

**DRAINAGE CALCULATIONS AND
STORMWATER MANAGEMENT REPORT**

For:

**PROPOSED MEDICAL OFFICE
SITE DEVELOPMENT**

Located at:

**20 HENRY GRAF JR. ROAD
NEWBURYPORT, MASSACHUSETTS 01950**

Submitted to:

TOWN OF NEWBURYPORT

Prepared For:

**SPORTS MEDICINE NORTH ORTHOPEDIC SURGERY, INC.
C/O CONSERV GROUP INC.
110 STATE ROAD
SAGAMORE BEACH, MASSACHUSETTS 02562**



**Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com**

March 17, 2020

TABLE OF CONTENTS

| | |
|---|-------------|
| 1. NARRATIVE | <u>Page</u> |
| ▪ Project Summary | 1 |
| ▪ Pre-Development Condition | 1 |
| ▪ Post-Development Condition | 2 |
| ▪ Stormwater Best Management Practices (BMP's) | 3 |
| ▪ Erosion and Sedimentation Control | 3 |
| ▪ Compliance with Stormwater Management Standards | 3 |
| ▪ Figure 1 (USGS Locus Map) | 6 |
| ▪ Figure 2 (FEMA Flood Map) | 7 |
| ▪ Figure 3 (NRCS Soils Map) | 8 |
| | |
| 2. APPENDICES | |
| ▪ APPENDIX A: Pre-Development Condition | |
| ▪ APPENDIX B: Post Development Condition | |
| ▪ APPENDIX C: Checklist for Stormwater Report | |
| ▪ APPENDIX D: Illicit Discharge Compliance Statement Supplemental BMP Calculations | |
| ▪ APPENDIX E: Soil Testing Data | |
| ▪ APPENDIX F: Best Management Practices Operation & Maintenance Plans | |

**Drainage Calculations and Stormwater Management Report
Proposed Medical Building
20 Henry Graf Jr. Road
Newburyport, Massachusetts**

Project Summary

The project proponent, Sports Medicine North Orthopedic Surgery, Inc. and ConServ Group Inc., proposes to develop the approximate 2-acre parcel at 20 Henry Graf Jr. Road (Assessor's Parcel 82-2-B) as a medical office use. The proposed development will consist of the construction of a 20,000 square ft. (GFA) medical office building with related site improvements including asphalt parking area and access driveway, landscaping, stormwater management facilities, utility connections and other relevant infrastructure. The site is located within the Town of Newburyport's Industrial I-1 Zoning District. The site is not located within a DEP Zone 2 or Town of Newburyport's Aquifer Protection Zone. Refer to Figure 1- USGS Locus Map for the location of the parcel.

This report contains stormwater runoff calculations for the pre-development and post-development conditions and includes the sizing of the proposed stormwater best management practices (BMPs). The proposed and existing site conditions are illustrated on the project *site plans* entitled "Site Development Plan – Proposed Medical Building, 20 Henry Graf Jr. Road, Newburyport, Massachusetts", prepared by McKenzie Engineering Group, Inc. dated March 17, 2020.

Pre-Development Condition

The property has frontage on Henry Graf Jr. Road to the east and is bordered by developed commercial and light industrial property to the north, south and west. The parcel is currently undeveloped and is primarily devoid of vegetation. The site has historically been used as a contractor's yard with storage of heavy equipment and large stockpiles of various types of fill. The site is bounded by bordering vegetated wetlands located along all sides. The topography of the site ranges in elevation from approximately 16 ft. (NAVD 1988) slightly west of the center of the site to elevations of approximately 13-14 ft. (NAVD 1988) at the wetland boundaries. The site has a municipal drainage easement located at the eastern property line along the frontage of Henry Graf Jr. Road. Runoff from a portion of the site flows in an easterly direction to the municipal drainage system located within the wetland adjacent to Henry Graf Jr. Road, and southerly to the existing wetlands. The limit of bordering vegetated wetland resource area on the site was delineated by Hughes Environmental Consulting in January of 2020.

The site is located within the Zone X of the Flood Insurance Rate Map, as shown on the current FEMA Flood Insurance Rate Map Panel No. 25009C0117G with an effective date of July 16, 2014. Refer to Figure 2 – FEMA Flood Map.

The soil types as identified by the Soil Survey, Essex County, MA prepared by the NRCS Soil Conservation Service (NRCS) are classified as 16A-Scantic Silt Loam, 0 to 3 percent slopes with hydrologic soil group (HSG) C/D. Soil testing conducted by McKenzie Engineering Group, Inc. (MEG) and by CGE Engineering, Inc. (CGE) on December 4, 2019 identified the soils to be fill comprised of silty, gravelly sand underlain by a clay parent layer. Refer to Figure 3 - Soil Map for the NRCS delineation of soil

types. Refer to Appendix E for Soil Testing Results and the Engineers Field Report dated December 4, 2019 prepared by CGE.

In the pre- and post- development stormwater analysis, the watershed area analyzed was approximately 1.75 acres consisting of the subject parcel to be developed and offsite tributary areas to the north and south. The watershed consists of four (4) sub-catchments. Refer to Pre-Development Watershed Delineation Plan WS-1 in Appendix A for a delineation of drainage subareas for the pre-development design condition.

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method-based program "HydroCAD" was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas.

Post-Development Condition

The proposed development will consist of a two-story, 20,000 square foot medical office building with bituminous concrete access driveway, parking area, sidewalks, stormwater management system and associated infrastructure. The project will access existing utility infrastructure located on Henry Graf Jr. Road, including water, sewer, electric, telephone and cable. The stormwater management system and will be designed to fully comply with all standards of the Department of Environment Protection's Stormwater Management Regulations.

Watershed areas were analyzed in the post-development condition to design low impact stormwater management facilities to mitigate impacts resulting from developing the property. The objective in designing the proposed drainage facilities for the project was to maintain existing drainage patterns to the extent practicable and to ensure that the post-development rates of runoff are less than pre-development rates at the design points.

Refer to the Post-Development Watershed Plan WS-2 in Appendix B for a delineation of post-development drainage subareas. The design points for the post-development design conditions correspond to those analyzed for the pre-development design condition.

The proposed stormwater management system utilizes deep sump hooded catch basins, proprietary pre-treatment units and stormwater detention basins. The detention basins were designed to accommodate peak flows generated by all storms up to the 100-year storm event, and will outlet stormwater into the municipal stormwater drainage system located within the wetland east of the site at a regulated rate. The detention basins will be connected in series, with the easterly detention basin accepting flow from the westerly detention basin via a subsurface culvert. All BMPs shall be supported by a comprehensive Construction Phase Pollution Prevention and Erosion Control Plan and Post-Development BMP Operation and Maintenance Plan.

Stormwater Best Management Practices (BMP's)

Treatment stream for the new development shall consist of parking lot maintenance and sweeping, deep sump hooded catch basins, and proprietary pre-treatment units to achieve the required removal of at least 80% of the total suspended solids (TSS) and mitigate the anticipated pollutant loading.

Refer to the TSS Removal Worksheets in Appendix D for TSS removal rates.

Erosion and Sedimentation Controls

Compost filter tube (Silt sock) erosion control barriers will be placed at the limit of work as indicated on the plan prior to the commencement of any construction activity. The integrity of the silt sock will be maintained by periodic inspection and replacement as necessary. The silt sock will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established. Refer to the Erosion Control details on the Site Development Plans and BMP Operation and Maintenance Plan for proposed erosion control measures to be employed for the project.

Compliance with Stormwater Management Standards

Standard 1 – No New Untreated Discharges

The proposed redevelopment will not introduce any new untreated discharges to a wetland area or waters of the Commonwealth of Massachusetts. All discharges from the site will be treated through proposed stormwater quality controls such as parking lot maintenance and sweeping, deep sump hooded catch basins, and pre-treatment structures including the establishment of proper maintenance procedures.

Standard 2 – Peak Rate Attenuation

The SCS Technical Release 20 (TR-20) and Technical Release 55 (TR-55) method-based program “HydroCAD” was employed to develop pre- and post-development peak flows. Drainage calculations were prepared for the pre-development condition for the 2, 10, 25 and 100-year, Type III storm events. Refer to Appendices A and B for computer results, soil characteristics, cover descriptions and times of concentrations for all subareas. All drainage structures will be designed employing the Rational Method and the Mass. DPW Design Manual to accommodate peak flows generated by a minimum of a 25-year storm event or a 100-year storm event where applicable. The stormwater management systems were designed to accommodate peak flows generated by a 100-year storm event.

In the pre-development and post-development stormwater analysis, the watershed area analyzed was approximately 1.75 acres consisting of the subject parcel to be developed and offsite tributary areas to the north and south. Refer to Existing Watershed Delineation Plan WS-1 for a delineation of drainage subareas for the pre-development design condition and refer to Post-Development Watershed Delineation Plan WS-2 for a delineation of drainage subareas for the post-development design condition.

The peak rates of runoff are as follows:

Pre-Development vs. Post-Development Peak Rates of Runoff

| Design Point | 2 Year Storm (3.10 Inches) | | 10 Year Storm (4.70 Inches) | | 25 Year Storm (5.80 Inches) | | 100 Year Storm (8.30 Inches) | |
|----------------|-------------------------------|----------------|--------------------------------|----------------|--------------------------------|----------------|---------------------------------|----------------|
| | Exist. (CFS) | Prop. (CFS) | Exist. (CFS) | Prop. (CFS) | Exist. (CFS) | Prop. (CFS) | Exist. (CFS) | Prop. (CFS) |
| Design Point 1 | 1.61 | 1.42 | 2.68 | 2.35 | 3.41 | 3.07 | 5.04 | 4.70 |
| Design Point 2 | 0.87 | 0.38 | 1.47 | 1.06 | 1.88 | 1.52 | 2.80 | 2.58 |
| Design Point 3 | 1.85 | 1.29 | 3.04 | 2.09 | 3.85 | 2.63 | 5.66 | 3.85 |
| Design Point 4 | 0.08 | 0.08 | 0.12 | 0.12 | 0.15 | 0.15 | 0.22 | 0.22 |

A comparison of the pre-development and post-development peak rates of runoff indicates that the peak rates of runoff for the post-development condition will be less than the pre-development condition for all storm events.

Standard 3 – Groundwater Recharge

An analysis of Soil Tests indicates that the site is comprised of very silty gravelly sand fill w/ cobbles and boulders, and dense clay that are not conducive to infiltration. The pre-development conditions indicate that the site's topsoil is almost entirely gravel and fallow, providing little if any groundwater recharge. The proposed development will provide significant landscaped areas, consisting of loam and seed, as well as stormwater plantings to promote infiltration. A calculation of the required recharge volume using the static method indicates that the Site requires a recharge volume of 389 C.F., based on a proposed impervious area of 46,716 S.F. and Hydrologic Soil Group (HSG), D soils (Target Depth Factor = 0.10).

Refer to Figure 3 - Soil Map for the NRCS delineation of soil types and Appendix E – Soil Testing Results for supporting data.

Standard 4 – Water Quality

The stormwater management system was designed to be in full compliance with the DEP Stormwater Management Policy. A treatment stream consisting of street sweeping, deep-sump catch basins with hooded outlets, First Defense proprietary separators (FD-3HC) and detention basins will be employed in the design of drainage facilities for the project to achieve the required removal of 80% total suspended solids. The proposed treatment streams will renovate the stormwater and improve the water quality by promoting the settlement of sediments and pollutants before runoff is released.

First Defense proprietary separators were sized to accommodate and treat all tributary impervious areas within the watershed using the half-inch rule of precipitation during the 100-year storm event. Refer to the TSS Removal Worksheets in Appendix D for TSS removal rates and water quality calculations. The water quality treatment volume is provided within the storm water management facilities as follows:

Water Quality Treatment Volume

| Design Point | Required WQ Volume (cf) | Proposed WQ Volume (cf) | |
|----------------|----------------------------|----------------------------|-----------------------------|
| Pond 1P | 491 | 2,824 | Detention Basin #1 (FD-3HC) |
| Pond 2P | 789 | 2,824 | Detention Basin #2 (FD-3HC) |
| Design Point 3 | 627 | 2,824 | Flared End Section (FD-3HC) |
| | 1,907 | 8,472 | |

Standard 5 – Land Use with Higher Potential Pollutant Loads (LUHPPL)

The proposed project does not include land uses with higher potential pollutant loads. Not Applicable.

Standard 6 – Critical Areas

The proposed project does not discharge to any critical areas. Not Applicable.

Standard 7 - Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

The proposed project is not a redevelopment project. Not Applicable.

Standard 8 – Construction Period Pollution Prevention and Erosion and Sedimentation Control

The project will require a NPDES Construction General Permit and the preparation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will be submitted prior to any proposed construction. A Construction Phase BMP Operation and Maintenance Plan is provided in Appendix F.

Standard 9 – Operation and Maintenance Plan

The Post Construction Operation and Maintenance Plan is provided in Appendix F.

Standard 10 – Prohibition of Illicit Discharges

No illicit discharges are anticipated on site. An Illicit Discharge Compliance Statement will be submitted prior to the discharge of any stormwater to the post-construction best management practices. Measures to prevent illicit discharges will be included in the Long-Term Pollution Prevention Plan.

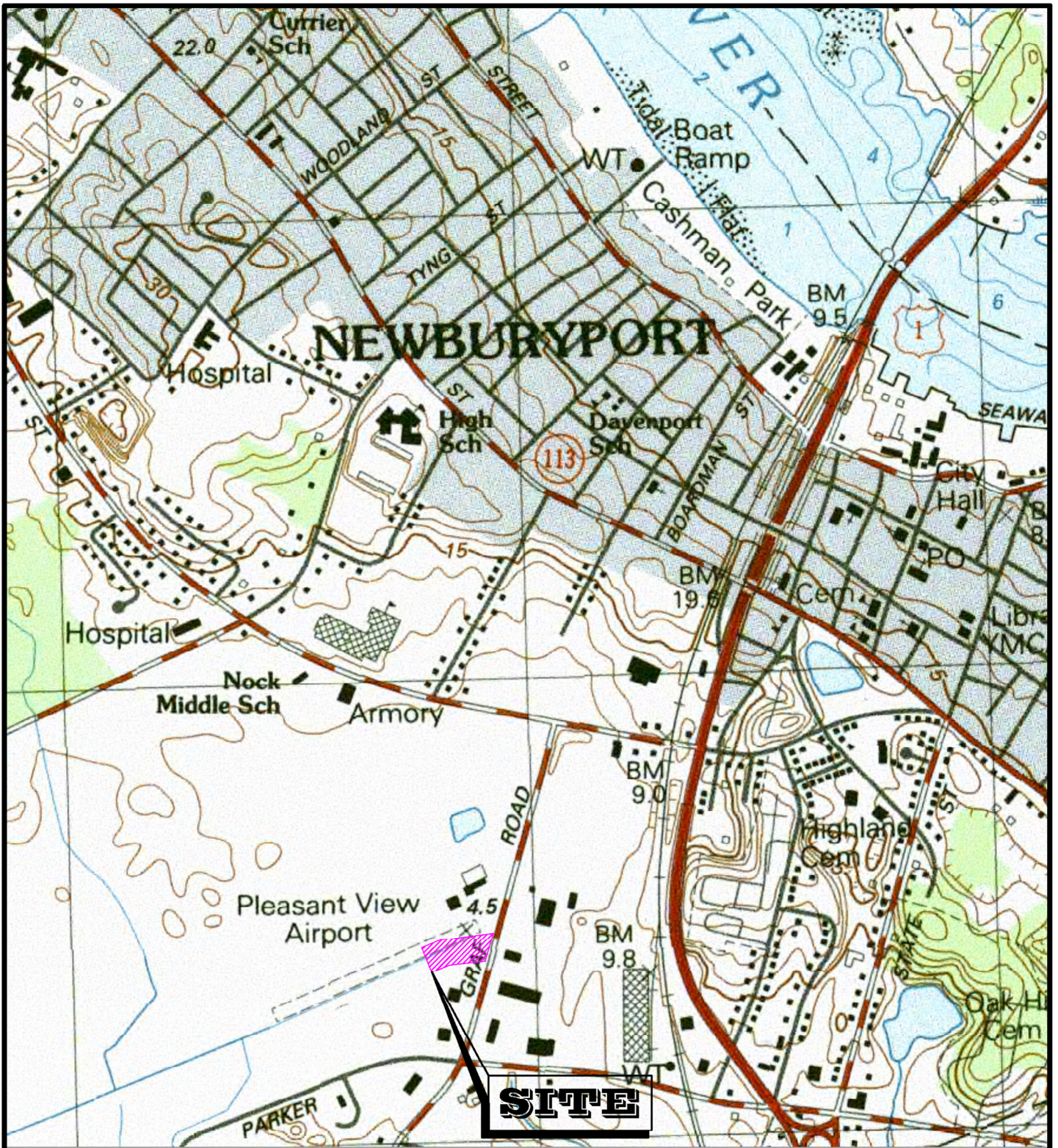
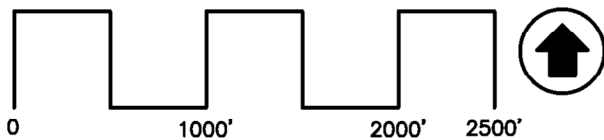


FIGURE - 1



U.S. GEOLOGICAL SURVEY
7.5 X 15 MINUTE SERIES



Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

USGS LOCUS MAP

20 HENRY GRAF JR. ROAD
(ASSESSOR'S PARCEL NO. 82-2-B)
NEWBURYPORT, MASSACHUSETTS

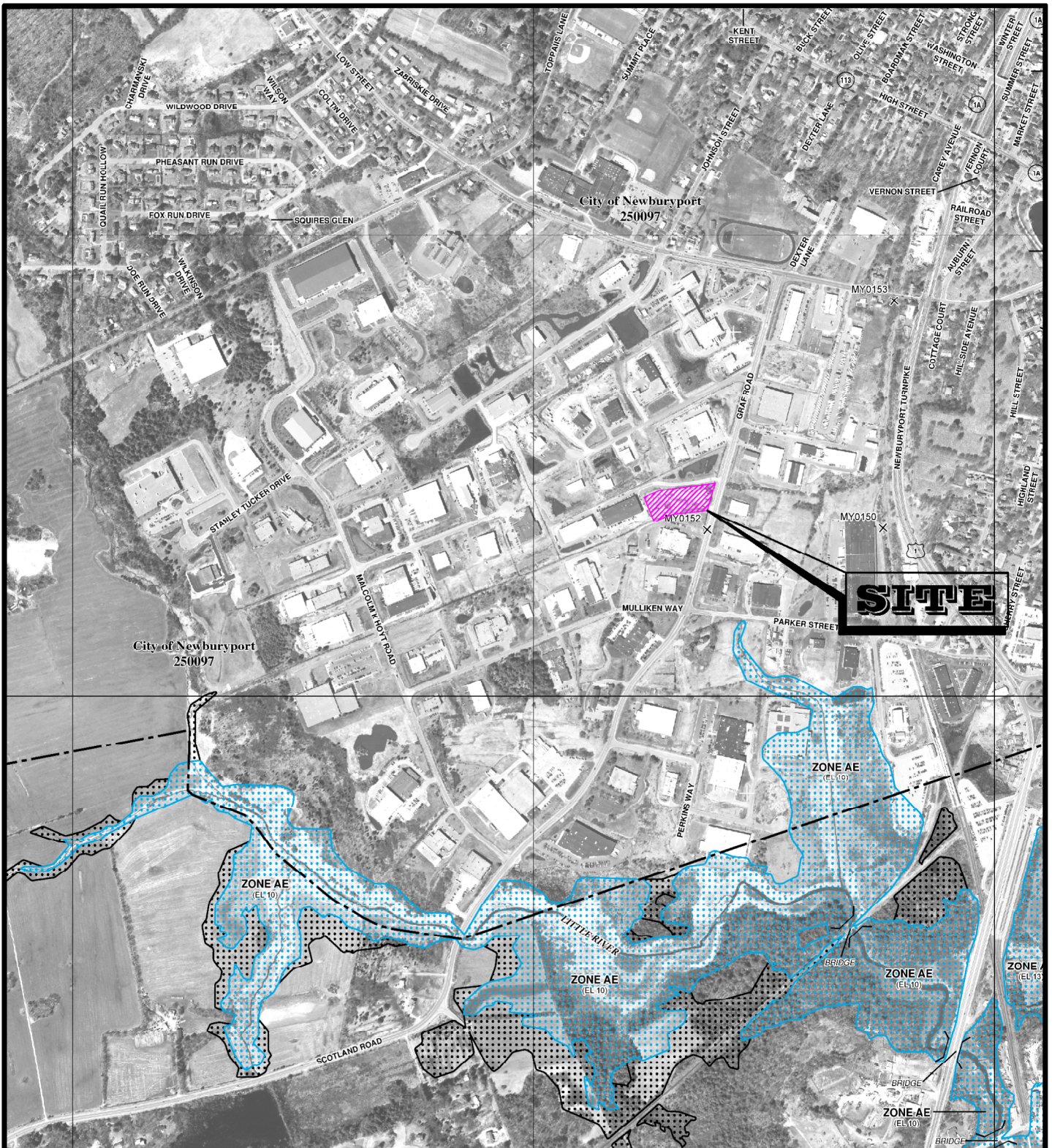
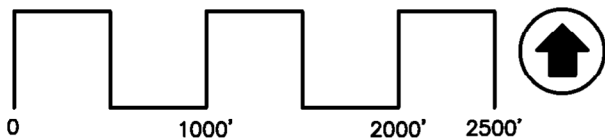


FIGURE - 2



COMMUNITY PANEL NO: 25009C0117G
EFFECTIVE DATE: JULY 16, 2014



Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

FEMA FLOOD MAP

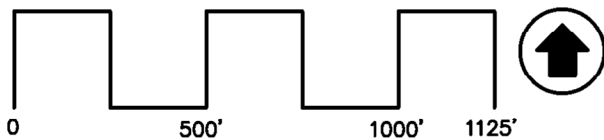
20 HENRY GRAF JR. ROAD
(ASSESSOR'S PARCEL NO. 82-2-B)
NEWBURYPORT, MASSACHUSETTS



SOIL KEY

| SOIL CLASSIFICATION | DESCRIPTION | HYDROLOGIC SOIL GROUP |
|---------------------|--------------------------------|-------------------------|
| 16A | SCANTIC SILT LOAM, 0-3% SLOPES | C/D |
| 602 | URBAN LAND | C/D (SURROUNDING SOILS) |

FIGURE - 3



NRCS SOIL SURVEY
NORFOLK COUNTY



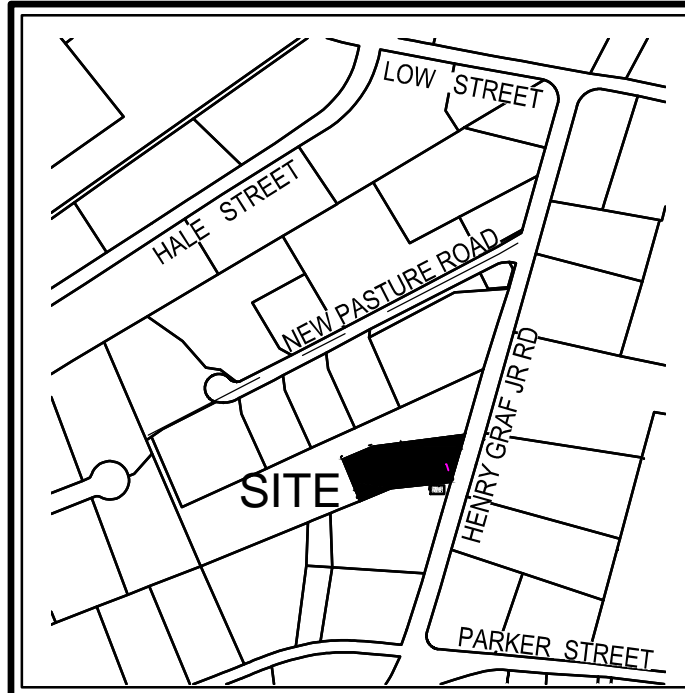
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

NRCS SOILS MAP

20 HENRY GRAF JR. ROAD
(ASSESSOR'S PARCEL NO. 82-2-B)
NEWBURYPORT, MASSACHUSETTS

APPENDIX A

Pre-Development Condition



LOCUS MAP
Not to Scale

ABBREVIATIONS

| | |
|-----------|------------------------------|
| FFE | FIRST FLOOR ELEVATION |
| BIT CONC. | BITUMINOUS CONCRETE PAVEMENT |
| CCB | CAPE COD BERM |
| EP | EDGE OF PAVEMENT |
| BC | BITUMINOUS CONCRETE CURB |
| (AM) | AS MEASURED |
| CALC | CALCULATED |
| RET WALL | RETAINING WALL |
| CONC. | CONCRETE |
| RCP | REINFORCED CONCRETE PIPE |
| VCC | VERTICAL GRANITE CURB |
| VCC | VERTICAL CONCRETE CURB |

LEGEND

SURVEY SYMBOLS

- REBAR
- CB/DH □ CONCRETE BOUND WITH DRILL HOLE
- SB □ STONE BOUND
- SB/DH □ STONE BOUND

UTILITY SYMBOLS

- ⊗ ELECTRIC HAND HOLE
- ⊗ GUY POLE
- GW— GUY WIRE
- ⊗ HVAC UNIT
- ⊗ TRANSFORMER
- ⊗ WATER GATE
- EMH ELECTRIC MANHOLE
- SMH SEWER MANHOLE
- DMH DRAIN MANHOLE
- TMH TELEPHONE MANHOLE
- CBN DRAINAGE CATCH BASIN
- ⊗ HYDRANT
- ⊗ POST INDICATOR VALVE
- ⊗ UTILITY POLE
- ⊗ YARD LIGHT
- ⊗ RIP RAP
- B BOLLARD
- ⊗ SIGN

LINE DESIGNATORS

- W — WATER MAIN
- JB — JERSEY BARRIER
- GR — GUARD RAIL
- OHW — OVERHEAD WIRES
- GL — GAS LINE
- WS — WATER SERVICE
- UE — UNDERGROUND ELECTRIC
- SL — STORM DRAIN LINE
- SS — SANITARY SEWER LINE
- DS — DRAINAGE SWALE
- X — CHAIN LINK FENCE

| REV | DATE | DESCRIPTION | BY | APP |
|-----|------|-------------|----|-----|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

MCKENZIE ENGINEERING GROUP
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwalk, MA 02061
P: 781.792.3900
F: 781.792.0333
www.mckeng.com

**SITE DEVELOPMENT PLAN
20 HENRY GRAF JR. ROAD
NEWBURYPORT, MASSACHUSETTS**

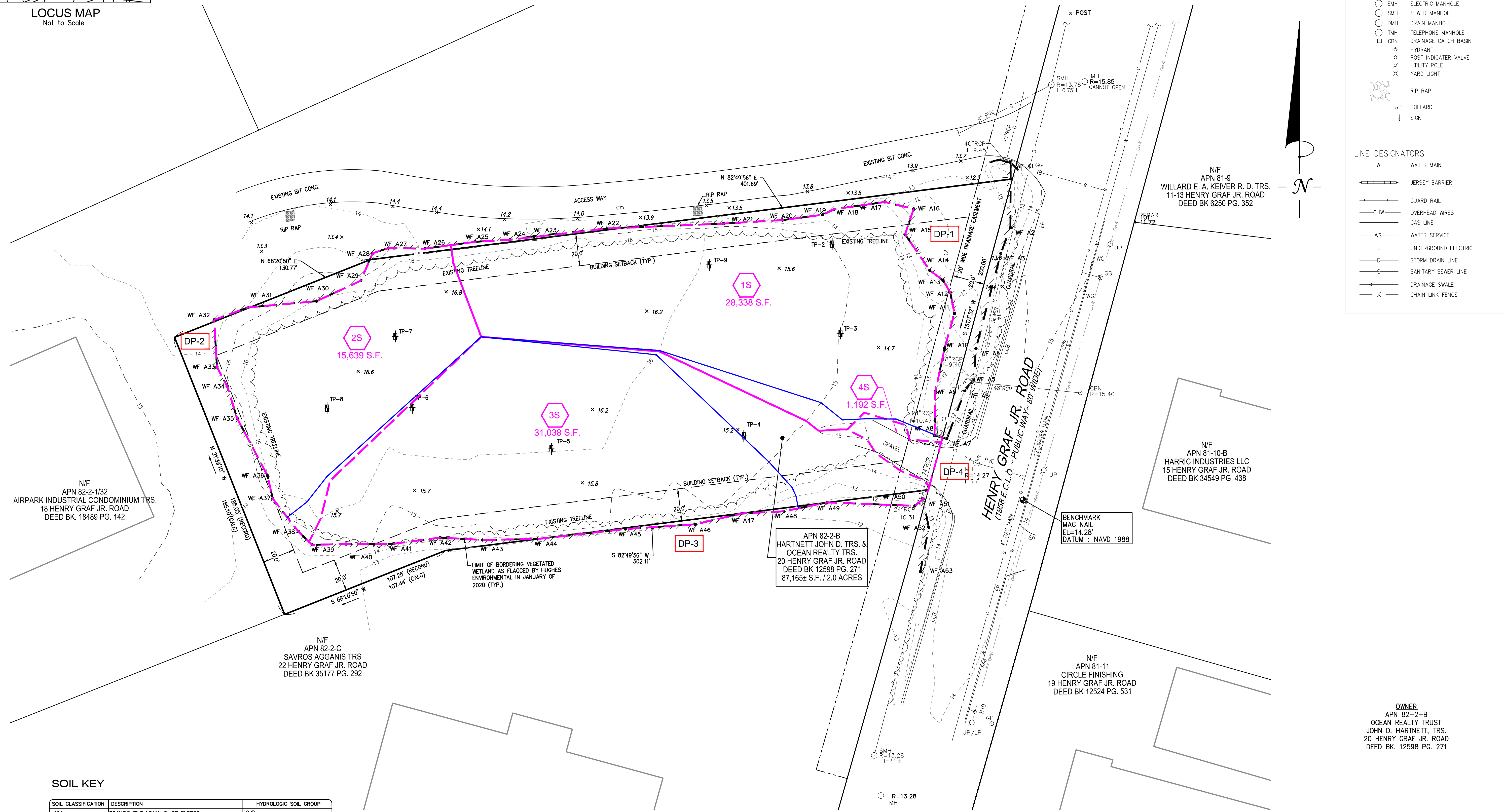
PROFESSIONAL SURVEYOR:

APPLICANT:
**SPORTS MEDICINE NORTH
ORTHOPEDIC SURGERY, INC.**
110 STATE ROAD
SAGAMORE BEACH, MASSACHUSETTS

DRAWN BY: ESS
DESIGNED BY: ESS
CHECKED BY: BCM
APPROVED BY: BCM
DATE: MARCH 17, 2020
SCALE: 1"=30'
PROJECT NO.: 219-180
DWG. TITLE:

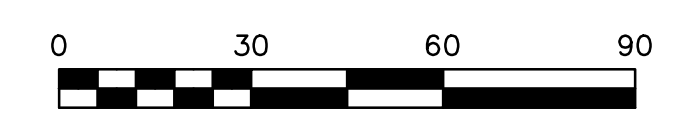
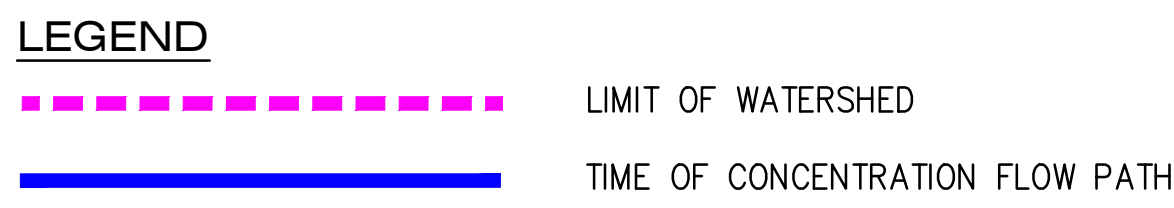
**PRE DEV.
WATERSHED
PLAN**

DWG. NO.: **WS-1**



SOIL KEY

| SOIL CLASSIFICATION | DESCRIPTION | HYDROLOGIC SOIL GROUP |
|---------------------|---------------------------------|-----------------------|
| 16A | SCANTILY SILT LOAM, 0-3% SLOPES | C/D |

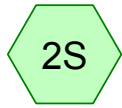




EAST SITE



NORTH/EAST WETLAND



WEST SITE



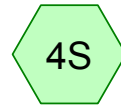
WEST WETLAND



SOUTH SITE



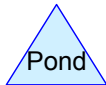
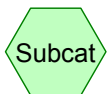
SOUTH WETLAND



DRIVEWAY



HENRY GRAF JR. ROAD



Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|---|
| 0.253 | 73 | Brush, Good, HSG D (1S, 2S, 3S) |
| 1.497 | 94 | Fallow, bare soil, HSG D (1S, 2S, 3S, 4S) |
| 1.749 | 91 | TOTAL AREA |

Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|-----------------|---------------|-------------------------|
| 0.000 | HSG A | |
| 0.000 | HSG B | |
| 0.000 | HSG C | |
| 1.749 | HSG D | 1S, 2S, 3S, 4S |
| 0.000 | Other | |
| 1.749 | | TOTAL AREA |

Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|------------------|------------------|------------------|------------------|------------------|------------------|-------------------|-------------------------|
| 0.000 | 0.000 | 0.000 | 0.253 | 0.000 | 0.253 | Brush, Good | 1S, 2S, 3S |
| 0.000 | 0.000 | 0.000 | 1.497 | 0.000 | 1.497 | Fallow, bare soil | 1S, 2S, 3S, 4S |
| 0.000 | 0.000 | 0.000 | 1.749 | 0.000 | 1.749 | TOTAL AREA | |

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EAST SITE

Runoff Area=28,338 sf 0.00% Impervious Runoff Depth=2.16"
Flow Length=291' Tc=5.4 min CN=91 Runoff=1.61 cfs 0.117 af

Subcatchment 2S: WEST SITE

Runoff Area=15,639 sf 0.00% Impervious Runoff Depth=2.08"
Tc=5.0 min CN=90 Runoff=0.87 cfs 0.062 af

Subcatchment 3S: SOUTH SITE

Runoff Area=31,038 sf 0.00% Impervious Runoff Depth>2.26"
Tc=5.0 min CN=92 Runoff=1.85 cfs 0.134 af

Subcatchment 4S: DRIVEWAY

Runoff Area=1,192 sf 0.00% Impervious Runoff Depth>2.44"
Tc=5.0 min CN=94 Runoff=0.08 cfs 0.006 af

Reach DP-1: NORTH/EAST WETLAND

Inflow=1.61 cfs 0.117 af
Outflow=1.61 cfs 0.117 af

Reach DP-2: WEST WETLAND

Inflow=0.87 cfs 0.062 af
Outflow=0.87 cfs 0.062 af

Reach DP-3: SOUTH WETLAND

Inflow=1.85 cfs 0.134 af
Outflow=1.85 cfs 0.134 af

Reach DP-4: HENRY GRAF JR. ROAD

Inflow=0.08 cfs 0.006 af
Outflow=0.08 cfs 0.006 af

Total Runoff Area = 1.749 ac Runoff Volume = 0.319 af Average Runoff Depth = 2.19"
100.00% Pervious = 1.749 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EAST SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 1.61 cfs @ 12.08 hrs, Volume= 0.117 af, Depth= 2.16"

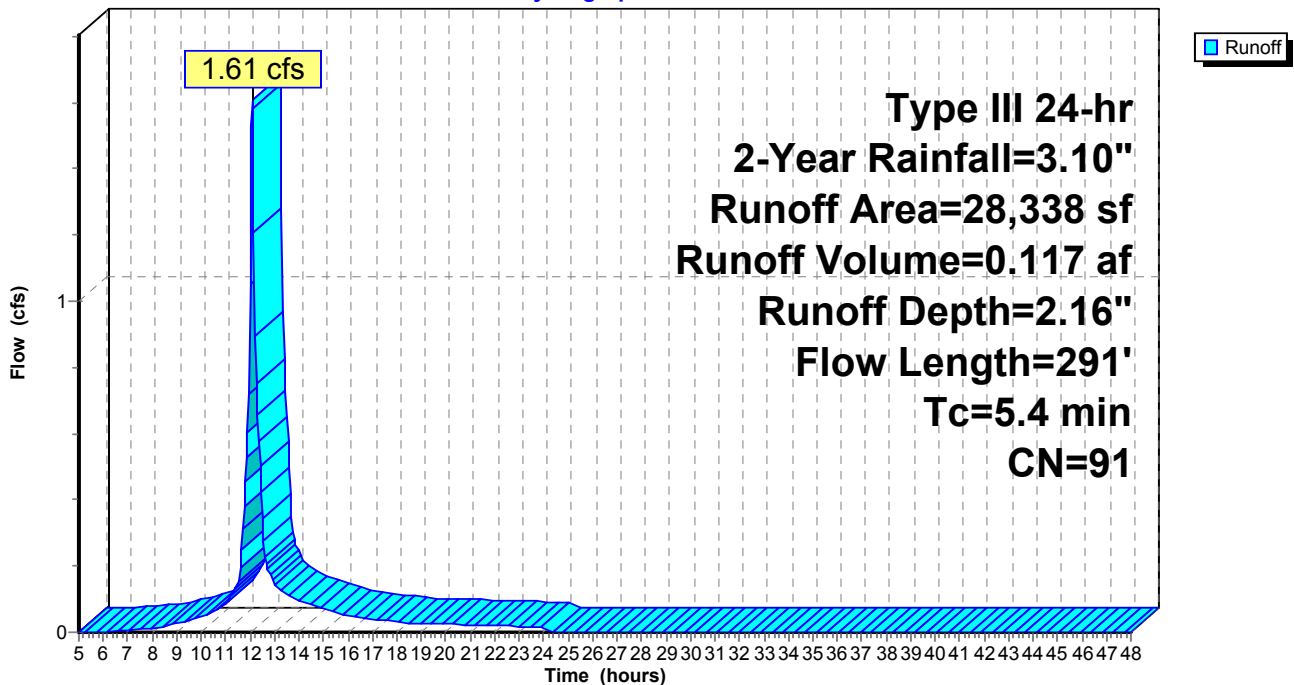
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 4,516 | 73 | Brush, Good, HSG D |
| 23,822 | 94 | Fallow, bare soil, HSG D |
| 28,338 | 91 | Weighted Average |
| 28,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 3.1 | 50 | 0.0100 | 0.27 | | Sheet Flow, SHEET Fallow n= 0.050 P2= 3.20" |
| 2.3 | 241 | 0.0120 | 1.76 | | Shallow Concentrated Flow, SHALLOW CONC. Unpaved Kv= 16.1 fps |
| 5.4 | 291 | Total | | | |

Subcatchment 1S: EAST SITE

Hydrograph



Summary for Subcatchment 2S: WEST SITE

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.87 cfs @ 12.07 hrs, Volume= 0.062 af, Depth= 2.08"

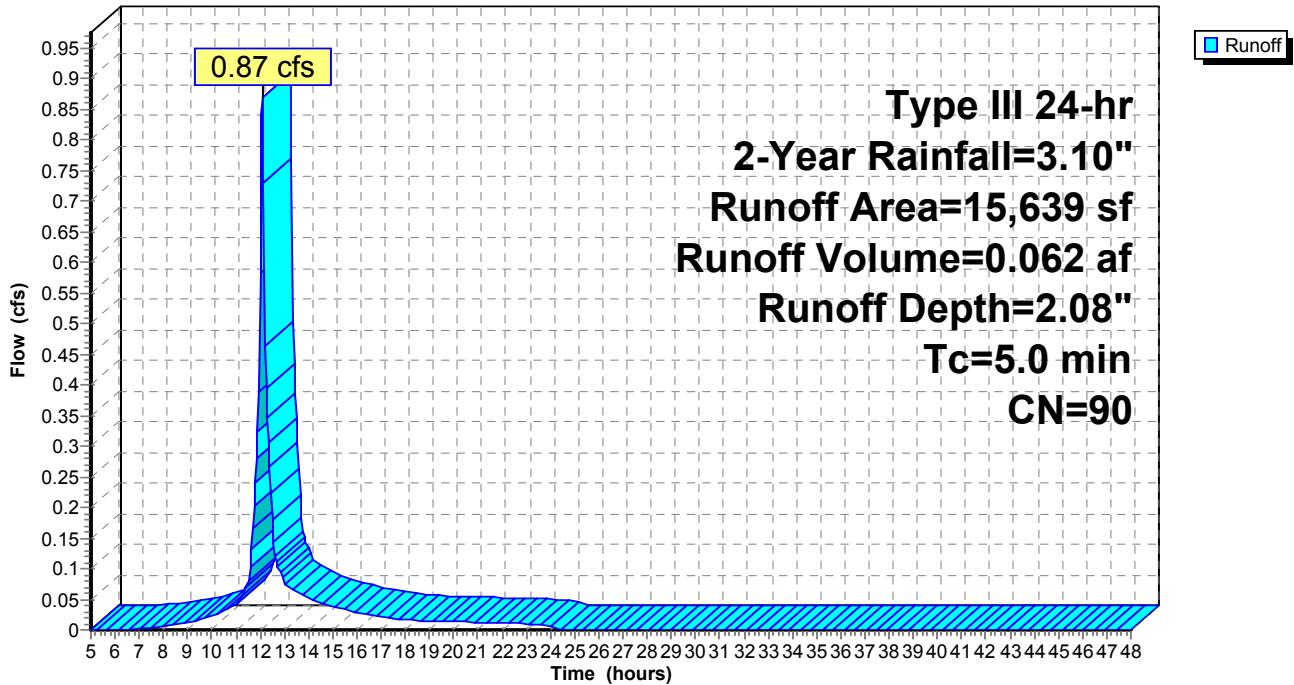
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,162 | 73 | Brush, Good, HSG D |
| 12,477 | 94 | Fallow, bare soil, HSG D |
| 15,639 | 90 | Weighted Average |
| 15,639 | | 100.00% Pervious Area |

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

Subcatchment 2S: WEST SITE

Hydrograph



Summary for Subcatchment 3S: SOUTH SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

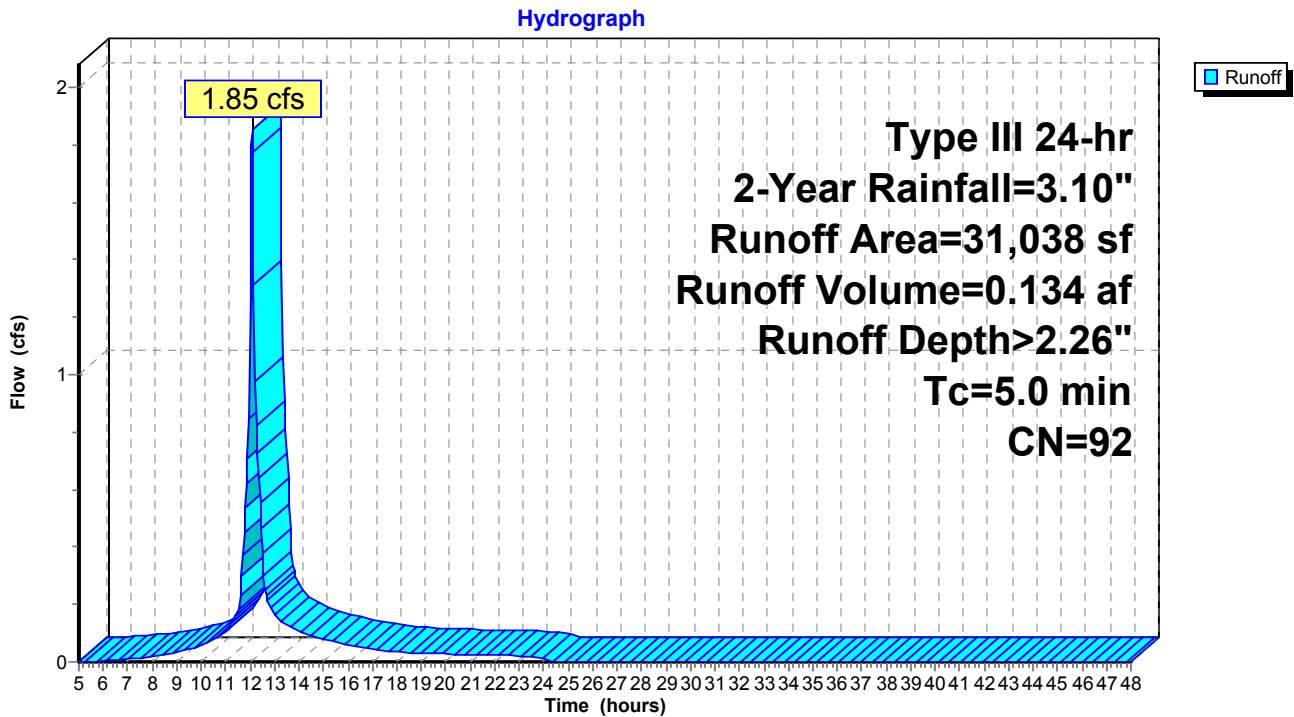
Runoff = 1.85 cfs @ 12.07 hrs, Volume= 0.134 af, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,337 | 73 | Brush, Good, HSG D |
| 27,701 | 94 | Fallow, bare soil, HSG D |
| 31,038 | 92 | Weighted Average |
| 31,038 | | 100.00% Pervious Area |

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

Subcatchment 3S: SOUTH SITE



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Depth> 2.44"

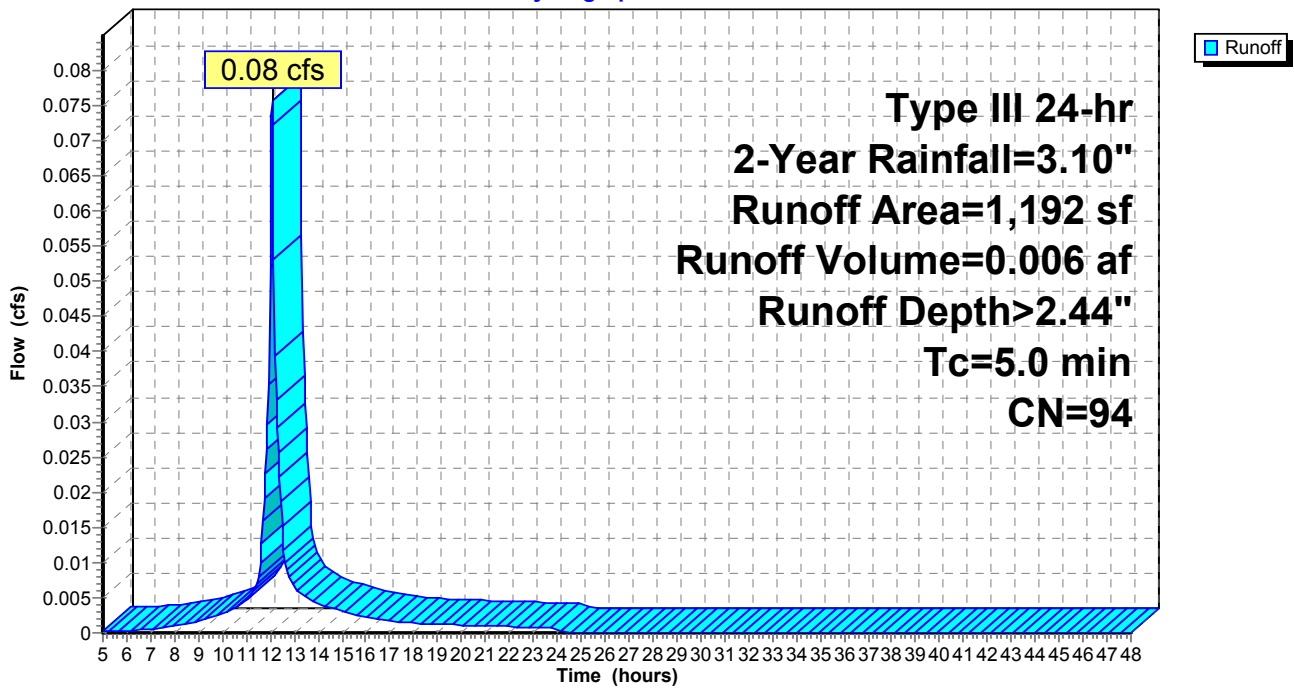
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 1,192 | 94 | Fallow, bare soil, HSG D |
| 1,192 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: NORTH/EAST WETLAND

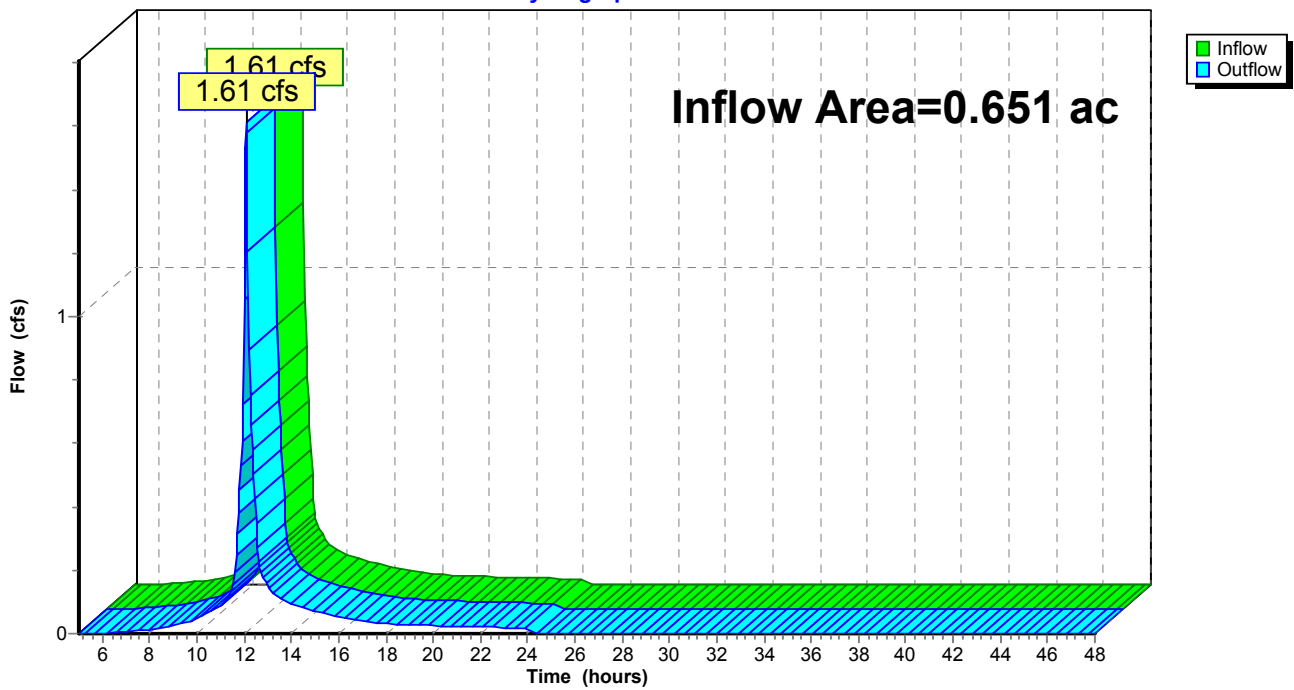
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.651 ac, 0.00% Impervious, Inflow Depth = 2.16" for 2-Year event
Inflow = 1.61 cfs @ 12.08 hrs, Volume= 0.117 af
Outflow = 1.61 cfs @ 12.08 hrs, Volume= 0.117 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: NORTH/EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

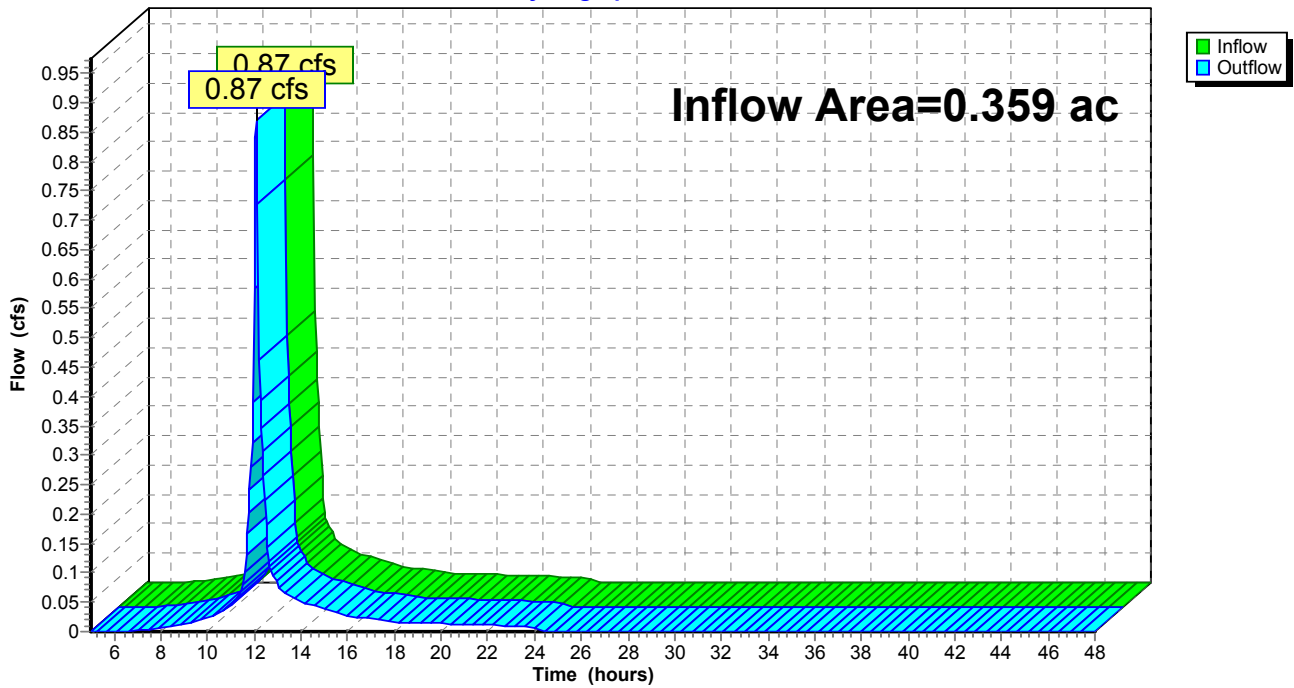
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.359 ac, 0.00% Impervious, Inflow Depth = 2.08" for 2-Year event
Inflow = 0.87 cfs @ 12.07 hrs, Volume= 0.062 af
Outflow = 0.87 cfs @ 12.07 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

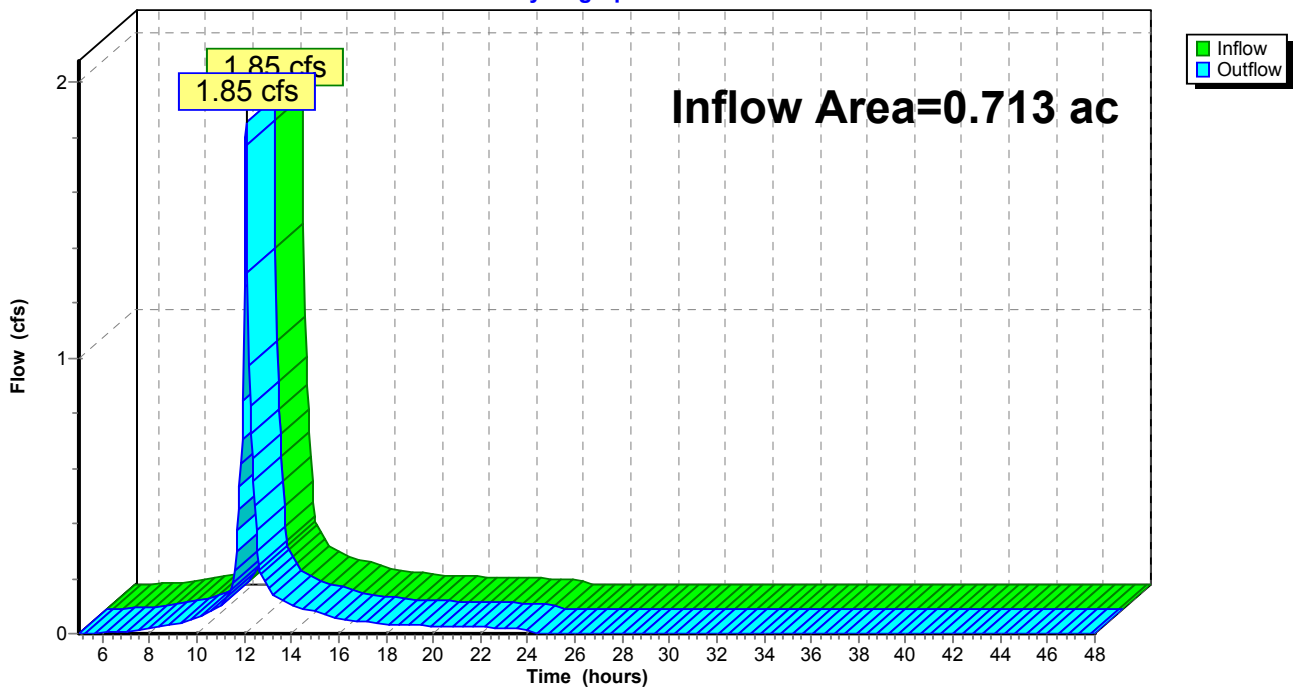
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.713 ac, 0.00% Impervious, Inflow Depth > 2.26" for 2-Year event
Inflow = 1.85 cfs @ 12.07 hrs, Volume= 0.134 af
Outflow = 1.85 cfs @ 12.07 hrs, Volume= 0.134 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

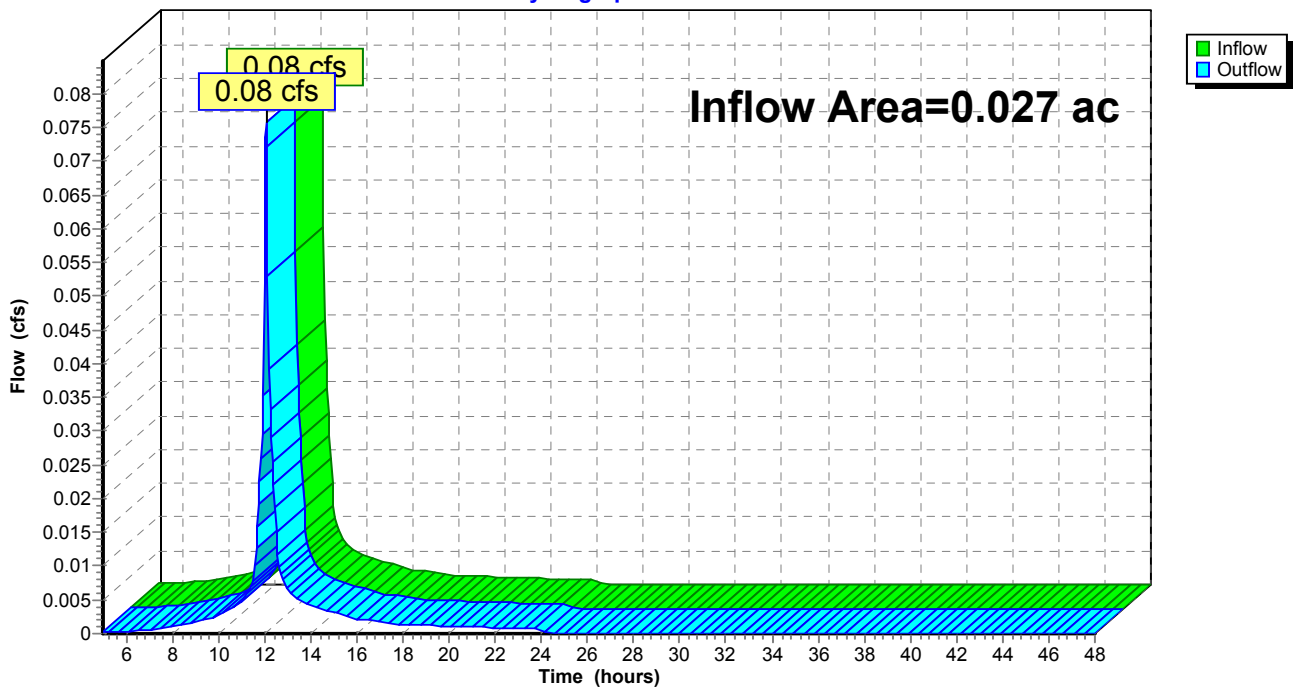
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 0.00% Impervious, Inflow Depth > 2.44" for 2-Year event
Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af
Outflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EAST SITE Runoff Area=28,338 sf 0.00% Impervious Runoff Depth>3.69"
Flow Length=291' Tc=5.4 min CN=91 Runoff=2.68 cfs 0.200 af

Subcatchment 2S: WEST SITE Runoff Area=15,639 sf 0.00% Impervious Runoff Depth>3.59"
Tc=5.0 min CN=90 Runoff=1.47 cfs 0.107 af

Subcatchment 3S: SOUTH SITE Runoff Area=31,038 sf 0.00% Impervious Runoff Depth>3.79"
Tc=5.0 min CN=92 Runoff=3.04 cfs 0.225 af

Subcatchment 4S: DRIVEWAY Runoff Area=1,192 sf 0.00% Impervious Runoff Depth>3.99"
Tc=5.0 min CN=94 Runoff=0.12 cfs 0.009 af

Reach DP-1: NORTH/EAST WETLAND Inflow=2.68 cfs 0.200 af
Outflow=2.68 cfs 0.200 af

Reach DP-2: WEST WETLAND Inflow=1.47 cfs 0.107 af
Outflow=1.47 cfs 0.107 af

Reach DP-3: SOUTH WETLAND Inflow=3.04 cfs 0.225 af
Outflow=3.04 cfs 0.225 af

Reach DP-4: HENRY GRAF JR. ROAD Inflow=0.12 cfs 0.009 af
Outflow=0.12 cfs 0.009 af

Total Runoff Area = 1.749 ac Runoff Volume = 0.541 af Average Runoff Depth = 3.71"
100.00% Pervious = 1.749 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EAST SITE

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.68 cfs @ 12.08 hrs, Volume= 0.200 af, Depth> 3.69"

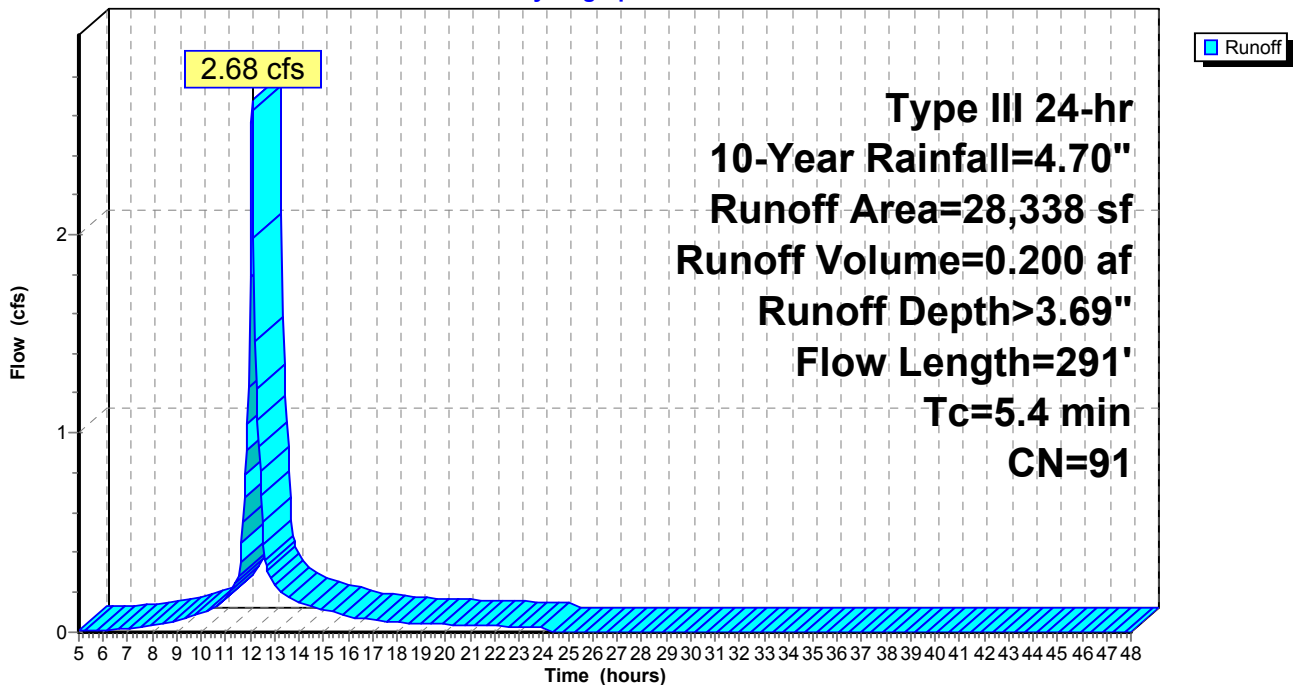
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 4,516 | 73 | Brush, Good, HSG D |
| 23,822 | 94 | Fallow, bare soil, HSG D |
| 28,338 | 91 | Weighted Average |
| 28,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 3.1 | 50 | 0.0100 | 0.27 | | Sheet Flow, SHEET Fallow n= 0.050 P2= 3.20" |
| 2.3 | 241 | 0.0120 | 1.76 | | Shallow Concentrated Flow, SHALLOW CONC. Unpaved Kv= 16.1 fps |
| 5.4 | 291 | Total | | | |

Subcatchment 1S: EAST SITE

Hydrograph



Summary for Subcatchment 2S: WEST SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

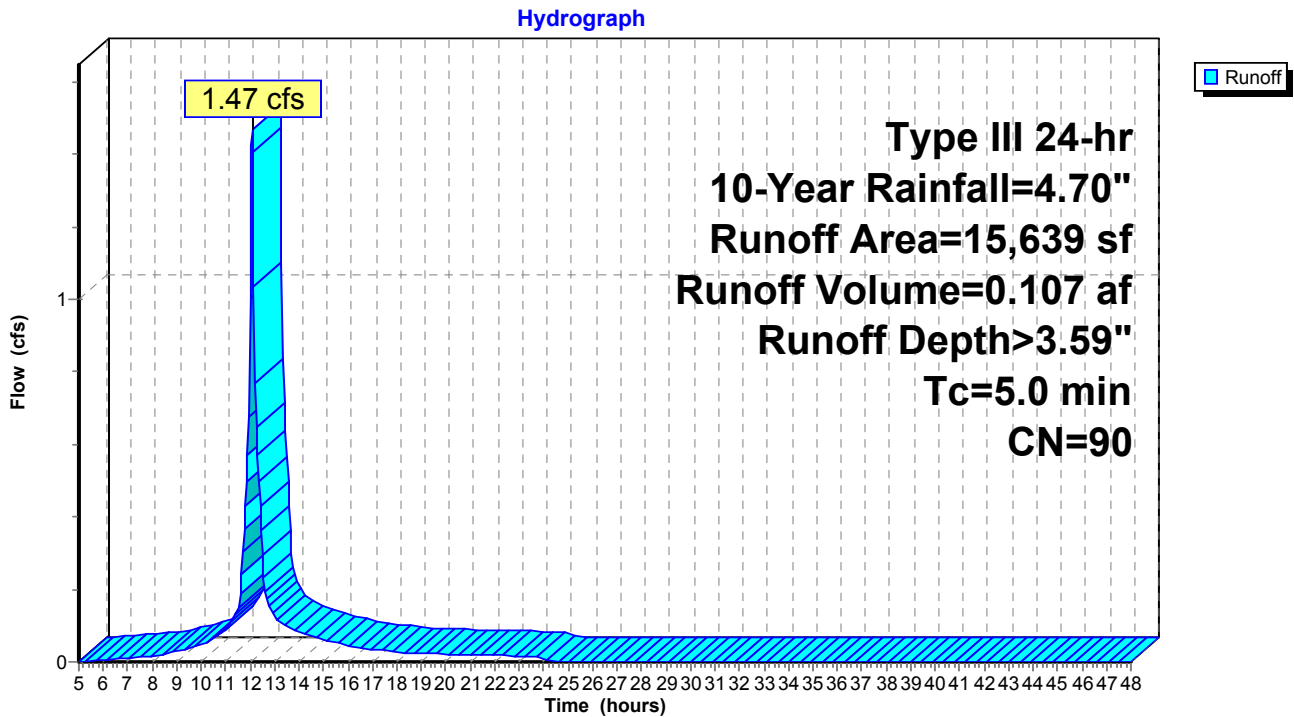
Runoff = 1.47 cfs @ 12.07 hrs, Volume= 0.107 af, Depth> 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,162 | 73 | Brush, Good, HSG D |
| 12,477 | 94 | Fallow, bare soil, HSG D |
| 15,639 | 90 | Weighted Average |
| 15,639 | | 100.00% Pervious Area |

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

Subcatchment 2S: WEST SITE



Summary for Subcatchment 3S: SOUTH SITE

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.04 cfs @ 12.07 hrs, Volume= 0.225 af, Depth> 3.79"

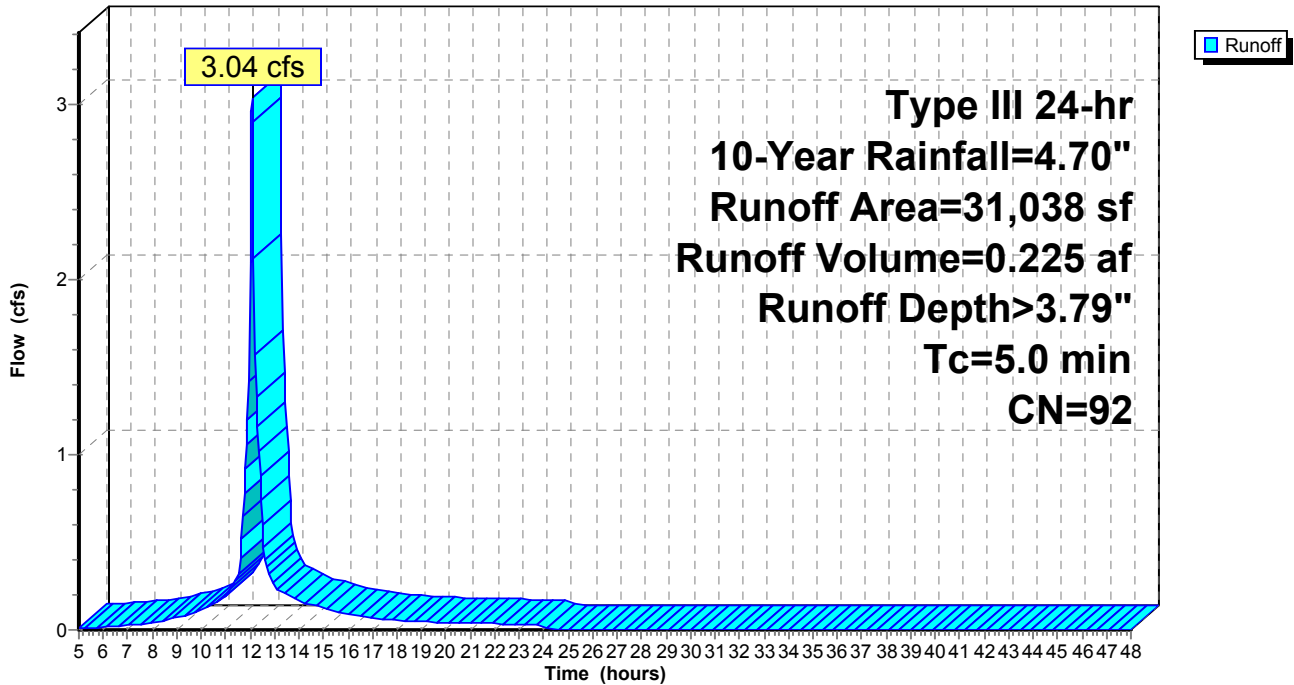
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,337 | 73 | Brush, Good, HSG D |
| 27,701 | 94 | Fallow, bare soil, HSG D |
| 31,038 | 92 | Weighted Average |
| 31,038 | | 100.00% Pervious Area |

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

Subcatchment 3S: SOUTH SITE

Hydrograph



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af, Depth> 3.99"

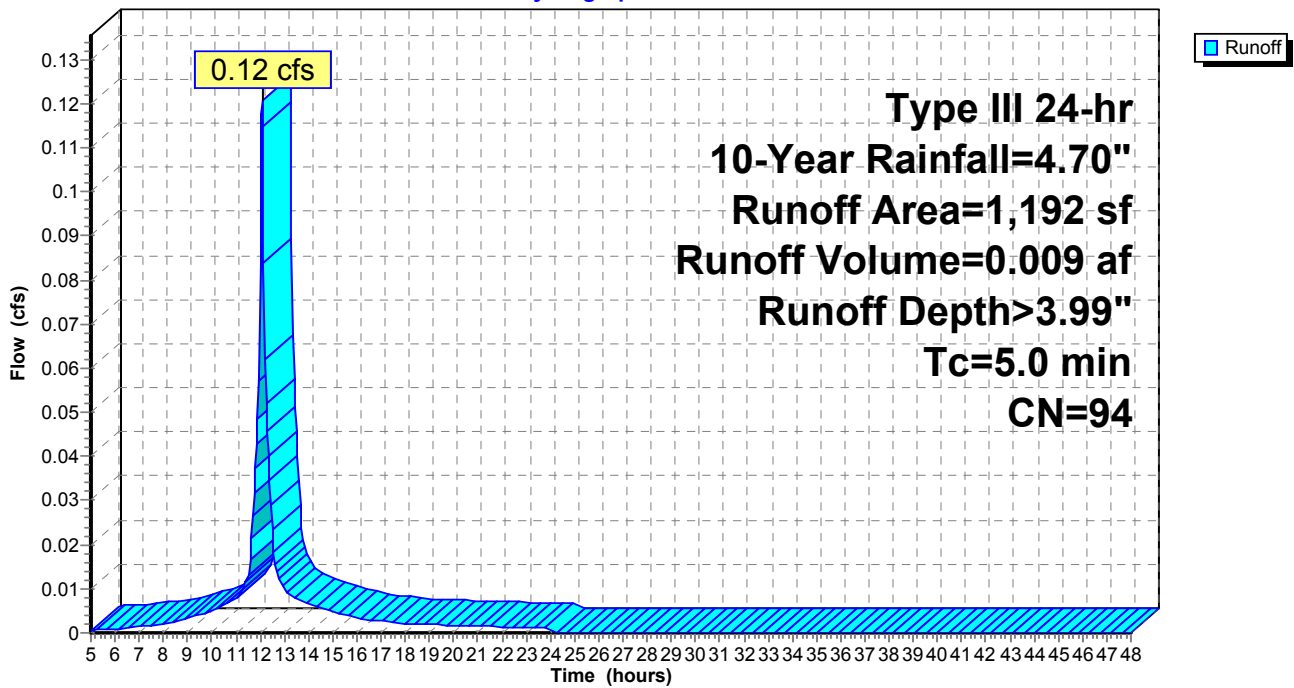
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 1,192 | 94 | Fallow, bare soil, HSG D |
| 1,192 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: NORTH/EAST WETLAND

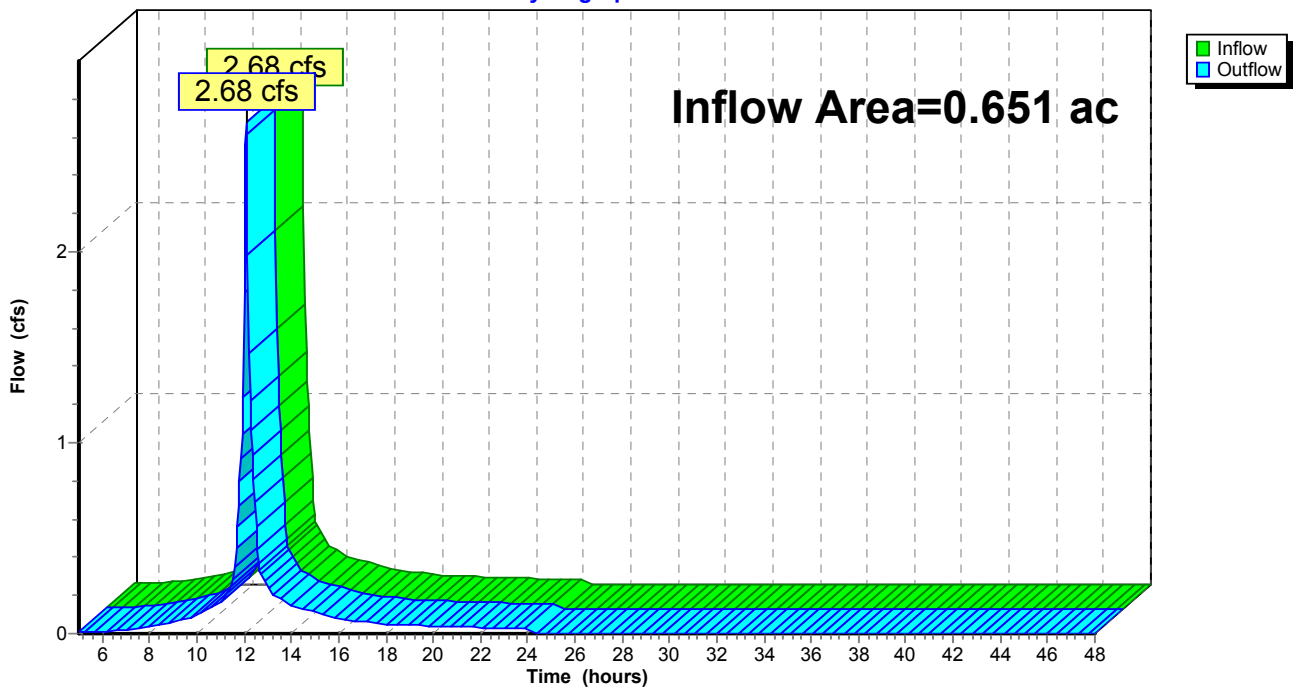
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.651 ac, 0.00% Impervious, Inflow Depth > 3.69" for 10-Year event
Inflow = 2.68 cfs @ 12.08 hrs, Volume= 0.200 af
Outflow = 2.68 cfs @ 12.08 hrs, Volume= 0.200 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: NORTH/EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

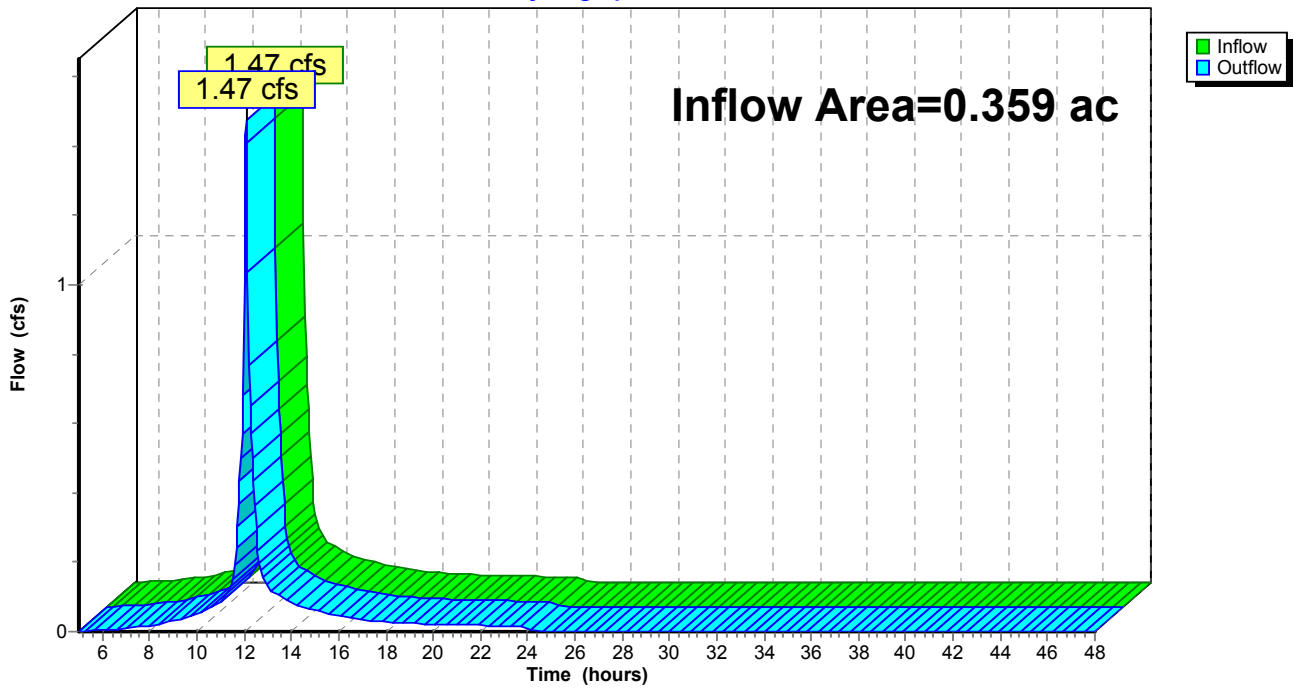
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.359 ac, 0.00% Impervious, Inflow Depth > 3.59" for 10-Year event
Inflow = 1.47 cfs @ 12.07 hrs, Volume= 0.107 af
Outflow = 1.47 cfs @ 12.07 hrs, Volume= 0.107 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

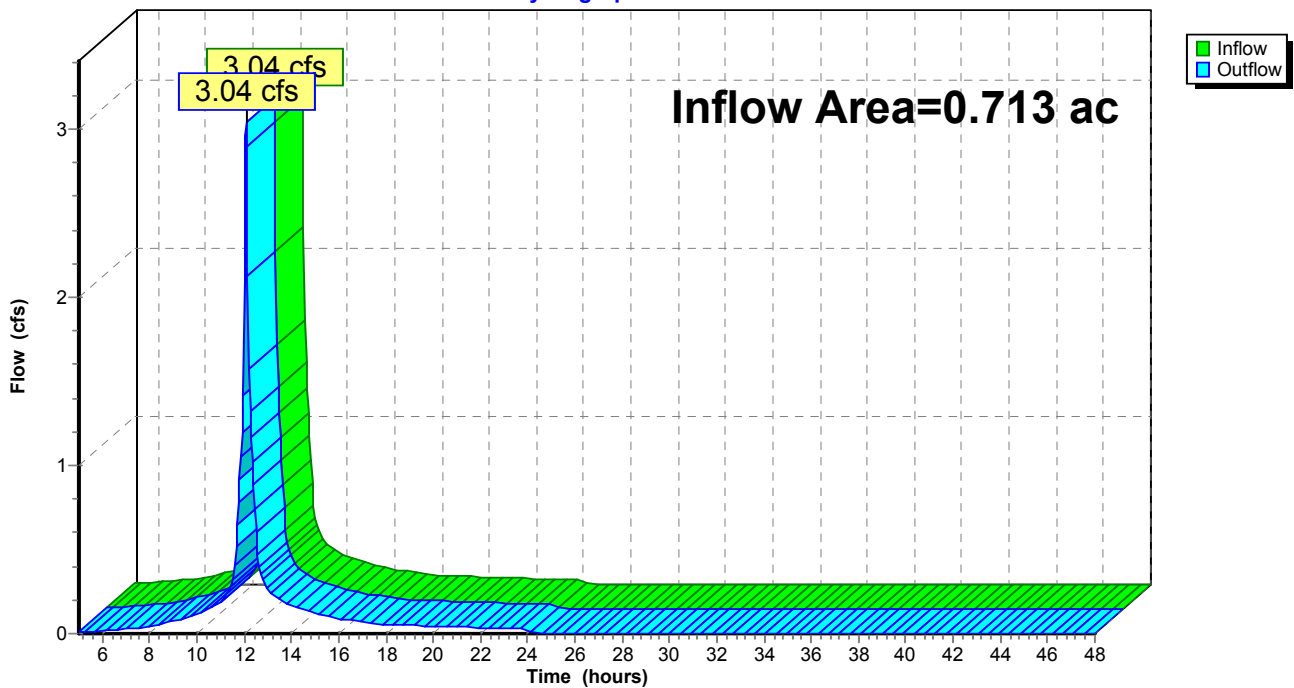
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.713 ac, 0.00% Impervious, Inflow Depth > 3.79" for 10-Year event
Inflow = 3.04 cfs @ 12.07 hrs, Volume= 0.225 af
Outflow = 3.04 cfs @ 12.07 hrs, Volume= 0.225 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

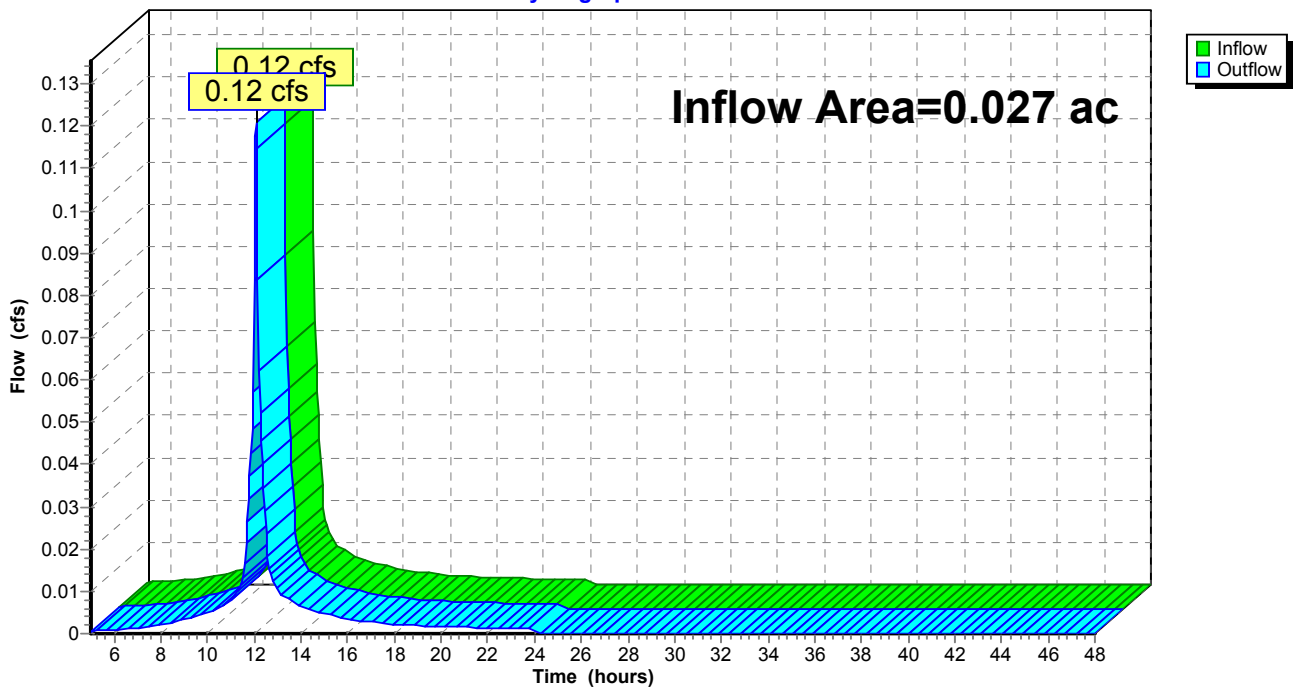
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 0.00% Impervious, Inflow Depth > 3.99" for 10-Year event
Inflow = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af
Outflow = 0.12 cfs @ 12.07 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|---|
| Subcatchment 1S: EAST SITE | Runoff Area=28,338 sf 0.00% Impervious Runoff Depth>4.75" Flow Length=291' Tc=5.4 min CN=91 Runoff=3.41 cfs 0.257 af |
| Subcatchment 2S: WEST SITE | Runoff Area=15,639 sf 0.00% Impervious Runoff Depth>4.64" Tc=5.0 min CN=90 Runoff=1.88 cfs 0.139 af |
| Subcatchment 3S: SOUTH SITE | Runoff Area=31,038 sf 0.00% Impervious Runoff Depth>4.85" Tc=5.0 min CN=92 Runoff=3.85 cfs 0.288 af |
| Subcatchment 4S: DRIVEWAY | Runoff Area=1,192 sf 0.00% Impervious Runoff Depth>5.05" Tc=5.0 min CN=94 Runoff=0.15 cfs 0.012 af |
| Reach DP-1: NORTH/EAST WETLAND | Inflow=3.41 cfs 0.257 af Outflow=3.41 cfs 0.257 af |
| Reach DP-2: WEST WETLAND | Inflow=1.88 cfs 0.139 af Outflow=1.88 cfs 0.139 af |
| Reach DP-3: SOUTH WETLAND | Inflow=3.85 cfs 0.288 af Outflow=3.85 cfs 0.288 af |
| Reach DP-4: HENRY GRAF JR. ROAD | Inflow=0.15 cfs 0.012 af Outflow=0.15 cfs 0.012 af |

Total Runoff Area = 1.749 ac Runoff Volume = 0.696 af Average Runoff Depth = 4.77"
100.00% Pervious = 1.749 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EAST SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 3.41 cfs @ 12.08 hrs, Volume= 0.257 af, Depth> 4.75"

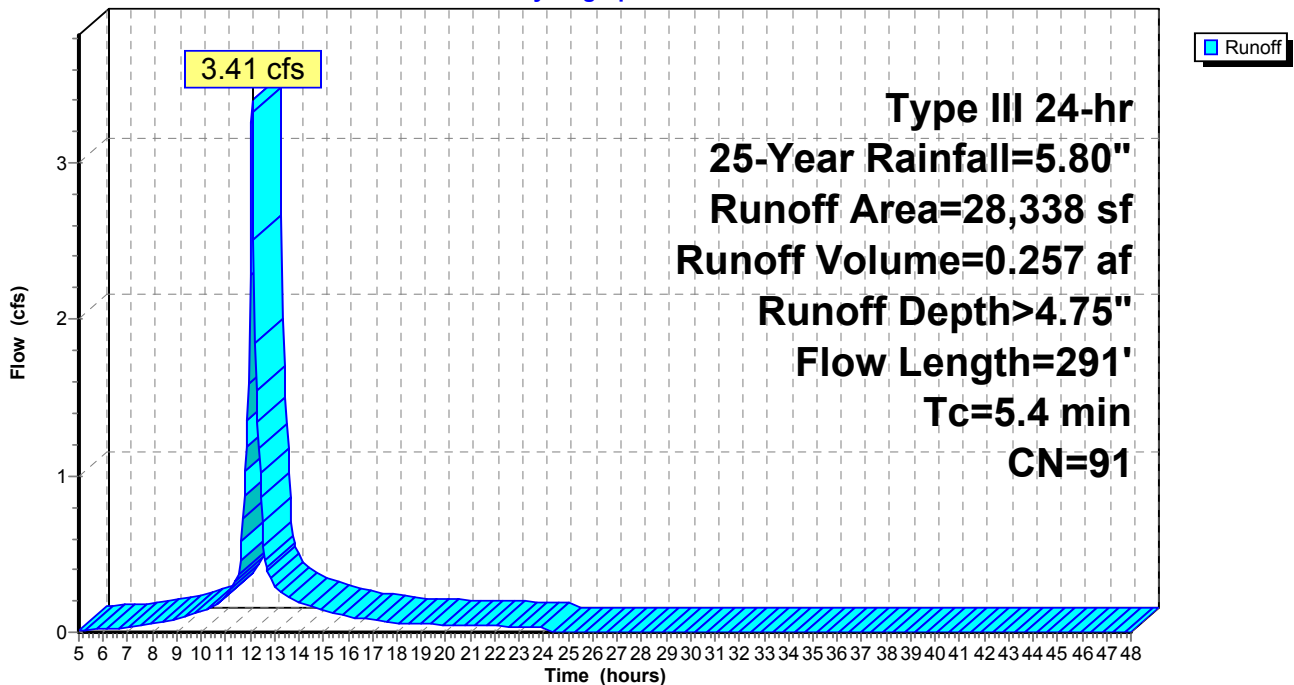
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 4,516 | 73 | Brush, Good, HSG D |
| 23,822 | 94 | Fallow, bare soil, HSG D |
| 28,338 | 91 | Weighted Average |
| 28,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 3.1 | 50 | 0.0100 | 0.27 | | Sheet Flow, SHEET Fallow n= 0.050 P2= 3.20" |
| 2.3 | 241 | 0.0120 | 1.76 | | Shallow Concentrated Flow, SHALLOW CONC. Unpaved Kv= 16.1 fps |
| 5.4 | 291 | Total | | | |

Subcatchment 1S: EAST SITE

Hydrograph



Summary for Subcatchment 2S: WEST SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

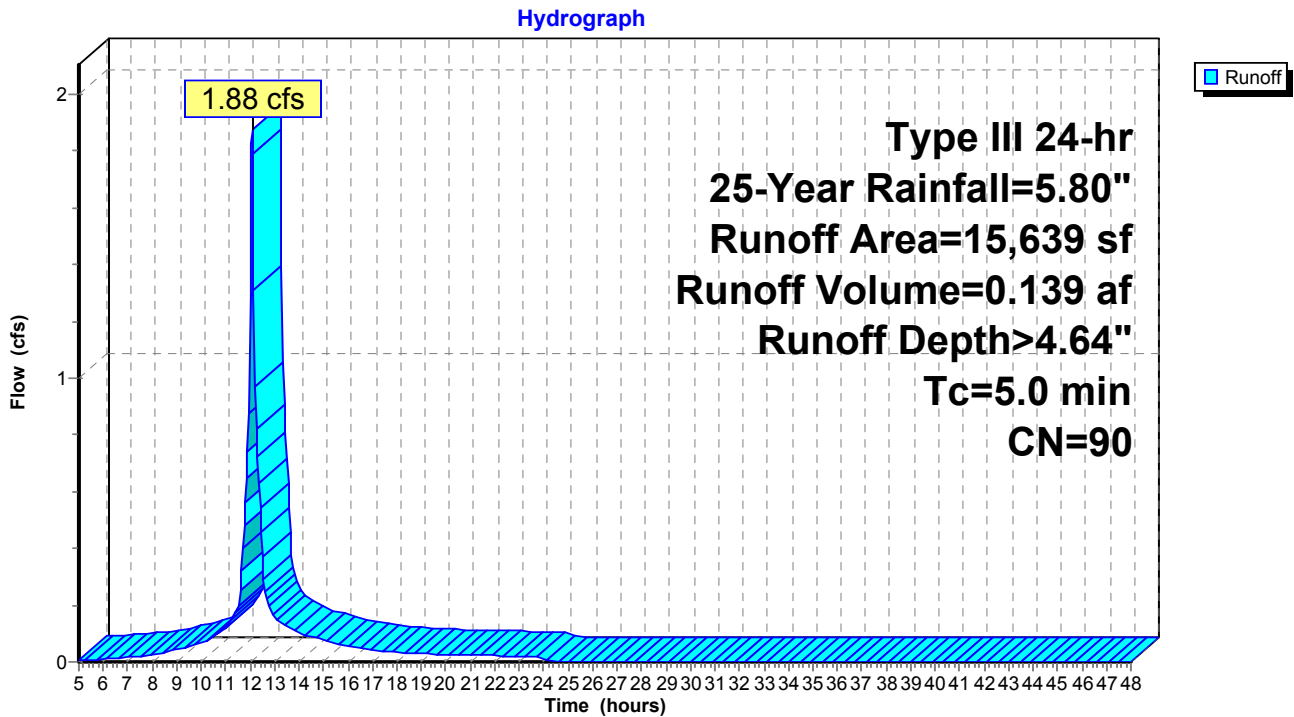
Runoff = 1.88 cfs @ 12.07 hrs, Volume= 0.139 af, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,162 | 73 | Brush, Good, HSG D |
| 12,477 | 94 | Fallow, bare soil, HSG D |
| 15,639 | 90 | Weighted Average |
| 15,639 | | 100.00% Pervious Area |

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

Subcatchment 2S: WEST SITE



Summary for Subcatchment 3S: SOUTH SITE

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.85 cfs @ 12.07 hrs, Volume= 0.288 af, Depth> 4.85"

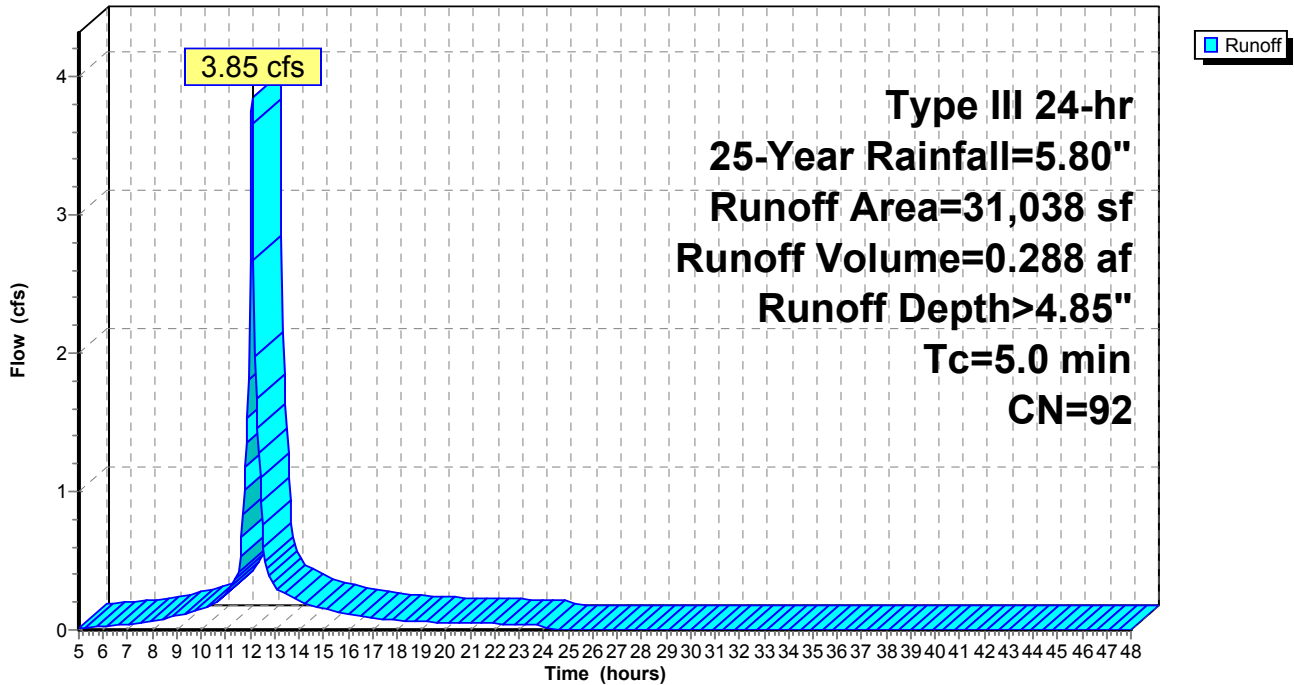
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,337 | 73 | Brush, Good, HSG D |
| 27,701 | 94 | Fallow, bare soil, HSG D |
| 31,038 | 92 | Weighted Average |
| 31,038 | | 100.00% Pervious Area |

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

Subcatchment 3S: SOUTH SITE

Hydrograph



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.15 cfs @ 12.07 hrs, Volume= 0.012 af, Depth> 5.05"

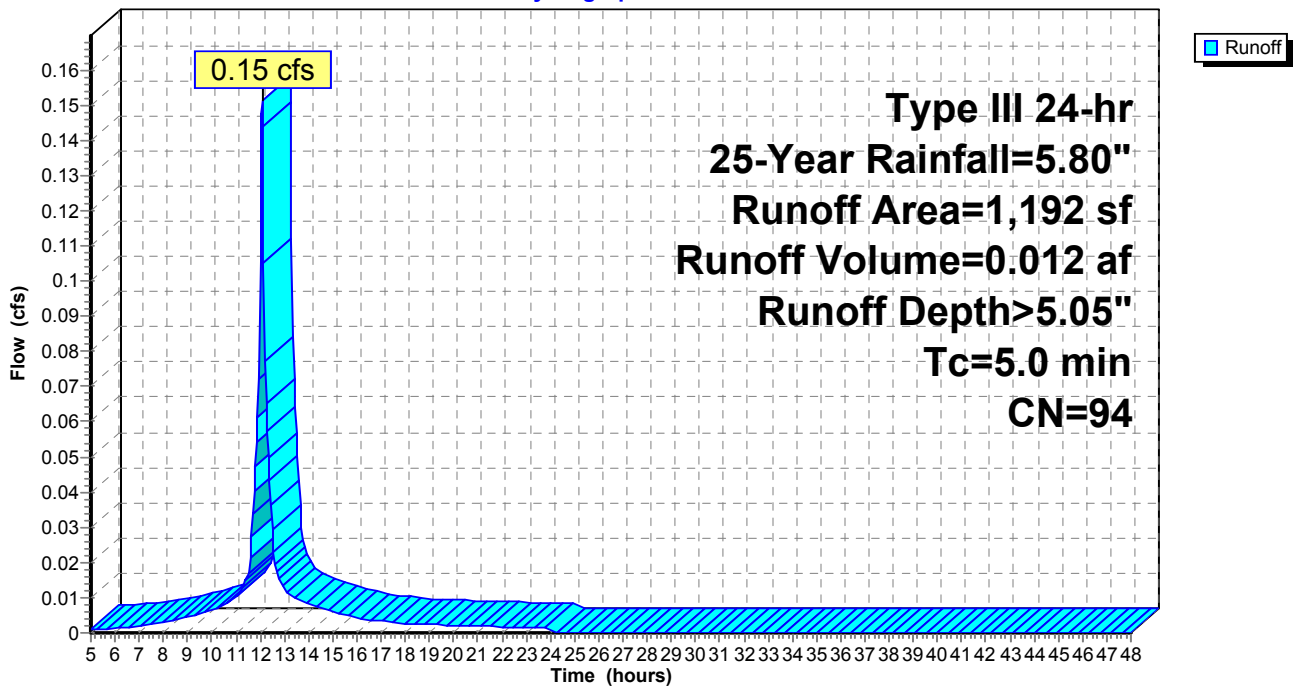
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 1,192 | 94 | Fallow, bare soil, HSG D |
| 1,192 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: NORTH/EAST WETLAND

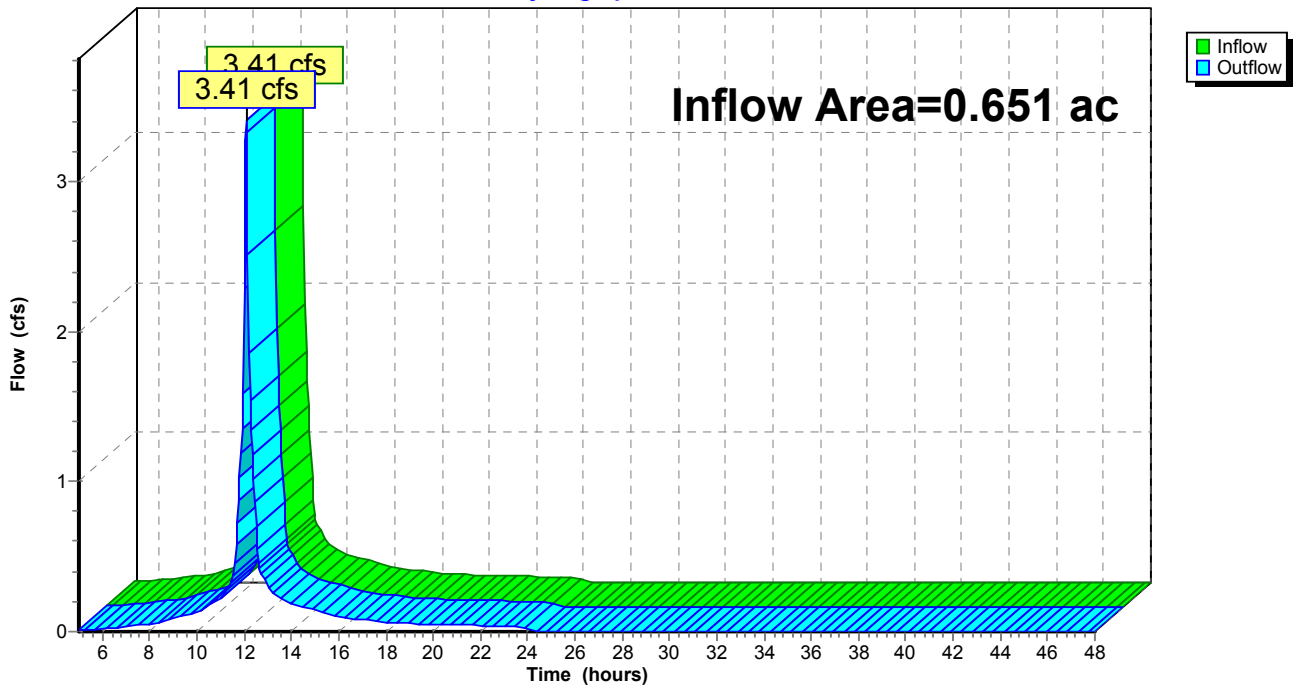
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.651 ac, 0.00% Impervious, Inflow Depth > 4.75" for 25-Year event
Inflow = 3.41 cfs @ 12.08 hrs, Volume= 0.257 af
Outflow = 3.41 cfs @ 12.08 hrs, Volume= 0.257 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: NORTH/EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

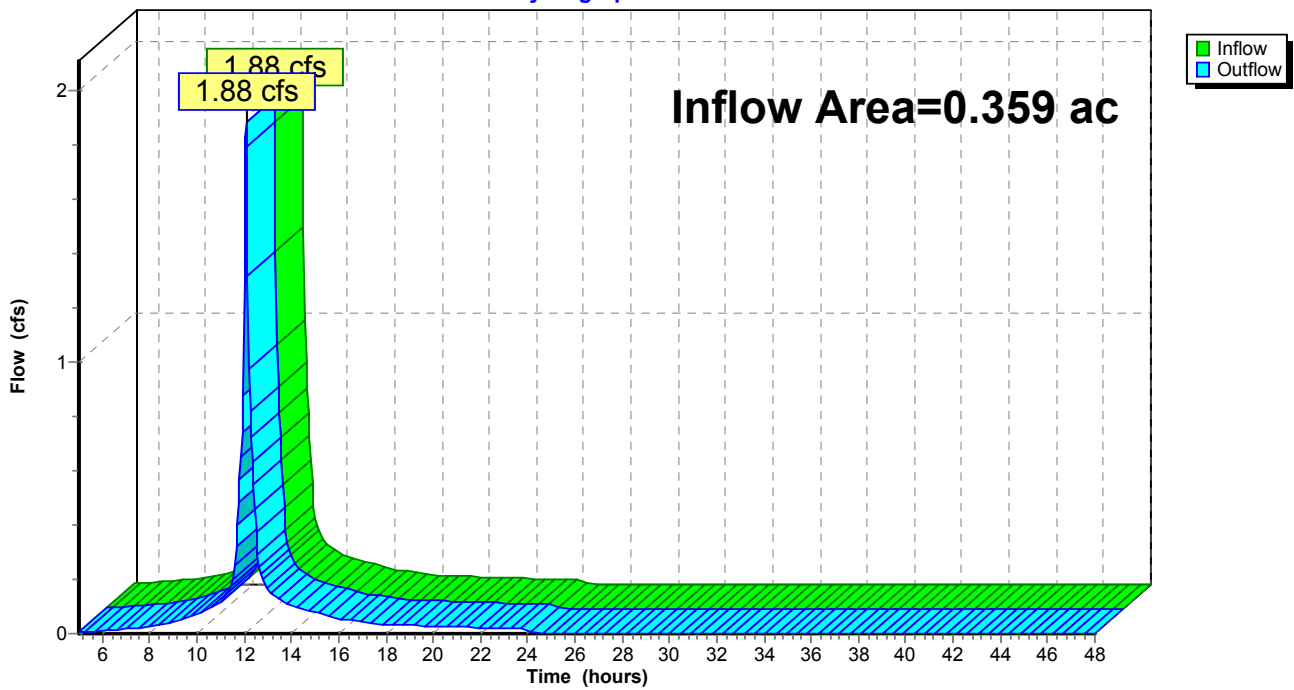
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.359 ac, 0.00% Impervious, Inflow Depth > 4.64" for 25-Year event
Inflow = 1.88 cfs @ 12.07 hrs, Volume= 0.139 af
Outflow = 1.88 cfs @ 12.07 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

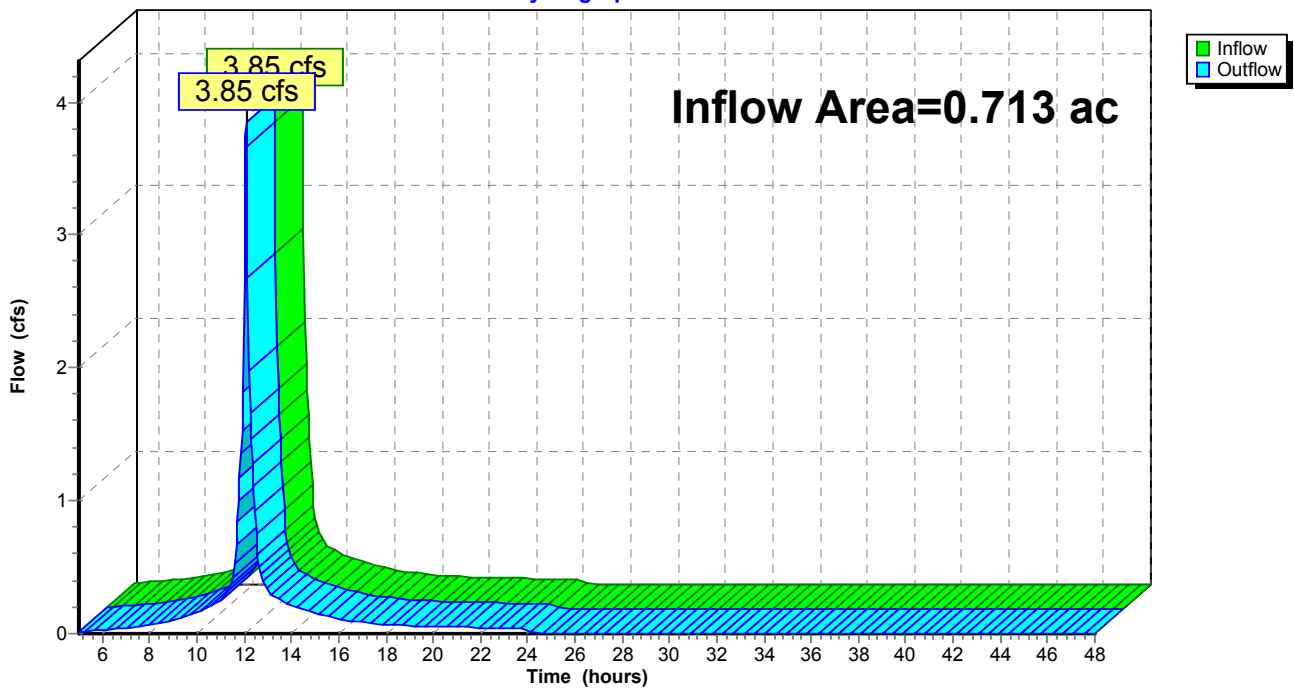
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.713 ac, 0.00% Impervious, Inflow Depth > 4.85" for 25-Year event
Inflow = 3.85 cfs @ 12.07 hrs, Volume= 0.288 af
Outflow = 3.85 cfs @ 12.07 hrs, Volume= 0.288 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

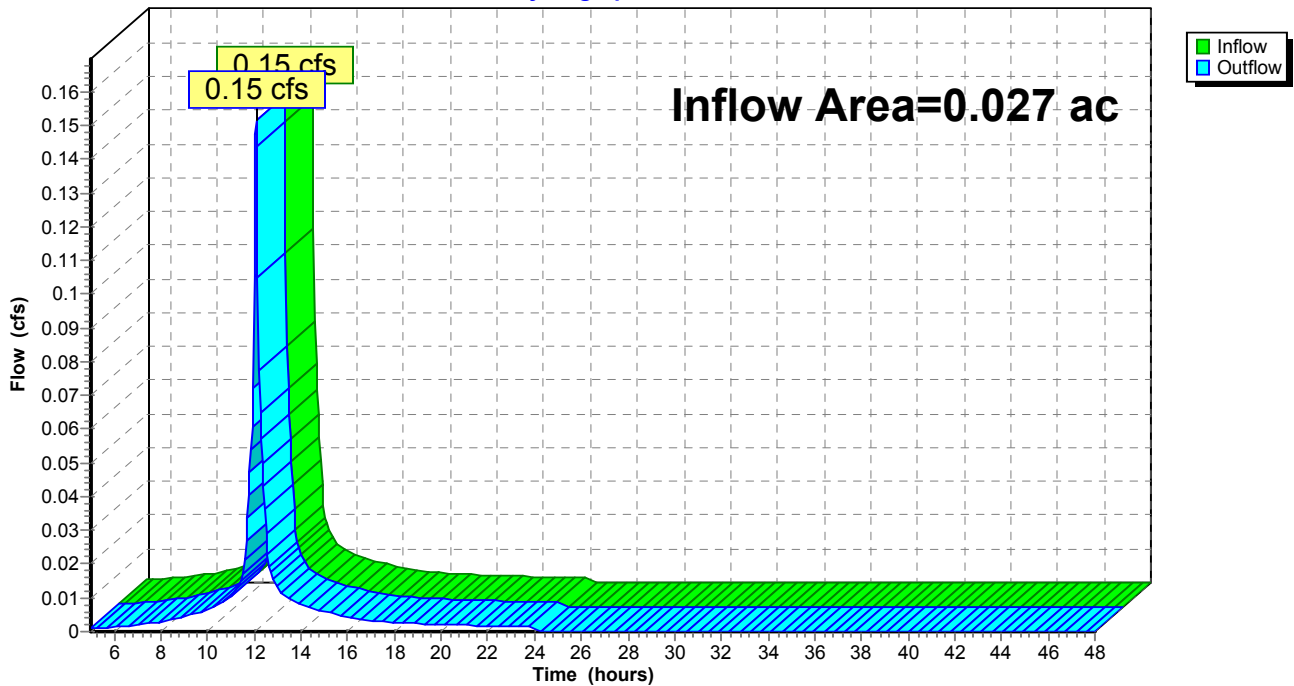
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 0.00% Impervious, Inflow Depth > 5.05" for 25-Year event
Inflow = 0.15 cfs @ 12.07 hrs, Volume= 0.012 af
Outflow = 0.15 cfs @ 12.07 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: EAST SITE Runoff Area=28,338 sf 0.00% Impervious Runoff Depth>7.17"
Flow Length=291' Tc=5.4 min CN=91 Runoff=5.04 cfs 0.389 af

Subcatchment 2S: WEST SITE Runoff Area=15,639 sf 0.00% Impervious Runoff Depth>7.06"
Tc=5.0 min CN=90 Runoff=2.80 cfs 0.211 af

Subcatchment 3S: SOUTH SITE Runoff Area=31,038 sf 0.00% Impervious Runoff Depth>7.27"
Tc=5.0 min CN=92 Runoff=5.66 cfs 0.432 af

Subcatchment 4S: DRIVEWAY Runoff Area=1,192 sf 0.00% Impervious Runoff Depth>7.47"
Tc=5.0 min CN=94 Runoff=0.22 cfs 0.017 af

Reach DP-1: NORTH/EAST WETLAND Inflow=5.04 cfs 0.389 af
Outflow=5.04 cfs 0.389 af

Reach DP-2: WEST WETLAND Inflow=2.80 cfs 0.211 af
Outflow=2.80 cfs 0.211 af

Reach DP-3: SOUTH WETLAND Inflow=5.66 cfs 0.432 af
Outflow=5.66 cfs 0.432 af

Reach DP-4: HENRY GRAF JR. ROAD Inflow=0.22 cfs 0.017 af
Outflow=0.22 cfs 0.017 af

Total Runoff Area = 1.749 ac Runoff Volume = 1.048 af Average Runoff Depth = 7.19"
100.00% Pervious = 1.749 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EAST SITE

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.04 cfs @ 12.08 hrs, Volume= 0.389 af, Depth> 7.17"

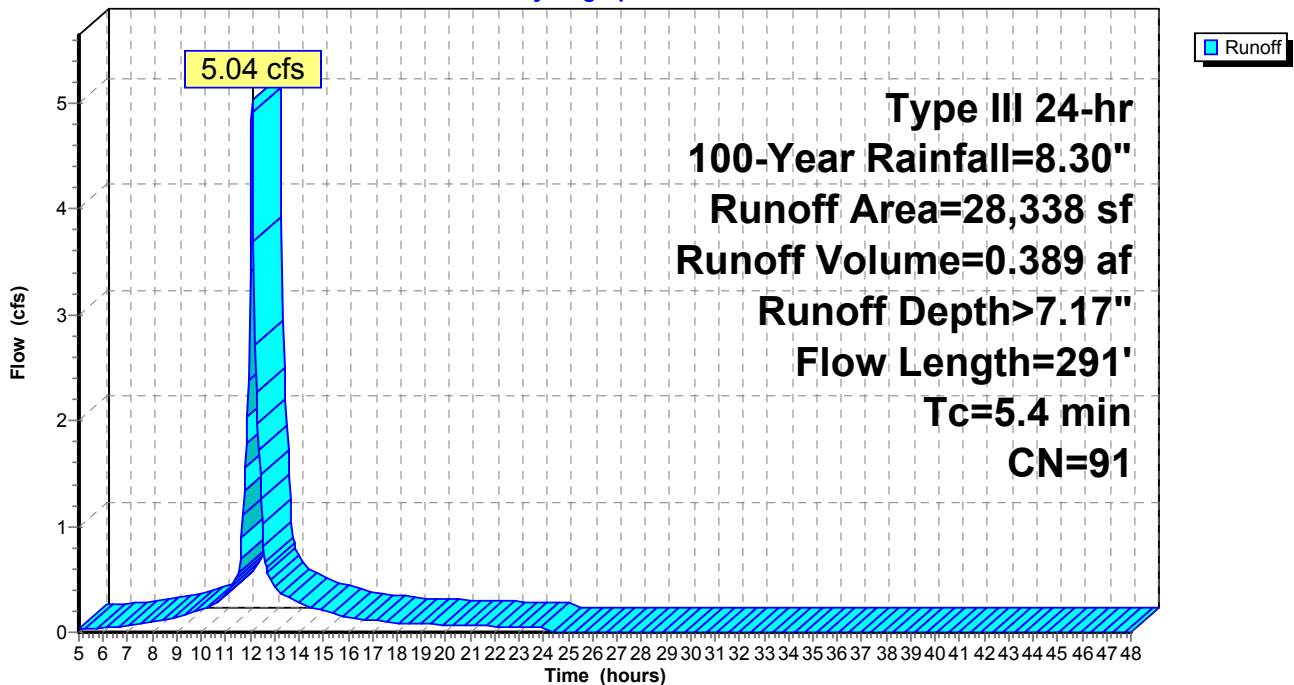
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 4,516 | 73 | Brush, Good, HSG D |
| 23,822 | 94 | Fallow, bare soil, HSG D |
| 28,338 | 91 | Weighted Average |
| 28,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---|
| 3.1 | 50 | 0.0100 | 0.27 | | Sheet Flow, SHEET Fallow n= 0.050 P2= 3.20" |
| 2.3 | 241 | 0.0120 | 1.76 | | Shallow Concentrated Flow, SHALLOW CONC. Unpaved Kv= 16.1 fps |
| 5.4 | 291 | Total | | | |

Subcatchment 1S: EAST SITE

Hydrograph



Summary for Subcatchment 2S: WEST SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

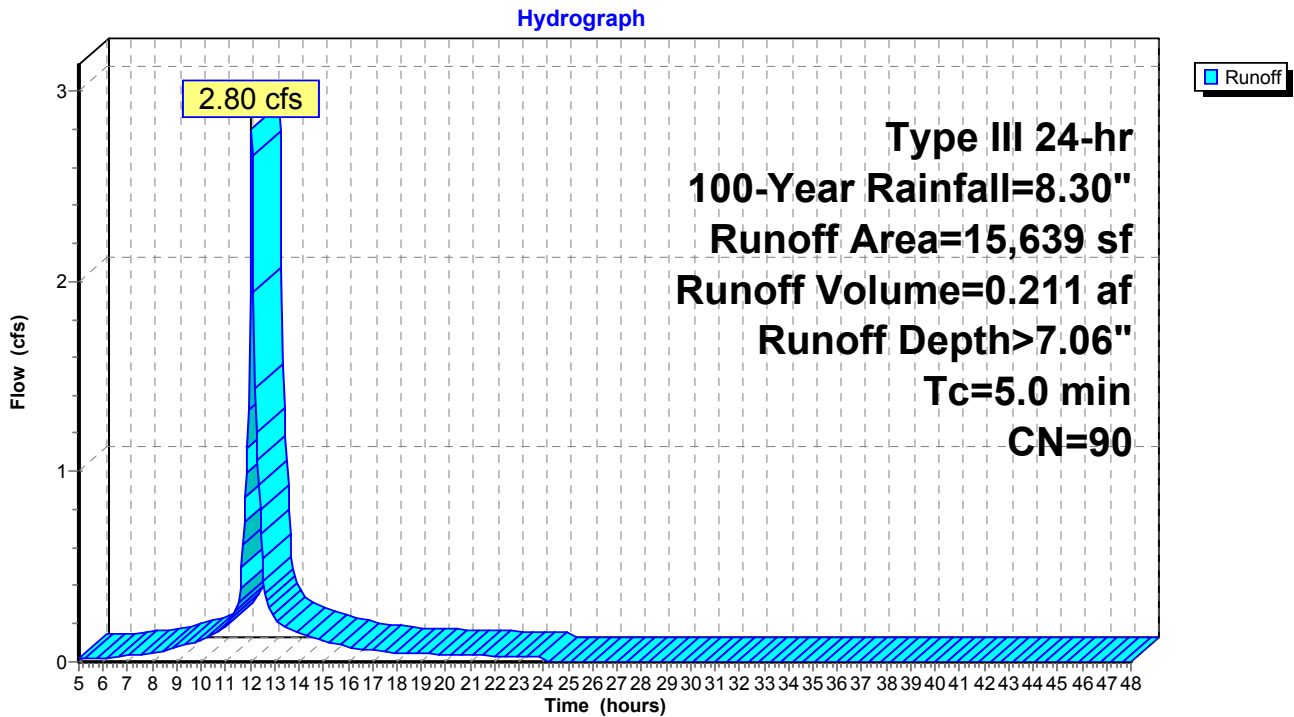
Runoff = 2.80 cfs @ 12.07 hrs, Volume= 0.211 af, Depth> 7.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,162 | 73 | Brush, Good, HSG D |
| 12,477 | 94 | Fallow, bare soil, HSG D |
| 15,639 | 90 | Weighted Average |
| 15,639 | | 100.00% Pervious Area |

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

Subcatchment 2S: WEST SITE



Summary for Subcatchment 3S: SOUTH SITE

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 5.66 cfs @ 12.07 hrs, Volume= 0.432 af, Depth> 7.27"

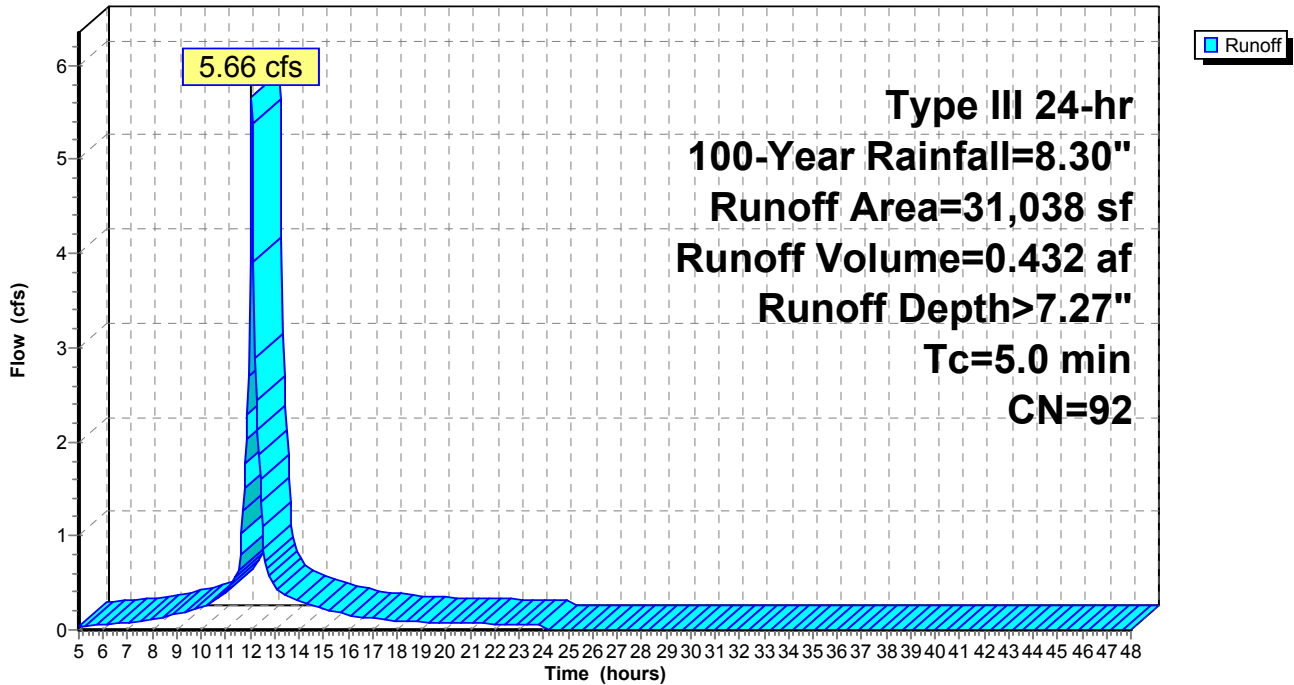
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 3,337 | 73 | Brush, Good, HSG D |
| 27,701 | 94 | Fallow, bare soil, HSG D |
| 31,038 | 92 | Weighted Average |
| 31,038 | | 100.00% Pervious Area |

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

Subcatchment 3S: SOUTH SITE

Hydrograph



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.22 cfs @ 12.07 hrs, Volume= 0.017 af, Depth> 7.47"

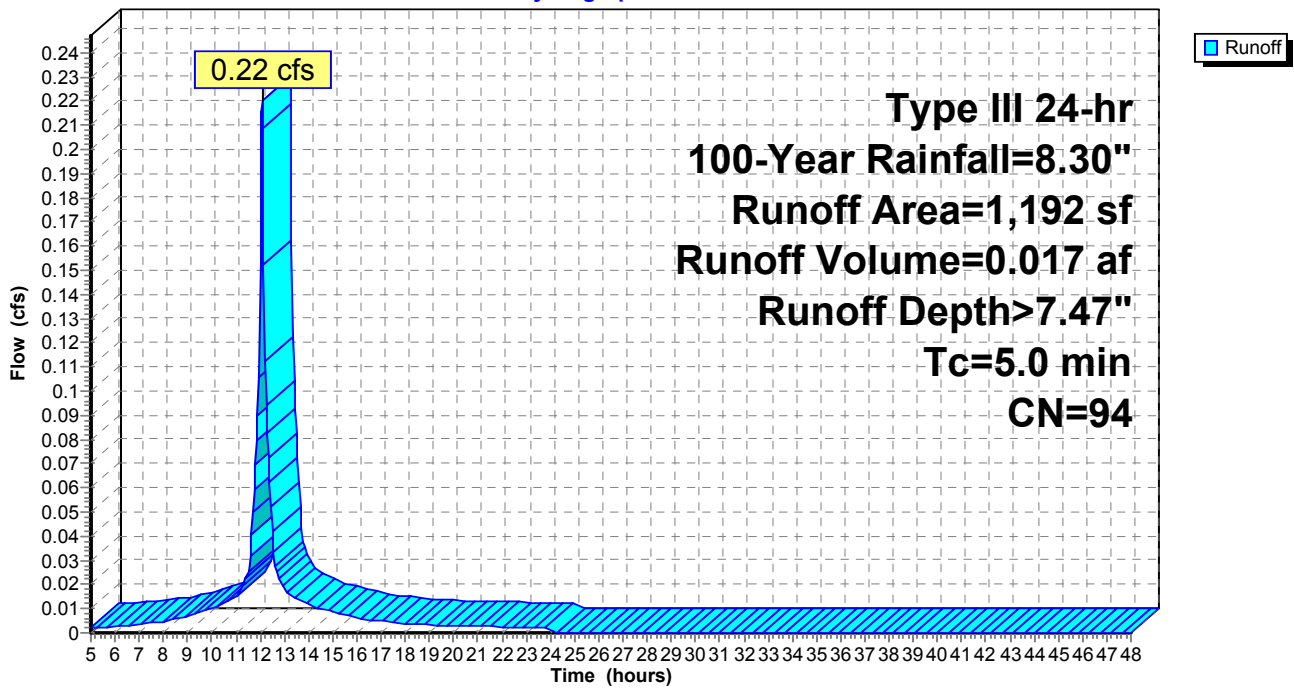
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| 1,192 | 94 | Fallow, bare soil, HSG D |
| 1,192 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: NORTH/EAST WETLAND

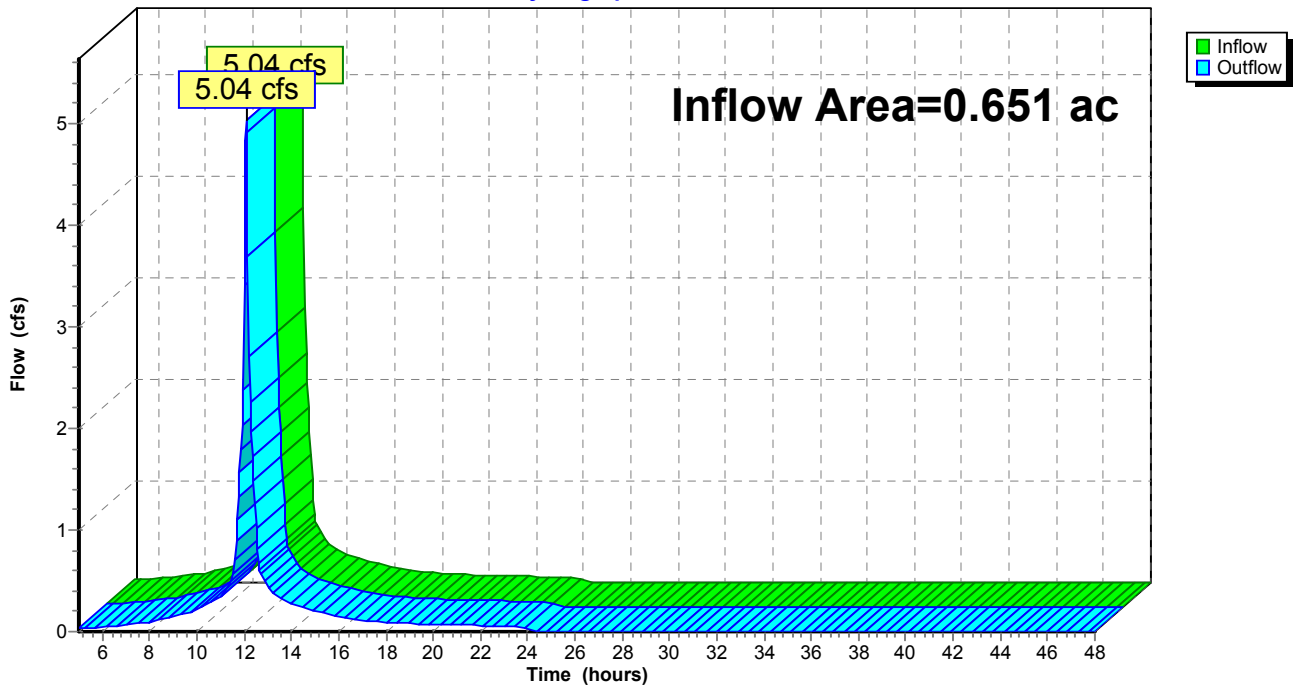
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.651 ac, 0.00% Impervious, Inflow Depth > 7.17" for 100-Year event
Inflow = 5.04 cfs @ 12.08 hrs, Volume= 0.389 af
Outflow = 5.04 cfs @ 12.08 hrs, Volume= 0.389 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: NORTH/EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

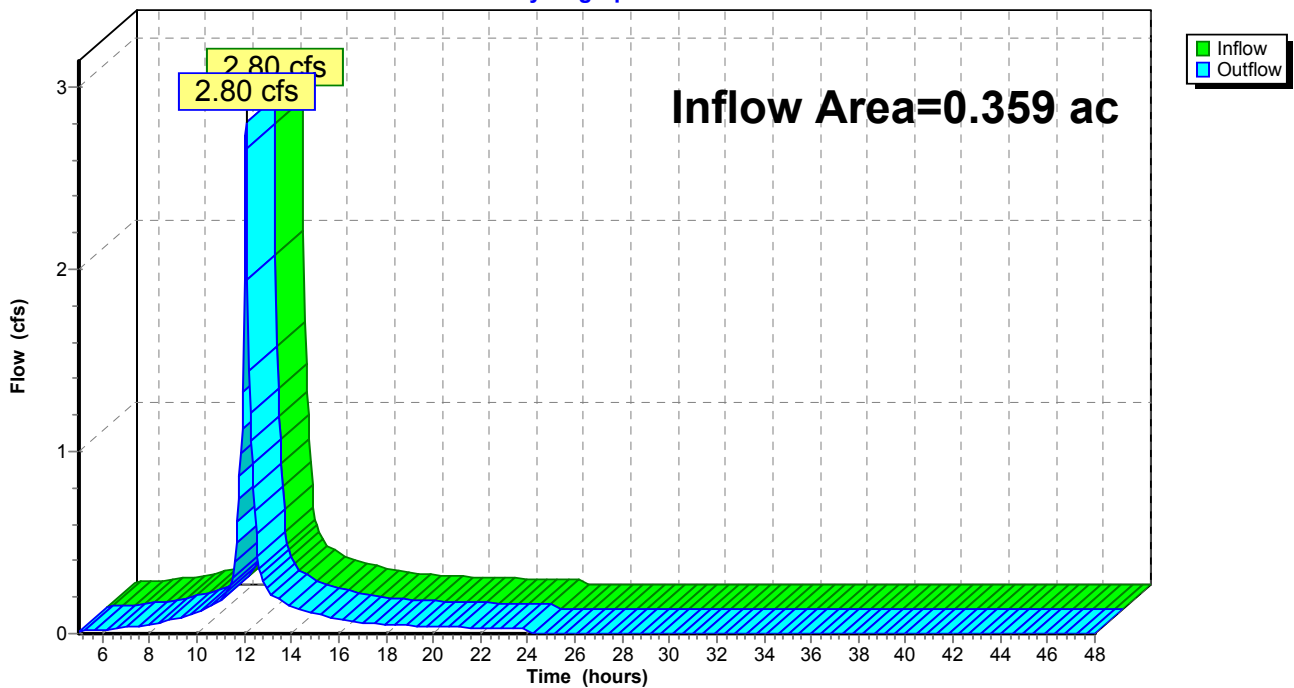
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.359 ac, 0.00% Impervious, Inflow Depth > 7.06" for 100-Year event
Inflow = 2.80 cfs @ 12.07 hrs, Volume= 0.211 af
Outflow = 2.80 cfs @ 12.07 hrs, Volume= 0.211 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

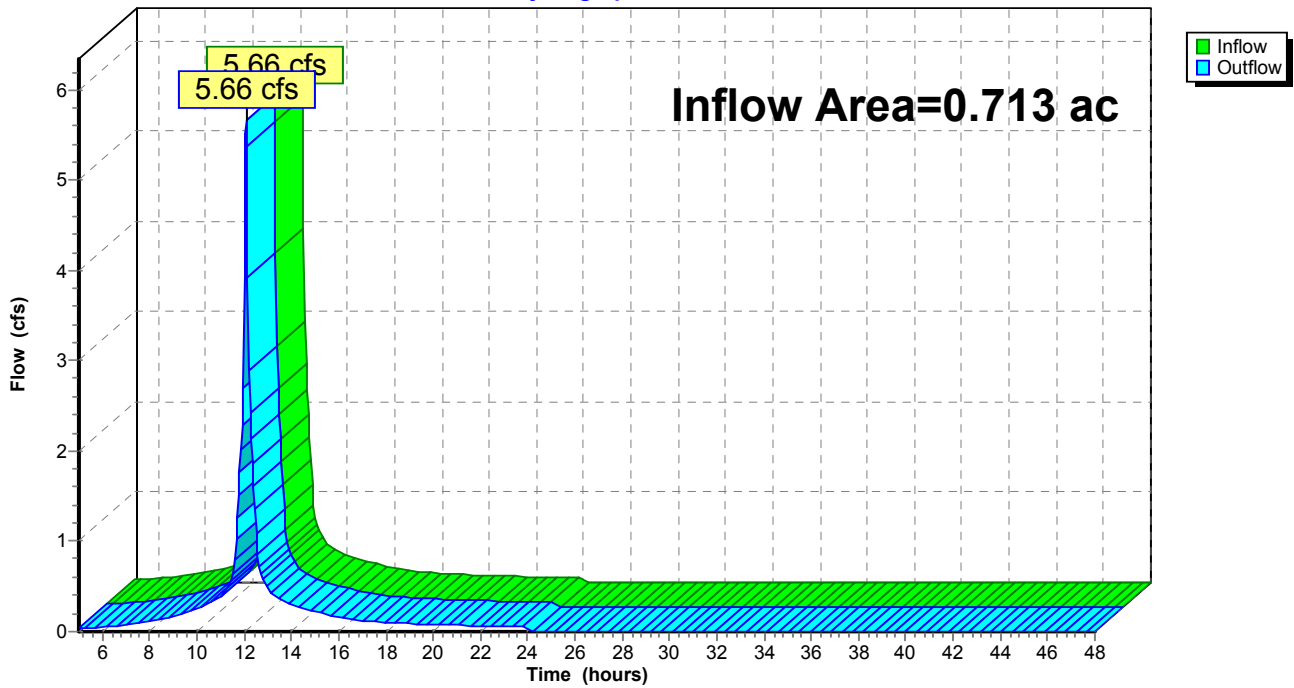
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.713 ac, 0.00% Impervious, Inflow Depth > 7.27" for 100-Year event
Inflow = 5.66 cfs @ 12.07 hrs, Volume= 0.432 af
Outflow = 5.66 cfs @ 12.07 hrs, Volume= 0.432 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

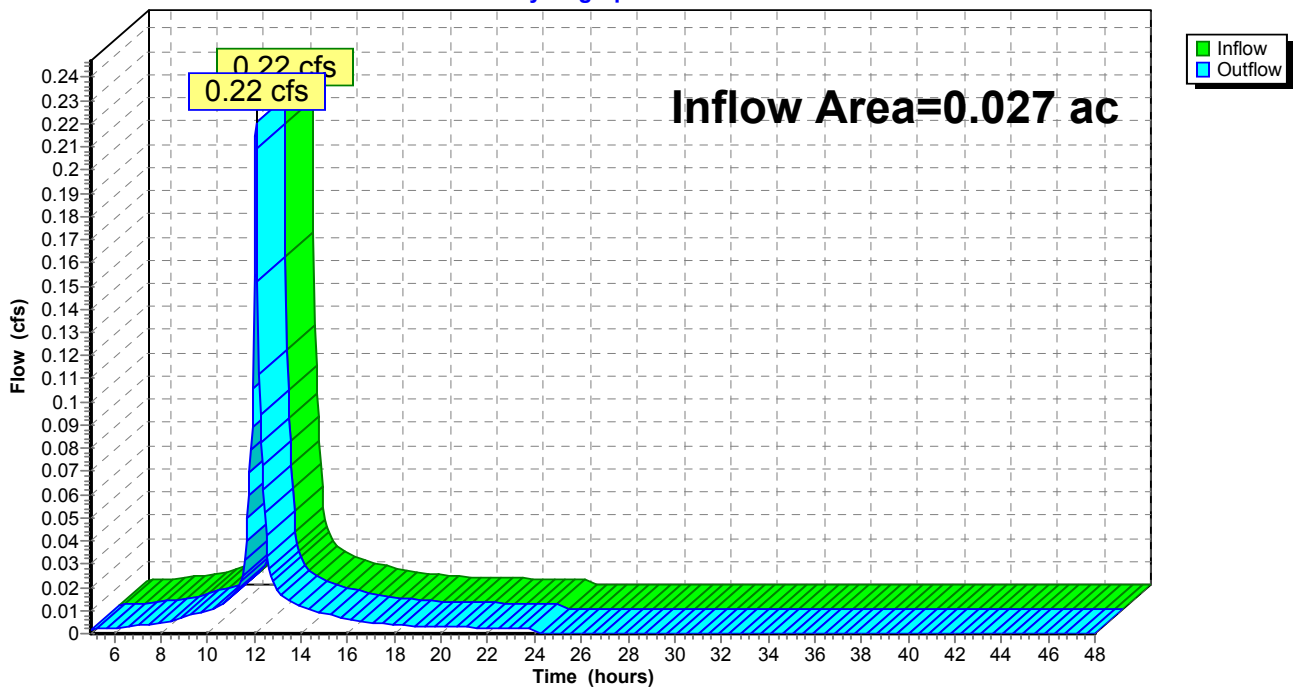
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 0.00% Impervious, Inflow Depth > 7.47" for 100-Year event
Inflow = 0.22 cfs @ 12.07 hrs, Volume= 0.017 af
Outflow = 0.22 cfs @ 12.07 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

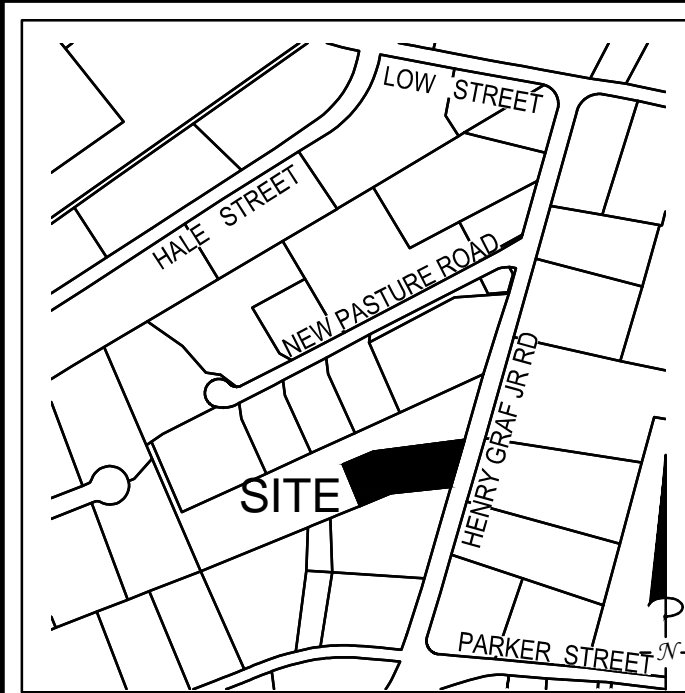
Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



A P P E N D I X B

Post-Development Condition



LOCUS MAP
Not to Scale

ABBREVIATIONS

| | |
|-----------|------------------------------|
| FFE | FIRST FLOOR ELEVATION |
| BIT CONC. | BITUMINOUS CONCRETE PAVEMENT |
| CCB | CAPE COD BERM |
| CCM | CONC. CEMENT CONCRETE |
| CCC | CEMENT CONCRETE CURB |
| C.I. | CAST IRON |
| C.L. | CEMENT LINED |
| EP | EDGE OF PAVEMENT |
| BC | BITUMINOUS CONCRETE CURB |
| (AM) | AS MEASURED |
| RET WALL | RETAINING WALL |
| CONC. | CONCRETE |
| RCP | REINFORCED CONCRETE PIPE |
| VCC | VERTICAL GRANITE CURB |
| ETW | EDGE OF TRAVEL WAY |
| MTL | METAL BERM |
| VCC | VERTICAL CONCRETE CURB |
| CMP | CORRUGATED METAL PIPE |
| LSA | LANDSCAPED AREA |
| TRANS. | TRANSFORMER |
| GEN. | GENERATOR |
| HOPE | HIGH-DENSITY POLYETHYLENE |

LEGEND

SURVEY SYMBOLS

- REBAR
- ∨ ANGLE IRON
- CB/DH □ CONCRETE BOUND WITH DRILL HOLE
- SB □ STONE BOUND
- SB/DH □ STONE BOUND

UTILITY SYMBOLS

- CHIMNEY
- ELECTRIC HAND HOLE
- GUY POLE
- GUY WIRE
- HYVAC UNIT
- BUILDING LIGHT W/MAST
- BUILDING LIGHT
- TRANSFORMER
- WATER GATE
- EXHAUST VENT
- AIR VENT
- DRAINAGE SUMP
- EMH
- SMH
- DMH
- TMH
- CBN
- DRAINAGE CATCH BASIN
- DOOR WAY THRESHOLD
- HYDRANT
- POST INDICATOR VALVE
- UTILITY POLE
- YARD LIGHT
- RIP RAP
- BOLLARD
- SIGN
- FIRE ALARM
- DECIDUOUS TREE
- CONIFEROUS TREE

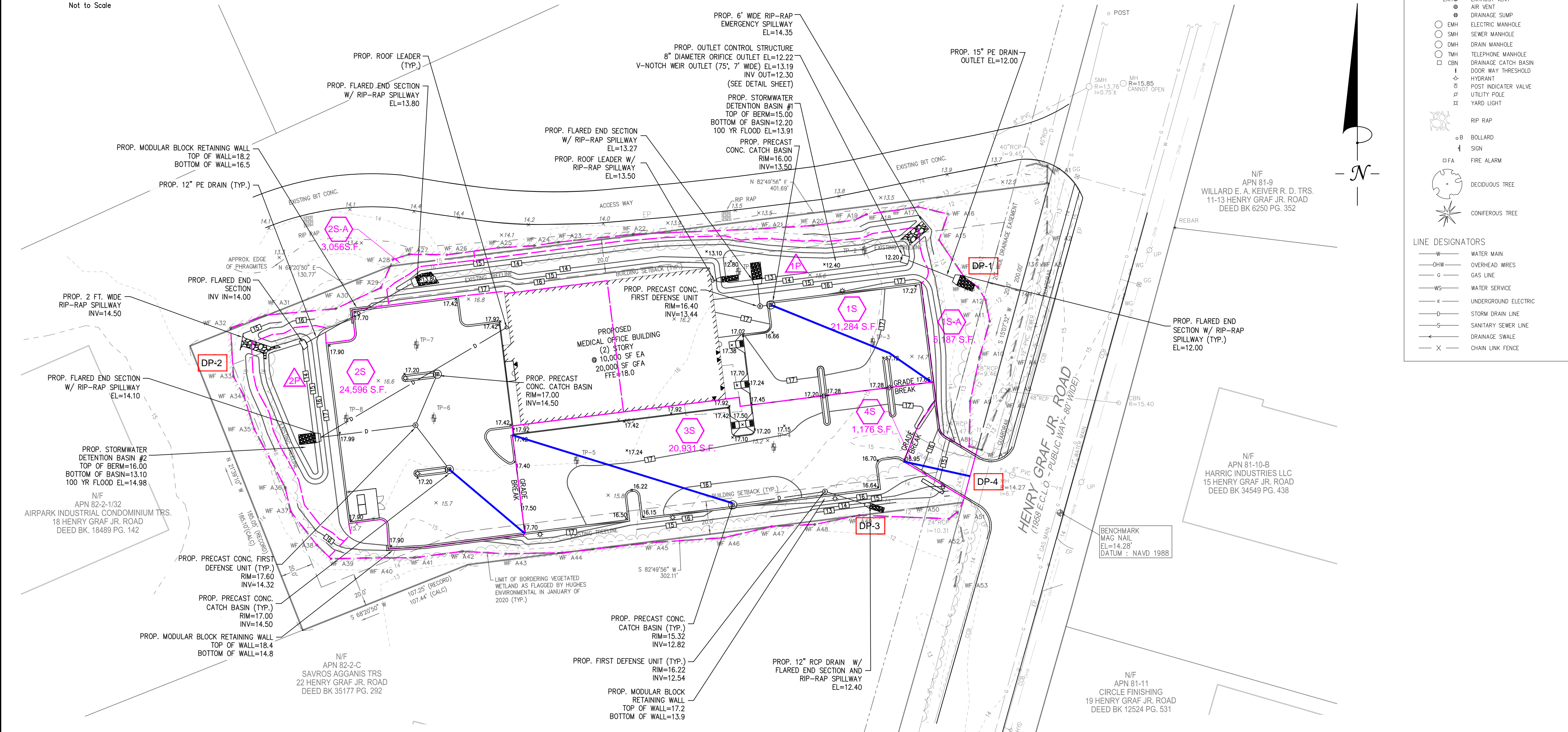
LINE DESIGNATORS

- W WATER MAIN
- OHW OVERHEAD WIRES
- G GAS LINE
- WS WATER SERVICE
- e UNDERGROUND ELECTRIC
- D STORM DRAIN LINE
- S SANITARY SEWER LINE
- SW DRAINAGE SWALE
- X CHAIN LINK FENCE

| REV | DATE | DESCRIPTION | BY | APP |
|-----|------|-------------|----|-----|
| | | | | |
| | | | | |
| | | | | |
| | | | | |



**SITE DEVELOPMENT PLAN
PROPOSED MEDICAL BUILDING
20 HENRY GRAF JR. ROAD
NEWBURYPORT, MASSACHUSETTS**



PROFESSIONAL ENGINEER:

APPLICANT:
**SPORTS MEDICINE NORTH
ORTHOPEDIC SURGERY, INC.
C/O CONSERV GROUP, INC.**
110 STATE ROAD
SAGAMORE BEACH, MASSACHUSETTS 02562

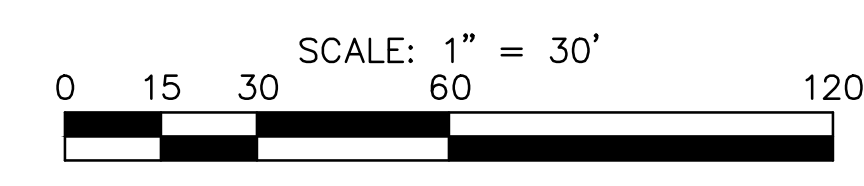
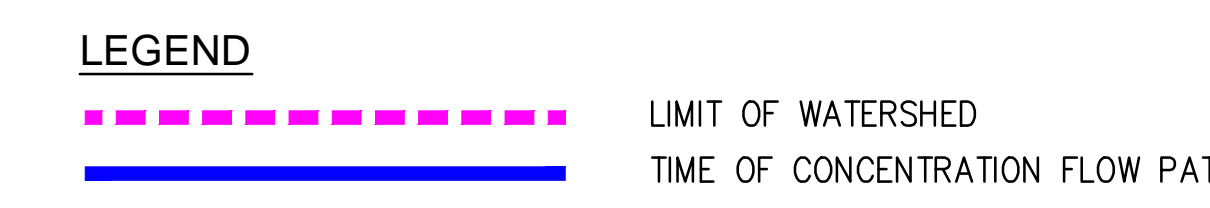
NOT FOR CONSTRUCTION

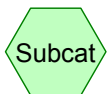
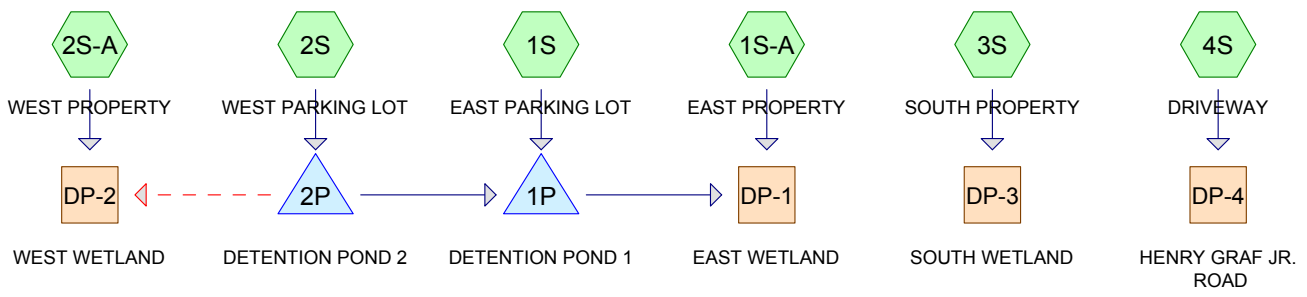
DRAWN BY: ESS
DESIGNED BY: ESS
CHECKED BY: BCM
APPROVED BY: BCM
DATE: MARCH 17, 2020
SCALE: 1" = 30'
PROJECT NO.: 219-180
DWG. TITLE:
**POST-DEV.
WATERSHED
PLAN**

DWG. NO.: **WS-2**

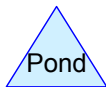
SOIL KEY

| SOIL CLASSIFICATION | DESCRIPTION | HYDROLOGIC SOIL GROUP |
|---------------------|--------------------------------|-----------------------|
| 16A | SCANTIC SILT LOAM, 0-3% SLOPES | C/D |





Reach



Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|--|
| 0.658 | 80 | >75% Grass cover, Good, HSG D (1S, 1S-A, 2S, 2S-A, 3S) |
| 0.861 | 98 | Paved parking, HSG D (1S, 2S, 3S, 4S) |
| 0.230 | 98 | Roofs, HSG D (1S, 2S) |
| 1.750 | 91 | TOTAL AREA |

Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|-----------------|---------------|----------------------------|
| 0.000 | HSG A | |
| 0.000 | HSG B | |
| 0.000 | HSG C | |
| 1.750 | HSG D | 1S, 1S-A, 2S, 2S-A, 3S, 4S |
| 0.000 | Other | |
| 1.750 | | TOTAL AREA |

Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------------|------------------------------|
| 0.000 | 0.000 | 0.000 | 0.658 | 0.000 | 0.658 | >75% Grass cover, Good | 1S, 1S-A, 2S, 2S-A, 3S |
| 0.000 | 0.000 | 0.000 | 0.861 | 0.000 | 0.861 | Paved parking | 1S, 2S, 3S, 4S |
| 0.000 | 0.000 | 0.000 | 0.230 | 0.000 | 0.230 | Roofs | 1S, 2S |
| 0.000 | 0.000 | 0.000 | 1.750 | 0.000 | 1.750 | TOTAL AREA | |

Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|-------|-------------|------------------|-------------------|---------------|---------------|-------|---------------------|-----------------|----------------------|
| 1 | 1P | 12.30 | 12.00 | 37.0 | 0.0081 | 0.013 | 15.0 | 0.0 | 0.0 |
| 2 | 2P | 14.00 | 13.80 | 68.0 | 0.0029 | 0.013 | 12.0 | 0.0 | 0.0 |

Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|---|
| Subcatchment 1S: EAST PARKING LOT | Runoff Area=21,284 sf 56.30% Impervious Runoff Depth=2.08" Tc=5.0 min CN=90 Runoff=1.18 cfs 0.085 af |
| Subcatchment 1S-A: EAST PROPERTY | Runoff Area=5,187 sf 0.00% Impervious Runoff Depth=1.33" Tc=5.0 min CN=80 Runoff=0.18 cfs 0.013 af |
| Subcatchment 2S: WEST PARKING LOT | Runoff Area=24,596 sf 78.23% Impervious Runoff Depth>2.44" Tc=5.0 min CN=94 Runoff=1.56 cfs 0.115 af |
| Subcatchment 2S-A: WEST PROPERTY | Runoff Area=3,056 sf 0.00% Impervious Runoff Depth=1.33" Tc=5.0 min CN=80 Runoff=0.11 cfs 0.008 af |
| Subcatchment 3S: SOUTH PROPERTY | Runoff Area=20,931 sf 72.46% Impervious Runoff Depth>2.35" Tc=5.0 min CN=93 Runoff=1.29 cfs 0.094 af |
| Subcatchment 4S: DRIVEWAY | Runoff Area=1,176 sf 100.00% Impervious Runoff Depth>2.82" Tc=5.0 min CN=98 Runoff=0.08 cfs 0.006 af |
| Reach DP-1: EAST WETLAND | Inflow=1.42 cfs 0.208 af Outflow=1.42 cfs 0.208 af |
| Reach DP-2: WEST WETLAND | Inflow=0.38 cfs 0.012 af Outflow=0.38 cfs 0.012 af |
| Reach DP-3: SOUTH WETLAND | Inflow=1.29 cfs 0.094 af Outflow=1.29 cfs 0.094 af |
| Reach DP-4: HENRY GRAF JR. ROAD | Inflow=0.08 cfs 0.006 af Outflow=0.08 cfs 0.006 af |
| Pond 1P: DETENTION POND 1 | Peak Elev=13.18' Storage=794 cf Inflow=2.00 cfs 0.195 af Outflow=1.33 cfs 0.195 af |
| Pond 2P: DETENTION POND 2 | Peak Elev=14.63' Storage=859 cf Inflow=1.56 cfs 0.115 af Primary=0.90 cfs 0.110 af Secondary=0.30 cfs 0.005 af Outflow=1.20 cfs 0.115 af |

Total Runoff Area = 1.750 ac Runoff Volume = 0.321 af Average Runoff Depth = 2.20"
37.60% Pervious = 0.658 ac 62.40% Impervious = 1.092 ac

Summary for Subcatchment 1S: EAST PARKING LOT

[49] Hint: Tc<2dt may require smaller dt

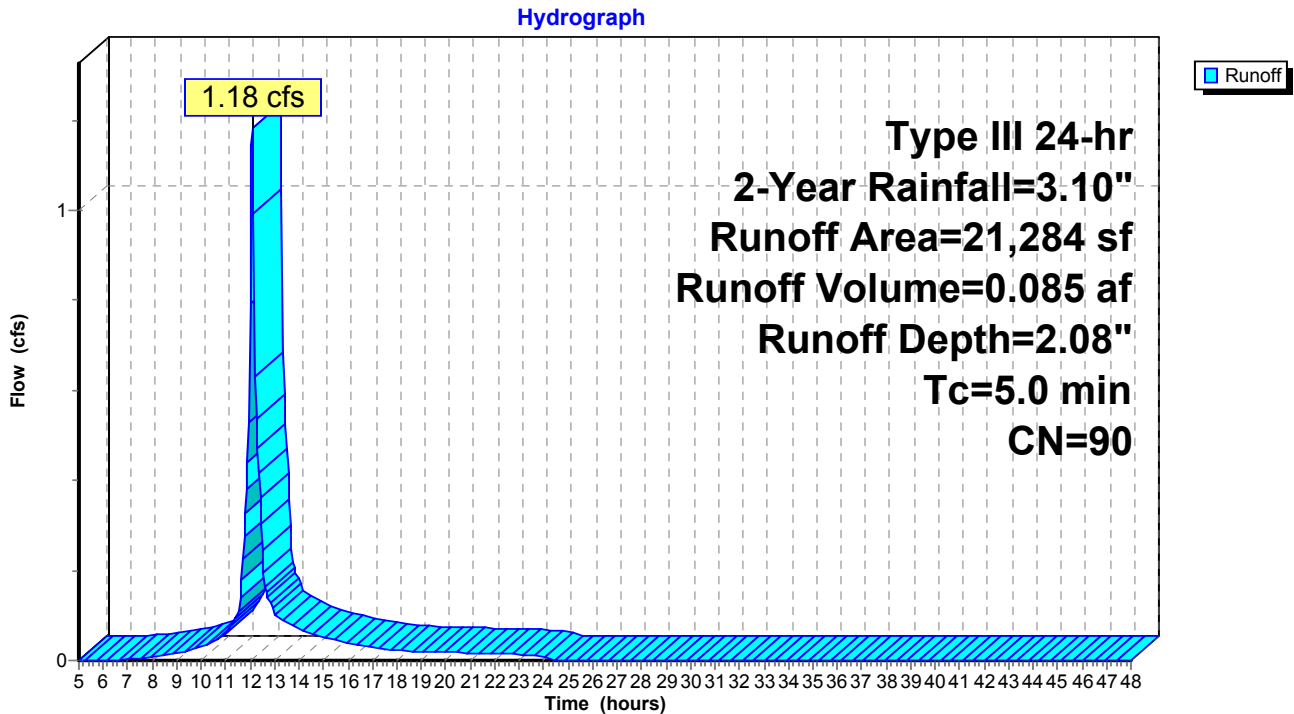
Runoff = 1.18 cfs @ 12.07 hrs, Volume= 0.085 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 9,235 | 80 | >75% Grass cover, Good, HSG D |
| 67 | 80 | >75% Grass cover, Good, HSG D |
| 6,962 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 21,284 | 90 | Weighted Average |
| 9,302 | | 43.70% Pervious Area |
| 11,982 | | 56.30% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S: EAST PARKING LOT



Summary for Subcatchment 1S-A: EAST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.013 af, Depth= 1.33"

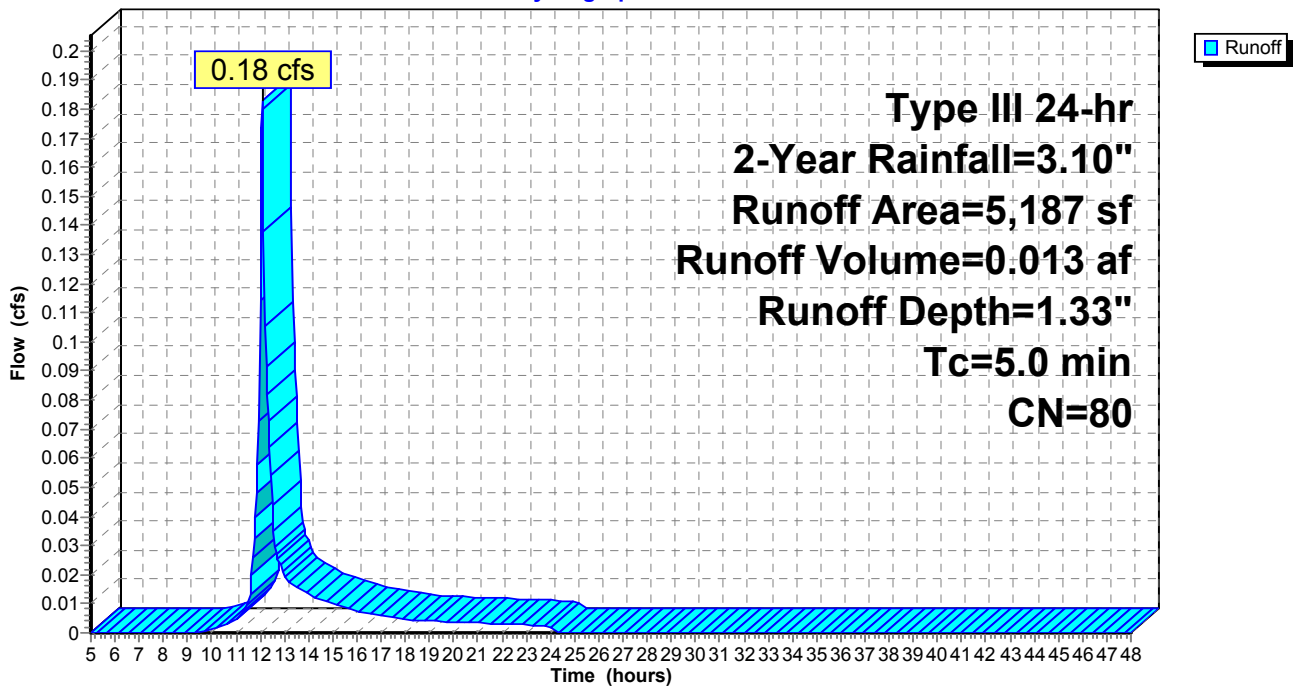
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,187 | 80 | >75% Grass cover, Good, HSG D |
| 5,187 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S-A: EAST PROPERTY

Hydrograph



Summary for Subcatchment 2S: WEST PARKING LOT

[49] Hint: $T_c < 2dt$ may require smaller dt

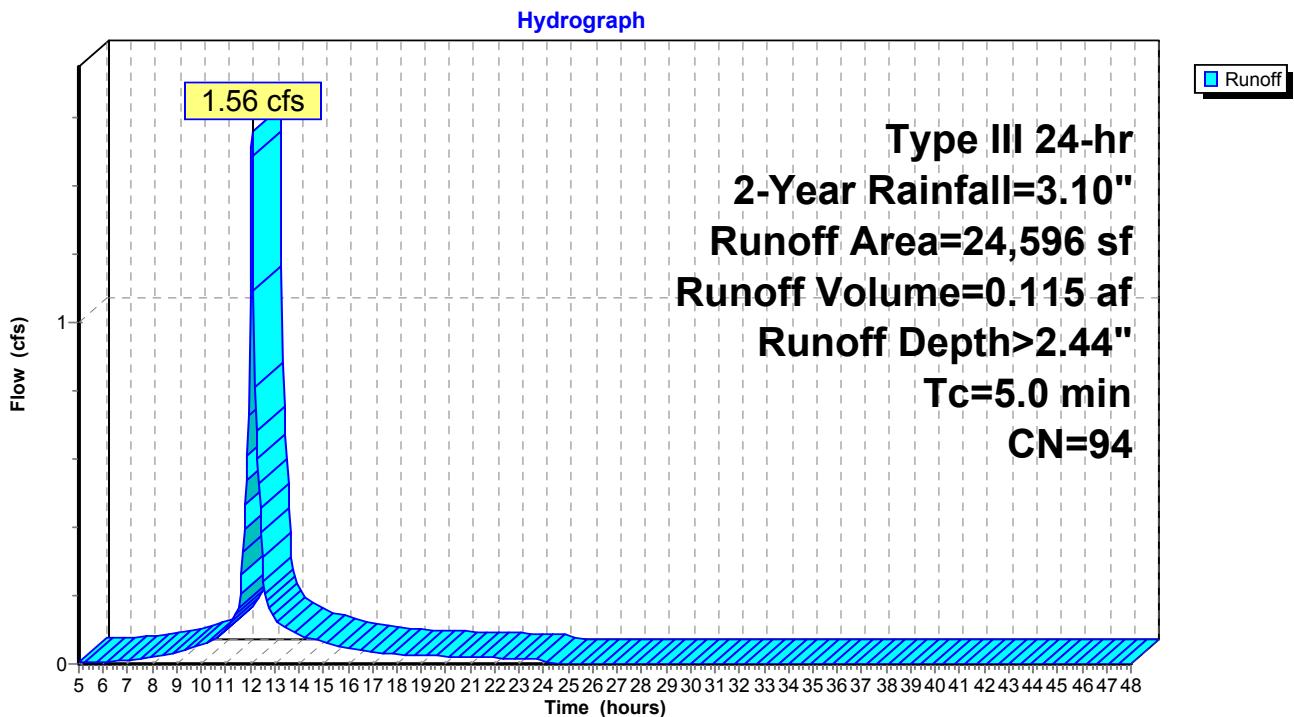
Runoff = 1.56 cfs @ 12.07 hrs, Volume= 0.115 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,354 | 80 | >75% Grass cover, Good, HSG D |
| 14,222 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 24,596 | 94 | Weighted Average |
| 5,354 | | 21.77% Pervious Area |
| 19,242 | | 78.23% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S: WEST PARKING LOT



Summary for Subcatchment 2S-A: WEST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.11 cfs @ 12.08 hrs, Volume= 0.008 af, Depth= 1.33"

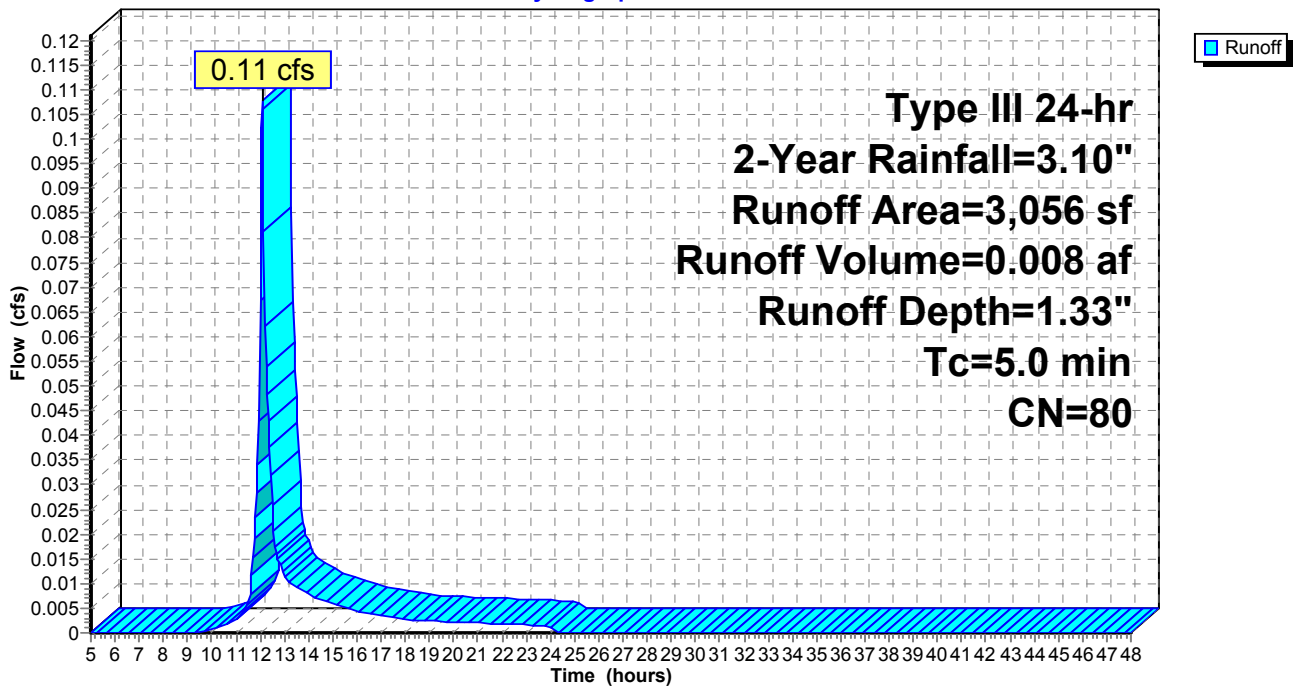
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,056 | 80 | >75% Grass cover, Good, HSG D |
| 3,056 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S-A: WEST PROPERTY

Hydrograph



Summary for Subcatchment 3S: SOUTH PROPERTY

[49] Hint: $T_c < 2dt$ may require smaller dt

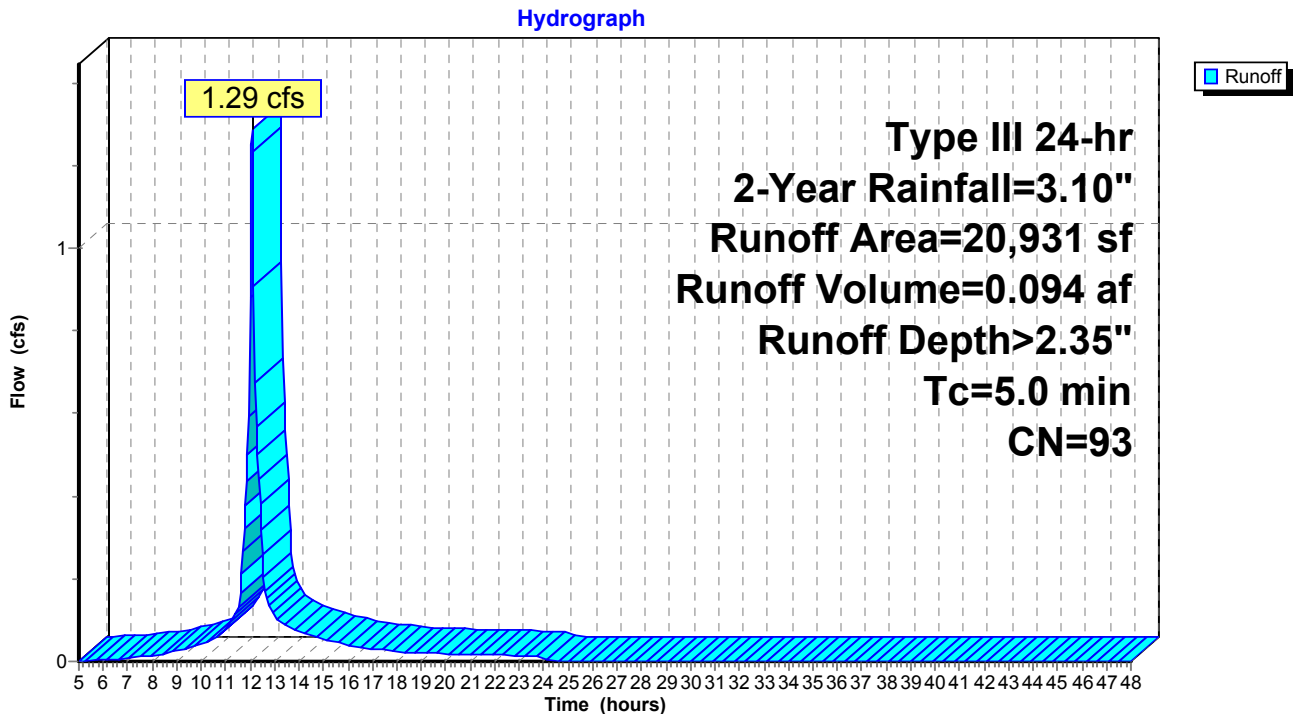
Runoff = 1.29 cfs @ 12.07 hrs, Volume= 0.094 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 15,166 | 98 | Paved parking, HSG D |
| 5,765 | 80 | >75% Grass cover, Good, HSG D |
| 20,931 | 93 | Weighted Average |
| 5,765 | | 27.54% Pervious Area |
| 15,166 | | 72.46% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 3S: SOUTH PROPERTY



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Depth> 2.82"

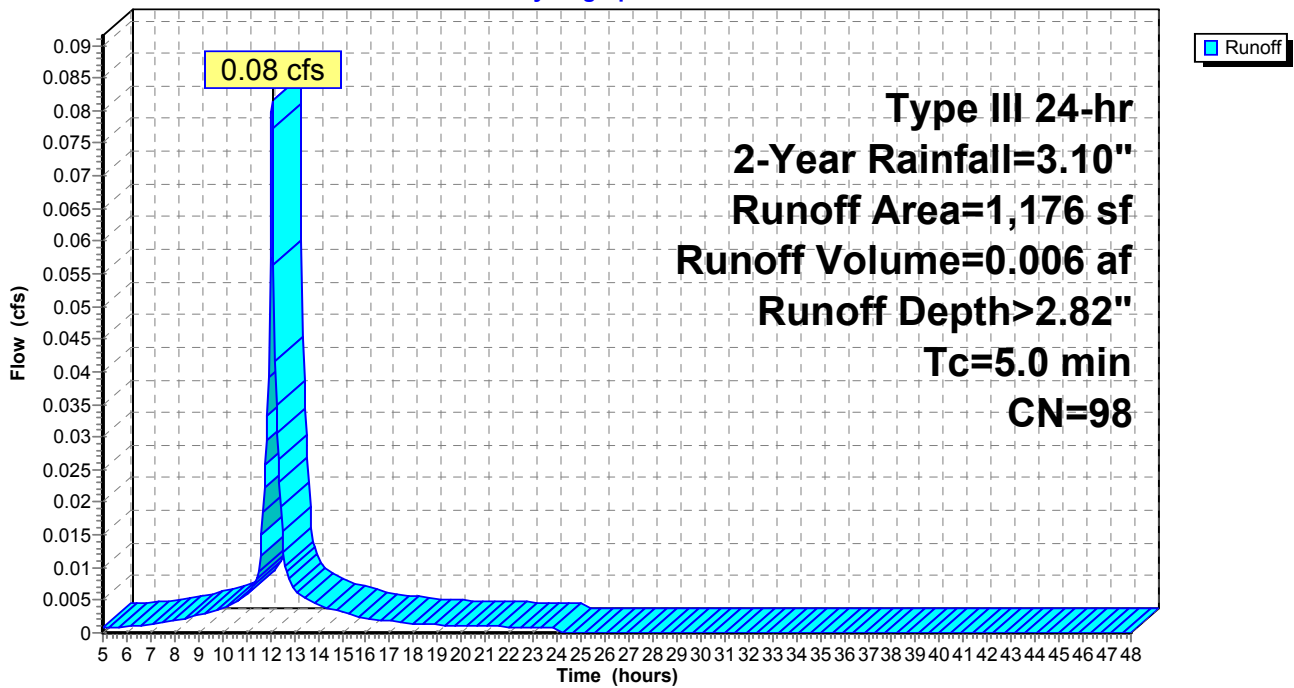
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,176 | 98 | Paved parking, HSG D |
| 1,176 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: EAST WETLAND

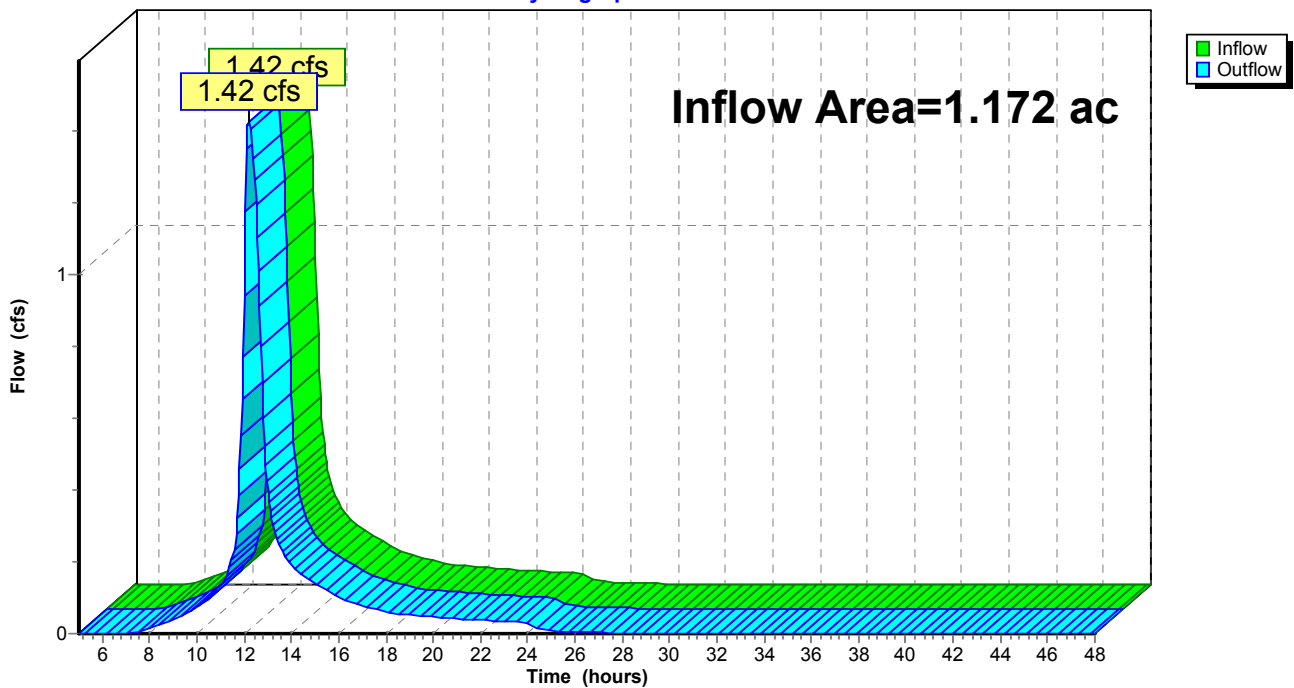
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.172 ac, 61.14% Impervious, Inflow Depth = 2.13" for 2-Year event
Inflow = 1.42 cfs @ 12.21 hrs, Volume= 0.208 af
Outflow = 1.42 cfs @ 12.21 hrs, Volume= 0.208 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

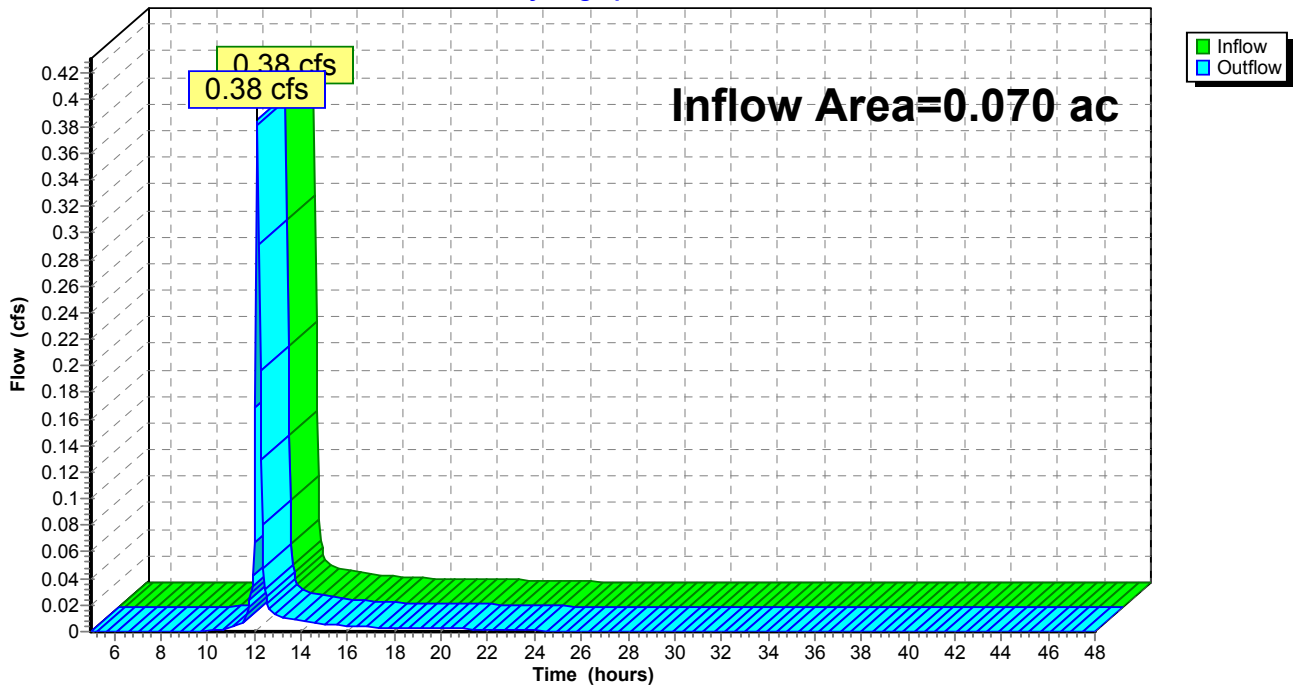
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.070 ac, 0.00% Impervious, Inflow Depth = 2.11" for 2-Year event
Inflow = 0.38 cfs @ 12.14 hrs, Volume= 0.012 af
Outflow = 0.38 cfs @ 12.14 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

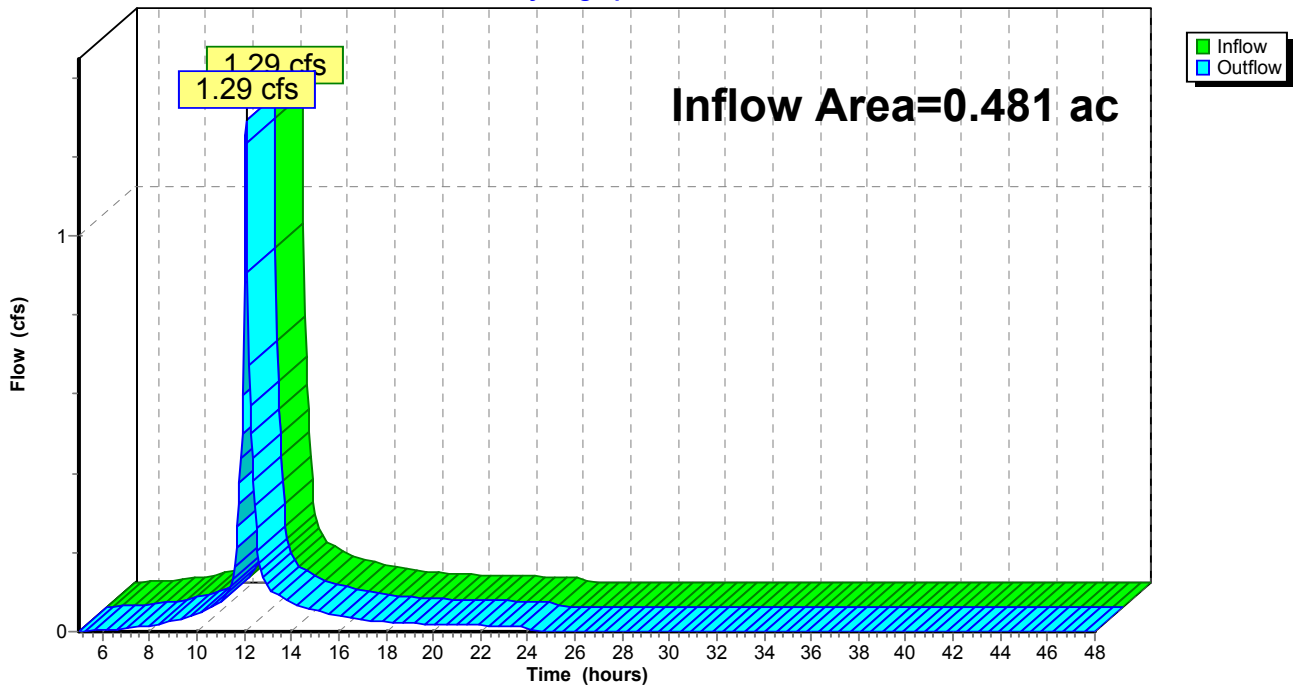
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.481 ac, 72.46% Impervious, Inflow Depth > 2.35" for 2-Year event
Inflow = 1.29 cfs @ 12.07 hrs, Volume= 0.094 af
Outflow = 1.29 cfs @ 12.07 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

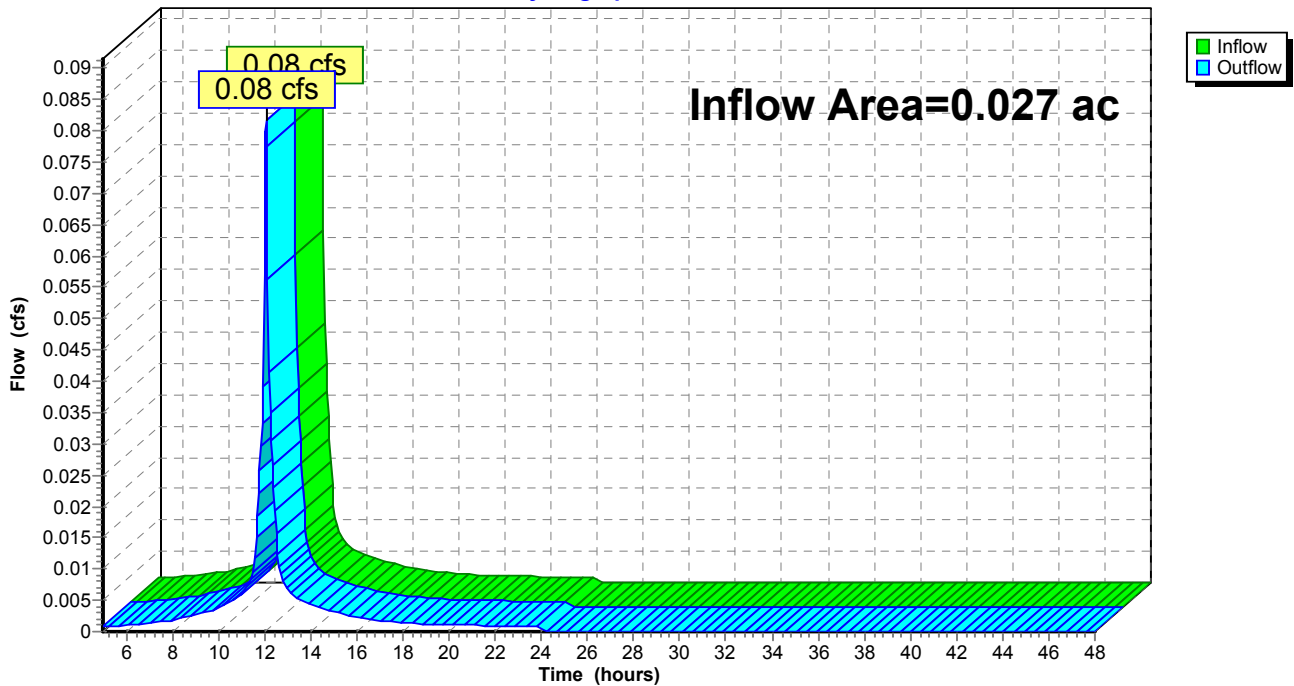
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 100.00% Impervious, Inflow Depth > 2.82" for 2-Year event
Inflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af
Outflow = 0.08 cfs @ 12.07 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Summary for Pond 1P: DETENTION POND 1

Inflow Area = 1.053 ac, 68.06% Impervious, Inflow Depth = 2.22" for 2-Year event
 Inflow = 2.00 cfs @ 12.09 hrs, Volume= 0.195 af
 Outflow = 1.33 cfs @ 12.25 hrs, Volume= 0.195 af, Atten= 34%, Lag= 9.3 min
 Primary = 1.33 cfs @ 12.25 hrs, Volume= 0.195 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 13.18' @ 12.25 hrs Surf.Area= 1,488 sf Storage= 794 cf

Plug-Flow detention time= 11.0 min calculated for 0.195 af (100% of inflow)
 Center-of-Mass det. time= 8.4 min (830.9 - 822.5)

| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 12.20' | 6,680 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 12.20 | 100 | 0 | 0 |
| 12.40 | 250 | 35 | 35 |
| 12.60 | 900 | 115 | 150 |
| 13.00 | 1,150 | 410 | 560 |
| 14.00 | 3,050 | 2,100 | 2,660 |
| 15.00 | 4,990 | 4,020 | 6,680 |

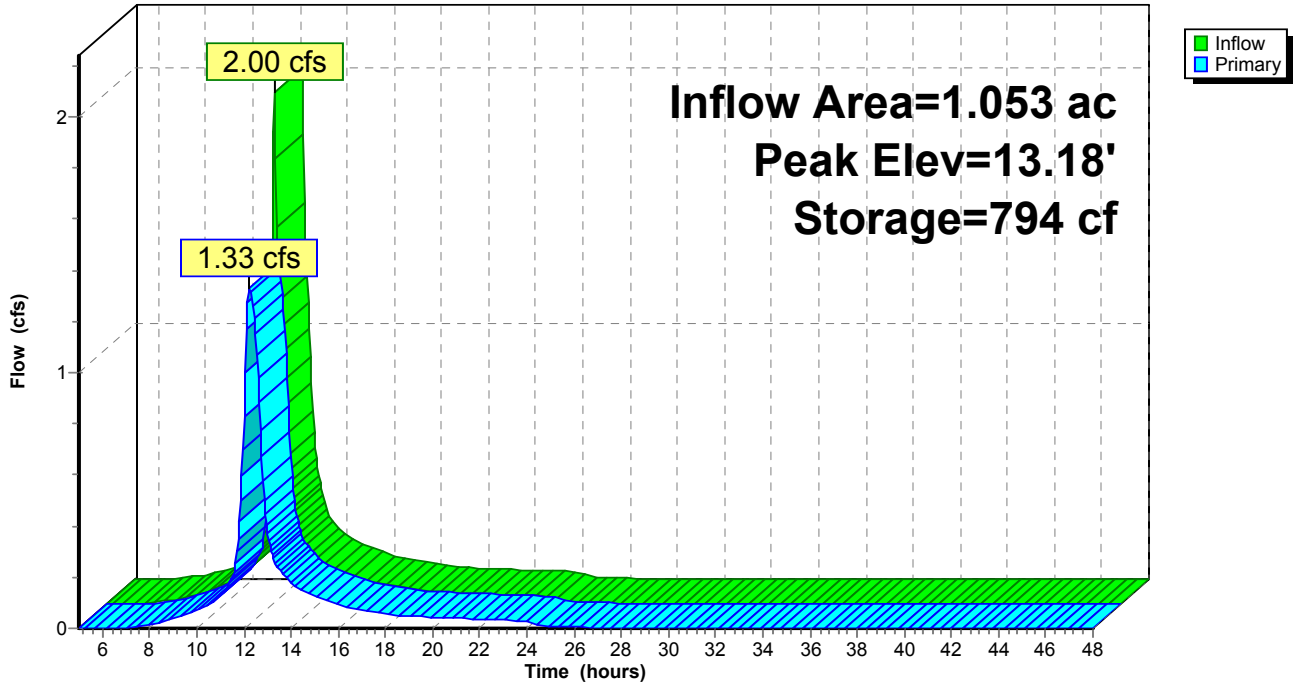
| Device | Routing | Invert | Outlet Devices |
|--------|----------|--------|--|
| #1 | Primary | 12.30' | 15.0" Round Culvert L= 37.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.30' / 12.00' S= 0.0081 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 12.22' | 8.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 13.19' | 75.0 deg x 0.7' long Sharp-Crested Vee/Trap Weir Cv= 2.51 (C= 3.14) |

Primary OutFlow Max=1.33 cfs @ 12.25 hrs HW=13.18' (Free Discharge)

- ↑ 1=Culvert (Passes 1.33 cfs of 2.48 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 1.33 cfs @ 3.80 fps)
- ↑ 3=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Pond 1P: DETENTION POND 1

Hydrograph



Summary for Pond 2P: DETENTION POND 2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.565 ac, 78.23% Impervious, Inflow Depth > 2.44" for 2-Year event
 Inflow = 1.56 cfs @ 12.07 hrs, Volume= 0.115 af
 Outflow = 1.20 cfs @ 12.15 hrs, Volume= 0.115 af, Atten= 23%, Lag= 4.5 min
 Primary = 0.90 cfs @ 12.15 hrs, Volume= 0.110 af
 Secondary = 0.30 cfs @ 12.15 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 14.63' @ 12.15 hrs Surf.Area= 1,583 sf Storage= 859 cf

Plug-Flow detention time= 41.6 min calculated for 0.115 af (100% of inflow)
 Center-of-Mass det. time= 42.3 min (830.1 - 787.8)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 14.00' | 3,720 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 14.00 | 1,150 | 0 | 0 |
| 15.00 | 1,840 | 1,495 | 1,495 |
| 16.00 | 2,610 | 2,225 | 3,720 |

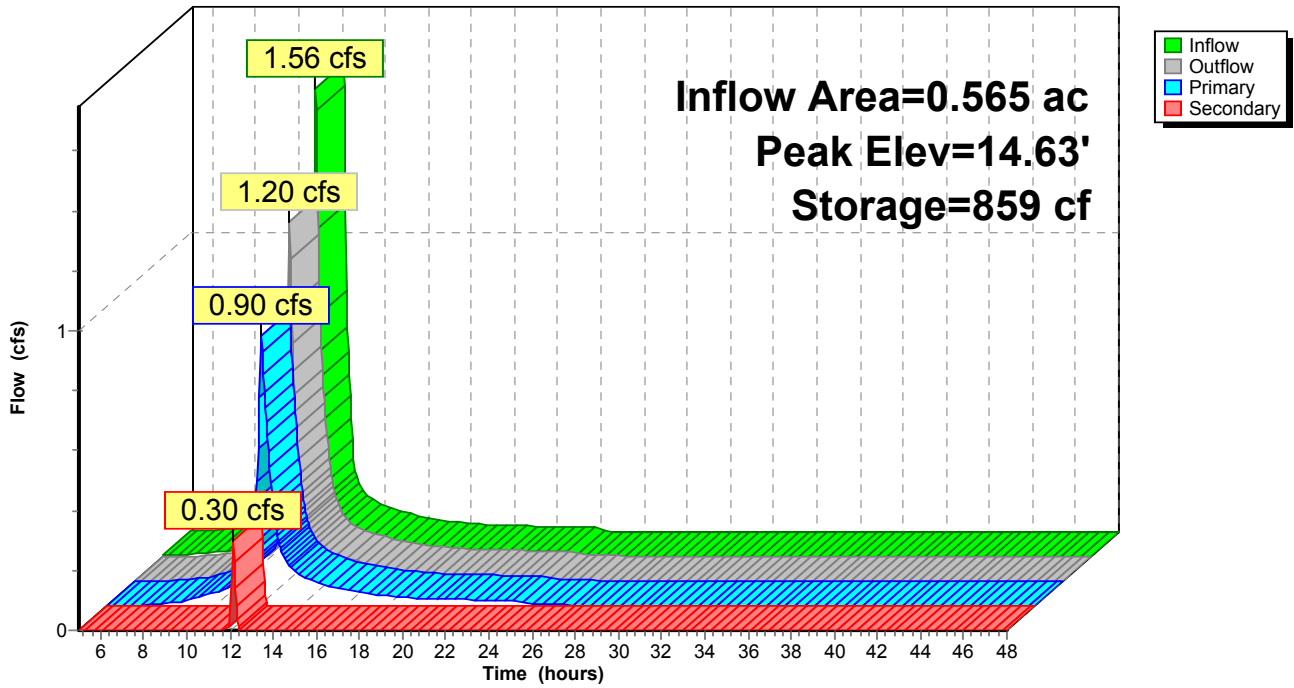
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 14.00' | 12.0" Round Culvert L= 68.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.00' / 13.80' S= 0.0029 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf |
| #2 | Secondary | 14.50' | 2.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.5' Crest Height |

Primary OutFlow Max=0.90 cfs @ 12.15 hrs HW=14.63' (Free Discharge)
 ↑1=Culvert (Barrel Controls 0.90 cfs @ 2.47 fps)

Secondary OutFlow Max=0.30 cfs @ 12.15 hrs HW=14.63' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 0.30 cfs @ 1.18 fps)

Pond 2P: DETENTION POND 2

Hydrograph



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|---|
| Subcatchment 1S: EAST PARKING LOT | Runoff Area=21,284 sf 56.30% Impervious Runoff Depth>3.59" Tc=5.0 min CN=90 Runoff=2.00 cfs 0.146 af |
| Subcatchment 1S-A: EAST PROPERTY | Runoff Area=5,187 sf 0.00% Impervious Runoff Depth=2.63" Tc=5.0 min CN=80 Runoff=0.37 cfs 0.026 af |
| Subcatchment 2S: WEST PARKING LOT | Runoff Area=24,596 sf 78.23% Impervious Runoff Depth>3.99" Tc=5.0 min CN=94 Runoff=2.49 cfs 0.188 af |
| Subcatchment 2S-A: WEST PROPERTY | Runoff Area=3,056 sf 0.00% Impervious Runoff Depth=2.63" Tc=5.0 min CN=80 Runoff=0.22 cfs 0.015 af |
| Subcatchment 3S: SOUTH PROPERTY | Runoff Area=20,931 sf 72.46% Impervious Runoff Depth>3.89" Tc=5.0 min CN=93 Runoff=2.09 cfs 0.156 af |
| Subcatchment 4S: DRIVEWAY | Runoff Area=1,176 sf 100.00% Impervious Runoff Depth>4.35" Tc=5.0 min CN=98 Runoff=0.12 cfs 0.010 af |
| Reach DP-1: EAST WETLAND | Inflow=2.35 cfs 0.341 af Outflow=2.35 cfs 0.341 af |
| Reach DP-2: WEST WETLAND | Inflow=1.06 cfs 0.034 af Outflow=1.06 cfs 0.034 af |
| Reach DP-3: SOUTH WETLAND | Inflow=2.09 cfs 0.156 af Outflow=2.09 cfs 0.156 af |
| Reach DP-4: HENRY GRAF JR. ROAD | Inflow=0.12 cfs 0.010 af Outflow=0.12 cfs 0.010 af |
| Pond 1P: DETENTION POND 1 | Peak Elev=13.51' Storage=1,390 cf Inflow=3.17 cfs 0.315 af Outflow=2.15 cfs 0.315 af |
| Pond 2P: DETENTION POND 2 | Peak Elev=14.76' Storage=1,074 cf Inflow=2.49 cfs 0.188 af Primary=1.25 cfs 0.169 af Secondary=0.86 cfs 0.018 af Outflow=2.12 cfs 0.188 af |

Total Runoff Area = 1.750 ac Runoff Volume = 0.541 af Average Runoff Depth = 3.71"
37.60% Pervious = 0.658 ac 62.40% Impervious = 1.092 ac

Summary for Subcatchment 1S: EAST PARKING LOT

[49] Hint: Tc<2dt may require smaller dt

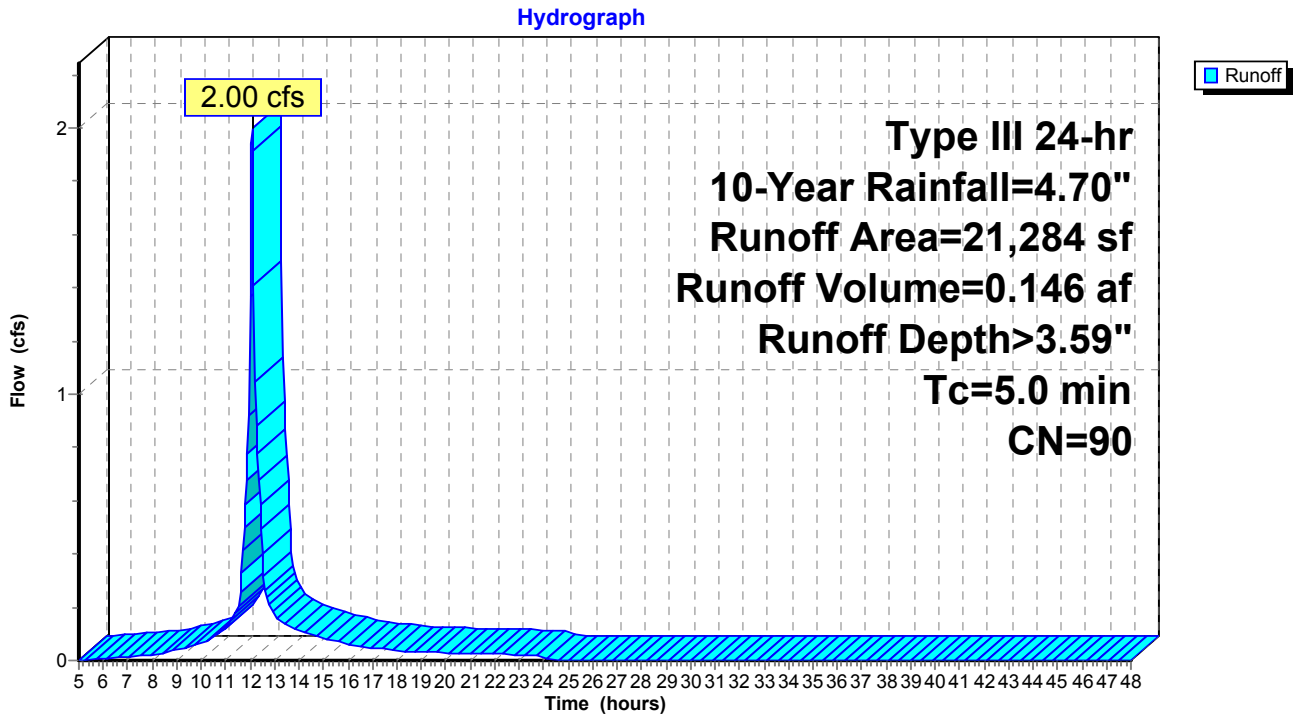
Runoff = 2.00 cfs @ 12.07 hrs, Volume= 0.146 af, Depth> 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 9,235 | 80 | >75% Grass cover, Good, HSG D |
| 67 | 80 | >75% Grass cover, Good, HSG D |
| 6,962 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 21,284 | 90 | Weighted Average |
| 9,302 | | 43.70% Pervious Area |
| 11,982 | | 56.30% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S: EAST PARKING LOT



Summary for Subcatchment 1S-A: EAST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.026 af, Depth= 2.63"

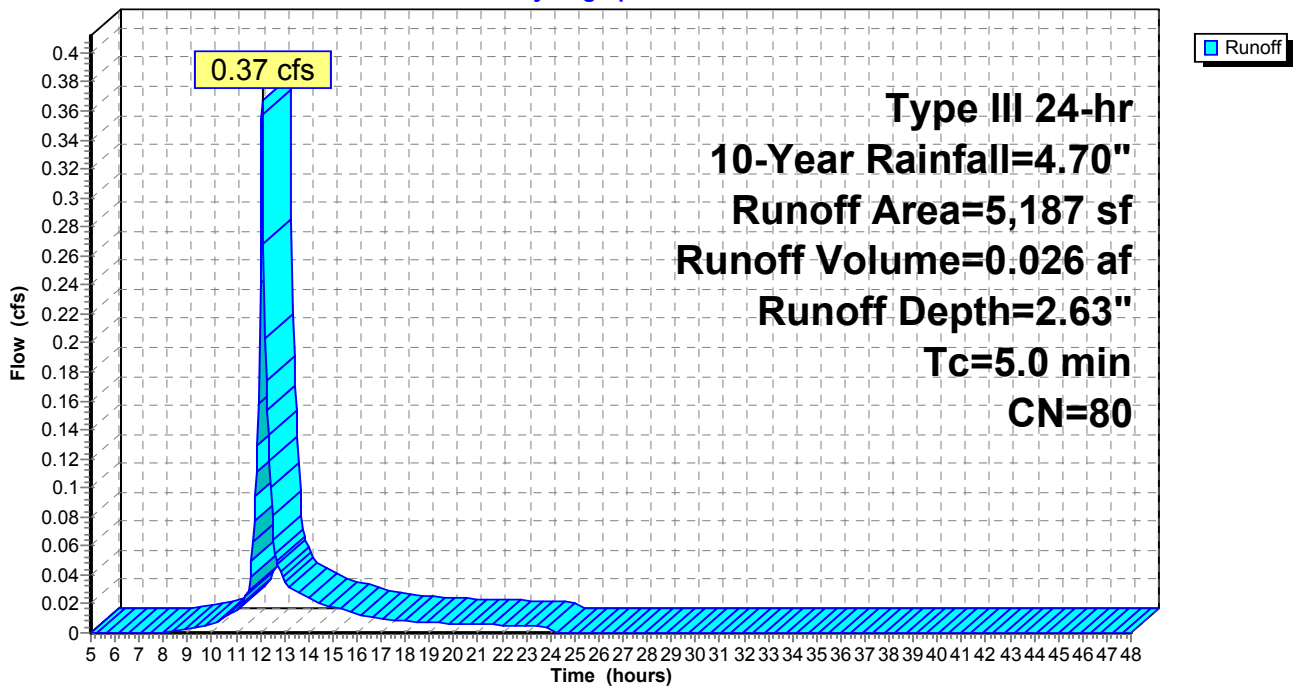
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,187 | 80 | >75% Grass cover, Good, HSG D |
| 5,187 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S-A: EAST PROPERTY

Hydrograph



Summary for Subcatchment 2S: WEST PARKING LOT

[49] Hint: Tc<2dt may require smaller dt

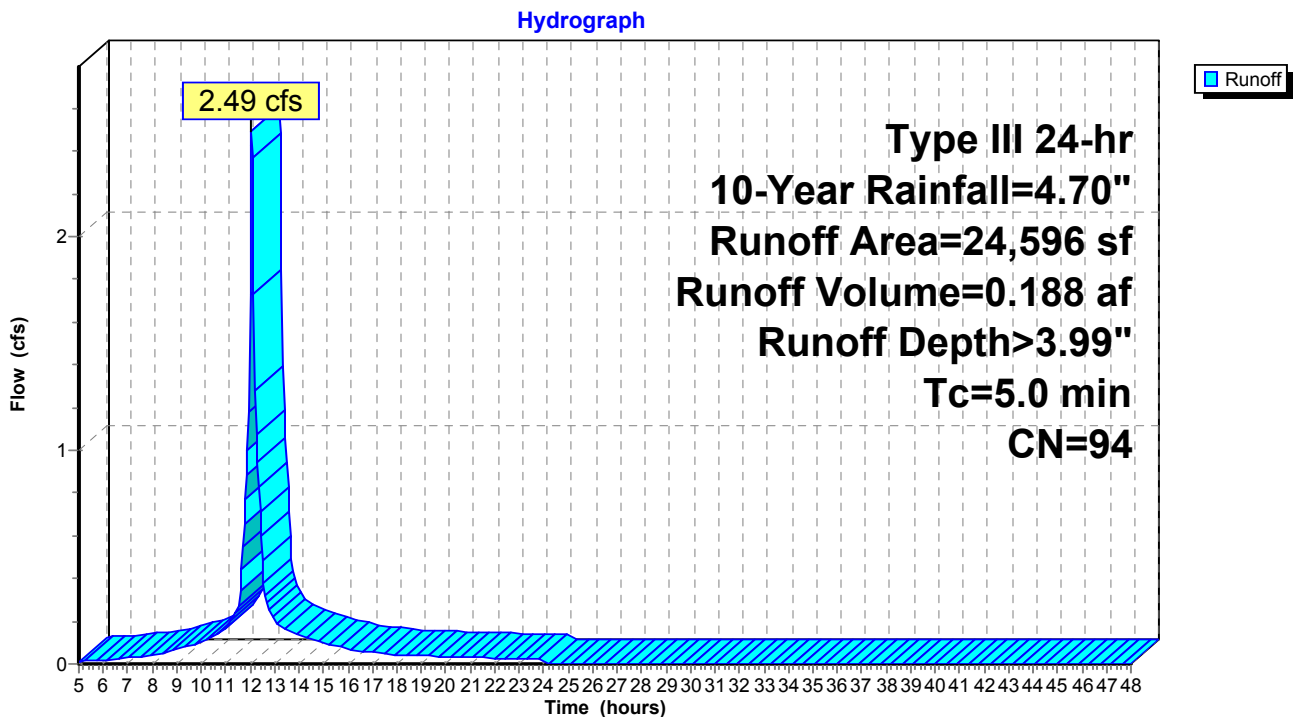
Runoff = 2.49 cfs @ 12.07 hrs, Volume= 0.188 af, Depth> 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,354 | 80 | >75% Grass cover, Good, HSG D |
| 14,222 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 24,596 | 94 | Weighted Average |
| 5,354 | | 21.77% Pervious Area |
| 19,242 | | 78.23% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S: WEST PARKING LOT



Summary for Subcatchment 2S-A: WEST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.015 af, Depth= 2.63"

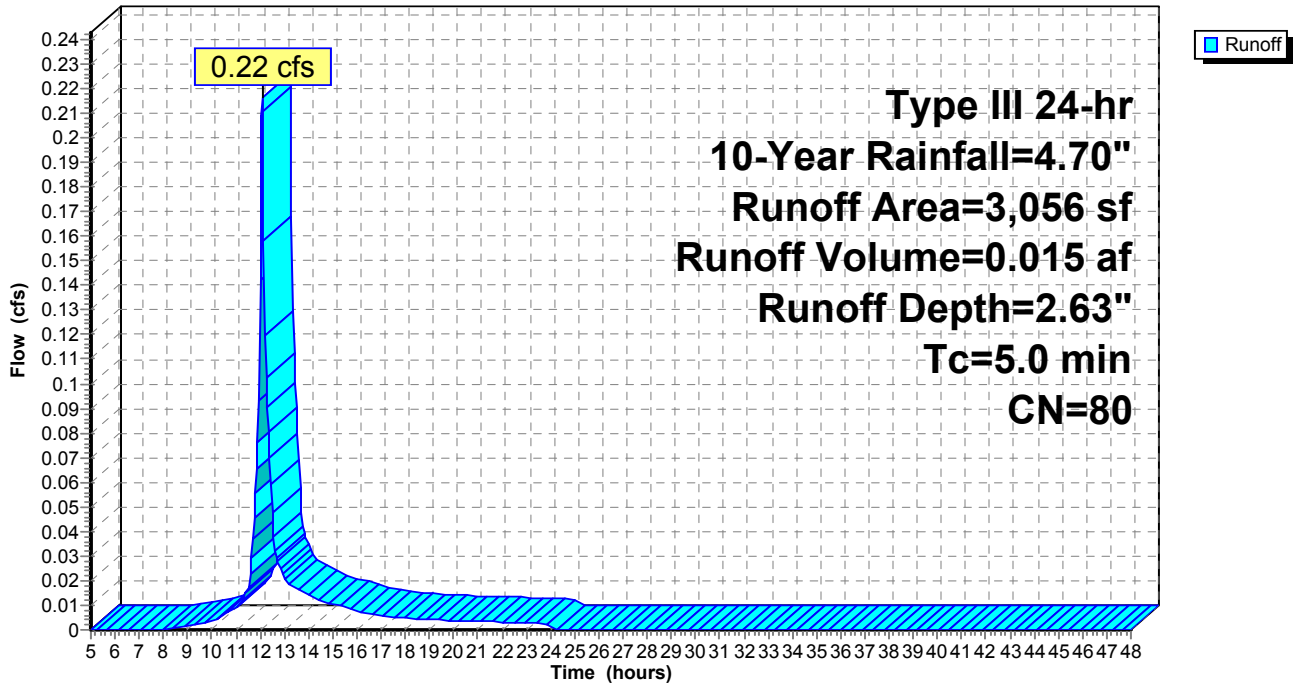
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,056 | 80 | >75% Grass cover, Good, HSG D |
| 3,056 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S-A: WEST PROPERTY

Hydrograph



Summary for Subcatchment 3S: SOUTH PROPERTY

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 2.09 cfs @ 12.07 hrs, Volume= 0.156 af, Depth> 3.89"

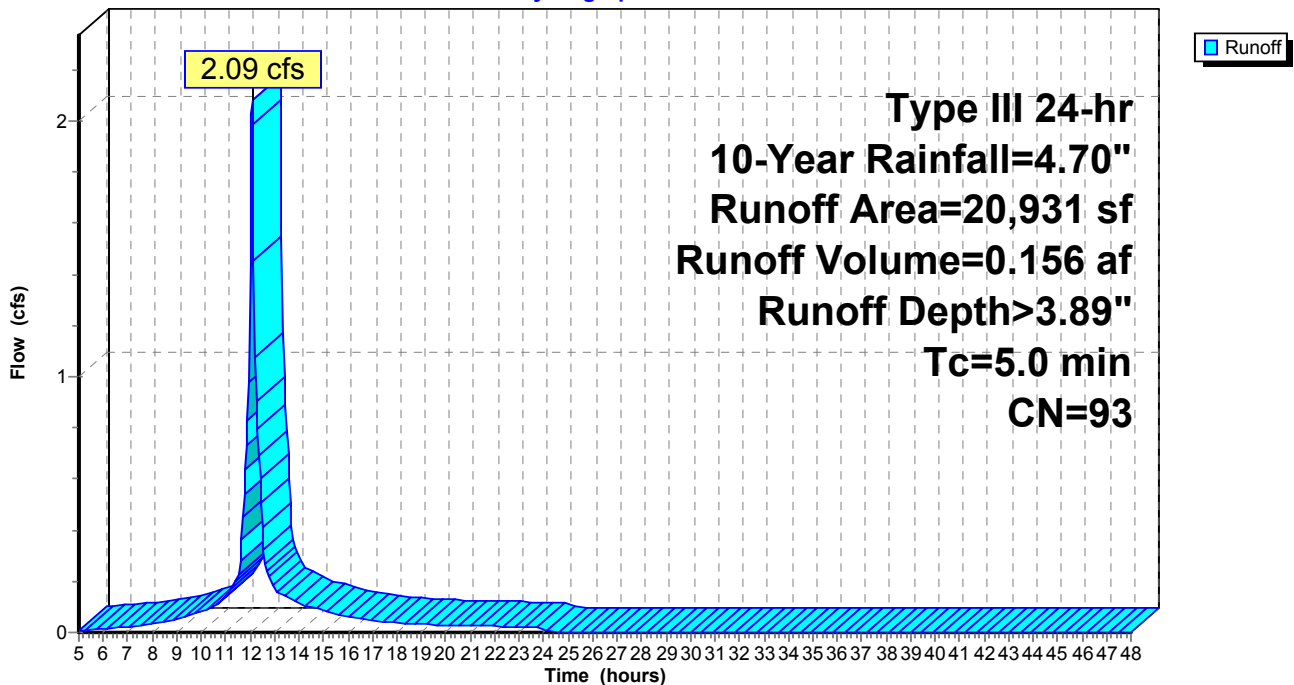
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 15,166 | 98 | Paved parking, HSG D |
| 5,765 | 80 | >75% Grass cover, Good, HSG D |
| 20,931 | 93 | Weighted Average |
| 5,765 | | 27.54% Pervious Area |
| 15,166 | | 72.46% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 3S: SOUTH PROPERTY

Hydrograph



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.12 cfs @ 12.07 hrs, Volume= 0.010 af, Depth> 4.35"

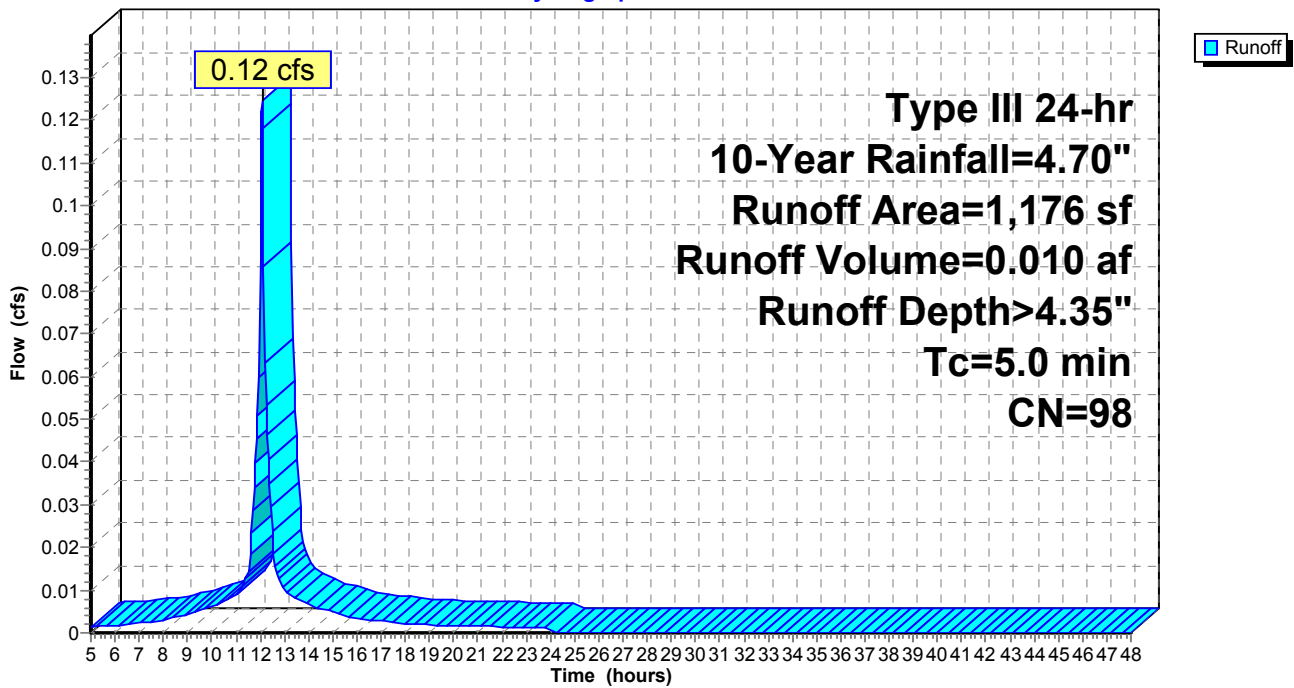
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,176 | 98 | Paved parking, HSG D |
| 1,176 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: EAST WETLAND

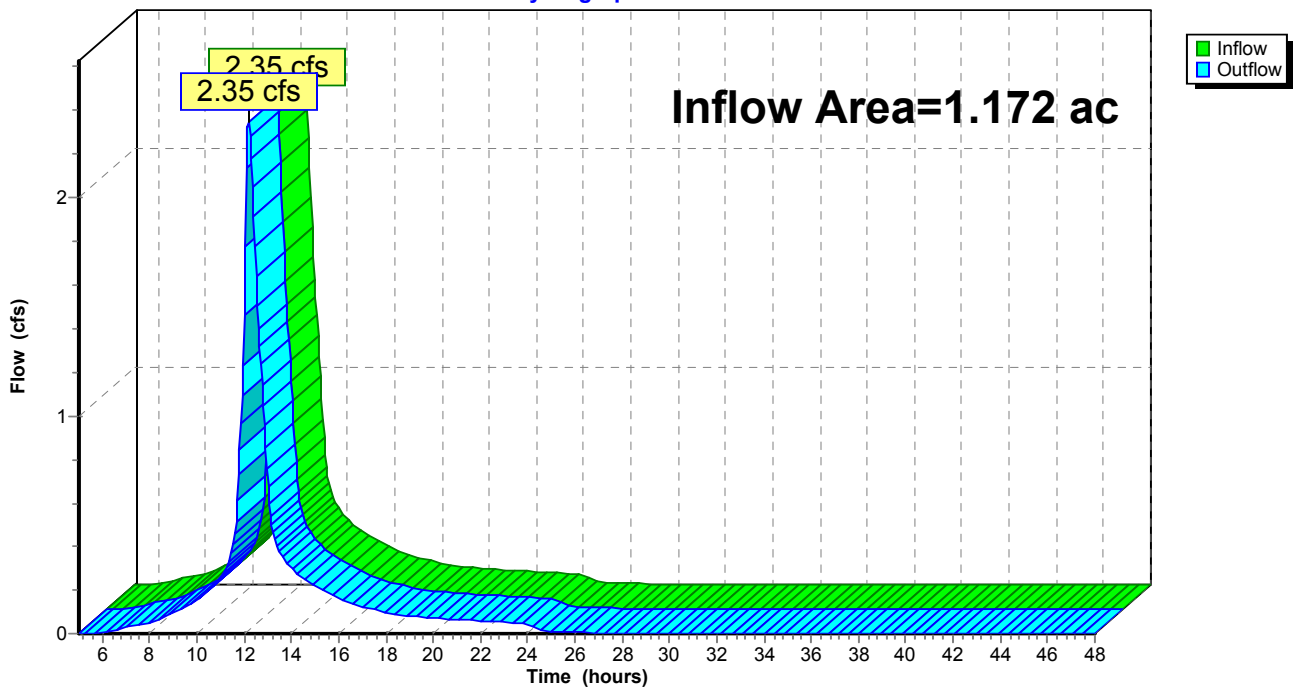
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.172 ac, 61.14% Impervious, Inflow Depth = 3.49" for 10-Year event
Inflow = 2.35 cfs @ 12.19 hrs, Volume= 0.341 af
Outflow = 2.35 cfs @ 12.19 hrs, Volume= 0.341 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

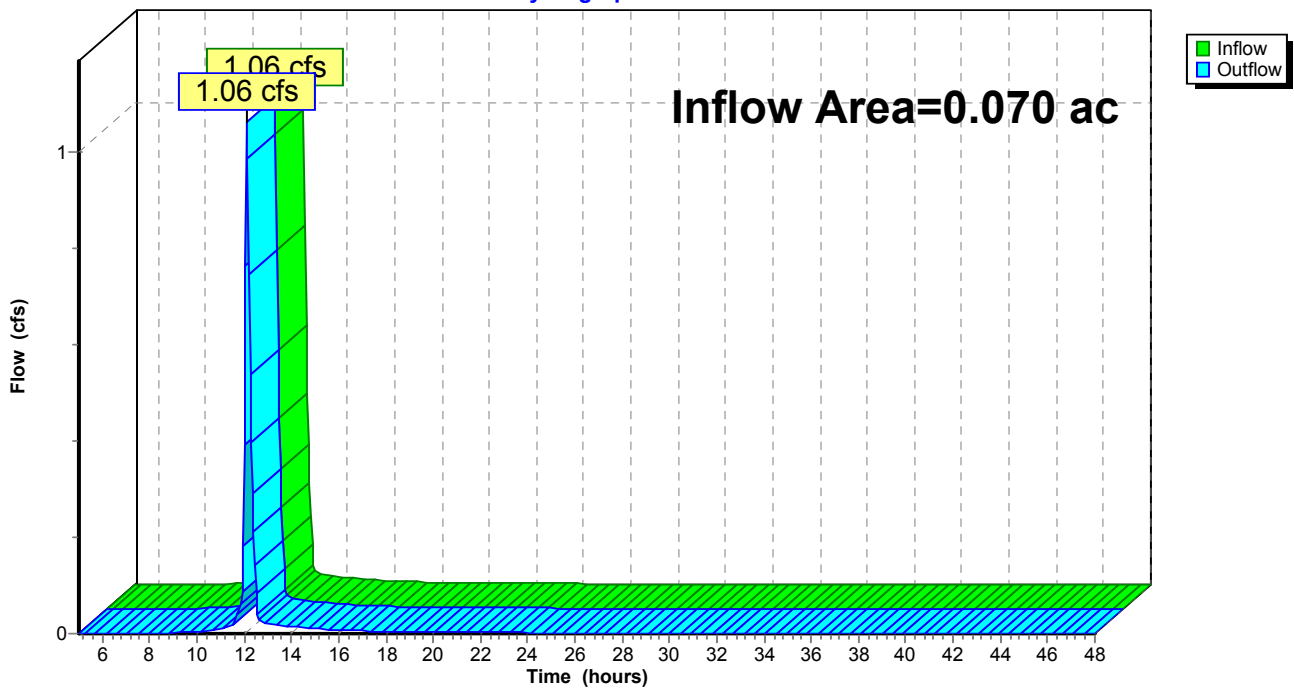
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.070 ac, 0.00% Impervious, Inflow Depth = 5.74" for 10-Year event
Inflow = 1.06 cfs @ 12.12 hrs, Volume= 0.034 af
Outflow = 1.06 cfs @ 12.12 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

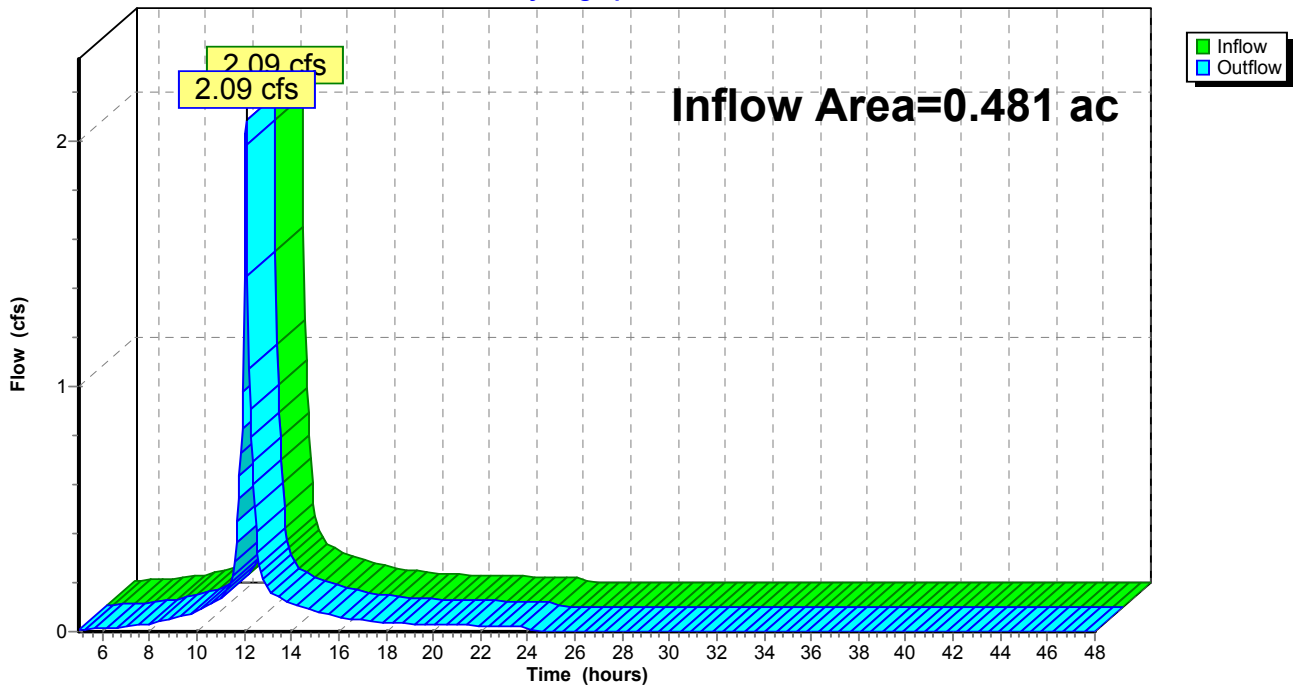
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.481 ac, 72.46% Impervious, Inflow Depth > 3.89" for 10-Year event
Inflow = 2.09 cfs @ 12.07 hrs, Volume= 0.156 af
Outflow = 2.09 cfs @ 12.07 hrs, Volume= 0.156 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

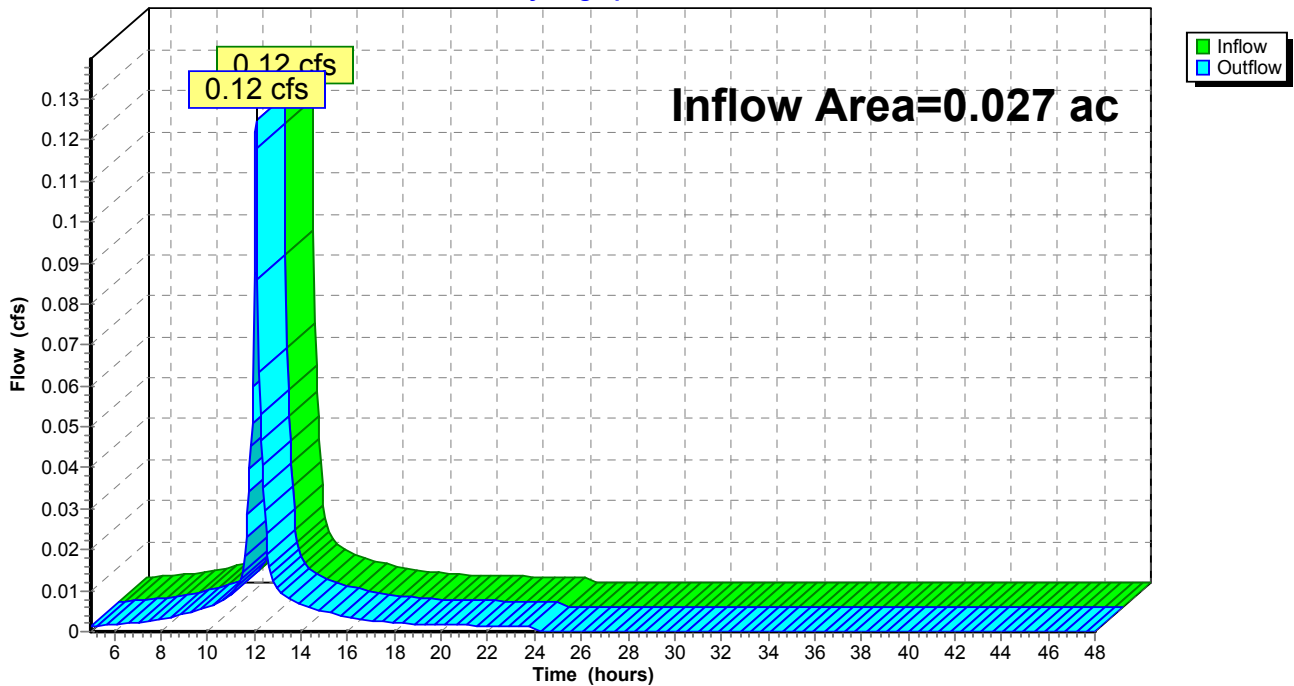
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 100.00% Impervious, Inflow Depth > 4.35" for 10-Year event
Inflow = 0.12 cfs @ 12.07 hrs, Volume= 0.010 af
Outflow = 0.12 cfs @ 12.07 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Summary for Pond 1P: DETENTION POND 1

Inflow Area = 1.053 ac, 68.06% Impervious, Inflow Depth > 3.59" for 10-Year event
 Inflow = 3.17 cfs @ 12.09 hrs, Volume= 0.315 af
 Outflow = 2.15 cfs @ 12.21 hrs, Volume= 0.315 af, Atten= 32%, Lag= 7.6 min
 Primary = 2.15 cfs @ 12.21 hrs, Volume= 0.315 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 13.51' @ 12.21 hrs Surf.Area= 2,116 sf Storage= 1,390 cf

Plug-Flow detention time= 10.2 min calculated for 0.315 af (100% of inflow)
 Center-of-Mass det. time= 8.5 min (815.1 - 806.6)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 12.20' | 6,680 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 12.20 | 100 | 0 | 0 |
| 12.40 | 250 | 35 | 35 |
| 12.60 | 900 | 115 | 150 |
| 13.00 | 1,150 | 410 | 560 |
| 14.00 | 3,050 | 2,100 | 2,660 |
| 15.00 | 4,990 | 4,020 | 6,680 |

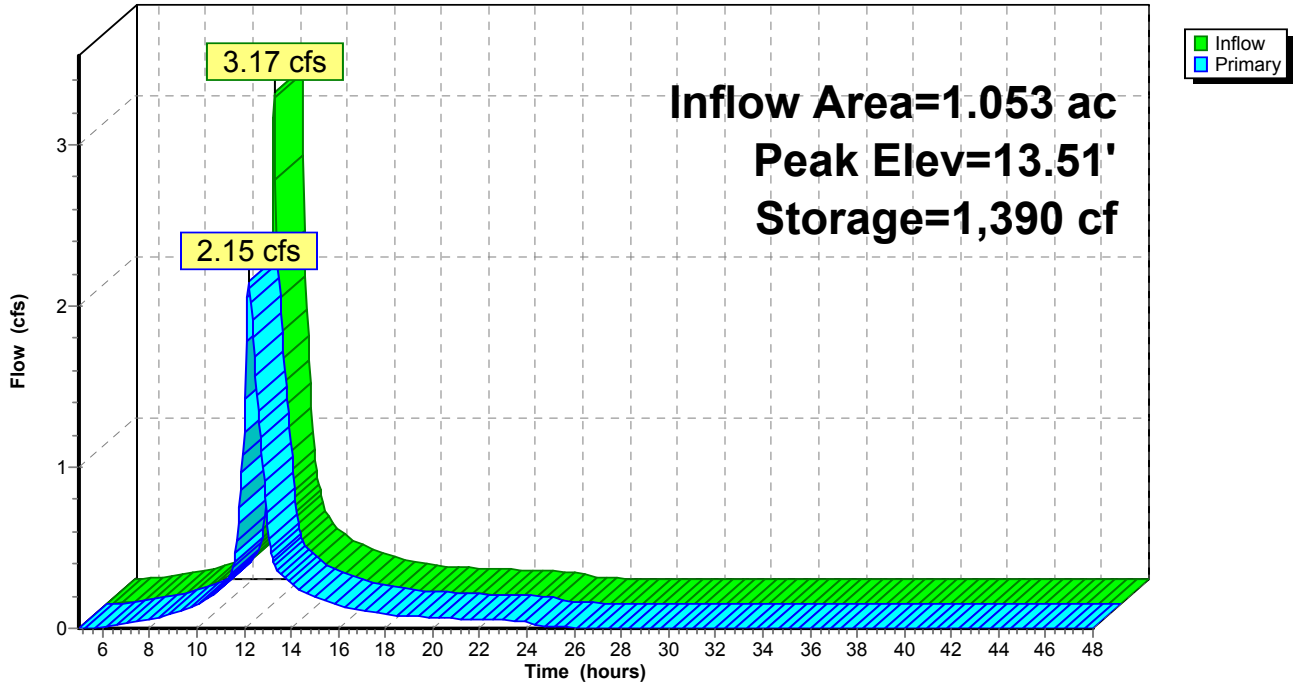
| Device | Routing | Invert | Outlet Devices |
|--------|----------|--------|--|
| #1 | Primary | 12.30' | 15.0" Round Culvert L= 37.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.30' / 12.00' S= 0.0081 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 12.22' | 8.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 13.19' | 75.0 deg x 0.7' long Sharp-Crested Vee/Trap Weir Cv= 2.51 (C= 3.14) |

Primary OutFlow Max=2.14 cfs @ 12.21 hrs HW=13.51' (Free Discharge)

- 1=Culvert (Passes 2.14 cfs of 4.01 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.64 cfs @ 4.70 fps)
- 3=Sharp-Crested Vee/Trap Weir (Weir Controls 0.50 cfs @ 1.67 fps)

Pond 1P: DETENTION POND 1

Hydrograph



Summary for Pond 2P: DETENTION POND 2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.565 ac, 78.23% Impervious, Inflow Depth > 3.99" for 10-Year event
 Inflow = 2.49 cfs @ 12.07 hrs, Volume= 0.188 af
 Outflow = 2.12 cfs @ 12.12 hrs, Volume= 0.188 af, Atten= 15%, Lag= 3.2 min
 Primary = 1.25 cfs @ 12.12 hrs, Volume= 0.169 af
 Secondary = 0.86 cfs @ 12.12 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 14.76' @ 12.12 hrs Surf.Area= 1,675 sf Storage= 1,074 cf

Plug-Flow detention time= 33.8 min calculated for 0.188 af (100% of inflow)
 Center-of-Mass det. time= 33.2 min (810.5 - 777.3)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 14.00' | 3,720 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 14.00 | 1,150 | 0 | 0 |
| 15.00 | 1,840 | 1,495 | 1,495 |
| 16.00 | 2,610 | 2,225 | 3,720 |

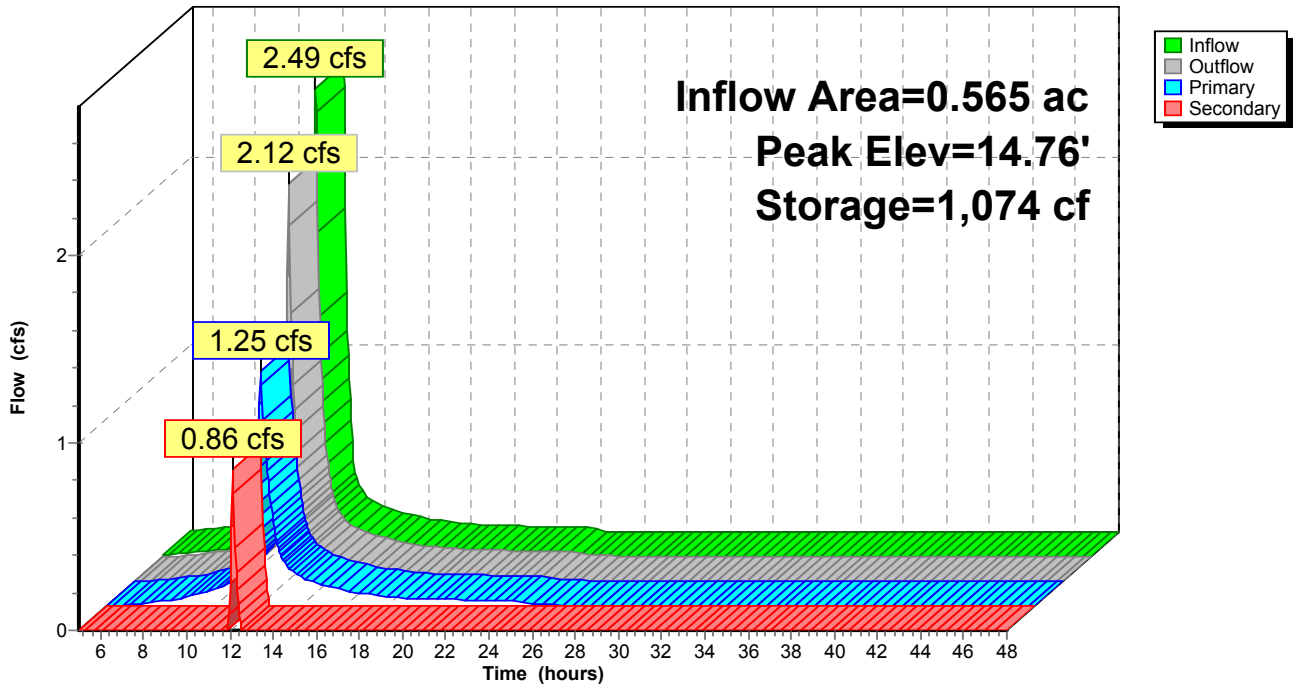
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 14.00' | 12.0" Round Culvert L= 68.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.00' / 13.80' S= 0.0029 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf |
| #2 | Secondary | 14.50' | 2.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.5' Crest Height |

Primary OutFlow Max=1.23 cfs @ 12.12 hrs HW=14.75' (Free Discharge)
 ↑1=Culvert (Barrel Controls 1.23 cfs @ 2.70 fps)

Secondary OutFlow Max=0.83 cfs @ 12.12 hrs HW=14.75' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 0.83 cfs @ 1.68 fps)

Pond 2P: DETENTION POND 2

Hydrograph



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|---|
| Subcatchment 1S: EAST PARKING LOT | Runoff Area=21,284 sf 56.30% Impervious Runoff Depth>4.64" Tc=5.0 min CN=90 Runoff=2.56 cfs 0.189 af |
| Subcatchment 1S-A: EAST PROPERTY | Runoff Area=5,187 sf 0.00% Impervious Runoff Depth=3.60" Tc=5.0 min CN=80 Runoff=0.50 cfs 0.036 af |
| Subcatchment 2S: WEST PARKING LOT | Runoff Area=24,596 sf 78.23% Impervious Runoff Depth>5.05" Tc=5.0 min CN=94 Runoff=3.13 cfs 0.238 af |
| Subcatchment 2S-A: WEST PROPERTY | Runoff Area=3,056 sf 0.00% Impervious Runoff Depth=3.60" Tc=5.0 min CN=80 Runoff=0.30 cfs 0.021 af |
| Subcatchment 3S: SOUTH PROPERTY | Runoff Area=20,931 sf 72.46% Impervious Runoff Depth>4.95" Tc=5.0 min CN=93 Runoff=2.63 cfs 0.198 af |
| Subcatchment 4S: DRIVEWAY | Runoff Area=1,176 sf 100.00% Impervious Runoff Depth>5.40" Tc=5.0 min CN=98 Runoff=0.15 cfs 0.012 af |
| Reach DP-1: EAST WETLAND | Inflow=3.07 cfs 0.433 af Outflow=3.07 cfs 0.433 af |
| Reach DP-2: WEST WETLAND | Inflow=1.52 cfs 0.051 af Outflow=1.52 cfs 0.051 af |
| Reach DP-3: SOUTH WETLAND | Inflow=2.63 cfs 0.198 af Outflow=2.63 cfs 0.198 af |
| Reach DP-4: HENRY GRAF JR. ROAD | Inflow=0.15 cfs 0.012 af Outflow=0.15 cfs 0.012 af |
| Pond 1P: DETENTION POND 1 | Peak Elev=13.66' Storage=1,727 cf Inflow=3.92 cfs 0.397 af Outflow=2.76 cfs 0.397 af |
| Pond 2P: DETENTION POND 2 | Peak Elev=14.83' Storage=1,198 cf Inflow=3.13 cfs 0.238 af Primary=1.46 cfs 0.208 af Secondary=1.25 cfs 0.030 af Outflow=2.70 cfs 0.238 af |

Total Runoff Area = 1.750 ac Runoff Volume = 0.694 af Average Runoff Depth = 4.76"
37.60% Pervious = 0.658 ac 62.40% Impervious = 1.092 ac

Summary for Subcatchment 1S: EAST PARKING LOT

[49] Hint: $T_c < 2dt$ may require smaller dt

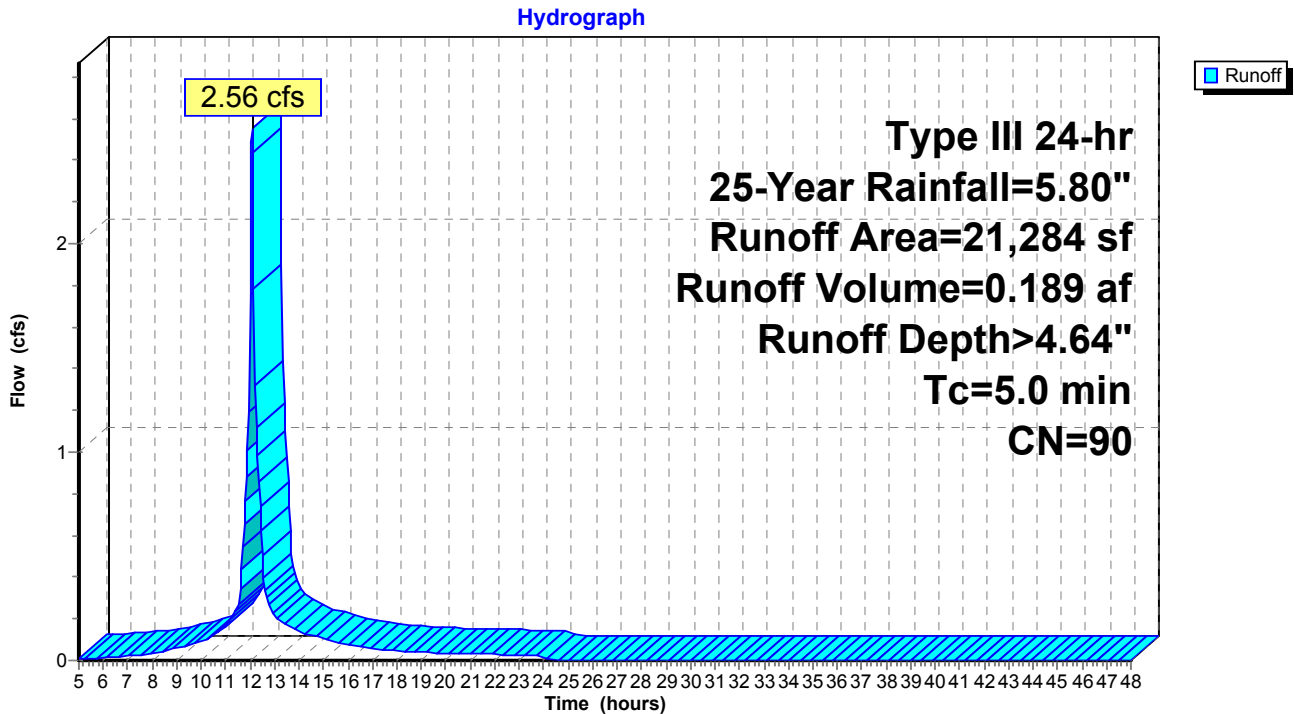
Runoff = 2.56 cfs @ 12.07 hrs, Volume= 0.189 af, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 9,235 | 80 | >75% Grass cover, Good, HSG D |
| 67 | 80 | >75% Grass cover, Good, HSG D |
| 6,962 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 21,284 | 90 | Weighted Average |
| 9,302 | | 43.70% Pervious Area |
| 11,982 | | 56.30% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S: EAST PARKING LOT



Summary for Subcatchment 1S-A: EAST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.50 cfs @ 12.08 hrs, Volume= 0.036 af, Depth= 3.60"

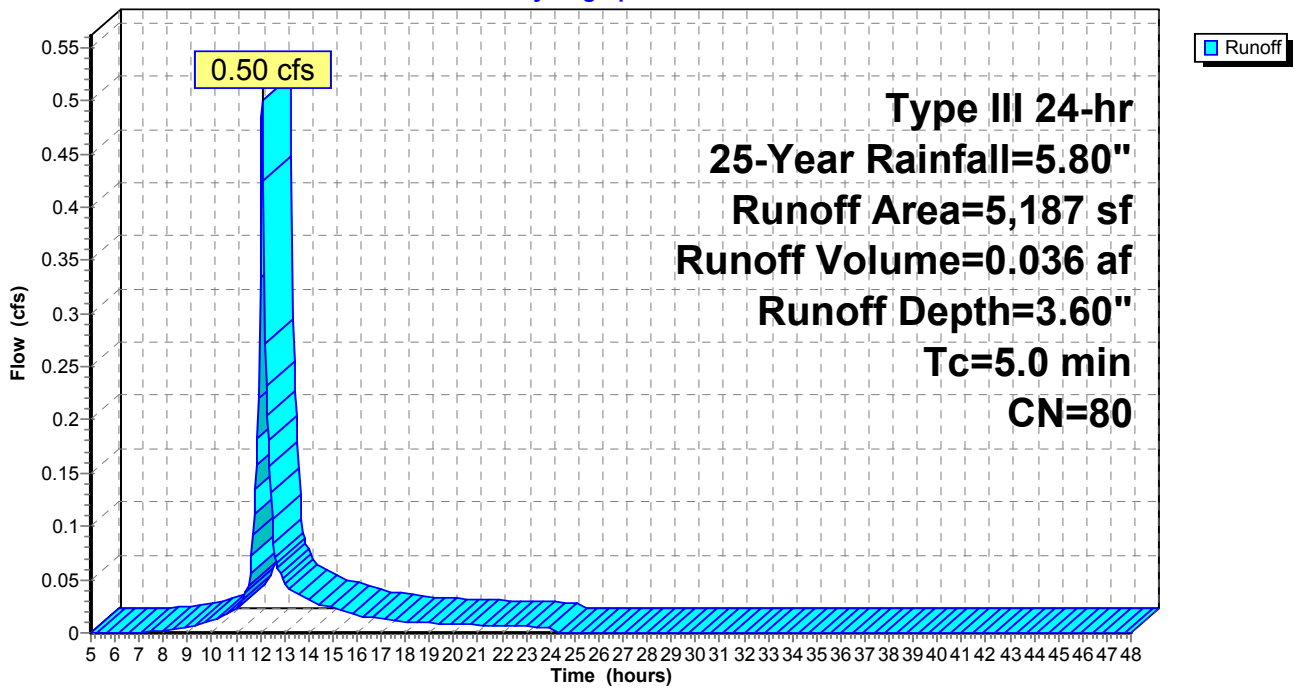
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,187 | 80 | >75% Grass cover, Good, HSG D |
| 5,187 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S-A: EAST PROPERTY

Hydrograph



Summary for Subcatchment 2S: WEST PARKING LOT

[49] Hint: Tc<2dt may require smaller dt

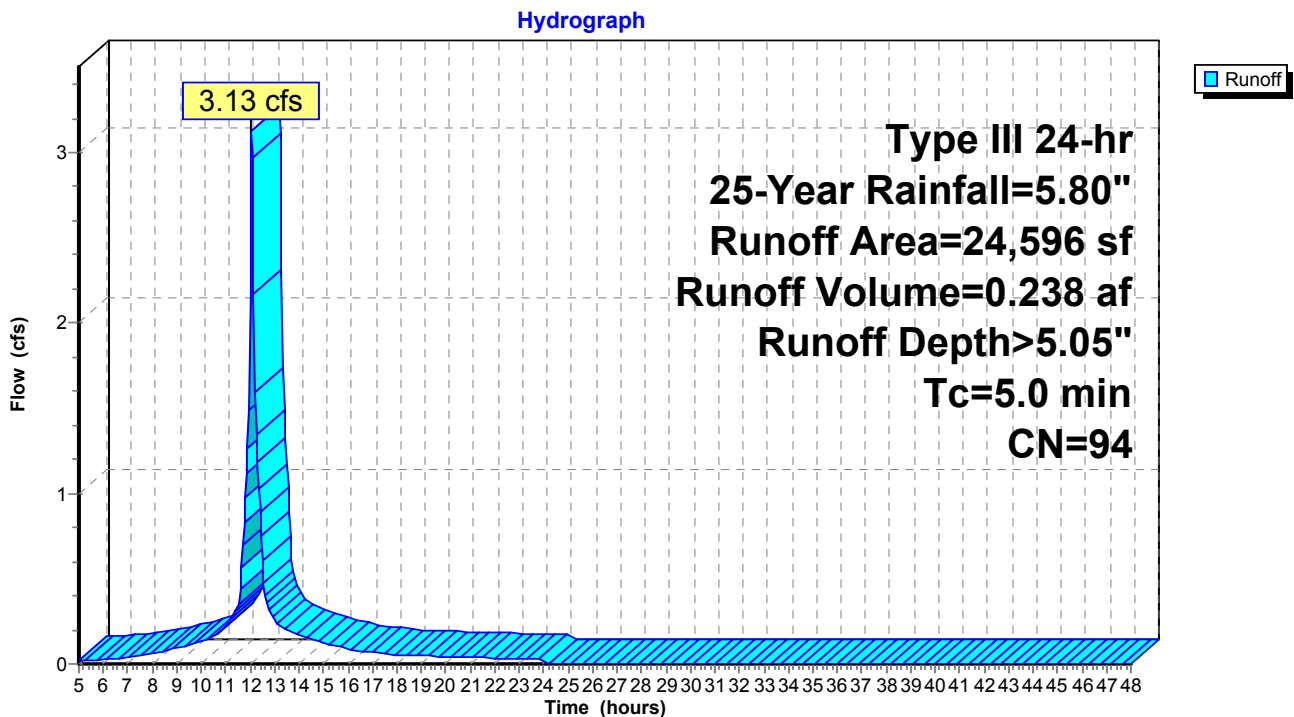
Runoff = 3.13 cfs @ 12.07 hrs, Volume= 0.238 af, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,354 | 80 | >75% Grass cover, Good, HSG D |
| 14,222 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 24,596 | 94 | Weighted Average |
| 5,354 | | 21.77% Pervious Area |
| 19,242 | | 78.23% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S: WEST PARKING LOT



Summary for Subcatchment 2S-A: WEST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.021 af, Depth= 3.60"

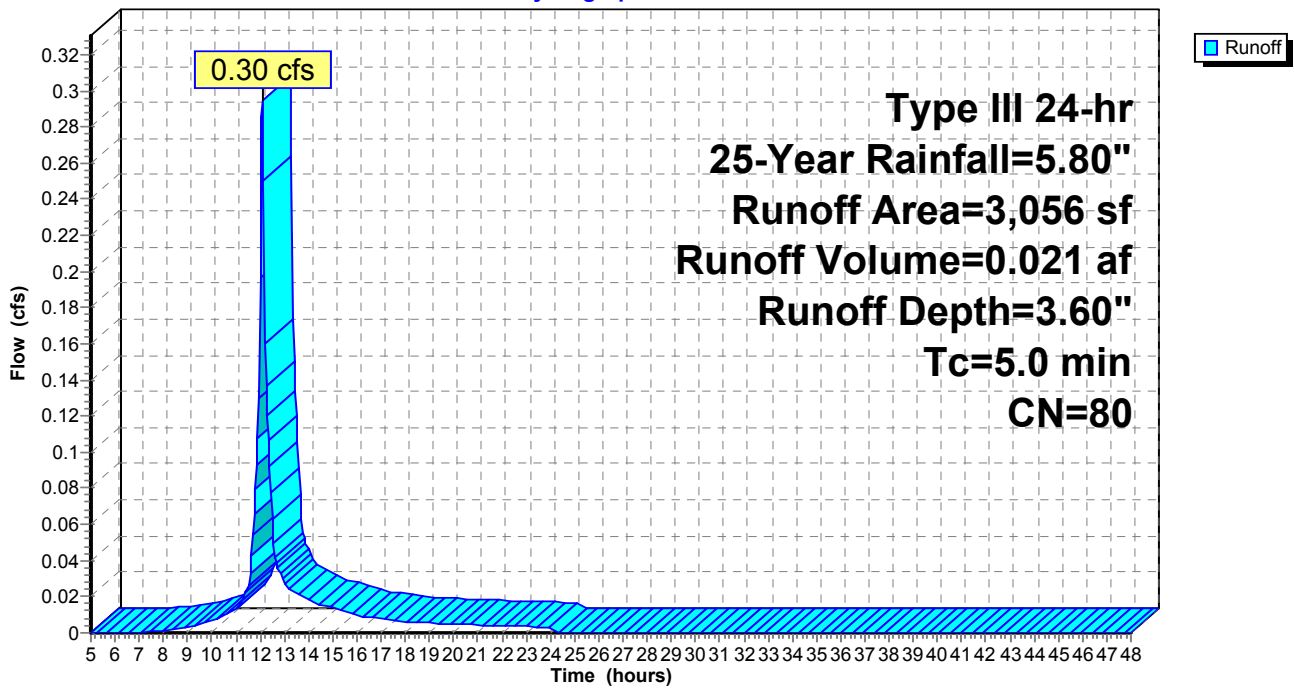
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,056 | 80 | >75% Grass cover, Good, HSG D |
| 3,056 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S-A: WEST PROPERTY

Hydrograph



Summary for Subcatchment 3S: SOUTH PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.63 cfs @ 12.07 hrs, Volume= 0.198 af, Depth> 4.95"

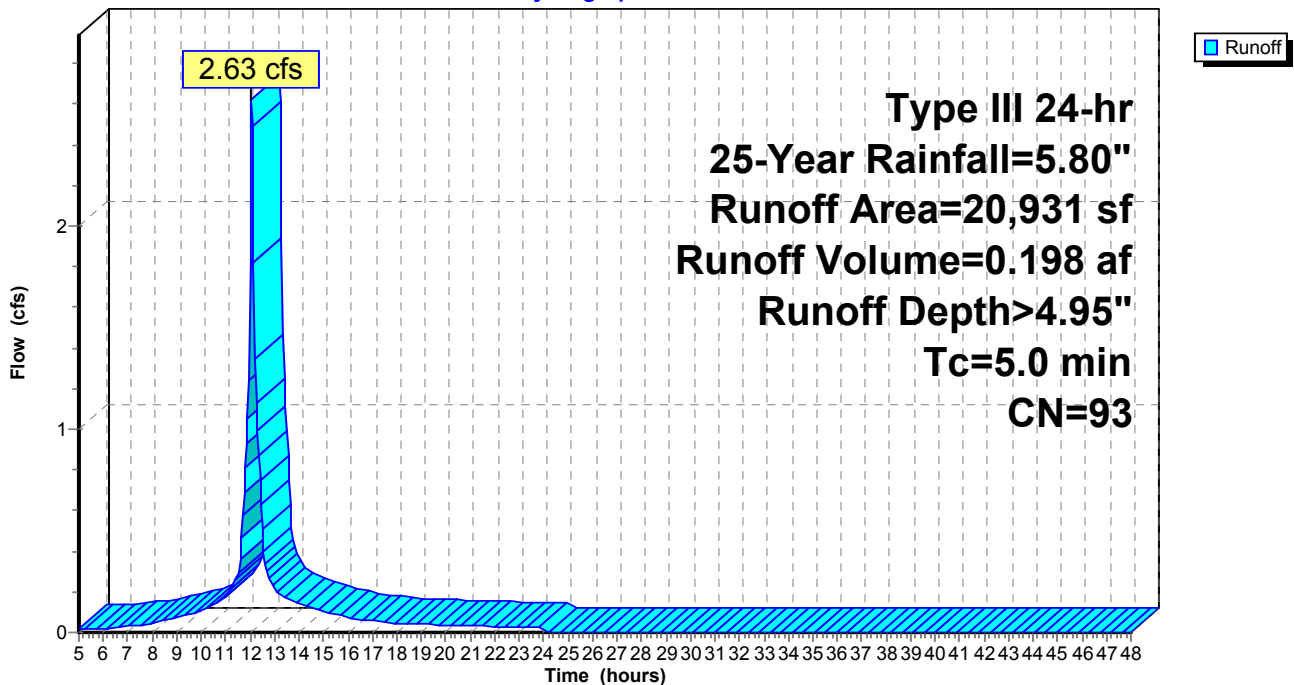
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 15,166 | 98 | Paved parking, HSG D |
| 5,765 | 80 | >75% Grass cover, Good, HSG D |
| 20,931 | 93 | Weighted Average |
| 5,765 | | 27.54% Pervious Area |
| 15,166 | | 72.46% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 3S: SOUTH PROPERTY

Hydrograph



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.15 cfs @ 12.07 hrs, Volume= 0.012 af, Depth> 5.40"

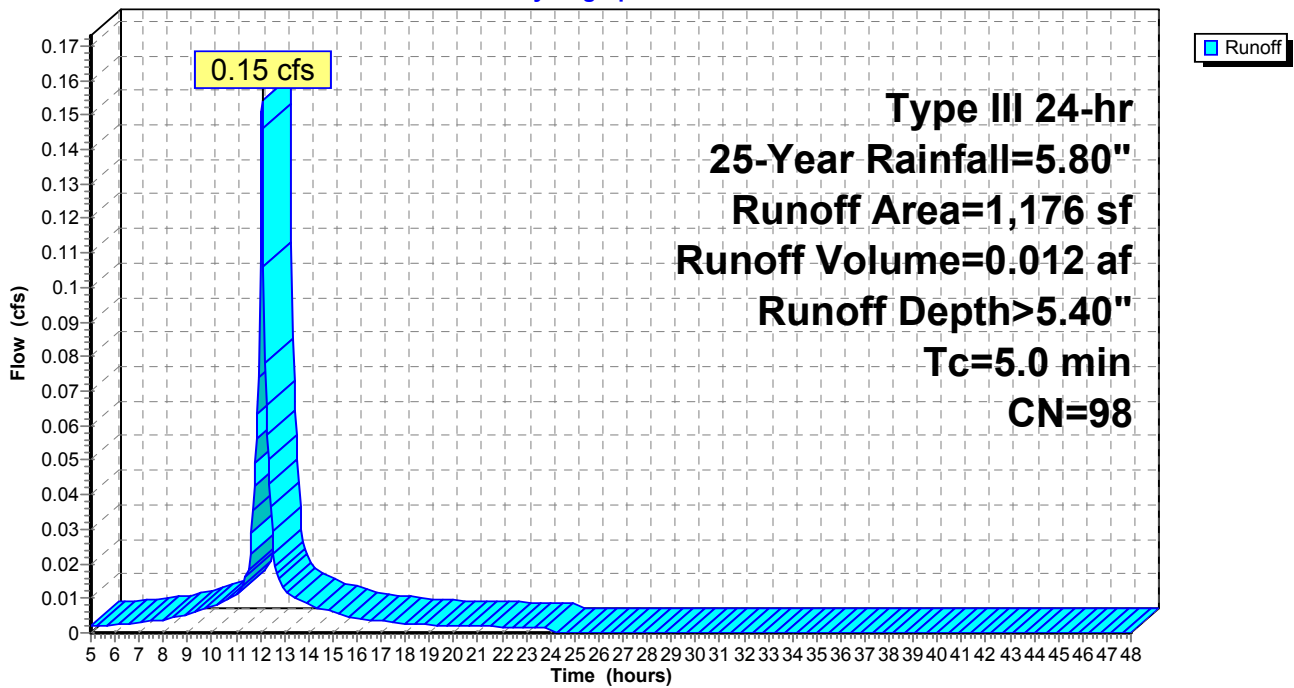
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 25-Year Rainfall=5.80"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,176 | 98 | Paved parking, HSG D |
| 1,176 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: EAST WETLAND

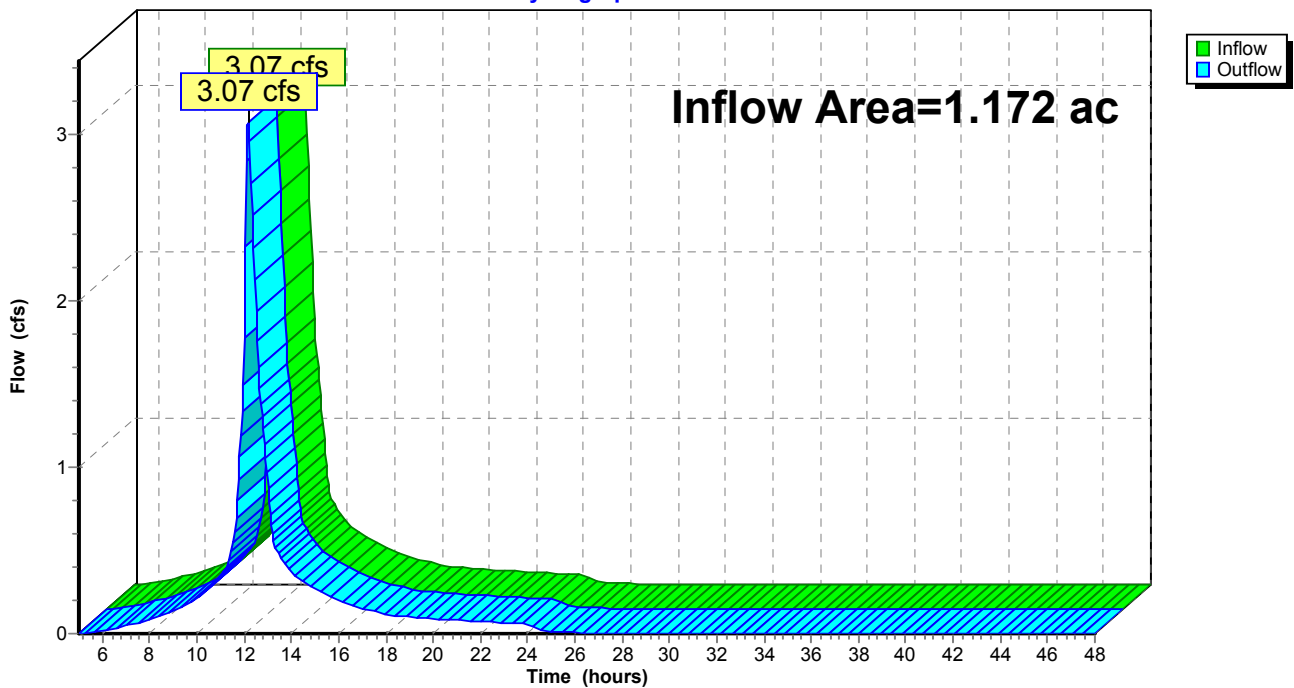
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.172 ac, 61.14% Impervious, Inflow Depth = 4.43" for 25-Year event
Inflow = 3.07 cfs @ 12.17 hrs, Volume= 0.433 af
Outflow = 3.07 cfs @ 12.17 hrs, Volume= 0.433 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

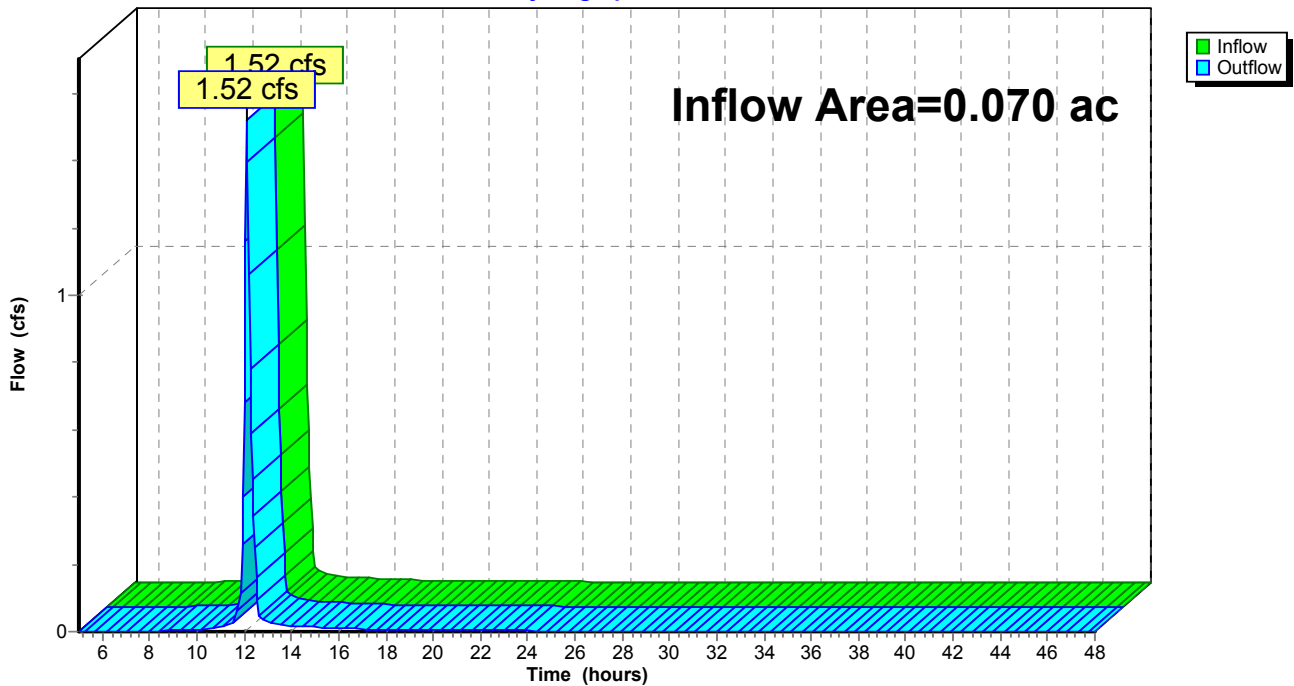
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.070 ac, 0.00% Impervious, Inflow Depth = 8.66" for 25-Year event
Inflow = 1.52 cfs @ 12.11 hrs, Volume= 0.051 af
Outflow = 1.52 cfs @ 12.11 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

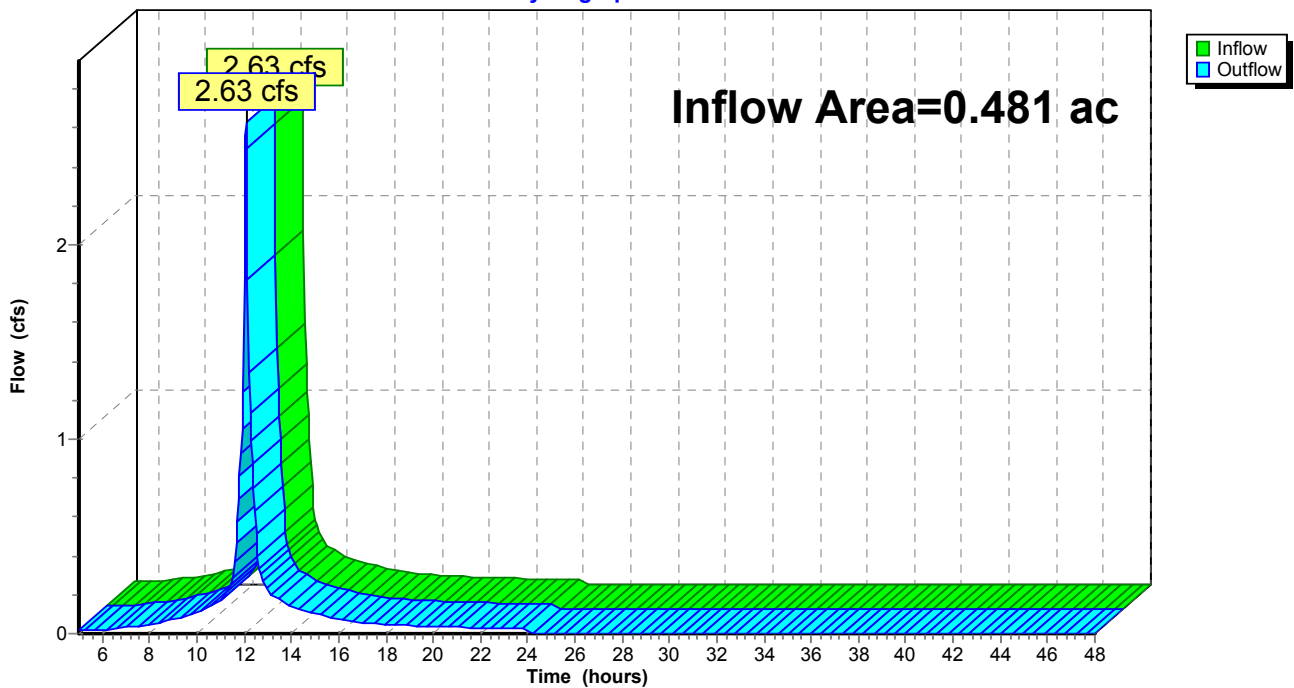
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.481 ac, 72.46% Impervious, Inflow Depth > 4.95" for 25-Year event
Inflow = 2.63 cfs @ 12.07 hrs, Volume= 0.198 af
Outflow = 2.63 cfs @ 12.07 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

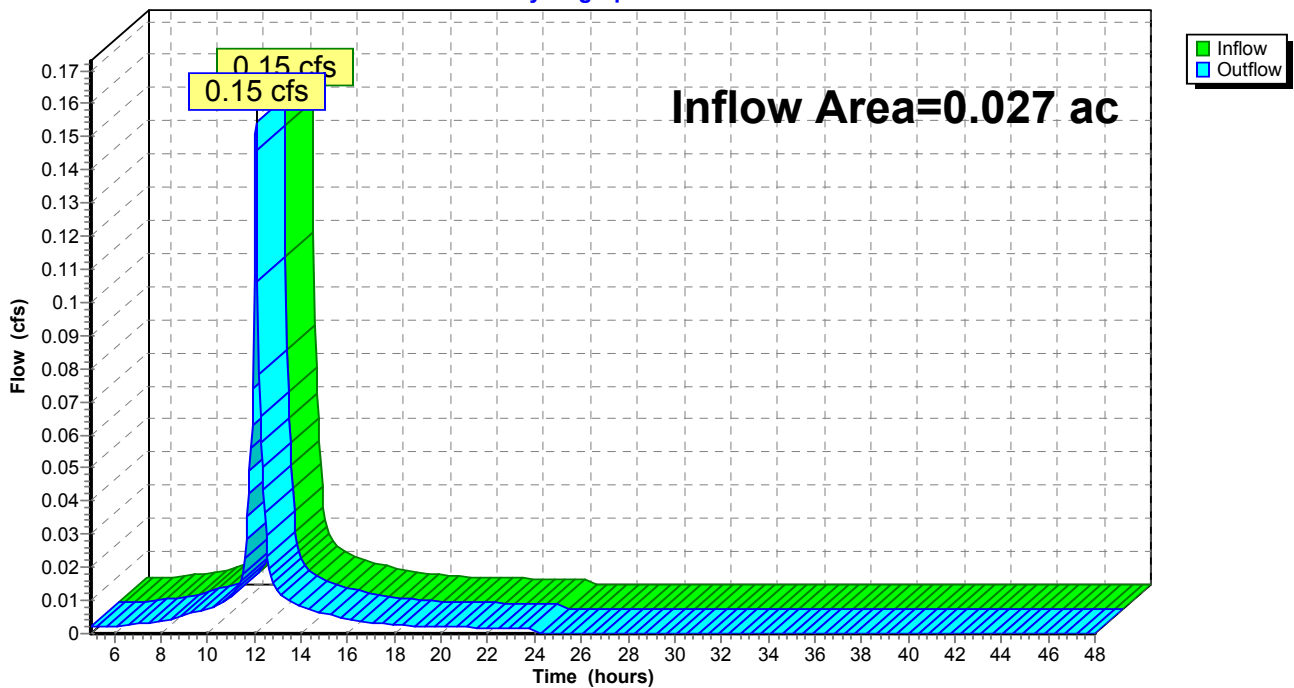
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 100.00% Impervious, Inflow Depth > 5.40" for 25-Year event
Inflow = 0.15 cfs @ 12.07 hrs, Volume= 0.012 af
Outflow = 0.15 cfs @ 12.07 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Summary for Pond 1P: DETENTION POND 1

[82] Warning: Early inflow requires earlier time span

Inflow Area = 1.053 ac, 68.06% Impervious, Inflow Depth > 4.53" for 25-Year event
 Inflow = 3.92 cfs @ 12.08 hrs, Volume= 0.397 af
 Outflow = 2.76 cfs @ 12.19 hrs, Volume= 0.397 af, Atten= 30%, Lag= 6.6 min
 Primary = 2.76 cfs @ 12.19 hrs, Volume= 0.397 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 13.66' @ 12.19 hrs Surf.Area= 2,399 sf Storage= 1,727 cf

Plug-Flow detention time= 9.2 min calculated for 0.396 af (100% of inflow)
 Center-of-Mass det. time= 8.4 min (808.5 - 800.0)

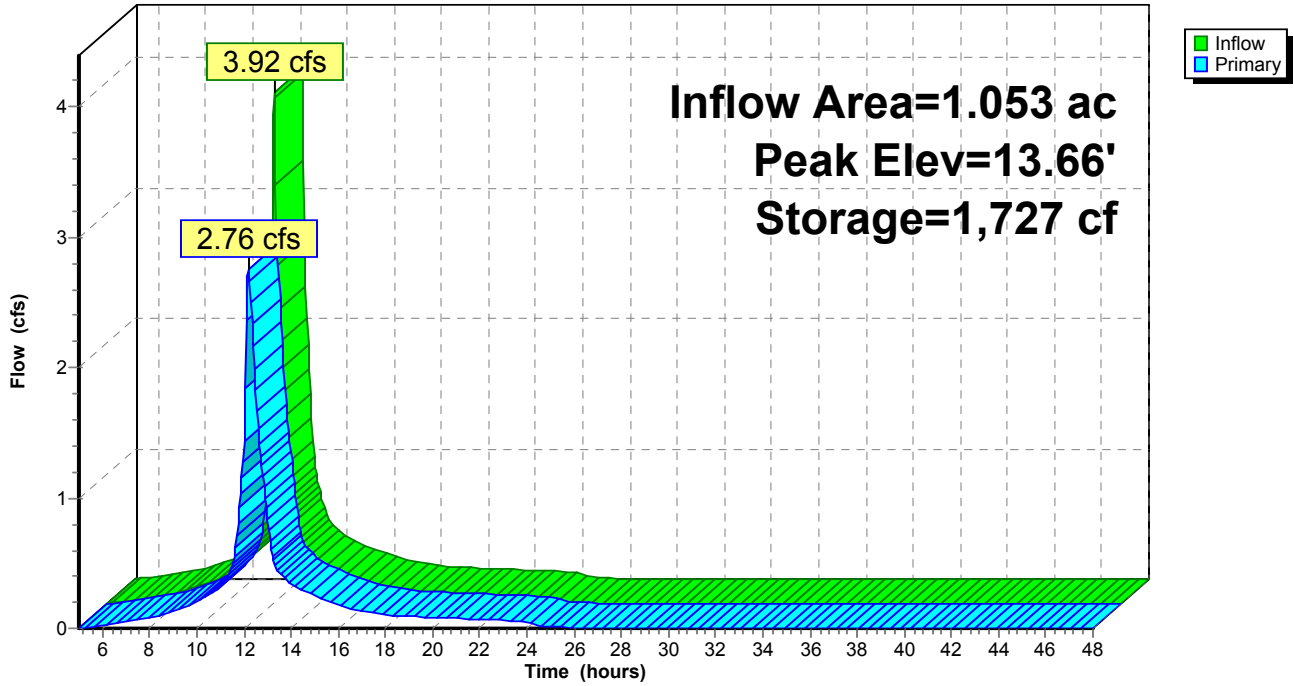
| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 12.20' | 6,680 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 12.20 | 100 | 0 | 0 |
| 12.40 | 250 | 35 | 35 |
| 12.60 | 900 | 115 | 150 |
| 13.00 | 1,150 | 410 | 560 |
| 14.00 | 3,050 | 2,100 | 2,660 |
| 15.00 | 4,990 | 4,020 | 6,680 |

| Device | Routing | Invert | Outlet Devices |
|--------|----------|--------|--|
| #1 | Primary | 12.30' | 15.0" Round Culvert L= 37.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.30' / 12.00' S= 0.0081 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 12.22' | 8.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 13.19' | 75.0 deg x 0.7' long Sharp-Crested Vee/Trap Weir Cv= 2.51 (C= 3.14) |

Primary OutFlow Max=2.75 cfs @ 12.19 hrs HW=13.66' (Free Discharge)
 1=Culvert (Passes 2.75 cfs of 4.66 cfs potential flow)
 2=Orifice/Grate (Orifice Controls 1.76 cfs @ 5.06 fps)
 3=Sharp-Crested Vee/Trap Weir (Weir Controls 0.98 cfs @ 2.00 fps)

Pond 1P: DETENTION POND 1

Hydrograph



Summary for Pond 2P: DETENTION POND 2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.565 ac, 78.23% Impervious, Inflow Depth > 5.05" for 25-Year event
 Inflow = 3.13 cfs @ 12.07 hrs, Volume= 0.238 af
 Outflow = 2.70 cfs @ 12.12 hrs, Volume= 0.238 af, Atten= 14%, Lag= 3.0 min
 Primary = 1.46 cfs @ 12.12 hrs, Volume= 0.208 af
 Secondary = 1.25 cfs @ 12.12 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 14.83' @ 12.12 hrs Surf.Area= 1,725 sf Storage= 1,198 cf

Plug-Flow detention time= 28.9 min calculated for 0.237 af (100% of inflow)
 Center-of-Mass det. time= 29.5 min (802.6 - 773.1)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 14.00' | 3,720 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 14.00 | 1,150 | 0 | 0 |
| 15.00 | 1,840 | 1,495 | 1,495 |
| 16.00 | 2,610 | 2,225 | 3,720 |

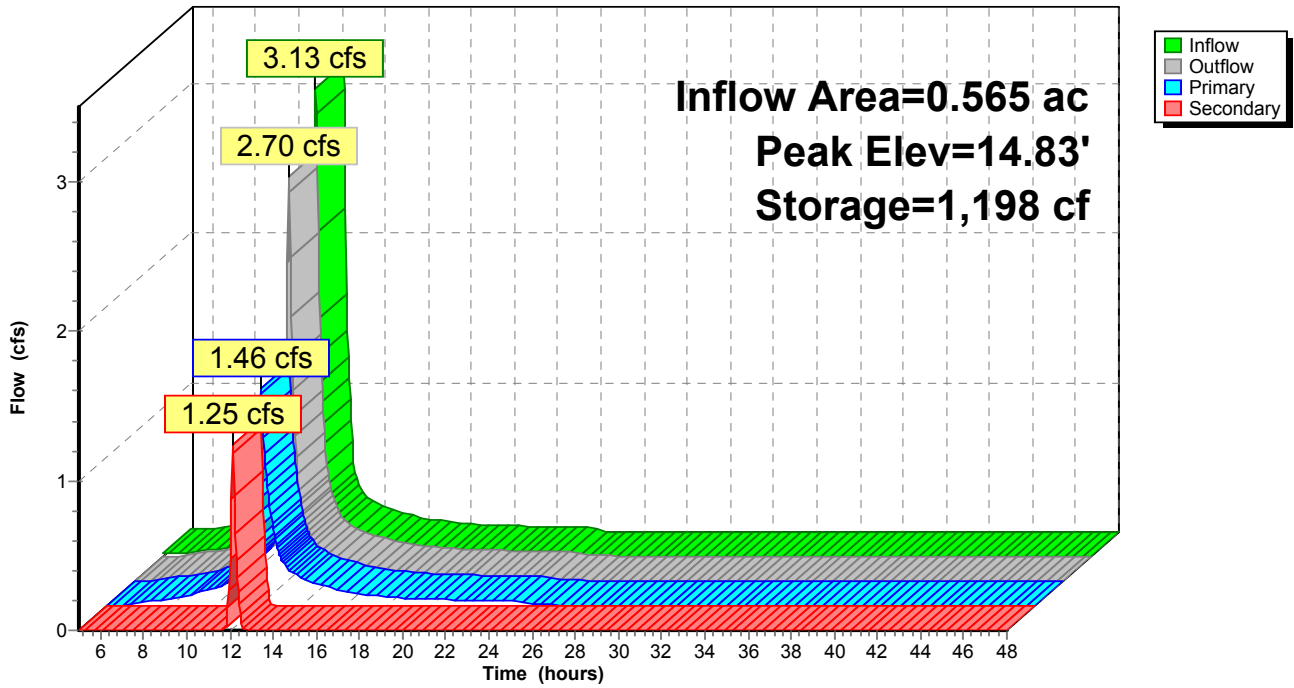
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 14.00' | 12.0" Round Culvert L= 68.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.00' / 13.80' S= 0.0029 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf |
| #2 | Secondary | 14.50' | 2.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.5' Crest Height |

Primary OutFlow Max=1.43 cfs @ 12.12 hrs HW=14.82' (Free Discharge)
 ↑1=Culvert (Barrel Controls 1.43 cfs @ 2.81 fps)

Secondary OutFlow Max=1.20 cfs @ 12.12 hrs HW=14.82' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 1.20 cfs @ 1.91 fps)

Pond 2P: DETENTION POND 2

Hydrograph



Time span=5.00-48.00 hrs, dt=0.05 hrs, 861 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|---|
| Subcatchment 1S: EAST PARKING LOT | Runoff Area=21,284 sf 56.30% Impervious Runoff Depth>7.06" Tc=5.0 min CN=90 Runoff=3.82 cfs 0.287 af |
| Subcatchment 1S-A: EAST PROPERTY | Runoff Area=5,187 sf 0.00% Impervious Runoff Depth=5.91" Tc=5.0 min CN=80 Runoff=0.81 cfs 0.059 af |
| Subcatchment 2S: WEST PARKING LOT | Runoff Area=24,596 sf 78.23% Impervious Runoff Depth>7.47" Tc=5.0 min CN=94 Runoff=4.55 cfs 0.351 af |
| Subcatchment 2S-A: WEST PROPERTY | Runoff Area=3,056 sf 0.00% Impervious Runoff Depth=5.91" Tc=5.0 min CN=80 Runoff=0.48 cfs 0.035 af |
| Subcatchment 3S: SOUTH PROPERTY | Runoff Area=20,931 sf 72.46% Impervious Runoff Depth>7.37" Tc=5.0 min CN=93 Runoff=3.85 cfs 0.295 af |
| Subcatchment 4S: DRIVEWAY | Runoff Area=1,176 sf 100.00% Impervious Runoff Depth>7.78" Tc=5.0 min CN=98 Runoff=0.22 cfs 0.018 af |
| Reach DP-1: EAST WETLAND | Inflow=4.70 cfs 0.638 af Outflow=4.70 cfs 0.638 af |
| Reach DP-2: WEST WETLAND | Inflow=2.58 cfs 0.094 af Outflow=2.58 cfs 0.094 af |
| Reach DP-3: SOUTH WETLAND | Inflow=3.85 cfs 0.295 af Outflow=3.85 cfs 0.295 af |
| Reach DP-4: HENRY GRAF JR. ROAD | Inflow=0.22 cfs 0.018 af Outflow=0.22 cfs 0.018 af |
| Pond 1P: DETENTION POND 1 | Peak Elev=13.91' Storage=2,400 cf Inflow=5.55 cfs 0.580 af Outflow=4.16 cfs 0.579 af |
| Pond 2P: DETENTION POND 2 | Peak Elev=14.98' Storage=1,455 cf Inflow=4.55 cfs 0.351 af Primary=1.86 cfs 0.292 af Secondary=2.14 cfs 0.059 af Outflow=3.99 cfs 0.351 af |

Total Runoff Area = 1.750 ac Runoff Volume = 1.045 af Average Runoff Depth = 7.16"
37.60% Pervious = 0.658 ac 62.40% Impervious = 1.092 ac

Summary for Subcatchment 1S: EAST PARKING LOT

[49] Hint: $T_c < 2dt$ may require smaller dt

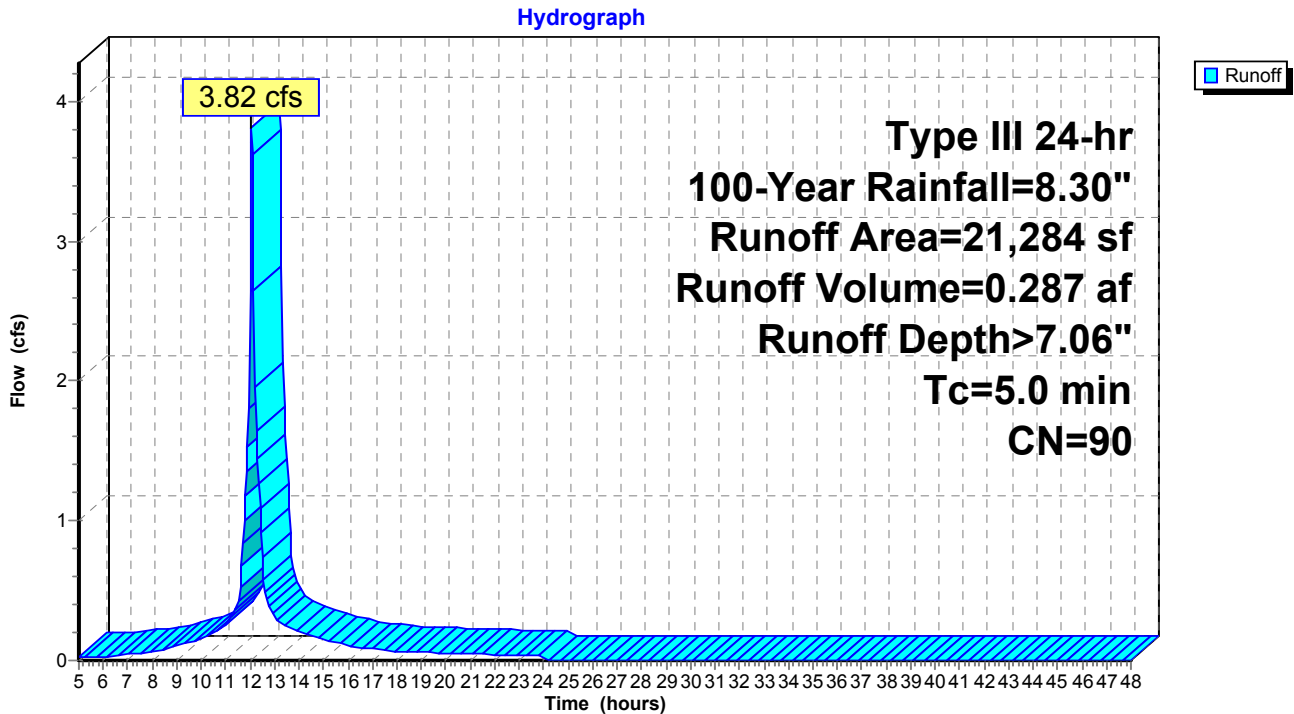
Runoff = 3.82 cfs @ 12.07 hrs, Volume= 0.287 af, Depth> 7.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 9,235 | 80 | >75% Grass cover, Good, HSG D |
| 67 | 80 | >75% Grass cover, Good, HSG D |
| 6,962 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 21,284 | 90 | Weighted Average |
| 9,302 | | 43.70% Pervious Area |
| 11,982 | | 56.30% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S: EAST PARKING LOT



Summary for Subcatchment 1S-A: EAST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.81 cfs @ 12.07 hrs, Volume= 0.059 af, Depth= 5.91"

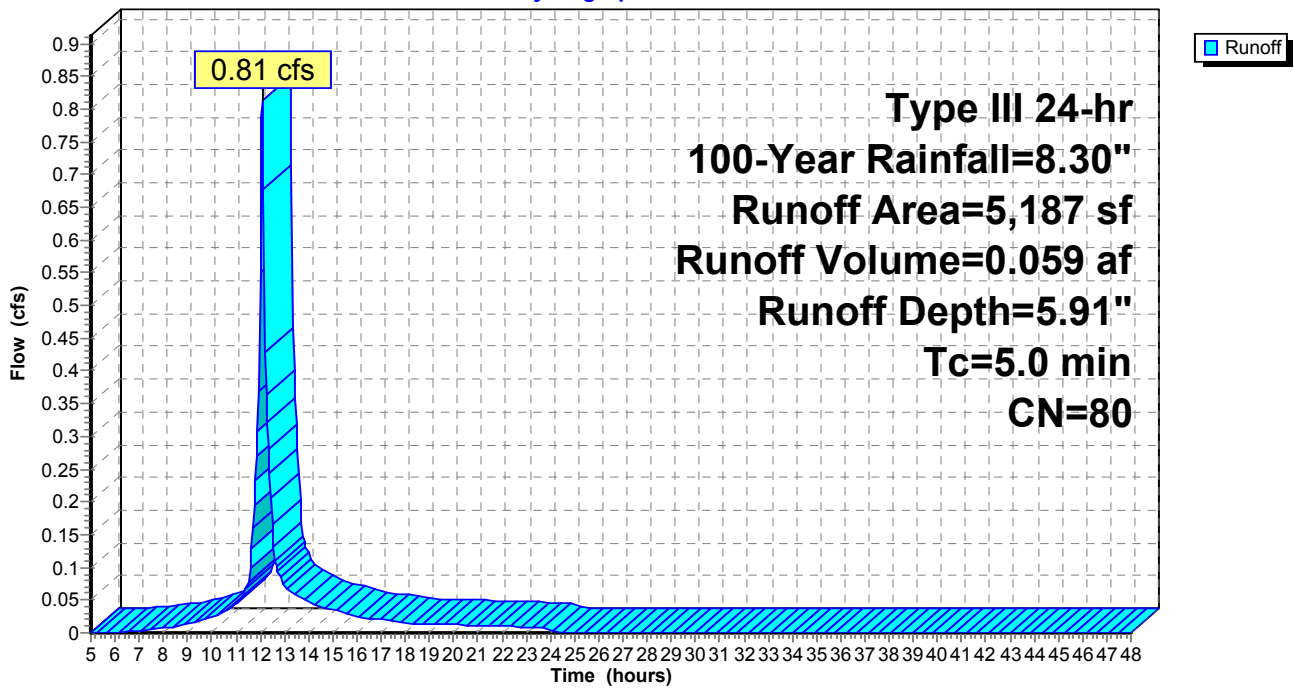
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,187 | 80 | >75% Grass cover, Good, HSG D |
| 5,187 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 1S-A: EAST PROPERTY

Hydrograph



Summary for Subcatchment 2S: WEST PARKING LOT

[49] Hint: Tc<2dt may require smaller dt

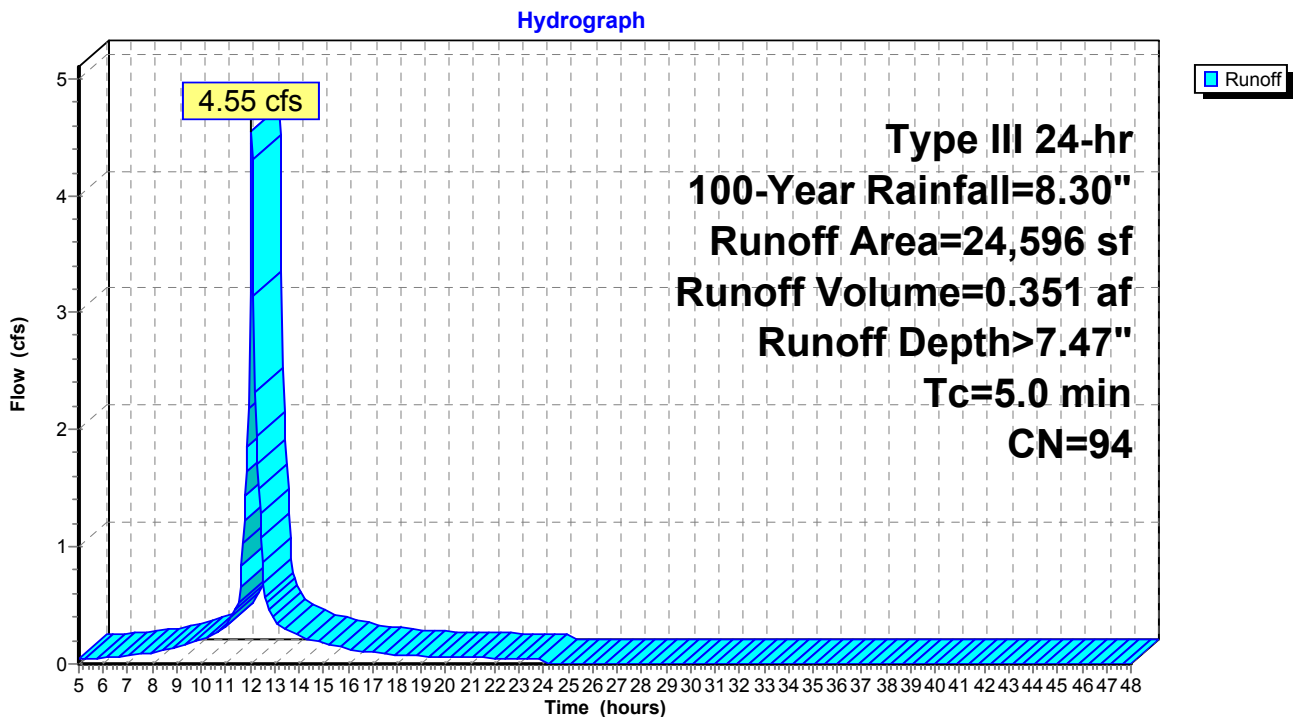
Runoff = 4.55 cfs @ 12.07 hrs, Volume= 0.351 af, Depth> 7.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,354 | 80 | >75% Grass cover, Good, HSG D |
| 14,222 | 98 | Paved parking, HSG D |
| 5,020 | 98 | Roofs, HSG D |
| 24,596 | 94 | Weighted Average |
| 5,354 | | 21.77% Pervious Area |
| 19,242 | | 78.23% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S: WEST PARKING LOT



Summary for Subcatchment 2S-A: WEST PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.48 cfs @ 12.07 hrs, Volume= 0.035 af, Depth= 5.91"

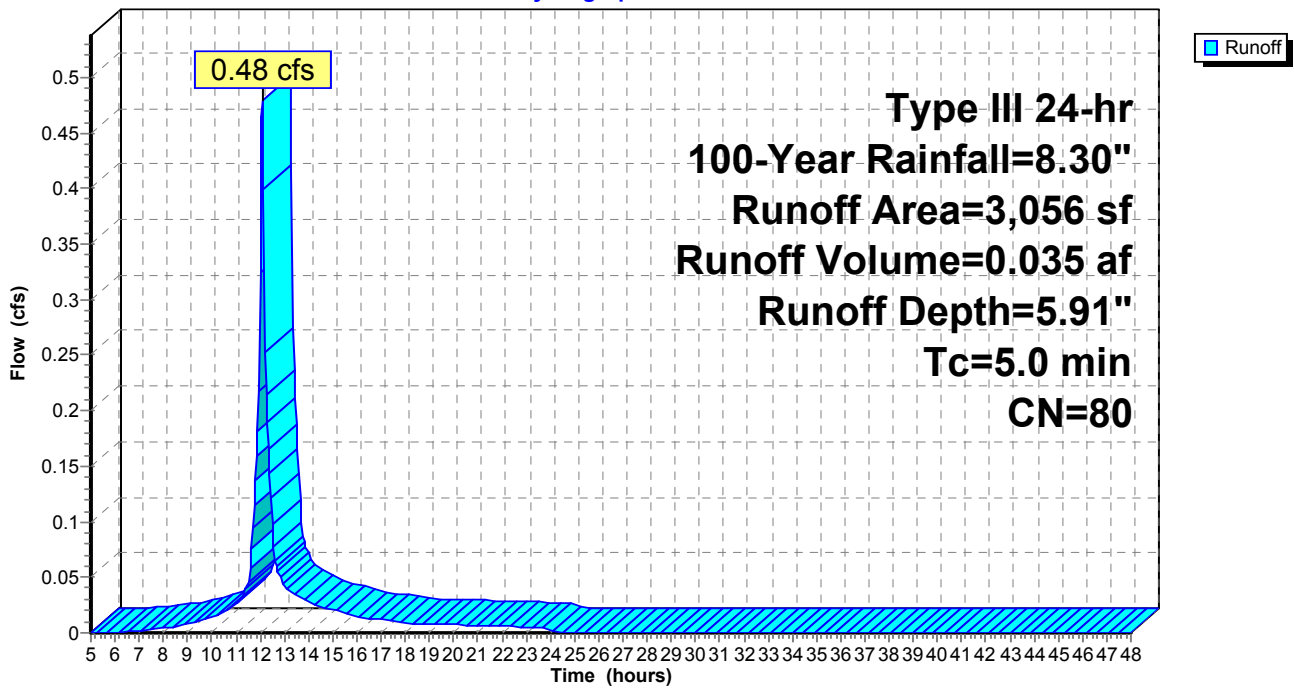
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,056 | 80 | >75% Grass cover, Good, HSG D |
| 3,056 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 2S-A: WEST PROPERTY

Hydrograph



Summary for Subcatchment 3S: SOUTH PROPERTY

[49] Hint: Tc<2dt may require smaller dt

Runoff = 3.85 cfs @ 12.07 hrs, Volume= 0.295 af, Depth> 7.37"

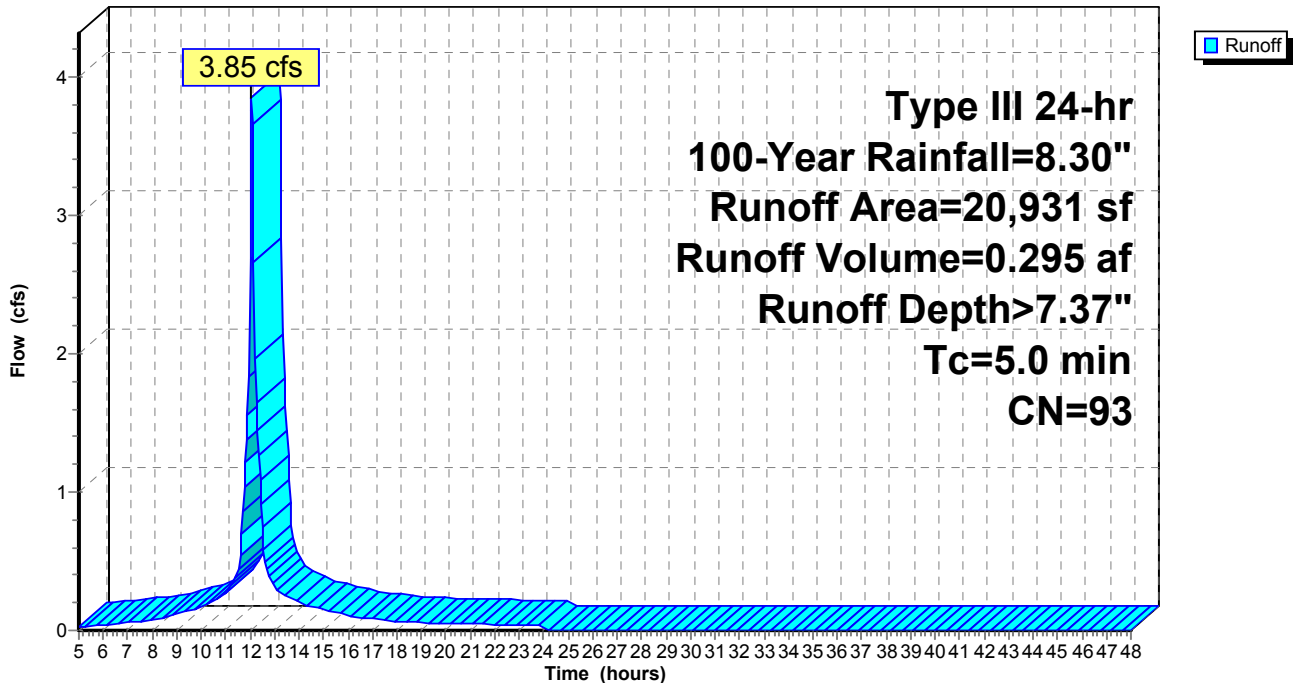
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 15,166 | 98 | Paved parking, HSG D |
| 5,765 | 80 | >75% Grass cover, Good, HSG D |
| 20,931 | 93 | Weighted Average |
| 5,765 | | 27.54% Pervious Area |
| 15,166 | | 72.46% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 3S: SOUTH PROPERTY

Hydrograph



Summary for Subcatchment 4S: DRIVEWAY

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.22 cfs @ 12.07 hrs, Volume= 0.018 af, Depth> 7.78"

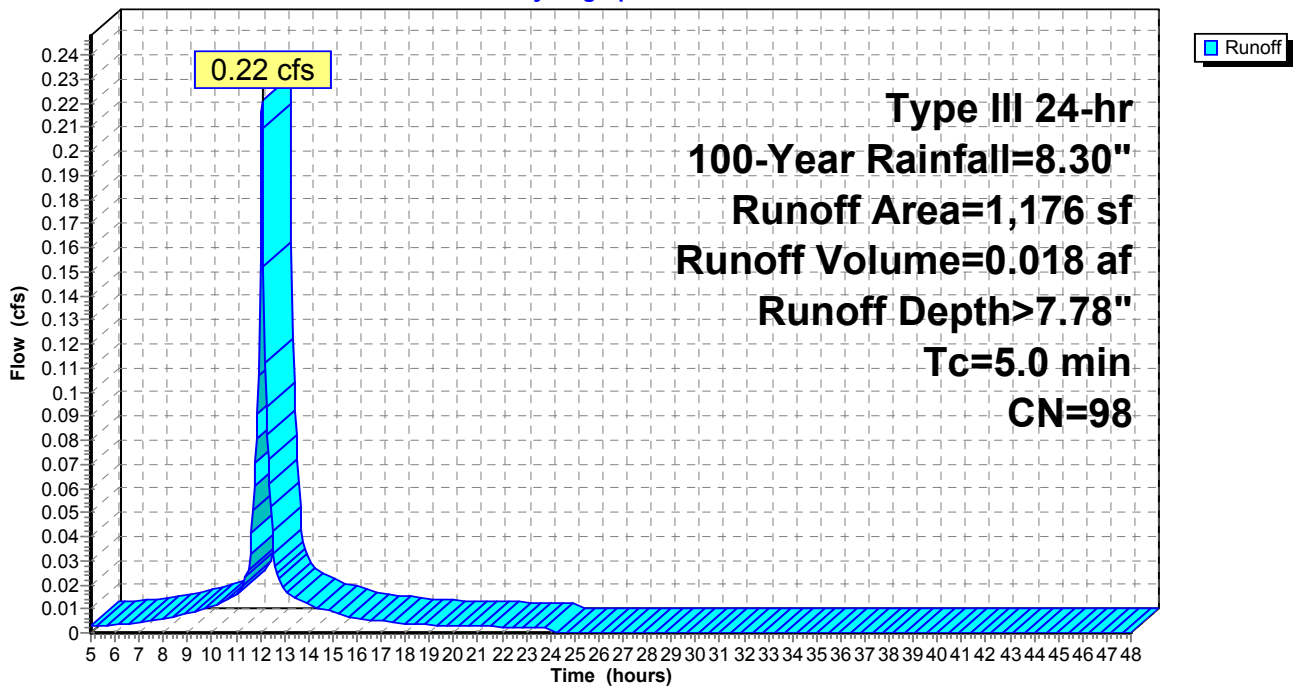
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-48.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-Year Rainfall=8.30"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,176 | 98 | Paved parking, HSG D |
| 1,176 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|----------------------------|
| 5.0 | | | | | Direct Entry, DIRECT ENTRY |

Subcatchment 4S: DRIVEWAY

Hydrograph



Summary for Reach DP-1: EAST WETLAND

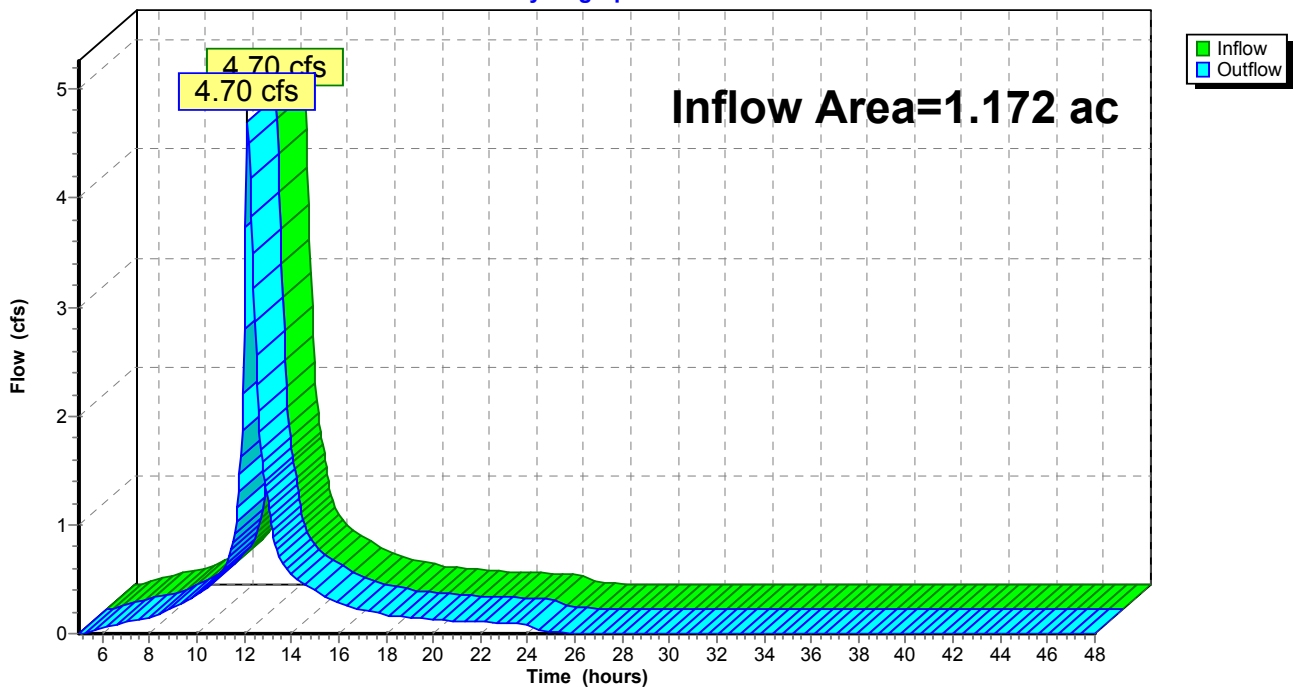
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.172 ac, 61.14% Impervious, Inflow Depth = 6.53" for 100-Year event
Inflow = 4.70 cfs @ 12.15 hrs, Volume= 0.638 af
Outflow = 4.70 cfs @ 12.15 hrs, Volume= 0.638 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-1: EAST WETLAND

Hydrograph



Summary for Reach DP-2: WEST WETLAND

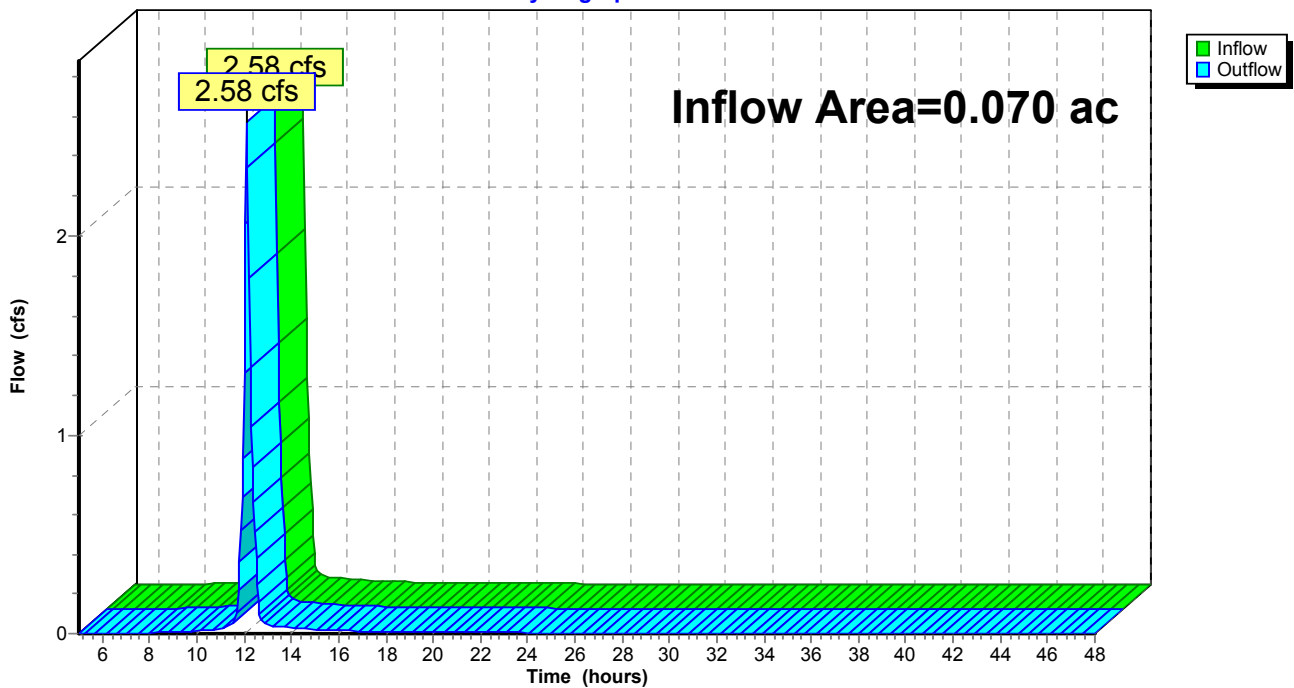
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.070 ac, 0.00% Impervious, Inflow Depth = 16.00" for 100-Year event
Inflow = 2.58 cfs @ 12.11 hrs, Volume= 0.094 af
Outflow = 2.58 cfs @ 12.11 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-2: WEST WETLAND

Hydrograph



Summary for Reach DP-3: SOUTH WETLAND

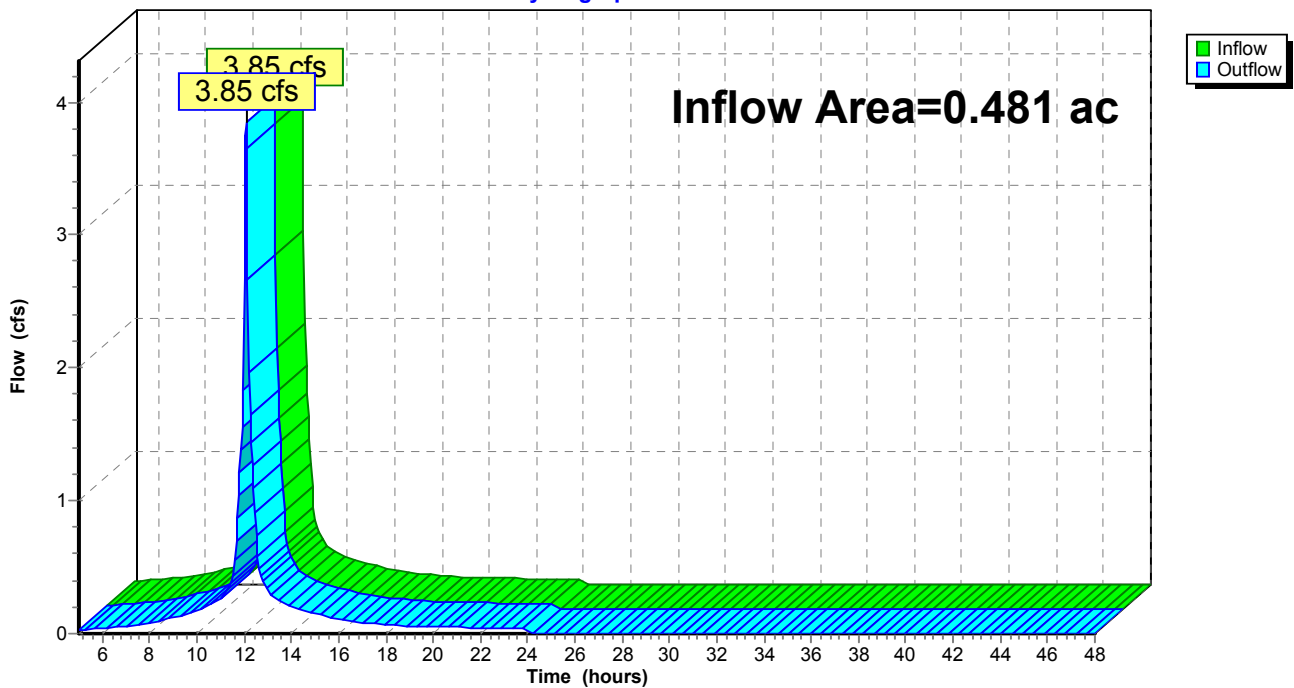
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.481 ac, 72.46% Impervious, Inflow Depth > 7.37" for 100-Year event
Inflow = 3.85 cfs @ 12.07 hrs, Volume= 0.295 af
Outflow = 3.85 cfs @ 12.07 hrs, Volume= 0.295 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-3: SOUTH WETLAND

Hydrograph



Summary for Reach DP-4: HENRY GRAF JR. ROAD

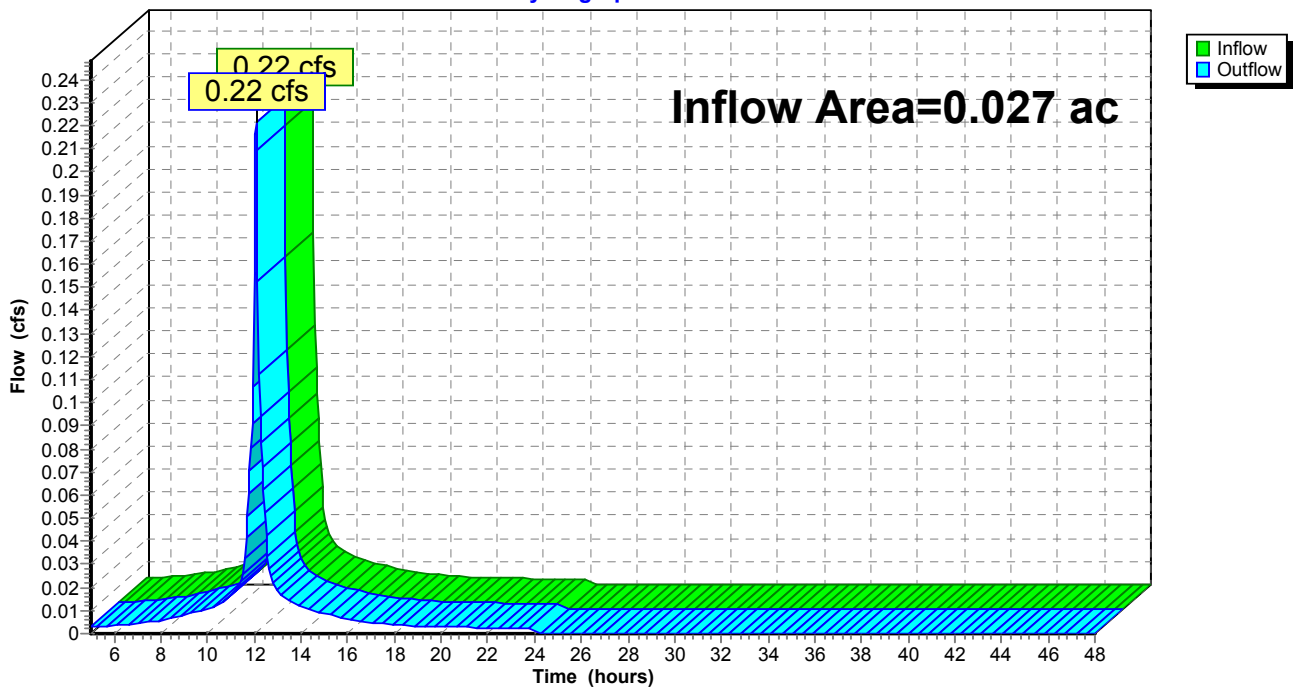
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.027 ac, 100.00% Impervious, Inflow Depth > 7.78" for 100-Year event
Inflow = 0.22 cfs @ 12.07 hrs, Volume= 0.018 af
Outflow = 0.22 cfs @ 12.07 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs

Reach DP-4: HENRY GRAF JR. ROAD

Hydrograph



Summary for Pond 1P: DETENTION POND 1

[82] Warning: Early inflow requires earlier time span

[79] Warning: Submerged Pond 2P Primary device # 1 OUTLET by 0.11'

Inflow Area = 1.053 ac, 68.06% Impervious, Inflow Depth > 6.60" for 100-Year event
 Inflow = 5.55 cfs @ 12.08 hrs, Volume= 0.580 af
 Outflow = 4.16 cfs @ 12.17 hrs, Volume= 0.579 af, Atten= 25%, Lag= 5.4 min
 Primary = 4.16 cfs @ 12.17 hrs, Volume= 0.579 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 13.91' @ 12.17 hrs Surf.Area= 2,884 sf Storage= 2,400 cf

Plug-Flow detention time= 9.4 min calculated for 0.579 af (100% of inflow)
 Center-of-Mass det. time= 8.2 min (799.1 - 790.9)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 12.20' | 6,680 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 12.20 | 100 | 0 | 0 |
| 12.40 | 250 | 35 | 35 |
| 12.60 | 900 | 115 | 150 |
| 13.00 | 1,150 | 410 | 560 |
| 14.00 | 3,050 | 2,100 | 2,660 |
| 15.00 | 4,990 | 4,020 | 6,680 |

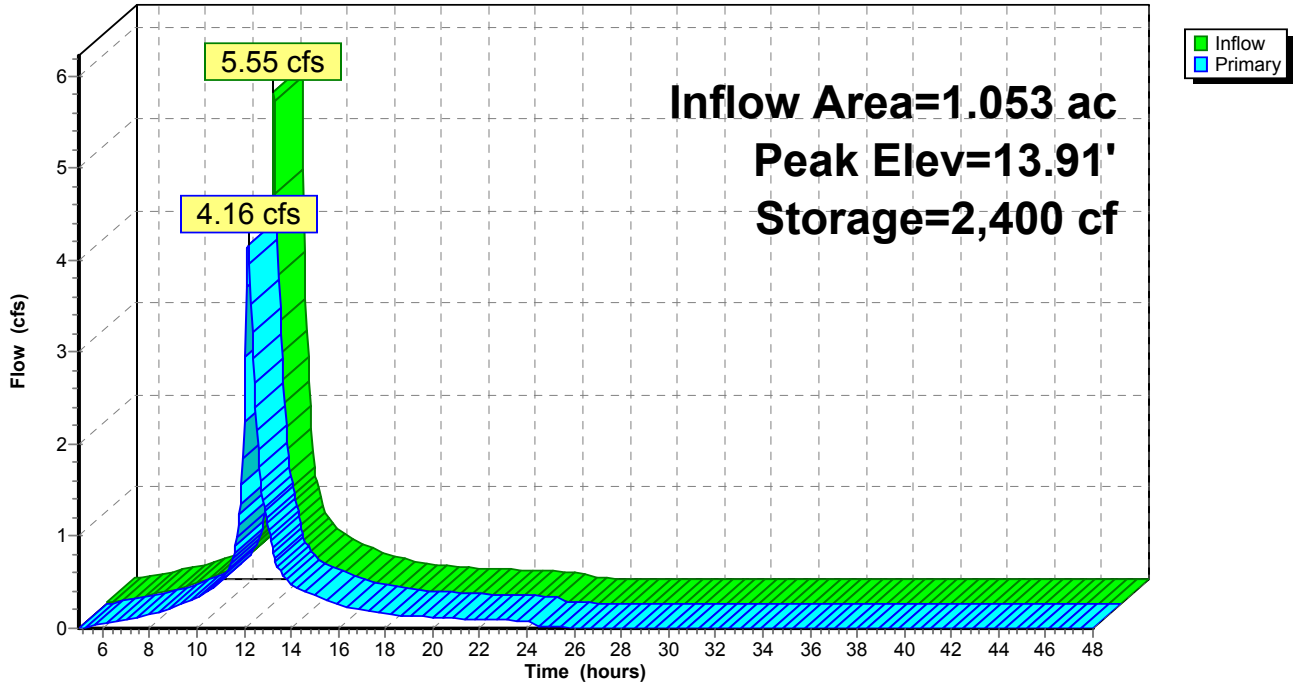
| Device | Routing | Invert | Outlet Devices |
|--------|----------|--------|--|
| #1 | Primary | 12.30' | 15.0" Round Culvert L= 37.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.30' / 12.00' S= 0.0081 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |
| #2 | Device 1 | 12.22' | 8.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 13.19' | 75.0 deg x 0.7' long Sharp-Crested Vee/Trap Weir Cv= 2.51 (C= 3.14) |

Primary OutFlow Max=4.11 cfs @ 12.17 hrs HW=13.90' (Free Discharge)

- 1=Culvert (Passes 4.11 cfs of 5.45 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.95 cfs @ 5.59 fps)
- 3=Sharp-Crested Vee/Trap Weir (Weir Controls 2.15 cfs @ 2.42 fps)

Pond 1P: DETENTION POND 1

Hydrograph



Summary for Pond 2P: DETENTION POND 2

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.565 ac, 78.23% Impervious, Inflow Depth > 7.47" for 100-Year event
 Inflow = 4.55 cfs @ 12.07 hrs, Volume= 0.351 af
 Outflow = 3.99 cfs @ 12.12 hrs, Volume= 0.351 af, Atten= 12%, Lag= 2.8 min
 Primary = 1.86 cfs @ 12.12 hrs, Volume= 0.292 af
 Secondary = 2.14 cfs @ 12.12 hrs, Volume= 0.059 af

Routing by Stor-Ind method, Time Span= 5.00-48.00 hrs, dt= 0.05 hrs
 Peak Elev= 14.98' @ 12.12 hrs Surf.Area= 1,825 sf Storage= 1,455 cf

Plug-Flow detention time= 25.0 min calculated for 0.351 af (100% of inflow)
 Center-of-Mass det. time= 24.3 min (791.9 - 767.6)

| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 14.00' | 3,720 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 14.00 | 1,150 | 0 | 0 |
| 15.00 | 1,840 | 1,495 | 1,495 |
| 16.00 | 2,610 | 2,225 | 3,720 |

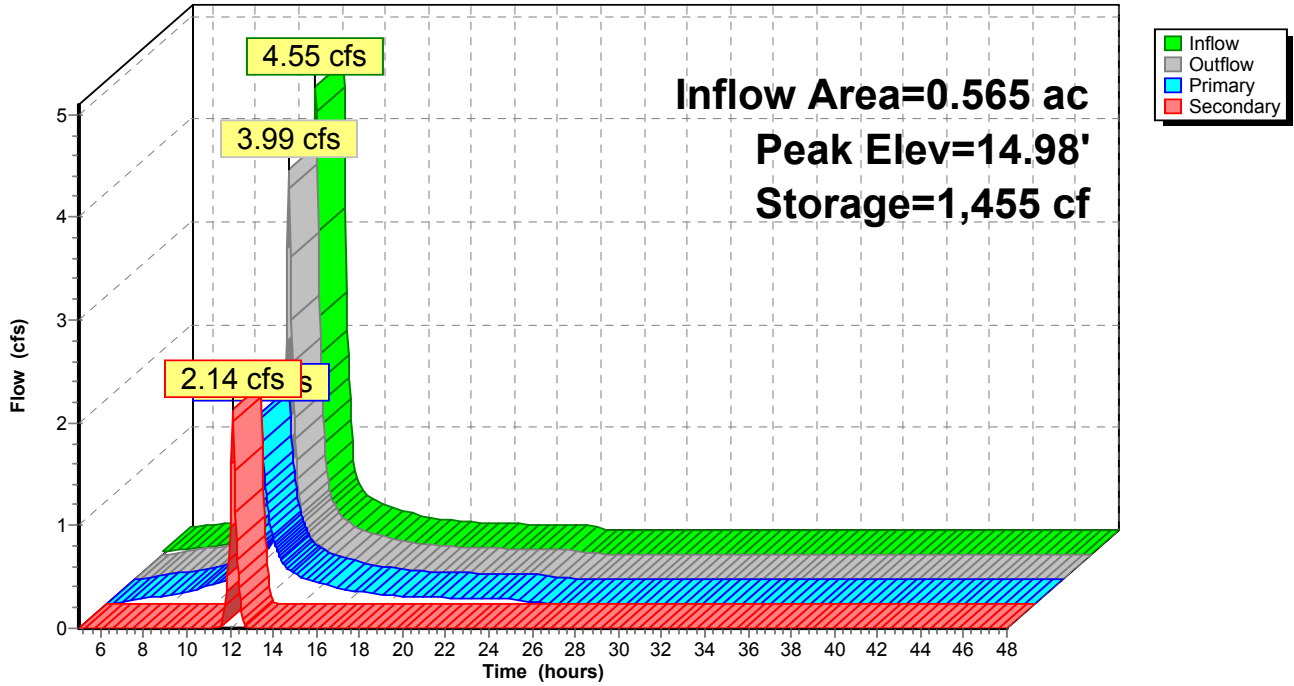
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 14.00' | 12.0" Round Culvert L= 68.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 14.00' / 13.80' S= 0.0029 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf |
| #2 | Secondary | 14.50' | 2.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.5' Crest Height |

Primary OutFlow Max=1.83 cfs @ 12.12 hrs HW=14.97' (Free Discharge)
 ↑1=Culvert (Barrel Controls 1.83 cfs @ 2.99 fps)

Secondary OutFlow Max=2.07 cfs @ 12.12 hrs HW=14.97' (Free Discharge)
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 2.07 cfs @ 2.32 fps)

Pond 2P: DETENTION POND 2

Hydrograph



APPENDIX C

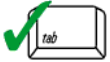
Checklist for Stormwater Report



Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- New development
- Redevelopment
- Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- No disturbance to any Wetland Resource Areas
- Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- Reduced Impervious Area (Redevelopment Only)
- Minimizing disturbance to existing trees and shrubs
- LID Site Design Credit Requested:
 - Credit 1
 - Credit 2
 - Credit 3
- Use of “country drainage” versus curb and gutter conveyance and pipe
- Bioretention Cells (includes Rain Gardens)
- Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- Treebox Filter
- Water Quality Swale
- Grass Channel
- Green Roof
- Other (describe): _____

Standard 1: No New Untreated Discharges

- No new untreated discharges
- Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

A P P E N D I X D

**Illicit Discharge Compliance Statement
Supplemental BMP Calculations**

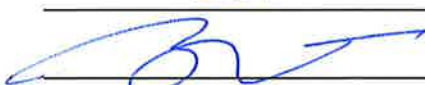
Illicit Discharge Compliance Statement

I, Bradley C. McKenzie, P.E., hereby notify the Newburyport Conservation Commission that I have not witnessed, nor am aware of any existing illicit discharges at the site known as 20 Henry Graf Jr. Road in Newburyport, Massachusetts. I also hereby certify that the development of said property as illustrated on the final plans entitled "Site Development Plan, 20 Henry Graf Jr. Road, Newburyport, MA," prepared by McKenzie Engineering Group, Inc. dated March 17, 2020 and as revised and approved by the Newburyport Conservation Commission and maintenance thereof in accordance with the "Construction Phase Operations and Maintenance Plan" and "Long-Term Operations and Maintenance Plan" prepared by McKenzie Engineering Group, Inc. dated March 17, 2020 and as revised and approved by the Newburyport Conservation Commission will not create any new illicit discharges. There is no warranty implied regarding future illicit discharges that may occur as a result of improper construction or maintenance of the stormwater management system or unforeseen accidents.

Name: Bradley C. McKenzie, P.E.

Company: McKenzie Engineering Group, Inc.

Title: President

Signature:  _____

Date: 3-17-2020

Standard 4-Water Quality

Pond 1P: designed as detention basin w/ outlet

- total subcatchment area = 21,150 SF
- impervious area = 11,804 SF

$$\text{Min. } V_{WQ} = 0.5''/12 \times 11,804 \text{ SF} = \underline{491 \text{ CF}}$$

- Proposed First Defense Unit shall treat V_{WQ}
- During 100-yr storm: time of 0.5" precip. = 5.23 hrs
- First Defense Unit (FD-3HG) Treated $Q = 0.3 \text{ cfs}$

$$0.3 \text{ cfs} \times 5.23 \text{ hrs} \times \frac{3600 \text{ s}}{\text{hr}} \times \frac{1}{2} = \underline{2824 \text{ CF}}$$

$$= \underline{2824 \text{ CF}} > 491 \text{ CF} \checkmark$$

Pond 2P: designed as detention basin w/ outlet

- total subcatchment area = 24,482 SF
- total impervious area = 18,956 SF

$$\text{Min. } V_{WQ} = 0.5''/12 \times 18,956 \text{ SF} = \underline{789 \text{ CF}}$$

- Proposed First Defense Unit shall treat V_{WQ}
- During 100-yr storm: time of 0.5" precip. = 5.23 hrs
- First Defense Unit (FD-3HG) Treated $Q = 0.3 \text{ cfs}$

$$0.3 \text{ cfs} \times 5.23 \text{ hrs} \times \frac{3600 \text{ s}}{\text{hr}} \times \frac{1}{2} = \underline{2824 \text{ CF}}$$

$$\underline{2824 \text{ CF}} > 789 \text{ CF} \checkmark$$

DP-3: Designed as catch basin w/ outlet

- total subcatchment area = 26,135 SF
- total impervious area = 15,051 SF

$$\text{Min VWA} = 0.5''/12 \times 15,051 \text{ SF} = \underline{627 \text{ CF}}$$

- Proposed First Defense Unit shall treat VWA
- During 100-yr storm: time of 0.5" precip = 5.23 hrs
- First Defense Unit (FD-3HC) Treated Q = 0.3 cfs

$$0.3 \text{ cfs} \times 5.23 \text{ hrs} \times \frac{3600 \text{ s}}{\text{hr}} \times \frac{1}{2} = \underline{2824 \text{ CF}}$$

$$\underline{2824 \text{ CF}} > 627 \text{ CF} \quad \checkmark$$



**Standard 4: Total Suspended Solids Calculation:
Detention Basin 1-P**

NAME: 20 Henry Graf Jr. Road
Newburyport, MA
CLIENT: Conserv Group Inc.
COUNTY: Essex

Proj. No.: 219-180
Date: 2/25/2020
Revised:
Computed by: ESS
Checked by: BCM

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

**TSS Removal
Calculation
Worksheet**

| B BMP | C TSS Removal Rate | D Starting TSS Load (*F) | E Amount Removed (C*D) | F Remaining Load (D-E) |
|---|--------------------------|--------------------------------|------------------------------|------------------------------|
| Parking Lot Maintenance/Sweeping | 0.10 | 1.00 | 0.10 | 0.90 |
| Deep Sump Hooded Catch Basins | 0.25 | 0.90 | 0.23 | 0.68 |
| First Defense Unit- Recommended TSS Removal Per Mass STEP | 0.70 | 0.68 | 0.47 | 0.20 |
| | | | | |
| | | | | |

Total TSS Removal = 80%

*Equals remaining load from previous BMP (E)
which enters the BMP



**Standard 4: Total Suspended Solids Calculation:
Detention Basin 2-P**

NAME: 20 Henry Graf Jr. Road
Newburyport, MA
CLIENT: Conserv Group Inc.
COUNTY: Essex

Proj. No.: 219-180
Date: 2/25/2020
Revised:
Computed by: ESS
Checked by: BCM

Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

**TSS Removal
Calculation
Worksheet**

| B BMP | C TSS Removal Rate | D Starting TSS Load (*F) | E Amount Removed (C*D) | F Remaining Load (D-E) |
|---|--------------------------|--------------------------------|------------------------------|------------------------------|
| Parking Lot Maintenance/Sweeping | 0.10 | 1.00 | 0.10 | 0.90 |
| Deep Sump Hooded Catch Basins | 0.25 | 0.90 | 0.23 | 0.68 |
| First Defense Unit- Recommended TSS Removal Per Mass STEP | 0.70 | 0.68 | 0.47 | 0.20 |
| | | | | |
| | | | | |

Total TSS Removal = 80%

*Equals remaining load from previous BMP (E)
which enters the BMP



**Standard 4: Total Suspended Solids Calculation:
Design Point #3**

NAME: 20 Henry Graf Jr. Road
Newburyport, MA
CLIENT: Conserv Group Inc.
COUNTY: Essex

Proj. No.: 219-180
Date: 2/25/2020
Revised:
Computed by: ESS
Checked by: BCM

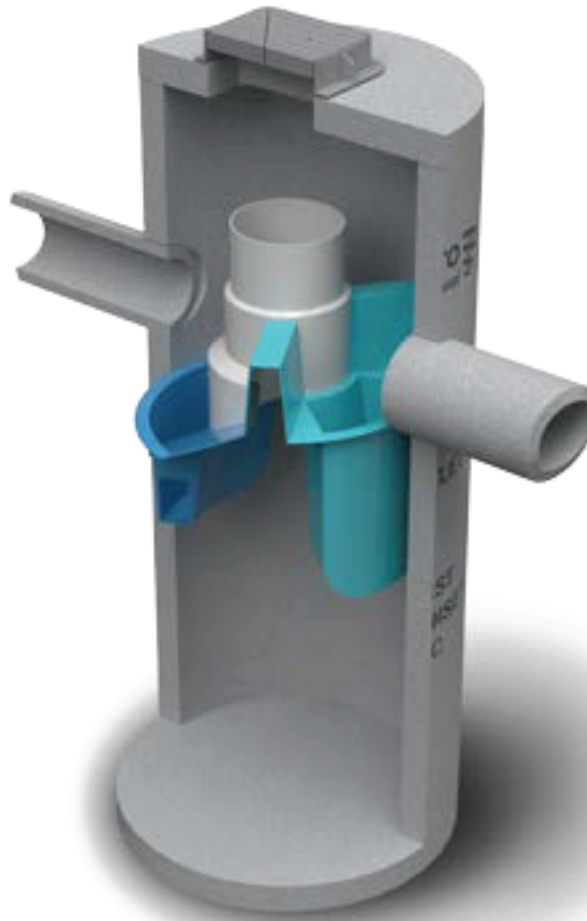
Assinippi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061

**TSS Removal
Calculation
Worksheet**

| B BMP | C TSS Removal Rate | D Starting TSS Load (*F) | E Amount Removed (C*D) | F Remaining Load (D-E) |
|---|--------------------------|--------------------------------|------------------------------|------------------------------|
| Parking Lot Maintenance/Sweeping | 0.10 | 1.00 | 0.10 | 0.90 |
| Deep Sump Hooded Catch Basins | 0.25 | 0.90 | 0.23 | 0.68 |
| First Defense Unit- Recommended TSS Removal Per Mass STEP | 0.70 | 0.68 | 0.47 | 0.20 |
| | | | | |
| | | | | |

Total TSS Removal = 80%

*Equals remaining load from previous BMP (E)
which enters the BMP



Operation and Maintenance Manual

First Defense® and First Defense® High Capacity

Vortex Separator for Stormwater Treatment

Table of Contents

| | |
|----------|--|
| 3 | FIRST DEFENSE® BY HYDRO INTERNATIONAL <ul style="list-style-type: none">- INTRODUCTION- OPERATION- POLLUTANT CAPTURE AND RETENTION |
| 4 | MODEL SIZES & CONFIGURATIONS <ul style="list-style-type: none">- FIRST DEFENSE® COMPONENTS |
| 5 | MAINTENANCE <ul style="list-style-type: none">- OVERVIEW- MAINTENANCE EQUIPMENT CONSIDERATIONS- DETERMINING YOUR MAINTENANCE SCHEDULE |
| 6 | MAINTENANCE PROCEDURES <ul style="list-style-type: none">- INSPECTION- FLOATABLES AND SEDIMENT CLEAN OUT |
| 8 | FIRST DEFENSE® INSTALLATION LOG |
| 9 | FIRST DEFENSE® INSPECTION AND MAINTENANCE LOG |

COPYRIGHT STATEMENT: The contents of this manual, including the graphics contained herein, are intended for the use of the recipient to whom the document and all associated information are directed. Hydro International plc owns the copyright of this document, which is supplied in confidence. It must not be used for any purpose other than that for which it is supplied and must not be reproduced, in whole or in part stored in a retrieval system or transmitted in any form or by any means without prior permission in writing from Hydro International plc. First Defense® is a trademarked hydrodynamic vortex separation device of Hydro International plc. A patent covering the First Defense® has been granted.

DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's First Defense®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc has a policy of continuous product development and reserves the right to amend specifications without notice.

HYDRO MAINTENANCE SERVICES

Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

NOBODY KNOWS OUR SYSTEMS BETTER THAN WE DO



AVOID SERVICE NEGLIGENCE

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan
- Charging for maintenance that may not yet have been required.

LEAVE THE DIRTY WORK TO US

Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vactor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)



BETTER TOOLS, BETTER RESULTS

Not all vacor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.

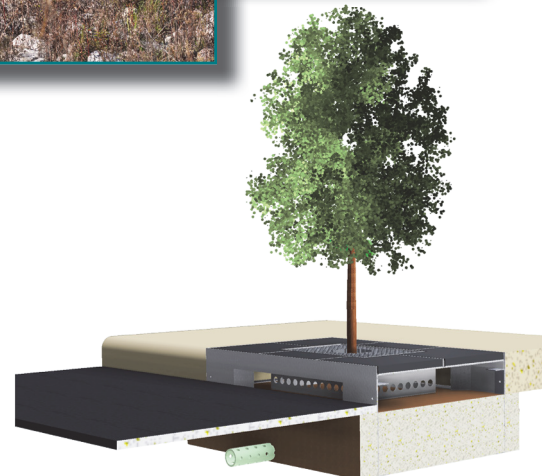


SERVICE WARRANTY

Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

TREATMENT SYSTEMS SERVICED BY HYDRO:

- Stormwater filters
- Stormwater separators
- Baffle boxes
- Biofilters/biorention systems
- Storage structures
- Catch basins
- Stormwater ponds
- Permeable pavement



SAVE TIME & MONEY: CALL HYDRO FOR A QUOTE

1 (888) 382-7808

LEARN MORE AT HYDRO-INT.COM/SERVICE

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

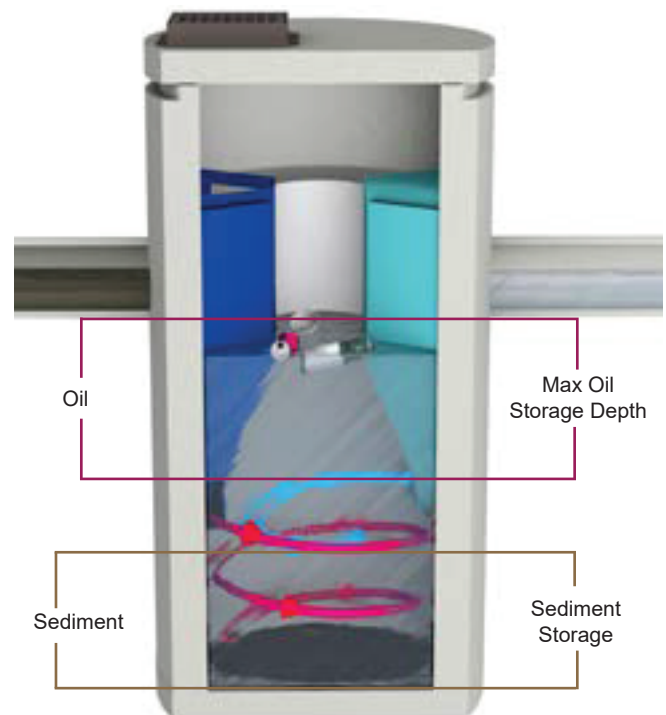


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2a - 2b). First Defense® model parameters and design criteria are shown in Table 1.

First Defense® Components

- 1. Built-In Bypass
- 2. Inlet Pipe
- 3. Inlet Chute
- 4. Floatables Draw-off Port
- 5. Outlet Pipe
- 6. Floatables Storage
- 7. Sediment Storage
- 8. Inlet Grate or Cover

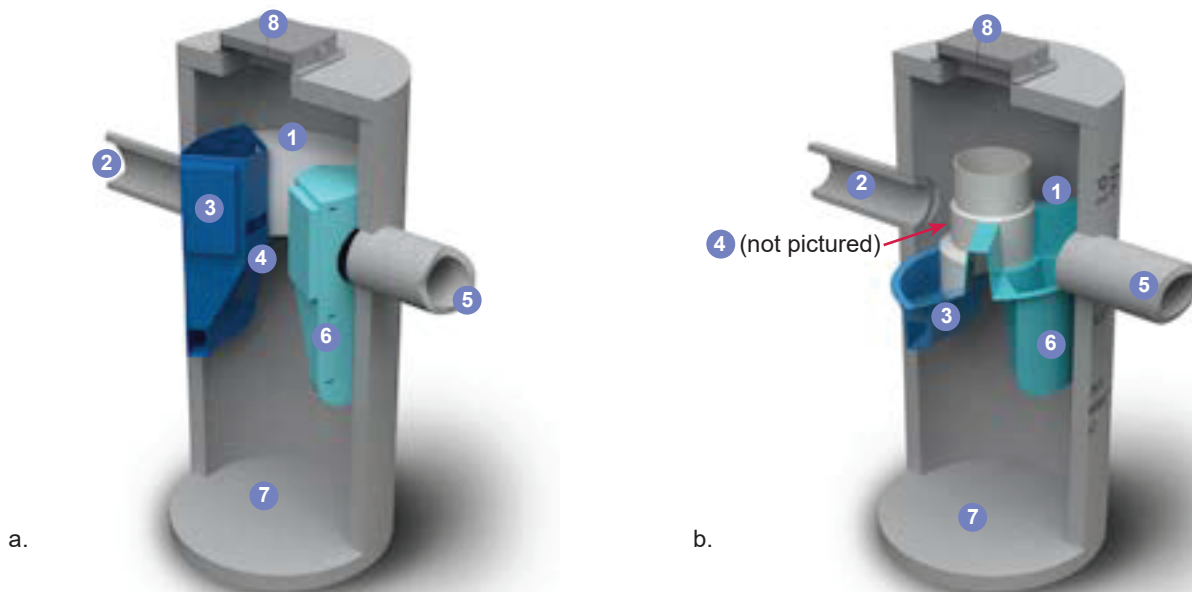


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

| First Defense® High Capacity Model Number | Diameter | Typical TSS Treatment Flow Rates | | Peak Online Flow Rate | Maximum Pipe Diameter ¹ | Oil Storage Capacity | Typical Sediment Storage Capacity ² | Minimum Distance from Outlet Invert to Top of Rim ³ | Standard Distance from Outlet Invert to Sump Floor |
|---|----------|----------------------------------|--------------|-----------------------|------------------------------------|----------------------|--|--|--|
| | | NJDEP Certified | 106µm | | | | | | |
| | (ft / m) | (cfs / L/s) | (cfs / L/s) | (cfs / L/s) | (in / mm) | (gal / L) | (yd ³ / m ³) | (ft / m) | (ft / m) |
| FD-3HC | 3 / 0.9 | 0.84 / 23.7 | 1.60 / 45.3 | 15 / 424 | 18 / 457 | 125 / 473 | 0.4 / 0.3 | 2.0 - 3.5 / 0.6 - 1.0 | 3.71 / 1.13 |
| FD-4HC | 4 / 1.2 | 1.50 / 42.4 | 1.88 / 50.9 | 18 / 510 | 24 / 600 | 191 / 723 | 0.7 / 0.5 | 2.3 - 3.9 / 0.7 - 1.2 | 4.97 / 1.5 |
| FD-5HC | 5 / 1.5 | 2.34 / 66.2 | 2.94 / 82.1 | 20 / 566 | 24 / 609 | 300 / 1135 | 1.1 / .84 | 2.5 - 4.5 / 0.7 - 1.3 | 5.19 / 1.5 |
| FD-6HC | 6 / 1.8 | 3.38 / 95.7 | 4.73 / 133.9 | 32 / 906 | 30 / 750 | 496 / 1,878 | 1.6 / 1.2 | 3.0 - 5.1 / 0.9 - 1.6 | 5.97 / 1.8 |
| FD-8HC | 8 / 2.4 | 6.00 / 169.9 | 7.52 / 212.9 | 50 / 1,415 | 48 / 1219 | 1120 / 4239 | 2.8 / 2.1 | 3.0 - 6.0 / 0.9 - 1.8 | 7.40 / 2.2 |

¹Contact Hydro International when larger pipe sizes are required.

²Contact Hydro International when custom sediment storage capacity is required.

³Minimum distance for models depends on pipe diameter.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense®-HC have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

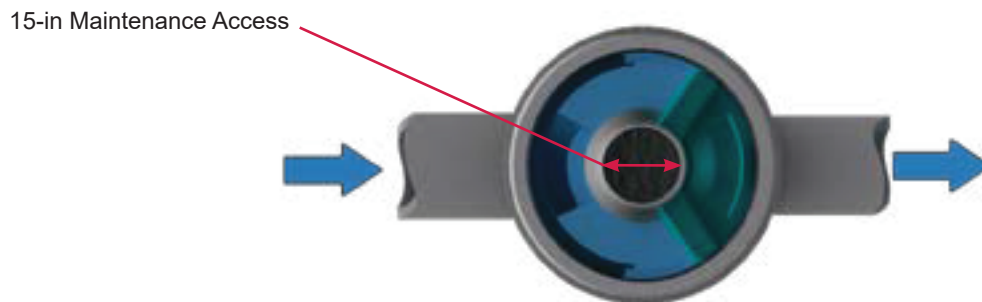


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / floatables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.
- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

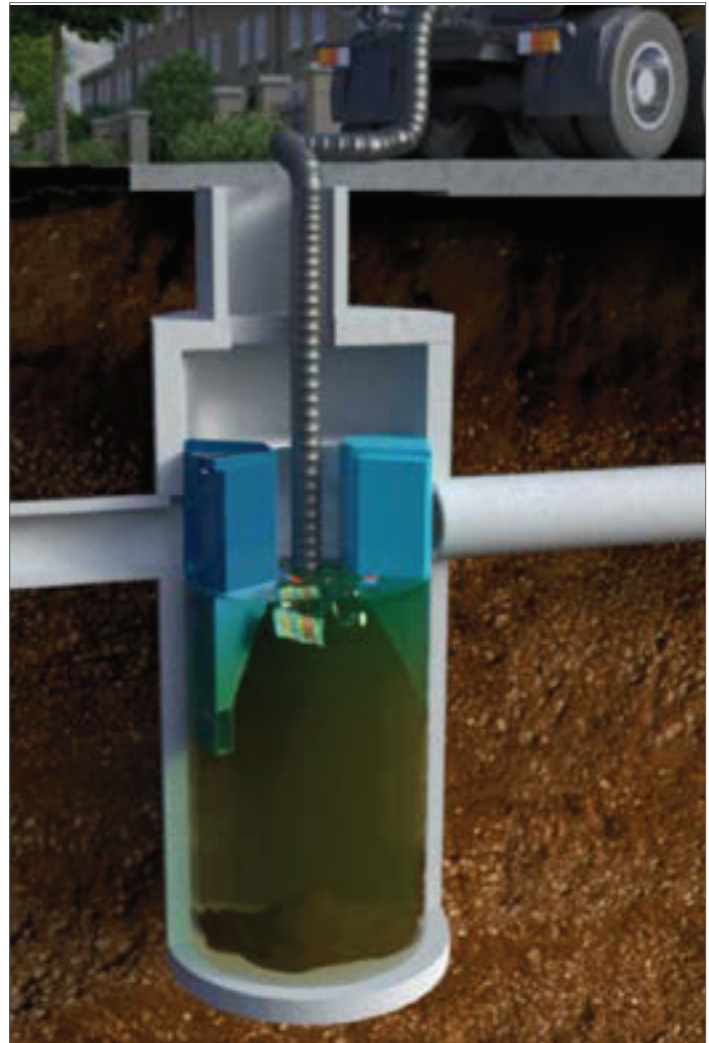


Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).
7. Retract the vactor hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.
9. Securely replace the grate or lid.



Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

| | |
|----------------------------|--|
| Inspection | <ul style="list-style-type: none"> - Regularly during first year of installation - Every 6 months after the first year of installation |
| Oil and Floatables Removal | <ul style="list-style-type: none"> - Once per year, with sediment removal - Following a spill in the drainage area |
| Sediment Removal | <ul style="list-style-type: none"> - Once per year or as needed - Following a spill in the drainage area |

NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.



First Defense® Installation Log

| | |
|---------------------------------------|---------------|
| HYDRO INTERNATIONAL REFERENCE NUMBER: | |
| SITE NAME: | |
| SITE LOCATION: | |
| OWNER: | CONTRACTOR: |
| CONTACT NAME: | CONTACT NAME: |
| COMPANY NAME: | COMPANY NAME: |
| ADDRESS: | ADDRESS: |
| TELEPHONE: | TELEPHONE: |
| FAX: | FAX: |

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): FD-4 FD-4HC FD-6 FD-6HC

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

DO IT RIGHT THE FIRST TIME

LEARN MORE AT HYDRO-INT.COM/SERVICE



CALL 1 (888) 382-7808 TO SCHEDULE AN INSPECTION

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

APPENDIX E

Soil Testing Data

CGE Engineering, Inc.

Civil ♦ Geotechnical ♦ Environmental

Consulting
Engineers & Scientists

ENGINEER'S FIELD REPORT

FIELD REPORT: 01

December 4, 2019

PROJECT:

Proposed Commercial Building Site

Test Pit Observations

20 Henry Graft Jr. Road

Newburyport, MA

CGE Project No. 191210

PURPOSE: CGE Engineering, Inc. (CGE) was requested by Mr. Pieter Van Slyck, of the ConServ Group to observe test pit excavations performed at the direction of the McKenzie Engineering Group. CGE was provided two site plans prepared by McKenzie Engineering Group dated November 8, 2019 showing Existing Conditions and the Conceptual Development Plan of the site and a Google Earth satellite image of the proposed locations of eight test pits. The test pit excavations were to be used for preliminary subsurface soil and groundwater information that would aid in site development considerations. The proposed test pit locations were outside the proposed building footprint.

INSPECTOR: Ronald F. Bukoski, P.E., L.S.P., - Prepared Engineer's Field Report

PROJECT CONTACT INFORMATION:

DESIGNER & BUILDING CONTRACTOR:

Mr. Pieter Van Slyck

ConServ Group, Inc.

110 State Road, Suite 7

Sagamore Beach, MA 02562

T: (508) 888-6555

E-Mail: pvan Slyck@conservgroup.com

SITE DESIGN

Mr. Bradley C. McKenzie, P.E.

McKenzie Engineering Group

150 Longwater Drive, Suite 101

Norwell, MA 02061

T: (781) 792-3900

E-Mail: BMckenzie@mckeng.com

BACKGROUND

The proposed site development consists of a three-story commercial building having a 10,000 square foot footprint situated on a 2-acre site. Specific building design details have not been developed at this time. As early as 1995, a portion of the site was used for storage of construction aggregates, and by the end of 2000, essentially the entire site was utilized for storage of construction aggregates in large piles, as seen from Google Earth satellite images appended to this report. The developed portion of the site is relatively level with wetlands and ponding of water proximal to the site.

The Natural Resources Conservation Service Soil Survey for Essex County was reviewed for general soils found in the vicinity of the site. The site was mapped as Scantic silt loam formed from soft fine-silty glaciolacustrine deposits and/or soft fine-silty glaciomarine deposits over hard fine-silty glaciolacustrine or glaciomarine deposits. The typical soil profile was noted to consist

of 0 to 11 inches of silt loam overlying 11-26 inches of silty clay loam above 26 to 60 inches of clay. Groundwater is shallow, ranging from 0 to 12 inches with the underlying soils poorly drained.

Wednesday, December 4, 2019, 1100 - 1300 hrs, Test Pit Observations, Cloudy, 33° F

Arrived on-site around 1100 hrs and visually observed nine test pit excavations as shown in the Test Pit Location Plan, Photo 1. Test Pit logs were prepared for three test pits proximal to the proposed building footprint, as time allowed. Each test pit excavation was terminated when naturally occurring Clay soils were encountered. Photographs of each logged test pit are presented in attached Photos 2 through 11.

| Project: 20 Henry Graft Jr. Road, Newburyport | | Test Pit No. TP-5 |
|--|--|--------------------------|
| Date: December 4, 2019 | | |
| Depth (Inches) | Description of Materials & Remarks | |
| 0 - 46 | Surface: Partially snow-covered soil. Fill: Silty Gravelly Sand w/ 5-15% Cobbles , apparent Fill to 46" with variable layers and densities, near surface - occasional brick fragment, damp – no groundwater weeping, c-f Sand, 20-30% c-f Gravel, 10-20% nonplastic Fines, dark brown with dark gray layer. | |
| 46 - 58 | Silty Gravelly Sand , c- f Sand, 25-35% c-f subangular to subrounded Gravel, 5-10% nonplastic fines, damp, brown. | |
| 58 - 72 | Clay , dense/ very stiff to hard, low to moderate plasticity, gray. PP* >4.5 tsf. | |
| 72 | Bottom of Test Pit | |
| Notes: TP location southern side of proposed building footprint. *PP = Pocket Penetrometer, provides approximate equivalent unconfined compressive strength, tons per square foot (tsf). | | |

| Project: 20 Henry Graft Jr. Road, Newburyport | | Test Pit No. TP-7 |
|---|---|--------------------------|
| Date: December 4, 2019 | | |
| Depth (Inches) | Description of Materials & Remarks | |
| 0 - 56 | Surface: Partially snow-covered soil. Fill: Silty Gravelly Sand w/ 5-15% Cobbles , apparent Fill to 56" with variable layers and densities, near surface - occasional brick fragment, few small roots, damp – groundwater weeping very slowly at 39", c-f Sand, 20-30% c-f Gravel, 10-20% nonplastic Fines, dark brown with dark gray layer. | |
| 56 - 68 | Silty Gravelly Sand , c- f Sand, 25-35% c-f subangular to subrounded Gravel, 5-10% nonplastic fines, moist, brown. | |
| 68 - 78 | Clay , dense/ very stiff to hard, low to moderate plasticity, gray. PP* >4.5 tsf. | |
| 78 | Bottom of Test Pit | |
| Notes: TP located western side of building footprint. *PP = Pocket Penetrometer, provides approximate equivalent unconfined compressive strength, tons per square foot (tsf). | | |

| Project: 20 Henry Graft Jr. Road, Newburyport | | Test Pit No. TP-9 |
|---|--|--------------------------|
| Date: December 4, 2019 | | |
| Depth (Inches) | Description of Materials & Remarks | |
| 0 - 57 | Surface: Partially snow-covered soil. Fill: Silty Gravelly Sand w/ 5-15% Cobbles and Boulders to 18" , apparent Fill to 57" with variable layers and densities, near surface - occasional brick fragment and wire, damp to saturated – groundwater weeping at 37", c-f Sand, 20-30% c-f Gravel - significant increase in Gravel above Clay layer, 10-20% nonplastic Fines, brown to nearly black just above Clay layer. | |
| 57 - 78 | Clay , dense/ very stiff to hard, low to moderate plasticity, gray. PP* >4.5 tsf. | |
| 78 | Bottom of Test Pit | |
| Notes: TP located northeastern corner of the proposed building footprint. *PP = Pocket Penetrometer, provides approximate equivalent unconfined compressive strength, tons per square foot (tsf). | | |

EVALUATION

Development of the site has been as a staging area for stockpiling construction aggregates as early as 1995. The three test pit logs presented herein were judged to be representative of the other six test pits. From observations of the nine test pits, most of the site and presumed within the proposed building footprint has been filled above the Clay or Silty Gravelly Sand layer located just above the Clay layer. The Fill consists of variable soil layers and consistency, interspersed with occasional miscellaneous construction debris. There was no obvious sign of previous overfilling of topsoil or wetland deposits at the test pit locations. The site was subsequently surcharged with various stockpiles of construction aggregates as seen from Google Earth satellite images appended to this report. Significant stockpiles were estimated from 10 to 15 feet high, corresponding with the proposed building footprint between September 2012 and April 2016.

Table 1806.2a contained in the *Massachusetts State Building Code, 9th Edition*, provides presumptive allowable vertical bearing capacity for soils and bedrock. Clay soils having a consistency of stiff to hard have an assumed net bearing capacity from 2 to 4 tons per square foot, respectively.

To provide uniform bearing soils for supporting a shallow foundation scheme using strip and spread footings, the existing fill should be removed from within the building footprint to a depth of the Silty Gravelly Sand as encountered in TP-5 and TP-7, and less pronounced in TP-9, or Clay layer at approximately 4 to 5 feet below grade and replaced with uniform compacted lifts of Structural Fill across the proposed Building footprint. This would provide uniform bearing soils for supporting a shallow foundation scheme and concrete floor slab. It is assumed that the exterior building foundation for frost protection will bear a minimum of 4 feet below grade and bear on Structural Fill. For design, a bearing capacity for compacted Structural Fill of 2 tons per square foot may be used.

Other *in situ* geotechnical concerns are associated with the following:

- Soils within the proposed Building area should be carefully inspected during excavation activities for suitable bearing materials and appropriate compaction for its intended use,
- Groundwater/ weeping was encountered between 37 and 39 inches below the existing grade with the potential for perched groundwater on the Clay soil layer,
- Adequate site drainage or dewatering must be provided to preclude the accumulation of surface or groundwater within the building footprint area so that all work can proceed in-the-dry,
- Proof-compaction of all surfaces prior to placing Structural Fill and foundation bearing surfaces within the proposed Building footprint,
- Soil excavation activities on-site must comply with all local, state, and federal regulations,
- Excavation sidewalls may be unstable, particularly in non-cohesive granular soils, and
- Surface water runoff should be controlled from entering the site area/ excavations.

It is recommended that competent field monitoring services be retained at the site during earthwork and foundation construction in order to:

1. Observe removal of unsuitable material from within the building footprint.
2. Determine that suitable soil exists at foundation bearing elevations and confirm the bearing capacity recommendations made herein.
3. Observe preparation of bearing surfaces for footings prior to forming and placement of concrete.
4. It is also recommended that a soil-testing technician be retained to observe and test placement and compaction of Granular/ Structural Fill and backfill.

Overburden soils may be excavated by conventional earth-moving equipment. The foundation bearing surfaces should be free from loose or disturbed soil and inspected by a geotechnical engineer.

The contractor is solely responsible for construction site safety and maintaining safe and stable slopes. Depending upon the excavation depths below grade, the excavation sidewalls should be flattened or braced to meet current OSHA requirements, or those specified in local, state, and federal regulations. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate all excavations as part of the contractor's safety procedures. CGE is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Excavation of any uncontrolled Fill or unsuitable soils around and beneath structures should be accomplished to provide adequate structural bearing soil. Excavation of unsuitable soils should extend a minimum of 3 feet from the outside of the foundation footing and continue at

a 1h:1v (horizontal:vertical) slope to suitable bearing soils. Backfilling with compacted Granular/Structural Fill should follow the same slope and offset requirement from the footing for proper bearing and lateral support.


Backfill around foundations should consist of clean 3/4-minus stone or well graded sand and gravel free of organic material, trash, ice, frozen soil, and other deleterious materials. The recommended gradation for Granular/Structural Fill should satisfy the following limits.

| U.S. Sieve Size and Number | Percent Finer by Weight | |
|----------------------------|-------------------------|---------|
| | Minimum | Maximum |
| 4-inch | 100 | --- |
| 2-inch | 65 | 100 |
| No. 4 | 30 | 80 |
| No. 20 | 10 | 65 |
| No. 40 | 5 | 40 |
| No. 100 | 0 | 20 |
| No. 200 | 0 | 8 |

The moisture content of the Granular Fill material should be adjusted prior to placement so that it is within 2 percent of the optimum moisture content. Fill should be placed in loose lifts not exceeding 6 inches in thickness and compacted with a minimum of 4 passes of a vibratory compactor to a dry density of at least 95 percent of the maximum dry density as determined by the laboratory test designated ASTM D 1557.

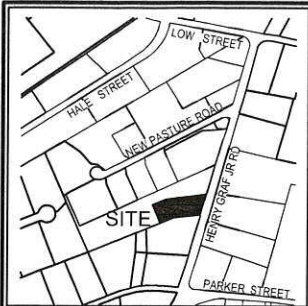
If you have any questions regarding the above activities, please contact the undersigned.

Respectfully submitted,



Ronald F. Bukoski, P.E., L.S.P.

Attachments: McKenzie Engineering Group Plans
Test Pit Location Plan, Photo 1
Photos - 6 Pages/ 11 Photos
Google Earth Satellite Earth Images - 6 Pages/ 12 Images



LOCUS MAP
Not to Scale

ABBREVIATIONS

| | |
|----------|------------------------------|
| FTE | FIRST FLOOR ELEVATION |
| BT CONC. | BITUMINOUS CONCRETE PAVEMENT |
| CCB | CAPE COD BERM |
| EP | EDGE OF PAVEMENT |
| BC | BITUMINOUS CONCRETE CURB |
| (AM) | AS MEASURED |
| CALC. | CALCULATED |
| RET WALL | RETAINING WALL |
| CONC. | CONCRETE |
| RCP | REINFORCED CONCRETE PIPE |
| VCC | VERTICAL GRANITE CURB |
| VCC | VERTICAL CONCRETE CURB |

LEGEND

SURVEY SYMBOLS

- REBAR
- CONCRETE BOUND WITH DRILL HOLE
- STONE BOUND
- STONE BOUND

UTILITY SYMBOLS

- ⊗ ELECTRIC HAND HOLE
- ⊗ GUY POLE
- GW GUY WIRE
- ⊗ HVAC UNIT
- ⊗ TRANSFORMER
- ⊗ WATER GATE
- ⊗ E/MH ELECTRIC MANHOLE
- ⊗ S/MH SEWER MANHOLE
- ⊗ D/MH DRAIN MANHOLE
- ⊗ T/MH TELEPHONE MANHOLE
- ⊗ C/BN DRAINAGE CATCH BASIN
- ⊗ HYDRANT
- ⊗ POST INDICATOR VALVE
- ⊗ UTILITY POLE
- ⊗ YARD LIGHT
- ⊗ RIP RAP
- ⊗ BOLLARD
- ⊗ SIGN

LINE DESIGNATORS

- WATER MAIN
- JERSEY BARRIER
- GUARD RAIL
- OHW OVERHEAD WIRES
- GAS LINE
- WS WATER SERVICE
- UNDERGROUND ELECTRIC
- STORM DRAIN LINE
- SANITARY SEWER LINE
- DRAINAGE SWALE
- CHAIN LINK FENCE

| REV | DATE | DESCRIPTION |
|-----|------|-------------|
| | | |
| | | |
| | | |



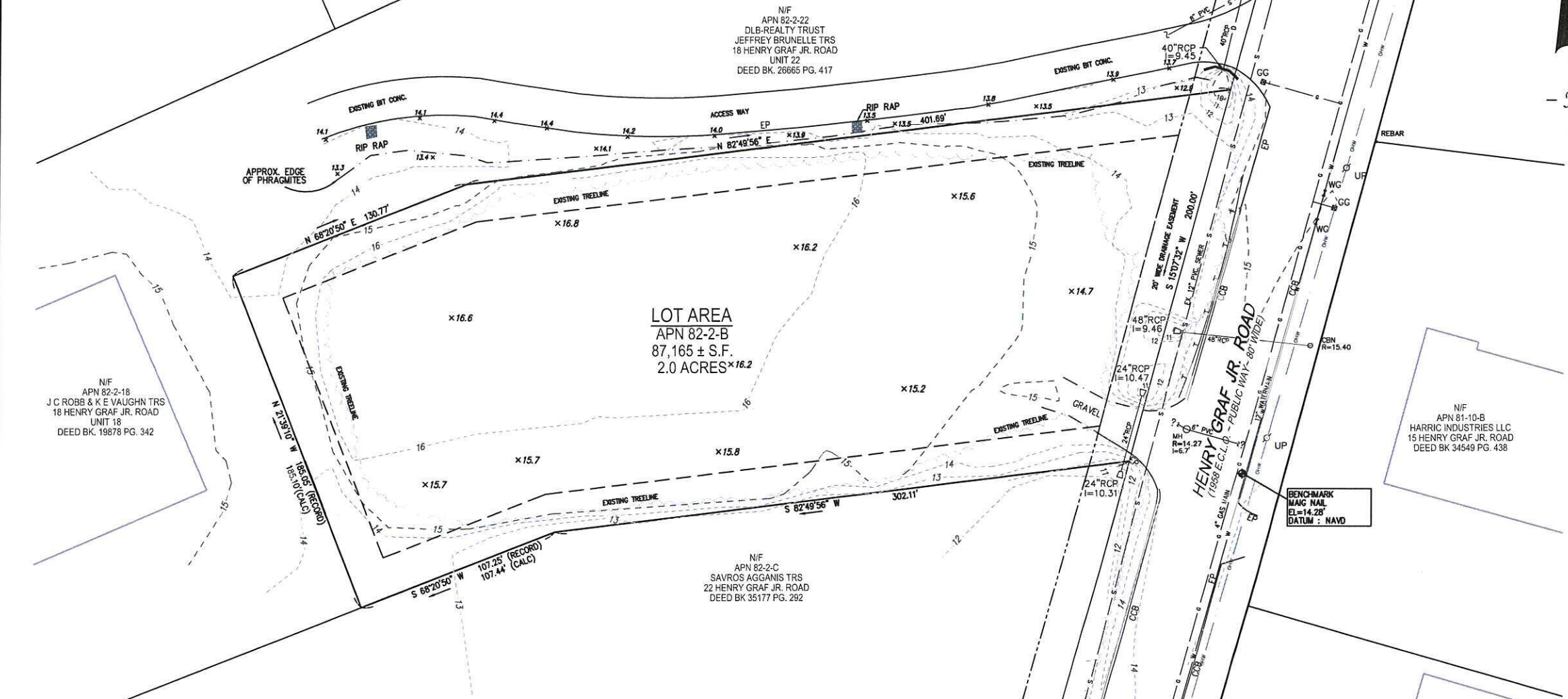
20 HENRY GRAF JR. ROAD
NEWBURYPORT, MASSACHUSETTS

PROFESSIONAL SURVEYOR:

APPLICANT:
CONSERV GROUP INC
110 STATE ROAD
SAGAMORE BEACH, MASSACHUSETTS

DESIGNED BY: ---
CHECKED BY: R.J.H.
APPROVED BY: ---
DATE: NOVEMBER 8, 2019
SCALE: 1"=30'
PROJECT NO.: 219-180
DWG. TITLE:
EXISTING CONDITIONS PLAN
DWG. NO.: **EX-1**

NOT FOR CONSTRUCTION



- SURVEY NOTES:**
- LOCUS IS SHOWN AS PARCEL NUMBER 82-2-2B ON THE TOWN OF NEWBURYPORT ASSESSORS MAPS.
 - DEED TO LOCUS IS RECORDED IN THE ESSEX COUNTY REGISTRY OF DEEDS AT BOOK 12598, PAGE 271.
 - THIS SURVEY WAS MADE ON THE GROUND IN OCTOBER OF 2019 BY MCKENZIE ENGINEERING GROUP, INC.
 - ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
 - LOCUS IS ZONED INDUSTRIAL - II
 - MINIMUM SETBACK REQUIREMENTS:**
FRONT YARD 20'
SIDE YARD 20'
REAR YARD 20'
 - LOCUS IS SITUATED IN ZONE X AS SHOWN ON F.I.R.M. No 25009C0117G, EFFECTIVE 7/16/2004.
 - LOCUS IS NOT LOCATED IN A DEP ZONE 2 AND TOWN OF NEWBURYPORT AQUIFER PROTECTION DISTRICT ZONE.
 - UTILITY INFORMATION FROM ABOVE GROUND OBSERVED EVIDENCE IN CONJUNCTION WITH DIG SAFE MARKINGS AND RECORD PLANS. THE LAND SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE LAND SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. BEFORE CONSTRUCTION CALL DIG SAFE SYSTEMS, INC. AT 1-888-344-7233.
 - PLAN REFERENCES:
PB 451 PG 5



SITE

LOCUS MAP
Not to Scale

ABBREVIATIONS

| | |
|----------|------------------------------|
| F.F.E. | FIRST FLOOR ELEVATION |
| BT CONC. | BITUMINOUS CONCRETE PAVEMENT |
| CCB | CAPE COD BERM |
| EP | EDGE OF PAVEMENT |
| BC | BITUMINOUS CONCRETE CURB |
| (A/C) | AS MEASURED |
| CALC. | CALCULATED |
| RET WALL | RETAINING WALL |
| CONC. | CONCRETE |
| RCP | REINFORCED CONCRETE PIPE |
| VCC | VERTICAL GRANITE CURB |
| VCC | VERTICAL CONCRETE CURB |

LEGEND

SURVEY SYMBOLS

| | |
|----------------------------|----------------------------|
| REBAR | REBAR |
| CONC BOUND WITH DRILL HOLE | CONC BOUND WITH DRILL HOLE |
| STONE BOUND | STONE BOUND |
| STONE BOUND | STONE BOUND |

UTILITY SYMBOLS

| | |
|----------------------|----------------------|
| ELECTRIC HAND HOLE | ELECTRIC HAND HOLE |
| GUY POLE | GUY POLE |
| GUY WIRE | GUY WIRE |
| HVAC UNIT | HVAC UNIT |
| TRANSFORMER | TRANSFORMER |
| WATER GATE | WATER GATE |
| ELECTRIC MANHOLE | ELECTRIC MANHOLE |
| SEWER MANHOLE | SEWER MANHOLE |
| DRAIN MANHOLE | DRAIN MANHOLE |
| TELEPHONE MANHOLE | TELEPHONE MANHOLE |
| DRAINAGE CATCH BASIN | DRAINAGE CATCH BASIN |
| HYDRANT | HYDRANT |
| POST INDICATOR VALVE | POST INDICATOR VALVE |
| UTILITY POLE | UTILITY POLE |
| YARD LIGHT | YARD LIGHT |
| RP RAP | RP RAP |
| BOLLARD | BOLLARD |
| SIEN | SIEN |

LINE DESIGNATORS

| | |
|----------------------|----------------------|
| WATER MAIN | WATER MAIN |
| JERSEY BARRIER | JERSEY BARRIER |
| GUARD RAIL | GUARD RAIL |
| OVERHEAD WIRES | OVERHEAD WIRES |
| GAS LINE | GAS LINE |
| WATER SERVICE | WATER SERVICE |
| UNDERGROUND ELECTRIC | UNDERGROUND ELECTRIC |
| STORM DRAIN LINE | STORM DRAIN LINE |
| SANITARY SEWER LINE | SANITARY SEWER LINE |
| DRAINAGE SWALE | DRAINAGE SWALE |
| CHAIN LINK FENCE | CHAIN LINK FENCE |

| REV | DATE | DESCRIPTION |
|-----|------|-------------|
| 1 | | |
| 1 | | |

M&G
MCKENZIE
ENGINEERING GROUP

Asstingpi Office Park
150 Longwater Drive, Suite 101
Norwell, MA 02061
P: 781.792.3900
F: 781.792.3333
www.mckeng.com

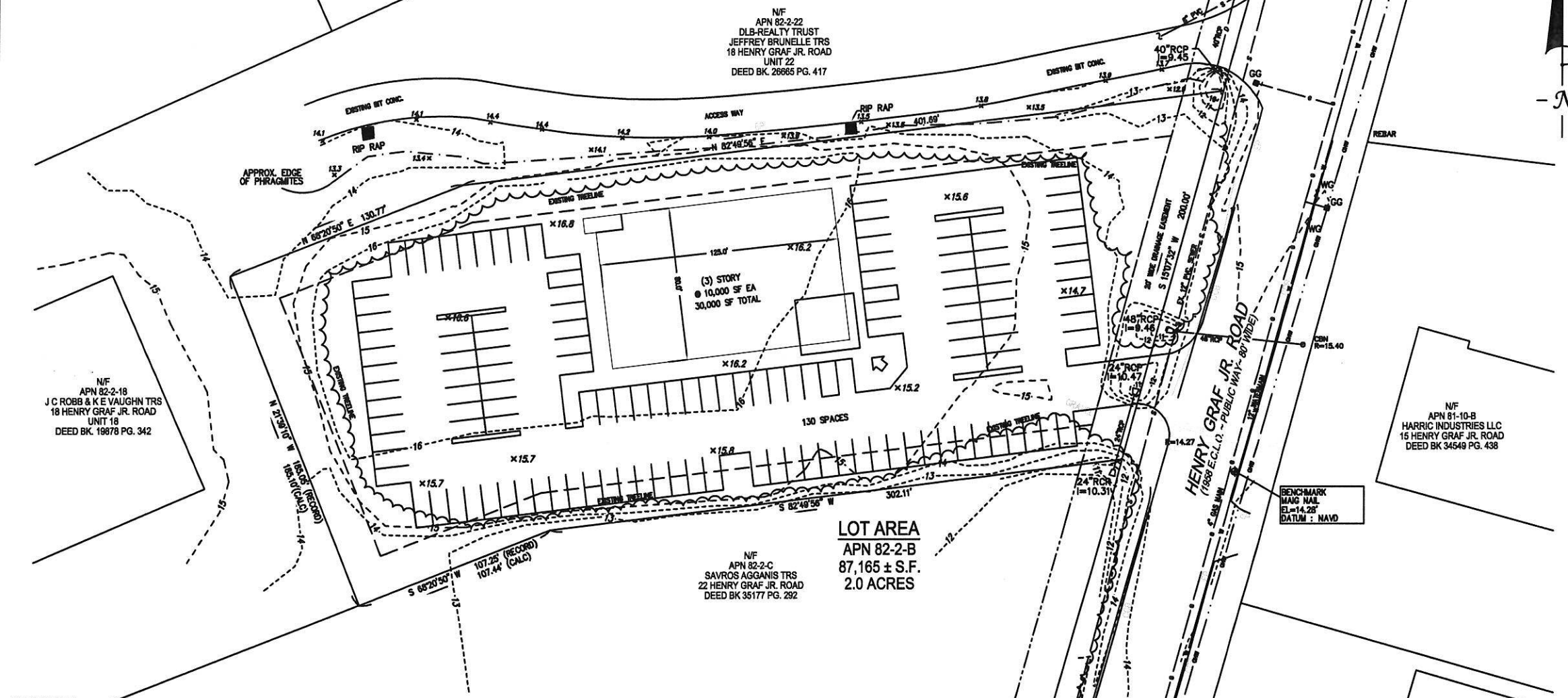
20 HENRY GRAF JR. ROAD
NEWBURYPORT, MASSACHUSETTS

PROFESSIONAL SURVEYOR:

APPLICANT:
CONSERV GROUP INC
110 STATE ROAD
SAGAMORE BEACH, MASSACHUSETTS

NOT FOR CONSTRUCTION

DRAWN BY: RTLS
DESIGNED BY: --
CHECKED BY: R.J.H.
APPROVED BY: --
DATE: NOVEMBER 8, 2019
SCALE: 1"=30'
PROJECT NO.: 219-180
DWG. TITLE:
**EXISTING
CONDITIONS
PLAN**
DWG. NO.: EX-1



- SURVEY NOTES:**
- LOCUS IS SHOWN AS PARCEL NUMBER 82-2-2B ON THE TOWN OF NEWBURYPORT ASSESSORS MAPS.
 - DEED TO LOCUS IS RECORDED IN THE ESSEX COUNTY REGISTRY OF DEEDS AT BOOK 12598, PAGE 271.
 - THIS SURVEY WAS MADE ON THE GROUND IN OCTOBER OF 2019 BY MCKENZIE ENGINEERING GROUP, INC.
 - ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.
 - LOCUS IS ZONED INDUSTRIAL - I1
MINIMUM SETBACK REQUIREMENTS:
FRONT YARD 20'
SIDE YARD 20'
REAR YARD 20'
 - LOCUS IS SITUATED IN ZONE X AS SHOWN ON F.L.R.M. No 25009C0117G, EFFECTIVE 7/16/2004.
 - LOCUS IS NOT LOCATED IN A DEP ZONE 2 AND TOWN OF NEWBURYPORT AQUIFER PROTECTION DISTRICT ZONE.
 - UTILITY INFORMATION FROM ABOVE GROUND OBSERVED EVIDENCE IN CONJUNCTION WITH DIG SAFE MARKINGS AND RECORD PLANS. THE LAND SURVEYOR MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN HEREON COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE LAND SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. BEFORE CONSTRUCTION CALL DIG SAFE SYSTEMS, INC. AT 1-888-344-7233.
 - PLAN REFERENCES: PG 461 PG 5

OWNER
APN 82-2-B
OCEAN REALTY TRUST
JOHN D. HARTNETT, TRS.
20 HENRY GRAF JR. ROAD
DEED BK. 12598 PG. 271

0 30 60 90

© MCKENZIE ENGINEERING GROUP, INC.

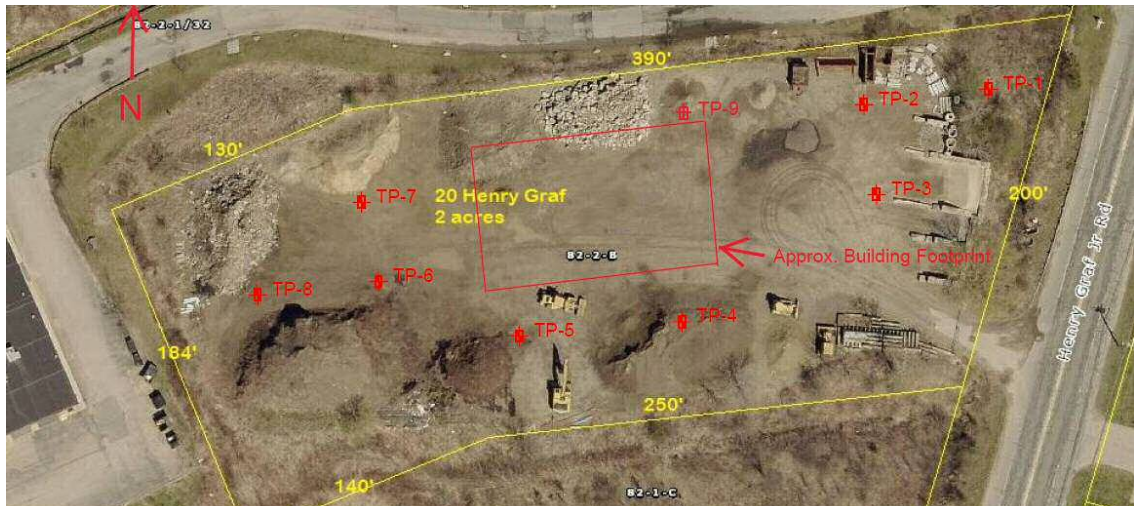


Photo 1: Test Pit locations as proposed by McKenzie Engineering Group, TP-9 was added in the field. Actual locations varied and were not surveyed at the time of excavation. It is believed that TP-4 and TP-5 were shifted to the east with TP-5 closer to the centerline of the southern side of the footprint. A CAT 320B Excavator was used to excavate nine test pits to a Clay layer, typically around 5 to 6 feet below grade. Excavation activities were completed prior to our arrival on-site. CGE logged TP -5, TP-7, and TP-9, three proximal test pits to the conceptual foundation location.



Photo 2: Eastern sidewall of TP-5.



Photo 3: Eastern sidewall of Test Pit TP-5.



Photo 4: Test Pit TP-7.



Photo 5: Eastern sidewall of Test Pit TP-7.



Photo 6: Clay soil excavated from the bottom of Test Pit TP-7.



Photo 7: Excavated soil from Test Pit TP-7.



Photo 8: Test Pit TP-9 as viewed from the east.



Photo 9: Bottom of TP-9 excavation.



Photo 10: Clay soil excavated from the bottom of TP-9.



Photo 11: TP-9 Excavated soil.



Photo 1: Google Earth satellite image of Site March 28, 1995.



Photo 2: Google Earth satellite image of Site December 31, 2000.



Photo 3: Google Earth satellite image of Site March 31, 2005.



Photo 4: Google Earth satellite image of Site July 28, 2007.



Photo 5: Google Earth satellite image of Site April 9, 2008.



Photo 6: Google Earth ground level view of the Site from Henry Graft Jr. Road looking west, September 2012.



Photo 7: Google Earth satellite image of Site April 7, 2013.

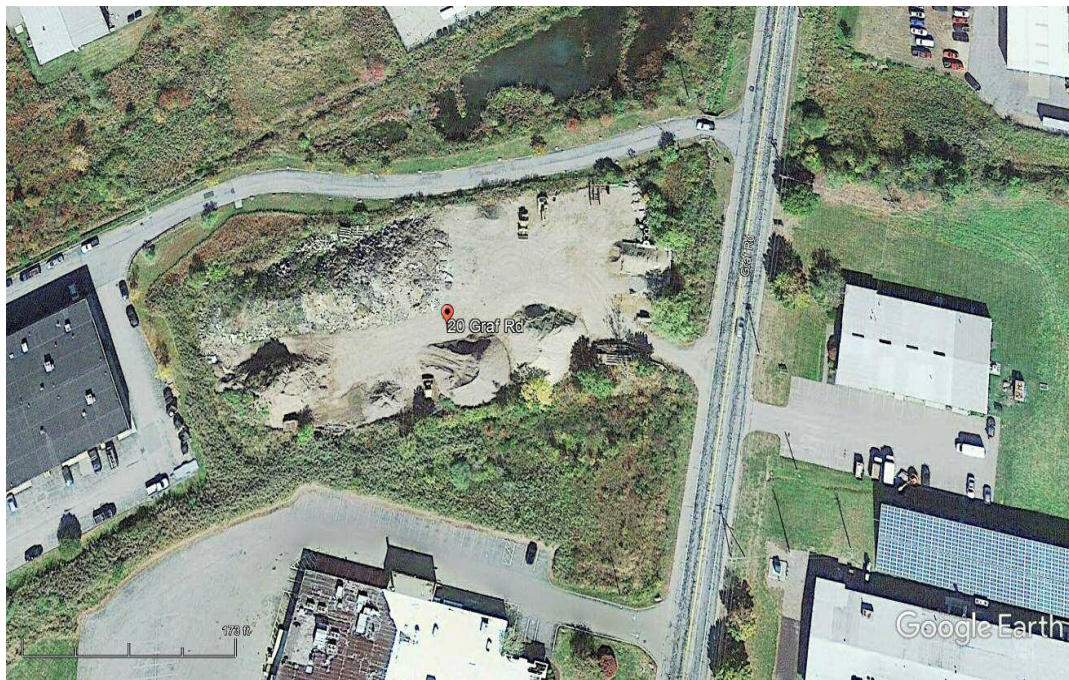


Photo 8: Google Earth satellite image October 9, 2014.



Photo 9: Google Earth satellite image May 7, 2015



Photo 10: Google Earth satellite image April 27, 2016



Photo 11: Google Earth satellite image October 5, 2016.

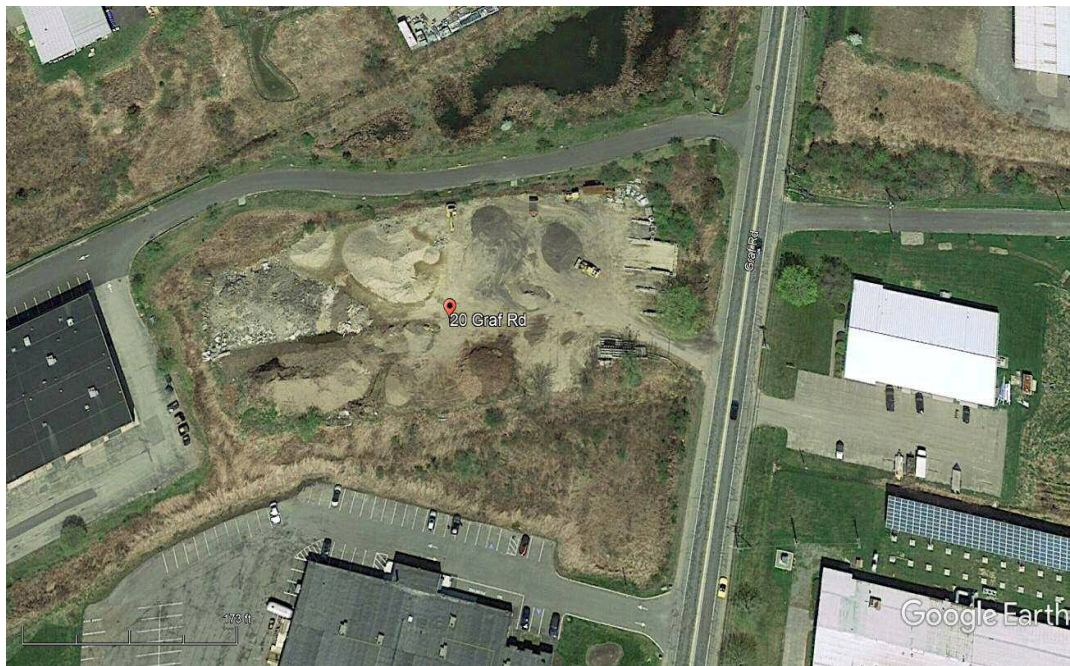


Photo 12: Google Earth satellite image May 4, 2018



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name
20 Henry Graf Jr. Road
Street Address
Newburyport MA APN 82-2-B
City State Zip Code
01950
Map/Lot #
Zip Code

B. Site Information

- (Check one) New Construction Upgrade Repair
- Soil Survey Available? Yes No If yes: NRCS 16A
Source Soil Map Unit
Scantic Silt Loam, 0-3% Slopes poorly drained
Soil Name Soil Limitations
soft fine-silty glaciolacustrine deposits drainageways, depressions
Soil Parent material Landform
- Surficial Geological Report Available? Yes No If yes: 2018/U.S. Geological Survey Glaciomarine fine deposits
Year Published/Source Map Unit
Includes clay, silt clay, fine sand, and some fine gravel deposited in a higher level sea in environments of low wave energy.
Description of Geologic Map Unit:
- Flood Rate Insurance Map Within a regulatory floodway? Yes No
- Within a velocity zone? Yes No
- Within a Mapped Wetland Area? Yes No If yes, MassGIS Wetland Data Layer: Wetland Type
- Current Water Resource Conditions (USGS): 12/4/19 Range: Above Normal Normal Below Normal
Month/Day/ Year
- Other references reviewed: _____



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (minimum of two holes required at every proposed primary and reserve disposal area)

Deep Observation Hole Number: 2 Hole # 12/4/19 Date 8:30am Time sunny Weather 42°48'11"N Latitude 70°53'05"W Longitude:

1. Land Use vacant (e.g., woodland, agricultural field, vacant lot, etc.) gravel, fallow Vegetation stones, boulders Surface Stones (e.g., cobbles, stones, boulders, etc.) 2% Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits Landform drainageways, depressions Position on Landscape (SU, SH, BS, FS, TS) SH

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands 20 feet
Property Line 25 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 46 Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-46 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 46-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 3 12/4/19 9:30am sunny 42°48'11"N 70°53'05"W
Hole # Date Time Weather Latitude Longitude:

1. Land Use: vacant gravel, fallow stones, boulders 2%
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits drainageways, depressions SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands 65 feet
Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable

Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-50 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 50-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:
- | | | |
|---|----------------------|-------------------|
| <input type="checkbox"/> Depth observed standing water in observation hole | Obs. Hole # <u>1</u> | Obs. Hole # _____ |
| | _____ inches | _____ inches |
| <input type="checkbox"/> Depth weeping from side of observation hole | <u>46</u> inches | _____ inches |
| <input type="checkbox"/> Depth to soil redoximorphic features (mottles) | _____ inches | _____ inches |
| <input type="checkbox"/> Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) | _____ inches | _____ inches |

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

Yes No

b. If yes, at what depth was it observed (exclude A and O Horizons)?

Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed?

Upper boundary: _____ inches Lower boundary: _____ inches



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

Erik Schoumaker / SE14264

Typed or Printed Name of Soil Evaluator / License #

Date

Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 3 12/4/19 930am sunny 42°48'11"N 70°53'05"W
Hole # Date Time Weather Latitude Longitude:

1. Land Use vacant gravel, fallow stones, boulders
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.)
 Slope (%): 2%

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits drainageways, depressions SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands 50 feet
 Property Line 50 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-55 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 55-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 5 12/4/19 10am sunny 42°48'11"N 70°53'05"W
Hole # Date Time Weather Latitude Longitude:

1. Land Use: vacant gravel, fallow stones, boulders 2%
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits drainageways, depressions SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands 65 feet
Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable

Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 54 Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-54 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 54-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:
- | | | |
|---|-------------------|----------------------|
| <input type="checkbox"/> Depth observed standing water in observation hole | Obs. Hole # _____ | Obs. Hole # <u>5</u> |
| | _____ inches | _____ inches |
| <input type="checkbox"/> Depth weeping from side of observation hole | _____ inches | <u>54</u> inches |
| <input type="checkbox"/> Depth to soil redoximorphic features (mottles) | _____ inches | _____ inches |
| <input type="checkbox"/> Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) | _____ inches | _____ inches |

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

Yes No

b. If yes, at what depth was it observed (exclude A and O Horizons)?

Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed?

Upper boundary: _____ inches Lower boundary: _____ inches



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Erik Schoumaker
Signature of Soil Evaluator

_____ Date

Erik Schoumaker / SE14264
Typed or Printed Name of Soil Evaluator / License #

_____ Expiration Date of License

_____ Name of Approving Authority Witness

_____ Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:





Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Owner Name

20 Henry Graf Jr. Road

Street Address

Newburyport

City

MA

State

APN 82-2-B

Map/Lot #

01950

Zip Code

B. Site Information

1. (Check one) New Construction Upgrade Repair

2. Soil Survey Available? Yes No If yes:

NRCS
Source

16A
Soil Map Unit

Scantic Silt Loam, 0-3% Slopes

Soil Name

poorly drained

Soil Limitations

soft fine-silty glaciolacustrine deposits

Soil Parent material

drainageways, depressions

Landform

3. Surficial Geological Report Available? Yes No

If yes: 2018/U.S. Geological Survey Glaciomarine fine deposits

Year Published/Source

Map Unit

Includes clay, silt clay, fine sand, and some fine gravel deposited in a higher level sea in environments of low wave energy.

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? Yes No

5. Within a velocity zone? Yes No

6. Within a Mapped Wetland Area? Yes No

If yes, MassGIS Wetland Data Layer:

Wetland Type

7. Current Water Resource Conditions (USGS):

12/4/19

Month/Day/ Year

Range: Above Normal

Normal

Below Normal

8. Other references reviewed:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 6 Hole # 12/4/19 Date 11am Time sunny Weather 42°48'11"N Latitude 70°53'05"W Longitude:

1. Land Use vacant (e.g., woodland, agricultural field, vacant lot, etc.) gravel, fallow Vegetation stones, boulders Surface Stones (e.g., cobbles, stones, boulders, etc.) 2% Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits Landform drainageways, depressions Position on Landscape (SU, SH, BS, FS, TS) SH

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands 80 feet
 Property Line 100 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-60 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 60-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 7 12/4/19 1130am sunny 42°48'11"N 70°53'05"W
Hole # Date Time Weather Latitude Longitude:

1. Land Use: vacant gravel, fallow stones, boulders 2%
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits drainageways, depressions SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body feet Drainage Way feet Wetlands 40 feet
Property Line 50 feet Drinking Water Well feet Other feet

4. Unsuitable

Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 65 Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-65 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 65-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:
- | | | |
|---|-------------------|----------------------|
| <input type="checkbox"/> Depth observed standing water in observation hole | Obs. Hole # _____ | Obs. Hole # <u>7</u> |
| | _____ inches | _____ inches |
| <input type="checkbox"/> Depth weeping from side of observation hole | _____ inches | <u>65</u> inches |
| <input type="checkbox"/> Depth to soil redoximorphic features (mottles) | _____ inches | _____ inches |
| <input type="checkbox"/> Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) | _____ inches | _____ inches |

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

- Yes No

b. If yes, at what depth was it observed (exclude A and O Horizons)?

Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed?

Upper boundary: _____ inches Lower boundary: _____ inches



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 8 Hole # 12/4/19 Date 12pm Time sunny Weather 42°48'11"N Latitude 70°53'05"W Longitude:

1. Land Use vacant (e.g., woodland, agricultural field, vacant lot, etc.) gravel, fallow Vegetation stones, boulders Surface Stones (e.g., cobbles, stones, boulders, etc.) 2% Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits Landform drainageways, depressions Position on Landscape (SU, SH, BS, FS, TS) SH

3. Distances from: Open Water Body feet Drainage Way feet Wetlands 50 feet
 Property Line 70 feet Drinking Water Well feet Other feet

4. Unsuitable Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 48 Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-48 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 48-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 9 12/4/19 1pm sunny 42°48'11"N 70°53'05"W
Hole # Date Time Weather Latitude Longitude:

1. Land Use: vacant gravel, fallow stones, boulders 2%
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: undeveloped and mostly cleared of vegetation

2. Soil Parent Material: soft fine-silty glaciolacustrine deposits drainageways, depressions SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body feet Drainage Way feet Wetlands 25 feet
Property Line 30 feet Drinking Water Well feet Other feet

4. Unsuitable

Materials Present: Yes No If Yes: Disturbed Soil Fill Material Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 36 Depth Weeping from Pit Depth Standing Water in Hole

Soil Log

| Depth (in) | Soil Horizon /Layer | Soil Texture (USDA) | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|------------|---------------------|---------------------|------------------------------------|------------------------|-------|---------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | | Depth | Color | Percent | Gravel | Cobbles & Stones | | | |
| 0-36 | A | L | | - | - | - | - | 10 | M | F | FILL |
| 36-72 | C1 | Clay | | - | - | - | - | - | M | F | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Additional Notes:



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:
- | | | |
|---|----------------------|----------------------|
| <input type="checkbox"/> Depth observed standing water in observation hole | Obs. Hole # <u>8</u> | Obs. Hole # <u>9</u> |
| | _____ inches | _____ inches |
| <input type="checkbox"/> Depth weeping from side of observation hole | <u>48</u> inches | <u>36</u> inches |
| <input type="checkbox"/> Depth to soil redoximorphic features (mottles) | _____ inches | _____ inches |
| <input type="checkbox"/> Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) | _____ inches | _____ inches |

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

Yes No

b. If yes, at what depth was it observed (exclude A and O Horizons)?

Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed?

Upper boundary: _____ inches Lower boundary: _____ inches



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Erik Schoumaker
Signature of Soil Evaluator

_____ Date

Erik Schoumaker / SE14264
Typed or Printed Name of Soil Evaluator / License #

_____ Expiration Date of License

_____ Name of Approving Authority Witness

_____ Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:

**CONSTRUCTION PHASE POLLUTION
PREVENTION AND EROSION AND
SEDIMENTATION CONTROL PLAN
(BEST MANAGEMENT PRACTICES
OPERATION AND MAINTENANCE PLAN)**

for

**Proposed Medical Building
20 Henry Graf Jr. Road
Newburyport, Massachusetts
(Assessor's Parcel Number 82-2-B)**

Submitted to:

Town of Newburyport

Prepared for:

**Sports Medicine North Orthopedic Surgery, Inc.
c/o Conserv Group Inc.
110 State Road
Sagamore Beach, Massachusetts 02562**

Prepared by:



**Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com**

March 17, 2020

TABLE OF CONTENTS

| | Page |
|--|------|
| Project Narrative | |
| - Project Description | 1 |
| - Pre-development Condition | 2 |
| - Post-development Condition | 2 |
| Erosion and Sedimentation Controls - Best Management Practices (BMP's) | |
| - Structural Practices | 2 |
| - Stabilization Practices | 5 |
| - Dust Control | 10 |
| - Non-Stormwater Discharges | 11 |
| - Soil Stockpiling | 11 |
| - Pollution Prevention | 11 |
| - Inspection/Maintenance | 15 |
| - Inspection Schedule and Evaluation Checklist | 16 |
| - Spill Containment and Management Plan | 18 |
| Plans | |
| - Figure-1 USGS Locus Map (Refer to Drainage Report) | |
| - Site Topographic Map (Existing Conditions Plans within Plan Set) | |
| - Site Development Map (Grading and Drainage Plans within Plan Set) | |
| - Site Erosion and Sedimentation Plan (Grading and Drainage Plans within Plan Set) | |
| - Construction Detail Plan (Construction Details within Plan Set) | |

Construction Phase Best Management Practices (BMP's)

Erosion and Sedimentation will be controlled at the site by utilizing Structural Practices, Stabilization Practices, and Dust Control. These practices correspond with plans entitled "Site Development Plan, 20 Henry Graf Jr. Road, Newburyport, Massachusetts", issued March 17, 2020 and as revised hereinafter referred to as the Site Plans.

Responsible Party Contact Information:

Stormwater Management System Owner: Sports Medicine North Orthopedic Surgery, Inc.
c/o ConServ Group, Inc.
110 State Road
Sagamore Beach, Massachusetts 02562
Phone: (508) 888-6555

Town of Newburyport Contact Information:

Newburyport Department of Public Works/Engineering Division
Jon-Eric White, PE
16A Perry Way
Newburyport, MA 01950
Phone: (978) 465-4464 ext. 1710

Newburyport Conservation Commission
Julia Godtfredsen
60 Pleasant Street
Newburyport, MA 01950
Phone: (978) 465-4400

Newburyport Building Department
Peter Binette
60 Pleasant Street
Newburyport, MA 01950
Phone: (978) 465-4405

Structural Practices:

- 1) **Compost Filter Tube Barrier Controls** – A compost filter tube barrier will be constructed along downward slopes at the limit of work in locations shown on the plans. This control will be installed prior to major soil disturbance on the site. The sediment silt sack barrier should be installed as shown on the Construction Detail Plan.

Compost Filter Tube Design/Installation Requirements *

- a) Locate the compost filter tube where identified on the plans.
- b) The compost filter tube line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the

silt sack should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.

- c) The compost filter tube shall be staked every 8 linear feet with 1-inch by 1-inch stakes.
- d) Compost filter tubes should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Compost Filter Tube Inspection/Maintenance *

- a) Compost filter tubes should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, and to see that the fence posts are firmly in the ground. Repair or replace as necessary.
 - b) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the compost filter tube. Take care to avoid undermining fence during cleanout.
 - c) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.
 - d) Remove all compost filter tube materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform with the existing topography and vegetated.
- 2) **Sediment Fence Controls** – A sediment fence will be constructed along the limit of work as needed to prevent the spreading of fine sediments from the site. This control will be installed prior to major soil disturbance on the site. The sediment fence should be installed as shown on the Erosion Control Detail Plan and be Amoco woven polypropylene 1198 or equivalent.

Sediment Fence Design/Installation Requirements *

- e) Locate the fence upland of the hay bale barriers and where identified on the plans.
- f) The fence line should be nearly level through most of its length to impound a broad, temporary pool. The last 10 to 20 feet at each end of the fence should be swung slightly uphill (approximately 0.5 feet in elevation) to provide storage capacity.
- g) Excavate a trench approximately 8 inches deep and 4 inches wide, or a V-trench; along the line of the fence, upslope side.

- h) Fasten support wire fence (14 gauge with 6-inch mesh) securely to the upslope side of the fence posts with wire ties or staples. Wire should extend 6 inches into the trench.
- i) Attach continuous length of fabric to upslope side of fence posts. Avoid joints, particularly at low points in the fence line. Where joints are necessary, fasten fabric securely to support posts and overlap to the next post.
- j) Place the bottom one foot of fabric in the trench. Backfill with compacted earth or gravel.
- k) Filter cloth shall be fastened securely to the woven wire fence with ties spaced every 24 inches at the top, mid-section, and bottom.
- l) Sediment fences should be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized through one growing season and only following approval by the Engineering Department or their representative. Retained sediment must be removed and properly disposed of, or mulched and seeded.

Sediment Fence Inspection/Maintenance *

- e) Silt fences should be inspected immediately after each rainfall event of 1-inch or greater, and at least daily during prolonged rainfall. Inspect the depth of sediment, fabric tears, if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground. Repair or replace as necessary.
 - f) Remove sediment deposits promptly after storm events to provide adequate storage volume for the next rain and to reduce pressure on the fence. Sediment will be removed from behind the sediment fence when it becomes about ½ foot deep at the fence. Take care to avoid undermining fence during cleanout.
 - g) If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.
 - h) Remove all fencing materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fabric has been removed should be graded to conform to the existing topography and vegetation.
- 3) **Stabilized Construction Entrance** – A stabilized construction entrance will be placed at the proposed entrance of the Site at 20 Henry Graf Jr. Road. The construction entrance will keep mud and sediment from being tracked off the construction site onto Henry Graf Jr. Road by vehicles leaving the site. The stabilized construction entrance will be installed immediately after the clear and grubbing of the roadway entrance and associated roadway fill to maintain access to the site are completed. The stormwater runoff from the entrance will be diverted to a temporary sedimentation basin. The stabilized construction entrance shall be constructed as shown on the Construction Detail Plans.

Construction Entrance Design/Construction Requirements *

- a) Grade foundation for positive drainage towards the temporary sedimentation basin.
- b) Stone for a stabilized construction entrance shall consist of 1 to 3-inch stone placed on a stable foundation.
- c) Pad dimensions: The minimum length of the gravel pad should be 50 feet. The pad should extend the full width of the proposed roadway, or wide enough so that the largest construction vehicle will fit in the entrance with room to spare; whichever is greater.
- d) A geotextile filter fabric shall be placed between the stone fill and the earth surface below the pad to reduce the migration of soil particles from the underlying soil into the stone and vice versa. The filter fabric should be Amoco woven polypropylene 1198 or equivalent.
- e) Washing: If the site conditions are such that the majority of mud is not removed from the vehicle tires by the gravel pad, then the tires should be washed before the vehicle enters the street. The wash area shall be located at the stabilized construction entrance.
- f) Water employed in the washing process shall be directed to the temporary sedimentation basin/dewatering area as shown on the plans prior to discharge. Sediment should be prevented from entering any watercourses.

Construction Entrance Inspection/Maintenance *

- a) The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto Henry Graf Jr. Road. This may require periodic topdressing with additional stone
- b) The construction entrance and sediment disposal area shall be inspected weekly and after heavy rains or heavy use.
- c) Mud and sediment tracked or washed onto public road shall be immediately removed by sweeping.
- d) Once mud and soil particles clog the voids in the gravel and the effectiveness of the gravel pad is no longer satisfactory, the pad must be topdressed with new stone. Replacement of the entire pad may be necessary when the pad becomes completely clogged.
- e) If washing facilities are used, the temporary sedimentation basin/dewatering area should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available. Any water pumped from the temporary sedimentation basin shall be directed into a sediment dirt bag or equivalent inlet protection prior to discharge. Discharge should not be across the disturbed construction site but rather to undisturbed areas.

- f) The pad shall be reshaped as needed for drainage and runoff control.
- g) Broken road pavement on Henry Graf Jr. Road shall be repaired immediately.
- h) All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed and only following approval by the Public Works Department or their representative. Trapped sediment shall be removed or stabilized on site. Disturbed soil areas resulting from removal shall be permanently stabilized.

Stabilization Practices:

Stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased, with the following exceptions.

- Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures shall be initiated as soon as practicable.
 - Where construction activity will resume on a portion of the site within 21 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 21 days) then stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.
 - The contractor shall provide erosion control measures around all soil stockpiles.
- 1) **Temporary Seeding** – Temporary seeding will allow a short-term vegetative cover on disturbed site areas that may be in danger of erosion. Temporary seeding will be done at stock piles and disturbed portions of the site where construction activity will temporarily cease for at least 21 days. The temporary seedings will stabilize cleared and unvegetated areas that will not be brought into final grade for several weeks or months.

Temporary Seeding Planting Procedures *

- a) Planting should preferably be done between April 1st and June 30th, and September 1st through September 31st. If planting is done in the months of July and August, irrigation may be required. If planting is done between October 1st and March 31st, mulching should be applied immediately after planting. If seeding is done during the summer months, irrigation of some sort will probably be necessary.
- b) Before seeding, install structural practice controls. Utilize Amoco supergro or equivalent.

c) Select the appropriate seed species for temporary cover from the following table.

| Species | Seeding Rate (lbs/1,000 sq.ft.) | Seeding Rate (lbs/acre) | Recommended Seeding Dates | Seed Cover required |
|-----------------|------------------------------------|----------------------------|--|------------------------|
| Annual Ryegrass | 1 | 40 | April 1 st to June 1 st August 15 th to Sept. 15 th | ¼ inch |
| Foxtail Millet | 0.7 | 30 | May 1 st to June 30 th | ½ to ¾ inch |
| Oats | 2 | 80 | April 1 st to July 1 st August 15 th to Sept. 15 th | 1 to 1-½ inch |
| Winter Rye | 3 | 120 | August 15 th to Oct. 15 th | 1 to 1-½ inch |

Apply the seed uniformly by hydroseeding, broadcasting, or by hand.

d) Use effective mulch, such as clean grain straw; tacked and/or tied with netting to protect seedbed and encourage plant growth.

Temporary Seeding Inspection/Maintenance *

- a) Inspect within 6 weeks of planting to see if stands are adequate. Check for damage within 24 hours of the end to a heavy rainfall, defined as a 2-year storm event (i.e., 3.2 inches of rainfall within a twenty-four hour period). Stands should be uniform and dense. Reseed and mulch damaged and sparse areas immediately. Tack or tie down mulch as necessary.
 - b) Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.
- 2) **Geotextiles** - Geotextiles such as jute netting will be used in combination with other practices such as mulching to stabilize slopes. The following geotextile materials or equivalent are to be utilized for structural and nonstructural controls as shown in the following table.

| Practice | Manufacturer | Product | Remarks |
|-----------------------------------|--------------|---|--|
| Sediment Fence | Amoco | Woven polypropylene 1198 or equivalent | 0.425 mm opening |
| Construction Entrance | Amoco | Woven polypropylene 2002 or equivalent | 0.300 mm opening |
| Outlet Protection | Amoco | Nonwoven polypropylene 4551 or equivalent | 0.150 mm opening |
| Erosion Control (slope stability) | Amoco | Supergro or equivalent | Erosion control revegetation mix, open polypropylene fiber on degradable polypropylene net scrim |

Amoco may be reached at (800) 445-7732

Geotextile Installation

- a) Netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold the soil and erosion will occur underneath the material.

Geotextile Inspection/Maintenance *

- a) In the field, regular inspections should be made to check for cracks, tears, or breaches in the fabric. The appropriate repairs should be made.
- 3) **Mulching and Netting** – Mulching will provide immediate protection to exposed soils during the period of short construction delays, or over winter months through the application of plant residues, or other suitable materials, to exposed soil areas. In areas, which have been seeded either for temporary or permanent cover, mulching should immediately follow seeding. On steep slopes, mulch must be supplemented with netting. The preferred mulching material is straw. All netting shall be biodegradable or photodegradable.

Mulch (Hay or Straw) Materials and Installation

- a) Straw has been found to be one of the most effective organic mulch materials. The specifications for straw are described below, but other material may be appropriate. The straw should be air-dried; free of undesirable seeds & coarse materials. The application rate per 1,000 sq.ft. is 90-100 lbs. (2-3 bales) and the application rate per acre is 2 tons (100-120 bales). The application should cover about 90% of the surface. The use of straw mulch is appropriate where mulch is maintained for more than three months. Straw mulch is subject to wind blowing unless anchored, is the most commonly used mulching material, and has the best microenvironment for germinating seeds.

Mulch Maintenance *

- a) Inspect after rainstorms to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, repair surface, reseed, remulch, and install new netting.
- b) Straw or grass mulches that blow or wash away should be repaired promptly.
- c) If plastic netting is used to anchor mulch, care should be taken during initial mowings to keep the mower height high. Otherwise, the netting can wrap up on the mower blade shafts. After a period of time, the netting degrades and becomes less of a problem.
- d) Continue inspections until vegetation is well established.

- 4) **Land Grading** – Grading on fill slopes, cut slopes, and stockpile areas will be done with full siltation controls in place.

Land Grading Design/Installation Requirements

- a) Areas to be graded should be cleared and grubbed of all timber, logs, brush, rubbish, and vegetated matter that will interfere with the grading operation. Topsoil should be stripped and stockpiled for use on critical disturbed areas for establishment of vegetation. Cut slopes to be topsoiled should be thoroughly scarified to a minimum depth of 3-inches prior to placement of topsoil.
- b) Fill materials should be generally free of brush, rubbish, rocks, and stumps. Frozen materials or soft and easily compressible materials should not be used in fills intended to support buildings, parking lots, roads, conduits, or other structures.
- c) Earth fill intended to support structural measures should be compacted to a minimum of 90 percent of Standard Proctor Test density with proper moisture control, or as otherwise specified by the engineer responsible for the design. Compaction of other fills should be to the density required to control sloughing, erosion or excessive moisture content. Maximum thickness of fill layers prior to compaction should not exceed 9 inches.
- d) The uppermost one foot of fill slopes should be compacted to at least 85 percent of the maximum unit weight (based on the modified AASHTO compaction test). This is usually accomplished by running heavy equipment over the fill.
- e) Fill should consist of material from borrow areas and excess cut will be stockpiled in areas shown on the Site Plans. All disturbed areas should be free draining, left with a neat and finished appearance, and should be protected from erosion.
- f) Detention basins shall be excavated, graded and shaped to subgrade elevation and shall then be suitably protected with installation of erosion control measures to prevent sediment-laden runoff from washing into the basins. The basins shall also be protected from heavy equipment activity from this point forward. Prior to application of loam and seed to detention basin surfaces, the contractor shall remove any unsuitable soil such as silt or clay that may have been deposited during construction. The surface shall be scarified with a York rake or other small tractor mounted equipment. The loam and seed shall then be applied as required by this document.

Land Grading Stabilization Inspection/Maintenance *

- a) All slopes should be checked periodically to see that vegetation is in good condition. Any rills or damage from erosion and animal burrowing should be repaired immediately to avoid further damage.
- b) If seeps develop on the slopes, the area should be evaluated to determine if the seep will cause an unstable condition. Subsurface drains or a gravel mulch may be required to solve seep problems. However, no seeps are anticipated.

- c) Areas requiring revegetation should be repaired immediately. Control undesirable vegetation such as weeds and woody growth to avoid bank stability problems in the future.
- 5) **Topsoiling** * – Topsoiling will help establish vegetation on all disturbed areas throughout the site during the seeding process. The soil texture of the topsoil to be used will be a sandy loam to a silt loam texture with 15% to 20% organic content.

Topsoiling Placement

- a) Topsoil should not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or when conditions exist that may otherwise be detrimental to proper grading or proposed seeding.
 - b) Do not place topsoil on slopes steeper than 2.5:1, as it will tend to erode.
 - c) If topsoil and subsoil are not properly bonded, water will not infiltrate the soil profile evenly and it will be difficult to establish vegetation. The best method is to actually work the topsoil into the layer below for a depth of at least 6 inches.
- 6) **Permanent Seeding** – Permanent Seeding should be done immediately after the final design grades are achieved. Native species of plants should be used to establish perennial vegetative cover on disturbed areas. The revegetation should be done early enough in the fall so that a good cover is established before cold weather comes and growth stops until the spring. A good cover is defined as vegetation covering 75 percent or more of the ground surface.

Permanent Seeding Seedbed Preparation

- a) In infertile or coarse-textured subsoil, it is best to stockpile topsoil and re-spread it over the finished slope at a minimum 2 to 6-inch depth and roll it to provide a firm seedbed. The topsoil must have a sandy loam to silt loam texture with 15% to 20% organic content. If construction fill operations have left soil exposed with a loose, rough, or irregular surface, smooth with blade and roll.
- b) Loosen the soil to a depth of 3-5 inches with suitable agricultural or construction equipment.
- c) Areas not to receive topsoil shall be treated to firm the seedbed after incorporation of the lime and fertilizer so that it is depressed no more than ½ - 1 inch when stepped on with a shoe. Areas to receive topsoil shall not be firmed until after topsoiling and lime and fertilizer is applied and incorporated, at which time it shall be treated to firm the seedbed as described above.

Permanent Seeding Grass Selection/Application

- a) Select an appropriate cool or warm season grass based on site conditions and seeding date. Apply the seed uniformly by hydro-seeding, broadcasting, or by hand. Uniform seed distribution is essential. On steep slopes, hydroseeding may be the most effective seeding method. Surface roughening is particularly important when preparing slopes for hydroseeding.

- b) Lime and fertilize. Organic fertilizer shall be utilized in areas within the 100 foot buffer zone to a wetland resource area.
- c) Mulch the seedings with straw applied at the rate of ½ tons per acre. Anchor the mulch with erosion control netting or fabric on sloping areas. Amoco supergro or equivalent should be utilized.

Permanent Seeding Inspection/Maintenance *

- a) Frequently inspect seeded areas for failure and make necessary repairs and reseed immediately. Conduct or follow-up survey after one year and replace failed plants where necessary.
- b) If vegetative cover is inadequate to prevent rill erosion, overseed and fertilize in accordance with soil test results.
- c) If a stand has less than 40% cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand following seedbed preparation and seeding recommendations, omitting lime and fertilizer in the absence of soil test results. If the season prevents resowing, mulch or jute netting is an effective temporary cover.
- d) Seeded areas should be fertilized during the second growing season. Lime and fertilize thereafter at periodic intervals, as needed.

Fueling and Maintenance of Equipment and Vehicles:

1. Refueling/maintenance Rules – The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. This document shall include language that shall permit the maintenance of vehicles only in designated locations on the job site. In the event of mechanical failure of a vehicle, the vehicle shall be moved to the designated maintenance area on the site to perform maintenance. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. Refueling for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.
2. Installation Schedule: Prior to start of Work
3. Maintenance and Inspection: The site supervisor shall maintain a log of individuals receiving these instructions.
4. Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

- a. Description: Fueling operations shall take place in designated area(s) as shown on site maps. Provide temporary drip protection during fueling operations which take place outside of designated area(s). Materials necessary to address a spill shall be made readily available in a location known to the site supervisor or his/her designee.
- b. Installation: Fueling operation procedures shall be in effect throughout the project duration.
- c. Maintenance Requirements: All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Dust Control:

Dust control will be utilized throughout the entire construction process of the site. For example, keeping disturbed surfaces moist during windy periods will be an effective control measure, especially for construction access roads. The use of dust control will prevent the movement of soil to offsite areas. However, care must be taken to not create runoff from excessive use of water to control dust. The following are methods of Dust Control that may be used on-site:

- Vegetative Cover – The most practical method for disturbed areas not subject to traffic.
- Calcium Chloride – Calcium chloride may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage.
- Sprinkling – The site may be sprinkled until the surface is wet. Sprinkling will be effective for dust control on haul roads and other traffic routes.
- Stone – Stone will be used to stabilize construction roads; will also be effective for dust control.

The general contractor shall employ an on-site water vehicle for the control of dust as necessary.

Washing of Equipment and Vehicles

Vehicle Washing Rules - The site supervisor shall produce a written document received by all subcontractors and employees that delineates their responsibilities on site. The site supervisor shall document receipt of these instructions by obtaining the signatures of subcontractors and individuals that may enter the site and the date in which they were notified of their responsibilities. This document shall include language that shall not permit vehicle washing on the job site. Concrete trucks shall be exempt from this rule. Concrete truck cleaning shall be confined within the work area and conducted in a manner to prevent water drainage beyond the specified area of work. Concrete truck washout shall be conducted in designated areas and shall not be discharged in areas which would allow wash water to leave the site or enter protected areas.

Maintenance Requirements

1. The site supervisor shall maintain a log of individuals receiving these instructions.

Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

Building Products - Building products are not anticipated during this phase of construction.

Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

The use of pesticides and herbicides is not currently anticipated for this site. Fertilizers and landscape materials will be used to stabilize slopes and other disturbed areas.

1. Store all fertilizers and landscape materials in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.

Maintenance Requirements

1. The site supervisor shall regularly inspect the designated storage areas as well as any portions of the site under construction to ensure that all materials are properly stored. The site supervisor shall immediately address any issues and instruct personnel to secure and properly store all materials.

Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

Refueling and maintenance for vehicles or equipment shall occur either within the designated washout area or shall utilize temporary drip protection measures at the location of fueling. The site supervisor or their representative shall be present at the time of any fueling procedure. The site supervisor shall have a fuel spill plan and measures on site to initiate containment and clean-up in the event a fuel spill occurs.

Refueling and maintenance of equipment shall take place in designated areas whenever possible. Refueling or maintenance of equipment in locations other than those designated for such activity shall be performed under the supervision of the site supervisor or his/her designee and shall employ drip pans or other suitable means of preventing fuel, hydraulic fluid, etc. from spilling or being otherwise carried offsite or into protected areas.

Maintenance Requirements

1. All emergency response equipment listed in the Emergency Response Equipment Inventory shall be made readily available and kept in a designated location known to the site supervisor or his/her designee. All such materials shall be replenished as necessary to the listed amounts.

Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

Hazardous or toxic waste associated with paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations.

Hazardous or toxic waste shall be collected in approved containers and disposed of in accordance with municipal, state and federal regulations. Hazardous and toxic waste

shall not be disposed of in solid waste containers intended for non-hazardous construction debris.

Maintenance Requirements

1. The site supervisor shall regularly inspect all portions of the project under construction and ensure that all hazardous or toxic materials are disposed of in accordance with the practices detailed above and shall immediately correct any improper disposal practices.

Construction and Domestic Waste

(Note: Examples include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, and other trash or building materials.)

Construction and domestic waste shall be disposed of in a trash receptacle (dumpster) which shall be removed and disposed of at an approved land fill.

Recyclable waste material shall be stored in an appropriate container or in a designated location on site until it can be removed.

1. Trash receptacles (dumpsters) and recyclable waste material containers shall be located as needed throughout the site.

Maintenance Requirements

1. The site supervisor shall inspect all trash receptacles and containers to confirm that construction and domestic waste is properly contained, and shall also ascertain that waste is being picked up in a timely manner to ensure that no receptacles are overflowing. Pick-up schedules shall be modified or the number of receptacles shall be increased as needed.

Sanitary Waste

During the construction process, portable toilets will be provided in an appropriate location during the construction process.

Maintenance Requirements

1. The site supervisor shall execute a contract with a vendor to supply and maintain portable toilets throughout the site for the project duration. The site supervisor shall determine if a sufficient number of toilets are present to meet staffing levels and shall ensure that the toilets are regularly and properly maintained.

Washing of Applicators and Containers used for Paint, Concrete or Other Materials

Concrete washout shall be restricted to designated areas. Paints, form release oils, curing compounds, etc. shall be recycled and/or disposed of utilizing appropriate containers in accordance with manufacturer's recommendations and EPA guidelines.

1. Install straw bale and plastic liner washout pit at the designated location on site. Concrete trucks shall wash out only at washout pit or other similar acceptable facility such as a portable roll-off washout pit.
2. Provide suitable containers for recycling or disposal for cleanup of paints, form release oils, curing compounds, etc.

Maintenance Requirements

1. The site supervisor shall inspect concrete washout pits (or other acceptable facility) to ensure that they are properly maintained. If necessary, wash water in a concrete washout pit shall be vacuumed off and the hardened concrete broken up and recycled. Wash water and broken up concrete shall be properly disposed of at a suitable facility. If necessary the wash out pit shall be repaired and relined with plastic prior to continued use.
2. Containers for waste paint, form release oil, curing compounds, etc. shall be sealed and removed from the site and properly disposed of at a suitable facility. Empty containers shall replace those being removed for disposal.

Fertilizers

Fertilizers shall be used only as necessary to establish vegetative stabilized slopes and disturbed areas. Apply at recommended rates. Use only slow release fertilizers to minimize discharge of nitrogen or phosphorous.

1. Store all fertilizers in designated locations. Store all weather sensitive materials in closed containers in accordance with manufacturer's recommendations.
2. To prevent accidental release of fertilizers, the site supervisor shall attempt to coordinate delivery of fertilizers to coincide with application and reduce the need to warehouse large quantities on-site.

Maintenance Requirements

1. Site supervisor shall make regular inspections to ensure that fertilizer is being applied at proper rates and that all perimeter controls are in place and properly maintained to control runoff which may contain fertilizer. Stored fertilizer shall be properly covered or enclosed in a designated location to prevent introduction into stormwater runoff.

Spill Prevention and Response

The site supervisor or their representative shall be present on the job site at all times during the course of work and shall be present during the delivery, removal of any liquid/chemical materials to or from the job site. They will also be present during any refueling practices. All subcontractors will be notified of their responsibilities in writing. In the event a spill occurs, the site supervisor shall be notified immediately.

The site supervisor shall have in place a spill prevention plan and resources to contain and clean up any potential spills in a timely manner. Refer to the following Spill Containment & Management Plan, including Spill Report, Emergency Response Equipment Inventory, and Emergency Notification and phone numbers.

Non-Stormwater Discharges:

The construction de-watering and all non-stormwater discharges will be directed into a sediment dirt bag (or equivalent inlet protection) or a sediment basin. Sediment material removed shall be disposed of in accordance with all applicable local, state, and federal regulations.

The developer and site general contractor will comply with the E.P.A.'s Final General Permit for Construction De-watering Discharges, (N.P.D.E.S., Section 402 and 40 C.F.R. 122.26(b)(14)(x).

Inspection/Maintenance:

Operator personnel must inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½-inch or greater. The applicant shall be responsible to secure the services of a design professional or similar professional (inspector) on an on-going basis throughout all phases of the project. Refer to the Inspection/Maintenance Requirements presented earlier in the “Structural and Stabilization Practices.” The inspector should review the erosion and sediment controls with respect to the following:

- Whether or not the measure was installed/performed correctly.
- Whether or not there has been damage to the measure since it was installed or performed.
- What should be done to correct any problems with the measure.

The inspector should complete the Stormwater Management Construction Phase BMP Inspection Schedule and Evaluation Checklist, as attached, for documenting the findings and should request the required maintenance or repair for the pollution prevention measures when the inspector finds that it is necessary for the measure to be effective. The inspector should notify the appropriate person to make the changes and submit copies of the form to the Newburyport Highway Department.

Project Location: 20 Henry Graf Jr. Road, APN 82-2-B, Newburyport, MA
Stormwater Management – Construction Phase
Best Management Practices – Inspection Schedule and Evaluation Checklist

Date:

Construction Practices

| Best Management Practice | Inspection Frequency | Date Inspected | Inspector | Minimum Maintenance and Key Items to Check | Cleaning/Repair Needed: (List Items) | Date of Cleaning/Repair | Performed by |
|---------------------------------------|--|----------------|-----------|--|--|-------------------------|--------------|
| Silt Sock and Sediment Fence Controls | After heavy rainfall events (minimum weekly) | | | 1. Sediment Fence Design/Installation Requirements 2. Sediment Fence Inspection/Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| Stabilized Construction Entrance | After heavy rainfall events (minimum weekly) | | | 1. Construction Entrance Design/Construction Requirements 2. Construction Entrance Inspection/Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| Temporary Sedimentation Basins | After heavy rainfall events (minimum weekly) | | | 1. Sediment Basin Inspection/Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| Temporary Seeding | After heavy rainfall events (minimum weekly) | | | 1. Temporary Seeding Planting Procedures 2. Temporary Seeding Inspection/Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| Geotextiles | After heavy rainfall events (minimum weekly) | | | 1. Geotextile Inspection/Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| Mulching & Netting | After heavy rainfall events (minimum weekly) | | | 1. Mulch Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| Land Grading | After heavy rainfall events (minimum weekly) | | | 1. Land Grading Stabilization Inspection/Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |

| | | | | | | | |
|-------------------|--|--|--|--|--|--|--|
| Permanent Seeding | After heavy rainfall events (minimum weekly) | | | 1. Permanent Seeding Inspection/ Maintenance | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| | | | | | | | |
| Dust Control | After heavy rainfall events (minimum weekly) | | | | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| | | | | | | | |
| Soil Stockpiling | After heavy rainfall events (minimum weekly) | | | | <input type="checkbox"/> yes <input type="checkbox"/> no | | |
| | | | | | | | |

(1) Refer to the Massachusetts Stormwater Handbook issued January 2, 2008.

Notes (Include deviations from : Definitive Subdivision Decision and Special Conditions and Approved Plan):

Stormwater Control Manager _____

Spill Containment and Management Plan

March 17, 2020

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) Sports Medicine North Orthopedic Surgery, Inc.
c/oConServ Group, Inc.
110 State Road
Sagamore Beach, Massachusetts 02562

Facility Manager (phone) (508) 888-6555

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

| <u>Contact:</u> | <u>Phone Number:</u> |
|--------------------------------|---------------------------------|
| Fire Department: | <u>911</u> |
| Police Department: | <u>911</u> |
| Department of Public Works: | <u>(978) 465-4464 ext. 1710</u> |
| Board of Health Phone: | <u>(978) 465-4410</u> |
| Conservation Commission Phone: | <u>(978) 465-4400</u> |

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date ___ / ___ / ___

Time _____ AM / PM

Exact location (Transformer #) _____

Type of equipment _____ Make _____ Size _____

S / N _____ Weather Conditions _____

On or near water Yes No
If yes, name of body of water _____

Type of chemical / oil spilled _____

Amount of chemical / oil spilled _____

Cause of spill _____

Measures taken to contain or clean up spill _____

Amount of chemical / oil recovered _____ Method _____

Material collected as a result of clean up

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal _____

Name and address of any person, firm, or corporation suffering damages _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring _____

Spill reported to General Office by _____ Time _____ AM / PM

Spill reported to DEP / National Response Center by _____

DEP Date ___ / ___ / ___ Time _____ AM / PM Inspector _____

NRC Date ___ / ___ / ___ Time _____ AM / PM Inspector _____

Additional comments _____

EMERGENCY RESPONSE EQUIPMENT INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

| | | |
|----|--------------------------|---------------|
| -- | SORBENT PADS | 1 BALE |
| -- | SAND BAGS (empty) | 5 |
| -- | SPEEDI-DRI ABSORBENT | 2 – 40LB BAGS |
| -- | 12" INFLATABLE PIPE PLUG | 1 |
| -- | SQUARE END SHOVELS | 1 |
| -- | PRY BAR | 1 |
| -- | CATCH BASIN COVER | 1 |

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
NAME: ConServ Group, Inc. BEEPER: _____
PHONE: (508) 888-6555 CELL PHONE: _____

ALTERNATE:
NAME: _____ BEEPER: N/A _____
PHONE: _____ CEL PHONE: N/A _____
2. FIRE DEPARTMENT
EMERGENCY: 911
BUSINESS: (978) 465-4427

POLICE DEPARTMENT
EMERGENCY: 911
BUSINESS: (978) 462-4411

DEPARTMENT OF PUBLIC WORKS
CONTACT: Jon-Eric White, PE
BUSINESS: (978) 465-4464 ext. 1710
ALTERNATE:

CONSERVATION COMMISSION
CONTACT: Julia Godtfredsen
BUSINESS: (978) 465-4400

BOARD OF HEALTH
CONTACT: Frank Giacalone
BUSINESS: (978) 465-4410
3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
EMERGENCY: (978) 694-3200
NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200
4. NATIONAL RESPONSE CENTER
PHONE: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
EMERGENCY: (617) 223-7265
BUSINESS: (617) 860-4300

**POST-DEVELOPMENT BEST MANAGEMENT
PRACTICE
OPERATION AND MAINTENANCE PLAN &
LONG-TERM POLLUTION PREVENTION PLAN**

for

**Proposed Medical Building
20 Henry Graf Jr. Road
Newburyport, Massachusetts
(Assessor's Parcel Number 82-2-B)**

Submitted to:

Town of Newburyport

Prepared for:

**Sports Medicine North Orthopedic Surgery, Inc.
c/o Conserv Group Inc.
110 State Road
Sagamore Beach, Massachusetts 02562**

Prepared by:



**Professional Civil Engineering • Project Management • Land Planning
150 Longwater Drive, Suite 101, Norwell, Massachusetts 02061
Tel.: (781) 792-3900 Facsimile: (781) 792-0333
www.mckeng.com**

March 17, 2020

TABLE OF CONTENTS

| | Page |
|---|------|
| Long Term Best Management Practices (BMP's) | |
| - Responsible Party Contact Information | 1 |
| - Long-Term Operation and Maintenance | 1 |
| - BMP Operation and Maintenance | 2 |
| - Maintenance Responsibilities | 4 |
| - Long-Term Pollution Prevention Plan | 4 |
| - Inspection Schedule and Evaluation Checklist | 7 |
| - Spill Containment and Management Plan | 8 |
| - First Defense Unit Operation & Maintenance Manual | 12 |

**Post-Development Best Management Practice
Operation and Maintenance Plan &
Long-Term Pollution Prevention Plan**

**Post-Development Best Management Practices (BMPs)
Operation and Maintenance Plan**

Responsible Party/Property Owner/Developer contact information:

Property Owner: Ocean Realty Trust
 John D. Hartnett, Trs.
 20 Henry Graf Jr. Road
 Newburyport, MA

Developer Contact Information:
Sports Medicine North Orthopedic Surgery, Inc.
c/o ConServ Group, Inc.
110 State Road
Sagamore Beach, Massachusetts 02562
Phone: (508) 888-6555

Town of Newburyport Contact Information:

Newburyport Department of Public Works/Engineering Division
Jon-Eric White, PE
16A Perry Way
Newburyport, MA 01950
Phone: (978) 465-4464 ext. 1710

Newburyport Conservation Commission
Julia Godtfredsen
60 Pleasant Street
Newburyport, MA 01950
Phone: (978) 465-4400

Newburyport Building Department
Peter Binette
60 Pleasant Street
Newburyport, MA 01950
Phone: (978) 465-4405

Best Management Practices (BMPs) of the Commonwealth of Massachusetts Department of Environmental Protection's (DEP's) Stormwater Management Policy (SMP) have been implemented and utilized for the project. The following information provided is to be used as a guideline for monitoring and maintaining the performance of the drainage facilities and to ensure that the quality of water runoff meets the standards set forth by the SMP. The structural Best Management Practices (BMPs) shall be inspected during rainfall conditions during the first year of operation to verify functionality.

BMPs included in the design consist of the use of:

- Deep sump catch basins with hooded outlets
- First Defense units
- Stormwater management basins
- Outlet protection at stormwater management basins
- Roadway pavement maintenance
- Restrictions on the use of pesticides and herbicides within the 100-foot buffer zone

Operation:

Once the stormwater management basins have been constructed and the site has been permanently and the stormwater facilities are online, the operation of the stormwater management system will function as intended. Stormwater runoff is directed into the catch basins and closed drainage system to the First Defense units, and lastly to the storage portion of the detention basins where it will outlet into municipal closed drainage system located adjacent to Henry Graf Jr. Road. The stormwater management basins have been designed to attenuate peak flows for the 2-year through 100-year storm events, and will provide the required one foot of freeboard above the 100-year storm storage level.

Maintenance:

1. **Paved Areas** –Sweepers shall sweep paved areas periodically during dry weather to remove excess sediments and to reduce the amount of sediments that the drainage system shall have to remove from the runoff. The sweeping shall be conducted primarily between March 15th and November 15th. Special attention should be made to sweeping paved surfaces in March and April before spring rains wash residual sand into the drainage system.

The frequency of sweeping shall average:

- Monthly if by a high-efficiency vacuum sweeper
- Bi-weekly if by a regenerative air sweeper
- Weekly if by a mechanical sweeper

Salt used for de-icing on the parking lot during winter months shall be limited as much as possible as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities.

Cost: The property owner should consult local sweeping contractors for detailed cost estimates.

2. **Catch Basins** - Catch basin grates shall be checked quarterly and following heavy rainfalls to verify that the inlet openings are not clogged by debris. Debris shall be removed from the grates and disposed of properly. Deep sump catch basins shall be inspected and cleaned bi-annually of all accumulated sediments. Catch basins with hoods shall be inspected annually to check oil build-up and outlet obstructions. Material shall be removed from catch basins and disposed of in accordance with all applicable regulations.

Cost: Estimated \$50 - \$100 per cleaning as needed. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 3. Proprietary Pretreatment Units** – The proprietary pretreatment units shall be inspected and maintained from the surface, without entry into the unit a minimum of annually and following heavy rain events. Perform maintenance once the stored volume reaches 15% of the unit capacity, or immediately in the event of a spill. Perform Maintenance at quarterly intervals during the first year of installation, so an accurate maintenance schedule can be established. Sediment and debris should be removed through the 12-inch diameter outlet pipe. Alternatively, oil and floatables should be removed through the 12-inch oil inspection port. The requirements for the disposal from the units should be in compliance with all local, state and federal regulations. Consult the Newburyport Board of Health for transfer station locations prior to disposing the separator contents. Please refer to the Manufacturer’s Manual for additional detail on proper inspection and maintenance of the First Defense units.

Cost: Cleaning should be included along with the routine maintenance of the catch basins. The property owner should consult local vacuum cleaning contractors for detailed cost estimates.

- 4. Detention Basins** - The detention basins, emergency spillway, inlets and vehicular access shall be checked for debris accumulation on a quarterly basis. Additional inspections should be scheduled during the first few months to make sure that the vegetation becomes adequately established in the detention basin and that the facility is functioning as intended. Trash, leaves, branches, etc. shall be removed from facility. Silt, sand and sediment, if significant accumulation occurs, shall be removed by rubber-tired excavator annually. Material removed from the basin shall be disposed of in accordance with all applicable local, state, and federal regulations. The detention basins and vehicular access shall be kept free of woody vegetation by mowing at least twice per year. Reseeding, weed control, and invasive species removal may need to be performed periodically to maintain healthy vegetation and maintain the pollutant removal efficiency of the facilities. In the case that water remains in the detention facilities for greater than three (3) days after a storm event, an inspection is warranted and necessary maintenance or repairs to the outlet control structure or bottom of the basin may be necessary. Any slope erosion within the facility shall be stabilized and repaired as soon as practical.

The emergency spillway and embankment shall be inspected annually for structural integrity. The inspections shall be conducted by qualified personnel.

Cost: \$500-\$1000 per cleaning if excavator is necessary to remove sediment. The Owner should consult local landscape contractors for a detailed cost estimate.

- 5. Outlet Protection** - All outfall protection structures shall be inspected quarterly and following major storm events defined as a storm event exceeding one inch of rainfall within a twenty-four-hour period to check for signs for erosion. Any necessary repairs shall be performed promptly and cleaned to remove accumulated sediment as necessary. Material removed shall be disposed of in accordance with all applicable local, state, and federal regulations. Rip-Rap overflow structure shall be weeded and cleaned on a quarterly basis to ensure that water overflowing the spillway will not become obstructed by debris.

- 6. Pesticides, Herbicides, and Fertilizers** - Pesticides and herbicides shall be used sparingly. Fertilizers should be restricted to the use of organic fertilizers only.

All structural BMP's as identified on the site plans will be owned and maintained by the homeowner's association of the development and shall run with the title of the property.

Cost: Included in the routine landscaping maintenance schedule. The Owner should consult local landscaping contractors for details.

7. Snow Removal - Snow accumulations removed from driveway and parking areas should be placed in upland areas only, where sand and other debris will remain after snowmelt for later removal. Excess snow should be removed from the site and properly disposed of in an approved snow disposal facility. Care must be exercised not to deposit snow in the following areas: in the wetland, drainage depression, detention basin, bioswales, and where sand and debris can get into the watercourse.

Cost: The owner should consult local snow removal contractors for a detailed cost estimate.

Maintenance Responsibilities:

All post construction maintenance activities will be documented and kept on file. Annual inspection reports in the form of an Evaluation Checklist, see attached form, will be submitted to the Town of Newburyport. Inspections shall be performed by a licensed engineer or similar professional (inspector).

All BMPs located within drainage easements will be owned and maintained by the developer until such time that a homeowners association is created, then the homeowners association will maintain the BMPs.

Long-Term Pollution Prevention Plan

Good Housekeeping:

To develop and implement an operation and maintenance program with the goal of preventing or reducing pollutant runoff by keeping potential pollutants from coming into contact with stormwater or being transported off site without treatment, the following efforts will be made:

- Property Management awareness and training on how to incorporate pollution prevention techniques into maintenance operations.
- Follow appropriate best management practices (BMPs) by proper maintenance and inspection procedures.
- Homeowner education outreach, including promoting recycling through the Town of Newburyport Transfer Station.

Storage and Disposal of Household Waste and Toxics:

This management measure involves educating the general public on the management considerations for hazardous materials. Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Many people have hazardous chemicals stored throughout their homes, especially in garages and storage sheds. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts. Property owners are encouraged to support the household hazardous product collection events sponsored by the Town of Newburyport.

MADEP has prepared several materials for homeowners on how to properly use and dispose of household hazardous materials:

<http://www.mass.gov/dep/recycle/reduce/househol.htm>

For consumer questions on household hazardous waste call the following number:

DEP Household Hazardous Waste Hotline 800-343-3420

The following is a list of management considerations for hazardous materials as outlined by the EPA:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport;
- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself;
- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests.

The following is a list of commonly used hazardous materials used in the household:

Batteries – automotive and rechargeable

.....nickel cadmium batteries

.....(no alkaline batteries)

Gasoline

Oil-based paints

Fluorescent light bulbs and lamps

Pool chemicals

Propane tanks

Lawn chemicals,

fertilizers and weed killers

Turpentine

Bug sprays

Antifreeze

Paint thinners, strippers, varnishes and

..... stains

Arts and crafts chemicals

Charcoal lighter fluid

Disinfectant

Drain clog dissolvers

Driveway sealer

Flea dips, sprays and collars

Houseplant insecticides

Metal polishes

Mothballs

Motor oil and filters

Muriatic acid (concrete cleaner)

Nail polishes and nail polish

removers

Oven cleaner

Household pest and rat poisons

Rug and upholstery cleaners

Shoe polish

Windshield wiper fluid

Vehicle Washing:

This management measure involves educating the general public on the water quality impacts of the outdoor washing of automobiles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor car washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions in many watersheds, as the detergent-rich water used to wash the grime off our cars flows down the street and into the storm drain. The following management practices will be encouraged:

- Washing cars on gravel, grass, or other permeable surfaces.
- Blocking off the storm drain during car washing and redirecting wash water onto grass or landscaping to provide filtration.
- Using hoses with nozzles that automatically turn off when left unattended.
- Using only biodegradable soaps.
- Minimize the amounts of soap and water used. Wash cars less frequently.
- Promote use of commercial car wash services.

Landscape Maintenance:

This management measure seeks to control the storm water impacts of landscaping and lawn care practices through education and outreach on methods that reduce nutrient loadings and the amount of storm water runoff generated from lawns. Nutrient loads generated by fertilizer use on suburban lawns can be significant, and recent research has shown that lawns produce more surface runoff than previously thought.

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. These practices can benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife. The following lawn and landscaping management practices will be encouraged:

- Mow lawns at the highest recommended height.
- Minimize lawn size and maintain existing native vegetation.
- Collect rainwater for landscaping/gardening needs (rain barrels and cisterns to capture roof runoff).
- Raise public awareness for promoting the water efficient maintenance practices by informing users of water efficient irrigation techniques and other innovative approaches to water conservation.
- Abide by water restrictions and other conservation measures implemented by the Town of Newburyport.
- Water only when necessary.
- Use automatic irrigation systems to reduce water use.

Integrated Pest Management (IPM):

This management measure seeks to limit the adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests.

The presence of pesticides in stormwater runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chlorpyrifos, which even at very low levels can be harmful to aquatic life. The major source of pesticides to urban streams is home application of products designed to

kill insects and weeds in the lawn and garden. The following IPM practices will be encouraged:

- Lawn care and landscaping management programs including appropriate pesticide use management as part of program.
- Raise public awareness by referring homeowners to “A Homeowner’s Guide to Environmentally Sound Lawncare, Maintaining a Healthy Lawn the IPM Way”, Massachusetts Department of Food and Agriculture, Pesticide Bureau or link <http://www.mass.gov/dep/water/resources/nonpoint.htm#megaman>>

Pet Waste Management:

Pet waste management involves using a combination of pet waste collection programs, pet awareness and education, to alert residents to the proper disposal techniques for pet droppings. The following management practices will be encouraged:

- Raise awareness of homeowners that are also pet owners that they are encouraged to pick up after their pets and dispose of the waste either in the trash, including on their own lawns and walking trails.
- Provide signage along walking trails.

Proper Management of Deicing Chemicals and Snow:

Roadways shall be maintained by the Developer/Property Owners until such time that the Town of Newburyport accepts the roadways, then the Town of Newburyport shall maintain the roadways. The following deicing chemicals and snow storage practices will be encouraged:

- Select effective snow disposal sites adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris, which can be removed in the springtime.
- No roadway deicing materials shall be stockpiled on site unless all storage areas are protected from exposure to rain, snow, snowmelt and runoff.
- Avoid dumping snow into any waterbody, including wetlands, cranberry bogs, detention/infiltration basins, and grassed swales/channels.
- Avoid disposing of snow on top of storm drain catch basins.

Project Location: 20 Henry Graf Jr. Road, APN 82-2-B, Newburyport, MA

Stormwater Management – Post Construction Phase

Best Management Practices – Inspection Schedule and Evaluation Checklist

Long Term Practices

| Best Management Practice | Inspection Frequency (1) | Date Inspected | Inspector | Minimum Maintenance and Key Items to Check (1) | Cleaning/Repair Needed: <input type="checkbox"/> yes <input type="checkbox"/> no (List Items) | Date of Cleaning/Repair | Performed by |
|----------------------------------|--|----------------|-----------|---|---|-------------------------|--------------|
| Street Sweeping Maintenance | 4-times annually - specifically in Spring and Fall | | | 1. Sediment build-up 2. Trash and debris 3. Minor Spills (vehicular) | | | |
| Deep Sump and Hooded Catch basin | After heavy rainfall events (minimum quarterly) | | | 1. Sediment level exceeds 8" 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Grate or outlet blockages | | | |
| Drainage Depression Areas | (minimum monthly) (Cleaned quarterly) | | | 1. Sediment and debris build-up 2. Standing water greater than 48 hours | | | |
| Proprietary Pretreatment Units | After heavy rainfall events (minimum annually) | | | 1. Sediment level exceeds Manufacturer's specification 2. Trash and debris 3. Floatable oils or hydrocarbons 4. Outlet blockages | | | |
| Outlet Protection | Quarterly | | | 1. Sediment build-up 2. Trash and debris 3. Displacement of rip rap 4. Excess vegetation | | | |

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.

Notes (Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan):

1.

Stormwater Control Manager _____

Stamp:

Spill Containment and Management Plan

March 17, 2020

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) Sports Medicine North Orthopedic Surgery, Inc.
c/oConServ Group, Inc.
110 State Road
Sagamore Beach, Massachusetts 02562

Facility Manager (phone) (508) 888-6555

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

| <u>Contact:</u> | <u>Phone Number:</u> |
|--------------------------------|---------------------------------|
| Fire Department: | <u>911</u> |
| Police Department: | <u>911</u> |
| Department of Public Works: | <u>(978) 465-4464 ext. 1710</u> |
| Board of Health Phone: | <u>(978) 465-4410</u> |
| Conservation Commission Phone: | <u>(978) 465-4400</u> |

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date ___ / ___ / ___

Time _____ AM / PM

Exact location (Transformer #) _____

Type of equipment _____ Make _____ Size _____

S / N _____ Weather Conditions _____

On or near water Yes If yes, name of body of water _____
 No

Type of chemical / oil spilled _____

Amount of chemical / oil spilled _____

Cause of spill _____

Measures taken to contain or clean up spill _____

Amount of chemical / oil recovered _____ Method _____

Material collected as a result of clean up

_____ drums containing _____

_____ drums containing _____

_____ drums containing _____

Location and method of debris disposal _____

Name and address of any person, firm, or corporation suffering damages _____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring _____

Spill reported to General Office by _____ Time _____ AM / PM

Spill reported to DEP / National Response Center by _____

DEP Date ___ / ___ / ___ Time _____ AM / PM Inspector _____

NRC Date ___ / ___ / ___ Time _____ AM / PM Inspector _____

Additional comments _____

EMERGENCY RESPONSE EQUIPMENT INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

| | | |
|----|--------------------------|---------------|
| -- | SORBENT PADS | 1 BALE |
| -- | SAND BAGS (empty) | 5 |
| -- | SPEEDI-DRI ABSORBENT | 2 – 40LB BAGS |
| -- | 12" INFLATABLE PIPE PLUG | 1 |
| -- | SQUARE END SHOVELS | 1 |
| -- | PRY BAR | 1 |
| -- | CATCH BASIN COVER | 1 |

EMERGENCY NOTIFICATION PHONE NUMBERS

1. FACILITY MANAGER
NAME: ConServ Group, Inc. BEEPER: _____
PHONE: (508) 888-6555 CELL PHONE: _____

ALTERNATE:
NAME: _____ BEEPER: N/A _____
PHONE: _____ CEL PHONE: N/A _____
2. FIRE DEPARTMENT
EMERGENCY: 911
BUSINESS: (978) 465-4427

POLICE DEPARTMENT
EMERGENCY: 911
BUSINESS: (978) 462-4411

DEPARTMENT OF PUBLIC WORKS
CONTACT: Jon-Eric White, PE
BUSINESS: (978) 465-4464 ext. 1710
ALTERNATE:

CONSERVATION COMMISSION
CONTACT: Julia Godtfredsen
BUSINESS: (978) 465-4400

BOARD OF HEALTH
CONTACT: Frank Giacalone
BUSINESS: (978) 465-4410
3. MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
EMERGENCY: (978) 694-3200
NORTHEAST REGION - WILMINGTON OFFICE: (978) 694-3200
4. NATIONAL RESPONSE CENTER
PHONE: (800) 424-8802

ALTERNATE: U.S. ENVIRONMENTAL PROTECTION AGENCY
EMERGENCY: (617) 223-7265
BUSINESS: (617) 860-4300