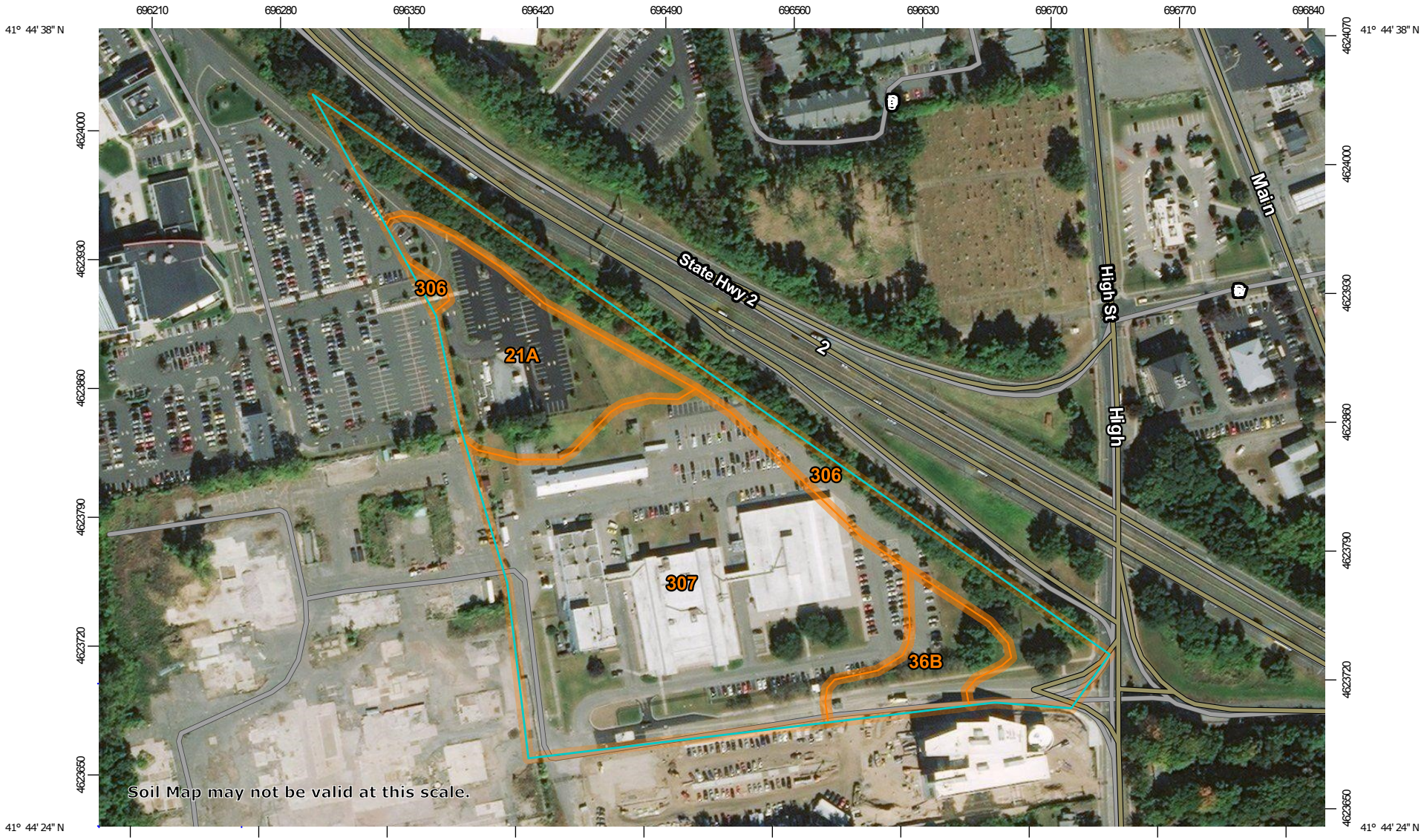
MAP REVISED
SEPTEMBER 16, 2011

Federal Emergency Management Agency

JOINS PANEL 0526

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Soil Map—State of Connecticut
(Goodwin Annex Soils)



Map Scale: 1:3,060 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: State of Connecticut
Survey Area Data: Version 16, Sep 15, 2017

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

Date(s) aerial images were photographed: Sep 29, 2013—Oct 16, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
21A	Ninigret and Tisbury soils, 0 to 5 percent slopes	2.3	16.2%
36B	Windsor loamy sand, 3 to 8 percent slopes	1.0	6.7%
306	Udorthents-Urban land complex	2.9	20.5%
307	Urban land	8.1	56.5%
Totals for Area of Interest		**14.3**	**100.0%**

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LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Geotechnical Report
Goodwin College, Connecticut River Academy
Pent Road, East Hartford, Connecticut

July 31, 2017

Freeman File No.: 2016-0809

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1. Site Location Map
2. Subsurface Exploration Location Plan

Appendices

A. Test Boring Logs
B. Results of Laboratory Testing

1.0 INTRODUCTION

1.1 Summary

This report presents the results of subsurface explorations and our geotechnical design and construction recommendations for the proposed Goodwin College Connecticut River Academy. Subsurface conditions consist of fill and alluvium overlying extensive deposits of varved clay.

In summary, we recommend that the existing fill and alluvial deposits be densified with intensive surface compaction conducted following removal of all existing foundations and utilities. The building may be founded on spread footing foundations bearing on a 12-inch thick layer of crushed stone placed over geotextile fabric.

1.2 Scope of Work

Freeman Companies conducted the following work:

- Arranged for a utility clearance contractor to conduct Ground Penetrating Radar (GPR) in advance of drilling;
- Arranged for a qualified test boring contractor to drill test borings and collect soil samples;
- Met with Pratt & Whitney, Ensafe, and Goodwin College personnel to discuss environmental procedures for test borings;
- Observed the test borings, described soil samples and prepared logs;
- Arranged for laboratory testing of selected soil samples;
- Evaluated the subsurface conditions and prepared this report containing geotechnical design recommendations and construction considerations.

1.3 Authorization

The work was completed in accordance with our proposal dated December 23, 2016.

1.4 Elevation Datum

Elevations are in feet and reference the NGVD-29 datum.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Proposed Building

The proposed Goodwin College Connecticut River Academy is located on Pent Road in East Hartford Connecticut, north of the Goodwin College CRA-Advance Manufacturing Annex, as shown on Figure 1, Site Location Map. It is understood that the site is owned by Pratt and Whitney and leased to Goodwin College.

The building will have a footprint area of about 15,000 square feet, as shown on Figure 2, Subsurface Exploration Location Plan. It will be a one-story building with no basement. An upper level mezzanine/storage area will be constructed within the eastern portion of the building. A corridor will connect the building with the existing Manufacturing Annex. It is understood that column loads will be approximately 100 kips.

The proposed floor grade will be El. 34.7, and will match the floor grade for the Manufacturing Annex. Up to about one foot of fill will be required below the floor slab to bring existing grades up to floor slab subgrade.

2.2 Site Description

The site is a paved parking lot with grassed-covered landscape areas adjacent to the Manufacturing Annex building. Site grades range from about El. 33.5 to El. 34.

Record drawings indicate that a previous building referred to as "Storage Building, Former Physical Chemistry Building" was present within the northwestern portion of the proposed building footprint, but has been demolished. Previous water and sewer pipelines (indicated "abandoned") and manholes are also present within the proposed building. The approximate locations of previous structures are shown on Figure 2.

A large partially-excavated area is present to the west of the site and is surrounded by a chain link fence. It is understood that this area is being remediated for environmental impacts.

3.0 EXPLORATIONS AND SUBSURFACE CONDITIONS

3.1 Subsurface Explorations

Four test borings (B-1 through B-4) were drilled by Seaboard Drilling, Inc., of Springfield, Massachusetts during the periods March 9 to April 6, 2017. Borings B-1 and B-3 were terminated at a depth of 50 feet, and borings B-2 and B-4 were terminated at a depth of 100 feet.

Split-spoon samples were recovered at standard 5-foot intervals with additional samples taken within the top ten feet. Four undisturbed Shelby tube samples of fine grained soils (varved clay deposit) were recovered from boring B-2.

Boreholes were backfilled upon completion with cement-bentonite grout to a depth of two feet, and sand was placed within the upper two feet. A bituminous cold-patch was placed at ground surface in pavement areas. Excess soil and groundwater from the drilling was placed in 55 gallon drums and left at the site as directed by Pratt & Whitney.

Test boring locations, as shown on Figure 2 were taped from existing site features, and are considered approximate. Freeman Companies personnel observed the drilling and prepared the logs, included in Appendix A.

3.2 Laboratory Testing

Laboratory tests included two one-dimensional consolidation tests, three consolidated-undrained triaxial compression tests, four Atterberg Limits, and four grain size analyses. Laboratory testing was conducted by Geotesting Express, of Acton, Massachusetts. Results of laboratory testing are provided in Appendix B.

3.3 Subsurface Conditions

Subsurface conditions encountered in the borings are described below. Conditions are known only at boring locations and may differ significantly between borings.

Stratum	Thickness	Generalized Description
Pavement /Base or Topsoil	2 to 3 in. Asphalt 0 to 8 in. Gravel Base 6 inches Topsoil	Asphalt, Gravel Base, or Topsoil
Fill	4 ft.	Brown to tan, poorly graded SAND (SP), trace organic matter. Standard Penetration Test (SPT) N-values ranged from 9 to 35 blows per foot (bpf) (loose to dense).
Alluvium	10 to 14 ft.	Brown to tan, poorly graded SAND to poorly graded SAND with gravel (SP). SPT N-values ranged from 3 to 22 bpf (very loose to medium dense).
Varved Clay	Greater than 85 ft.	Red-brown to gray, varved lean to fat clay and silt (CL &ML or CH & ML), with 1 inch to 1¼ inch thick red-brown clay varves and ¼ inch to ½ inch thick gray silt varves.

Groundwater was encountered at depths ranging from 6 to 6.5 feet below ground surface, based on wet soil samples. Groundwater level measurements represent conditions at the times and locations measured. Significantly different groundwater levels may occur at other times and locations. Groundwater levels are expected to fluctuate with variations in season, temperature, soil conditions, construction activity in the area, and water level changes in the Connecticut River.

3.4 Results of Laboratory Testing

Consolidation tests were conducted on samples of the varved clay from Boring B-2, recovered from 40 and 50 feet below ground surface. Test results indicate maximum past pressures of 6,000 pounds per square foot (psf) and 7,000 psf, and overconsolidation ratios of about 2.4 and 2.0.

Results of Atterberg Limit tests indicate the clay is either CL (low plasticity clay, one test) or CH (fat clay, three tests).

Three consolidated undrained triaxial tests were conducted on a sample of the varved clay from boring B-2, recovered from 40 feet below ground surface. Measured shear strength values were 952 psf, 1,110 psf, and 1,164 psf, which indicates the deposit is medium stiff. Test results indicate a drained cohesion of 218 psf and internal angle of friction of 25 degrees.

Results of laboratory testing are provided in Appendix B.

4.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

4.1 Foundation Design

Records indicate that a previous building was present within the northwest portion of the proposed building footprint. Several utilities currently or formerly cross through the proposed building footprint area. Remnants of these structures may still be present. We recommend that the items be further investigated and completely removed.

The existing fill and alluvial deposits should be densified prior to placement of foundations using intensive surface compaction. Intensive surface compaction should consist of a minimum of eight slow passes of a heavy self-propelled vibratory compactor with a static weight of at least 2,000 pounds moving at a forward speed no greater than one to two feet per second. If loose materials are detected during compaction, they should be excavated and replaced with compacted structural fill or crushed stone over geotextile fabric.

Footings should be designed for a maximum allowable bearing pressure of 2,000 pounds per square foot (psf), which assumes footings have a minimum dimension of at least three feet. The bearing pressure should be reduced proportionally for foundations less than three feet wide. Foundations should be designed to bear on a 12-inch thick layer of compacted crushed stone overlying geotextile fabric.

Exterior foundations exposed to freezing should bear at a minimum depth of 3.5 feet below adjacent grade for protection against frost action. Footings at interior locations may be placed at shallower depths.

Post-construction settlement is estimated to be less 1 inch. Differential settlement is estimated to be less than ¾-inch.

4.2 Floor Slab Design

The lowest level floor should be designed as a slab-on-grade bearing on a minimum 12-inch thick layer of compacted crushed stone (ConnDOT Form 817, M.01.01, No 6) placed over geotextile fabric. A vapor barrier should be provided beneath the floor slab.

Underslab drainage is not required provided that exterior grades are lower than the floor slab. Exterior grades should slope away from the building to shed water.

If vaults or pits below the floor slab are envisioned, they should be waterproofed and designed to resist full hydrostatic uplift assuming the vault is drained and groundwater outside the structure is at ground surface. Resistance to uplift may be provided by extending the base of the structure outward and engaging the buoyant unit weight of soil (assume 55 pounds per cubic foot) above the extension.

Pratt & Whitney indicated that contaminants may be present at the site. If contaminants are present that can volatilize, a venting system be considered, to remove and discharge vapors that might collect within the crushed stone.

4.3 Seismic Design

Soil conditions within the top 100 feet include 15 to 19 feet of fill and alluvial sand overlying 81 to 89 feet of varved clay. Based on the results of laboratory testing we expect the average shear strength of the varved clay to be greater than 1,000 pounds per square foot (psf), which indicates a seismic site class D. The alluvial sand has corrected Standard Penetration Test (SPT) N-values close to 15 blows per foot, although low SPT values were encountered in test boring B-2. Previous geotechnical studies conducted by others for River Academy located near the site encountered similar conditions and classified that site as Class D. Based on the subsurface and laboratory data obtained for this project, the previous geotechnical evaluations and our engineering judgement, we recommend site class D for this project.

4.4 Site Filling

The loose alluvial deposits and lacustrine clay will settle in response to fill and structure loads. Up to one foot of fill will be required to raise existing site grade up to the proposed floor grade, and we included that amount in our settlement evaluation. We recommend that additional raises in site grade be avoided.

4.5 Pavement Design

We recommend the following flexible pavement sections for parking (light duty) and roadway (heavy duty) areas:

Material	Parking	Roadway
Bituminous Concrete (placed in two layers)	3 inches	3 inches
Base Course (ConnDOT Form 817 M.02.01, 2-Bank or Crushed Gravel)	8 inches	14 inches

The base course will be placed over existing fill which overlies free-draining alluvial deposits. Portions of the fill contain a significant amount of fines and are not expected to be free-draining, whereas the underlying alluvial deposits are considered free-draining. A storm drain within the proposed pavement area will be reconstructed. We recommend that the storm drain be backfilled with base course material, to allow water from the base to drain into the trench backfill and then into the alluvial deposits.

Soils at the site are susceptible to frost action, and the recommended pavement section does not provide full protection against frost action. Therefore, some non-uniform frost heave is expected to occur.

4.6 Backfill Materials

Structural Fill - Structural Fill should be used within the limits of the existing building. Structural Fill should consist of hard, durable sand and gravel, free of clay, organic matter, surface coatings, recycled material, and other deleterious materials, and conform to ConnDOT M.02.06, Grading A. Structural Fill should be compacted in maximum 9-inch-thick, loose lifts to at least 95 percent of the maximum dry density determined in accordance with ASTM D1557.

Crushed Stone – Crushed Stone should be used for filling below foundations and around drain pipes, and should consist of hard, durable, crushed or broken stone, free from loam or clay, surface materials. Crushed Stone should meet the requirements of ConnDOT M.01.01, No. 6 (¾-inch minus). Crushed stone should be placed in maximum 12-inch-thick loose lifts and compacted with at least 4 to 6 passes of a double-drum, walk-behind, vibratory compactor.

Geotextile Fabric – Geotextile fabric should consist of Mirafi 140N or an approved equal product.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Subgrade Preparation

All existing foundations, former structures, and utilities should be removed within the limits of the proposed building prior to the start of construction. Excavations to remove these items should be backfilled in compacted maximum 9-inch lifts of structural fill, or crushed stone over geotextile fabric.

Foundations will bear within the existing fill and alluvial deposits. The existing fill, following removal of existing foundations and utilities, should be densified by conducting intensive surface compaction, as described below, prior to foundation construction.

The existing fill and alluvial deposit are susceptible to disturbance by construction equipment, and may be wet due to shallow groundwater. Excavation to footing subgrade should be made using a smooth-bladed backhoe bucket. A 12-inch thick layer of crushed stone over geotextile fabric should be placed over the subgrade immediately following footing excavation.

5.2 Intensive Surface Compaction

The existing fill and alluvial deposits should be densified prior to placement of foundations using intensive surface compaction. Intensive surface compaction should consist of a minimum of eight slow passes of a heavy self-propelled vibratory compactor with a static weight of at least 2,000 pounds moving at a forward speed no greater than one to two feet per second. If loose materials are detected, these soils should be excavated and replaced with compacted structural fill or crushed stone over geotextile fabric. We recommend that intensive surface compaction be monitored by qualified geotechnical personnel. Intensive surface compaction procedures will be included in the earthwork specification.

Vibrations from intensive surface compaction may be noticeable or disturbing to persons within nearby buildings. Building occupants should be notified in advance of the compaction operation and informed that vibrations may be felt. We recommend that a preconstruction survey of these buildings be conducted in advance of construction, and vibration monitoring be conducted during intensive surface compaction.

5.3 Excavation and Dewatering

Excavation with conventional earth-moving equipment appears feasible.

Groundwater is expected to be encountered in excavations for this project. Excavation dewatering by open pumping from properly filtered sumps appears feasible. The site should be graded to direct runoff away from excavations.

The specifications should require the contractor to maintain groundwater one foot below the bottom of the excavation at all times. Discharge of excavation dewatering fluids should comply with all applicable regulations.

Excavated materials and groundwater are understood to be impacted with contaminants. Excavation and dewater should comply with applicable environmental protocols in accordance with local, State and Federal regulatory agency requirements.

5.4 Temporary Lateral Support

Temporary lateral support of excavations may be required in areas where excavations are located adjacent to existing property lines, structures or utilities. Steel sheetpiling and soldier piles and lagging appear feasible.

Excavations and excavation support should be designed and constructed in conformance all OSHA, State, and Federal Regulations.

5.5 Freezing Conditions

Soils at the site are susceptible to frost action. If construction is performed during freezing weather, special precautions will be required to prevent the subgrade from freezing. Freezing of the soil beneath foundations and slabs during construction may result in settlement when the soil thaws.

All subgrades should be free of frost before placement of concrete. Frost-susceptible soils that have frozen should be removed and replaced with compacted structural fill or crushed stone over geotextile fabric. The footing and the soil adjacent to the footing should be protected from freezing until they are backfilled. Soil placed as fill should be free of frost, as should be the ground on which it is placed. Slabs-on-grade should be heated or insulated during freezing weather to prevent freezing of the subgrade.

6.0 FUTURE SERVICES AND LIMITATIONS

6.1 Construction Services

We recommend that Freeman Companies be engaged during construction to:

- Review contractor submittals related to earthwork, and other geotechnical issues.
- Observe intensive surface compaction.
- Provide construction monitoring to verify that soil conditions exposed in excavations are in general conformance with our design assumption, and that the geotechnical aspects of construction are consistent with the project specifications.
- Provide consultation to the design team on geotechnical issues.

6.2 Limitations

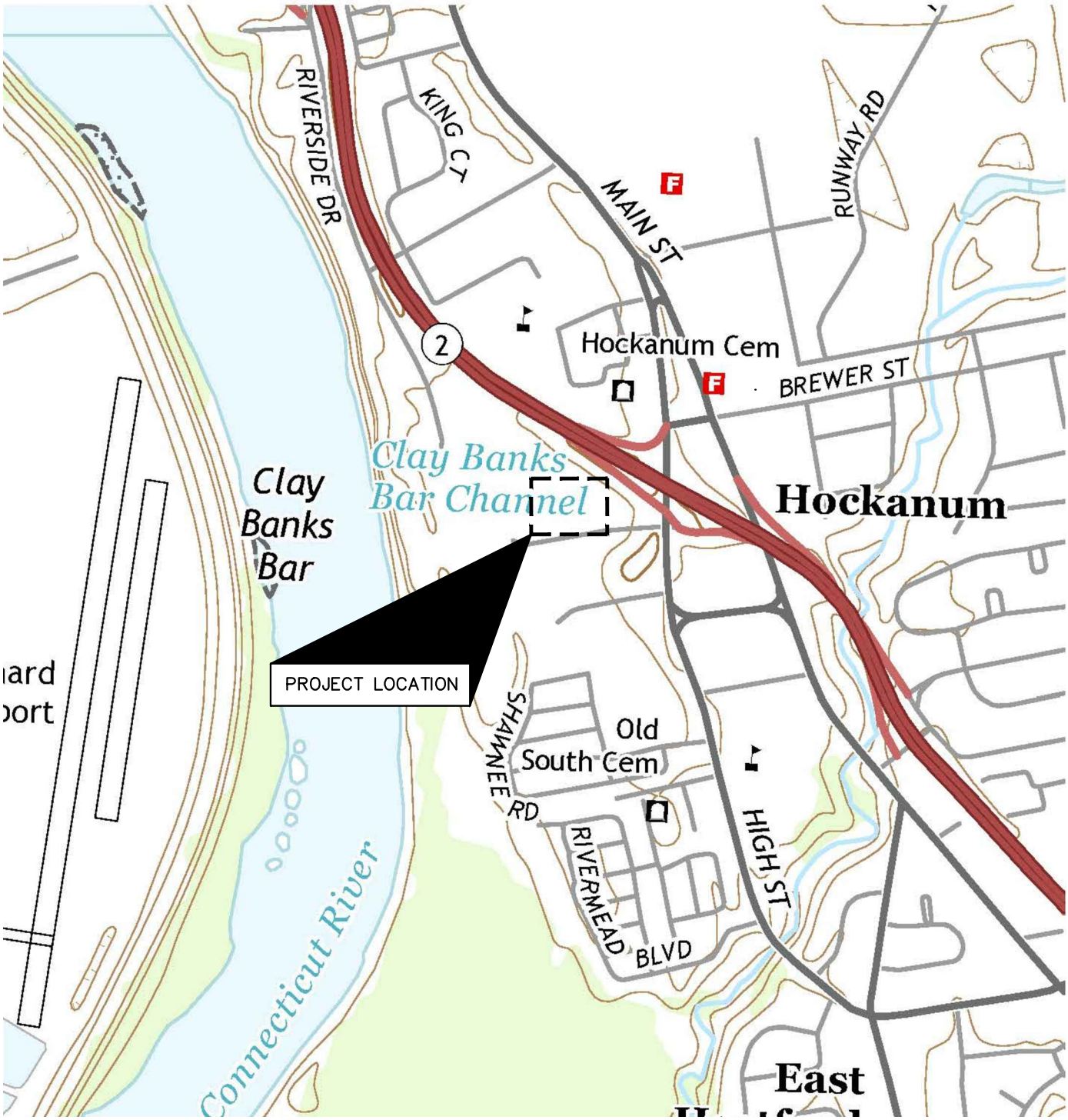
This report was prepared for the exclusive use of JCJ Architects, Inc. and the project design team. The recommendations provided herein are based on the project information provided at the time of this report and may require modification if there are any changes in the nature, design, or location of the facility.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report.

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

FREEMAN COMPANIES

FIGURES



USGS QUADRANGLE MAP
HARTFORD SOUTH, CONNECTICUT
DATE 2015

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

SITE LOCATION MAP

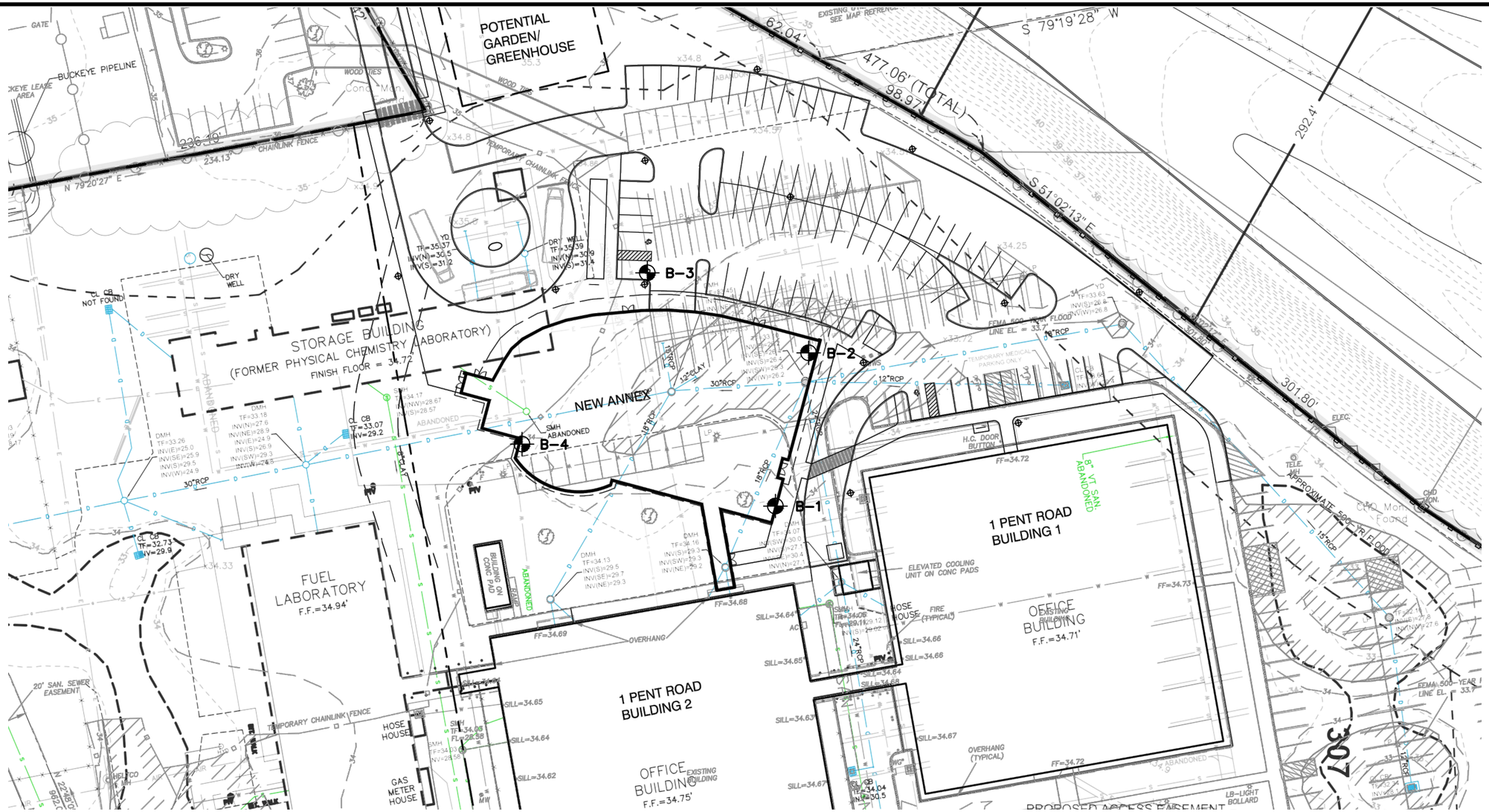
GOODWIN COLLEGE - CT RIVER ACADEMY
PENT ROAD
EAST HARTFORD, CONNECTICUT

DRAFTED:	T.T.
CHECKED:	A.M.
APPROVED:	A.M.
SCALED:	1"=1000'
PROJECT NO.:	2016-0809
DATE:	02/28/2017

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2016\2016-0809 Goodwin College-CT River Academy - Adv. Man\DWG\GEOTECH\Figure 1.dwg Feb 27, 2017-10:30am Plotted By: tta



LEGEND:

B-1 TEST BORINGS

NOTES:

1. BASE PLAN PREPARED BY JCJ ARCHITECTURE
2. EXPLORATION LOCATIONS WERE TAPED FROM EXISTING SITE FEATURES AND ARE APPROXIMATE
3. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION

GRAPHIC SCALE

60 30 0 60

SCALE IN FEET

SUBSURFACE EXPLORATION LOCATION PLAN

GOODWIN COLLEGE - CT RIVER ACADEMY
PENT ROAD
EAST HARTFORD, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DRAWN:	T.T.
CHECKED:	N.W.
APPROVED:	N.W.
SCALE:	1"=60'
PROJECT NO.:	2016-0809
DATE:	02/27/2017

SHEET NO.

FIGURE 2

Freeman Companies, LLC . Y:\2016\2016-0809 Goodwin College-CT River Academy - Adv. Man\DWG\GEOTECH\Figure 2.dwg Apr 05, 2017-4:33pm Plotted By: byuan

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

APPENDIX A

TEST BORING LOGS

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0
LOCATION: Refer to Figure 2

EXPLORATION

B-1

Drilling Information

DATE START / END: 4/6/2017 - 4/6/2017
TOTAL DEPTH (FT): 50.0
CONTRACTOR: Seaboard Drilling, Inc **DRILLER:** Jeff Nitch **LOGGED BY (Person):** T. Ta
EQUIPMENT: Mobile B-53 **EXPLORATION TYPE/METHOD:** Cased Boring
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / 3 in **CORE INFO:**
HAMMER TYPE: Automatic Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 6.00ATD
GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/18	3-6-8-6			TOPSOIL (6") POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown, FILL.		
			S-2		2 to 4	24/14	3-5-6-7			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown, FILL.		
30			S-3		4 to 6	24/18	4-4-6-5			POORLY GRADED SAND WITH GRAVEL (SP); ~85% coarse sand, 10% fine gravel, ~5% fines, brown to tan, ALLUVIUM, (rust bands towards bottom of spoon).	▽	
	5		S-4		6 to 8	24/16	3-4-5-4			POORLY GRADED SAND WITH GRAVEL (SP); ~85% coarse sand, 10% fine gravel, ~5% fines, brown to tan, ALLUVIUM.		
			S-5		8 to 10	24/22	4-6-6-5			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown to tan, ALLUVIUM.		
25	10		S-6		10 to 12	24/22	3-4-6-5			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown, ALLUVIUM.		
20			S-7		14 to 16	24/22	3-2-4-3			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown, ALLUVIUM.		
	15									SANDY SILT (ML); ~70% fines, ~30% sand; brown, LACUSTRINE.		
15			S-8		19 to 21	24/20	2-4-6-5			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0

LOCATION: Refer to Figure 2

EXPLORATION

B-1

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
5	25		S-9		25 to 27	24/24	1-2-2-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
0	30		S-10		30 to 32	24/24	WOH-1-1-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-5	35		S-11		35 to 37	24/24	WOR-WOH-1-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-10	40		S-12		40 to 42	24/24	WOH/12"-2-1			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	45		S-13		45 to 47	24/24	WOH/18"-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-15			S-14		48 to 50	24/24	WOH/18"-1			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	50									End of Boring at 50 feet Cement and bentionate grout mixture to 2' belew existing ground surface followed by sand upon completion		
-20												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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www.freemancos.com

FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 33.5
LOCATION: Refer to Figure 2

EXPLORATION

B-2

Drilling Information

DATE START / END: 3/9/2017 - 3/10/2017
TOTAL DEPTH (FT): 100.0
CONTRACTOR: Seaboard Drilling, Inc **DRILLER:** Jeff Nitch **LOGGED BY (Person):** T. Ta
EQUIPMENT: Mobile B-53 **EXPLORATION TYPE/METHOD:** Cased Boring
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / 4.25 in **CORE INFO:** _____
HAMMER TYPE: Automatic Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 6.50ATD
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
										ASPHALT (3 inches)		
			S-1		1 to 3	24/14	11-9-9-3			POORLY GRADED SAND WITH GRAVEL (SP); ~80% sand, ~15% gravel, ~5% fines; brown to red, FILL.		
										POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown to tan, FILL.		
30			S-2		3 to 5	24/14	6-5-4-4			POORLY GRADED SAND (SP); 89% sand, 9% fines, 2% gravel, brown to tan, FILL.		
	5		S-3		5 to 7	24/6	2-2-3-3			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown to tan, ALLUVIUM.	▽	
			S-4		7 to 9	24/16	3-3-3-3			POORLY GRADED SAND (SP); 97% sand, 2% fines, 1% gravel, brown, ALLUVIUM.		
25			S-5		9 to 11	24/22	2-2-2-4			POORLY GRADED SAND WITH GRAVEL (SP); ~85% sand, ~10% gravel, ~5% fines; brown, ALLUVIUM.		
	10											
20			S-6		14 to 16	24/4	2-3-4-5			POORLY GRADED SAND WITH SILT AND GRAVEL (SP); ~75% sand, ~15% gravel, ~10% fines; brown, ALLUVIUM.		
	15											
15			S-7		19 to 21	24/0	4-5-6-6			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
	20											
10												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 33.5

LOCATION: Refer to Figure 2

EXPLORATION

B-2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	25		S-8		24 to 26	24/16	3-3-3-4			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
5			T-1		29 to 31	24/24	P-U-S-H					
	30											
0			S-9		34 to 36	24/24	WOH-2-2-1			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
	35											
-5			T-2		39 to 41	24/24	P-U-S-H	Q_P=0.1tsf S_V=0.15tsf				
	40											
-10			S-10		44 to 46	24/24	WOH-WOH-1-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
	45											
-15			T-3		49 to 51	24/24	P-U-S-H	Q_P=.06tsf S_V=0.2tsf				
	50											
-20			S-11		54 to	24/24	WOH-WOH-			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown,		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

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FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 33.5

LOCATION: Refer to Figure 2

EXPLORATION

B-2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
					56		2-3			LACUSTRINE.		
-25			T-4		59 to 61	24/24	P-U-S-H	Q_p=0.1tsf S_V=0.1tsf				
	60											
-30			S-12		64 to 66	24/24	WOH-WOH-2-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	65											
-35			T-5		69 to 71	24/24	P-U-S-H	Q_p=0.1tsf S_V=0.125tsf				
	70											
-40			S-13		74 to 76	24/24	WOR-WOR-2-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	75											
-45			S-14		79 to 81	24/24	WOR-WOR-2-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	80											
-50			S-15		84 to 86	24/24	WOH-WOH-3-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	85											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 33.5

LOCATION: Refer to Figure 2

EXPLORATION

B-2

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
-55												
	90		S-16		89 to 91	24/24	WOH-WOH-2-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-60												
	95		S-17		94 to 96	24/24	WOR-WOR-WOH-5			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-65			S-18		98 to 100	24/24	WOR-WOH-2-5			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	100									End of Boring at 100 feet Cement and bentionate grout mixture to 2' belew existing ground surface followed by sand upon completion		
-70												
	105											
-75												
	110											
-80												
	115											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0
LOCATION: Refer to Figure 2

EXPLORATION

B-3

Drilling Information

DATE START / END: 4/3/2017 - 4/3/2017
TOTAL DEPTH (FT): 50.0
CONTRACTOR: Seaboard Drilling, Inc **DRILLER:** Doug Feeley **LOGGED BY (Person):** T. Ta
EQUIPMENT: Mobile B-53 **EXPLORATION TYPE/METHOD:** Cased Boring
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / 3 in **CORE INFO:**
HAMMER TYPE: Automatic Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 6.00ATD
GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/10	18-15-20-23			ASPHALT (3") (0.3'- 1') SILTY SAND WITH GRAVEL (SM); ~75% sand, ~15% fines, ~10% gravel; red to brown, FILL.		
			S-2		2 to 4	24/0	22-16-15-11			(1'- 2') SILTY SAND (SM); ~80% sand, ~15% fines, ~5% gravel; brown, FILL. (2'- 4') No Recovery - Pushed Gravel.		
30			S-3		4 to 6	24/14	9-6-6-12			(4'- 5') SANDY SILT (ML); ~60% fines, ~40% sand; trace wood, black, FILL. (5'- 6') POORLY GRADED SAND (SP); ~90% sand, ~5% fines; ~5% fine gravel, brown, FILL.	▽	
	5		S-4		6 to 8	24/3	13-15-14-15			(6'- 8') SILTY SAND (SM); ~80% sand, ~15% fines; ~5% fine gravel, gray to brown, FILL.		
			S-5		8 to 10	24/20	11-12-10-8			POORLY GRADED SAND WITH GRAVEL (SP); ~80% coarse sand, ~15% fine gravel, ~5% fines, brown, ALLUVIUM.		
25	10		S-6		10 to 12	24/20	4-1-2-3			POORLY GRADED SAND (SP); ~80% coarse sand, ~15% fine gravel, ~5% fines, brown, ALLUVIUM.		
20												
	15		S-7		15 to 17	24/14	8-6-7-11			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown, ALLUVIUM.		
15										At 18' - Change in drilling rate and wash color		
	20		S-8		20 to 22	24/6	3-6-6-5			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0

LOCATION: Refer to Figure 2

EXPLORATION

B-3

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
5	25		S-9		25 to 27	24/22	2-3-3-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
0	30		S-10		30 to 32	24/24	1-2-1-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-5	35		S-11		35 to 37	24/24	1-1-1-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-10	40		S-12		40 to 42	24/24	1/12"-2-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	45		S-13		45 to 47	24/20	2-2-2-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-15			S-14		48 to 50	24/24	3-2-3-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
	50									End of Boring at 50 feet Cement and bentionate grout mixture to 2' belew existing ground surface followed by sand upon completion		
-20												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

FREEMAN COMPANIES
LAND DEVELOPMENT · ENGINEERING DESIGN · CONSTRUCTION SERVICES

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FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0
LOCATION: Refer to Figure 2

EXPLORATION

B-4

Drilling Information

DATE START / END: 3/9/2017 - 3/10/2017
TOTAL DEPTH (FT): 100.0
CONTRACTOR: Seaboard Drilling, Inc **DRILLER:** Mike Glynn
LOGGED BY (Person): T. Ta
EQUIPMENT: Mobile B-53
EXPLORATION TYPE/METHOD: Cased Boring
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / 4.25 in
CORE INFO:
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▽ 6.00ATD
GENERAL NOTES:

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
										ASPHALT (2 inches)		
										GRAVEL BASE (8 inches)		
			S-1		1 to 3	24/14	4-9-10-9			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; trace organics, brown to tan, FILL.		
30			S-2		3 to 5	24/12	7-4-5-8			POORLY GRADED SAND (SP); ~90% sand, ~5% gravel, ~5% fines; brown to tan, FILL.		
	5		S-3		5 to 7	24/10	10-9-9-12			POORLY GRADED SAND (SP); 98% sand, 2% fines, brown to tan, ALLUVIUM.	▽	
			S-4		7 to 9	24/16	5-5-9-14			POORLY GRADED SAND WITH GRAVEL (SP); ~90% sand, ~5% gravel, ~5% fines; brown, ALLUVIUM.		
25												
	10		S-5		10 to 12	24/20	4-6-7-6			POORLY GRADED SAND WITH SILT AND GRAVEL (SP); 99% sand, 1% fines, brown, ALLUVIUM.		
20												
	15		S-6		15 to 17	24/4	6-8-8-11			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~90% fines, ~5% gravel, ~5% sand; gray, LACUSTRINE.		
15												
	20		S-7		20 to 22	24/14	3-3-3-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

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PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0

LOCATION: Refer to Figure 2

EXPLORATION

B-4

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
	25		S-8		25 to 27	24/18	2-2-3-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to, LACUSTRINE.		
5												
	30		S-9		30 to 32	24/24	1-2-2-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
0												
	35		S-10		35 to 37	24/24	1-2-2-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
-5												
	40		S-11		40 to 42	24/24	1-1-2-2			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray, LACUSTRINE.		
-10												
	45		S-12		45 to 47	24/24	2-2-2-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-15												
	50		S-13		50 to 52	24/24	WOR-WOH-WOH-6			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-20												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
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CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

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FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0

LOCATION: Refer to Figure 2

EXPLORATION

B-4

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
			S-14		55 to 57	24/24	WOR-WOR-WOR-WOH			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-25	60		S-15		60 to 62	24/24	WOR-2-3-3			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-30	65		S-16		65 to 67	24/24	WOR-WOR-WOR-WOH			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-35	70		S-17		70 to 72	24/24	WOR-WOR-WOR-WOR			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-40	75		S-18		75 to 77	24/24	WOR-WOR-WOR-WOR			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-45	80		S-19		80 to 82	24/24	WOR-WOR-WOR-WOR			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown, LACUSTRINE.		
-50	85		S-20		85 to	24/24	5-7-6-11			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to brown,		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
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CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

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FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** 34.0

LOCATION: Refer to Figure 2

EXPLORATION

B-4

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
					87					LACUSTRINE.		
-55												
	90		S-21		90 to 92	24/24	WOR-WOR-WOH-6			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-60												
	95		S-22		95 to 97	24/24	WOR-WOR-WOR-WOH			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
			S-23		98 to 100	24/24	WOR-WOH-7-8			VARVED DEPOSITS: FAT CLAY AND SILT (CH-ML); ~95% fines, ~5% sand; gray to reddish brown, LACUSTRINE.		
-65												
	100									End of Boring at 100 feet Cement and bentionate grout mixture to 2' belew existing ground surface followed by sand upon completion		
-70												
	105											
-75												
	110											
-80												
	115											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies
PROJECT NAME: Goodwin College - CT River Academy
CITY/STATE: East Hartford, CT
PROJECT NUMBER: 2016-0809

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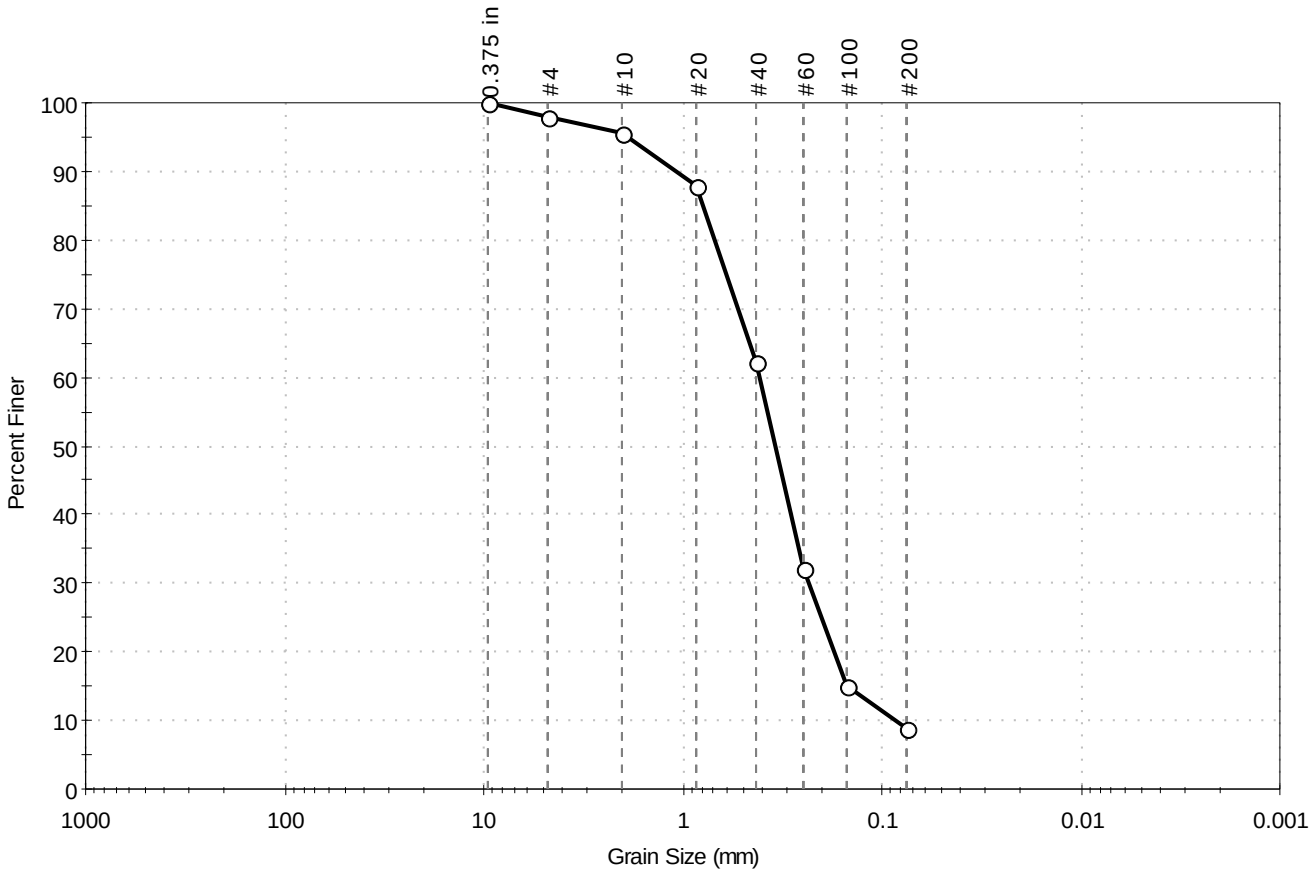
FREEMAN COMPANIES PROJECT 2016-0809 - GOODWIN COLLEGE - CT RIVER ACADEMY.GPJ GINT STD US LAB.GDT 4/10/17

APPENDIX B

RESULTS OF LABORATORY TESTING

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B2	Sample Type:	jar	Tested By:	jbr
Sample ID:	S2	Test Date:	03/23/17	Checked By:	emm
Depth :	3-5	Test Id:	406806		
Test Comment:	---				
Visual Description:	Moist, brown sand with silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	2.0	89.1	8.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	96		
#20	0.85	88		
#40	0.42	62		
#60	0.25	32		
#100	0.15	15		
#200	0.075	8.9		

Coefficients

D_{85} = 0.7874 mm	D_{30} = 0.2342 mm
D_{60} = 0.4078 mm	D_{15} = 0.1480 mm
D_{50} = 0.3421 mm	D_{10} = 0.0850 mm
C_u = 4.798	C_c = 1.582

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

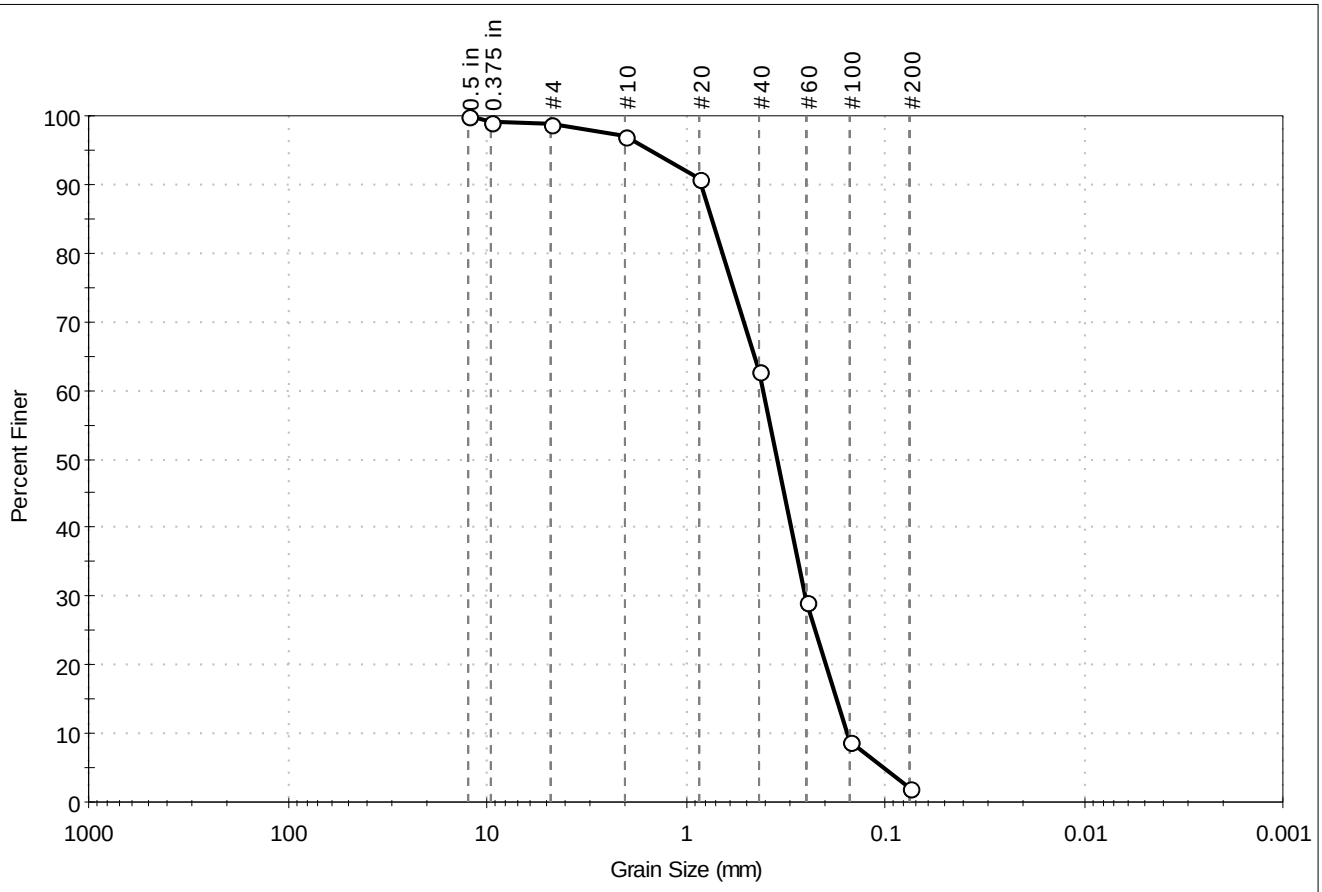
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B2	Sample Type:	jar	Tested By:	jbr
Sample ID:	S4	Test Date:	03/23/17	Checked By:	emm
Depth :	7-9	Test Id:	406807		
Test Comment:	---				
Visual Description:	Moist, brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	1.2	96.8	2.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	99		
#4	4.75	99		
#10	2.00	97		
#20	0.85	91		
#40	0.42	63		
#60	0.25	29		
#100	0.15	9		
#200	0.075	2.0		

Coefficients

D_{85} = 0.7351 mm	D_{30} = 0.2534 mm
D_{60} = 0.4068 mm	D_{15} = 0.1755 mm
D_{50} = 0.3475 mm	D_{10} = 0.1549 mm
C_u = 2.626	C_c = 1.019

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (1))

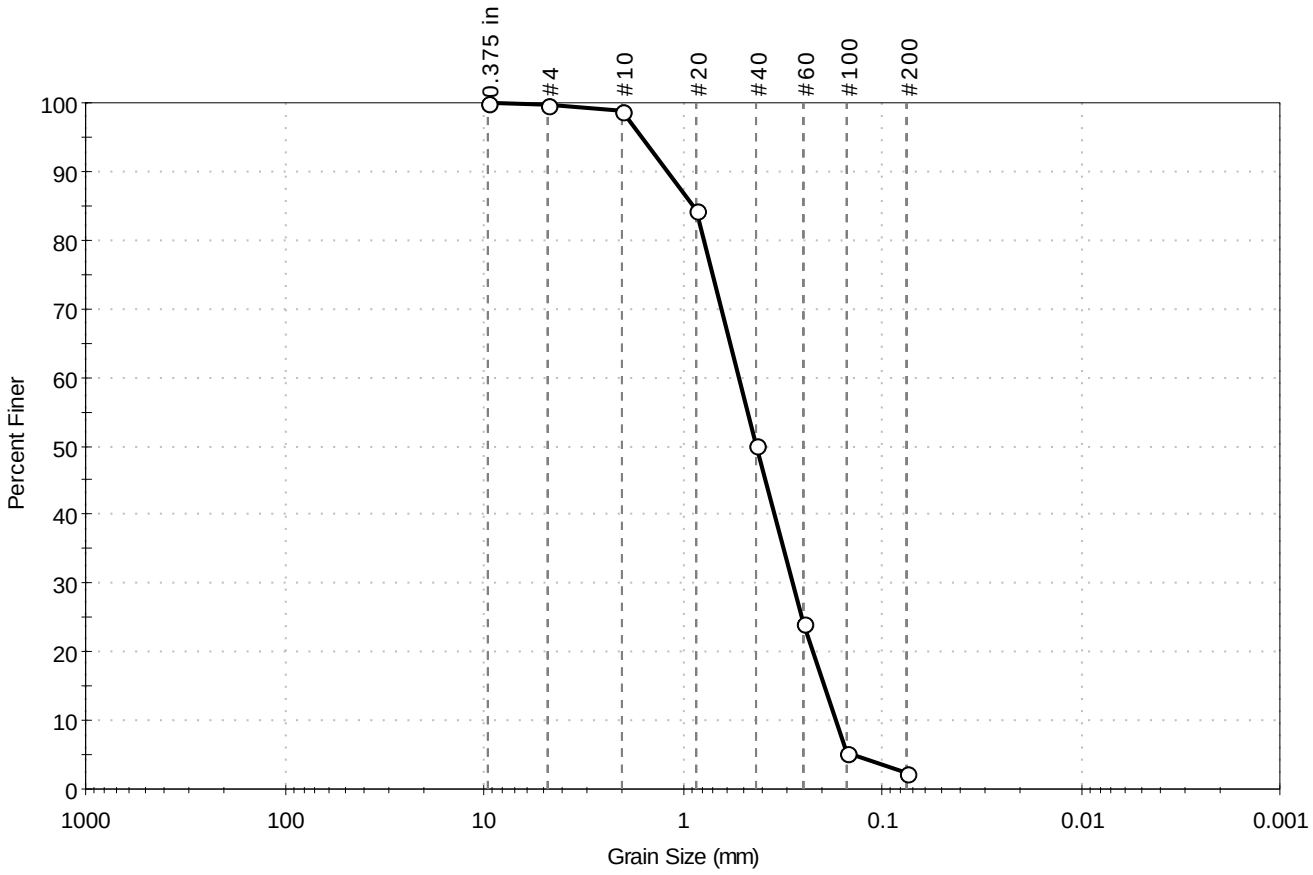
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B4	Sample Type:	jar	Tested By:	jbr
Sample ID:	S3	Test Date:	03/23/17	Checked By:	emm
Depth :	5-7	Test Id:	406808		
Test Comment:	---				
Visual Description:	Moist, brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	0.2	97.5	2.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	84		
#40	0.42	50		
#60	0.25	24		
#100	0.15	5		
#200	0.075	2.3		

Coefficients

D_{85} = 0.8839 mm	D_{30} = 0.2812 mm
D_{60} = 0.5181 mm	D_{15} = 0.1946 mm
D_{50} = 0.4227 mm	D_{10} = 0.1699 mm
C_u = 3.049	C_c = 0.898

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (1))

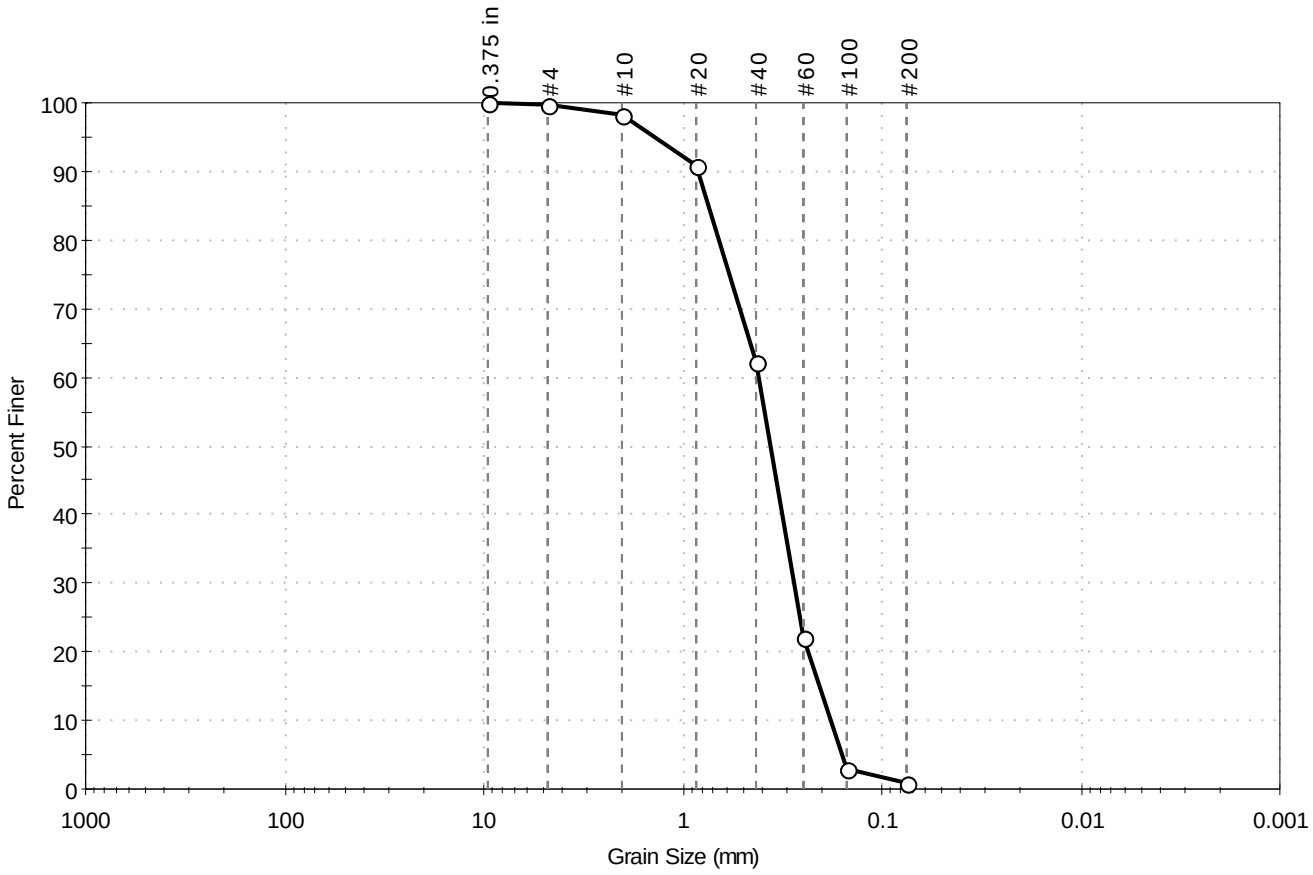
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B4	Sample Type:	jar	Tested By:	jbr
Sample ID:	S5	Test Date:	03/23/17	Checked By:	emm
Depth :	10-12	Test Id:	406809		
Test Comment:	---				
Visual Description:	Moist, brown sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.4	98.8	0.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	98		
#20	0.85	91		
#40	0.42	62		
#60	0.25	22		
#100	0.15	3		
#200	0.075	0.8		

Coefficients

D_{85} = 0.7378 mm	D_{30} = 0.2770 mm
D_{60} = 0.4121 mm	D_{15} = 0.2065 mm
D_{50} = 0.3610 mm	D_{10} = 0.1811 mm
C_u = 2.276	C_c = 1.028

Classification

ASTM Poorly graded sand (SP)

AASHTO Fine Sand (A-3 (1))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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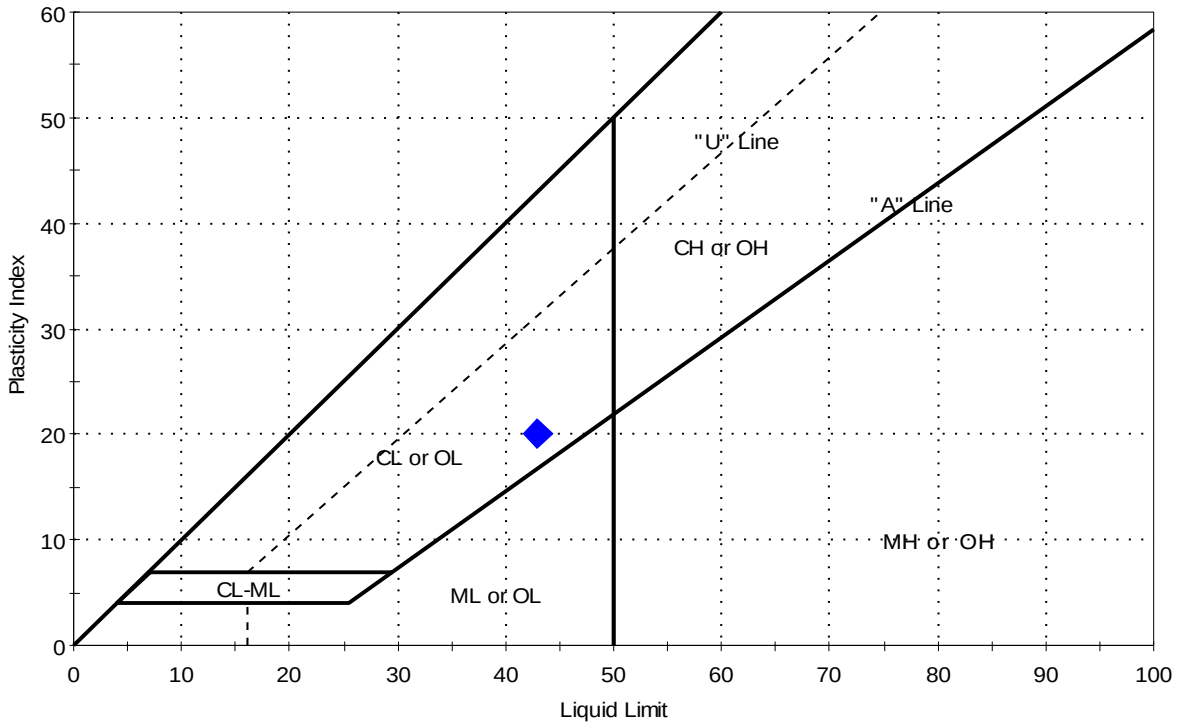
Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B2	Sample Type:	tube	Tested By:	cam
Sample ID:	T-2 (top)	Test Date:	03/27/17	Checked By:	emm
Depth :	39-41	Test Id:	406817		
Test Comment:	---				
Visual Description:	Wet, olive clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	T-2 (top)	B2	39-41	51	43	23	20	1.4	

Sample Prepared using the WET method

Dry Strength: HIGH

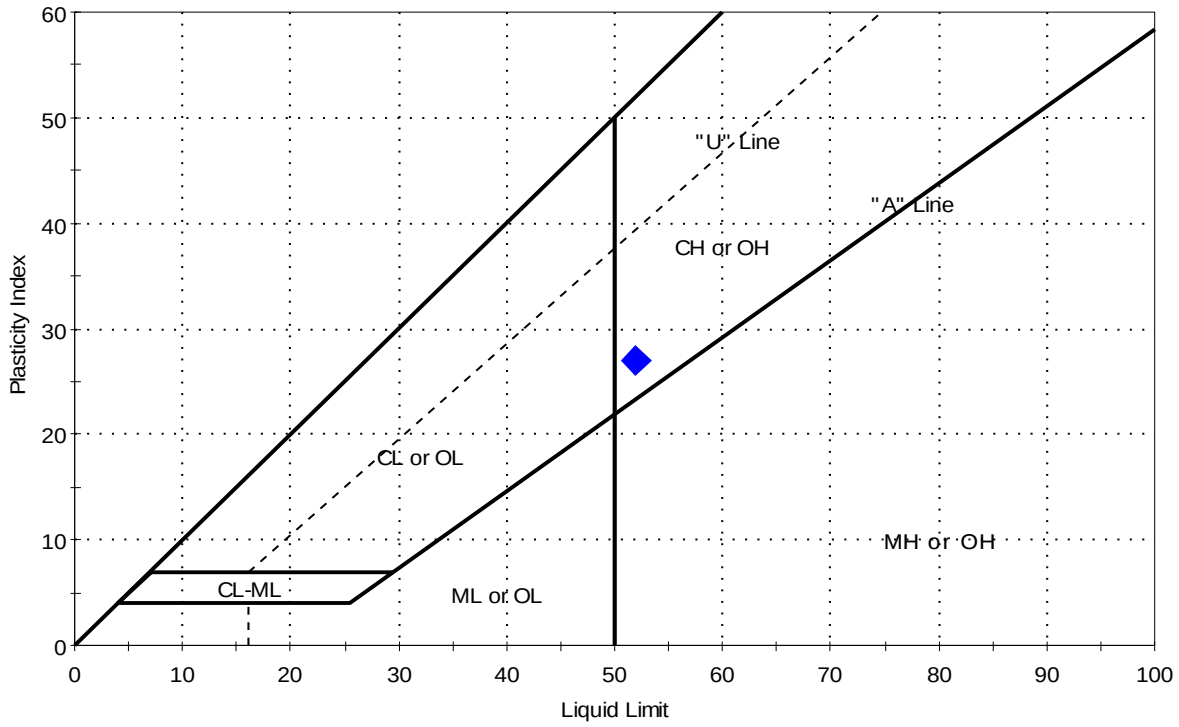
Dilatancy: SLOW

Toughness: LOW

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B2	Sample Type:	tube	Tested By:	cam
Sample ID:	T-2	Test Date:	03/27/17	Checked By:	emm
Depth :	39-41	Test Id:	406804		
Test Comment:	---				
Visual Description:	Moist, olive clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318

Plasticity Chart



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	T-2	B2	39-41	52	52	25	27	1	

Sample Prepared using the WET method

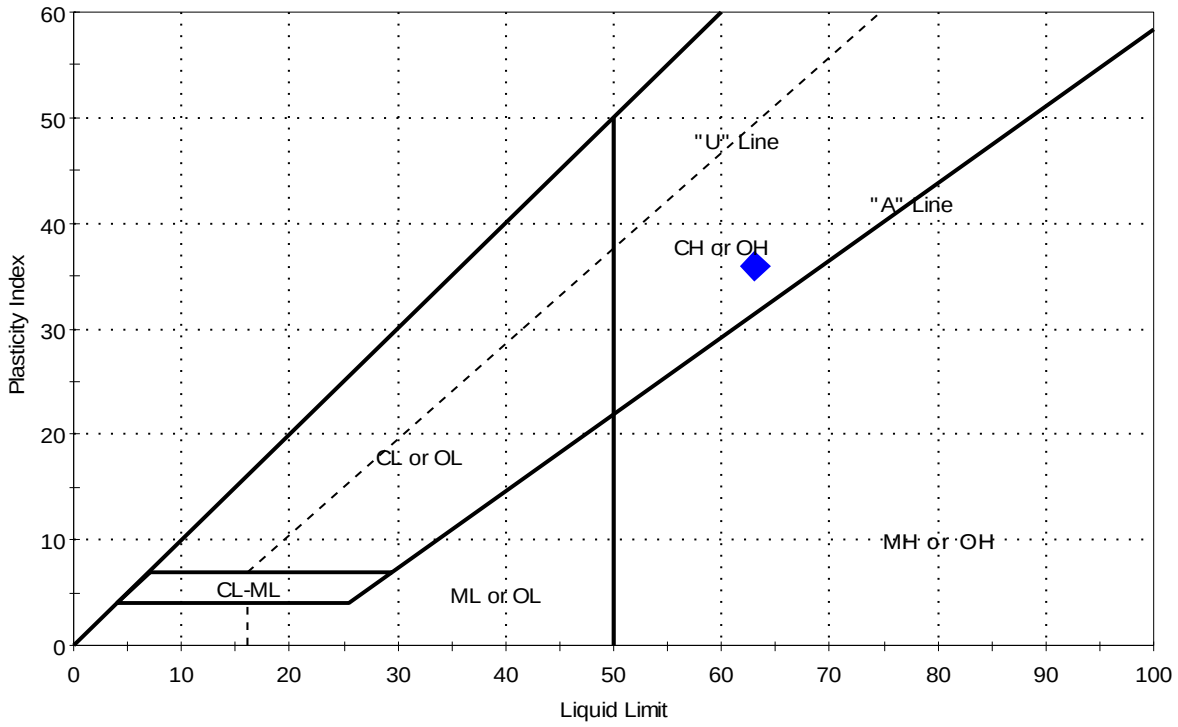
Dry Strength: HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B2	Sample Type:	tube	Tested By:	cam
Sample ID:	T-3 (top)	Test Date:	03/27/17	Checked By:	emm
Depth :	49-51	Test Id:	406818		
Test Comment:	---				
Visual Description:	Moist, olive clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	T-3 (top)	B2	49-51	57	63	27	36	0.8	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

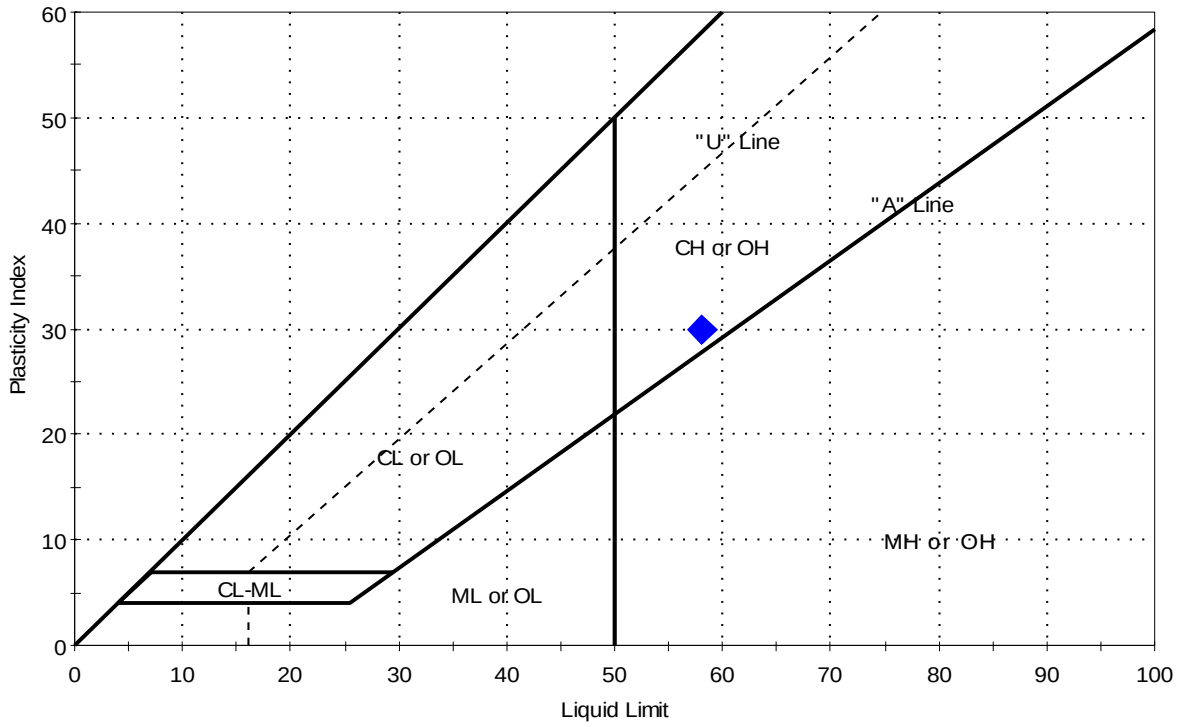
Dilatancy: SLOW

Toughness: LOW

Client:	Freeman Companies, LLC				
Project:	Goodwin, CT Riv. Academy				
Location:	East Hartford, CT			Project No:	GTX-306164
Boring ID:	B2	Sample Type:	tube	Tested By:	cam
Sample ID:	T-3	Test Date:	03/27/17	Checked By:	emm
Depth :	49-51	Test Id:	406805		
Test Comment:	---				
Visual Description:	Moist, olive clay				
Sample Comment:	----				

Atterberg Limits - ASTM D4318

Plasticity Chart



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	T-3	B2	49-51	59	58	28	30	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Appendix B

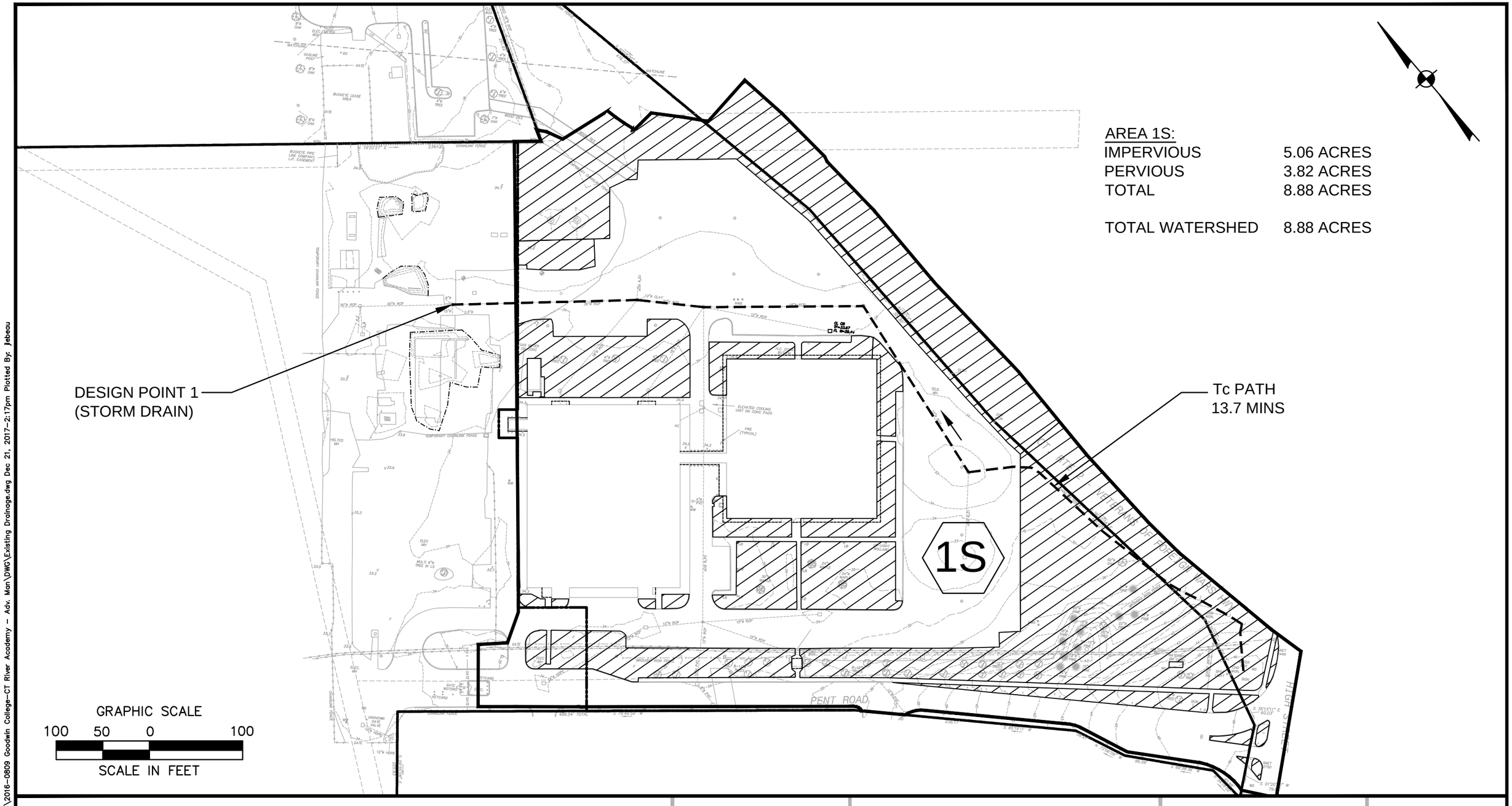
Existing Drainage Area Map

Proposed Drainage Area Map

Pre and Post Development Hydrologic Computations (HydroCAD)

Detention Calculations

Hydraflow Storm Sewers Calculations



EXISTING DRAINAGE AREA MAP
CONNECTICUT RIVER ACADEMY MANUFACTURING ANNEX
1 PENT ROAD
EAST HARTFORD, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

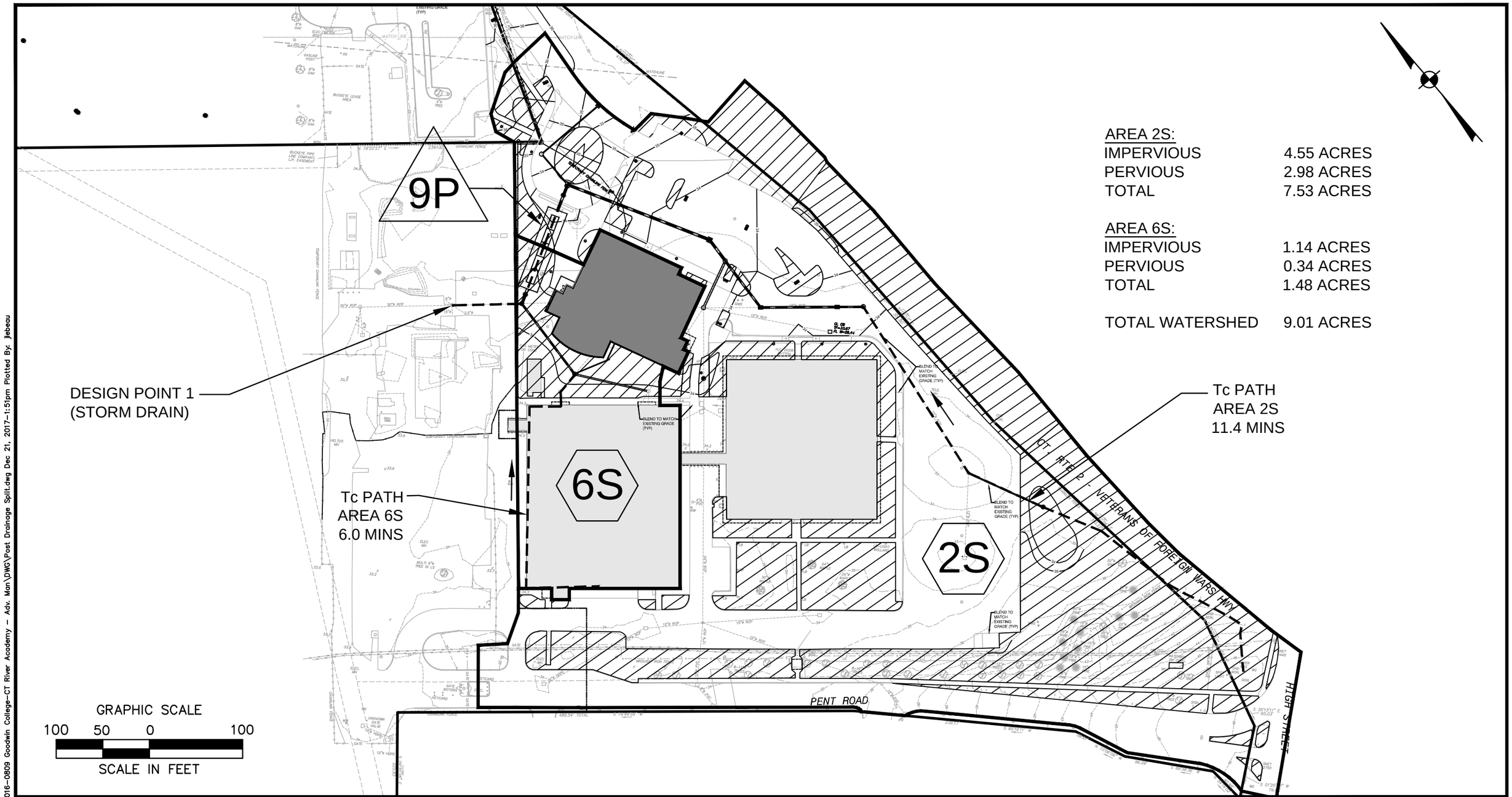
DRAWN:	MK
CHECKED:	JNL
APPROVED:	PAR
SCALE:	1"=100'
PROJECT NO.:	2016–0809
DATE:	12/21/17

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2016\2016-0809 Goodwin College-CT River Academy - Adv. Man\DWG\Existing Drainage.dwg Dec 21, 2017-2:17pm Plotted By: Jebeau

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC



AREA 2S:

IMPERVIOUS	4.55 ACRES
PERVIOUS	2.98 ACRES
TOTAL	7.53 ACRES

AREA 6S:

IMPERVIOUS	1.14 ACRES
PERVIOUS	0.34 ACRES
TOTAL	1.48 ACRES

TOTAL WATERSHED 9.01 ACRES

PROPOSED DRAINAGE AREA MAP
CONNECTICUT RIVER ACADEMY MANUFACTURING ANNEX
1 PENT ROAD
EAST HARTFORD, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
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TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DRAWN:	MK
CHECKED:	JNL
APPROVED:	PAR
SCALE:	1"=100'
PROJECT NO.:	2016–0809
DATE:	12/21/17

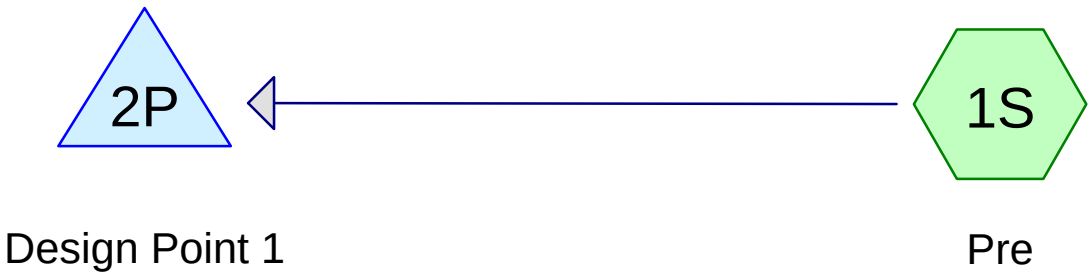
SHEET NO.

FIGURE 2

Freeman Companies, LLC . Y:\2016\2016-0809 Goodwin College-CT River Academy - Adv. Man\DWG\Post Drainage Split.dwg Dec 21, 2017-1:51pm Plotted By: Jebeau

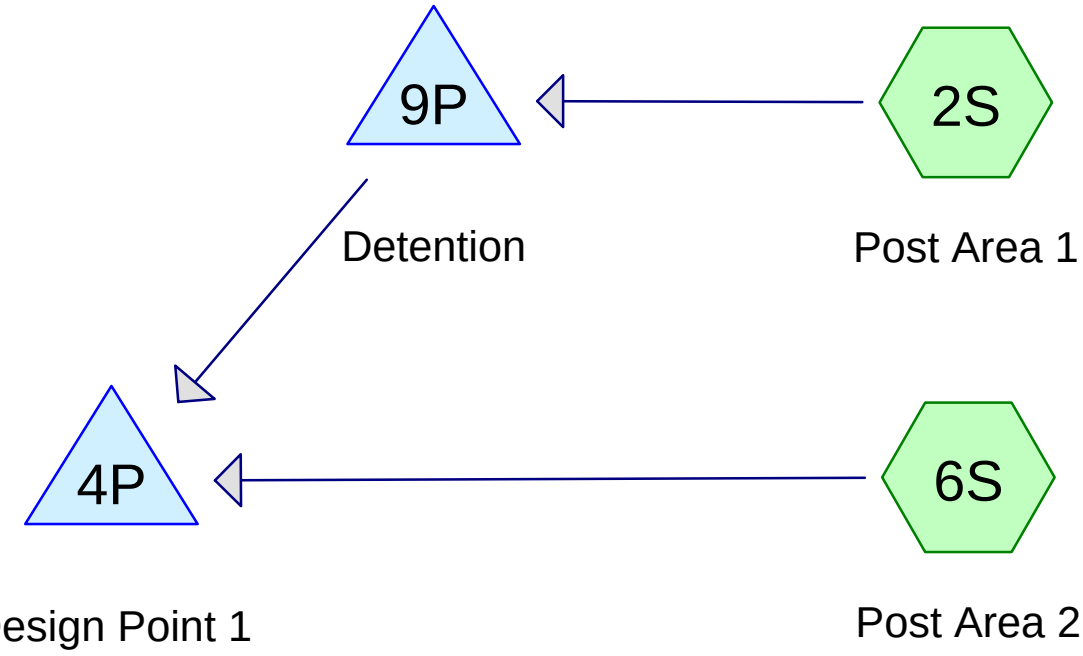
THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

Pre and Post Development Computations



Design Point 1

Pre



Design Point 1

Post Area 2

Subcat Reach Pond Link

Summary for Subcatchment 1S: Pre

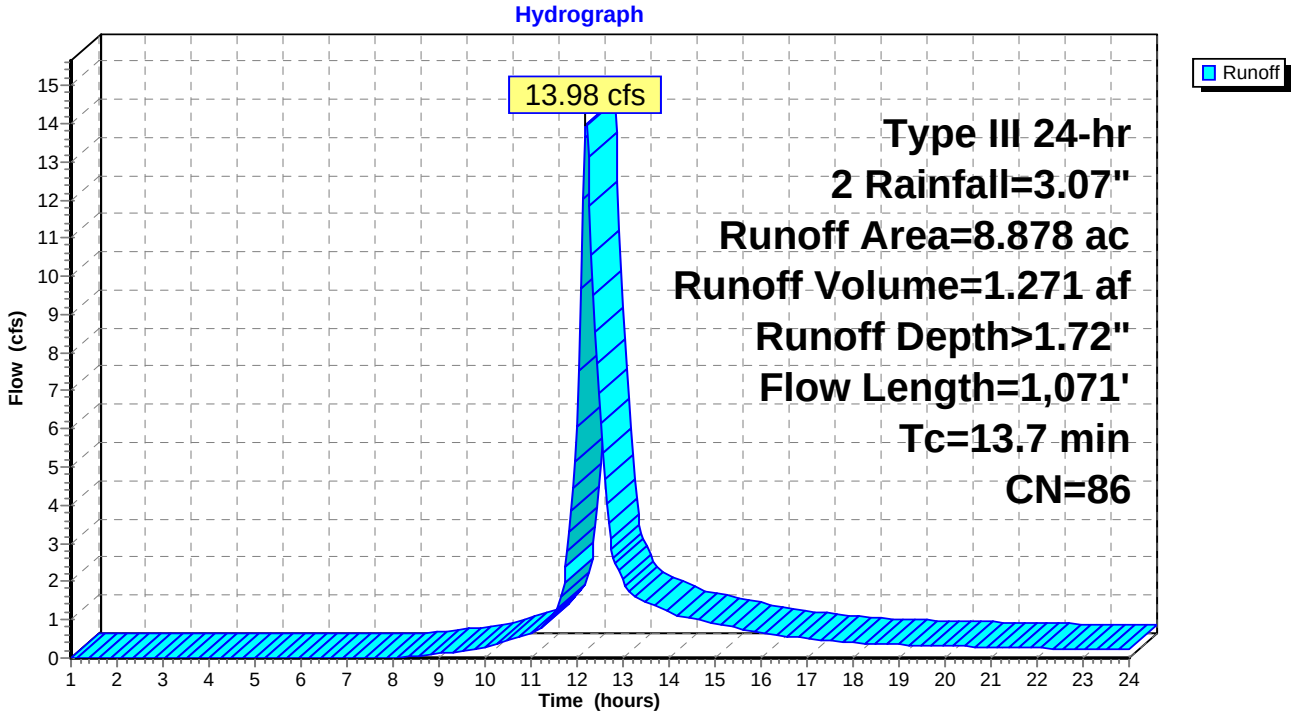
Runoff = 13.98 cfs @ 12.19 hrs, Volume= 1.271 af, Depth> 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2 Rainfall=3.07"

Area (ac)	CN	Description
5.060	98	Paved parking, HSG A
3.818	69	50-75% Grass cover, Fair, HSG B
8.878	86	Weighted Average
3.818		43.01% Pervious Area
5.060		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	121	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	47	0.0391	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
1.0	172	0.0024	2.91	5.15	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.2	72	0.0090	7.93	38.91	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
0.9	199	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
13.7	1,071	Total			

Subcatchment 1S: Pre



Summary for Subcatchment 2S: Post Area 1

Runoff = 11.00 cfs @ 12.16 hrs, Volume= 0.941 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2 Rainfall=3.07"

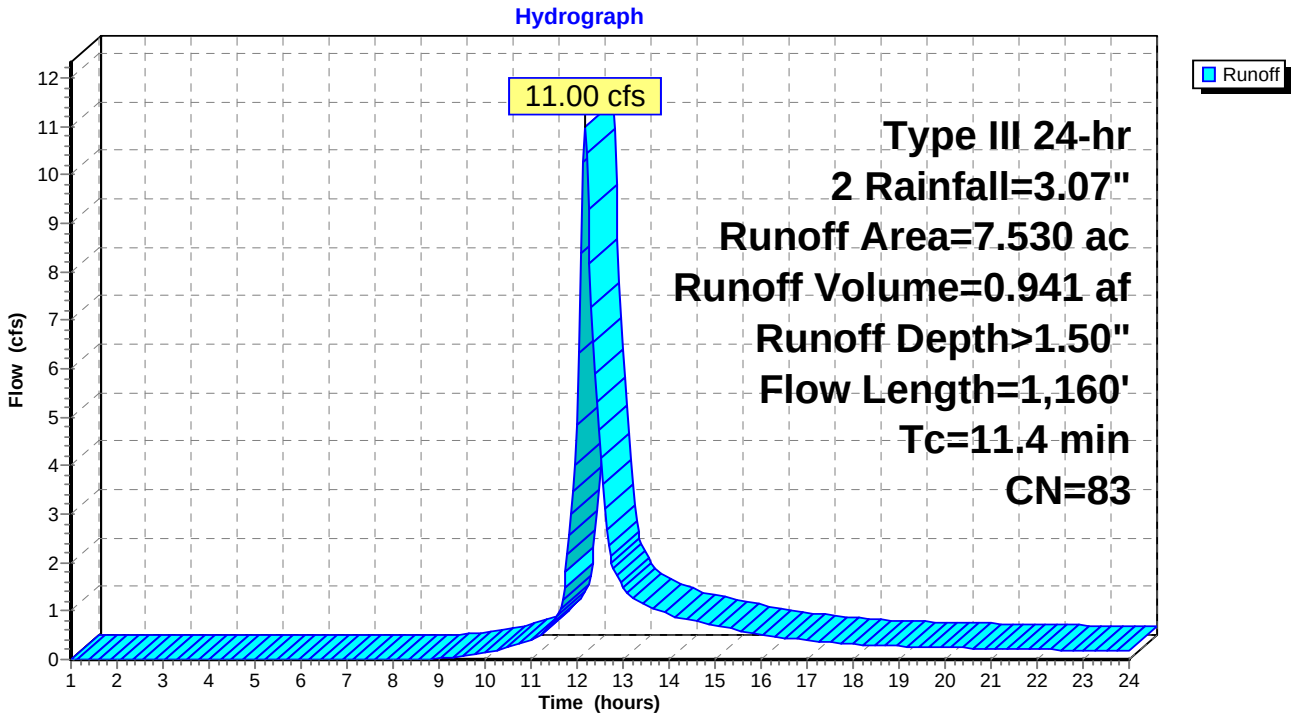
Area (ac)	CN	Description
4.550	98	Paved parking, HSG A
2.980	61	>75% Grass cover, Good, HSG B
7.530	83	Weighted Average
2.980		39.58% Pervious Area
4.550		60.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	68	0.0222	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	84	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.1	23	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	79	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.3	59	0.0033	3.41	6.03	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.1	24	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.6	160	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.2	64	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'

n= 0.013 Corrugated PE, smooth interior

0.2	64	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.3	75	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.4	1,160	Total			

Subcatchment 2S: Post Area 1



Summary for Subcatchment 6S: Post Area 2

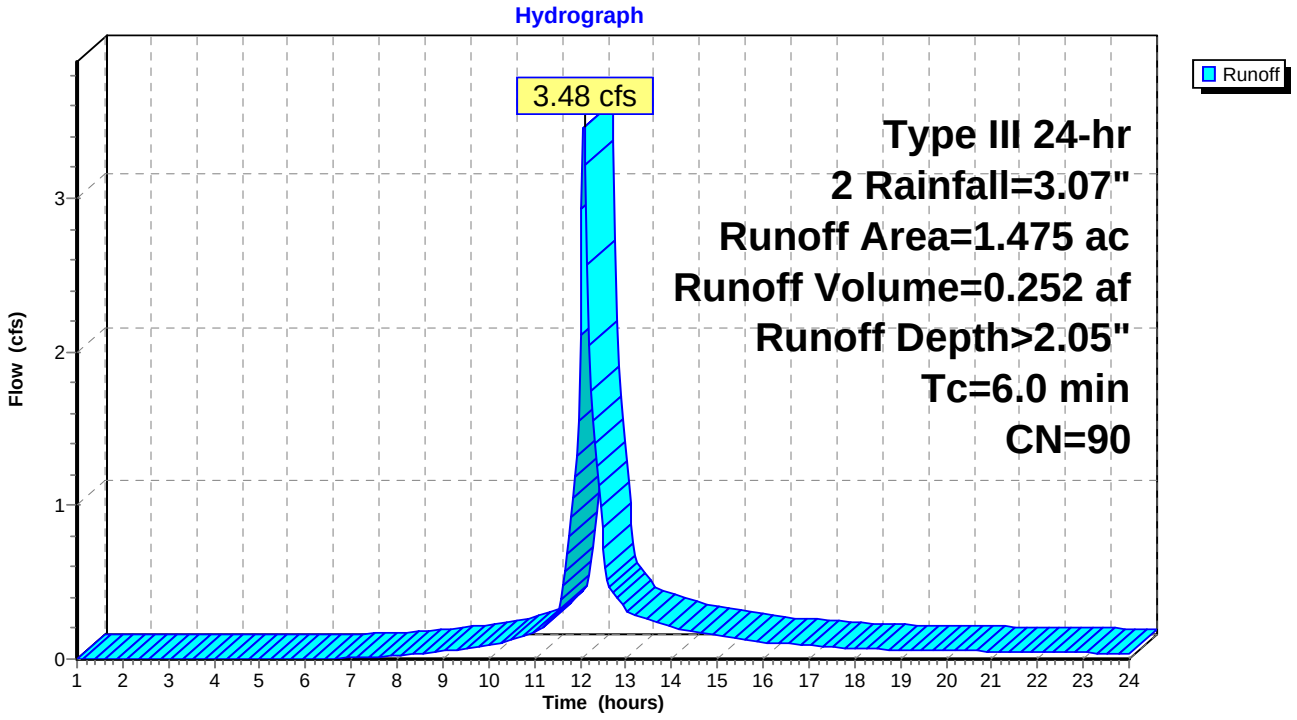
Runoff = 3.48 cfs @ 12.09 hrs, Volume= 0.252 af, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 2 Rainfall=3.07"

Area (ac)	CN	Description
1.139	98	Paved parking, HSG A
0.336	61	>75% Grass cover, Good, HSG B
1.475	90	Weighted Average
0.336		22.78% Pervious Area
1.139		77.22% Impervious Area

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

Subcatchment 6S: Post Area 2

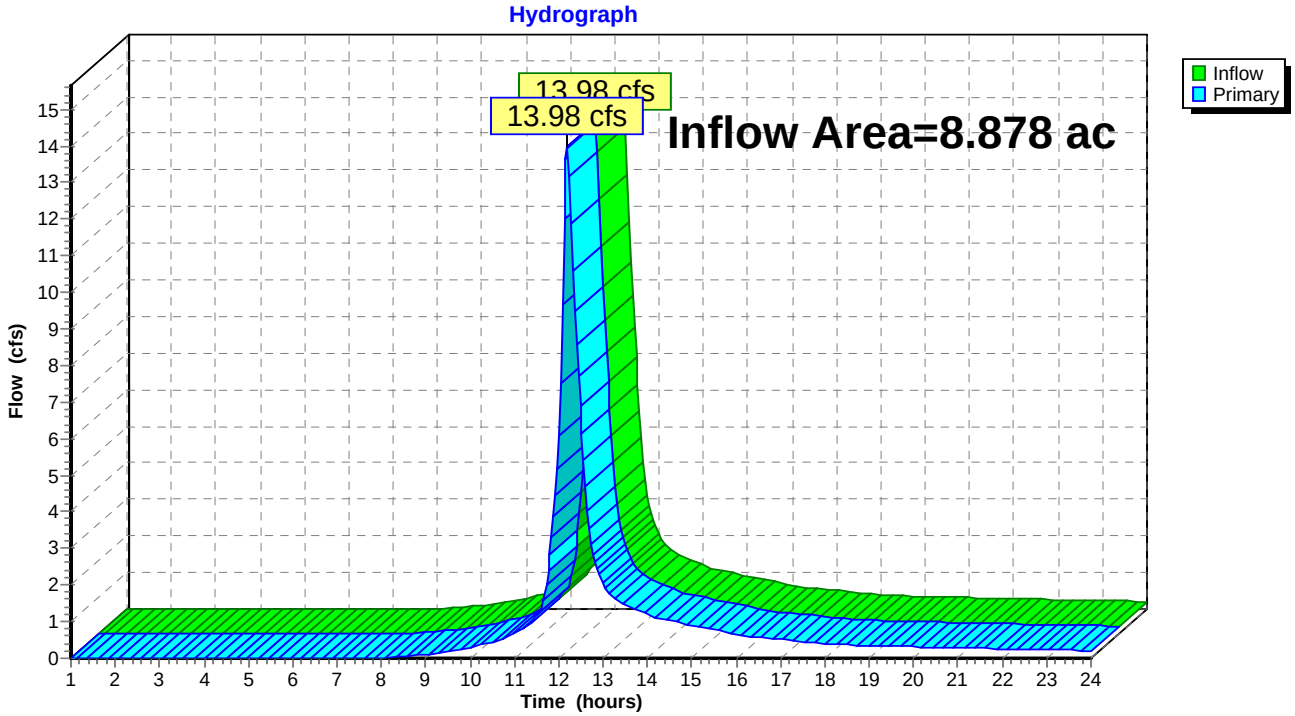


Summary for Pond 2P: Design Point 1

Inflow Area = 8.878 ac, 56.99% Impervious, Inflow Depth > 1.72" for 2 event
Inflow = 13.98 cfs @ 12.19 hrs, Volume= 1.271 af
Primary = 13.98 cfs @ 12.19 hrs, Volume= 1.271 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 2P: Design Point 1

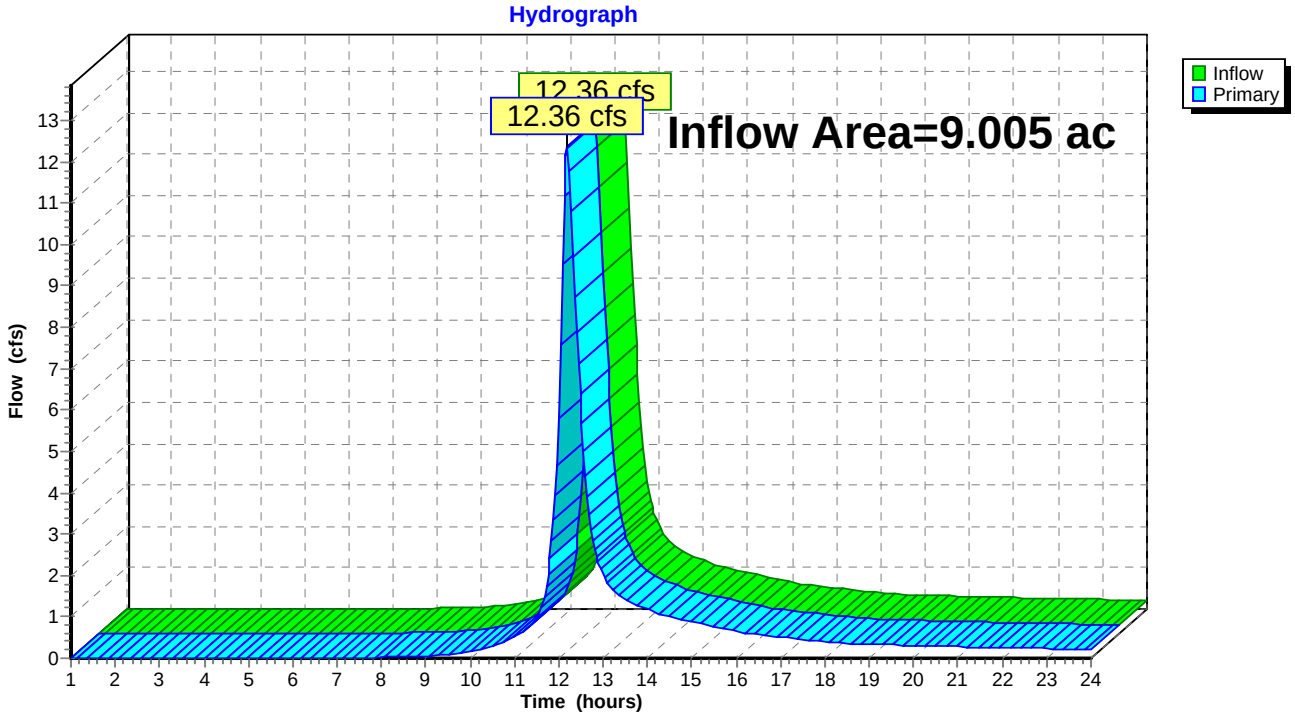


Summary for Pond 4P: Design Point 1

Inflow Area = 9.005 ac, 63.18% Impervious, Inflow Depth > 1.58" for 2 event
Inflow = 12.36 cfs @ 12.19 hrs, Volume= 1.186 af
Primary = 12.36 cfs @ 12.19 hrs, Volume= 1.186 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 4P: Design Point 1



Summary for Subcatchment 1S: Pre

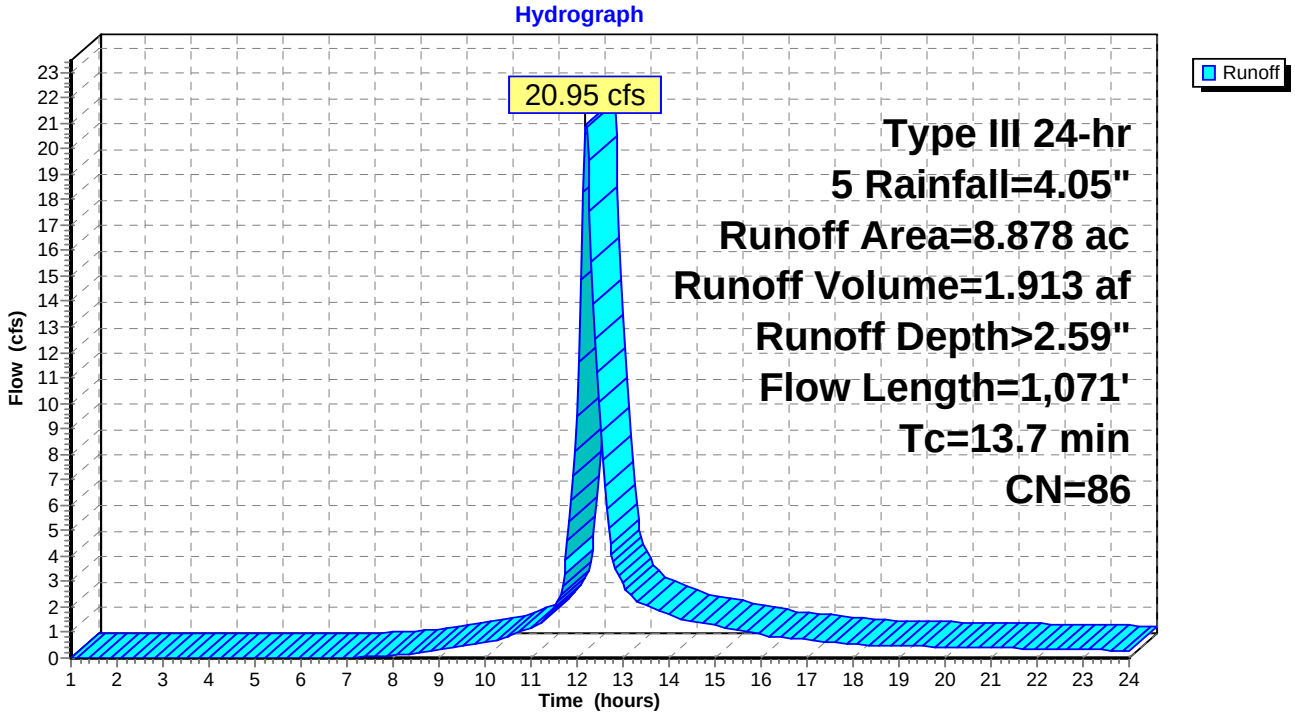
Runoff = 20.95 cfs @ 12.19 hrs, Volume= 1.913 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 5 Rainfall=4.05"

Area (ac)	CN	Description
5.060	98	Paved parking, HSG A
3.818	69	50-75% Grass cover, Fair, HSG B
8.878	86	Weighted Average
3.818		43.01% Pervious Area
5.060		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	121	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	47	0.0391	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
1.0	172	0.0024	2.91	5.15	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.2	72	0.0090	7.93	38.91	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
0.9	199	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
13.7	1,071	Total			

Subcatchment 1S: Pre



Summary for Subcatchment 2S: Post Area 1

Runoff = 17.12 cfs @ 12.16 hrs, Volume= 1.459 af, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 5 Rainfall=4.05"

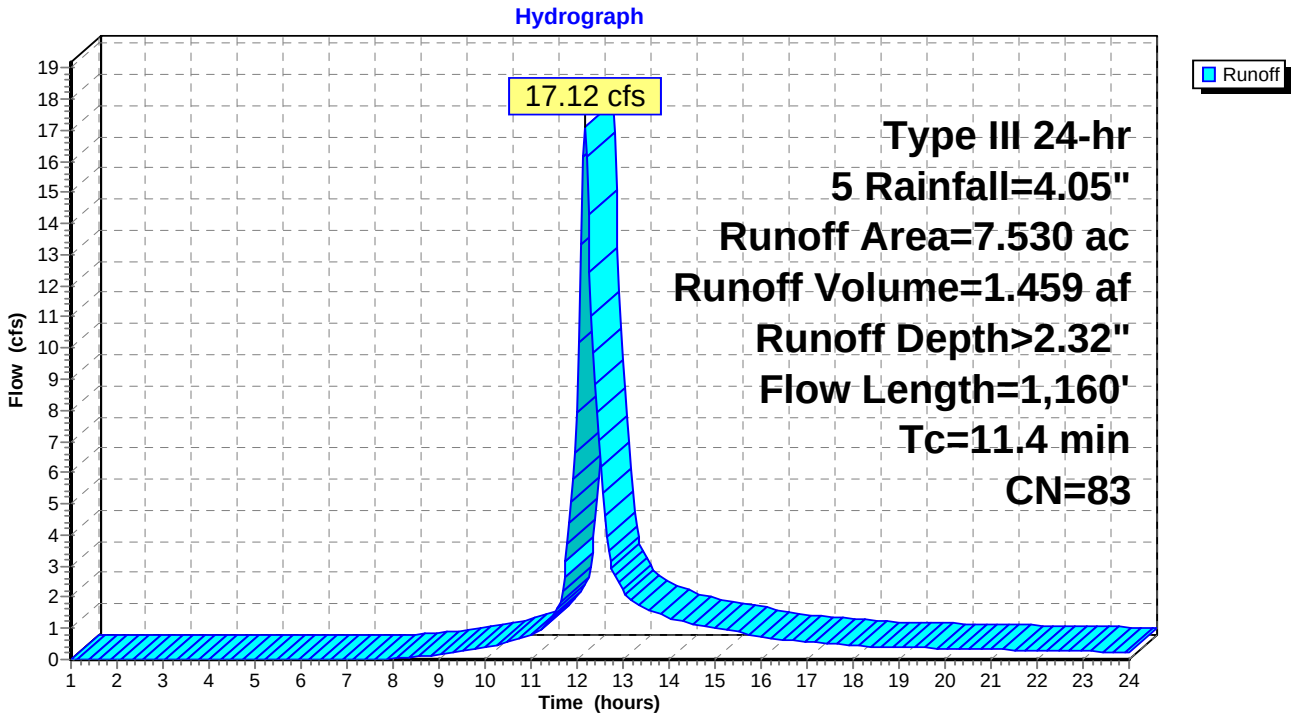
Area (ac)	CN	Description
4.550	98	Paved parking, HSG A
2.980	61	>75% Grass cover, Good, HSG B
7.530	83	Weighted Average
2.980		39.58% Pervious Area
4.550		60.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	68	0.0222	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	84	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.1	23	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	79	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.3	59	0.0033	3.41	6.03	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.1	24	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.6	160	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.2	64	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'

n= 0.013 Corrugated PE, smooth interior

0.2	64	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.3	75	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.4	1,160	Total			

Subcatchment 2S: Post Area 1



Summary for Subcatchment 6S: Post Area 2

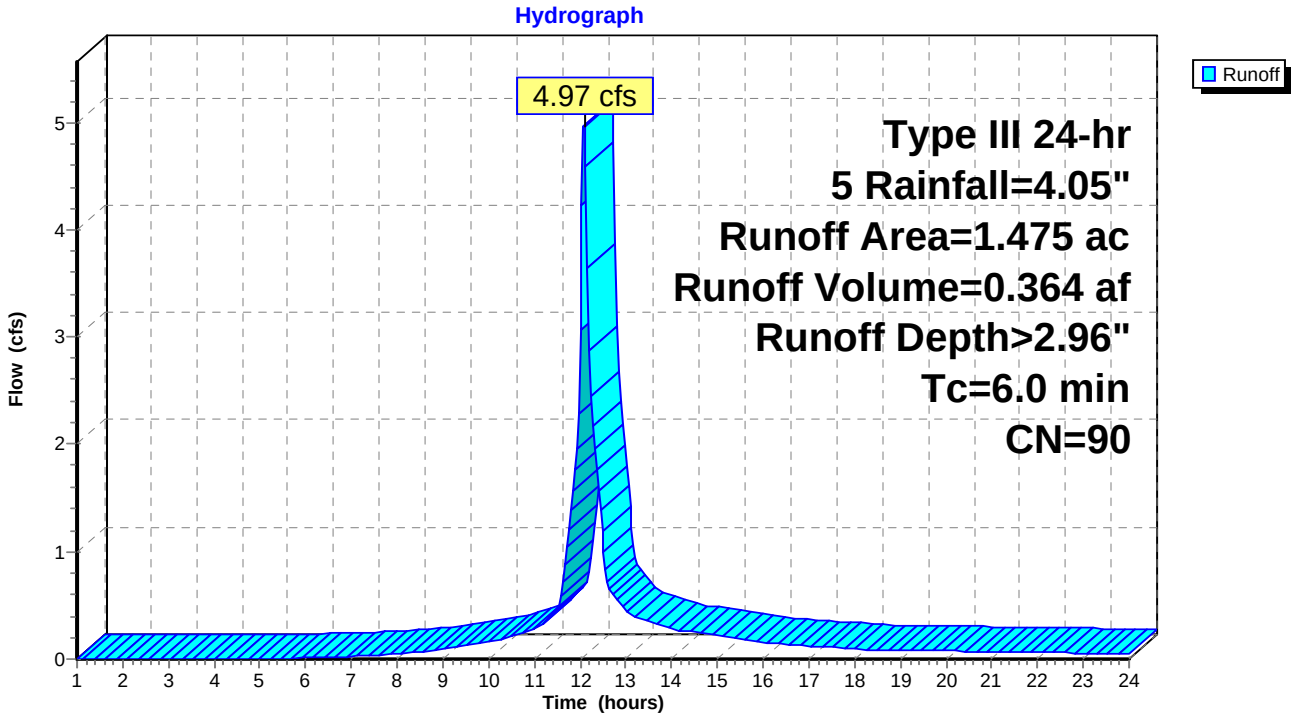
Runoff = 4.97 cfs @ 12.09 hrs, Volume= 0.364 af, Depth> 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 5 Rainfall=4.05"

Area (ac)	CN	Description
1.139	98	Paved parking, HSG A
0.336	61	>75% Grass cover, Good, HSG B
1.475	90	Weighted Average
0.336		22.78% Pervious Area
1.139		77.22% Impervious Area

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

Subcatchment 6S: Post Area 2

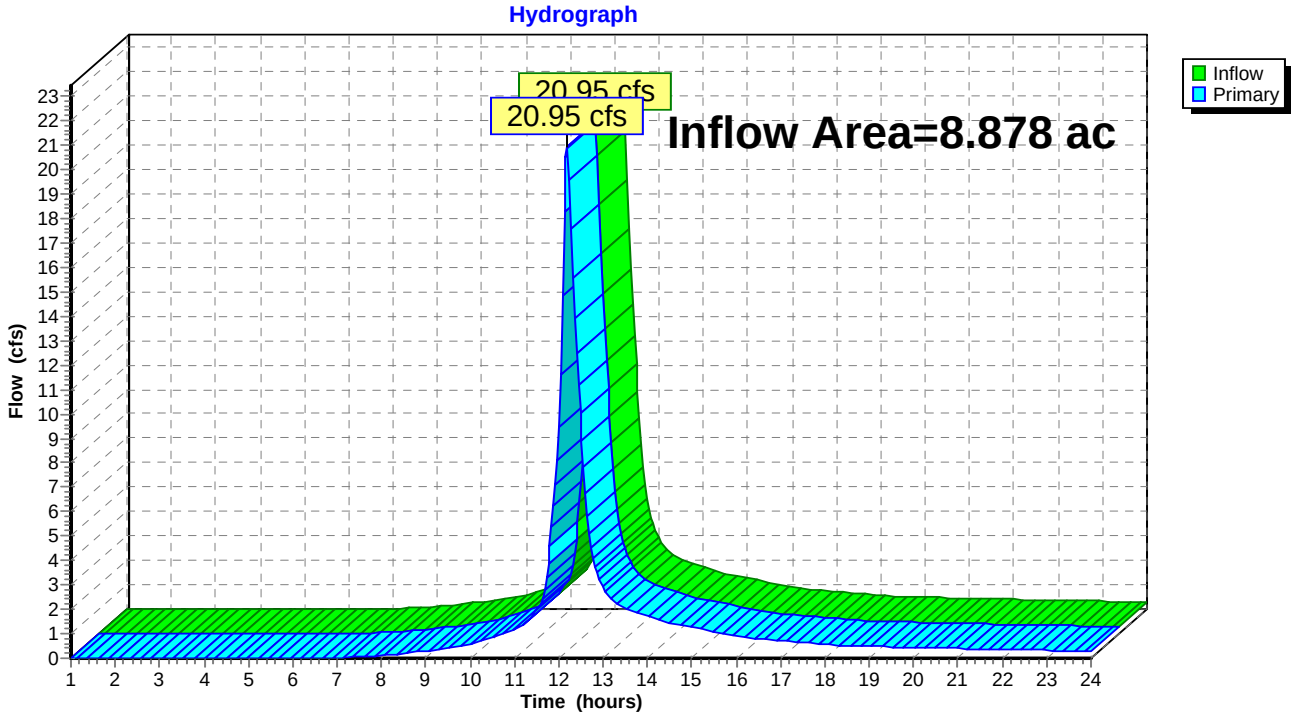


Summary for Pond 2P: Design Point 1

Inflow Area = 8.878 ac, 56.99% Impervious, Inflow Depth > 2.59" for 5 event
Inflow = 20.95 cfs @ 12.19 hrs, Volume= 1.913 af
Primary = 20.95 cfs @ 12.19 hrs, Volume= 1.913 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 2P: Design Point 1

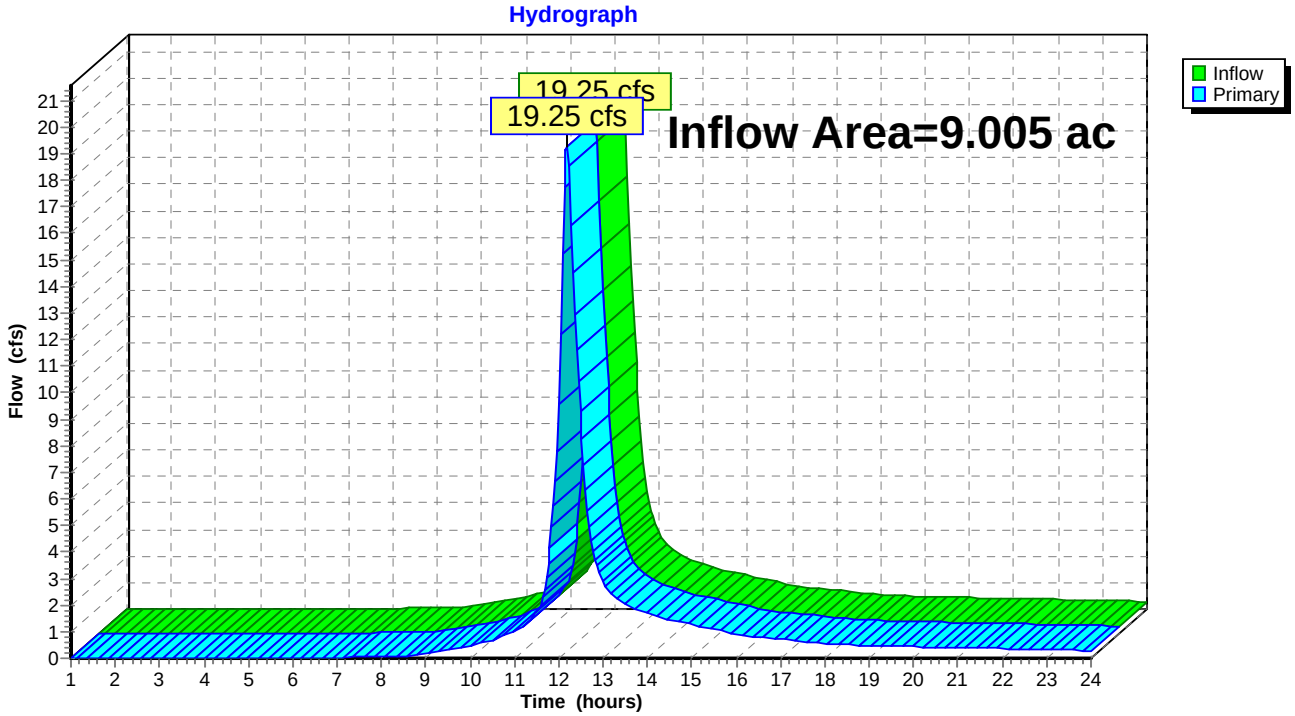


Summary for Pond 4P: Design Point 1

Inflow Area = 9.005 ac, 63.18% Impervious, Inflow Depth > 2.42" for 5 event
Inflow = 19.25 cfs @ 12.18 hrs, Volume= 1.815 af
Primary = 19.25 cfs @ 12.18 hrs, Volume= 1.815 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 4P: Design Point 1



Summary for Subcatchment 1S: Pre

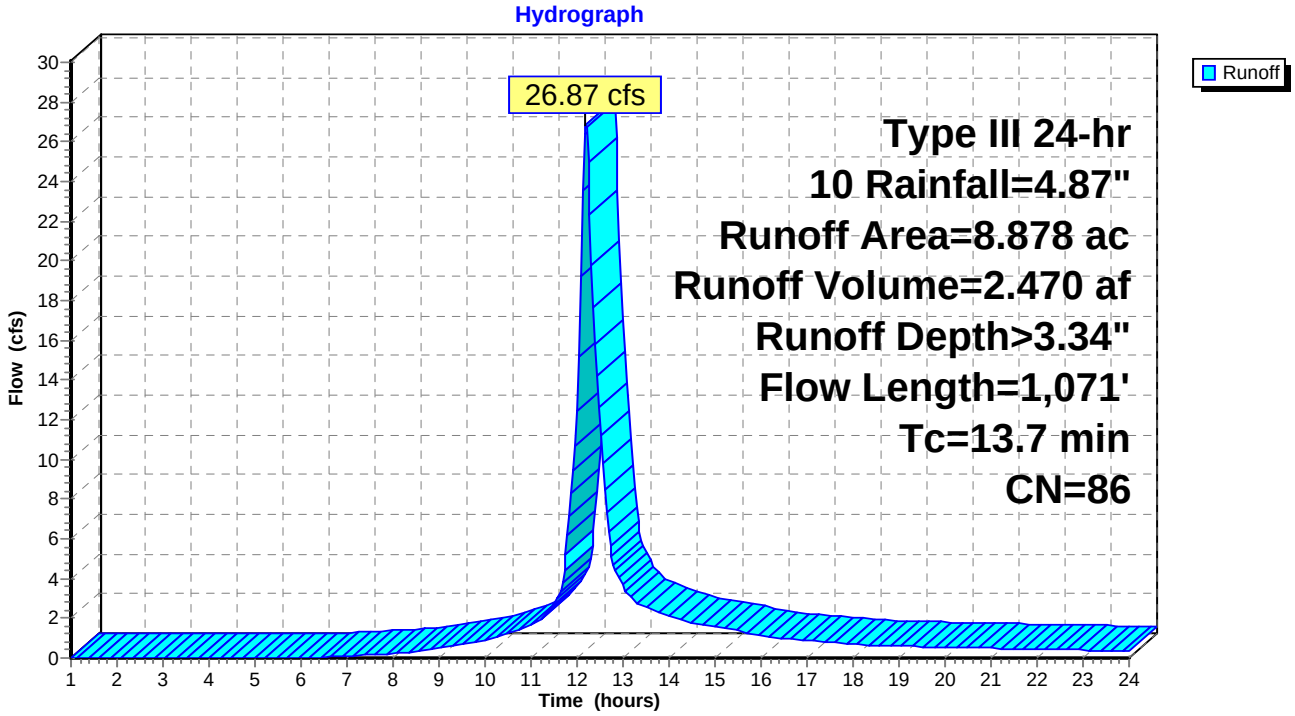
Runoff = 26.87 cfs @ 12.19 hrs, Volume= 2.470 af, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10 Rainfall=4.87"

Area (ac)	CN	Description
5.060	98	Paved parking, HSG A
3.818	69	50-75% Grass cover, Fair, HSG B
8.878	86	Weighted Average
3.818		43.01% Pervious Area
5.060		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	121	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	47	0.0391	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
1.0	172	0.0024	2.91	5.15	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.2	72	0.0090	7.93	38.91	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
0.9	199	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
13.7	1,071	Total			

Subcatchment 1S: Pre



Summary for Subcatchment 2S: Post Area 1

Runoff = 22.40 cfs @ 12.16 hrs, Volume= 1.914 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10 Rainfall=4.87"

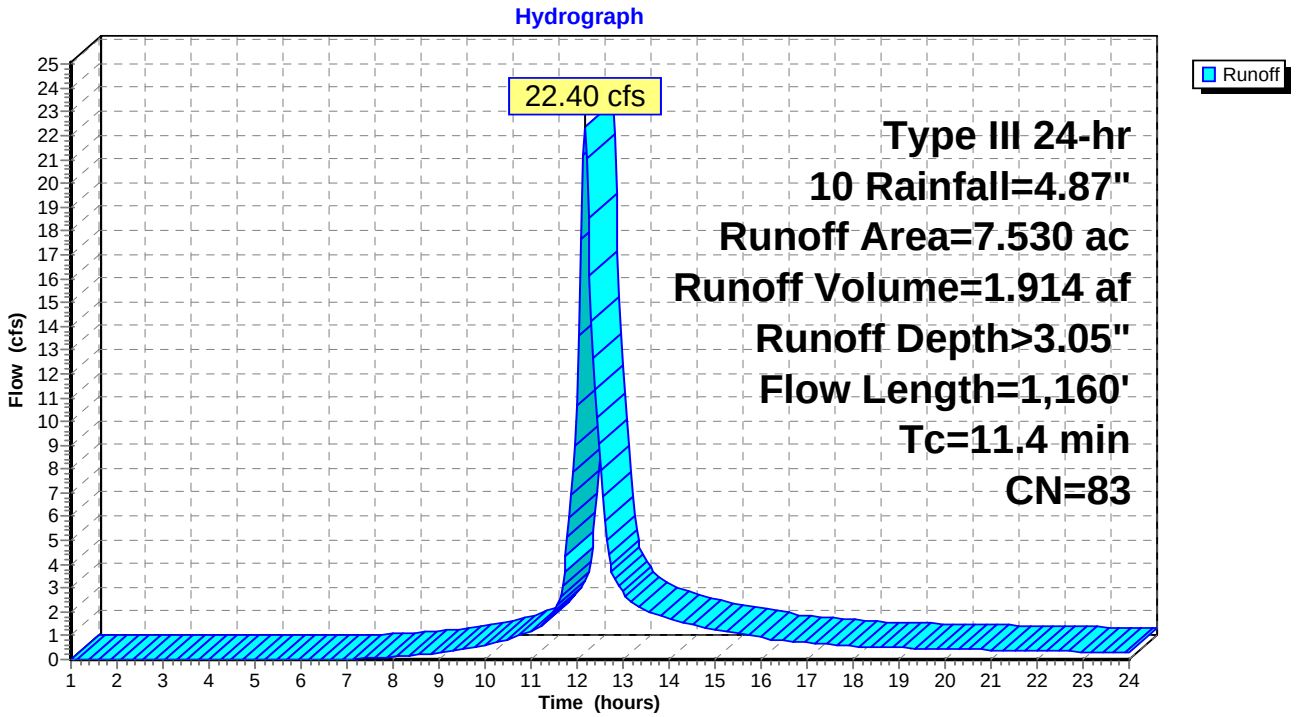
Area (ac)	CN	Description
4.550	98	Paved parking, HSG A
2.980	61	>75% Grass cover, Good, HSG B
7.530	83	Weighted Average
2.980		39.58% Pervious Area
4.550		60.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	68	0.0222	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	84	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.1	23	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	79	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.3	59	0.0033	3.41	6.03	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.1	24	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.6	160	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.2	64	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'

n= 0.013 Corrugated PE, smooth interior

0.2	64	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.3	75	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.4	1,160	Total			

Subcatchment 2S: Post Area 1



Summary for Subcatchment 6S: Post Area 2

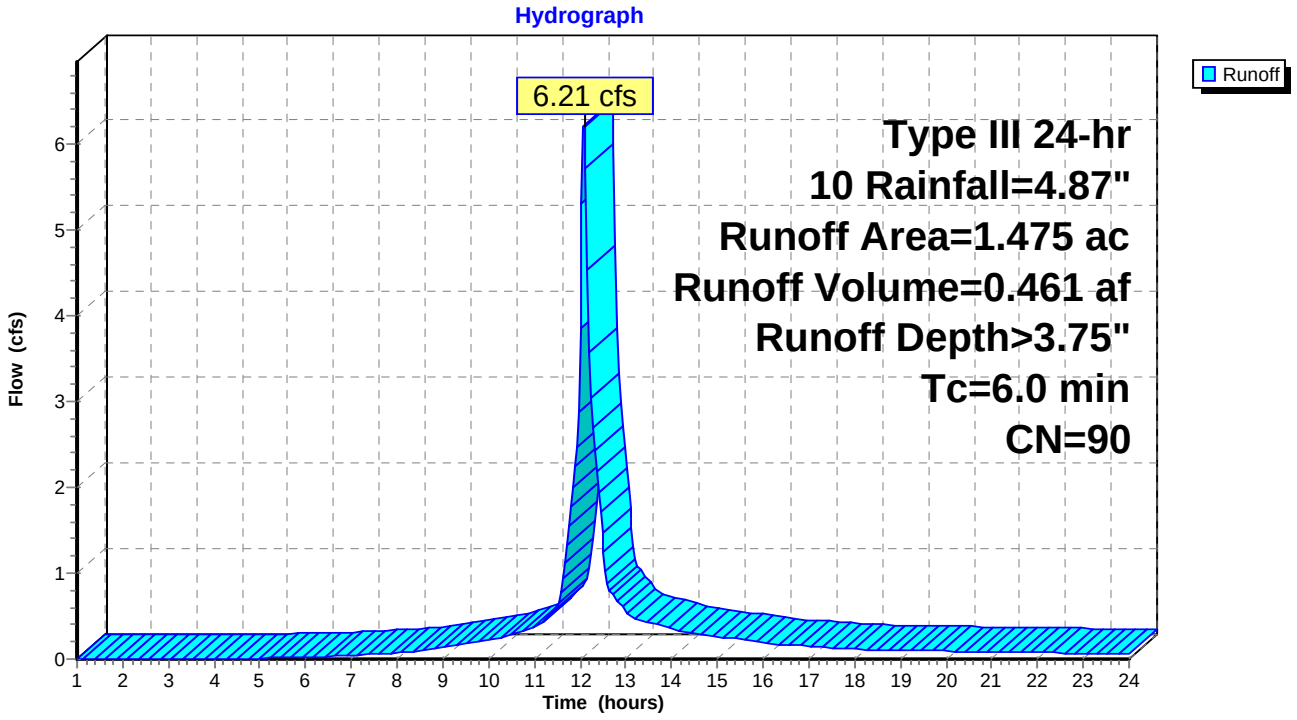
Runoff = 6.21 cfs @ 12.09 hrs, Volume= 0.461 af, Depth> 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 10 Rainfall=4.87"

Area (ac)	CN	Description
1.139	98	Paved parking, HSG A
0.336	61	>75% Grass cover, Good, HSG B
1.475	90	Weighted Average
0.336		22.78% Pervious Area
1.139		77.22% Impervious Area

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

Subcatchment 6S: Post Area 2

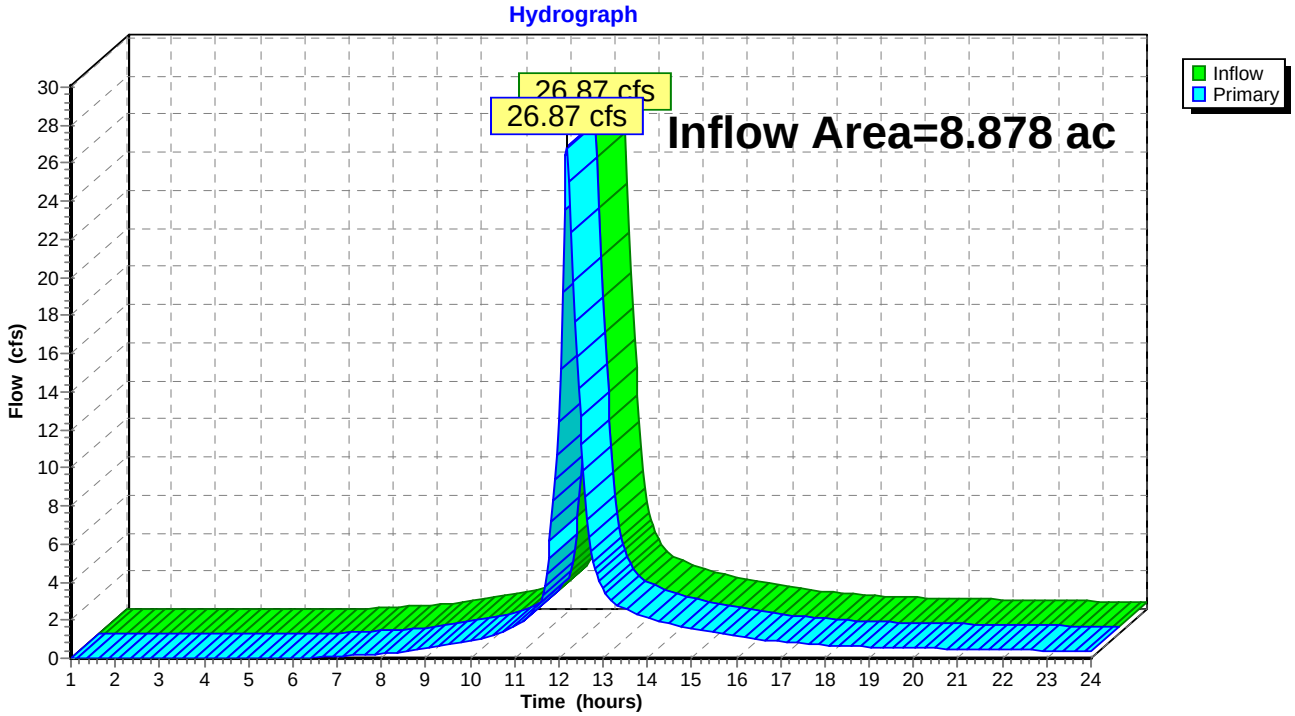


Summary for Pond 2P: Design Point 1

Inflow Area = 8.878 ac, 56.99% Impervious, Inflow Depth > 3.34" for 10 event
Inflow = 26.87 cfs @ 12.19 hrs, Volume= 2.470 af
Primary = 26.87 cfs @ 12.19 hrs, Volume= 2.470 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 2P: Design Point 1

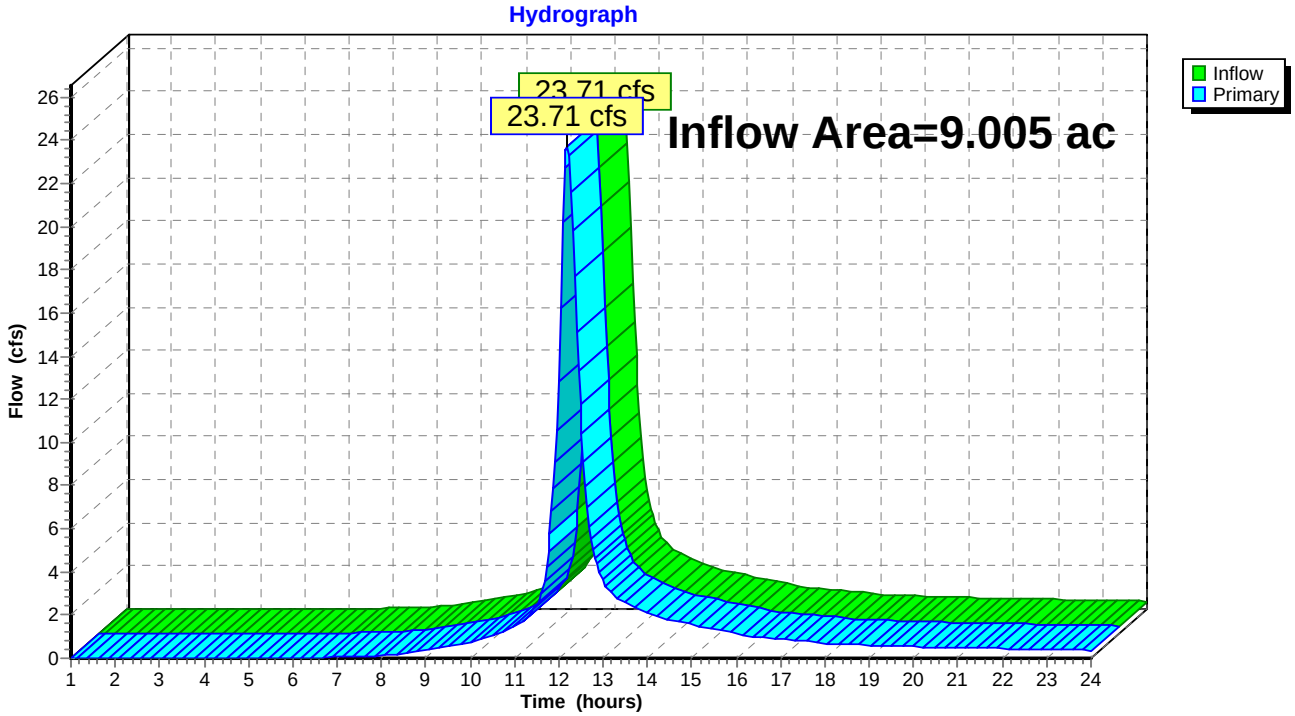


Summary for Pond 4P: Design Point 1

Inflow Area = 9.005 ac, 63.18% Impervious, Inflow Depth > 3.15" for 10 event
Inflow = 23.71 cfs @ 12.19 hrs, Volume= 2.366 af
Primary = 23.71 cfs @ 12.19 hrs, Volume= 2.366 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 4P: Design Point 1



Summary for Subcatchment 1S: Pre

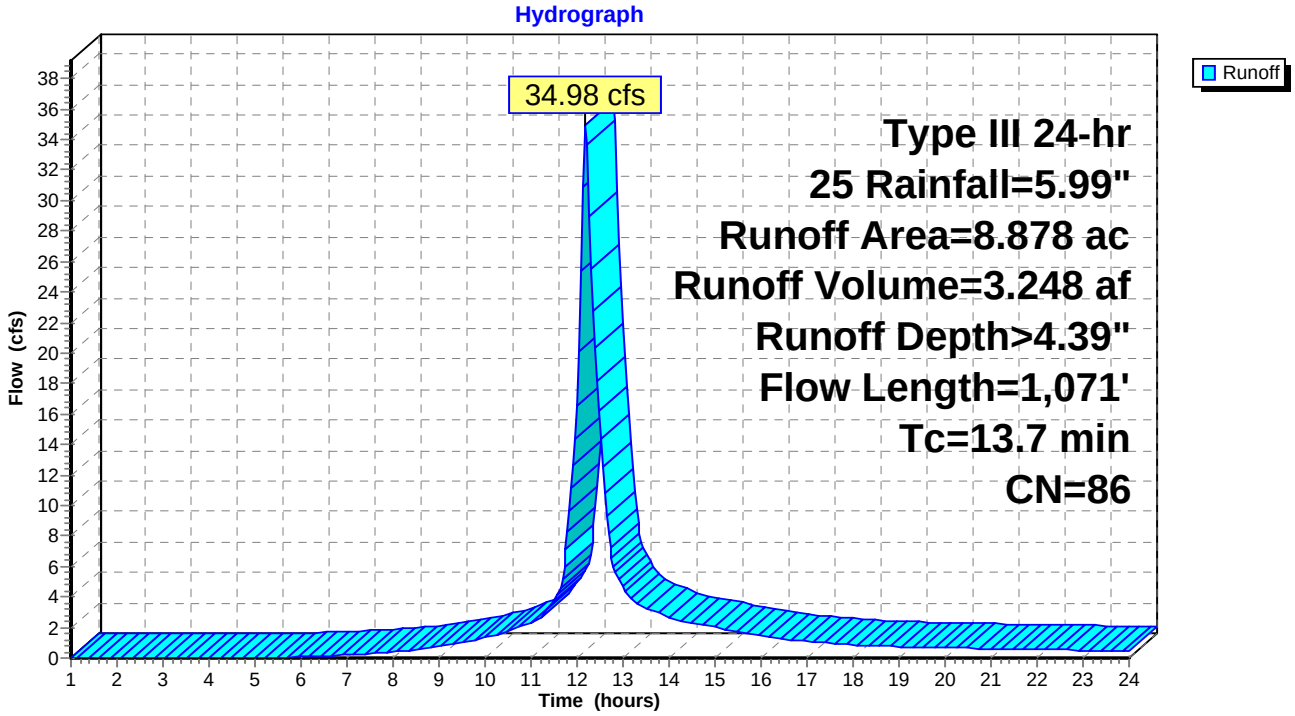
Runoff = 34.98 cfs @ 12.18 hrs, Volume= 3.248 af, Depth> 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25 Rainfall=5.99"

Area (ac)	CN	Description
5.060	98	Paved parking, HSG A
3.818	69	50-75% Grass cover, Fair, HSG B
8.878	86	Weighted Average
3.818		43.01% Pervious Area
5.060		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	121	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	47	0.0391	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
1.0	172	0.0024	2.91	5.15	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.2	72	0.0090	7.93	38.91	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
0.9	199	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
13.7	1,071	Total			

Subcatchment 1S: Pre



Summary for Subcatchment 2S: Post Area 1

Runoff = 29.71 cfs @ 12.16 hrs, Volume= 2.557 af, Depth> 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25 Rainfall=5.99"

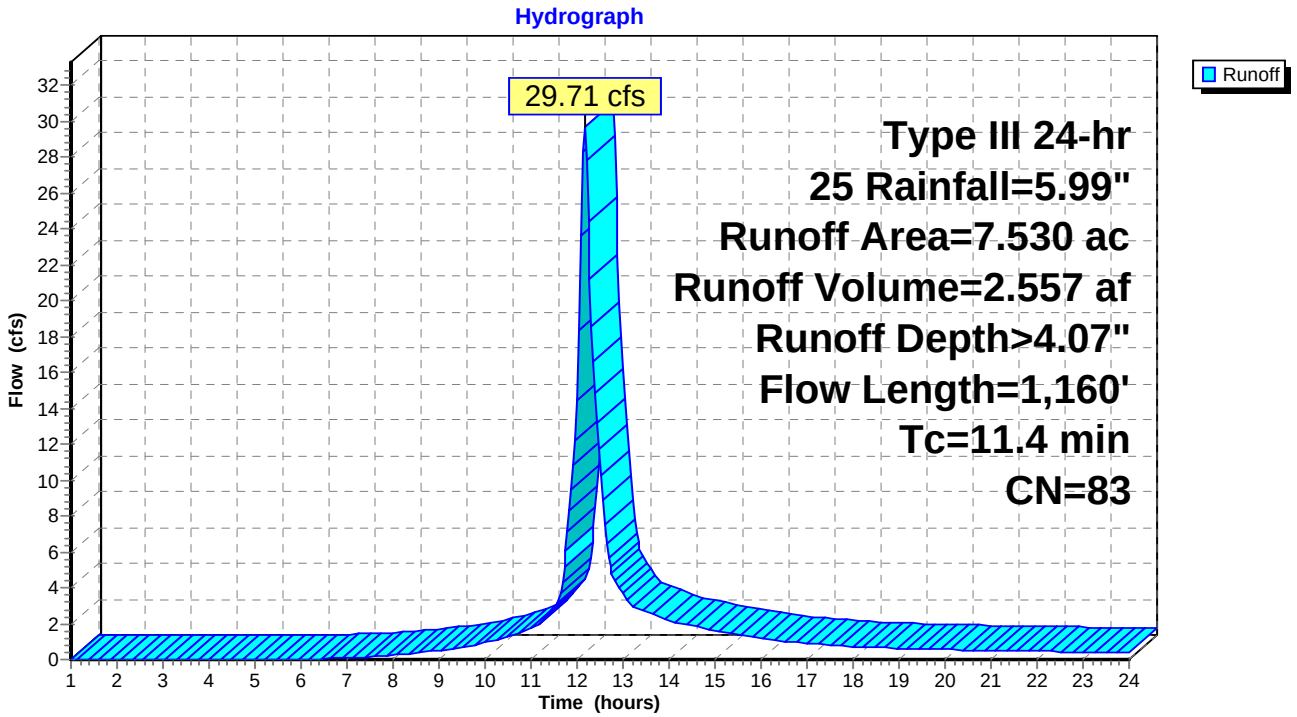
Area (ac)	CN	Description
4.550	98	Paved parking, HSG A
2.980	61	>75% Grass cover, Good, HSG B
7.530	83	Weighted Average
2.980		39.58% Pervious Area
4.550		60.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	68	0.0222	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	84	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.1	23	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	79	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.3	59	0.0033	3.41	6.03	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.1	24	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.6	160	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.2	64	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'

n= 0.013 Corrugated PE, smooth interior

0.2	64	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.3	75	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.4	1,160	Total			

Subcatchment 2S: Post Area 1



Summary for Subcatchment 6S: Post Area 2

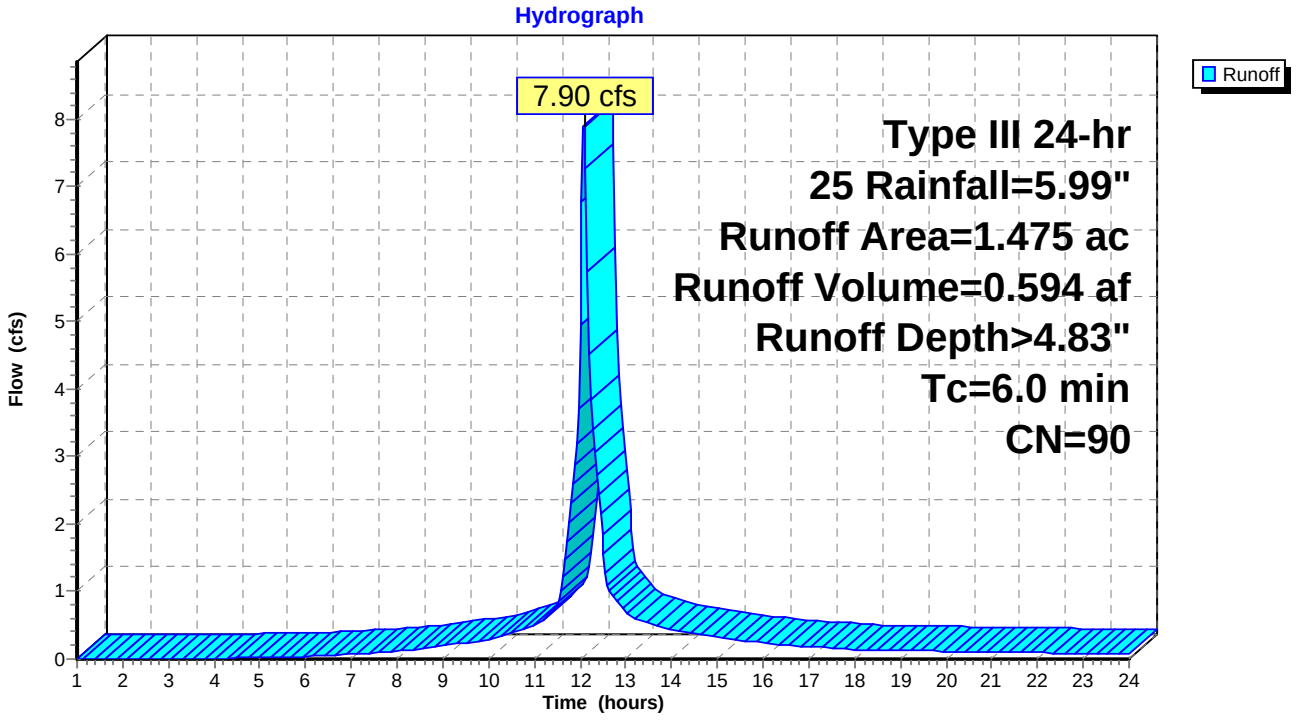
Runoff = 7.90 cfs @ 12.09 hrs, Volume= 0.594 af, Depth> 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 25 Rainfall=5.99"

Area (ac)	CN	Description
1.139	98	Paved parking, HSG A
0.336	61	>75% Grass cover, Good, HSG B
1.475	90	Weighted Average
0.336		22.78% Pervious Area
1.139		77.22% Impervious Area

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

Subcatchment 6S: Post Area 2

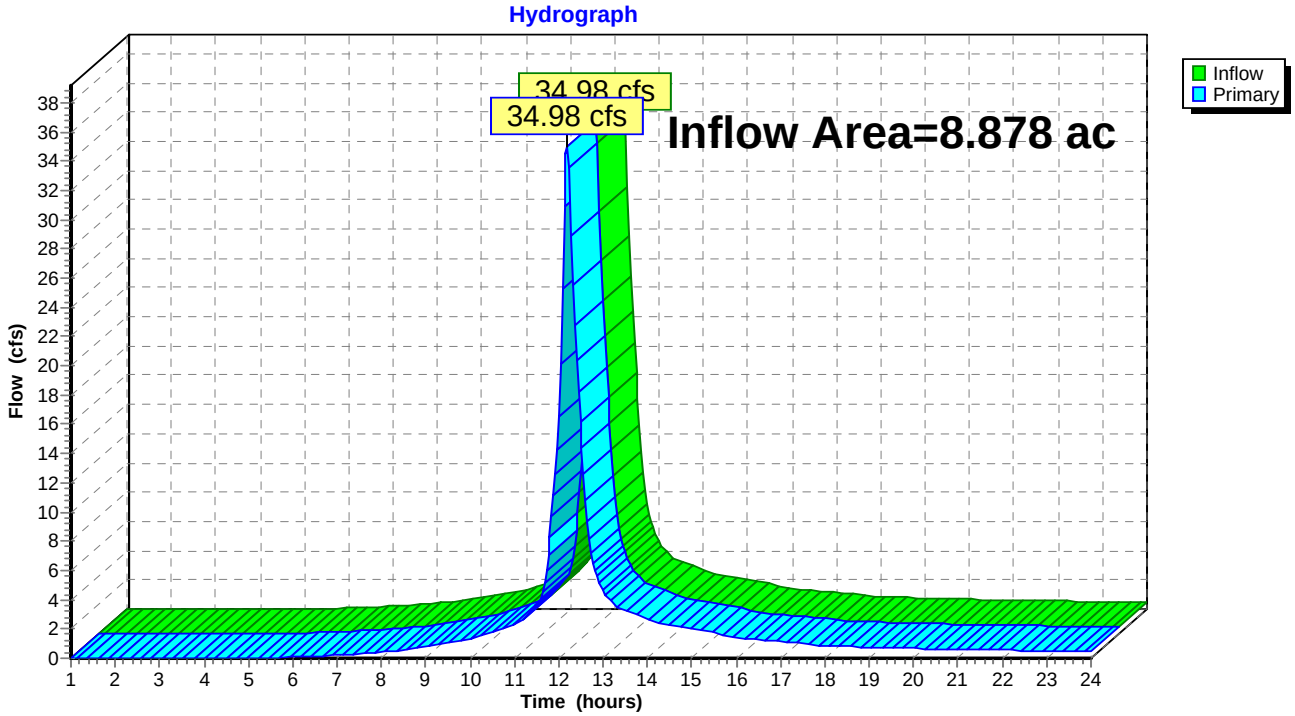


Summary for Pond 2P: Design Point 1

Inflow Area = 8.878 ac, 56.99% Impervious, Inflow Depth > 4.39" for 25 event
Inflow = 34.98 cfs @ 12.18 hrs, Volume= 3.248 af
Primary = 34.98 cfs @ 12.18 hrs, Volume= 3.248 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 2P: Design Point 1

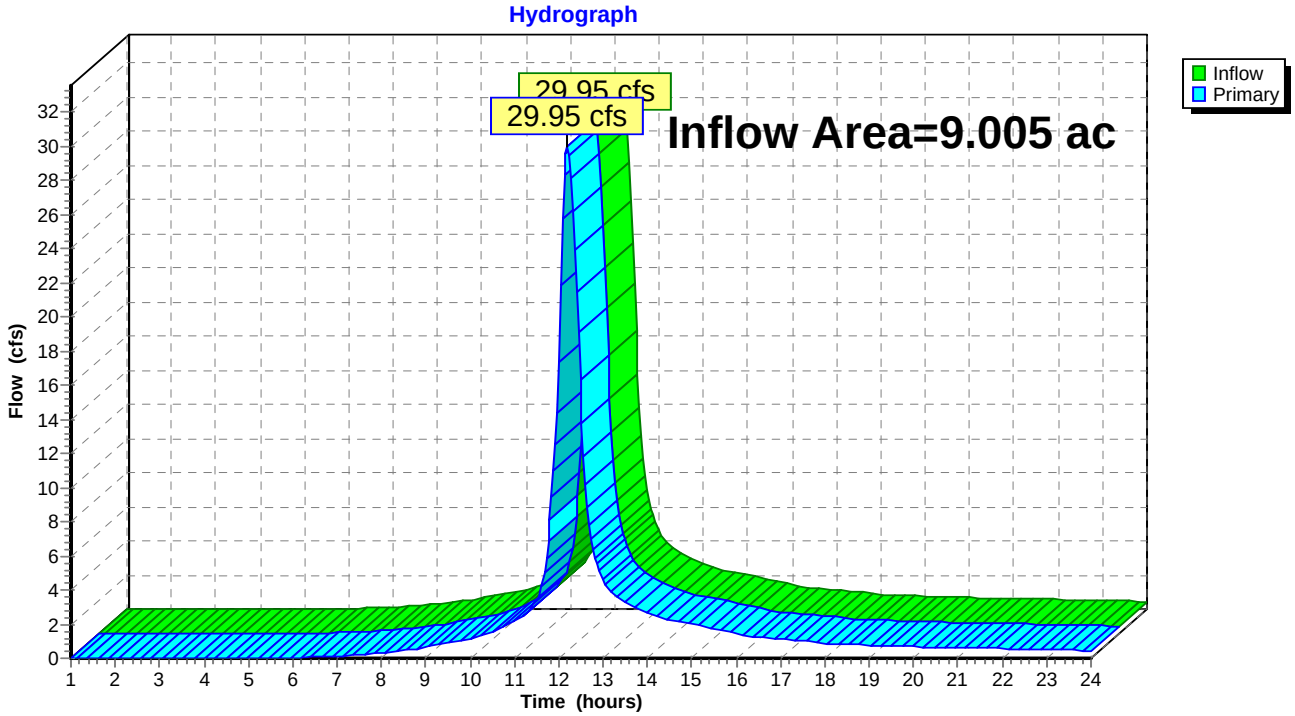


Summary for Pond 4P: Design Point 1

Inflow Area = 9.005 ac, 63.18% Impervious, Inflow Depth > 4.18" for 25 event
Inflow = 29.95 cfs @ 12.20 hrs, Volume= 3.140 af
Primary = 29.95 cfs @ 12.20 hrs, Volume= 3.140 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 4P: Design Point 1



Summary for Subcatchment 1S: Pre

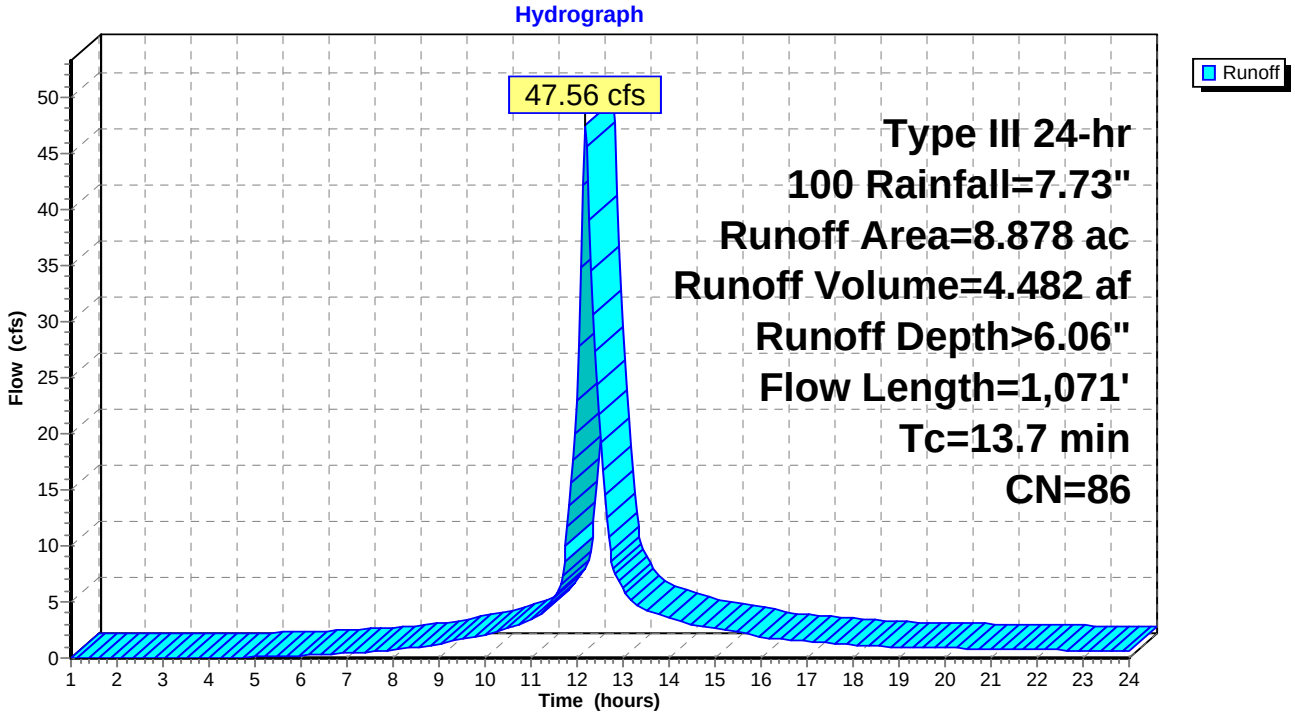
Runoff = 47.56 cfs @ 12.18 hrs, Volume= 4.482 af, Depth> 6.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100 Rainfall=7.73"

Area (ac)	CN	Description
5.060	98	Paved parking, HSG A
3.818	69	50-75% Grass cover, Fair, HSG B
8.878	86	Weighted Average
3.818		43.01% Pervious Area
5.060		56.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.2	121	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	47	0.0391	1.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
1.0	172	0.0024	2.91	5.15	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Concrete pipe, bends & connections
0.2	72	0.0090	7.93	38.91	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
0.9	199	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
13.7	1,071	Total			

Subcatchment 1S: Pre



Summary for Subcatchment 2S: Post Area 1

Runoff = 41.10 cfs @ 12.16 hrs, Volume= 3.583 af, Depth> 5.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100 Rainfall=7.73"

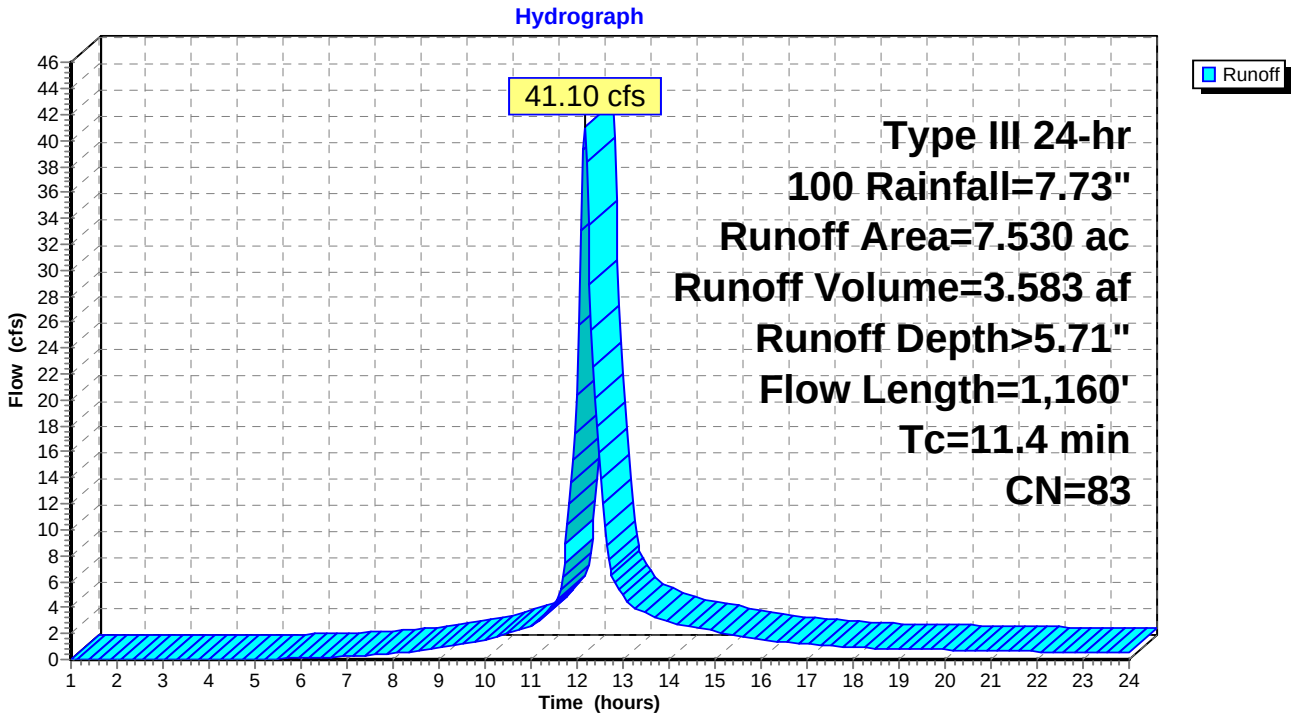
Area (ac)	CN	Description
4.550	98	Paved parking, HSG A
2.980	61	>75% Grass cover, Good, HSG B
7.530	83	Weighted Average
2.980		39.58% Pervious Area
4.550		60.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0368	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.06"
0.1	17	0.1152	2.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	108	0.0557	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	21	0.0478	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	54	0.0184	0.95		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	68	0.0222	1.04		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	84	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.0	210	0.0048	3.65	4.48	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
0.1	23	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	79	0.0034	3.47	6.13	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.3	59	0.0033	3.41	6.03	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.1	24	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.6	160	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.2	64	0.0033	4.80	23.56	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63'

n= 0.013 Corrugated PE, smooth interior

0.2	64	0.0030	4.58	22.47	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
0.3	75	0.0021	3.83	18.80	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.4	1,160	Total			

Subcatchment 2S: Post Area 1



Summary for Subcatchment 6S: Post Area 2

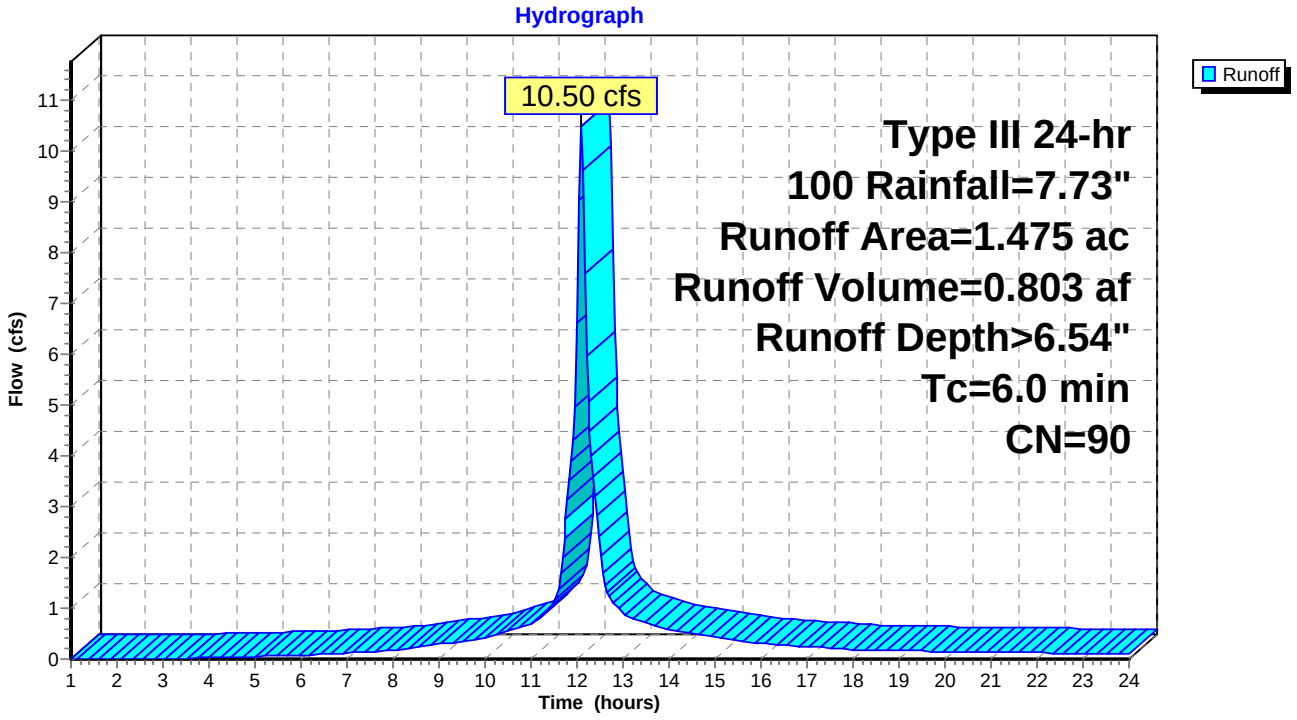
Runoff = 10.50 cfs @ 12.09 hrs, Volume= 0.803 af, Depth> 6.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Type III 24-hr 100 Rainfall=7.73"

Area (ac)	CN	Description
1.139	98	Paved parking, HSG A
0.336	61	>75% Grass cover, Good, HSG B
1.475	90	Weighted Average
0.336		22.78% Pervious Area
1.139		77.22% Impervious Area

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

Subcatchment 6S: Post Area 2

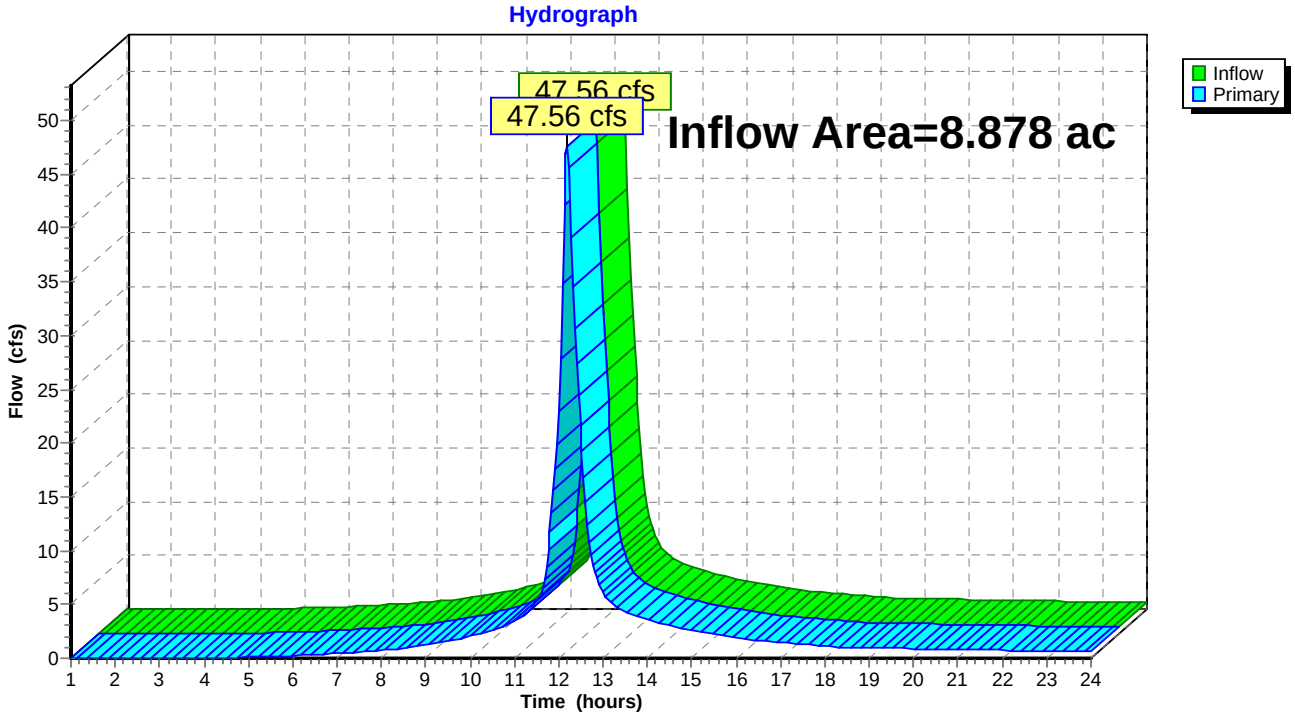


Summary for Pond 2P: Design Point 1

Inflow Area = 8.878 ac, 56.99% Impervious, Inflow Depth > 6.06" for 100 event
Inflow = 47.56 cfs @ 12.18 hrs, Volume= 4.482 af
Primary = 47.56 cfs @ 12.18 hrs, Volume= 4.482 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 2P: Design Point 1

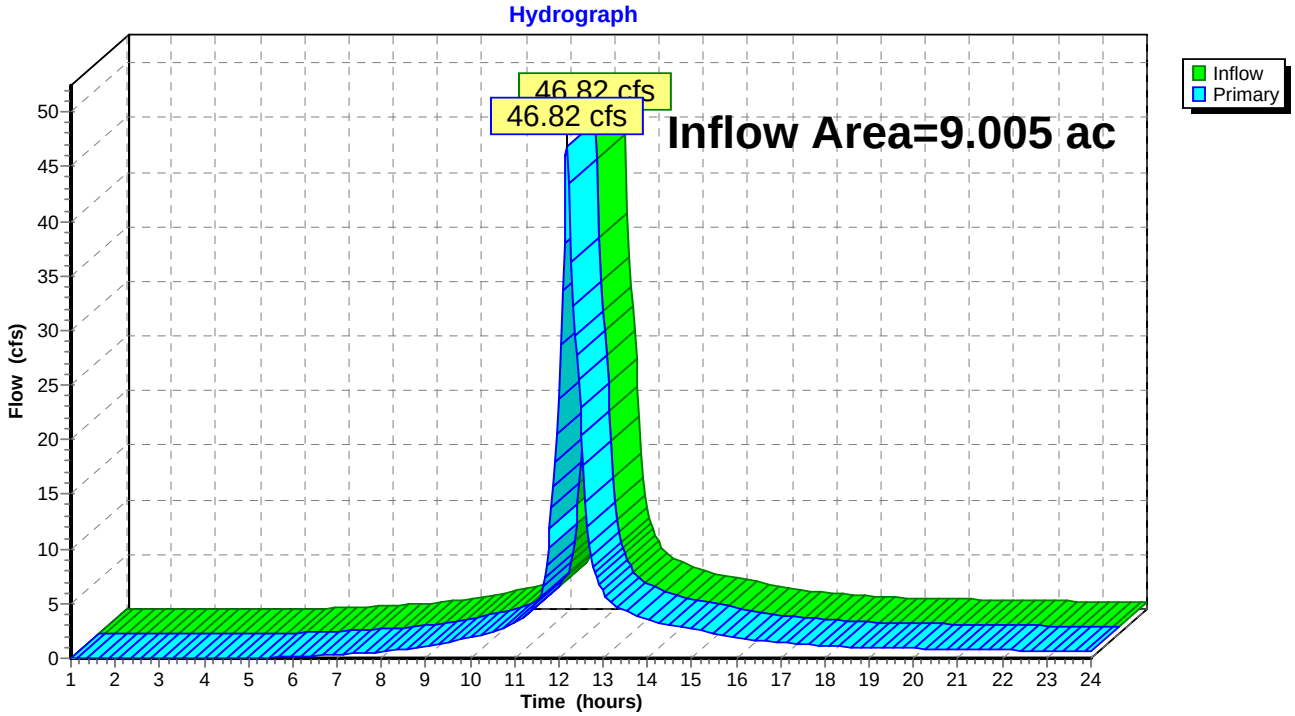


Summary for Pond 4P: Design Point 1

Inflow Area = 9.005 ac, 63.18% Impervious, Inflow Depth > 5.83" for 100 event
Inflow = 46.82 cfs @ 12.18 hrs, Volume= 4.374 af
Primary = 46.82 cfs @ 12.18 hrs, Volume= 4.374 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs

Pond 4P: Design Point 1



Detention Calculations

Summary for Pond 9P: Detention

Inflow Area = 7.530 ac, 60.42% Impervious, Inflow Depth > 1.50" for 2 event
Inflow = 11.00 cfs @ 12.16 hrs, Volume= 0.941 af
Outflow = 10.32 cfs @ 12.21 hrs, Volume= 0.934 af, Atten= 6%, Lag= 2.8 min
Primary = 10.32 cfs @ 12.21 hrs, Volume= 0.934 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 26.74' @ 12.21 hrs Surf.Area= 0.045 ac Storage= 0.064 af

Plug-Flow detention time= 12.2 min calculated for 0.932 af (99% of inflow)
Center-of-Mass det. time= 7.8 min (846.3 - 838.6)

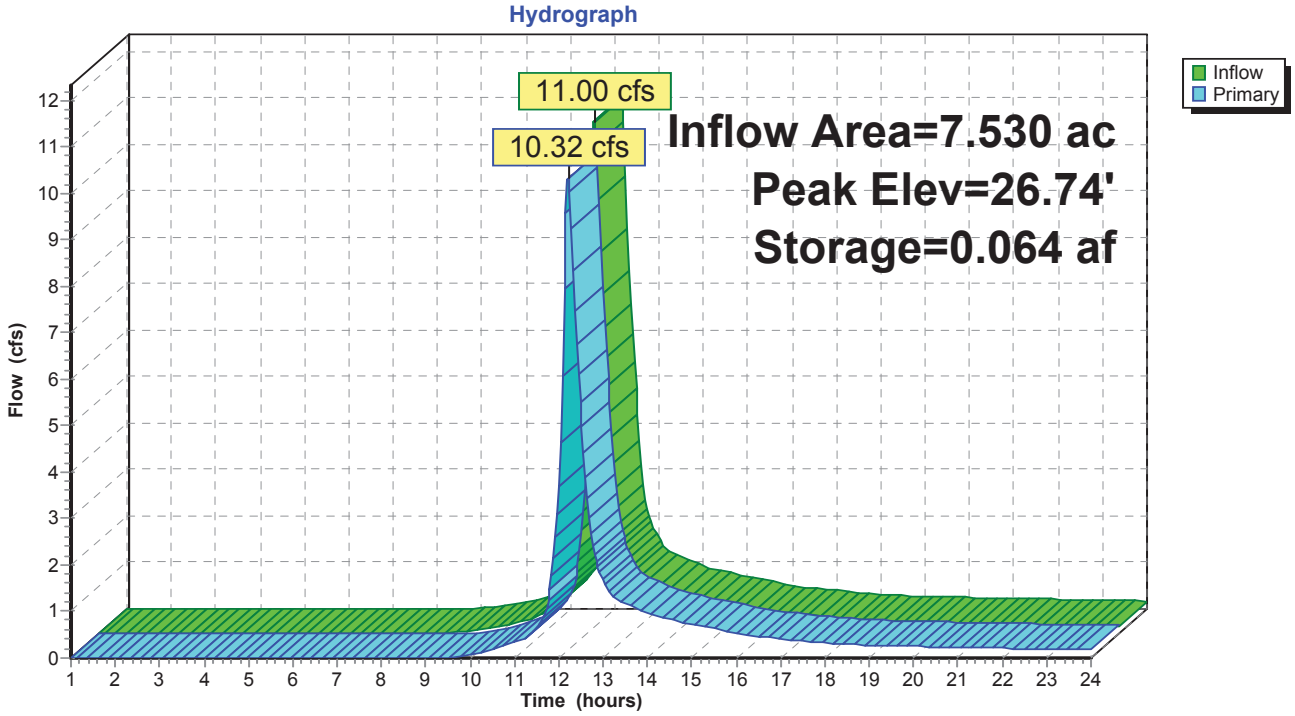
Volume	Invert	Avail.Storage	Storage Description
#1A	24.62'	0.000 af	**21.79'W x 90.29'L x 7.00'H Field A** 0.316 af Overall - 0.316 af Embedded = 0.000 af x 40.0% Voids
#2A	24.62'	0.238 af	**StormTrap DoubleTrap 6-0** x 5 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 76.98' Core + 6.66' Border = 21.79' x 90.29' System
		0.238 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	25.12'	**30.0" Round Culvert** L= 6.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 25.12' / 25.07' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf
#2	Device 1	25.12'	**24.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	29.12'	**4.0' long x 2.30' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=10.23 cfs @ 12.21 hrs HW=26.74' (Free Discharge)
↑**1=Culvert** (Barrel Controls 10.23 cfs @ 4.33 fps)
↑**2=Orifice/Grate** (Passes 10.23 cfs of 11.78 cfs potential flow)
3=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond 9P: Detention



Summary for Pond 9P: Detention

Inflow Area = 7.530 ac, 60.42% Impervious, Inflow Depth > 2.32" for 5 event
Inflow = 17.12 cfs @ 12.16 hrs, Volume= 1.459 af
Outflow = 16.11 cfs @ 12.20 hrs, Volume= 1.450 af, Atten= 6%, Lag= 2.6 min
Primary = 16.11 cfs @ 12.20 hrs, Volume= 1.450 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 27.25' @ 12.20 hrs Surf.Area= 0.045 ac Storage= 0.085 af

Plug-Flow detention time= 10.2 min calculated for 1.450 af (99% of inflow)
Center-of-Mass det. time= 6.7 min (832.7 - 826.0)

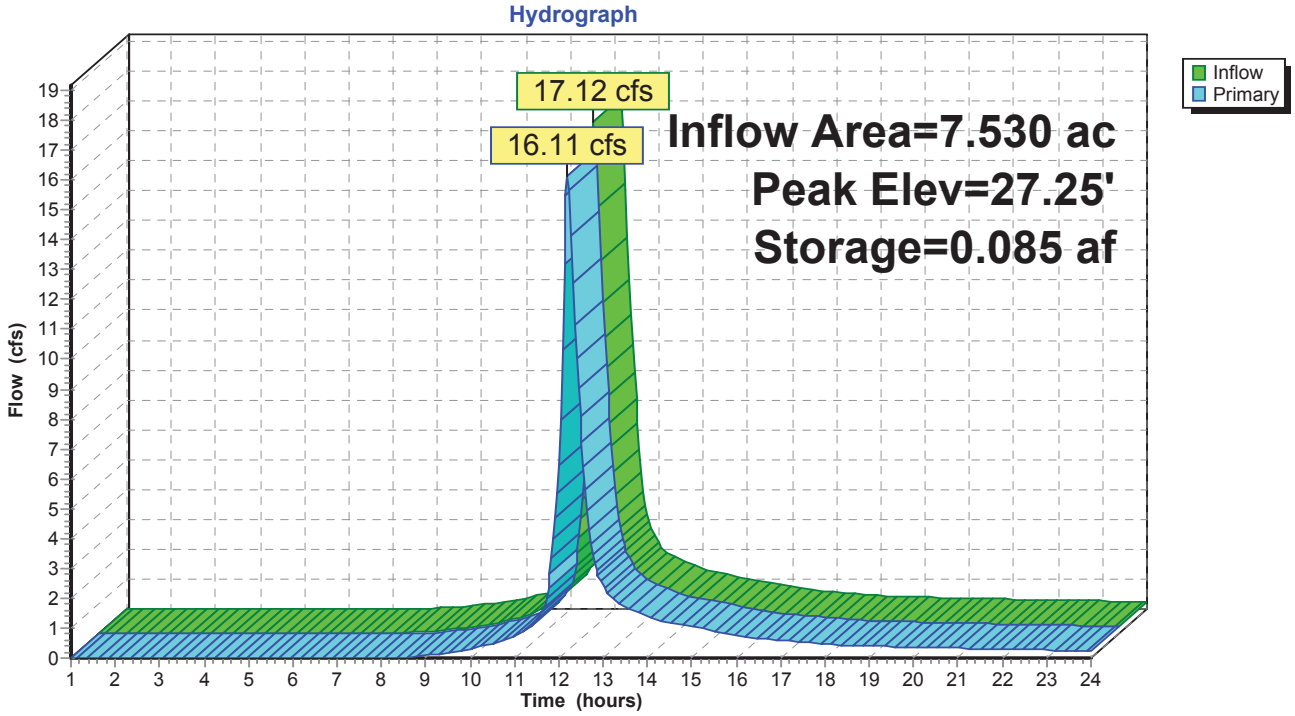
Volume	Invert	Avail.Storage	Storage Description
#1A	24.62'	0.000 af	**21.79'W x 90.29'L x 7.00'H Field A** 0.316 af Overall - 0.316 af Embedded = 0.000 af x 40.0% Voids
#2A	24.62'	0.238 af	**StormTrap DoubleTrap 6-0** x 5 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 76.98' Core + 6.66' Border = 21.79' x 90.29' System
		0.238 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	25.12'	**30.0" Round Culvert** L= 6.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 25.12' / 25.07' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf
#2	Device 1	25.12'	**24.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	29.12'	**4.0' long x 2.30' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=16.08 cfs @ 12.20 hrs HW=27.25' (Free Discharge)
↑**1=Culvert** (Passes 16.08 cfs of 16.31 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 16.08 cfs @ 5.12 fps)
3=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond 9P: Detention



Summary for Pond 9P: Detention

Inflow Area = 7.530 ac, 60.42% Impervious, Inflow Depth > 3.05" for 10 event
Inflow = 22.40 cfs @ 12.16 hrs, Volume= 1.914 af
Outflow = 20.18 cfs @ 12.22 hrs, Volume= 1.905 af, Atten= 10%, Lag= 3.4 min
Primary = 20.18 cfs @ 12.22 hrs, Volume= 1.905 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 27.90' @ 12.22 hrs Surf.Area= 0.045 ac Storage= 0.110 af

Plug-Flow detention time= 9.2 min calculated for 1.905 af (100% of inflow)
Center-of-Mass det. time= 6.2 min (824.5 - 818.3)

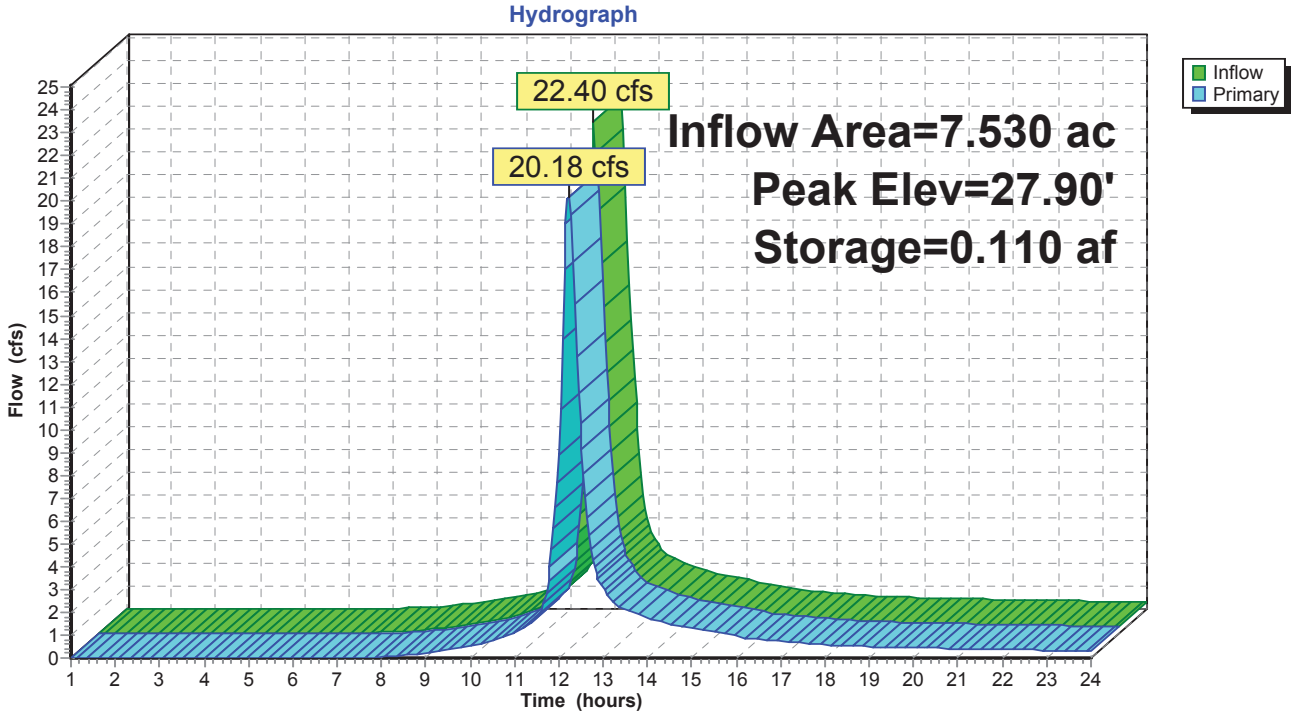
Volume	Invert	Avail.Storage	Storage Description
#1A	24.62'	0.000 af	**21.79'W x 90.29'L x 7.00'H Field A** 0.316 af Overall - 0.316 af Embedded = 0.000 af x 40.0% Voids
#2A	24.62'	0.238 af	**StormTrap DoubleTrap 6-0** x 5 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 76.98' Core + 6.66' Border = 21.79' x 90.29' System
		0.238 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	25.12'	**30.0" Round Culvert** L= 6.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 25.12' / 25.07' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf
#2	Device 1	25.12'	**24.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	29.12'	**4.0' long x 2.30' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=20.04 cfs @ 12.22 hrs HW=27.87' (Free Discharge)
↑**1=Culvert** (Passes 20.04 cfs of 24.09 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 20.04 cfs @ 6.38 fps)
3=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond 9P: Detention



Summary for Pond 9P: Detention

Inflow Area = 7.530 ac, 60.42% Impervious, Inflow Depth > 4.07" for 25 event
Inflow = 29.71 cfs @ 12.16 hrs, Volume= 2.557 af
Outflow = 25.69 cfs @ 12.23 hrs, Volume= 2.546 af, Atten= 14%, Lag= 4.2 min
Primary = 25.69 cfs @ 12.23 hrs, Volume= 2.546 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 29.00' @ 12.23 hrs Surf.Area= 0.045 ac Storage= 0.154 af

Plug-Flow detention time= 8.4 min calculated for 2.546 af (100% of inflow)
Center-of-Mass det. time= 5.8 min (815.9 - 810.1)

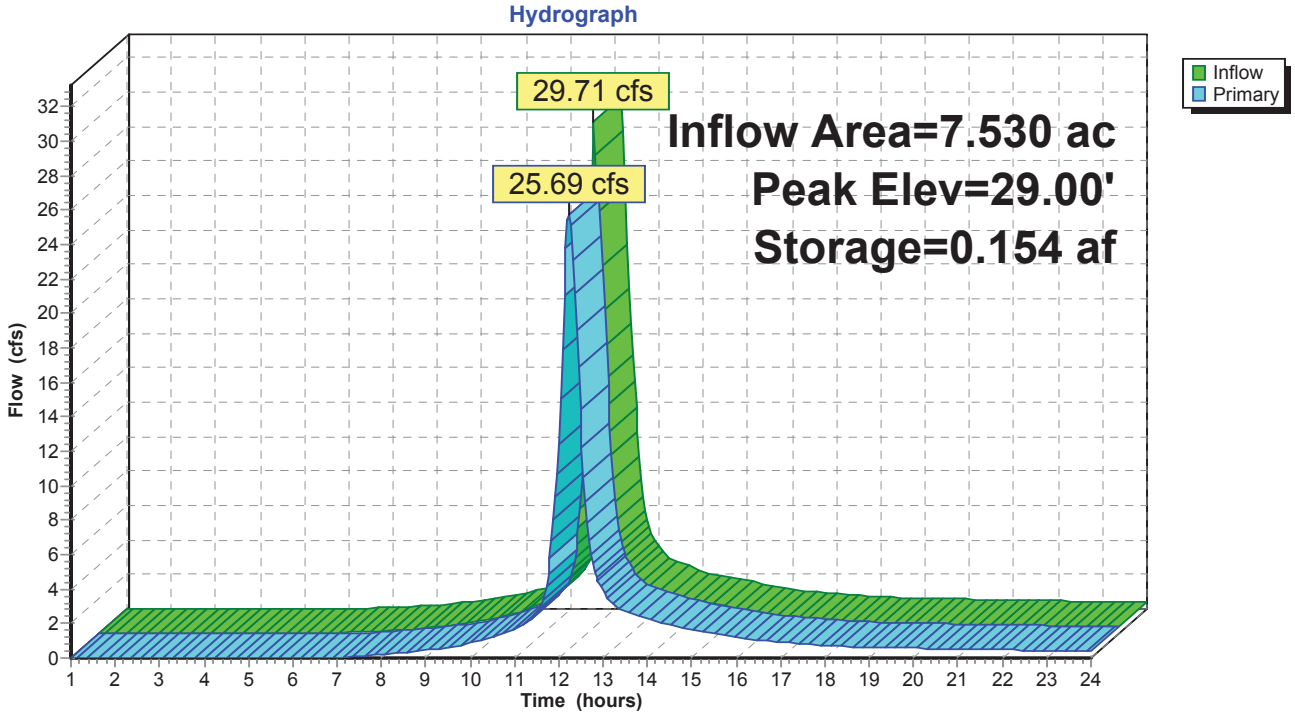
Volume	Invert	Avail.Storage	Storage Description
#1A	24.62'	0.000 af	**21.79'W x 90.29'L x 7.00'H Field A** 0.316 af Overall - 0.316 af Embedded = 0.000 af x 40.0% Voids
#2A	24.62'	0.238 af	**StormTrap DoubleTrap 6-0** x 5 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 76.98' Core + 6.66' Border = 21.79' x 90.29' System
		0.238 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	25.12'	**30.0" Round Culvert** L= 6.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 25.12' / 25.07' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf
#2	Device 1	25.12'	**24.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	29.12'	**4.0' long x 2.30' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=25.57 cfs @ 12.23 hrs HW=28.98' (Free Discharge)
↑└**1=Culvert** (Passes 25.57 cfs of 37.47 cfs potential flow)
↑ ├**2=Orifice/Grate** (Orifice Controls 25.57 cfs @ 8.14 fps)
 └**3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 9P: Detention



Summary for Pond 9P: Detention

Inflow Area = 7.530 ac, 60.42% Impervious, Inflow Depth > 5.71" for 100 event
Inflow = 41.10 cfs @ 12.16 hrs, Volume= 3.583 af
Outflow = 39.74 cfs @ 12.19 hrs, Volume= 3.571 af, Atten= 3%, Lag= 2.1 min
Primary = 39.74 cfs @ 12.19 hrs, Volume= 3.571 af

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.04 hrs
Peak Elev= 29.96' @ 12.19 hrs Surf.Area= 0.045 ac Storage= 0.192 af

Plug-Flow detention time= 7.5 min calculated for 3.571 af (100% of inflow)
Center-of-Mass det. time= 5.3 min (806.0 - 800.7)

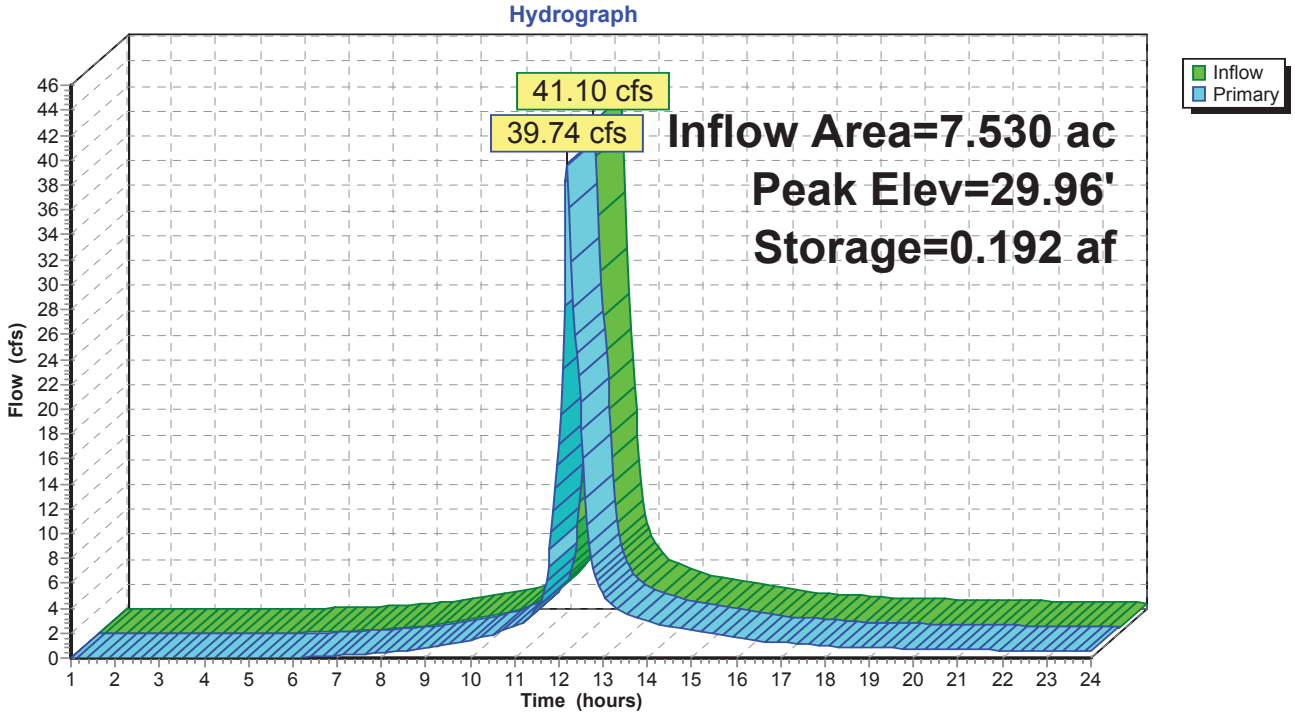
Volume	Invert	Avail.Storage	Storage Description
#1A	24.62'	0.000 af	**21.79'W x 90.29'L x 7.00'H Field A** 0.316 af Overall - 0.316 af Embedded = 0.000 af x 40.0% Voids
#2A	24.62'	0.238 af	**StormTrap DoubleTrap 6-0** x 5 Inside #1 Inside= 101.7"W x 72.0"H => 45.99 sf x 15.40'L = 708.0 cf Outside= 101.7"W x 84.0"H => 59.35 sf x 15.40'L = 913.8 cf 8.48' x 76.98' Core + 6.66' Border = 21.79' x 90.29' System
		0.238 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	25.12'	**30.0" Round Culvert** L= 6.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 25.12' / 25.07' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 4.91 sf
#2	Device 1	25.12'	**24.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	29.12'	**4.0' long x 2.30' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

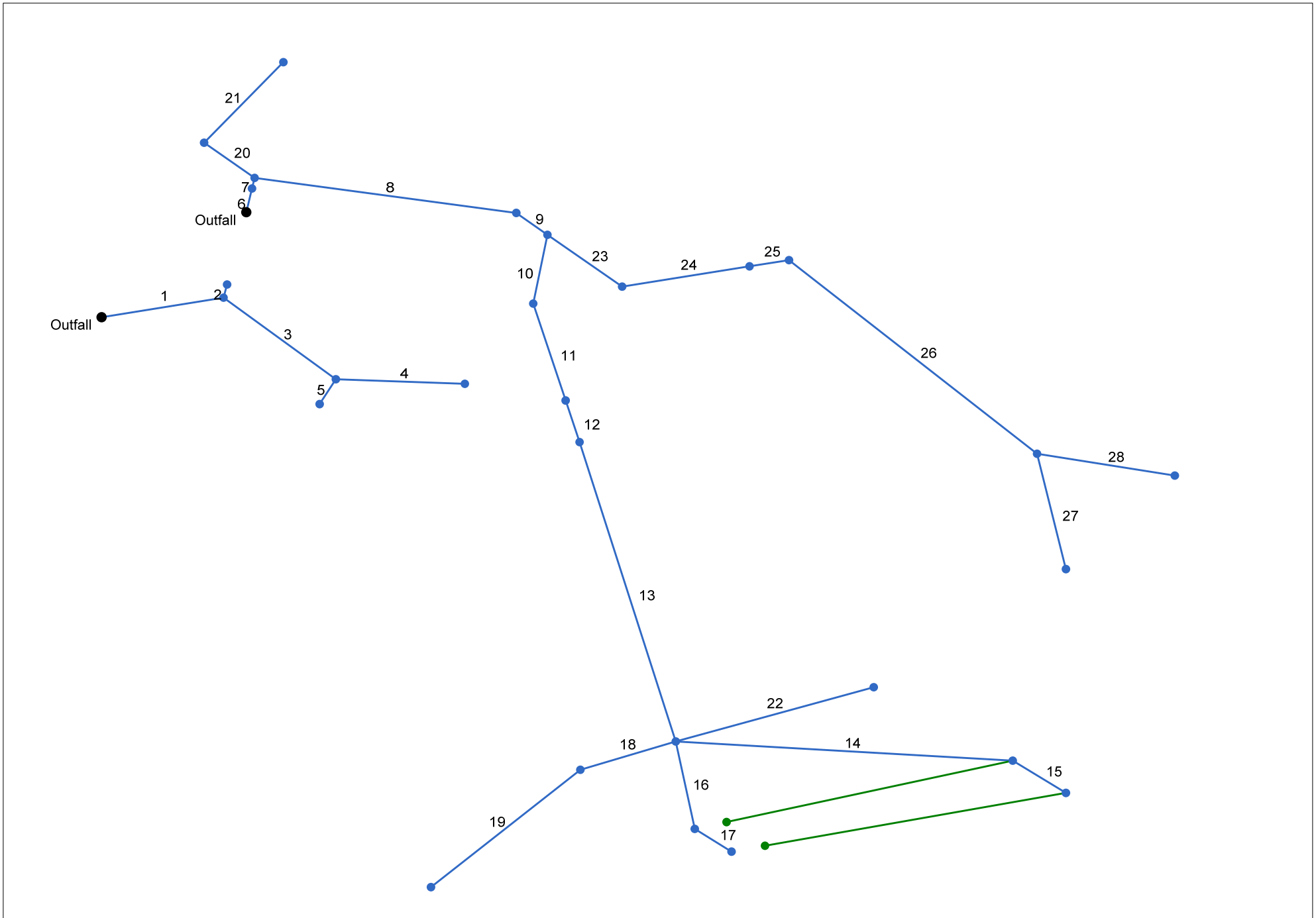
Primary OutFlow Max=39.31 cfs @ 12.19 hrs HW=29.94' (Free Discharge)
↑└**1=Culvert** (Passes 39.31 cfs of 44.66 cfs potential flow)
↑ ├**2=Orifice/Grate** (Orifice Controls 29.57 cfs @ 9.41 fps)
 └**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 9.74 cfs @ 2.97 fps)

Pond 9P: Detention



Hydraflow Storm Sewers Calculations

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2013 Plan



Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm	Number of lines: 28	Date: 12/21/2017

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	74.814	-11.251	Grate	0.00	0.13	0.35	5.0	24.91	0.21	25.07	30	Cir	0.013	1.87	33.00	Pipe - 1
2	1	10.000	-66.606	MH	20.09	0.00	0.00	0.0	25.07	0.50	25.12	30	Cir	0.013	1.00	34.40	Pipe - 2
3	1	90.835	53.220	Grate	2.36	0.20	0.30	5.0	26.07	2.79	28.60	18	Cir	0.013	1.46	33.00	Pipe - 3
4	3	77.697	-39.464	MH	2.50	0.00	0.00	0.0	28.70	0.67	29.22	18	Cir	0.013	1.00	34.17	Pipe - 4
5	3	20.911	75.876	MH	2.50	0.00	0.00	0.0	28.70	2.68	29.26	18	Cir	0.013	1.00	34.11	Pipe - 5
6	End	18.000	-79.000	MH	0.00	0.00	0.00	0.0	25.12	0.44	25.20	30	Cir	0.013	0.15	33.45	Pipe - 6
7	6	8.000	0.000	Grate	0.00	0.41	0.75	5.0	25.20	0.50	25.24	30	Cir	0.013	2.00	33.20	Pipe - 7
8	7	159.583	88.393	Grate	0.00	0.81	0.80	5.0	25.24	0.44	25.95	30	Cir	0.013	0.87	33.00	Pipe - 8
9	8	24.837	31.548	MH	0.00	0.00	0.00	0.0	25.95	0.40	26.05	30	Cir	0.013	0.88	33.50	Pipe - 9
10	9	51.895	58.529	MH	0.00	0.00	0.00	0.0	26.05	0.54	26.33	24	Cir	0.013	0.47	34.50	Pipe - 10
11	10	74.697	-24.609	Grate	0.00	0.17	0.85	5.0	26.43	0.62	26.89	24	Cir	0.013	0.50	33.50	Pipe - 11
12	11	32.089	0.005	MH	5.76	0.00	0.00	0.0	26.86	0.75	27.10	24	Cir	0.013	0.15	34.01	Pipe - 12
13	12	230.197	0.579	MH	0.00	0.00	0.00	0.0	27.10	0.35	27.90	24	Cir	0.013	1.00	34.50	Pipe - 13
14	13	203.262	-71.430	Grate	0.00	0.36	0.75	5.0	27.99	2.07	32.20	15	Cir	0.013	0.90	36.47	Pipe - 14
15	14	39.977	32.900	Grate	0.00	0.22	0.89	5.0	32.20	0.38	32.35	12	Cir	0.013	1.00	37.30	Pipe - 15
16	13	66.019	4.559	Grate	0.00	0.16	0.75	5.0	30.50	1.73	31.64	12	Cir	0.013	1.08	36.14	Pipe - 16
17	16	27.874	-42.535	Grate	0.00	0.09	0.90	5.0	32.14	-0.61	31.97	12	Cir	0.013	1.00	35.97	Pipe - 17
18	13	61.102	84.442	Grate	0.00	0.38	0.65	5.0	28.70	1.31	29.50	12	Cir	0.013	0.70	34.10	Pipe - 18
19	18	125.334	-24.073	Grate	0.00	0.21	0.80	5.0	30.10	0.64	30.90	12	Cir	0.013	1.00	33.85	Pipe - 19
20	7	40.103	-60.128	MH	0.00	0.00	0.00	0.0	27.44	3.49	28.84	12	Cir	0.013	1.00	34.40	Pipe - 20
21	20	76.529	87.626	Grate	0.00	0.12	0.80	5.0	28.84	0.99	29.60	12	Cir	0.013	1.00	34.60	Pipe - 21
22	13	125.775	-94.187	Grate	0.00	0.50	0.65	5.0	27.99	1.55	29.94	15	Cir	0.013	1.00	34.21	Pipe - 22
23	9	59.252	-0.313	Grate	0.00	0.20	0.90	5.0	26.05	0.32	26.24	24	Cir	0.013	1.23	33.00	Pipe - 23

Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm

Number of lines: 28

Date: 12/21/2017

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
24	23	78.086	-51.814	Grate	0.00	0.40	0.90	5.0	26.24	0.35	26.51	24	Cir	0.013	0.50	33.00	Pipe - 24
25	24	24.203	0.290	MH	0.00	0.00	0.00	0.0	26.51	0.33	26.59	18	Cir	0.013	0.85	33.59	Pipe - 25
26	25	207.465	54.889	Grate	0.00	0.84	0.60	5.0	26.59	0.49	27.60	15	Cir	0.013	0.93	32.15	Pipe - 26
27	26	87.554	34.594	Grate	0.00	0.94	0.65	5.0	27.80	0.25	28.02	12	Cir	0.013	1.00	32.35	Pipe - 27
28	26	84.440	-32.904	Grate	0.00	0.93	0.35	10.0	27.80	0.99	28.64	12	Cir	0.013	1.00	33.10	Pipe - 28

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	AD-1	Grate	33.00	Cir	4.00	4.00	30	Cir	25.07	30 18	Cir Cir	25.07 26.07
2	CDS-1	Manhole	34.40	Cir	4.00	4.00	30	Cir	25.12			
3	AD-2	Grate	33.00	Cir	4.00	4.00	18	Cir	28.60	18 18	Cir Cir	28.70 28.70
4	E-DMH-2	Manhole	34.17	Cir	4.00	4.00	18	Cir	29.22			
5	E-DMH-1	Manhole	34.11	Cir	4.00	4.00	18	Cir	29.26			
6	CDS	Manhole	33.45	Cir	4.00	4.00	30	Cir	25.20	30	Cir	25.20
7		Grate	33.20	Cir	4.00	4.00	30	Cir	25.24	30 12	Cir Cir	25.24 27.44
8	CB-2	Grate	33.00	Cir	4.00	4.00	30	Cir	25.95	30	Cir	25.95
9	DMH-1	Manhole	33.50	Cir	4.00	4.00	30	Cir	26.05	24 24	Cir Cir	26.05 26.05
10	E-DMH-3	Manhole	34.50	Cir	4.00	4.00	24	Cir	26.33	24	Cir	26.43
11	AD-3	Grate	33.50	Cir	4.00	4.00	24	Cir	26.89	24	Cir	26.86
12	Structure - 12	Manhole	34.01	Cir	4.00	4.00	24	Cir	27.10	24	Cir	27.10
13	Structure - 13	Manhole	34.50	Cir	4.00	4.00	24	Cir	27.90	15 12 12 15	Cir Cir Cir Cir	27.99 30.50 28.70 27.99
14	Structure - 15	Grate	36.47	Cir	4.00	4.00	15	Cir	32.20	12	Cir	32.20
15	Structure - 16	Grate	37.30	Cir	4.00	4.00	12	Cir	32.35			
16	Structure - 17	Grate	36.14	Cir	4.00	4.00	12	Cir	31.64	12	Cir	32.14
17	Structure - 18	Grate	35.97	Cir	4.00	4.00	12	Cir	31.97			
18	Structure - 19	Grate	34.10	Cir	4.00	4.00	12	Cir	29.50	12	Cir	30.10
19	Structure - 20	Grate	33.85	Cir	4.00	4.00	12	Cir	30.90			

Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm | Number of Structures: 28 | Run Date: 12/21/2017

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
20	DMH-2	Manhole	34.40	Cir	4.00	4.00	12	Cir	28.84	12	Cir	28.84
21	CB-5	Grate	34.60	Cir	4.00	4.00	12	Cir	29.60			
22	Structure - 14	Grate	34.21	Cir	4.00	4.00	15	Cir	29.94			
23	CB-3	Grate	33.00	Cir	4.00	4.00	24	Cir	26.24	24	Cir	26.24
24	CB-4	Grate	33.00	Cir	4.00	4.00	24	Cir	26.51	18	Cir	26.51
25	E-DMH-4	Manhole	33.59	Cir	4.00	4.00	18	Cir	26.59	15	Cir	26.59
26	Structure - 10	Grate	32.15	Cir	4.00	4.00	15	Cir	27.60	12 12	Cir Cir	27.80 27.80
27	Structure - 11	Grate	32.35	Cir	4.00	4.00	12	Cir	28.02			
28	AD-4	Grate	33.10	Cir	4.00	4.00	12	Cir	28.64			

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - 1	28.21	30	Cir	74.814	24.91	25.07	0.214	27.41*	27.76*	0.96	28.72	End	Grate
2	Pipe - 2	20.09	30	Cir	10.000	25.07	25.12	0.500	28.72*	28.75*	0.26	29.01	1	Manhole
3	Pipe - 3	7.81	18	Cir	90.835	26.07	28.60	2.785	28.72	29.67	n/a	29.67 j	1	Grate
4	Pipe - 4	2.50	18	Cir	77.697	28.70	29.22	0.669	29.67	29.77	n/a	29.77	3	Manhole
5	Pipe - 5	2.50	18	Cir	20.911	28.70	29.26	2.678	29.67	29.65	n/a	29.65	3	Manhole
6	Pipe - 6	27.25	30	Cir	18.000	25.12	25.20	0.444	27.16	27.24	0.09	27.34	End	Manhole
7	Pipe - 7	27.27	30	Cir	8.000	25.20	25.24	0.500	27.34	27.36	1.17	28.53	6	Grate
8	Pipe - 8	25.84	30	Cir	159.583	25.24	25.95	0.445	28.53*	29.17*	0.37	29.54	7	Grate
9	Pipe - 9	22.80	30	Cir	24.837	25.95	26.05	0.403	29.54*	29.62*	0.30	29.92	8	Manhole
10	Pipe - 10	14.93	24	Cir	51.895	26.05	26.33	0.540	29.92*	30.14*	0.17	30.31	9	Manhole
11	Pipe - 11	15.08	24	Cir	74.697	26.43	26.89	0.616	30.31*	30.64*	0.18	30.82	10	Grate
12	Pipe - 12	14.27	24	Cir	32.089	26.86	27.10	0.748	30.82*	30.95*	0.05	30.99	11	Manhole
13	Pipe - 13	9.27	24	Cir	230.197	27.10	27.90	0.348	30.99*	31.38*	0.14	31.52	12	Manhole
14	Pipe - 14	3.37	15	Cir	203.262	27.99	32.20	2.071	31.52	32.93	n/a	32.93 j	13	Grate
15	Pipe - 15	1.46	12	Cir	39.977	32.20	32.35	0.375	32.93	33.01	0.11	33.12	14	Grate
16	Pipe - 16	1.42	12	Cir	66.019	30.50	31.64	1.727	31.52	32.15	n/a	32.15 j	13	Grate
17	Pipe - 17	0.60	12	Cir	27.874	32.14	31.97	-0.610	32.47	32.64	0.02	32.66	16	Grate
18	Pipe - 18	2.79	12	Cir	61.102	28.70	29.50	1.309	31.52*	31.89*	0.14	32.03	13	Grate
19	Pipe - 19	1.25	12	Cir	125.334	30.10	30.90	0.638	32.03*	32.18*	0.04	32.22	18	Grate
20	Pipe - 20	0.64	12	Cir	40.103	27.44	28.84	3.491	28.53	29.18	n/a	29.18 j	7	Manhole
21	Pipe - 21	0.71	12	Cir	76.529	28.84	29.60	0.993	29.18	29.90	n/a	29.90	20	Grate
22	Pipe - 22	2.42	15	Cir	125.775	27.99	29.94	1.550	31.52*	31.69*	0.06	31.75	13	Grate
23	Pipe - 23	9.70	24	Cir	59.252	26.05	26.24	0.321	29.92*	30.02*	0.18	30.21	9	Grate
24	Pipe - 24	9.02	24	Cir	78.086	26.24	26.51	0.346	30.21*	30.33*	0.06	30.39	23	Grate

Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm | Number of lines: 28 | Run Date: 12/21/2017

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	Pipe - 25	7.25	18	Cir	24.203	26.51	26.59	0.331	30.39*	30.51*	0.22	30.73	24	Manhole
26	Pipe - 26	7.45	15	Cir	207.465	26.59	27.60	0.487	30.73*	33.50*	0.53	34.03	25	Grate
27	Pipe - 27	4.55	12	Cir	87.554	27.80	28.02	0.251	34.03*	35.46*	0.52	35.98	26	Grate
28	Pipe - 28	1.74	12	Cir	84.440	27.80	28.64	0.995	34.03*	34.23*	0.08	34.31	26	Grate

Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm | Number of lines: 28 | Run Date: 12/21/2017

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	74.814	0.13	0.33	0.35	0.05	0.11	5.0	5.3	7.2	28.21	18.97	5.75	30	0.21	24.91	25.07	27.41	27.76	33.17	33.00	Pipe - 1
2	1	10.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	20.09	29.00	4.09	30	0.50	25.07	25.12	28.72	28.75	33.00	34.40	Pipe - 2
3	1	90.835	0.20	0.20	0.30	0.06	0.06	5.0	5.0	7.4	7.81	17.53	5.11	18	2.79	26.07	28.60	28.72	29.67	33.00	33.00	Pipe - 3
4	3	77.697	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.50	8.59	2.95	18	0.67	28.70	29.22	29.67	29.77	33.00	34.17	Pipe - 4
5	3	20.911	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.50	17.18	4.31	18	2.68	28.70	29.26	29.67	29.65	33.00	34.11	Pipe - 5
6	End	18.000	0.00	6.74	0.00	0.00	4.58	0.0	12.7	4.7	27.25	27.34	6.35	30	0.44	25.12	25.20	27.16	27.24	33.60	33.45	Pipe - 6
7	6	8.000	0.41	6.74	0.75	0.31	4.58	5.0	12.7	4.7	27.27	29.00	6.12	30	0.50	25.20	25.24	27.34	27.36	33.45	33.20	Pipe - 7
8	7	159.583	0.81	6.21	0.80	0.65	4.18	5.0	12.2	4.8	25.84	27.36	5.26	30	0.44	25.24	25.95	28.53	29.17	33.20	33.00	Pipe - 8
9	8	24.837	0.00	5.40	0.00	0.00	3.53	0.0	12.1	4.8	22.80	26.02	4.64	30	0.40	25.95	26.05	29.54	29.62	33.00	33.50	Pipe - 9
10	9	51.895	0.00	2.09	0.00	0.00	1.55	0.0	8.2	5.9	14.93	16.61	4.75	24	0.54	26.05	26.33	29.92	30.14	33.50	34.50	Pipe - 10
11	10	74.697	0.17	2.09	0.85	0.14	1.55	5.0	8.0	6.0	15.08	17.75	4.80	24	0.62	26.43	26.89	30.31	30.64	34.50	33.50	Pipe - 11
12	11	32.089	0.00	1.92	0.00	0.00	1.41	0.0	7.9	6.0	14.27	19.56	4.54	24	0.75	26.86	27.10	30.82	30.95	33.50	34.01	Pipe - 12
13	12	230.197	0.00	1.92	0.00	0.00	1.41	0.0	6.6	6.6	9.27	13.33	2.95	24	0.35	27.10	27.90	30.99	31.38	34.01	34.50	Pipe - 13
14	13	203.262	0.36	0.58	0.75	0.27	0.47	5.0	5.4	7.2	3.37	9.29	3.62	15	2.07	27.99	32.20	31.52	32.93	34.50	36.47	Pipe - 14
15	14	39.977	0.22	0.22	0.89	0.20	0.20	5.0	5.0	7.4	1.46	2.18	2.51	12	0.38	32.20	32.35	32.93	33.01	36.47	37.30	Pipe - 15
16	13	66.019	0.16	0.25	0.75	0.12	0.20	5.0	5.6	7.1	1.42	4.68	2.69	12	1.73	30.50	31.64	31.52	32.15	34.50	36.14	Pipe - 16
17	16	27.874	0.09	0.09	0.90	0.08	0.08	5.0	5.0	7.4	0.60	0.00	1.87	12	-0.61	32.14	31.97	32.47	32.64	36.14	35.97	Pipe - 17
18	13	61.102	0.38	0.59	0.65	0.25	0.42	5.0	6.3	6.7	2.79	4.07	3.55	12	1.31	28.70	29.50	31.52	31.89	34.50	34.10	Pipe - 18
19	18	125.334	0.21	0.21	0.80	0.17	0.17	5.0	5.0	7.4	1.25	2.85	1.59	12	0.64	30.10	30.90	32.03	32.18	34.10	33.85	Pipe - 19
20	7	40.103	0.00	0.12	0.00	0.00	0.10	0.0	6.4	6.7	0.64	6.65	1.77	12	3.49	27.44	28.84	28.53	29.18	33.20	34.40	Pipe - 20
21	20	76.529	0.12	0.12	0.80	0.10	0.10	5.0	5.0	7.4	0.71	3.55	2.75	12	0.99	28.84	29.60	29.18	29.90	34.40	34.60	Pipe - 21
22	13	125.775	0.50	0.50	0.65	0.33	0.33	5.0	5.0	7.4	2.42	8.04	1.97	15	1.55	27.99	29.94	31.52	31.69	34.50	34.21	Pipe - 22

Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm

Number of lines: 28

Run Date: 12/21/2017

NOTES:Intensity = 35.85 / (Inlet time + 3.70) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	9	59.252	0.20	3.31	0.90	0.18	1.98	5.0	11.8	4.9	9.70	12.81	3.09	24	0.32	26.05	26.24	29.92	30.02	33.50	33.00	Pipe - 23
24	23	78.086	0.40	3.11	0.90	0.36	1.80	5.0	11.3	5.0	9.02	13.30	2.87	24	0.35	26.24	26.51	30.21	30.33	33.00	33.00	Pipe - 24
25	24	24.203	0.00	2.71	0.00	0.00	1.44	0.0	11.2	5.0	7.25	6.04	4.10	18	0.33	26.51	26.59	30.39	30.51	33.00	33.59	Pipe - 25
26	25	207.465	0.84	2.71	0.60	0.50	1.44	5.0	10.6	5.2	7.45	4.51	6.08	15	0.49	26.59	27.60	30.73	33.50	33.59	32.15	Pipe - 26
27	26	87.554	0.94	0.94	0.65	0.61	0.61	5.0	5.0	7.4	4.55	1.79	5.79	12	0.25	27.80	28.02	34.03	35.46	32.15	32.35	Pipe - 27
28	26	84.440	0.93	0.93	0.35	0.33	0.33	10.0	10.0	5.3	1.74	3.55	2.22	12	0.99	27.80	28.64	34.03	34.23	32.15	33.10	Pipe - 28

Project File: Goodwin Manufacturing Annex drain pipe design with detention.stm

Number of lines: 28

Run Date: 12/21/2017

NOTES:Intensity = 35.85 / (Inlet time + 3.70) ^ 0.73; Return period =Yrs. 10 ; c = cir e = ellip b = box