STORM WATER POLLUTION PREVENTION PLAN FOR THE CONSTRUCTION OF

LIFE CHURCH – NEW GATHERING & WORSHIP SPACE

4928 Seneca Street
West Seneca, New York

Prepared for:
Life Church
4928 Seneca Street
West Seneca, NY 14224

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1.0 INTRODUCTION

The Clean Water Act states that storm water discharges associated with an industrial activity from a point source, including through a separate municipal storm sewer system, is unlawful unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. In New York State, the New York State Department of Environmental Conservation (NYSDEC) administers the NPDES through the State Pollution Discharge Elimination System (SPDES) program. According to the SPDES General Permit, construction sites or common plans of development, that result in soil disturbance of one or more acres that are not classified single family residential or agricultural, are subject to permitting requirements.

This plan outlines the manner in which to reduce the potential of storm water runoff pollution and assigns responsibilities to ensure that the contractor and his subcontractors implement the requirements of the Storm Water Pollution Prevention Plan (SWPPP) during construction activities until the site is stabilized. The SWPPP was developed based on the SPDES General Permit for Storm Water Discharges from Construction Activity Permit No. GP-0-20-001, dated January 29, 2020.

2.0 NOTICE OF INTENT REQUIREMENTS

To obtain coverage under a general permit, a Notice of Intent (NOI) must be submitted by the owner at least five (5) days prior to commencement of construction activities. Once completed, the NOI shall be sent to:

Notice of Intent
NYS DEC, Bureau of Water Permits
625 Broadway, 4^{th} Floor
Albany, NY 12233-3505

A completed copy of a NOI form has been included in Appendix B-1.

3.0 STORM WATER POLLUTION PREVENTION PLAN

This Storm Water Pollution Prevention Plan (SWPPP) was developed to set operating guidelines during construction activities. A copy of this SWPPP shall be retained at the construction site throughout the duration of this project.

The Contractor shall meet all conditions of this SWPPP and all conditions within the NYSDEC SPDES General Permit for Stormwater discharges from Construction Activities - Permit No. GP-0-20-001 dated January 29, 2020. The contractor shall be responsible for all measures of the SWPPP including being responsible for any subcontractors who may implement the SWPPP.

During the course of the project and upon approval by the owner, the contractor shall amend the plan whenever there is a change in construction, operation, or maintenance, which may have an effect on the potential for the discharge of pollutants. In addition, if a new subcontractor is utilized at the site who will implement tasks included in the plan, the SWPPP shall be amended.

3.1 Site Description

The project site is located at 4928 Seneca Street, in the Town of West Seneca, New York. See location map in Appendix A. The project site is 8.41 acres and consists of a single-story residential home(used as the church's office space) along the frontage of the property with associated parking behind the residence, a single-story brick church near the middle of the property with associated asphalt paved parking along three sides of the church and a one-way, paved, ring road which encircles both buildings. Site amenities include a covered pavilion, a playground and utility infrastructure to service the existing buildings. A small portion of the site is wooded and undeveloped, along the north end of the parcel.

The existing drainage patterns on the site consist of three main drainage areas; a north drainage area, a middle drainage area and a south drainage area. The north drainage area consists of the northern portion of the asphalt-paved parking lot, the covered pavilion, playground, lawn areas and the forested/wooded area. The northern drainage area drains in a southwesterly direction and stormwater runoff is conveyed to the adjacent property to the west. The middle drainage area consists of both the single-story residence and the church building, along with the remainder of the asphalt-paved parking and entrance/exit drives. The middle drainage area drains to a drainage swale, which flows across the property. The drainage swale flows into a 12-inch culvert, which discharges to the property to the west. The south drainage area is small and consists of the existing house, a small portion of lawn area and concrete sidewalk, which drains towards and is collected in the Seneca Street drainage system.

The soils on site, per the USDA NRCS web soil survey consist of the following; Canadice silt loam, which is listed as HSG "D", is poorly drained and has a water table at or near the surface; Cayuga silt loam, also listed as HSG "D", is well drained and has a water table at approximately 2-feet below the surface; Churchville silt loam, which is listed as HSG "C/D", is poorly drained and has a water table greater than 1-foot below the surface; and Rhinebeck silt loam, which is listed as HSG "C/D", is poorly drained and has a water table elevation greater than 1-foot below the surface.

A preliminary wetland investigation was performed by Earth Dimensions on October 2, 2019. Based upon their site visit, they identified 0.9+/- acre of wetland as defined by the U.S. Army Corps of Engineers (USACE) wetland delineation manuals within the investigation area (the northern portion of the site, which includes wooded/brush areas). It is their professional opinion that the wetland is likely regulated by the USACE under Section 404 of the Clean Water Act. The New York State Department of Environmental Conservation (NYSDEC) On-line Resource Mapper does not depict any Freshwater Wetlands within or adjacent to the site. Thus, NYSDEC has no apparent jurisdiction over any wetlands under Article 24 of the New York Conservation Law. The proposed improvements on the site have been designed to avoid any impacts to the wetland.

Development will consist of the demolition of a portion of the existing parking lot to accommodate the construction of a single-story, 11,915 square foot, building addition along with additional parking and associated site improvements. The site, upon project completion, will accommodate a total of 323 parking spaces, including 8 accessible spaces. Site improvements include concrete sidewalks, landscaping, and site utilities. Site utilities will include a stormwater management system, a new private, fire protection service for the new addition and tying the proposed sewer lateral into the existing church building's sewer lateral.

Upon completion, the proposed project will add 2.01 acres of new impervious cover and 1.01 acres of reconstructed impervious areas. The total anticipated ground disturbance during construction of this project will be approximately 4.60 acres. Due to the increase in impervious areas, stormwater detention is required. Additionally, since the construction of this site will disturb more than one acre, a Storm Water Pollution Prevention Plan (SWPPP), in accordance with the New York State Department of Environmental Conservation (NYSDEC) standards must be prepared and a Notice of Intent (NOI) must be filed prior to beginning construction.

B. Below is a description of the intended sequence of major construction activities which involve soil disturbance:

- Install silt sock.
- Clear, grub and install temporary erosion and sediment controls simultaneously where possible.
- Remove debris from site. (Debris to be disposed of in a NYSDEC approved landfill approved to accept this type of material.)
- Remove, stockpile and seed any excess topsoil and install temporary erosion and sediment controls simultaneously.
- Excavate and rough grade the construction site and stormwater detention facility.
- Install utilities, construct building, install pavement and pour concrete sidewalks
- Final grade, replace topsoil, seed and mulch all disturbed turf areas outside of pavement limits immediately upon acceptance of the grade.
- Construct bio-retention facilities and all plantings within
- Replace remaining topsoil and seed and mulch all areas disturbed from construction activities.
- After stabilization, remove temporary erosion and sediment controls.

C. Plans and details for temporary stormwater controls have been included in Appendix G-1. The plans have been included to indicate grading limits, drainage patterns, grade slopes, and location of erosion and sediment controls and storm water discharge locations.

The owner/operator is: Life Church
4928 Seneca Street

West Seneca, NY 14224

The contact person is: Loren Sperrey
(phone) 716-675-5433
(email) loren@lifechurchbuffalo.com

3.2 Construction Controls

The Contractor shall be required to construct and maintain the following controls in accordance with this document and the associated Contract Documents for this project. There shall not be more than five (5) acres of disturbed soil at any one time without prior written approval from the NYSDEC.

A. Stabilization Practices.

1. Seeding.
Immediately after completion of grading operations, topsoil shall be replaced and all areas disturbed from grading operations shall be seeded in an effort to stabilize the site. Where land disturbance is necessary, temporary seeding or mulching must be used on areas which will be exposed for more than 14 days. Permanent stabilization should be performed as soon as possible after completion of grading.

2. Mulching.
Directly after seeding, all disturbed areas shall be mulched to prevent surface compaction, reduce runoff and erosion, control weeds and help establish plant cover.

3. Preservation of Vegetation.
The contractor shall make every effort to protect trees, shrubs, ground cover and any other vegetation adjacent to the work areas. The purpose of preserving existing vegetation where obtainable is to reduce soil erosion and enhance water quality.

4. Dust Control.
Dust resulting from land-disturbing activities shall be controlled to prevent surface and air movement of dust from disturbed soil surfaces. Dust control measures are necessary on construction roads, access points and other disturbed areas subject to dust movement.

5. Equipment/Material Storage.
An equipment and material storage area shall be determined by the site contractor prior to any ground disturbance. The location of the storage area may be modified if deemed necessary. The storage area will be graded to insure that any material spillage shall be directed away from the adjacent property. In addition, any identified chemical spills (oil, grease, etc.) shall be addressed immediately, a written log prepared and kept on-site with the SWPPP and appropriate local officials contacted, if necessary.

6. Temporary Soil Stockpiles.
   A temporary stockpile area shall be determined by the site contractor prior to any ground disturbance. The shape, size and location of this area may be modified by the site contractor if deemed necessary. The stockpile area shall be perimeter protected with silt fence and seeded as soon as possible to minimize the potential for sediment transport and erosion.

7. Staging Area
   The contractor staging area shall be determined by the site contractor prior to any ground disturbance. The shape, size and location of this area may be modified by the site contractor if deemed necessary.

B. Structural Practices.

1. Silt Sock (Temporary)
   - A silt sock is used to intercept sheet flow runoff from small drainage areas. The silt sock also reduces runoff velocity and promotes deposition of transported sediment.
   - Silt sock shall be maintained to prevent sediment bypass and shall be removed and replaced when bulges and/or tears develop in the silt sock.

2. Storm Drain Inlet Protection (Temporary)
   - A storm drain inlet barrier shall be installed around inlets. The purpose is to prevent sediment - laden water from entering inlets to a storm drain system.
   - Inspect and clean after every storm. Sediment should be removed when 50 percent of the storage volume is achieved. This material should be incorporated in the site in a stabilized manner.

3. Stabilized Construction Entrance (Temporary).
   A stabilized construction entrance shall be constructed where traffic will be entering or leaving a construction site to or from a street, alley, sidewalk or parking area. The purpose of the stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public streets.

C. Other Pollution Prevention Measures (Chemicals and Debris)
   - The Contractor shall be responsible for providing onsite trash receptacles appropriate to store all litter, construction chemicals and construction debris. The contents of the receptacles shall be properly disposed of at a NYSDEC licensed waste facility (or equal).
   - Hazardous products shall be maintained in their original containers when possible, and be kept with their original labels and applicable Material Safety Data Sheets (MSDS);
   - Fertilizers shall only be applied as recommended by the manufacturer, and once applied shall be worked into the soil to limit exposure to storm water runoff. Storage shall be within an enclosed or covered area.

- Paints, coatings and sealants shall be maintained in a tightly enclosed, leak-proof container at all times. Excess materials shall be disposed of as required by applicable laws and regulations.
- Excess concrete material shall be removed and disposed of off-site in an appropriate manner. Concrete wash water shall not be allowed to discharge to storm water conveyances.
- All petroleum product spills, if such occurs, shall be cleaned up immediately, the source of the spill be repaired or removed, and contained material shall be disposed of as required by applicable law. In the event a spill, the contractor shall contact the NYSDEC Spills Hotline at 1-800-457-7362 to report such spill. Within 2 hours of discovery, except spills which meet all of the following criteria:
    1) The quantity is known to be less than 5 gallons; and
    2) The spill is contained and under the control of the spiller; and
    3) The spill has not and will not reach the State's water or any land; and
    4) The spill is cleaned up within 2 hours of discovery.
    5) A spill is considered to have not impacted land if it occurs on a paved surface such as asphalt or concrete. A spill in a dirt or gravel parking lot is considered to have impacted land and is reportable.

  More details on notification and reporting requirements can be found at the NYSDEC Website (http://www.dec.ny.gov/chemical/8428.html

D. Good Housekeeping and Control of Construction Wastes and Chemicals

1. Good Housekeeping
   It is anticipated that construction materials such as concrete, asphalt, petroleum based products, stone, and fertilizers will be present on-site at various stages during the project. In order to prevent the conveyance to and contamination of any adjacent and/or downstream property, lands or water bodies, good housekeeping practices shall be employed. Such precautions shall include:
   - Storing of only enough materials to complete the project, or active phases of the project;
   - Materials stored on-site shall be stored in a neat and orderly manner and in their appropriate containers and, if possible, under a covered area or enclosed structure;
   - The manufacturer’s recommendations for use and disposal shall be followed at all times;
   - The project site superintendent shall inspect the site daily to ensure proper use, storage and disposal of all materials on-site.

2. Hazardous Products
   Hazardous products shall be maintained in their original containers when possible, and be kept with their original labels and applicable Material Safety Data Sheets (MSDS);
   - All petroleum product spills, if such occurs, shall be cleaned up immediately,

the source of the spill be repaired or removed, and contained material shall be disposed of as required by applicable law.

- Fertilizers shall only be applied as recommended by the manufacturer, and once applied shall be worked into the soil to limit exposure to storm water runoff. Storage shall be within an enclosed or covered area.
- Paints, coatings and sealants shall be maintained in a tightly enclosed, leak-proof container at all times. Excess materials shall be disposed of as required by applicable laws and regulations;
- Excess concrete material shall be removed and disposed of off-site in an appropriate manner. Concrete wash water shall not be allowed to discharge to storm water conveyances.

3.3 Storm Water Management.

The best approach to storm water management for construction activities is through the use of self-designed Storm Water Pollution Prevention Plan (SWPPP). The development of the SWPPP through the use of Best Management Practices (BMP) is to prevent erosion and pollutants from the construction materials mixing with storm water runoff and being discharged from the project site. BMP's should be designed to prevent, or at least control, the pollution of storm water before it has a chance to affect receiving waters. Using BMP's in this way improves the discharge water quality.

Specific requirements for management of storm water and maintaining water quality include, but are not limited to:

A. There shall be no increase in turbidity that will cause a substantial visible contrast to natural condition;
B. There shall be no suspended, colloidal, and settleable solids that will cause deposition or impair the waters for their best usages, and;

C. There shall be no residue from oil and floating substances, visible oil film, globules or grease.

In addition, local ordinances may affect these Best Management Practices. Any conditions or specific local ordinances are to be included in the development of the BMP's for the project.

3.4 Post Construction Water Quality & Quantity Controls

A. Chapters 3-5 of the NYSDEC Stormwater Management Design Manual (SMDM) provides a green infrastructure approach to stormwater management to reduce a site's impact on the aquatic ecosystem through the use of site planning techniques, runoff reduction techniques, and standard SMP's. Runoff Reduction Volume (RRv) is the reduction of the total Water Quality Volume (WQv) by application of green infrastructure techniques and SMP's to replicate pre-development hydrology.

Outlined below is the NYSDEC SMDM site planning flowchart in relation to this site.

Step 1: Site Planning – Green Infrastructure Method to Preserve Natural Resources and Reduce Impervious Cover

1. Preservation of Undisturbed Areas
    - Vegetative areas and natural terrain has been retained to the maximum extent practical/possible. The northern portion of the site has been left undisturbed and the proposed parking lot has been designed to avoid disturbance to the existing wetland.
2. Preservation of Buffer
    - Natural vegetative buffer has been retained to the maximum extent practical/possible. As many trees as possible have been saved.
3. Reduction of Clearing and Grading
    - Clearing and grading has been limited to the least amount possible while still allowing for development of the site.
4. Locating Development in Less Sensitive Areas
    - The project site is located on an archeological sensitive resource area, as listed on the NYS Office of Parks, Recreation and Historic Preservation (CRIS) website. However, the project site is currently a developed site. The project will have no effect upon cultural resources in or eligible for inclusion in the National Register of Historic Places.
5. Open Space Design
    - The impervious cover has been minimized to the smallest extent possible while still allowing for the required number of parking spaces.
6. Soil Restoration
    - Soil restoration will be applied to the proposed “bio-retention” areas and all landscaped areas.
7. Roadway Reduction
    - Roadway widths and lengths have been minimized to the maximum extent possible while still maintaining the intended use of the site.
8. Sidewalk Reduction
    - Sidewalk widths and lengths have been minimized to the smallest extent possible while still maintaining accessibility to the building.
9. Driveway Reduction
    - Driveways have been minimized as much as possible while still meeting site and fire code requirements.
10. Cul-de-sac Reduction
    - This project does not include a cul-de-sac. Therefore, cul-de-sac reduction is not applicable
11. Building Footprint Reduction
    - The smallest possible building footprint has been provided.
12. Parking Reduction

- Parking areas have been reduced to the maximum extent possible. The client requested the maximum amount of parking in order to meet their current needs.

Step 2: Water Quality Volume

The total water quality volume required is 7,797 c.f.

Step 3: Runoff Reduction by Applying Green Infrastructure Techniques and Standard SMPs with RRv Capacity

1. Conservation of Natural Areas
   - Natural areas and natural terrain have been retained to the maximum extent practical/possible while still allowing for the buildout of the property.
2. Sheet flow to Riparian Buffers or Filter Strips
   - Riprarian buffers are not present on site.
3. Vegetated Open Swale
   - Vegetative open swales are not used and not practical for the proposed improvements on site.
4. Tree Planting / Tree Box
   - New trees will be planted to enhance the landscaping on-site and meet the Town's Landscaping requirements. Although trees will be planted, RRv credit cannot be used. The planted areas drain to the bio-retention basins. Credit is already given for these areas.
5. Disconnection of Rooftop Runoff
   - Space is limited on site such that roof leaders cannot be disconnected. Runoff from the new building will be directed to the bioretention basins.
6. Stream Daylighting
   - Not applicable – This situation does not exist on this site.
7. Rain Garden
   - This method was considered but due to site constraints, a bio-retention basin is more applicable.
8. Green Roof
   - This method was considered but a bioretention basin was more applicable.
9. Stormwater Planters
   - This method was considered but a bioretention basin was more applicable.
10. Rain tanks/Cisterns
    - This method was considered, however, landscape irrigation will not be a concern.
11. Porous Pavement
    - Not applicable – Maintenance issues and the use of salts for parking lot deicing make this option impractical. Impervious soils on site make this option infeasible.

12. Standard SMPs with RRv Capacity

- The parking lots and new building will be conveyed to either bio-retention basins or the stormwater wet pond for water quality and quantity control.

The NYSDEC SMDM's intent is for projects to meet 100% of runoff reduction volume through the use of green infrastructure techniques. Projects that do not achieve runoff reduction to pre-construction condition must, at a minimum, provide the minimum RRv as well as provide the remaining WQv in standard SMPs.

A combination of a bioretention basin and a stormwater wet pond will be used to treat 100% of the new impervious area and reconstructed impervious area from the total site disturbance area.

The minimum RRv requirement has been attained through the use of the bioretention basins. Additionally, the water quality volume will be provided through a combination of the bioretention basins and the stormwater wet pond. This project is considered a redevelopment project with an increase in impervious area. Therefore, per Chapter 9.2.1.B.II, a standard SMP will be used to treat 100% of the WQv from new impervious areas and 25% of the WQv from reconstructed impervious areas.

Below is a summary of the water quality volume and runoff reduction volumes attained on site:

Total Water Quality Volume Required (WQv):	**7,797 cf**
WQv req'd from new impervious area:	6,926 cf
WQv req'd from reconsted impervious using standard SMP (=0.25 x 3,485cf):	871 cf
Minimum Runoff Reduction Volume Required (RRv, min)	**1,394 cf**
Northeast Bioretention Basin:	
WQ_v Required	1,089 cf
WQ_v Provided	653 cf
RR_v Provided	436 cf
(Standard SMP with Runoff Reduction Volume) – due to HSG C/D soils, RRv = 40% WQv for that practice	
Northwest Bioretention Basin:	
WQ_v Required	479 cf
WQ_v Provided	287 cf
RR_v Provided	192 cf
(Standard SMP with Runoff Reduction Volume) – due to HSG C/D soils, RRv = 40% WQv for that practice	

Middle Bioretention Basin:	
WQ_v Required	1,420 cf
WQ_v Provided	852 cf
RR_v Provided	568 cf
(Standard SMP with Runoff Reduction Volume) – due to HSG C/D soils, RRv = 40% WQv for that practice	
South Bioretention Basin:	
WQ_v Required	741 cf
WQ_v Provided	444 cf
RR_v Provided	297 cf
(Standard SMP with Runoff Reduction Volume) – due to HSG C/D soils, RRv = 40% WQv for that practice	
Stormwater Wet Pond	
WQ_v Required	4,068 cf
WQ_v Provided	16,601 cf

Total RRv Provided: **1,493 cf**

Total WQv Provided (WQv provided + RRv provided): **20,330 cf**

Post construction maintenance of the permanent water quality treatment facilities will be performed by the Owner. For the bioretention basins and wet pond this will include removing any litter, maintaining and replacing plantings as needed and adding/replacing mulch as needed.

B. New York State Department of Environmental Conservation regulations require design of stormwater detention facilities to limit the peak discharge produced by the 10-year and 100-year storm events to the pre-developed runoff rates, as well as provide extended detention of the 1-YR, 24-HR storm event (channel protection volume). This project is a redevelopment project with an increase in impervious area. Per the NYSDEC SMDM, specifically Chapter 9.2, the channel protection volume is relaxed for redevelopment projects. However, the 1-yr, 24-yr post-development peak discharge rate will be limited to the 1-yr, 24-hr pre-development peak discharge rate. Additionally, the majority of the site's runoff is directed to an existing 12-inch CMP pipe located along the west property line. The detention system was sized to limit the proposed discharge under a 10-yr storm event to the capacity of the 12-inch CMP in a surcharged condition with 1-foot of head. [Based on the topographic survey, the 12-inch CMP (with an invert elevation of 708.21) could have a maximum of 1-foot of head (elevation 710.2+/-)].

Water quantity control will be provided through the combination of the bioretention basins, the stormwater wet pond and 12-inch and 18-inch diameter HDPE pipe, as well as the pipe's encasing stone.

The bioretention basins will utilize 24” x 24” catch basins and a 12-inch diameter pipe to control the stormwater discharge from each of the basins.

The stormwater detention system will consist of the detention volume above the wet pond’s permanent pool elevation along with 1,195 linear feet of 12-inch and 895 linear feet of 18-inch diameter HDPE pipe, as well as the pipe’s encasing stone. The system will utilize one 4-foot diameter manhole as a control structure. The manhole will have a weir plate with a 6.5-inch diameter orifice to control the stormwater runoff rates from the site. A 12-inch diameter HDPE pipe will convey the stormwater discharges from the outlet structure to existing 12-inch CMP pipe.

The stormwater discharge rates for the 10 and 100-year storm events under developed conditions, will be at or below the stormwater discharge rates for the 10 and 100-year storm event under pre-developed conditions.

The stormwater detention calculations were completed using HYDROCAD, version 10 software. Following is a summary of the pre and post development discharge rates and associated detention volumes and water surface elevations:

Discharge to West Property

Storm Event	Pre-Development Discharge (cfs)	Post-Development Discharge (cfs)	Detention Volume (cf)	Water Surface Elevation (ft)
1-YR	6.42	2.40	8,430	708.94
10-YR	12.69	4.63	22,080	710.02
100-YR	23.24	21.80	35,290	710.99

Discharge to Seneca Street

Storm Event	Pre-Development Discharge (cfs)	Post-Development Discharge (cfs)
1-YR	0.19	0.19
10-YR	0.49	0.49
100-YR	1.00	1.00

3.5 Construction and Waste Materials

Some of the construction materials expected to be stored onsite include precast concrete drainage structures, corrugated HDPE pipe, under drain pipe, silt fence, etc. These materials will be stored in the contractor’s staging area. The Contractor shall install additional silt fence around the perimeter of both the staging and topsoil stockpile areas, should contaminated runoff flow off the area.

3.6 Other Requirements.

A. Any discharges other than storm water must be in compliance with the appropriate SPDES permit (other than this permit).
B. No solid materials including building materials shall be discharged to waters of the United States, except as authorized by a federal or state law.
C. All construction activities shall be in compliance with all federal, state and local laws as required.

3.7 Inspections.

A. Inspections are important for visually evaluating potential storm water runoff pollution sources at the facility. All projects should be inspected periodically to ensure contaminants are not present in the storm water exiting a project site. On projects which apply for coverage under the SPDES General Permit, qualified inspectors of the Owner shall inspect and evaluate the site. Qualified inspectors are persons knowledgeable in the principles and practices of erosion and sediment control such as a licensed professional engineer, Certified Professional in Erosion and Sediment Control (CPESC), or a soil scientist.

B. The Owner shall have a qualified inspector conduct an assessment of the site prior to the commencement of construction and certify in an inspection report that the erosion and sediment controls described in the SWPPP have been installed or implemented. Following the commencement of construction, site inspections shall occur at least once every seven calendar days. For construction sites where soil disturbance activities are on going and the owner or operator has received authorization to disturb greater than five (5) acres of soil at any one time, the qualified inspector shall conduct at least two (2) site inspections every seven (7) calendar days. When performing just two (2) inspections every seven (7) calendar days, the inspections shall be separated by a minimum of two (2) full calendar days.

C. For construction sites where soil disturbance activities have been temporarily suspended (e.g. winter shutdown) and temporary stabilization measures have been applied to all disturbed areas, the qualified inspector shall conduct a site inspection at least once every thirty (30) calendar days. The owner or operator shall notify the Regional Office stormwater contact person in writing prior to reducing the frequency of inspections

D. The owner shall prepare a written summary of the project status with respect to compliance with the Permit at a minimum frequency of every three months during which coverage under the Permit exists. The summary should address the status of achieving each component of the SWPPP. The Owner shall post at the site, in a publicly-accessible location, a summary of the site inspection activities on a monthly basis.

E. For construction sites where soil disturbance activities have been shut down with partial project completion, the qualified inspector can stop conducting inspections if all areas disturbed as of the project shutdown date have achieved final stabilization and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational. The owner or operator shall notify the Regional Office stormwater contact person in writing prior to the shutdown. If soil disturbance activities are not resumed within 2 years from the date of shutdown, the owner or operator shall have the qualified inspector(s) perform a final inspection and certify that all disturbed areas have achieved final stabilization, and all temporary, structural erosion and sediment control measures have been removed; and that all post-construction stormwater management practices have been constructed in conformance with the SWPPP by signing the "Final Stabilization" and "Post-Construction Stormwater Management Practice" certification statements on the Notice of Termination (N.O.T.). The owner or operator shall then submit the completed N.O.T. form to the address in Part II.A.1 of the permit.

F. Each inspection report shall, at the minimum, include the following:

- Date and time of inspection
- Name and title of person(s) performing inspection.
- A description of the weather and soil conditions (e.g. dry, wet, saturated) at the time of the inspection
- A description of the condition of the runoff at all points of discharge from the construction site. This shall include identification of any discharges of sediment from the construction site. Include discharges from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow.
- On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period.
- Indicate on a site map all areas of the site map that have undergone temporary or permanent stabilization.
- Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period.
- Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of the sediment storage volume.
- Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (silt fencing) and containment systems (sediment basins).
- Identification of all erosion and sediment control practices that were not installed properly or are not functioning as designed and need to be reinstalled or replaced
- Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching.
- Document any excessive deposition of sediment or ponding water along barriers or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters

around perforated riser pipes to pass water.

- Location where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking
- Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and technical standards
- Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s).

F. The process for conducting the evaluation shall follow these steps:

- Review the Storm Water Pollution Prevention Plan and draw up a list of any items of concern.
- List all specified control measures and areas covered in the plan.
- Conduct inspections to determine whether all storm water pollution prevention measures are accurately identified in the plan, are in place, and working properly.
- Document findings and inspections in a site log book.
- Modify SWPPP as appropriate. (Note: The plan shall be modified by the contractor and site inspector within 7 days of the inspection).

G. Within one business day of the completion of an inspection, the qualified inspector shall notify the owner or operator and appropriate contractor (or subcontractor) identified in Contractor's Certification Form of any corrective actions that need to be taken. The contractor (or subcontractor) shall begin implementing the corrective actions within one business day of this notification and shall complete the corrective actions in a reasonable time frame.

H. All inspection reports shall be signed by the qualified inspector. A copy of the inspection reports shall be maintained on site with the SWPPP.

A copy of the erosion and sediment control inspection checklist has been included in Appendix D-1.

3.8 Maintenance.

The contractor is required to inspect and maintain all soil erosion and siltation controls throughout the duration of the project and until final stabilization of the site. "Final Stabilization" means that all soil disturbing activities at the site have been completed, and that a uniform, perennial vegetative cover with a density of 80% has been obtained.

Maintenance shall include, but not be limited to, repair or replacement of any existing controls, removal of sediment and any other measures deemed necessary, which would reduce soil erosion and siltation runoff. Sediment shall be removed from sediment traps or sediment basins whenever their capacity has been reduced by fifty (50) percent from the design capacity. Refer to Section 3.2 for maintenance of individual controls.

Maintenance of the permanent bioretention and stormwater wet pond will be provided by the owner. Generally, this consists of inspecting and replacing diseased plants, removing litter and debris, checking for clogging of planting soil and replacing when necessary. Suggested inspection and maintenance checklists are provided in appendix H-1.

3.9 Contractors.

The contractor must sign a SWPPP certification form before undertaking any construction activity at the site identified in the Storm Water Pollution Prevention Plan. The contractor is responsible for any and all subcontractors working on the SWPPP. A copy of the Contractor's Certification Form has been included in Appendix E-1.

4.0 RECORD RETENTION

The owner or operator shall retain a copy of the NOI, NOI Acknowledgment Letter, SWPPP, MS4 SWPPP Acceptance form and any inspection reports that were prepared in conjunction with this permit for a period of at least five (5) years from the date that the site achieves final stabilization. This period may be extended by the Department, in its sole discretion, at any time upon written notification

5.0 NOTICE OF TERMINATION REQUIREMENTS

A. Prior to filing a Notice of Termination (NOT) the Owner shall have a qualified inspector perform a final site inspection. The qualified inspector shall certify that all disturbed areas have achieved final stabilization; and all temporary, structural erosion and sediment control measures have been removed; and that all post-construction stormwater management practices have been constructed in conformance with the SWPPP by signing the “Final Stabilization” and “Post-Construction Stormwater Management Practice” certification statements on the NOT.

B. Post-construction stormwater management practices that are owned by a public or private institution (e.g. school, college, university), or government agency or authority, the owner or operator has policy and procedures in place that ensures operation and maintenance of the practices in accordance with the operation and maintenance plan.

C. Post-construction stormwater management practices that are privately owned, the owner or operator has a deed restriction in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan.

D. Post-construction stormwater management practices that are privately owned, but will be maintained by a municipality, require an executed maintenance agreement be in place with the municipality that will maintain the post-construction stormwater management practice(s). Any right-of- way(s) needed to maintain such practice(s) must have been deeded to the municipality in which the practice(s) is located.

In addition, the Owner must certify that the permanent structure(s) have been constructed as described in the SWPPP.

When the project is completed and the site has been stabilized, the Owner must submit a NOT. A copy of the NOT form has been included in Appendix F-1. The NOT form shall be submitted to the following address:

NYS DEC "Notice of Termination"
Bureau of Water Permits
625 Broadway
Albany, NY 12233-3505

OPERATOR CERTIFICATION

"I hereby certify that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the *owner or operator* must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings."

Signature Date

Name, Title

Affiliation

APPENDIX A-1

NYSDEC SPDES GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED FROM CONSTRUCTION ACTIVITY
PERMIT NO. GP-0-20-001

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SPDES GENERAL PERMIT
FOR STORMWATER DISCHARGES

From

CONSTRUCTION ACTIVITY

Permit No. GP- 0-20-001

Issued Pursuant to Article 17, Titles 7, 8 and Article 70

of the Environmental Conservation Law

Effective Date: January 29, 2020

Expiration Date: January 28, 2025

John J. Ferguson

Chief Permit Administrator

1-23-20

Authorized Signature

Date

Address: NYS DEC
Division of Environmental Permits
625 Broadway, 4th Floor
Albany, N.Y. 12233-1750

PREFACE

Pursuant to Section 402 of the Clean Water Act ("CWA"), stormwater *discharges* from certain *construction activities* are unlawful unless they are authorized by a *National Pollutant Discharge Elimination System ("NPDES")* permit or by a state permit program. New York administers the approved State Pollutant Discharge Elimination System (SPDES) program with permits issued in accordance with the New York State Environmental Conservation Law (ECL) Article 17, Titles 7, 8 and Article 70.

An *owner or operator* of a *construction activity* that is eligible for coverage under this permit must obtain coverage prior to the *commencement of construction activity*. Activities that fit the definition of "*construction activity*", as defined under 40 CFR 122.26(b)(14)(x), (15)(i), and (15)(ii), constitute construction of a *point source* and therefore, pursuant to ECL section 17-0505 and 17-0701, the *owner or operator* must have coverage under a SPDES permit prior to *commencing construction activity*. The *owner or operator* cannot wait until there is an actual *discharge* from the *construction site* to obtain permit coverage.

***Note: The italicized words/phrases within this permit are defined in Appendix A.**

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SPDES GENERAL PERMIT FOR STORMWATER DISCHARGES FROM CONSTRUCTION ACTIVITIES

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Part 1. PERMIT COVERAGE AND LIMITATIONS

A. Permit Application

This permit authorizes stormwater *discharges* to *surface waters of the State* from the following *construction activities* identified within 40 CFR Parts 122.26(b)(14)(x), 122.26(b)(15)(i) and 122.26(b)(15)(ii), provided all of the eligibility provisions of this permit are met:

1. *Construction activities* involving soil disturbances of one (1) or more acres; including disturbances of less than one acre that are part of a *larger common plan of development or sale* that will ultimately disturb one or more acres of land; excluding *routine maintenance activity* that is performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility;

2. *Construction activities* involving soil disturbances of less than one (1) acre where the Department has determined that a *SPDES* permit is required for stormwater *discharges* based on the potential for contribution to a violation of a *water quality standard* or for significant contribution of *pollutants* to *surface waters of the State.*

3. *Construction activities* located in the watershed(s) identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.

B. Effluent Limitations Applicable to Discharges from Construction Activities

*Discharge*s authorized by this permit must achieve, at a minimum, the effluent limitations in Part I.B.1. (a) – (f) of this permit. These limitations represent the degree of effluent reduction attainable by the application of best practicable technology currently available.

1. Erosion and Sediment Control Requirements - The *owner or operator* must select, design, install, implement and maintain control measures to *minimize* the *discharge* of *pollutants* and prevent a violation of the *water quality standards*. The selection, design, installation, implementation, and maintenance of these control measures must meet the non-numeric effluent limitations in Part I.B.1.(a) – (f) of this permit and be in accordance with the New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016, using sound engineering judgment. Where control measures are not designed in conformance with the design criteria included in the technical standard, the *owner or operator* must include in the *Stormwater Pollution Prevention Plan* (“SWPPP”) the reason(s) for the

deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.

a. **Erosion and Sediment Controls.** Design, install and maintain effective erosion and sediment controls to *minimize* the *discharge* of *pollutants* and prevent a violation of the *water quality standards*. At a minimum, such controls must be designed, installed and maintained to:

(i) *Minimize* soil erosion through application of runoff control and soil stabilization control measure to *minimize pollutant discharges*;

(ii) Control stormwater *discharge*s, including both peak flowrates and total stormwater volume, to *minimize* channel and *streambank* erosion and scour in the immediate vicinity of the *discharge* points;

(iii) *Minimize* the amount of soil exposed during *construction activity*;

(iv) *Minimize* the disturbance of *steep slopes*;

(v) *Minimize* sediment *discharge*s from the site;

(vi) Provide and maintain *natural buffer*s around surface waters, direct stormwater to vegetated areas and maximize stormwater infiltration to reduce *pollutant discharge*s, unless *infeasible*;

(vii) *Minimize* soil compaction. Minimizing soil compaction is not required where the intended function of a specific area of the site dictates that it be compacted;

(viii) Unless *infeasible*, preserve a sufficient amount of topsoil to complete soil restoration and establish a uniform, dense vegetative cover; and

(ix) *Minimize* dust. On areas of exposed soil, *minimize* dust through the appropriate application of water or other dust suppression techniques to control the generation of pollutants that could be discharged from the site.

b. **Soil Stabilization**. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within fourteen (14) days from the date the current soil disturbance activity ceased. For construction sites that *directly discharge* to one of the 303(d) segments listed in Appendix E or is located in one of the watersheds listed in Appendix C, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. See Appendix A for definition of *Temporarily Ceased*.

c. **Dewatering**. *Discharge*s from *dewatering* activities, including *discharge*s from *dewatering* of trenches and excavations, must be managed by appropriate control measures.

d. **Pollution Prevention Measures**. Design, install, implement, and maintain effective pollution prevention measures to *minimize* the *discharge* of *pollutants* and prevent a violation of the *water quality standards*. At a minimum, such measures must be designed, installed, implemented and maintained to:

(i) *Minimize* the *discharge* of *pollutants* from equipment and vehicle washing, wheel wash water, and other wash waters. This applies to washing operations that use clean water only. Soaps, detergents and solvents cannot be used;

(ii) *Minimize* the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, hazardous and toxic waste, and other materials present on the site to precipitation and to stormwater. Minimization of exposure is not required in cases where the exposure to precipitation and to stormwater will not result in a *discharge* of *pollutants*, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use) ; and

(iii) Prevent the *discharge* of *pollutants* from spills and leaks and implement chemical spill and leak prevention and response procedures.

e. **Prohibited *Discharge*s.** The following *discharge*s are prohibited:

(i) Wastewater from washout of concrete;

(ii) Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;

(iii) Fuels, oils, or other *pollutants* used in vehicle and equipment operation and maintenance;

(iv) Soaps or solvents used in vehicle and equipment washing; and

(v) Toxic or hazardous substances from a spill or other release.

f. Surface Outlets. When discharging from basins and impoundments, the outlets shall be designed, constructed and maintained in such a manner that sediment does not leave the basin or impoundment and that erosion at or below the outlet does not occur.

C. Post-construction Stormwater Management Practice Requirements

1. The *owner or operator* of a *construction activity* that requires post-construction stormwater management practices pursuant to Part III.C. of this permit must select, design, install, and maintain the practices to meet the *performance criteria* in the New York State Stormwater Management Design Manual ("Design Manual"), dated January 2015, using sound engineering judgment. Where post-construction stormwater management practices ("SMPs") are not designed in conformance with the *performance criteria* in the Design Manual, the *owner or operator* must include in the SWPPP the reason(s) for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.

2. The *owner or operator* of a *construction activity* that requires post-construction stormwater management practices pursuant to Part III.C. of this permit must design the practices to meet the applicable *sizing criteria* in Part I.C.2.a., b., c. or d. of this permit.

a. Sizing Criteria for New Development

(i) Runoff Reduction Volume ("RRv"): Reduce the total Water Quality Volume ("WQv") by application of RR techniques and standard SMPs with RRv capacity. The total WQv shall be calculated in accordance with the criteria in Section 4.2 of the Design Manual.

(ii) Minimum RRv and Treatment of Remaining Total WQv: Construction activities that cannot meet the criteria in Part I.C.2.a.(i) of this permit due to site limitations shall direct runoff from all newly constructed impervious areas to a RR technique or standard SMP with RRv capacity unless infeasible. The specific site limitations that prevent the reduction of 100% of the WQv shall be documented in the SWPPP.

For each impervious area that is not directed to a RR technique or standard SMP with RRv capacity, the SWPPP must include documentation which demonstrates that all options were considered and for each option explains why it is considered infeasible.

In no case shall the runoff reduction achieved from the newly constructed impervious areas be less than the Minimum RRv as calculated using the criteria in Section 4.3 of the Design Manual. The remaining portion of the total WQv that cannot be reduced shall be treated by application of standard SMPs.

(iii) Channel Protection Volume ("Cpv"): Provide 24 hour extended detention of the post-developed 1-year, 24-hour storm event; remaining after runoff reduction. The Cpv requirement does not apply when:
(1) Reduction of the entire Cpv is achieved by application of runoff reduction techniques or infiltration systems, or
(2) The site discharges directly to tidal waters, or fifth order or larger streams.

(iv) *Overbank* Flood Control Criteria ("Qp"): Requires storage to attenuate the post-development 10-year, 24-hour peak discharge rate (Qp) to predevelopment rates. The Qp requirement does not apply when:
(1) the site discharges directly to tidal waters or fifth order or larger streams, or
(2) A downstream analysis reveals that *overbank* control is not required.

(v) Extreme Flood Control Criteria ("Qf"): Requires storage to attenuate the post-development 100-year, 24-hour peak discharge rate (Qf) to predevelopment rates. The Qf requirement does not apply when:
(1) the site discharges directly to tidal waters or fifth order or larger streams, or
(2) A downstream analysis reveals that *overbank* control is not required.

b. *Sizing Criteria* for *New Development* in Enhanced Phosphorus Removal Watershed

(i) Runoff Reduction Volume (RRv): Reduce the total Water Quality Volume (WQv) by application of RR techniques and standard SMPs with RRv capacity. The total WQv is the runoff volume from the 1-year, 24 hour design storm over the post-developed watershed and shall be calculated in accordance with the criteria in Section 10.3 of the Design Manual.

(ii) Minimum RRv and Treatment of Remaining Total WQv: *Construction activities* that cannot meet the criteria in Part I.C.2.b.(i) of this permit due to *site limitations* shall direct runoff from all newly constructed *impervious areas* to a RR technique or standard SMP with RRv capacity unless *infeasible*. The specific *site limitations* that prevent the reduction of 100% of the WQv shall be documented in the SWPPP. For each *impervious area* that is not directed to a RR technique or standard SMP with RRv capacity, the SWPPP must include documentation which demonstrates that all options were considered and for each option explains why it is considered *infeasible.*

In no case shall the runoff reduction achieved from the newly constructed *impervious areas* be less than the Minimum RRv as calculated using the criteria in Section 10.3 of the Design Manual. The remaining portion of the total WQv that cannot be reduced shall be treated by application of standard SMPs.

(iii) Channel Protection Volume (Cpv): Provide 24 hour extended detention of the post-developed 1-year, 24-hour storm event; remaining after runoff reduction. The Cpv requirement does not apply when:
(1) Reduction of the entire Cpv is achieved by application of runoff reduction techniques or infiltration systems, or
(2) The site *discharge*s directly to tidal waters, or fifth order or larger streams.

(iv) *Overbank* Flood Control Criteria (Qp): Requires storage to attenuate the post-development 10-year, 24-hour peak *discharge* rate (Qp) to predevelopment rates. The Qp requirement does not apply when:
(1) the site *discharge*s directly to tidal waters or fifth order or larger streams, or
(2) A downstream analysis reveals that *overbank* control is not required.

(v) Extreme Flood Control Criteria (Qf): Requires storage to attenuate the post-development 100-year, 24-hour peak *discharge* rate (Qf) to predevelopment rates. The Qf requirement does not apply when:
(1) the site *discharge*s directly to tidal waters or fifth order or larger streams, or
(2) A downstream analysis reveals that *overbank* control is not required.

c. Sizing Criteria for Redevelopment Activity

(i) Water Quality Volume (WQv): The WQv treatment objective for *redevelopment activity* shall be addressed by one of the following options. *Redevelopment activities* located in an Enhanced Phosphorus Removal Watershed (see Part III.B.3. and Appendix C of this permit) shall calculate the WQv in accordance with Section 10.3 of the Design Manual. All other *redevelopment activities* shall calculate the WQv in accordance with Section 4.2 of the Design Manual.

(1) Reduce the existing *impervious cover* by a minimum of 25% of the total disturbed, *impervious area*. The Soil Restoration criteria in Section 5.1.6 of the Design Manual must be applied to all newly created pervious areas, or

(2) Capture and treat a minimum of 25% of the WQv from the disturbed, *impervious area* by the application of standard SMPs; or reduce 25% of the WQv from the disturbed, *impervious area* by the application of RR techniques or standard SMPs with RRv capacity., or

(3) Capture and treat a minimum of 75% of the WQv from the disturbed, *impervious area* as well as any additional runoff from tributary areas by application of the alternative practices discussed in Sections 9.3 and 9.4 of the Design Manual., or

(4) Application of a combination of 1, 2 and 3 above that provide a weighted average of at least two of the above methods. Application of this method shall be in accordance with the criteria in Section 9.2.1(B) (IV) of the Design Manual.

If there is an existing post-construction stormwater management practice located on the site that captures and treats runoff from the *impervious area* that is being disturbed, the WQv treatment option selected must, at a minimum, provide treatment equal to the treatment that was being provided by the existing practice(s) if that treatment is greater than the treatment required by options 1 – 4 above.

(ii) Channel Protection Volume (Cpv): Not required if there are no changes to hydrology that increase the *discharge* rate from the project site.

(iii) *Overbank* Flood Control Criteria (Qp): Not required if there are no changes to hydrology that increase the *discharge* rate from the project site.

(iv) Extreme Flood Control Criteria (Qf): Not required if there are no changes to hydrology that increase the *discharge* rate from the project site

d. Sizing Criteria for Combination of Redevelopment Activity and New Development

Construction projects that include both New Development and Redevelopment Activity shall provide post-construction stormwater management controls that meet the sizing criteria calculated as an aggregate of the Sizing Criteria in Part I.C.2.a. or b. of this permit for the New Development portion of the project and Part I.C.2.c of this permit for Redevelopment Activity portion of the project.

D. Maintaining Water Quality

The Department expects that compliance with the conditions of this permit will control *discharge*s necessary to meet applicable *water quality standards*. It shall be a violation of the *ECL* for any discharge to either cause or contribute to a violation of *water quality standards* as contained in Parts 700 through 705 of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York, such as:

1. There shall be no increase in turbidity that will cause a substantial visible contrast to natural conditions;

2. There shall be no increase in suspended, colloidal or settleable solids that will cause deposition or impair the waters for their best usages; and

3. There shall be no residue from oil and floating substances, nor visible oil film, nor globules of grease.

If there is evidence indicating that the stormwater *discharge*s authorized by this permit are causing, have the reasonable potential to cause, or are contributing to a violation of the *water quality standards*; the *owner or operator* must take appropriate corrective action in accordance with Part IV.C.5. of this general permit and document in accordance with Part IV.C.4. of this general permit. To address the *water quality standard* violation the *owner or operator* may need to provide additional information, include and implement appropriate controls in the SWPPP to correct the problem, or obtain an individual SPDES permit.

If there is evidence indicating that despite compliance with the terms and conditions of this general permit it is demonstrated that the stormwater *discharge*s authorized by this permit are causing or contributing to a violation of *water quality standards*, or if the Department determines that a modification of the permit is necessary to prevent a violation of *water quality standards*, the authorized *discharge*s will no longer be eligible for coverage under this permit. The Department may require the *owner or operator* to obtain an individual SPDES permit to continue discharging.

E. Eligibility Under This General Permit

1. This permit may authorize all *discharges* of stormwater from *construction activity* to *surface waters of the State* and *groundwaters* except for ineligible *discharges* identified under subparagraph F. of this Part.

2. Except for non-stormwater *discharges* explicitly listed in the next paragraph, this permit only authorizes stormwater *discharge*s; including stormwater runoff, snowmelt runoff, and surface runoff and drainage, from *construction activities*.

3. Notwithstanding paragraphs E.1 and E.2 above, the following non-stormwater discharges are authorized by this permit: those listed in 6 NYCRR 750-1.2(a)(29)(vi), with the following exception: "Discharges from firefighting activities are authorized only when the firefighting activities are emergencies/unplanned"; waters to which other components have not been added that are used to control dust in accordance with the SWPPP; and uncontaminated *discharge*s from *construction site* de-watering operations. All non-stormwater discharges must be identified in the SWPPP. Under all circumstances, the *owner or operator* must still comply with *water quality standards* in Part I.D of this permit.

4. The *owner or operator* must maintain permit eligibility to *discharge* under this permit. Any *discharges* that are not compliant with the eligibility conditions of this permit are not authorized by the permit and the *owner or operator* must either apply for a separate permit to cover those ineligible *discharges* or take steps necessary to make the *discharge* eligible for coverage.

F. Activities Which Are Ineligible for Coverage Under This General Permit

All of the following are **<u>not</u>** authorized by this permit:

1. *Discharge*s after *construction activities* have been completed and the site has undergone *final stabilization*;

2. *Discharge*s that are mixed with sources of non-stormwater other than those expressly authorized under subsection E.3. of this Part and identified in the SWPPP required by this permit;

3. *Discharges* that are required to obtain an individual SPDES permit or another SPDES general permit pursuant to Part VII.K. of this permit;

4. *Construction activities* or *discharges* from *construction activities* that may adversely affect an *endangered or threatened species* unless the *owner or*

operator has obtained a permit issued pursuant to 6 NYCRR Part 182 for the project or the Department has issued a letter of non-jurisdiction for the project. All documentation necessary to demonstrate eligibility shall be maintained on site in accordance with Part II.D.2 of this permit;

5. *Discharges* which either cause or contribute to a violation of *water quality standards* adopted pursuant to the *ECL* and its accompanying regulations;

6. *Construction activities* for residential, commercial and institutional projects:

    a. Where the *discharge*s from the *construction activities* are tributary to waters of the state classified as AA or AA-s; and

    b. Which are undertaken on land with no existing *impervious cover*; and

    c. Which disturb one (1) or more acres of land designated on the current United States Department of Agriculture ("USDA") Soil Survey as Soil Slope Phase "D", (provided the map unit name is inclusive of slopes greater than 25%), or Soil Slope Phase "E" or "F" (regardless of the map unit name), or a combination of the three designations.

7. *Construction activities* for linear transportation projects and linear utility projects:

    a. Where the *discharge*s from the *construction activities* are tributary to waters of the state classified as AA or AA-s; and

    b. Which are undertaken on land with no existing *impervious cover*; and

    c. Which disturb two (2) or more acres of land designated on the current USDA Soil Survey as Soil Slope Phase "D" (provided the map unit name is inclusive of slopes greater than 25%), or Soil Slope Phase "E" or "F" (regardless of the map unit name), or a combination of the three designations.

8. *Construction activities* that have the potential to affect an *historic property*, unless there is documentation that such impacts have been resolved. The following documentation necessary to demonstrate eligibility with this requirement shall be maintained on site in accordance with Part II.D.2 of this permit and made available to the Department in accordance with Part VII.F of this permit:

   a. Documentation that the *construction activity* is not within an archeologically sensitive area indicated on the sensitivity map, and that the *construction activity* is not located on or immediately adjacent to a property listed or determined to be eligible for listing on the National or State Registers of Historic Places, and that there is no new permanent building on the *construction site* within the following distances from a building, structure, or object that is more than 50 years old, or if there is such a new permanent building on the *construction site* within those parameters that NYS Office of Parks, Recreation and Historic Preservation (OPRHP), a Historic Preservation Commission of a Certified Local Government, or a qualified preservation professional has determined that the building, structure, or object more than 50 years old is not historically/archeologically significant.

      - 1-5 acres of disturbance - 20 feet
      - 5-20 acres of disturbance - 50 feet
      - 20+ acres of disturbance - 100 feet, or

   b. DEC consultation form sent to OPRHP, and copied to the NYS DEC Agency Historic Preservation Officer (APO), and
      (i) the State Environmental Quality Review (SEQR) Environmental Assessment Form (EAF) with a negative declaration or the Findings Statement, with documentation of OPRHP's agreement with the resolution; or
      (ii) documentation from OPRHP that the *construction activity* will result in No Impact; or
      (iii) documentation from OPRHP providing a determination of No Adverse Impact; or
      (iv) a Letter of Resolution signed by the owner/operator, OPRHP and the DEC APO which allows for this *construction activity* to be eligible for coverage under the general permit in terms of the State Historic Preservation Act (SHPA); or

   c. Documentation of satisfactory compliance with Section 106 of the National Historic Preservation Act for a coterminous project area:

(i) No Affect
(ii) No Adverse Affect
(iii) Executed Memorandum of Agreement, or

d. Documentation that:

(i) SHPA Section 14.09 has been completed by NYS DEC or another state agency.

9. *Discharge*s from *construction activities* that are subject to an existing SPDES individual or general permit where a SPDES permit for *construction activity* has been terminated or denied; or where the *owner or operator* has failed to renew an expired individual permit.

Part II. PERMIT COVERAGE

A. How to Obtain Coverage

1. An *owner or operator* of a *construction activity* that is not subject to the requirements of a regulated, traditional land use control MS4 must first prepare a SWPPP in accordance with all applicable requirements of this permit and then submit a completed Notice of Intent (NOI) to the Department to be authorized to discharge under this permit.

2. An *owner or operator* of a *construction activity* that is subject to the requirements of a *regulated, traditional land use control MS4* must first prepare a SWPPP in accordance with all applicable requirements of this permit and then have the SWPPP reviewed and accepted by the *regulated, traditional land use control MS4* prior to submitting the NOI to the Department. The *owner or operator* shall have the “MS4 SWPPP Acceptance” form signed in accordance with Part VII.H., and then submit that form along with a completed NOI to the Department.

3. The requirement for an *owner or operator* to have its SWPPP reviewed and accepted by the *regulated, traditional land use control MS4* prior to submitting the NOI to the Department does not apply to an *owner or operator* that is obtaining permit coverage in accordance with the requirements in Part II.F. (Change of *Owner or Operator*) or where the *owner or operator* of the *construction activity* is the *regulated, traditional land use control MS4* . This exemption does not apply to *construction activities* subject to the New York City Administrative Code.

B. Notice of Intent (NOI) Submittal

1. Prior to December 21, 2020, an owner or operator shall use either the electronic (eNOI) or paper version of the NOI that the Department prepared. Both versions of the NOI are located on the Department's website (http://www.dec.ny.gov/). The paper version of the NOI shall be signed in accordance with Part VII.H. of this permit and submitted to the following address:

   NOTICE OF INTENT
   NYS DEC, Bureau of Water Permits
   625 Broadway, 4th Floor
   Albany, New York 12233-3505

2. Beginning December 21, 2020 and in accordance with EPA's 2015 NPDES Electronic Reporting Rule (40 CFR Part 127), the *owner or operator* must submit the NOI electronically using the *Department's* online NOI.

3. The *owner or operator* shall have the SWPPP preparer sign the "SWPPP Preparer Certification" statement on the NOI prior to submitting the form to the Department.

4. As of the date the NOI is submitted to the Department, the *owner or operator* shall make the NOI and SWPPP available for review and copying in accordance with the requirements in Part VII.F. of this permit.

C. Permit Authorization

1. An *owner or operator* shall not *commence construction activity* until their authorization to *discharge* under this permit goes into effect.

2. Authorization to *discharge* under this permit will be effective when the *owner or operator* has satisfied all of the following criteria:

   a. project review pursuant to the State Environmental Quality Review Act ("SEQRA") have been satisfied, when SEQRA is applicable. See the Department's website (http://www.dec.ny.gov/) for more information,

   b. where required, all necessary Department permits subject to the *Uniform Procedures Act ("UPA")* (see 6 NYCRR Part 621), or the equivalent from another New York State agency, have been obtained, unless otherwise notified by the Department pursuant to 6 NYCRR 621.3(a)(4). *Owners or operators* of *construction activities* that are required to obtain *UPA* permits must submit a preliminary SWPPP to the appropriate DEC Permit Administrator at the Regional Office listed in Appendix F at the time all other necessary *UPA* permit applications are submitted. The preliminary SWPPP must include sufficient information to demonstrate that the *construction activity* qualifies for authorization under this permit,

c. the final SWPPP has been prepared, and

d. a complete NOI has been submitted to the Department in accordance with the requirements of this permit.

3. An *owner or operator* that has satisfied the requirements of Part II.C.2 above will be authorized to *discharge* stormwater from their *construction activity* in accordance with the following schedule:

   a. For *construction activities* that are <u>not</u> subject to the requirements of a *regulated, traditional land use control MS4*:

      (i) Five (5) business days from the date the Department receives a complete electronic version of the NOI (eNOI) for *construction activities* with a SWPPP that has been prepared in conformance with the design criteria in the technical standard referenced in Part III.B.1 and the *performance criteria* in the technical standard referenced in Parts III.B., 2 or 3, for *construction activities* that require post-construction stormwater management practices pursuant to Part III.C.; or

      (ii) Sixty (60) business days from the date the Department receives a complete NOI (electronic or paper version) for *construction activities* with a SWPPP that has <u>not</u> been prepared in conformance with the design criteria in technical standard referenced in Part III.B.1. or, for *construction activities* that require post-construction stormwater management practices pursuant to Part III.C., the *performance criteria* in the technical standard referenced in Parts III.B., 2 or 3, or;

      (iii) Ten (10) business days from the date the Department receives a complete paper version of the NOI for *construction activities* with a SWPPP that has been prepared in conformance with the design criteria in the technical standard referenced in Part III.B.1 and the *performance criteria* in the technical standard referenced in Parts III.B., 2 or 3, for *construction activities* that require post-construction stormwater management practices pursuant to Part III.C.

b. For *construction activities* that are subject to the requirements of a *regulated, traditional land use control MS4*:

(i) Five (5) business days from the date the Department receives both a complete electronic version of the NOI (eNOI) and signed "*MS4* SWPPP Acceptance" form, or

(ii) Ten (10) business days from the date the Department receives both a complete paper version of the NOI and signed "MS4 SWPPP Acceptance" form.

4. Coverage under this permit authorizes stormwater *discharges* from only those areas of disturbance that are identified in the NOI. If an *owner or operator* wishes to have stormwater *discharges* from future or additional areas of disturbance authorized, they must submit a new NOI that addresses that phase of the development, unless otherwise notified by the Department. The *owner or operator* shall not *commence construction activity* on the future or additional areas until their authorization to *discharge* under this permit goes into effect in accordance with Part II.C. of this permit.

D. General Requirements For Owners or Operators With Permit Coverage

1. The *owner or operator* shall ensure that the provisions of the SWPPP are implemented from the *commencement of construction activity* until all areas of disturbance have achieved *final stabilization* and the Notice of Termination ("NOT") has been submitted to the Department in accordance with Part V. of this permit. This includes any changes made to the SWPPP pursuant to Part III.A.4. of this permit.

2. The *owner or operator* shall maintain a copy of the General Permit (GP-0-20-001), NOI, *NOI Acknowledgment Letter*, SWPPP, MS4 SWPPP Acceptance form, inspection reports, responsible contractor's or subcontractor's certification statement (see Part III.A.6.), and all documentation necessary to demonstrate eligibility with this permit at the *construction site* until all disturbed areas have achieved *final stabilization* and the NOT has been submitted to the Department. The documents must be maintained in a secure location, such as a job trailer, on-site construction office, or mailbox with lock. The secure location must be accessible during normal business hours to an individual performing a compliance inspection.

3. The *owner or operator* of a *construction activity* shall not disturb greater than five (5) acres of soil at any one time without prior written authorization from the Department or, in areas under the jurisdiction of a *regulated, traditional land* *use control MS4,* the *regulated, traditional land use control MS4* (provided the *regulated, traditional land use control MS4* is not the *owner or operator* of the *construction activity*). At a minimum, the *owner or operator* must comply with the following requirements in order to be authorized to disturb greater than five (5) acres of soil at any one time:

a. The *owner or operator* shall have a *qualified inspector* conduct **at least** two (2) site inspections in accordance with Part IV.C. of this permit every seven (7) calendar days, for as long as greater than five (5) acres of soil remain disturbed. The two (2) inspections shall be separated by a minimum of two (2) full calendar days.

b. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within seven (7) days from the date the current soil disturbance activity ceased. The soil stabilization measures selected shall be in conformance with the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016.

c. The *owner or operator* shall prepare a phasing plan that defines maximum disturbed area per phase and shows required cuts and fills.

d. The *owner or operator* shall install any additional site-specific practices needed to protect water quality.

e. The *owner or operator* shall include the requirements above in their SWPPP.

4. In accordance with statute, regulations, and the terms and conditions of this permit, the Department may suspend or revoke an *owner's or operator's* coverage under this permit at any time if the Department determines that the SWPPP does not meet the permit requirements or consistent with Part VII.K..

5. Upon a finding of significant non-compliance with the practices described in the SWPPP or violation of this permit, the Department may order an immediate stop to all activity at the site until the non-compliance is remedied. The stop work order shall be in writing, describe the non-compliance in detail, and be sent to the *owner or operator*.

6. For *construction activities* that are subject to the requirements of a *regulated, traditional land use control MS4*, the *owner or operator* shall notify the

regulated, traditional land use control MS4 in writing of any planned amendments or modifications to the post-construction stormwater management practice component of the SWPPP required by Part III.A. 4. and 5. of this permit. Unless otherwise notified by the *regulated, traditional land use control MS4*, the *owner or operator* shall have the SWPPP amendments or modifications reviewed and accepted by the *regulated, traditional land use control MS4* prior to commencing construction of the post-construction stormwater management practice.

E. Permit Coverage for Discharges Authorized Under GP-0-15-002

1. Upon renewal of SPDES General Permit for Stormwater Discharges from *Construction Activity* (Permit No. GP-0-15-002), an *owner or operator* of *a construction activity* with coverage under GP-0-15-002, as of the effective date of GP- 0-20-001, shall be authorized to *discharge* in accordance with GP- 0-20-001, unless otherwise notified by the Department.

   An *owner or operator* may continue to implement the technical/design components of the post-construction stormwater management controls provided that such design was done in conformance with the technical standards in place at the time of initial project authorization. However, they must comply with the other, non-design provisions of GP-0-20-001.

F. Change of Owner or Operator

1. When property ownership changes or when there is a change in operational control over the construction plans and specifications, the original *owner or operator* must notify the new *owner or operator*, <u>in writing,</u> of the requirement to obtain permit coverage by submitting a NOI with the Department. For *construction activities* subject to the requirements of a *regulated, traditional land use control MS4,* the original *owner or operator* must also notify the MS4, in writing, of the change in ownership at least 30 calendar days prior to the change in ownership.

2. Once the new *owner or operator* obtains permit coverage, the original *owner or operator* shall then submit a completed NOT with the name and permit identification number of the new *owner or operator* to the Department at the address in Part II.B.1. of this permit. If the original *owner or operator* maintains ownership of a portion of the *construction activity* and will disturb soil, they must maintain their coverage under the permit.

3. Permit coverage for the new *owner or operator* will be effective as of the date the Department receives a complete NOI, provided the original *owner or*

operator was not subject to a sixty (60) business day authorization period that has not expired as of the date the Department receives the NOI from the new *owner or operator*.

Part III. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A. General SWPPP Requirements

1. A SWPPP shall be prepared and implemented by the *owner or operator* of each *construction activity* covered by this permit. The SWPPP must document the selection, design, installation, implementation and maintenance of the control measures and practices that will be used to meet the effluent limitations in Part I.B. of this permit and where applicable, the post-construction stormwater management practice requirements in Part I.C. of this permit. The SWPPP shall be prepared prior to the submittal of the NOI. The NOI shall be submitted to the Department prior to the *commencement of construction activity*. A copy of the completed, final NOI shall be included in the SWPPP.

2. The SWPPP shall describe the erosion and sediment control practices and where required, post-construction stormwater management practices that will be used and/or constructed to reduce the *pollutants* in stormwater *discharges* and to assure compliance with the terms and conditions of this permit. In addition, the SWPPP shall identify potential sources of pollution which may reasonably be expected to affect the quality of stormwater *discharges*.

3. All SWPPPs that require the post-construction stormwater management practice component shall be prepared by a *qualified professional* that is knowledgeable in the principles and practices of stormwater management and treatment.

4. The *owner or operator* must keep the SWPPP current so that it at all times accurately documents the erosion and sediment controls practices that are being used or will be used during construction, and all post-construction stormwater management practices that will be constructed on the site. At a minimum, the *owner or operator* shall amend the SWPPP, including construction drawings:

    a. whenever the current provisions prove to be ineffective in minimizing *pollutants* in stormwater *discharges* from the site;

b. whenever there is a change in design, construction, or operation at the *construction site* that has or could have an effect on the *discharge* of *pollutants*;

c. to address issues or deficiencies identified during an inspection by the *qualified inspector,* the Department or other regulatory authority; and

d. to document the final construction conditions.

5. The Department may notify the *owner or operator* at any time that the SWPPP does not meet one or more of the minimum requirements of this permit. The notification shall be in writing and identify the provisions of the SWPPP that require modification. Within fourteen (14) calendar days of such notification, or as otherwise indicated by the Department, the *owner or operator* shall make the required changes to the SWPPP and submit written notification to the Department that the changes have been made. If the *owner or operator* does not respond to the Department's comments in the specified time frame, the Department may suspend the *owner's or operator's* coverage under this permit or require the *owner or operator* to obtain coverage under an individual SPDES permit in accordance with Part II.D.4. of this permit.

6. Prior to the *commencement of construction activity*, the *owner or operator* must identify the contractor(s) and subcontractor(s) that will be responsible for installing, constructing, repairing, replacing, inspecting and maintaining the erosion and sediment control practices included in the SWPPP; and the contractor(s) and subcontractor(s) that will be responsible for constructing the post-construction stormwater management practices included in the SWPPP. The *owner or operator* shall have each of the contractors and subcontractors identify at least one person from their company that will be responsible for implementation of the SWPPP. This person shall be known as the *trained contractor.* The *owner or operator* shall ensure that at least one *trained contractor* is on site on a daily basis when soil disturbance activities are being performed.

   The *owner or operator* shall have each of the contractors and subcontractors identified above sign a copy of the following certification statement below before they commence any *construction activity*:

   > "I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the *qualified inspector* during a site inspection. I also understand that the *owner or operator* must comply with

the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater *discharge*s from *construction activities* and that it is unlawful for any person to cause or contribute to a violation of *water quality standards*. Furthermore, I am aware that there are significant penalties for submitting false information, that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations"

In addition to providing the certification statement above, the certification page must also identify the specific elements of the SWPPP that each contractor and subcontractor will be responsible for and include the name and title of the person providing the signature; the name and title of the *trained contractor* responsible for SWPPP implementation; the name, address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification statement is signed. The *owner or operator* shall attach the certification statement(s) to the copy of the SWPPP that is maintained at the *construction site*. If new or additional contractors are hired to implement measures identified in the SWPPP after construction has commenced, they must also sign the certification statement and provide the information listed above.

7. For projects where the Department requests a copy of the SWPPP or inspection reports, the *owner or operator* shall submit the documents in both electronic (PDF only) and paper format within five (5) business days, unless otherwise notified by the Department.

B. Required SWPPP Contents

1. Erosion and sediment control component - All SWPPPs prepared pursuant to this permit shall include erosion and sediment control practices designed in conformance with the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016. Where erosion and sediment control practices are not designed in conformance with the design criteria included in the technical standard, the *owner or operator* must demonstrate *equivalence* to the technical standard. At a minimum, the erosion and sediment control component of the SWPPP shall include the following:

   a. Background information about the scope of the project, including the location, type and size of project

b. A site map/construction drawing(s) for the project, including a general location map. At a minimum, the site map shall show the total site area; all improvements; areas of disturbance; areas that will not be disturbed; existing vegetation; on-site and adjacent off-site surface water(s); floodplain/floodway boundaries; wetlands and drainage patterns that could be affected by the *construction activity*; existing and final contours ; locations of different soil types with boundaries; material, waste, borrow or equipment storage areas located on adjacent properties; and location(s) of the stormwater *discharge*(s);

c. A description of the soil(s) present at the site, including an identification of the Hydrologic Soil Group (HSG);

d. A construction phasing plan and sequence of operations describing the intended order of *construction activities*, including clearing and grubbing, excavation and grading, utility and infrastructure installation and any other activity at the site that results in soil disturbance;

e. A description of the minimum erosion and sediment control practices to be installed or implemented for each *construction activity* that will result in soil disturbance. Include a schedule that identifies the timing of initial placement or implementation of each erosion and sediment control practice and the minimum time frames that each practice should remain in place or be implemented;

f. A temporary and permanent soil stabilization plan that meets the requirements of this general permit and the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016, for each stage of the project, including initial land clearing and grubbing to project completion and achievement of *final stabilization*;

g. A site map/construction drawing(s) showing the specific location(s), size(s), and length(s) of each erosion and sediment control practice;

h. The dimensions, material specifications, installation details, and operation and maintenance requirements for all erosion and sediment control practices. Include the location and sizing of any temporary sediment basins and structural practices that will be used to divert flows from exposed soils;

i. A maintenance inspection schedule for the contractor(s) identified in Part III.A.6. of this permit, to ensure continuous and effective operation of the erosion and sediment control practices. The maintenance inspection schedule shall be in accordance with the requirements in the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016;

j. A description of the pollution prevention measures that will be used to control litter, construction chemicals and construction debris from becoming a *pollutant* source in the stormwater *discharges*;

k. A description and location of any stormwater *discharges* associated with industrial activity other than construction at the site, including, but not limited to, stormwater *discharges* from asphalt plants and concrete plants located on the *construction site*; and

l. Identification of any elements of the design that are not in conformance with the design criteria in the technical standard, New York State Standards and Specifications for Erosion and Sediment Control, dated November 2016. Include the reason for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.

2. Post-construction stormwater management practice component – The *owner or operator* of any construction project identified in Table 2 of Appendix B as needing post-construction stormwater management practices shall prepare a SWPPP that includes practices designed in conformance with the applicable *sizing criteria* in Part I.C.2.a., c. or d. of this permit and the *performance criteria* in the technical standard, New York State Stormwater Management Design Manual dated January 2015

   Where post-construction stormwater management practices are not designed in conformance with the *performance criteria* in the technical standard, the *owner or operator* must include in the SWPPP the reason(s) for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the technical standard.

   The post-construction stormwater management practice component of the SWPPP shall include the following:

   a. Identification of all post-construction stormwater management practices to be constructed as part of the project. Include the dimensions, material specifications and installation details for each post-construction stormwater management practice;

b. A site map/construction drawing(s) showing the specific location and size of each post-construction stormwater management practice;

c. A Stormwater Modeling and Analysis Report that includes:
   (i) Map(s) showing pre-development conditions, including watershed/subcatchments boundaries, flow paths/routing, and design points;

   (ii) Map(s) showing post-development conditions, including watershed/subcatchments boundaries, flow paths/routing, design points and post-construction stormwater management practices;

   (iii) Results of stormwater modeling (i.e. hydrology and hydraulic analysis) for the required storm events. Include supporting calculations (model runs), methodology, and a summary table that compares pre and post-development runoff rates and volumes for the different storm events;

   (iv) Summary table, with supporting calculations, which demonstrates that each post-construction stormwater management practice has been designed in conformance with the *sizing criteria* included in the Design Manual;

   (v) Identification of any *sizing criteria* that is not required based on the requirements included in Part I.C. of this permit; and

   (vi) Identification of any elements of the design that are not in conformance with the *performance criteria* in the Design Manual. Include the reason(s) for the deviation or alternative design and provide information which demonstrates that the deviation or alternative design is *equivalent* to the Design Manual;

d. Soil testing results and locations (test pits, borings);

e. Infiltration test results, when required; and

f. An operations and maintenance plan that includes inspection and maintenance schedules and actions to ensure continuous and effective operation of each post-construction stormwater management practice. The plan shall identify the entity that will be responsible for the long term operation and maintenance of each practice.

3. Enhanced Phosphorus Removal Standards - All construction projects identified in Table 2 of Appendix B that are located in the watersheds identified in Appendix C shall prepare a SWPPP that includes post-construction stormwater management practices designed in conformance with the applicable *sizing criteria* in Part I.C.2. b., c. or d. of this permit and the *performance criteria,* Enhanced Phosphorus Removal Standards included in the Design Manual. At a minimum, the post-construction stormwater management practice component of the SWPPP shall include items 2.a - 2.f. above.

C. Required SWPPP Components by Project Type

Unless otherwise notified by the Department, *owners or operators* of *construction activities* identified in Table 1 of Appendix B are required to prepare a SWPPP that only includes erosion and sediment control practices designed in conformance with Part III.B.1 of this permit. *Owners or operators* of the *construction activities* identified in Table 2 of Appendix B shall prepare a SWPPP that also includes post-construction stormwater management practices designed in conformance with Part III.B.2 or 3 of this permit.

Part IV. INSPECTION AND MAINTENANCE REQUIREMENTS

A. General Construction Site Inspection and Maintenance Requirements

1. The *owner or operator* must ensure that all erosion and sediment control practices (including pollution prevention measures) and all post-construction stormwater management practices identified in the SWPPP are inspected and maintained in accordance with Part IV.B. and C. of this permit.

2. The terms of this permit shall not be construed to prohibit the State of New York from exercising any authority pursuant to the ECL, common law or federal law, or prohibit New York State from taking any measures, whether civil or criminal, to prevent violations of the laws of the State of New York or protect the public health and safety and/or the environment.

B. Contractor Maintenance Inspection Requirements

1. The *owner or operator* of each *construction activity* identified in Tables 1 and 2 of Appendix B shall have a *trained contractor* inspect the erosion and sediment control practices and pollution prevention measures being implemented within the active work area daily to ensure that they are being maintained in effective operating condition at all times. If deficiencies are identified, the contractor shall

begin implementing corrective actions within one business day and shall complete the corrective actions in a reasonable time frame.

2. For construction sites where soil disturbance activities have been temporarily suspended (e.g. winter shutdown) and *temporary stabilization* measures have been applied to all disturbed areas, the *trained contractor* can stop conducting the maintenance inspections. The *trained contractor* shall begin conducting the maintenance inspections in accordance with Part IV.B.1. of this permit as soon as soil disturbance activities resume.

3. For construction sites where soil disturbance activities have been shut down with partial project completion, the *trained contractor* can stop conducting the maintenance inspections if all areas disturbed as of the project shutdown date have achieved *final stabilization* <u>and</u> all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational.

C. Qualified Inspector Inspection Requirements

The *owner or operator* shall have a *qualified inspector* conduct site inspections in conformance with the following requirements:

[Note: The *trained contractor* identified in Part III.A.6. and IV.B. of this permit **cannot** conduct the *qualified inspector* site inspections unless they meet the *qualified inspector* qualifications included in Appendix A. In order to perform these inspections, the *trained contractor* would have to be a:

- licensed Professional Engineer,
- Certified Professional in Erosion and Sediment Control (CPESC),
- New York State Erosion and Sediment Control Certificate Program holder
- Registered Landscape Architect, or
- someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided they have received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity].

1. A *qualified inspector* shall conduct site inspections for all *construction activities* identified in Tables 1 and 2 of Appendix B, <u>with the exception of</u>:

    a. the construction of a single family residential subdivision with 25% or less *impervious cover* at total site build-out that involves a soil disturbance of one (1) or more acres of land but less than five (5) acres and is <u>not</u> located in one of the watersheds listed in Appendix C and <u>not</u> directly discharging to one of the 303(d) segments listed in Appendix E;

b. the construction of a single family home that involves a soil disturbance of one (1) or more acres of land but less than five (5) acres and is <u>not</u> located in one of the watersheds listed in Appendix C and <u>not</u> directly discharging to one of the 303(d) segments listed in Appendix E;

c. construction on agricultural property that involves a soil disturbance of one (1) or more acres of land but less than five (5) acres; and

d. *construction activities* located in the watersheds identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.

2. Unless otherwise notified by the Department, the *qualified inspector* shall conduct site inspections in accordance with the following timetable:

   a. For construction sites where soil disturbance activities are on-going, the *qualified inspector* shall conduct a site inspection at least once every seven (7) calendar days.

   b. For construction sites where soil disturbance activities are on-going and the *owner or operator* has received authorization in accordance with Part II.D.3 to disturb greater than five (5) acres of soil at any one time, the *qualified inspector* shall conduct at least two (2) site inspections every seven (7) calendar days. The two (2) inspections shall be separated by a minimum of two (2) full calendar days.

   c. For construction sites where soil disturbance activities have been temporarily suspended (e.g. winter shutdown) and *temporary stabilization* measures have been applied to all disturbed areas, the *qualified inspector* shall conduct a site inspection at least once every thirty (30) calendar days. The *owner or operator* shall notify the DOW Water (SPDES) Program contact at the Regional Office (see contact information in Appendix F) or, in areas under the jurisdiction of a *regulated, traditional land use control MS4,* the *regulated, traditional land use control MS4* (provided the *regulated, traditional land use control MS4* is not the *owner or operator* of the *construction activity*) in writing prior to reducing the frequency of inspections.

d. For construction sites where soil disturbance activities have been shut down with partial project completion, the *qualified inspector* can stop conducting inspections if all areas disturbed as of the project shutdown date have achieved *final stabilization* and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational. The *owner or operator* shall notify the DOW Water (SPDES) Program contact at the Regional Office (see contact information in Appendix F) or, in areas under the jurisdiction of a *regulated, traditional land use control MS4,* the *regulated, traditional land use control MS4* (provided the *regulated, traditional land use control MS4* is not the *owner or operator* of the *construction activity*) in writing prior to the shutdown. If soil disturbance activities are not resumed within 2 years from the date of shutdown, the *owner or operator* shall have the *qualified inspector* perform a final inspection and certify that all disturbed areas have achieved *final stabilization,* and all temporary, structural erosion and sediment control measures have been removed; and that all post-construction stormwater management practices have been constructed in conformance with the SWPPP by signing the "*Final Stabilization*" and "Post-Construction Stormwater Management Practice" certification statements on the NOT. The *owner or operator* shall then submit the completed NOT form to the address in Part II.B.1 of this permit.

e. For construction sites that directly *discharge* to one of the 303(d) segments listed in Appendix E or is located in one of the watersheds listed in Appendix C, the *qualified inspector* shall conduct at least two (2) site inspections every seven (7) calendar days. The two (2) inspections shall be separated by a minimum of two (2) full calendar days.

3. At a minimum, the *qualified inspector* shall inspect all erosion and sediment control practices and pollution prevention measures to ensure integrity and effectiveness, all post-construction stormwater management practices under construction to ensure that they are constructed in conformance with the SWPPP, all areas of disturbance that have not achieved *final stabilization,* all points of *discharge* to natural surface waterbodies located within, or immediately adjacent to, the property boundaries of the *construction site*, and all points of *discharge* from the *construction site*.

4. The *qualified inspector* shall prepare an inspection report subsequent to each and every inspection. At a minimum, the inspection report shall include and/or address the following:

a. Date and time of inspection;

b. Name and title of person(s) performing inspection;

c. A description of the weather and soil conditions (e.g. dry, wet, saturated) at the time of the inspection;

d. A description of the condition of the runoff at all points of *discharge* from the *construction site*. This shall include identification of any *discharges* of sediment from the *construction site*. Include *discharges* from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow;

e. A description of the condition of all natural surface waterbodies located within, or immediately adjacent to, the property boundaries of the *construction site* which receive runoff from disturbed areas. This shall include identification of any *discharges* of sediment to the surface waterbody;

f. Identification of all erosion and sediment control practices and pollution prevention measures that need repair or maintenance;

g. Identification of all erosion and sediment control practices and pollution prevention measures that were not installed properly or are not functioning as designed and need to be reinstalled or replaced;

h. Description and sketch of areas with active soil disturbance activity, areas that have been disturbed but are inactive at the time of the inspection, and areas that have been stabilized (temporary and/or final) since the last inspection;

i. Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and technical standards;

j. Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices and pollution prevention measures; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s);

k. Identification and status of all corrective actions that were required by previous inspection; and

l. Digital photographs, with date stamp, that clearly show the condition of all practices that have been identified as needing corrective actions. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report being maintained onsite within seven (7) calendar days of the date of the inspection. The *qualified inspector* shall also take digital photographs, with date stamp, that clearly show the condition of the practice(s) after the corrective action has been completed. The *qualified inspector* shall attach paper color copies of the digital photographs to the inspection report that documents the completion of the corrective action work within seven (7) calendar days of that inspection.

5. Within one business day of the completion of an inspection, the *qualified inspector* shall notify the *owner or operator* and appropriate contractor or subcontractor identified in Part III.A.6. of this permit of any corrective actions that need to be taken. The contractor or subcontractor shall begin implementing the corrective actions within one business day of this notification and shall complete the corrective actions in a reasonable time frame.

6. All inspection reports shall be signed by the *qualified inspector.* Pursuant to Part II.D.2. of this permit, the inspection reports shall be maintained on site with the SWPPP.

Part V. TERMINATION OF PERMIT COVERAGE

A. Termination of Permit Coverage

1. An *owner or operator* that is eligible to terminate coverage under this permit must submit a completed NOT form to the address in Part II.B.1 of this permit. The NOT form shall be one which is associated with this permit, signed in accordance with Part VII.H of this permit.

2. An *owner or operator* may terminate coverage when one or more the following conditions have been met:

   a. Total project completion - All *construction activity* identified in the SWPPP has been completed; <u>and</u> all areas of disturbance have achieved *final stabilization*; <u>and</u> all temporary, structural erosion and sediment control measures have been removed; <u>and</u> all post-construction stormwater management practices have been constructed in conformance with the SWPPP and are operational;

b. Planned shutdown with partial project completion - All soil disturbance activities have ceased; and all areas disturbed as of the project shutdown date have achieved *final stabilization*; and all temporary, structural erosion and sediment control measures have been removed; and all post-construction stormwater management practices required for the completed portion of the project have been constructed in conformance with the SWPPP and are operational;

c. A new *owner or operator* has obtained coverage under this permit in accordance with Part II.F. of this permit.

d. The *owner or operator* obtains coverage under an alternative SPDES general permit or an individual SPDES permit.

3. For *construction activities* meeting subdivision 2a. or 2b. of this Part, the *owner or operator* shall have the *qualified inspector* perform a final site inspection prior to submitting the NOT. The *qualified inspector* shall, by signing the "*Final Stabilization*" and "Post-Construction Stormwater Management Practice certification statements on the NOT, certify that all the requirements in Part V.A.2.a. or b. of this permit have been achieved.

4. For *construction activities* that are subject to the requirements of a *regulated, traditional land use control MS4* and meet subdivision 2a. or 2b. of this Part, the *owner or operator* shall have the *regulated, traditional land use control MS4* sign the "MS4 Acceptance" statement on the NOT in accordance with the requirements in Part VII.H. of this permit. The *regulated, traditional land use control MS4* official, by signing this statement, has determined that it is acceptable for the *owner or operator* to submit the NOT in accordance with the requirements of this Part. The *regulated, traditional land use control MS4* can make this determination by performing a final site inspection themselves or by accepting the *qualified inspector*'s final site inspection certification(s) required in Part V.A.3. of this permit.

5. For *construction activities* that require post-construction stormwater management practices and meet subdivision 2a. of this Part, the *owner or operator* must, prior to submitting the NOT, ensure one of the following:

a. the post-construction stormwater management practice(s) and any right-of-way(s) needed to maintain such practice(s) have been deeded to the municipality in which the practice(s) is located,

b. an executed maintenance agreement is in place with the municipality that will maintain the post-construction stormwater management practice(s),

c. for post-construction stormwater management practices that are privately owned, the *owner or operator* has a mechanism in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan, such as a deed covenant in the *owner or operator's* deed of record,

d. for post-construction stormwater management practices that are owned by a public or private institution (e.g. school, university, hospital), government agency or authority, or public utility; the *owner or operator* has policy and procedures in place that ensures operation and maintenance of the practices in accordance with the operation and maintenance plan.

Part VI. REPORTING AND RETENTION RECORDS

A. Record Retention

The *owner or operator* shall retain a copy of the NOI, NOI Acknowledgment Letter, SWPPP, MS4 SWPPP Acceptance form and any inspection reports that were prepared in conjunction with this permit for a period of at least five (5) years from the date that the Department receives a complete NOT submitted in accordance with Part V. of this general permit.

B. Addresses

With the exception of the NOI, NOT, and MS4 SWPPP Acceptance form (which must be submitted to the address referenced in Part II.B.1 of this permit), all written correspondence requested by the Department, including individual permit applications, shall be sent to the address of the appropriate DOW Water (SPDES) Program contact at the Regional Office listed in Appendix F.

Part VII. STANDARD PERMIT CONDITIONS

A. Duty to Comply

The *owner or operator* must comply with all conditions of this permit. All contractors and subcontractors associated with the project must comply with the terms of the SWPPP. Any non-compliance with this permit constitutes a violation of the Clean Water

Act (CWA) and the ECL and is grounds for an enforcement action against the *owner or operator* and/or the contractor/subcontractor; permit revocation, suspension or modification; or denial of a permit renewal application. Upon a finding of significant non-compliance with this permit or the applicable SWPPP, the Department may order an immediate stop to all *construction activity* at the site until the non-compliance is remedied. The stop work order shall be in writing, shall describe the non-compliance in detail, and shall be sent to the *owner or operator*.

If any human remains or archaeological remains are encountered during excavation, the *owner or operator* must immediately cease, or cause to cease, all *construction activity* in the area of the remains and notify the appropriate Regional Water Engineer (RWE). *Construction activity* shall not resume until written permission to do so has been received from the RWE.

B. Continuation of the Expired General Permit

This permit expires five (5) years from the effective date. If a new general permit is not issued prior to the expiration of this general permit, an *owner or operator* with coverage under this permit may continue to operate and *discharge* in accordance with the terms and conditions of this general permit, if it is extended pursuant to the State Administrative Procedure Act and 6 NYCRR Part 621, until a new general permit is issued.

C. Enforcement

Failure of the *owner or operator,* its contractors, subcontractors, agents and/or assigns to strictly adhere to any of the permit requirements contained herein shall constitute a violation of this permit. There are substantial criminal, civil, and administrative penalties associated with violating the provisions of this permit. Fines of up to $37,500 per day for each violation and imprisonment for up to fifteen (15) years may be assessed depending upon the nature and degree of the offense.

D. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for an *owner or operator* in an enforcement action that it would have been necessary to halt or reduce the *construction activity* in order to maintain compliance with the conditions of this permit.

E. Duty to Mitigate

The *owner or operator* and its contractors and subcontractors shall take all reasonable steps to *minimize* or prevent any *discharge* in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

F. Duty to Provide Information

The *owner or operator* shall furnish to the Department, within a reasonable specified time period of a written request, all documentation necessary to demonstrate eligibility and any information to determine compliance with this permit or to determine whether cause exists for modifying or revoking this permit, or suspending or denying coverage under this permit, in accordance with the terms and conditions of this permit. The NOI, SWPPP and inspection reports required by this permit are public documents that the *owner or operator* must make available for review and copying by any person within five (5) business days of the *owner or operator* receiving a written request by any such person to review these documents. Copying of documents will be done at the requester's expense.

G. Other Information

When the *owner or operator* becomes aware that they failed to submit any relevant facts, or submitted incorrect information in the NOI or in any of the documents required by this permit , or have made substantive revisions to the SWPPP (e.g. the scope of the project changes significantly, the type of post-construction stormwater management practice(s) changes, there is a reduction in the sizing of the post-construction stormwater management practice, or there is an increase in the disturbance area or *impervious area*), which were not reflected in the original NOI submitted to the Department, they shall promptly submit such facts or information to the Department using the contact information in Part II.A. of this permit. Failure of the *owner or operator* to correct or supplement any relevant facts within five (5) business days of becoming aware of the deficiency shall constitute a violation of this permit.

H. Signatory Requirements

1. All NOIs and NOTs shall be signed as follows:

   a. For a corporation these forms shall be signed by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or

(ii) the manager of one or more manufacturing, production or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship these forms shall be signed by a general partner or the proprietor, respectively; or

c. For a municipality, State, Federal, or other public agency these forms shall be signed by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes:

(i) the chief executive officer of the agency, or

(ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of EPA).

2. The SWPPP and other information requested by the Department shall be signed by a person described in Part VII.H.1. of this permit or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Part VII.H.1. of this permit;

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of *equivalent* responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position) and,

c. The written authorization shall include the name, title and signature of the authorized representative and be attached to the SWPPP.

3. All inspection reports shall be signed by the *qualified inspector* that performs the inspection.

4. The MS4 SWPPP Acceptance form shall be signed by the principal executive officer or ranking elected official from the *regulated, traditional land use control MS4,* or by a duly authorized representative of that person.

   It shall constitute a permit violation if an incorrect and/or improper signatory authorizes any required forms, SWPPP and/or inspection reports.

I. Property Rights

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations. *Owners or operators* must obtain any applicable conveyances, easements, licenses and/or access to real property prior to *commencing construction activity*.

J. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

K. Requirement to Obtain Coverage Under an Alternative Permit

1. The Department may require any owner or operator authorized by this permit to apply for and/or obtain either an individual SPDES permit or another SPDES general permit. When the Department requires any discharger authorized by a general permit to apply for an individual SPDES permit, it shall notify the discharger in writing that a permit application is required. This notice shall

include a brief statement of the reasons for this decision, an application form, a statement setting a time frame for the owner or operator to file the application for an individual SPDES permit, and a deadline, not sooner than 180 days from owner or operator receipt of the notification letter, whereby the authorization to discharge under this general permit shall be terminated. Applications must be submitted to the appropriate Permit Administrator at the Regional Office. The Department may grant additional time upon demonstration, to the satisfaction of the Department, that additional time to apply for an alternative authorization is necessary or where the Department has not provided a permit determination in accordance with Part 621 of this Title.

2. When an individual SPDES permit is issued to a discharger authorized to *discharge* under a general SPDES permit for the same *discharge*(s), the general permit authorization for outfalls authorized under the individual SPDES permit is automatically terminated on the effective date of the individual permit unless termination is earlier in accordance with 6 NYCRR Part 750.

L. Proper Operation and Maintenance

The *owner or operator* shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the *owner or operator* to achieve compliance with the conditions of this permit and with the requirements of the SWPPP.

M. Inspection and Entry

The *owner or operator* shall allow an authorized representative of the Department, EPA, applicable county health department, or, in the case of a *construction site* which *discharges* through an *MS4*, an authorized representative of the *MS4* receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the owner’s or operator's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;

2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit; and

3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment), practices or operations regulated or required by this permit.

4. Sample or monitor at reasonable times, for purposes of assuring permit compliance or as otherwise authorized by the Act or ECL, any substances or parameters at any location.

N. Permit Actions

This permit may, at any time, be modified, suspended, revoked, or renewed by the Department in accordance with 6 NYCRR Part 621. The filing of a request by the *owner or operator* for a permit modification, revocation and reissuance, termination, a notification of planned changes or anticipated noncompliance does not limit, diminish and/or stay compliance with any terms of this permit.

O. Definitions

Definitions of key terms are included in Appendix A of this permit.

P. Re-Opener Clause

1. If there is evidence indicating potential or realized impacts on water quality due to any stormwater discharge associated with construction activity covered by this permit, the owner or operator of such discharge may be required to obtain an individual permit or alternative general permit in accordance with Part VII.K. of this permit or the permit may be modified to include different limitations and/or requirements.

2. Any Department initiated permit modification, suspension or revocation will be conducted in accordance with 6 NYCRR Part 621, 6 NYCRR 750-1.18, and 6 NYCRR 750-1.20.

Q. Penalties for Falsification of Forms and Reports

In accordance with 6NYCRR Part 750-2.4 and 750-2.5, any person who knowingly makes any false material statement, representation, or certification in any application, record, report or other document filed or required to be maintained under this permit, including reports of compliance or noncompliance shall, upon conviction, be punished in accordance with ECL §71-1933 and or Articles 175 and 210 of the New York State Penal Law.

R. Other Permits

Nothing in this permit relieves the *owner or operator* from a requirement to obtain any other permits required by law.

APPENDIX A – Acronyms and Definitions

Acronyms

APO – Agency Preservation Officer
BMP – Best Management Practice
CPESC – Certified Professional in Erosion and Sediment Control
Cpv – Channel Protection Volume
CWA – Clean Water Act (or the Federal Water Pollution Control Act, 33 U.S.C. §1251 et seq)
DOW – Division of Water
EAF – Environmental Assessment Form
ECL - Environmental Conservation Law
EPA – U. S. Environmental Protection Agency
HSG – Hydrologic Soil Group
MS4 – Municipal Separate Storm Sewer System
NOI – Notice of Intent
NOT – Notice of Termination
NPDES – National Pollutant Discharge Elimination System
OPRHP – Office of Parks, Recreation and Historic Places
Qf – Extreme Flood
Qp – Overbank Flood
RRv – Runoff Reduction Volume
RWE – Regional Water Engineer
SEQR – State Environmental Quality Review
SEQRA - State Environmental Quality Review Act
SHPA – State Historic Preservation Act
SPDES – State Pollutant Discharge Elimination System
SWPPP – Stormwater Pollution Prevention Plan
TMDL – Total Maximum Daily Load
UPA – Uniform Procedures Act
USDA – United States Department of Agriculture
WQv – Water Quality Volume

Definitions

<u>All definitions in this section are solely for the purposes of this permit.</u>

Agricultural Building – a structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products; excluding any structure designed, constructed or used, in whole or in part, for human habitation, as a place of employment where agricultural products are processed, treated or packaged, or as a place used by the public.

Agricultural Property –means the land for construction of a barn, *agricultural building*, silo, stockyard, pen or other structural practices identified in Table II in the "Agricultural Management Practices Catalog for Nonpoint Source Pollution in New York State" prepared by the Department in cooperation with agencies of New York Nonpoint Source Coordinating Committee (dated June 2007).

Alter Hydrology from Pre to Post-Development Conditions - means the post-development peak flow rate(s) has increased by more than 5% of the pre-developed condition for the design storm of interest (e.g. 10 yr and 100 yr).

Combined Sewer - means a sewer that is designed to collect and convey both "sewage" and "stormwater".

Commence (Commencement of) Construction Activities - means the initial disturbance of soils associated with clearing, grading or excavation activities; or other construction related activities that disturb or expose soils such as demolition, stockpiling of fill material, and the initial installation of erosion and sediment control practices required in the SWPPP. See definition for "*Construction Activity(ies)*" also.

Construction Activity(ies) - means any clearing, grading, excavation, filling, demolition or stockpiling activities that result in soil disturbance. Clearing activities can include, but are not limited to, logging equipment operation, the cutting and skidding of trees, stump removal and/or brush root removal. Construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

Construction Site – means the land area where *construction activity(ies)* will occur. See definition for "*Commence (Commencement of) Construction Activities"* and "*Larger Common Plan of Development or Sale" also.*

Dewatering – means the act of draining rainwater and/or groundwater from building foundations, vaults or excavations/trenches.

Direct Discharge (to a specific surface waterbody) - means that runoff flows from a *construction site* by overland flow and the first point of discharge is the specific surface waterbody, or runoff flows from a *construction site* to a separate storm sewer system and the first point of discharge from the separate storm sewer system is the specific surface waterbody.

Discharge(s) - means any addition of any pollutant to waters of the State through an outlet or *point source*.

Embankment –means an earthen or rock slope that supports a road/highway.

Endangered or Threatened Species – see 6 NYCRR Part 182 of the Department's rules and regulations for definition of terms and requirements.

Environmental Conservation Law (ECL) - means chapter 43-B of the Consolidated Laws of the State of New York, entitled the Environmental Conservation Law.

Equivalent (Equivalence) – means that the practice or measure meets all the performance, longevity, maintenance, and safety objectives of the technical standard and will provide an equal or greater degree of water quality protection.

Final Stabilization - means that all soil disturbance activities have ceased and a uniform, perennial vegetative cover with a density of eighty (80) percent over the entire pervious surface has been established; or other equivalent stabilization measures, such as permanent landscape mulches, rock rip-rap or washed/crushed stone have been applied on all disturbed areas that are not covered by permanent structures, concrete or pavement.

General SPDES permit - means a SPDES permit issued pursuant to 6 NYCRR Part 750-1.21 and Section 70-0117 of the ECL authorizing a category of discharges.

Groundwater(s) - means waters in the saturated zone. The saturated zone is a subsurface zone in which all the interstices are filled with water under pressure greater than that of the atmosphere. Although the zone may contain gas-filled interstices or interstices filled with fluids other than water, it is still considered saturated.

Historic Property – means any building, structure, site, object or district that is listed on the State or National Registers of Historic Places or is determined to be eligible for listing on the State or National Registers of Historic Places.

Impervious Area (Cover) - means all impermeable surfaces that cannot effectively infiltrate rainfall. This includes paved, concrete and gravel surfaces (i.e. parking lots, driveways, roads, runways and sidewalks); building rooftops and miscellaneous impermeable structures such as patios, pools, and sheds.

Infeasible – means not technologically possible, or not economically practicable and achievable in light of best industry practices.

Larger Common Plan of Development or Sale - means a contiguous area where multiple separate and distinct *construction activities* are occurring, or will occur, under one plan. The term "plan" in "larger common plan of development or sale" is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, marketing plan, advertisement, drawing, permit application, State Environmental Quality Review Act (SEQRA) environmental assessment form or other documents, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating that *construction activities* may occur on a specific plot.

For discrete construction projects that are located within a larger common plan of development or sale that are at least 1/4 mile apart, each project can be treated as a separate plan of development or sale provided any interconnecting road, pipeline or utility project that is part of the same "common plan" is not concurrently being disturbed.

Minimize – means reduce and/or eliminate to the extent achievable using control measures (including best management practices) that are technologically available and economically practicable and achievable in light of best industry practices.

Municipal Separate Storm Sewer (MS4) - a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

(i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to surface waters of the State*;*
(ii) Designed or used for collecting or conveying stormwater;
(iii) Which is not a *combined sewer*; and
(iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2.

National Pollutant Discharge Elimination System (NPDES) - means the national system for the issuance of wastewater and stormwater permits under the Federal Water Pollution Control Act (Clean Water Act).

Natural Buffer –means an undisturbed area with natural cover running along a surface water (e.g. wetland, stream, river, lake, etc.).

New Development – means any land disturbance that does not meet the definition of Redevelopment Activity included in this appendix.

New York State Erosion and Sediment Control Certificate Program – a certificate program that establishes and maintains a process to identify and recognize individuals who are capable of developing, designing, inspecting and maintaining erosion and sediment control plans on projects that disturb soils in New York State. The certificate program is administered by the New York State Conservation District Employees Association.

NOI Acknowledgment Letter - means the letter that the Department sends to an owner or operator to acknowledge the Department's receipt and acceptance of a complete Notice of Intent. This letter documents the owner's or operator's authorization to discharge in accordance with the general permit for stormwater discharges from *construction activity*.

Nonpoint Source - means any source of water pollution or pollutants which is not a discrete conveyance or *point source* permitted pursuant to Title 7 or 8 of Article 17 of the Environmental Conservation Law (see ECL Section 17-1403).

Overbank –means flow events that exceed the capacity of the stream channel and spill out into the adjacent floodplain.

Owner or Operator - means the person, persons or legal entity which owns or leases the property on which the *construction activity* is occurring; an entity that has operational control over the construction plans and specifications, including the ability to make modifications to the plans and specifications; and/or an entity that has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions.

Performance Criteria – means the design criteria listed under the "Required Elements" sections in Chapters 5, 6 and 10 of the technical standard, New York State Stormwater Management Design Manual, dated January 2015. It does not include the Sizing Criteria (i.e. WQv, RRv, Cpv, Qp and Qf) in Part I.C.2. of the permit.

Point Source - means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel or other floating craft, or landfill leachate collection system from which *pollutants* are or may be discharged.

Pollutant - means dredged spoil, filter backwash, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand and industrial, municipal, agricultural waste and ballast discharged into water; which may cause or might reasonably be expected to cause pollution of the waters of the state in contravention of the standards or guidance values adopted as provided in 6 NYCRR Parts 700 et seq .

Qualified Inspector - means a person that is knowledgeable in the principles and practices of erosion and sediment control, such as a licensed Professional Engineer, Certified Professional in Erosion and Sediment Control (CPESC), Registered Landscape Architect, New York State Erosion and Sediment Control Certificate Program holder or other Department endorsed individual(s).

It can also mean someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided that person has training in the principles and practices of erosion and sediment control. Training in the principles and practices of erosion and sediment control means that the individual working under the direct supervision of the licensed Professional Engineer or Registered Landscape Architect has received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity. After receiving the initial training, the individual working under the direct supervision of the licensed Professional Engineer or Registered Landscape Architect shall receive four (4) hours of training every three (3) years.

It can also mean a person that meets the *Qualified Professional* qualifications in addition to the *Qualified Inspector* qualifications.

Note: Inspections of any post-construction stormwater management practices that include structural components, such as a dam for an impoundment, shall be performed by a licensed Professional Engineer.

Qualified Professional - means a person that is knowledgeable in the principles and practices of stormwater management and treatment, such as a licensed Professional Engineer, Registered Landscape Architect or other Department endorsed individual(s). Individuals preparing SWPPPs that require the post-construction stormwater management practice component must have an understanding of the principles of hydrology, water quality management practice design, water quantity control design, and, in many cases, the principles of hydraulics. All components of the SWPPP that involve the practice of engineering, as defined by the NYS Education Law (see Article 145), shall be prepared by, or under the direct supervision of, a professional engineer licensed to practice in the State of New York.

Redevelopment Activity(ies) – means the disturbance and reconstruction of existing impervious area, including impervious areas that were removed from a project site within five (5) years of preliminary project plan submission to the local government (i.e. site plan, subdivision, etc.).

Regulated, Traditional Land Use Control MS4 - means a city, town or village with land use control authority that is authorized to discharge under New York State DEC's

SPDES General Permit For Stormwater Discharges from Municipal Separate Stormwater Sewer Systems (MS4s) or the City of New York's Individual SPDES Permit for their Municipal Separate Storm Sewer Systems (NY-0287890).

Routine Maintenance Activity - means *construction activity* that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility, including, but not limited to:

- Re-grading of gravel roads or parking lots,
- Cleaning and shaping of existing roadside ditches and culverts that maintains the approximate original line and grade, and hydraulic capacity of the ditch,
- Cleaning and shaping of existing roadside ditches that does not maintain the approximate original grade, hydraulic capacity and purpose of the ditch if the changes to the line and grade, hydraulic capacity or purpose of the ditch are installed to improve water quality and quantity controls (e.g. installing grass lined ditch),
- Placement of aggregate shoulder backing that stabilizes the transition between the road shoulder and the ditch or *embankment*,
- Full depth milling and filling of existing asphalt pavements, replacement of concrete pavement slabs, and similar work that does not expose soil or disturb the bottom six (6) inches of subbase material,
- Long-term use of equipment storage areas at or near highway maintenance facilities,
- Removal of sediment from the edge of the highway to restore a previously existing sheet-flow drainage connection from the highway surface to the highway ditch or *embankment*,
- Existing use of Canal Corp owned upland disposal sites for the canal, and
- Replacement of curbs, gutters, sidewalks and guide rail posts.

Site limitations – means site conditions that prevent the use of an infiltration technique and or infiltration of the total WQv. Typical site limitations include: seasonal high groundwater, shallow depth to bedrock, and soils with an infiltration rate less than 0.5 inches/hour. The existence of site limitations shall be confirmed and documented using actual field testing (i.e. test pits, soil borings, and infiltration test) or using information from the most current United States Department of Agriculture (USDA) Soil Survey for the County where the project is located.

Sizing Criteria – means the criteria included in Part I.C.2 of the permit that are used to size post-construction stormwater management control practices. The criteria include; Water Quality Volume (WQv), Runoff Reduction Volume (RRv), Channel Protection Volume (Cpv), *Overbank* Flood (Qp), and Extreme Flood (Qf).

State Pollutant Discharge Elimination System (SPDES) - means the system established pursuant to Article 17 of the ECL and 6 NYCRR Part 750 for issuance of permits authorizing discharges to the waters of the state.

Steep Slope – means land area designated on the current United States Department of Agriculture ("USDA") Soil Survey as Soil Slope Phase "D", (provided the map unit name is inclusive of slopes greater than 25%) , or Soil Slope Phase E or F, (regardless of the map unit name), or a combination of the three designations.

Streambank – as used in this permit, means the terrain alongside the bed of a creek or stream. The bank consists of the sides of the channel, between which the flow is confined.

Stormwater Pollution Prevention Plan (SWPPP) – means a project specific report, including construction drawings, that among other things: describes the construction activity(ies), identifies the potential sources of pollution at the *construction site*; describes and shows the stormwater controls that will be used to control the pollutants (i.e. erosion and sediment controls; for many projects, includes post-construction stormwater management controls); and identifies procedures the *owner or operator* will implement to comply with the terms and conditions of the permit. See Part III of the permit for a complete description of the information that must be included in the SWPPP.

Surface Waters of the State - shall be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic ocean within the territorial seas of the state of New York and all other bodies of surface water, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface waters), which are wholly or partially within or bordering the state or within its jurisdiction. Waters of the state are further defined in 6 NYCRR Parts 800 to 941.

Temporarily Ceased – means that an existing disturbed area will not be disturbed again within 14 calendar days of the previous soil disturbance.

Temporary Stabilization - means that exposed soil has been covered with material(s) as set forth in the technical standard, New York Standards and Specifications for Erosion and Sediment Control, to prevent the exposed soil from eroding. The materials can include, but are not limited to, mulch, seed and mulch, and erosion control mats (e.g. jute twisted yarn, excelsior wood fiber mats).

Total Maximum Daily Loads (TMDLs) - A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and *nonpoint source*s. It is a calculation of the maximum amount of a pollutant that a waterbody can receive on a daily basis and still meet *water quality standards*, and an allocation of that amount to the pollutant's sources. A TMDL stipulates wasteload allocations (WLAs) for *point source* discharges, load allocations (LAs) for *nonpoint source*s, and a margin of safety (MOS).

Trained Contractor - means an employee from the contracting (construction) company, identified in Part III.A.6., that has received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity. After receiving the initial training, the *trained contractor* shall receive four (4) hours of training every three (3) years.

It can also mean an employee from the contracting (construction) company, identified in Part III.A.6., that meets the *qualified inspector* qualifications (e.g. licensed Professional Engineer, Certified Professional in Erosion and Sediment Control (CPESC), Registered Landscape Architect, New York State Erosion and Sediment Control Certificate Program holder, or someone working under the direct supervision of, and at the same company as, the licensed Professional Engineer or Registered Landscape Architect, provided they have received four (4) hours of Department endorsed training in proper erosion and sediment control principles from a Soil and Water Conservation District, or other Department endorsed entity).

The *trained contractor* is responsible for the day to day implementation of the SWPPP.

Uniform Procedures Act (UPA) Permit - means a permit required under 6 NYCRR Part 621 of the Environmental Conservation Law (ECL), Article 70.

Water Quality Standard - means such measures of purity or quality for any waters in relation to their reasonable and necessary use as promulgated in 6 NYCRR Part 700 et seq.

APPENDIX B – Required SWPPP Components by Project Type

Table 1
Construction Activities that Require the Preparation of a SWPPP That Only Includes Erosion and Sediment Controls

The following construction activities that involve soil disturbances of one (1) or more acres of land, but less than five (5) acres: • Single family home not located in one of the watersheds listed in Appendix C or not *directly discharging* to one of the 303(d) segments listed in Appendix E • Single family residential subdivisions with 25% or less impervious cover at total site build-out and not located in one of the watersheds listed in Appendix C and not directly discharging to one of the 303(d) segments listed in Appendix E • Construction of a barn or other *agricultural building*, silo, stock yard or pen.
The following construction activities that involve soil disturbances between five thousand (5000) square feet and one (1) acre of land: All construction activities located in the watersheds identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.
The following construction activities that involve soil disturbances of one (1) or more acres of land: • Installation of underground, linear utilities; such as gas lines, fiber-optic cable, cable TV, electric, telephone, sewer mains, and water mains • Environmental enhancement projects, such as wetland mitigation projects, stormwater retrofits and stream restoration projects • Pond construction • Linear bike paths running through areas with vegetative cover, including bike paths surfaced with an impervious cover • Cross-country ski trails and walking/hiking trails • Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are not part of residential, commercial or institutional development; • Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that include incidental shoulder or curb work along an existing highway to support construction of the sidewalk, bike path or walking path. • Slope stabilization projects • Slope flattening that changes the grade of the site, but does not significantly change the runoff characteristics

Table 1 (Continued) CONSTRUCTION ACTIVITIES THAT REQUIRE THE PREPARATION OF A SWPPP THAT ONLY INCLUDES EROSION AND SEDIMENT CONTROLS

The following construction activities that involve soil disturbances of one (1) or more acres of land:

- Spoil areas that will be covered with vegetation
- Vegetated open space projects (i.e. recreational parks, lawns, meadows, fields, downhill ski trails) excluding projects that *alter hydrology from pre to post development* conditions,
- Athletic fields (natural grass) that do not include the construction or reconstruction of *impervious area* and do not *alter hydrology from pre to post development* conditions
- Demolition project where vegetation will be established, and no redevelopment is planned
- Overhead electric transmission line project that does not include the construction of permanent access roads or parking areas surfaced with *impervious cover*
- Structural practices as identified in Table II in the "Agricultural Management Practices Catalog for Nonpoint Source Pollution in New York State", excluding projects that involve soil disturbances of greater than five acres and construction activities that include the construction or reconstruction of impervious area
- Temporary access roads, median crossovers, detour roads, lanes, or other temporary impervious areas that will be restored to pre-construction conditions once the construction activity is complete

Table 2

CONSTRUCTION ACTIVITIES THAT REQUIRE THE PREPARATION OF A SWPPP THAT INCLUDES POST-CONSTRUCTION STORMWATER MANAGEMENT PRACTICES

The following construction activities that involve soil disturbances of one (1) or more acres of land:

- Single family home located in one of the watersheds listed in Appendix C or *directly discharging* to one of the 303(d) segments listed in Appendix E
- Single family home that disturbs five (5) or more acres of land
- Single family residential subdivisions located in one of the watersheds listed in Appendix C or *directly discharging* to one of the 303(d) segments listed in Appendix E
- Single family residential subdivisions that involve soil disturbances of between one (1) and five (5) acres of land with greater than 25% impervious cover at total site build-out
- Single family residential subdivisions that involve soil disturbances of five (5) or more acres of land, and single family residential subdivisions that involve soil disturbances of less than five (5) acres that are part of a larger common plan of development or sale that will ultimately disturb five or more acres of land
- Multi-family residential developments; includes duplexes, townhomes, condominiums, senior housing complexes, apartment complexes, and mobile home parks
- Airports
- Amusement parks
- Breweries, cideries, and wineries, including establishments constructed on agricultural land
- Campgrounds
- Cemeteries that include the construction or reconstruction of impervious area (>5% of disturbed area) or *alter the hydrology from pre to post development* conditions
- Commercial developments
- Churches and other places of worship
- Construction of a barn or other *agricultural building* (e.g. silo) and structural practices as identified in Table II in the “Agricultural Management Practices Catalog for Nonpoint Source Pollution in New York State” that include the construction or reconstruction of *impervious area*, excluding projects that involve soil disturbances of less than five acres.
- Golf courses
- Institutional development; includes hospitals, prisons, schools and colleges
- Industrial facilities; includes industrial parks
- Landfills
- Municipal facilities; includes highway garages, transfer stations, office buildings, POTW’s, water treatment plants, and water storage tanks
- Office complexes
- Playgrounds that include the construction or reconstruction of impervious area
- Sports complexes
- Racetracks; includes racetracks with earthen (dirt) surface
- Road construction or reconstruction, including roads constructed as part of the construction activities listed in Table 1

Table 2 (Continued)

Construction Activities that Require the Preparation of a SWPPP That Includes Post-construction Stormwater Management Practices

The following construction activities that involve soil disturbances of one (1) or more acres of land: • Parking lot construction or reconstruction, including parking lots constructed as part of the construction activities listed in Table 1 • Athletic fields (natural grass) that include the construction or reconstruction of impervious area (>5% of disturbed area) or *alter the hydrology from pre to post development* conditions • Athletic fields with artificial turf • Permanent access roads, parking areas, substations, compressor stations and well drilling pads, surfaced with *impervious cover,* and constructed as part of an over-head electric transmission line project, wind-power project, cell tower project, oil or gas well drilling project, sewer or water main project or other linear utility project • Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are part of a residential, commercial or institutional development • Sidewalk, bike path or walking path projects, surfaced with an impervious cover, that are part of a highway construction or reconstruction project • All other construction activities that include the construction or reconstruction of *impervious area* <u>or</u> *alter the hydrology from pre to post development* conditions, <u>and</u> are not listed in Table 1

APPENDIX C – Watersheds Requiring Enhanced Phosphorus Removal

Watersheds where *owners or operators* of construction activities identified in Table 2 of Appendix B must prepare a SWPPP that includes post-construction stormwater management practices designed in conformance with the Enhanced Phosphorus Removal Standards included in the technical standard, New York State Stormwater Management Design Manual ("Design Manual").

- Entire New York City Watershed located east of the Hudson River **-** Figure 1
- Onondaga Lake Watershed **-** Figure 2
- Greenwood Lake Watershed **-**Figure 3
- Oscawana Lake Watershed – Figure 4
- Kinderhook Lake Watershed – Figure 5

Figure 1 - New York City Watershed East of the Hudson

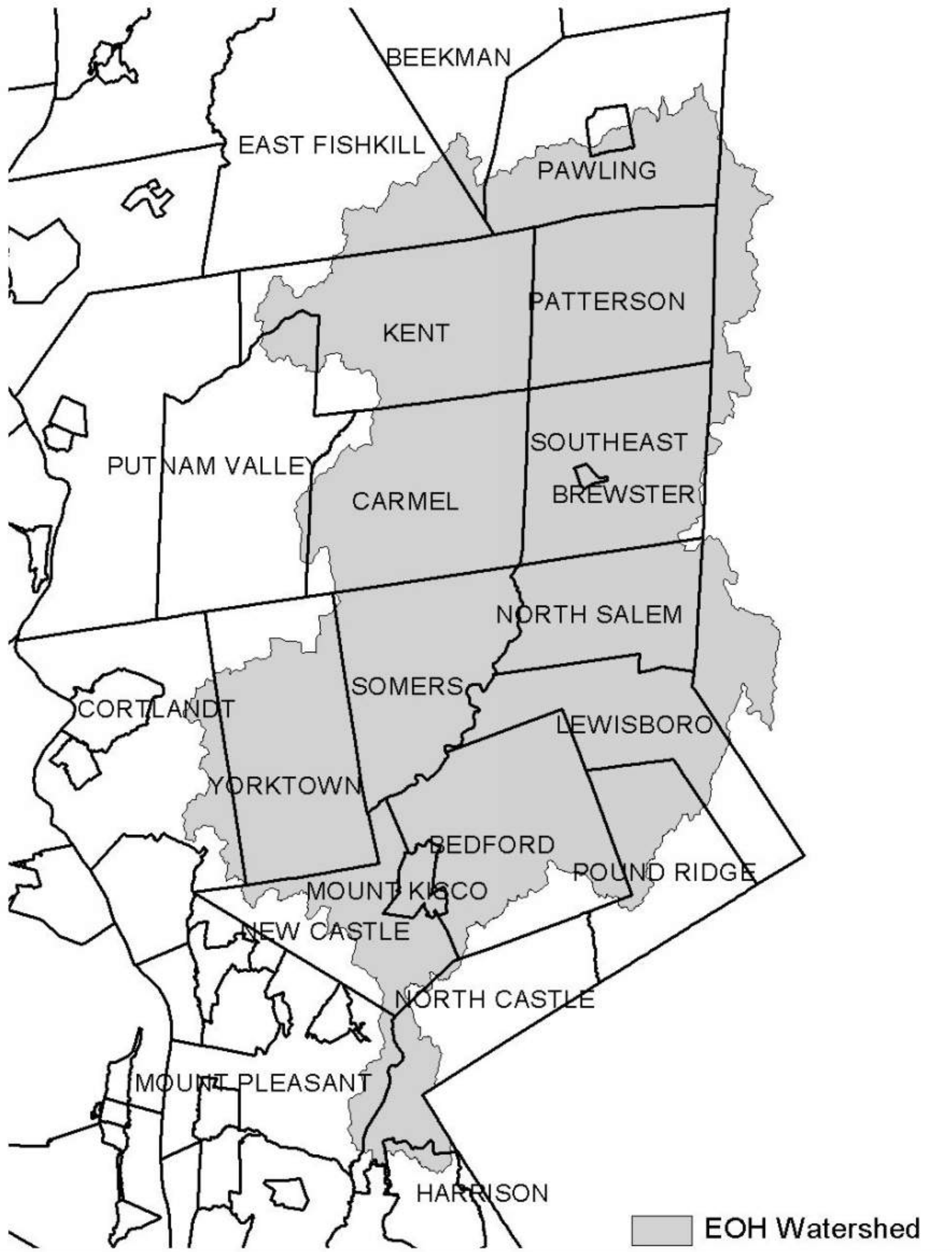


Figure 2 - Onondaga Lake Watershed

Figure 3 - Greenwood Lake Watershed

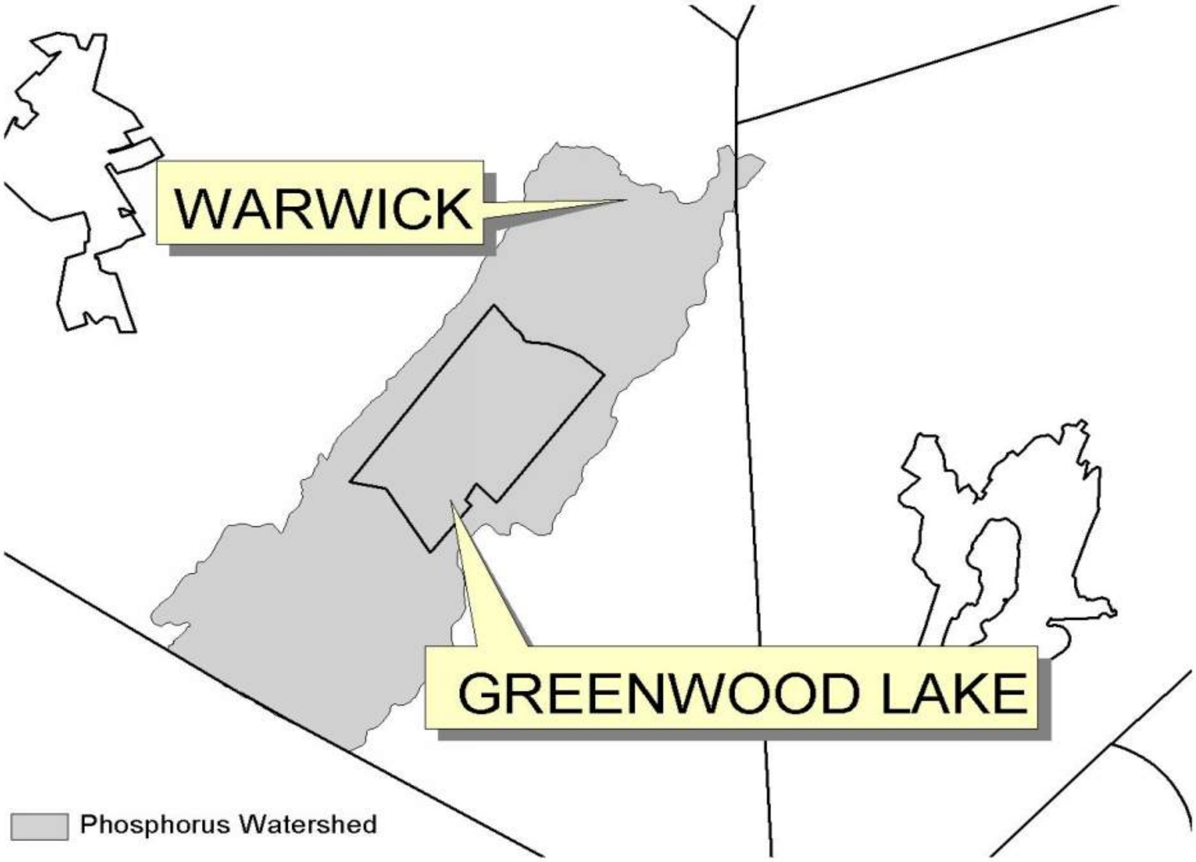


Figure 4 - Oscawana Lake Watershed

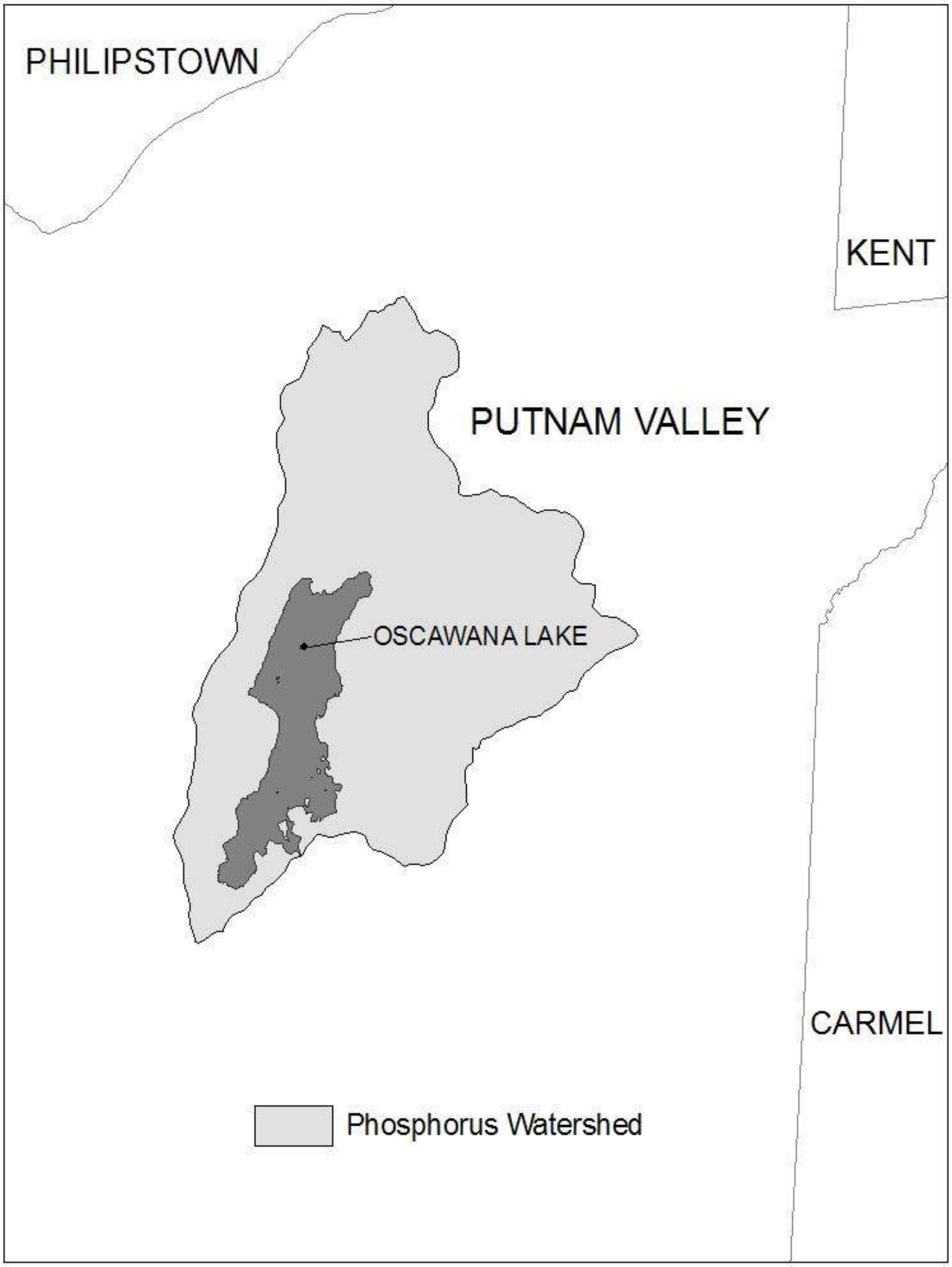
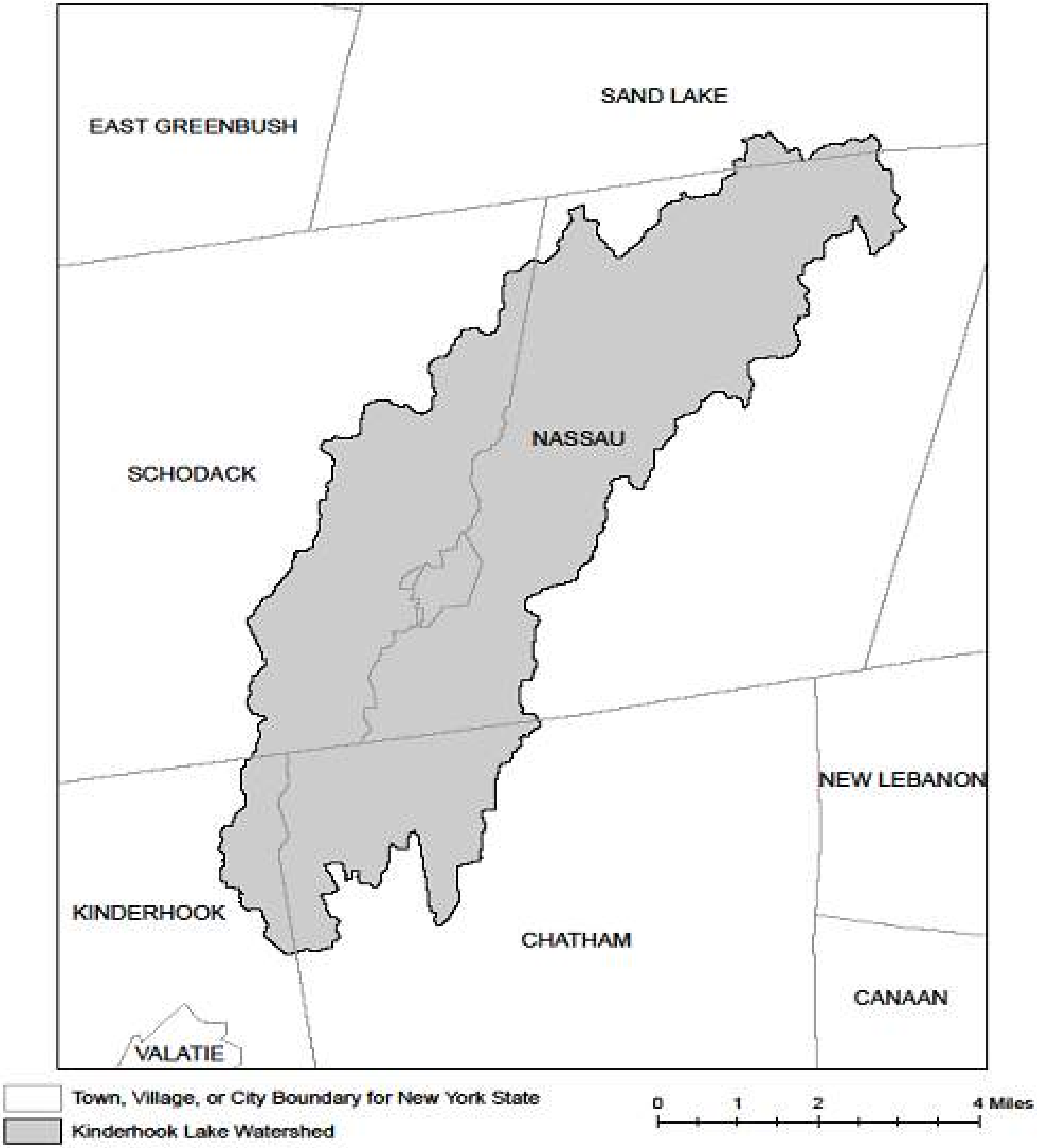


Figure 5 - Kinderhook Lake Watershed



APPENDIX D – Watersheds with Lower Disturbance Threshold

Watersheds where *owners or operators* of construction activities that involve soil disturbances between five thousand (5000) square feet and one (1) acre of land must obtain coverage under this permit.

Entire New York City Watershed that is located east of the Hudson River **-** See Figure 1 in Appendix C

APPENDIX E – 303(d) Segments Impaired by Construction Related Pollutant(s)

List of 303(d) segments impaired by pollutants related to *construction activity* (e.g. silt, sediment or nutrients). The list was developed using "The Final New York State 2016 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy" dated November 2016. *Owners or operators* of single family home and single family residential subdivisions with 25% or less total impervious cover at total site build-out that involve soil disturbances of one or more acres of land, but less than 5 acres, and *directly discharge* to one of the listed segments below shall prepare a SWPPP that includes post-construction stormwater management practices designed in conformance with the New York State Stormwater Management Design Manual ("Design Manual"), dated January 2015.

COUNTY	WATERBODY	POLLUTANT
Albany	Ann Lee (Shakers) Pond, Stump Pond	Nutrients
Albany	Basic Creek Reservoir	Nutrients
Allegany	Amity Lake, Saunders Pond	Nutrients
Bronx	Long Island Sound, Bronx	Nutrients
Bronx	Van Cortlandt Lake	Nutrients
Broome	Fly Pond, Deer Lake, Sky Lake	Nutrients
Broome	Minor Tribs to Lower Susquehanna (north)	Nutrients
Broome	Whitney Point Lake/Reservoir	Nutrients
Cattaraugus	Allegheny River/Reservoir	Nutrients
Cattaraugus	Beaver (Alma) Lake	Nutrients
Cattaraugus	Case Lake	Nutrients
Cattaraugus	Linlyco/Club Pond	Nutrients
Cayuga	Duck Lake	Nutrients
Cayuga	Little Sodus Bay	Nutrients
Chautauqua	Bear Lake	Nutrients
Chautauqua	Chadakoin River and tribs	Nutrients
Chautauqua	Chautauqua Lake, North	Nutrients
Chautauqua	Chautauqua Lake, South	Nutrients
Chautauqua	Findley Lake	Nutrients
Chautauqua	Hulburt/Clymer Pond	Nutrients
Clinton	Great Chazy River, Lower, Main Stem	Silt/Sediment
Clinton	Lake Champlain, Main Lake, Middle	Nutrients
Clinton	Lake Champlain, Main Lake, North	Nutrients
Columbia	Kinderhook Lake	Nutrients
Columbia	Robinson Pond	Nutrients
Cortland	Dean Pond	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Dutchess	Fall Kill and tribs	Nutrients
Dutchess	Hillside Lake	Nutrients
Dutchess	Wappingers Lake	Nutrients
Dutchess	Wappingers Lake	Silt/Sediment
Erie	Beeman Creek and tribs	Nutrients
Erie	Ellicott Creek, Lower, and tribs	Silt/Sediment
Erie	Ellicott Creek, Lower, and tribs	Nutrients
Erie	Green Lake	Nutrients
Erie	Little Sister Creek, Lower, and tribs	Nutrients
Erie	Murder Creek, Lower, and tribs	Nutrients
Erie	Rush Creek and tribs	Nutrients
Erie	Scajaquada Creek, Lower, and tribs	Nutrients
Erie	Scajaquada Creek, Middle, and tribs	Nutrients
Erie	Scajaquada Creek, Upper, and tribs	Nutrients
Erie	South Branch Smoke Cr, Lower, and tribs	Silt/Sediment
Erie	South Branch Smoke Cr, Lower, and tribs	Nutrients
Essex	Lake Champlain, Main Lake, South	Nutrients
Essex	Lake Champlain, South Lake	Nutrients
Essex	Willsboro Bay	Nutrients
Genesee	Bigelow Creek and tribs	Nutrients
Genesee	Black Creek, Middle, and minor tribs	Nutrients
Genesee	Black Creek, Upper, and minor tribs	Nutrients
Genesee	Bowen Brook and tribs	Nutrients
Genesee	LeRoy Reservoir	Nutrients
Genesee	Oak Orchard Cr, Upper, and tribs	Nutrients
Genesee	Tonawanda Creek, Middle, Main Stem	Nutrients
Greene	Schoharie Reservoir	Silt/Sediment
Greene	Sleepy Hollow Lake	Silt/Sediment
Herkimer	Steele Creek tribs	Silt/Sediment
Herkimer	Steele Creek tribs	Nutrients
Jefferson	Moon Lake	Nutrients
Kings	Hendrix Creek	Nutrients
Kings	Prospect Park Lake	Nutrients
Lewis	Mill Creek/South Branch, and tribs	Nutrients
Livingston	Christie Creek and tribs	Nutrients
Livingston	Conesus Lake	Nutrients
Livingston	Mill Creek and minor tribs	Silt/Sediment
Monroe	Black Creek, Lower, and minor tribs	Nutrients
Monroe	Buck Pond	Nutrients
Monroe	Cranberry Pond	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Monroe	Lake Ontario Shoreline, Western	Nutrients
Monroe	Long Pond	Nutrients
Monroe	Mill Creek and tribs	Nutrients
Monroe	Mill Creek/Blue Pond Outlet and tribs	Nutrients
Monroe	Minor Tribs to Irondequoit Bay	Nutrients
Monroe	Rochester Embayment - East	Nutrients
Monroe	Rochester Embayment - West	Nutrients
Monroe	Shipbuilders Creek and tribs	Nutrients
Monroe	Thomas Creek/White Brook and tribs	Nutrients
Nassau	Beaver Lake	Nutrients
Nassau	Camaans Pond	Nutrients
Nassau	East Meadow Brook, Upper, and tribs	Silt/Sediment
Nassau	East Rockaway Channel	Nutrients
Nassau	Grant Park Pond	Nutrients
Nassau	Hempstead Bay	Nutrients
Nassau	Hempstead Lake	Nutrients
Nassau	Hewlett Bay	Nutrients
Nassau	Hog Island Channel	Nutrients
Nassau	Long Island Sound, Nassau County Waters	Nutrients
Nassau	Massapequa Creek and tribs	Nutrients
Nassau	Milburn/Parsonage Creeks, Upp, and tribs	Nutrients
Nassau	Reynolds Channel, west	Nutrients
Nassau	Tidal Tribs to Hempstead Bay	Nutrients
Nassau	Tribs (fresh) to East Bay	Nutrients
Nassau	Tribs (fresh) to East Bay	Silt/Sediment
Nassau	Tribs to Smith/Halls Ponds	Nutrients
Nassau	Woodmere Channel	Nutrients
New York	Harlem Meer	Nutrients
New York	The Lake in Central Park	Nutrients
Niagara	Bergholtz Creek and tribs	Nutrients
Niagara	Hyde Park Lake	Nutrients
Niagara	Lake Ontario Shoreline, Western	Nutrients
Niagara	Lake Ontario Shoreline, Western	Nutrients
Oneida	Ballou, Nail Creeks and tribs	Nutrients
Onondaga	Harbor Brook, Lower, and tribs	Nutrients
Onondaga	Ley Creek and tribs	Nutrients
Onondaga	Minor Tribs to Onondaga Lake	Nutrients
Onondaga	Ninemile Creek, Lower, and tribs	Nutrients
Onondaga	Onondaga Creek, Lower, and tribs	Nutrients
Onondaga	Onondaga Creek, Middle, and tribs	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Onondaga	Onondaga Lake, northern end	Nutrients
Onondaga	Onondaga Lake, southern end	Nutrients
Ontario	Great Brook and minor tribs	Silt/Sediment
Ontario	Great Brook and minor tribs	Nutrients
Ontario	Hemlock Lake Outlet and minor tribs	Nutrients
Ontario	Honeoye Lake	Nutrients
Orange	Greenwood Lake	Nutrients
Orange	Monhagen Brook and tribs	Nutrients
Orange	Orange Lake	Nutrients
Orleans	Lake Ontario Shoreline, Western	Nutrients
Orleans	Lake Ontario Shoreline, Western	Nutrients
Oswego	Lake Neatahwanta	Nutrients
Oswego	Pleasant Lake	Nutrients
Putnam	Bog Brook Reservoir	Nutrients
Putnam	Boyd Corners Reservoir	Nutrients
Putnam	Croton Falls Reservoir	Nutrients
Putnam	Diverting Reservoir	Nutrients
Putnam	East Branch Reservoir	Nutrients
Putnam	Lake Carmel	Nutrients
Putnam	Middle Branch Reservoir	Nutrients
Putnam	Oscawana Lake	Nutrients
Putnam	Palmer Lake	Nutrients
Putnam	West Branch Reservoir	Nutrients
Queens	Bergen Basin	Nutrients
Queens	Flushing Creek/Bay	Nutrients
Queens	Jamaica Bay, Eastern, and tribs (Queens)	Nutrients
Queens	Kissena Lake	Nutrients
Queens	Meadow Lake	Nutrients
Queens	Willow Lake	Nutrients
Rensselaer	Nassau Lake	Nutrients
Rensselaer	Snyders Lake	Nutrients
Richmond	Grasmere Lake/Bradys Pond	Nutrients
Rockland	Congers Lake, Swartout Lake	Nutrients
Rockland	Rockland Lake	Nutrients
Saratoga	Ballston Lake	Nutrients
Saratoga	Dwaas Kill and tribs	Silt/Sediment
Saratoga	Dwaas Kill and tribs	Nutrients
Saratoga	Lake Lonely	Nutrients
Saratoga	Round Lake	Nutrients
Saratoga	Tribs to Lake Lonely	Nutrients

303(d) Segments Impaired by Construction Related Pollutant(s)

Schenectady	Collins Lake	Nutrients
Schenectady	Duane Lake	Nutrients
Schenectady	Mariaville Lake	Nutrients
Schoharie	Engleville Pond	Nutrients
Schoharie	Summit Lake	Nutrients
Seneca	Reeder Creek and tribs	Nutrients
St.Lawrence	Black Lake Outlet/Black Lake	Nutrients
St.Lawrence	Fish Creek and minor tribs	Nutrients
Steuben	Smith Pond	Nutrients
Suffolk	Agawam Lake	Nutrients
Suffolk	Big/Little Fresh Ponds	Nutrients
Suffolk	Canaan Lake	Silt/Sediment
Suffolk	Canaan Lake	Nutrients
Suffolk	Flanders Bay, West/Lower Sawmill Creek	Nutrients
Suffolk	Fresh Pond	Nutrients
Suffolk	Great South Bay, East	Nutrients
Suffolk	Great South Bay, Middle	Nutrients
Suffolk	Great South Bay, West	Nutrients
Suffolk	Lake Ronkonkoma	Nutrients
Suffolk	Long Island Sound, Suffolk County, West	Nutrients
Suffolk	Mattituck (Marratooka) Pond	Nutrients
Suffolk	Meetinghouse/Terrys Creeks and tribs	Nutrients
Suffolk	Mill and Seven Ponds	Nutrients
Suffolk	Millers Pond	Nutrients
Suffolk	Moriches Bay, East	Nutrients
Suffolk	Moriches Bay, West	Nutrients
Suffolk	Peconic River, Lower, and tidal tribs	Nutrients
Suffolk	Quantuck Bay	Nutrients
Suffolk	Shinnecock Bay and Inlet	Nutrients
Suffolk	Tidal tribs to West Moriches Bay	Nutrients
Sullivan	Bodine, Montgomery Lakes	Nutrients
Sullivan	Davies Lake	Nutrients
Sullivan	Evens Lake	Nutrients
Sullivan	Pleasure Lake	Nutrients
Tompkins	Cayuga Lake, Southern End	Nutrients
Tompkins	Cayuga Lake, Southern End	Silt/Sediment
Tompkins	Owasco Inlet, Upper, and tribs	Nutrients
Ulster	Ashokan Reservoir	Silt/Sediment
Ulster	Esopus Creek, Upper, and minor tribs	Silt/Sediment
Warren	Hague Brook and tribs	Silt/Sediment

303(d) Segments Impaired by Construction Related Pollutant(s)

Warren	Huddle/Finkle Brooks and tribs	Silt/Sediment
Warren	Indian Brook and tribs	Silt/Sediment
Warren	Lake George	Silt/Sediment
Warren	Tribs to L.George, Village of L George	Silt/Sediment
Washington	Cossayuna Lake	Nutrients
Washington	Lake Champlain, South Bay	Nutrients
Washington	Tribs to L.George, East Shore	Silt/Sediment
Washington	Wood Cr/Champlain Canal and minor tribs	Nutrients
Wayne	Port Bay	Nutrients
Westchester	Amawalk Reservoir	Nutrients
Westchester	Blind Brook, Upper, and tribs	Silt/Sediment
Westchester	Cross River Reservoir	Nutrients
Westchester	Lake Katonah	Nutrients
Westchester	Lake Lincolndale	Nutrients
Westchester	Lake Meahagh	Nutrients
Westchester	Lake Mohegan	Nutrients
Westchester	Lake Shenorock	Nutrients
Westchester	Long Island Sound, Westchester (East)	Nutrients
Westchester	Mamaroneck River, Lower	Silt/Sediment
Westchester	Mamaroneck River, Upper, and minor tribs	Silt/Sediment
Westchester	Muscoot/Upper New Croton Reservoir	Nutrients
Westchester	New Croton Reservoir	Nutrients
Westchester	Peach Lake	Nutrients
Westchester	Reservoir No.1 (Lake Isle)	Nutrients
Westchester	Saw Mill River, Lower, and tribs	Nutrients
Westchester	Saw Mill River, Middle, and tribs	Nutrients
Westchester	Sheldrake River and tribs	Silt/Sediment
Westchester	Sheldrake River and tribs	Nutrients
Westchester	Silver Lake	Nutrients
Westchester	Teatown Lake	Nutrients
Westchester	Titicus Reservoir	Nutrients
Westchester	Truesdale Lake	Nutrients
Westchester	Wallace Pond	Nutrients
Wyoming	Java Lake	Nutrients
Wyoming	Silver Lake	Nutrients

APPENDIX F – List of NYS DEC Regional Offices

Region	Covering the following counties:	DIVISION OF ENVIRONMENTAL PERMITS (DEP) Permit Administrators	DIVISION OF WATER (DOW) Water (SPDES) Program
1	Nassau and Suffolk	50 Circle Road Stony Brook, Ny 11790 Tel. (631) 444-0365	50 Circle Road Stony Brook, Ny 11790-3409 Tel. (631) 444-0405
2	Bronx, Kings, New York, Queens and Richmond	1 Hunters Point Plaza, 47-40 21st St. Long Island City, Ny 11101-5407 Tel. (718) 482-4997	1 Hunters Point Plaza, 47-40 21st St. Long Island City, Ny 11101-5407 Tel. (718) 482-4933
3	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster and Westchester	21 South Putt Corners Road New Paltz, Ny 12561-1696 Tel. (845) 256-3059	100 Hillside Avenue, Suite 1w White Plains, Ny 10603 Tel. (914) 428 - 2505
4	Albany, Columbia, Delaware, Greene, Montgomery, Otsego, Rensselaer, Schenectady and Schoharie	1150 North Westcott Road Schenectady, Ny 12306-2014 Tel. (518) 357-2069	1130 North Westcott Road Schenectady, Ny 12306-2014 Tel. (518) 357-2045
5	Clinton, Essex, Franklin, Fulton, Hamilton, Saratoga, Warren and Washington	1115 State Route 86, Po Box 296 Ray Brook, Ny 12977-0296 Tel. (518) 897-1234	232 Golf Course Road Warrensburg, Ny 12885-1172 Tel. (518) 623-1200
6	HERKIMER, JEFFERSON, LEWIS, ONEIDA AND ST. LAWRENCE	STATE OFFICE BUILDING 317 WASHINGTON STREET WATERTOWN, NY 13601-3787 TEL. (315) 785-2245	STATE OFFICE BUILDING 207 GENESEE STREET UTICA, NY 13501-2885 TEL. (315) 793-2554
7	BROOME, CAYUGA, CHENANGO, CORTLAND, MADISON, ONONDAGA, OSWEGO, TIOGA AND TOMPKINS	615 ERIE BLVD. WEST SYRACUSE, NY 13204-2400 TEL. (315) 426-7438	615 ERIE BLVD. WEST SYRACUSE, NY 13204-2400 TEL. (315) 426-7500
8	CHEMUNG, GENESEE, LIVINGSTON, MONROE, ONTARIO, ORLEANS, SCHUYLER, SENECA, STEUBEN, WAYNE AND YATES	6274 EAST AVON-LIMA ROADAVON, NY 14414-9519 TEL. (585) 226-2466	6274 EAST AVON-LIMA RD. AVON, NY 14414-9519 TEL. (585) 226-2466
9	ALLEGANY, CATTARAUGUS, CHAUTAUQUA, ERIE, NIAGARA AND WYOMING	270 MICHIGAN AVENUE BUFFALO, NY 14203-2999 TEL. (716) 851-7165	270 MICHIGAN AVENUE BUFFALO, NY 14203-2999 TEL. (716) 851-7070

APPENDIX B-1

NOTICE OF INTENT (NOI)

FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE SPDES GENERAL PERMIT

0644089821

NOTICE OF INTENT

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505

NYR (for DEC use only)

Stormwater Discharges Associated with Construction Activity Under State Pollutant Discharge Elimination System (SPDES) General Permit # GP-0-20-001

All sections must be completed unless otherwise noted. Failure to complete all items may result in this form being returned to you, thereby delaying your coverage under this General Permit. Applicants must read and understand the conditions of the permit and prepare a Stormwater Pollution Prevention Plan prior to submitting this NOI. Applicants are responsible for identifying and obtaining other DEC permits that may be required.

-IMPORTANT-
RETURN THIS FORM TO THE ADDRESS ABOVE
OWNER/OPERATOR MUST SIGN FORM

Owner/Operator Information

Owner/Operator (Company Name/Private Owner Name/Municipality Name)
LIFE CHURCH

Owner/Operator Contact Person Last Name (NOT CONSULTANT)
SPERREY

Owner/Operator Contact Person First Name
LOREN

Owner/Operator Mailing Address
4928 SENECA STREET

City
WEST SENECA

State
NY

Zip
14224 -

Phone (Owner/Operator)
716 - 984 - 2393

Fax (Owner/Operator)
 - -

Email (Owner/Operator)
LOREN@LIFECHURCHBUFFALO.COM

FED TAX ID
20 - 5755015 (not required for individuals)

6401089828

Project Site Information

Project/Site Name
LIFE CHURCH -NEW GATHERING/WORSHIP SPACE

Street Address (NOT P.O. BOX)
4928 SENECA STREET

Side of Street
● **North** ○ **South** ○ **East** ○ **West**

City/Town/Village (THAT ISSUES BUILDING PERMIT)
TOWN OF WEST SENECA

State	Zip	County	DEC Region
NY	14224 -	ERIE	9

Name of Nearest Cross Street
LEYDECKER ROAD

Distance to Nearest Cross Street (Feet)
600

Project In Relation to Cross Street
○ **North** ○ **South** ○ **East** ● **West**

Tax Map Numbers
Section-Block-Parcel
135.19-1-36

Tax Map Numbers

1. Provide the Geographic Coordinates for the project site. To do this, go to the NYSDEC Stormwater Interactive Map on the DEC website at:

https://gisservices.dec.ny.gov/gis/stormwater/

Zoom into your Project Location such that you can accurately click on the centroid of your site. Once you have located the centroid of your project site, go to the bottom right hand corner of the map for the X, Y coordinates. Enter the coordinates into the boxes below. For problems with the interactive map use the help function.

X Coordinates (Easting)	**Y Coordinates (Northing)**
-7 78722	42834
Ex. -73.749	**Ex. 42.652**

2. What is the nature of this construction project?

○ **New Construction**

● **Redevelopment with increase in impervious area**

○ **Redevelopment with no increase in impervious area**

3. Select the predominant land use for both pre and post development conditions.
SELECT ONLY ONE CHOICE FOR EACH

Pre-Development Existing Land Use

- ○ FOREST
- ○ PASTURE/OPEN LAND
- ○ CULTIVATED LAND
- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ● INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY
- ○ PARKING LOT
- ○ OTHER

Post-Development Future Land Use

- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION — Number of Lots
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ● INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ MUNICIPAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY (water, sewer, gas, etc.)
- ○ PARKING LOT
- ○ CLEARING/GRADING ONLY
- ○ DEMOLITION, NO REDEVELOPMENT
- ○ WELL DRILLING ACTIVITY *(Oil, Gas, etc.)
- ○ OTHER

***Note**: for gas well drilling, non-high volume hydraulic fractured wells only

4. In accordance with the larger common plan of development or sale, enter the total project site area; the total area to be disturbed; existing impervious area to be disturbed (for redevelopment activities); and the future impervious area constructed within the disturbed area. (Round to the nearest tenth of an acre.)

Total Site Area	Total Area To Be Disturbed	Existing Impervious Area To Be Disturbed	Future Impervious Area Within Disturbed Area
8.4	4.6	1.0	2.0

5. Do you plan to disturb more than 5 acres of soil at any one time? ○ **Yes** ○ **No**

6. Indicate the percentage of each Hydrologic Soil Group(HSG) at the site.

A	B	C	D
%	%	%	100 %

7. Is this a phased project? ● **Yes** ○ **No**

8. Enter the planned start and end dates of the disturbance activities.

Start Date 08/01/2020 - **End Date** 08/01/2021

9. Identify the nearest surface waterbody(ies) to which construction site runoff will discharge.

Name

CAZENOVIA CREEK

9a. Type of waterbody identified in Question 9?

- ○ Wetland / State Jurisdiction On Site (Answer 9b)
- ○ Wetland / State Jurisdiction Off Site
- ○ Wetland / Federal Jurisdiction On Site (Answer 9b)
- ○ Wetland / Federal Jurisdiction Off Site
- ○ Stream / Creek On Site
- ● Stream / Creek Off Site
- ○ River On Site
- ○ River Off Site
- ○ Lake On Site
- ○ Lake Off Site
- ○ Other Type On Site
- ○ Other Type Off Site

9b. How was the wetland identified?

- ○ Regulatory Map
- ○ Delineated by Consultant
- ○ Delineated by Army Corps of Engineers
- ○ Other (identify)

10. Has the surface waterbody(ies) in question 9 been identified as a 303(d) segment in Appendix E of GP-0-20-001? ○ Yes ● No

11. Is this project located in one of the Watersheds identified in Appendix C of GP-0-20-001? ○ Yes ● No

12. Is the project located in one of the watershed areas associated with AA and AA-S classified waters? ○ Yes ● No
If no, skip question 13.

13. Does this construction activity disturb land with no existing impervious cover and where the Soil Slope Phase is identified as an E or F on the USDA Soil Survey? ○ Yes ● No
If Yes, what is the acreage to be disturbed?

14. Will the project disturb soils within a State regulated wetland or the protected 100 foot adjacent area? ○ Yes ● No

15. Does the site runoff enter a separate storm sewer system (including roadside drains, swales, ditches, culverts, etc)? ● Yes ○ No ○ Unknown

16. What is the name of the municipality/entity that owns the separate storm sewer system?

TOWN OF WEST SENECA

17. Does any runoff from the site enter a sewer classified as a Combined Sewer? ○ Yes ● No ○ Unknown

18. Will future use of this site be an agricultural property as defined by the NYS Agriculture and Markets Law? ○ Yes ● No

19. Is this property owned by a state authority, state agency, federal government or local government? ○ Yes ● No

20. Is this a remediation project being done under a Department approved work plan? (i.e. CERCLA, RCRA, Voluntary Cleanup Agreement, etc.) ○ Yes ● No

21. Has the required Erosion and Sediment Control component of the SWPPP been developed in conformance with the current NYS Standards and Specifications for Erosion and Sediment Control (aka Blue Book)? ● Yes ○ No

22. Does this construction activity require the development of a SWPPP that includes the post-construction stormwater management practice component (i.e. Runoff Reduction, Water Quality and Quantity Control practices/techniques)? **If No, skip questions 23 and 27-39.** ● Yes ○ No

23. Has the post-construction stormwater management practice component of the SWPPP been developed in conformance with the current NYS Stormwater Management Design Manual? ● Yes ○ No

24. The Stormwater Pollution Prevention Plan (SWPPP) was prepared by:

- ● **Professional Engineer (P.E.)**
- ○ **Soil and Water Conservation District (SWCD)**
- ○ **Registered Landscape Architect (R.L.A)**
- ○ **Certified Professional in Erosion and Sediment Control (CPESC)**
- ○ **Owner/Operator**
- ○ **Other**

SWPPP Preparer
C&S ENGINEERS, INC.

Contact Name (Last, Space, First)
UTZIG JASON

Mailing Address
141 ELM STREET, SUITE 100

City
BUFFALO

State
NY

Zip
14203-

Phone
716-955-3013

Fax
716-847-1454

Email
JUTZIG@CSCOS.COM

SWPPP Preparer Certification

I hereby certify that the Stormwater Pollution Prevention Plan (SWPPP) for this project has been prepared in accordance with the terms and conditions of the GP-0-20-001. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of this permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

First Name
JASON

MI
P

Last Name
UTZIG

Signature
Jason Utzig

Date
06/25/2020

25. Has a construction sequence schedule for the planned management practices been prepared? ○ Yes ○ No

26. Select **all** of the erosion and sediment control practices that will be employed on the project site:

Temporary Structural

- ○ Check Dams
- ○ Construction Road Stabilization
- ○ Dust Control
- ○ Earth Dike
- ○ Level Spreader
- ○ Perimeter Dike/Swale
- ○ Pipe Slope Drain
- ○ Portable Sediment Tank
- ○ Rock Dam
- ○ Sediment Basin
- ○ Sediment Traps
- ● Silt Fence
- ● Stabilized Construction Entrance
- ● Storm Drain Inlet Protection
- ○ Straw/Hay Bale Dike
- ○ Temporary Access Waterway Crossing
- ○ Temporary Stormdrain Diversion
- ○ Temporary Swale
- ○ Turbidity Curtain
- ○ Water bars

Biotechnical

- ○ Brush Matting
- ○ Wattling

Vegetative Measures

- ○ Brush Matting
- ○ Dune Stabilization
- ○ Grassed Waterway
- ● Mulching
- ○ Protecting Vegetation
- ○ Recreation Area Improvement
- ● Seeding
- ○ Sodding
- ○ Straw/Hay Bale Dike
- ○ Streambank Protection
- ○ Temporary Swale
- ● Topsoiling
- ○ Vegetating Waterways

Permanent Structural

- ○ Debris Basin
- ○ Diversion
- ○ Grade Stabilization Structure
- ○ Land Grading
- ○ Lined Waterway (Rock)
- ○ Paved Channel (Concrete)
- ○ Paved Flume
- ○ Retaining Wall
- ○ Riprap Slope Protection
- ● Rock Outlet Protection
- ○ Streambank Protection

Other

0182089828

Post-construction Stormwater Management Practice (SMP) Requirements

Important: Completion of Questions 27-39 is not required if response to Question 22 is No.

27. Identify all site planning practices that were used to prepare the final site plan/layout for the project.

- ● **Preservation of Undisturbed Areas**
- ○ **Preservation of Buffers**
- ● **Reduction of Clearing and Grading**
- ○ **Locating Development in Less Sensitive Areas**
- ○ **Roadway Reduction**
- ○ **Sidewalk Reduction**
- ○ **Driveway Reduction**
- ○ **Cul-de-sac Reduction**
- ○ **Building Footprint Reduction**
- ● **Parking Reduction**

27a. Indicate which of the following soil restoration criteria was used to address the requirements in Section 5.1.6("Soil Restoration") of the Design Manual (2010 version).

- ● All disturbed areas will be restored in accordance with the Soil Restoration requirements in Table 5.3 of the Design Manual (see page 5-22).
- ○ Compacted areas were considered as impervious cover when calculating the **WQv Required**, and the compacted areas were assigned a post-construction Hydrologic Soil Group (HSG) designation that is one level less permeable than existing conditions for the hydrology analysis.

28. Provide the total Water Quality Volume (WQv) required for this project (based on final site plan/layout).

Total WQv Required

0.179 **acre-feet**

29. Identify the RR techniques (Area Reduction), RR techniques(Volume Reduction) and Standard SMPs with RRv Capacity in Table 1 (See Page 9) that were used to reduce the Total WQv Required(#28).

Also, provide in Table 1 the total impervious area that contributes runoff to each technique/practice selected. For the Area Reduction Techniques, provide the total contributing area (includes pervious area) and, if applicable, the total impervious area that contributes runoff to the technique/practice.

Note: Redevelopment projects shall use Tables 1 and 2 to identify the SMPs used to treat and/or reduce the WQv required. If runoff reduction techniques will not be used to reduce the required WQv, skip to question 33a after identifying the SMPs.

Table 1 - Runoff Reduction (RR) Techniques and Standard Stormwater Management Practices (SMPs)

RR Techniques (Area Reduction)	Total Contributing Area (acres)		Total Contributing Impervious Area(acres)
○ Conservation of Natural Areas (RR-1)	.	and/or	.
○ Sheetflow to Riparian Buffers/Filters Strips (RR-2)	.	and/or	.
○ Tree Planting/Tree Pit (RR-3)	.	and/or	.
○ Disconnection of Rooftop Runoff (RR-4)	.	and/or	.

RR Techniques (Volume Reduction)	Total Contributing Impervious Area(acres)
○ Vegetated Swale (RR-5)	.
○ Rain Garden (RR-6)	.
○ Stormwater Planter (RR-7)	.
○ Rain Barrel/Cistern (RR-8)	.
○ Porous Pavement (RR-9)	.
○ Green Roof (RR-10)	.
Standard SMPs with RRv Capacity	
○ Infiltration Trench (I-1)	.
○ Infiltration Basin (I-2)	.
○ Dry Well (I-3)	.
○ Underground Infiltration System (I-4)	.
● Bioretention (F-5)	1.05
○ Dry Swale (O-1)	.
Standard SMPs	
○ Micropool Extended Detention (P-1)	.
○ Wet Pond (P-2)	.
○ Wet Extended Detention (P-3)	.
○ Multiple Pond System (P-4)	.
● Pocket Pond (P-5)	1.576
○ Surface Sand Filter (F-1)	.
○ Underground Sand Filter (F-2)	.
○ Perimeter Sand Filter (F-3)	.
○ Organic Filter (F-4)	.
○ Shallow Wetland (W-1)	.
○ Extended Detention Wetland (W-2)	.
○ Pond/Wetland System (W-3)	.
○ Pocket Wetland (W-4)	.
○ Wet Swale (O-2)	.

Table 2 - Alternative SMPs (DO NOT INCLUDE PRACTICES BEING USED FOR PRETREATMENT ONLY)

Alternative SMP		Total Contributing Impervious Area(acres)
●	Hydrodynamic	1.576
○	Wet Vault	.
○	Media Filter	.
○	Other	.

Provide the name and manufacturer of the Alternative SMPs (i.e. proprietary practice(s)) being used for WQv treatment.

Name: BARRACUDA S6

Manufacturer: BAYSAVER

Note: Redevelopment projects which do not use RR techniques, shall use questions 28, 29, 33 and 33a to provide SMPs used, total WQv required and total WQv provided for the project.

30. Indicate the Total RRv provided by the RR techniques (Area/Volume Reduction) and Standard SMPs with RRv capacity identified in question 29.

Total RRv provided

0.034 **acre-feet**

31. Is the Total RRv provided (#30) greater than or equal to the total WQv required (#28).

○ **Yes** ● **No**

If Yes, go to question 36.
If No, go to question 32.

32. Provide the Minimum RRv required based on HSG.
[Minimum RRv Required = (P)(0.95)(Ai)/12, Ai=(S)(Aic)]

Minimum RRv Required

0.032 **acre-feet**

32a. Is the Total RRv provided (#30) greater than or equal to the Minimum RRv Required (#32)?

● **Yes** ○ **No**

If Yes, go to question 33.
Note: Use the space provided in question #39 to summarize the specific site limitations and justification for not reducing 100% of WQv required (#28). A detailed evaluation of the specific site limitations and justification for not reducing 100% of the WQv required (#28) must also be included in the SWPPP.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

33. Identify the Standard SMPs in Table 1 and, if applicable, the Alternative SMPs in Table 2 that were used to treat the remaining total WQv(=Total WQv Required in 28 - Total RRv Provided in 30).

Also, provide in Table 1 and 2 the total impervious area that contributes runoff to each practice selected.

Note: Use Tables 1 and 2 to identify the SMPs used on Redevelopment projects.

33a. Indicate the Total WQv provided (i.e. WQv treated) by the SMPs identified in question #33 and Standard SMPs with RRv Capacity identified in question 29.

WQv Provided

0.432 **acre-feet**

Note: For the standard SMPs with RRv capacity, the WQv provided by each practice = the WQv calculated using the contributing drainage area to the practice - RRv provided by the practice. (See Table 3.5 in Design Manual)

34. Provide the sum of the Total RRv provided (#30) and the WQv provided (#33a). 0.466

35. Is the sum of the RRv provided (#30) and the WQv provided (#33a) greater than or equal to the total WQv required (#28)? ● **Yes** ○ **No**

If Yes, go to question 36.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

36. Provide the total Channel Protection Storage Volume (CPv) required and provided or select waiver (36a), if applicable.

REFER TO QUESTION #39

CPv Required		**CPv Provided**	
.	**acre-feet**	.	**acre-feet**

36a. The need to provide channel protection has been waived because:

○ Site discharges directly to tidal waters or a fifth order or larger stream.

○ Reduction of the total CPv is achieved on site through runoff reduction techniques or infiltration systems.

37. Provide the Overbank Flood (Qp) and Extreme Flood (Qf) control criteria or select waiver (37a), if applicable.

Total Overbank Flood Control Criteria (Qp)

Pre-Development		**Post-development**	
12.69	**CFS**	4.63	**CFS**

Total Extreme Flood Control Criteria (Qf)

Pre-Development		**Post-development**	
23.24	**CFS**	21.80	**CFS**

37a. The need to meet the Qp and Qf criteria has been waived because:

- ○ Site discharges directly to tidal waters or a fifth order or larger stream.
- ○ Downstream analysis reveals that the Qp and Qf controls are not required

38. Has a long term Operation and Maintenance Plan for the post-construction stormwater management practice(s) been developed?

● Yes ○ No

If Yes, Identify the entity responsible for the long term Operation and Maintenance

LIFE CHURCH

39. Use this space to summarize the specific site limitations and justification for not reducing 100% of WQv required(#28). (See question 32a) This space can also be used for other pertinent project information.

As this is a redevelopment project, the CPv requirement is relaxed. However, the peak discharge for the 1-yr, 24-hr rainfall event under proposed conditions has been limited to below the peak discharge for the 1-yr, 24-hr rainfall event under existing conditions.

40. Identify other DEC permits, existing and new, that are required for this project/facility.

- ○ Air Pollution Control
- ○ Coastal Erosion
- ○ Hazardous Waste
- ○ Long Island Wells
- ○ Mined Land Reclamation
- ○ Solid Waste
- ○ Navigable Waters Protection / Article 15
- ○ Water Quality Certificate
- ○ Dam Safety
- ○ Water Supply
- ○ Freshwater Wetlands/Article 24
- ○ Tidal Wetlands
- ○ Wild, Scenic and Recreational Rivers
- ○ Stream Bed or Bank Protection / Article 15
- ○ Endangered or Threatened Species(Incidental Take Permit)
- ○ Individual SPDES
- ○ SPDES Multi-Sector GP NYR
- ○ Other
- ● None

41. Does this project require a US Army Corps of Engineers Wetland Permit? ○ Yes ● No
If Yes, Indicate Size of Impact. .

42. Is this project subject to the requirements of a regulated, traditional land use control MS4? ● Yes ○ No
(If No, skip question 43)

43. Has the "MS4 SWPPP Acceptance" form been signed by the principal executive officer or ranking elected official and submitted along with this NOI? ● Yes ○ No

44. If this NOI is being submitted for the purpose of continuing or transferring coverage under a general permit for stormwater runoff from construction activities, please indicate the former SPDES number assigned. NYR

3547089826

Owner/Operator Certification

I have read or been advised of the permit conditions and believe that I understand them. I also understand that, under the terms of the permit, there may be reporting requirements. I hereby certify that this document and the corresponding documents were prepared under my direction or supervision. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further understand that coverage under the general permit will be identified in the acknowledgment that I will receive as a result of submitting this NOI and can be as long as sixty (60) business days as provided for in the general permit. I also understand that, by submitting this NOI, I am acknowledging that the SWPPP has been developed and will be implemented as the first element of construction, and agreeing to comply with all the terms and conditions of the general permit for which this NOI is being submitted.

Print First Name LOREN

MI

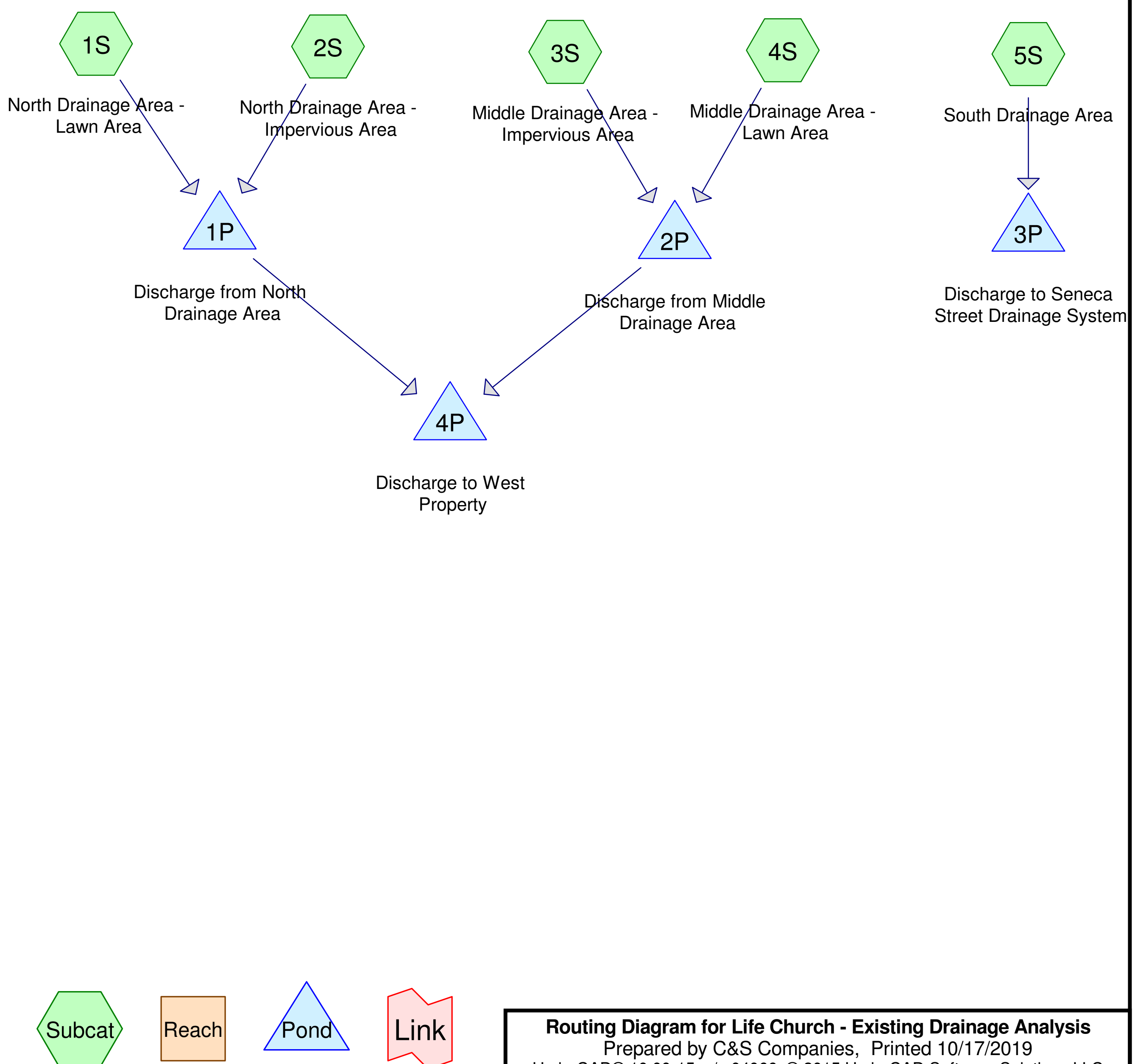
Print Last Name SPERREY

Owner/Operator Signature

Date 06/25/2020

APPENDIX C-1

DRAINAGE CALCULATIONS



Routing Diagram for Life Church - Existing Drainage Analysis
Prepared by C&S Companies, Printed 10/17/2019
HydroCAD® 10.00-15 s/n 04066 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.580	80	>75% Grass cover, Good, HSG D (1S, 4S, 5S)
2.520	98	Paved parking, HSG D (2S, 3S, 5S)
1.300	77	Woods, Good, HSG D (1S)
8.400	**85**	**TOTAL AREA**

Summary for Subcatchment 1S: North Drainage Area - Lawn Area

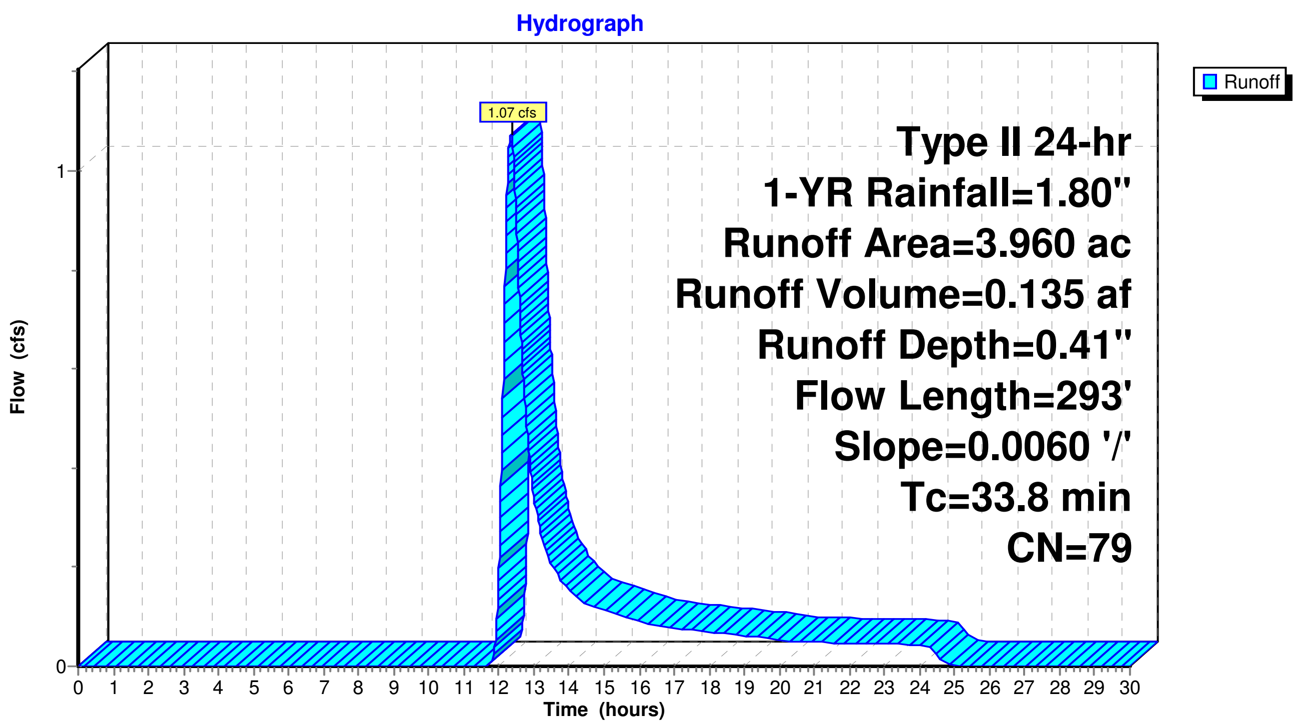
Runoff = 1.07 cfs @ 12.35 hrs, Volume= 0.135 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
2.660	80	>75% Grass cover, Good, HSG D
1.300	77	Woods, Good, HSG D
3.960	79	Weighted Average
3.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.9	100	0.0060	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
5.9	193	0.0060	0.54		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.8	293	Total			

Subcatchment 1S: North Drainage Area - Lawn Area



Summary for Subcatchment 2S: North Drainage Area - Impervious Area

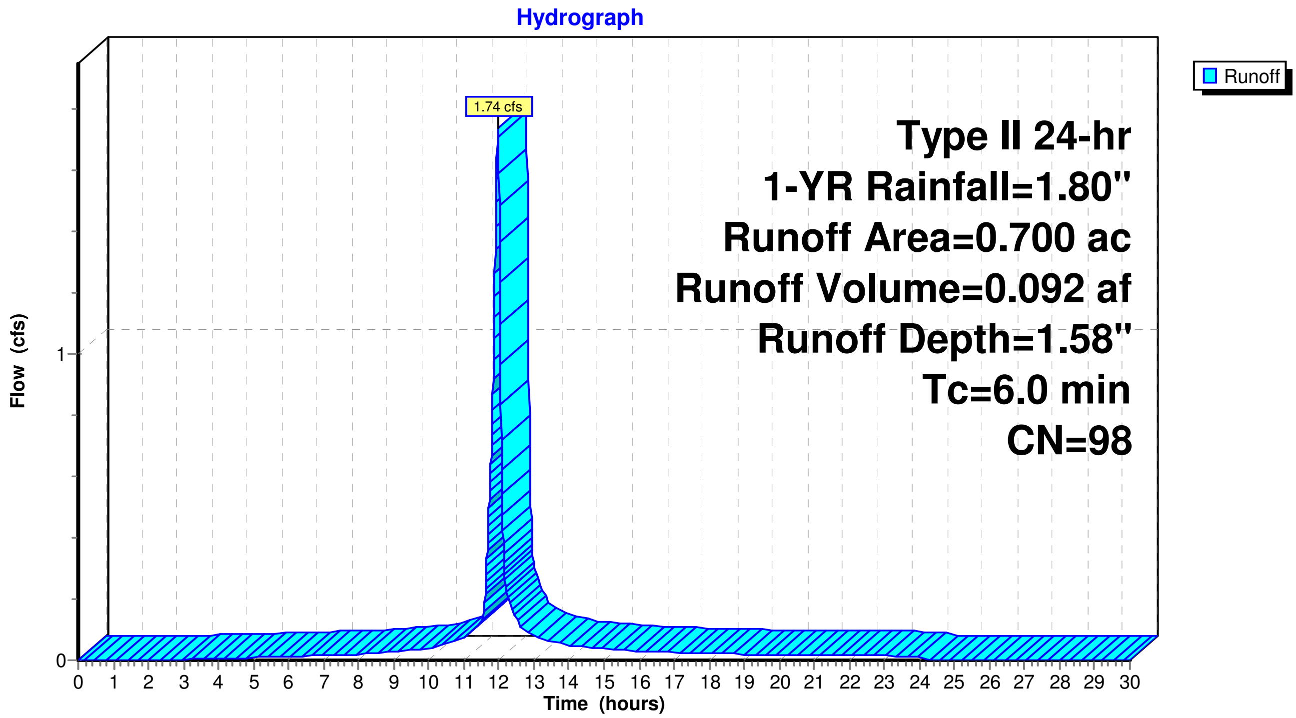
Runoff = 1.74 cfs @ 11.97 hrs, Volume= 0.092 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.700	98	Paved parking, HSG D
0.700		100.00% Impervious Area

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

Subcatchment 2S: North Drainage Area - Impervious Area



Summary for Subcatchment 3S: Middle Drainage Area - Impervious Area

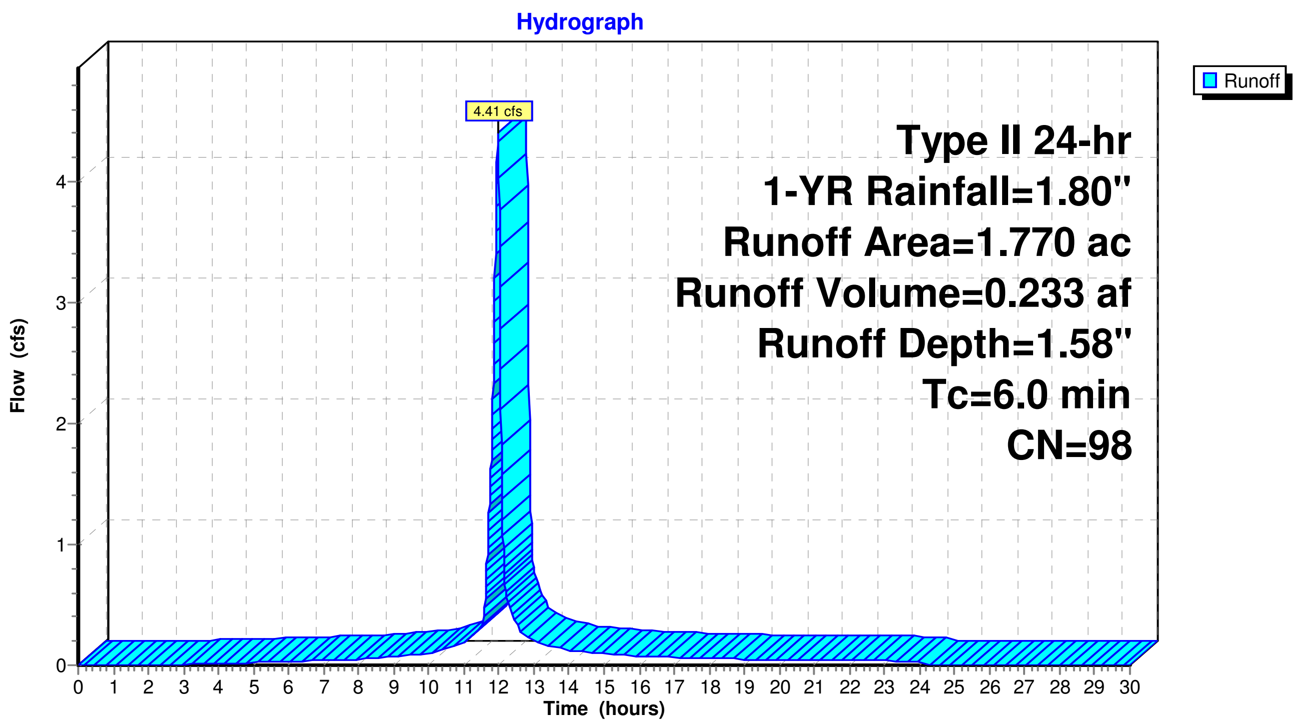
Runoff = 4.41 cfs @ 11.97 hrs, Volume= 0.233 af, Depth= 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
1.770	98	Paved parking, HSG D
1.770		100.00% Impervious Area

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

Subcatchment 3S: Middle Drainage Area - Impervious Area



Summary for Subcatchment 4S: Middle Drainage Area - Lawn Area

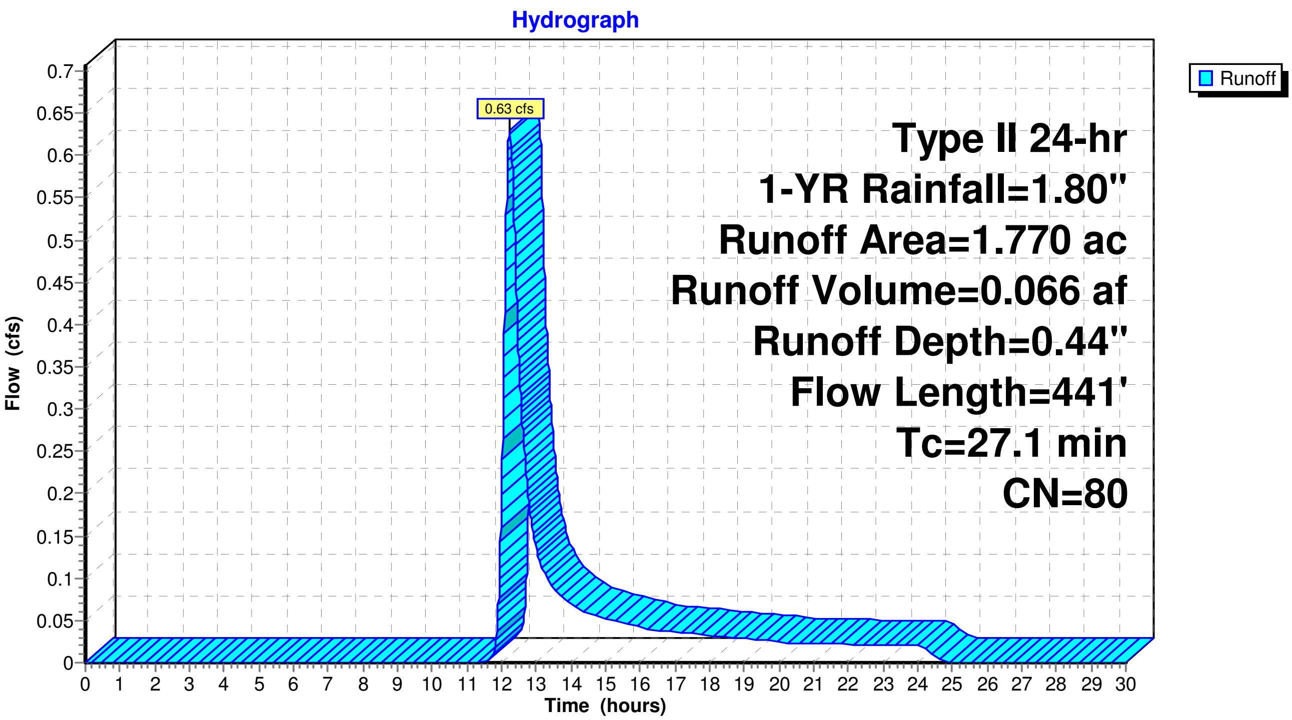
Runoff = 0.63 cfs @ 12.25 hrs, Volume= 0.066 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
1.770	80	>75% Grass cover, Good, HSG D
1.770		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.0140	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
1.5	73	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	121	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	79	0.0042	1.53	1.20	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.8	68	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
27.1	441	Total			

Subcatchment 4S: Middle Drainage Area - Lawn Area



Summary for Subcatchment 5S: South Drainage Area

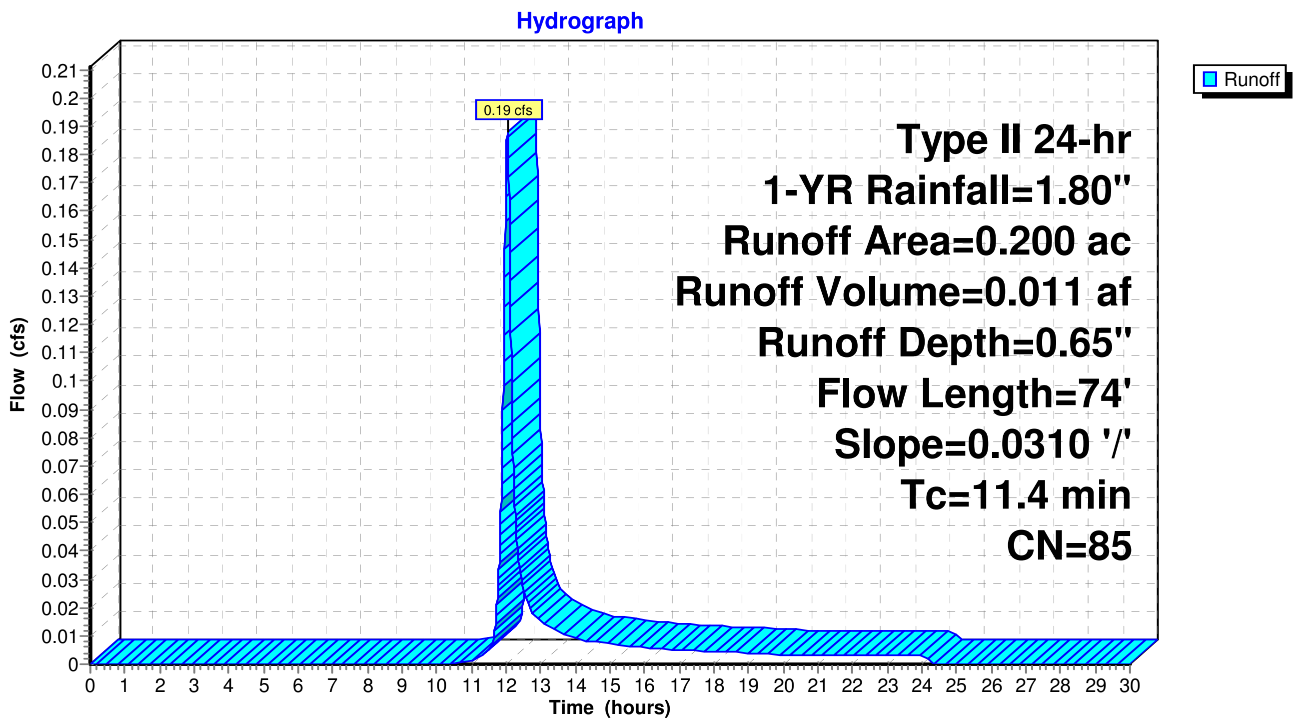
Runoff = 0.19 cfs @ 12.04 hrs, Volume= 0.011 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.050	98	Paved parking, HSG D
0.200	85	Weighted Average
0.150		75.00% Pervious Area
0.050		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	74	0.0310	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"

Subcatchment 5S: South Drainage Area



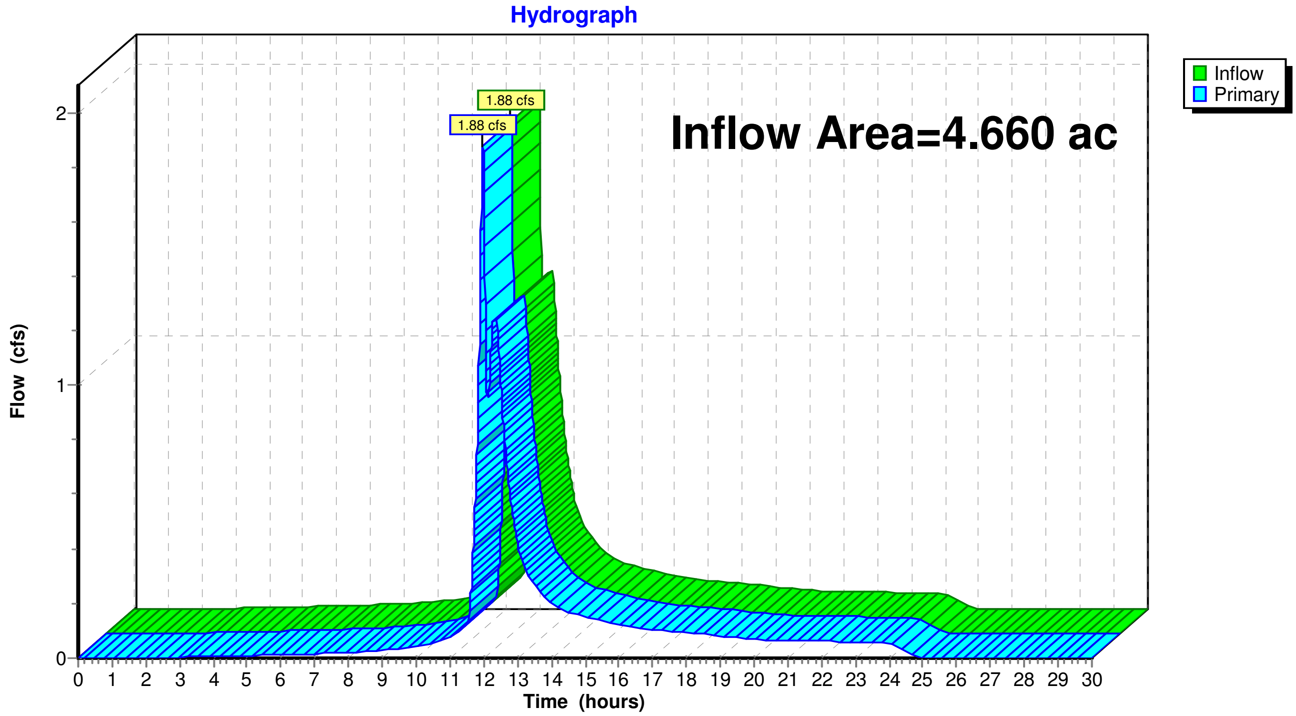
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 4.660 ac, 15.02% Impervious, Inflow Depth = 0.58" for 1-YR event
Inflow = 1.88 cfs @ 11.97 hrs, Volume= 0.227 af
Primary = 1.88 cfs @ 11.97 hrs, Volume= 0.227 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



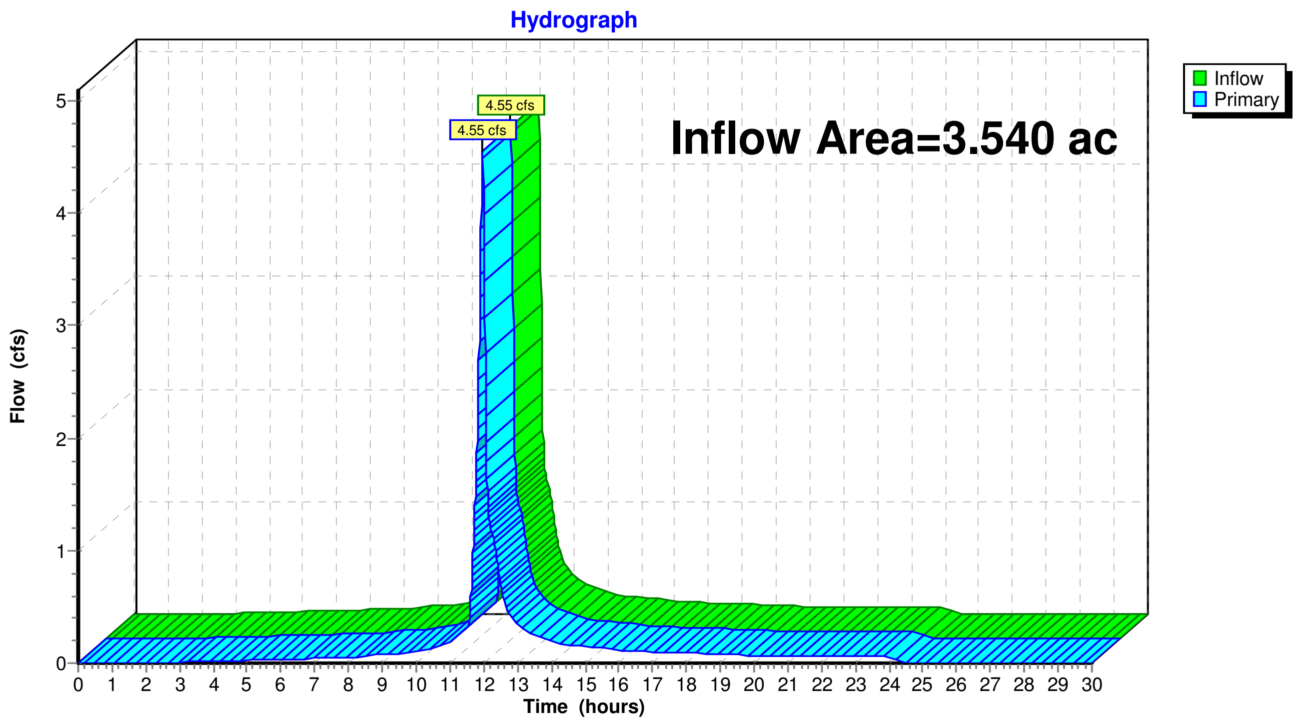
Summary for Pond 2P: Discharge from Middle Drainage Area

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

Inflow Area = 3.540 ac, 50.00% Impervious, Inflow Depth = 1.01" for 1-YR event
Inflow = 4.55 cfs @ 11.97 hrs, Volume= 0.298 af
Primary = 4.55 cfs @ 11.97 hrs, Volume= 0.298 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2

Pond 2P: Discharge from Middle Drainage Area



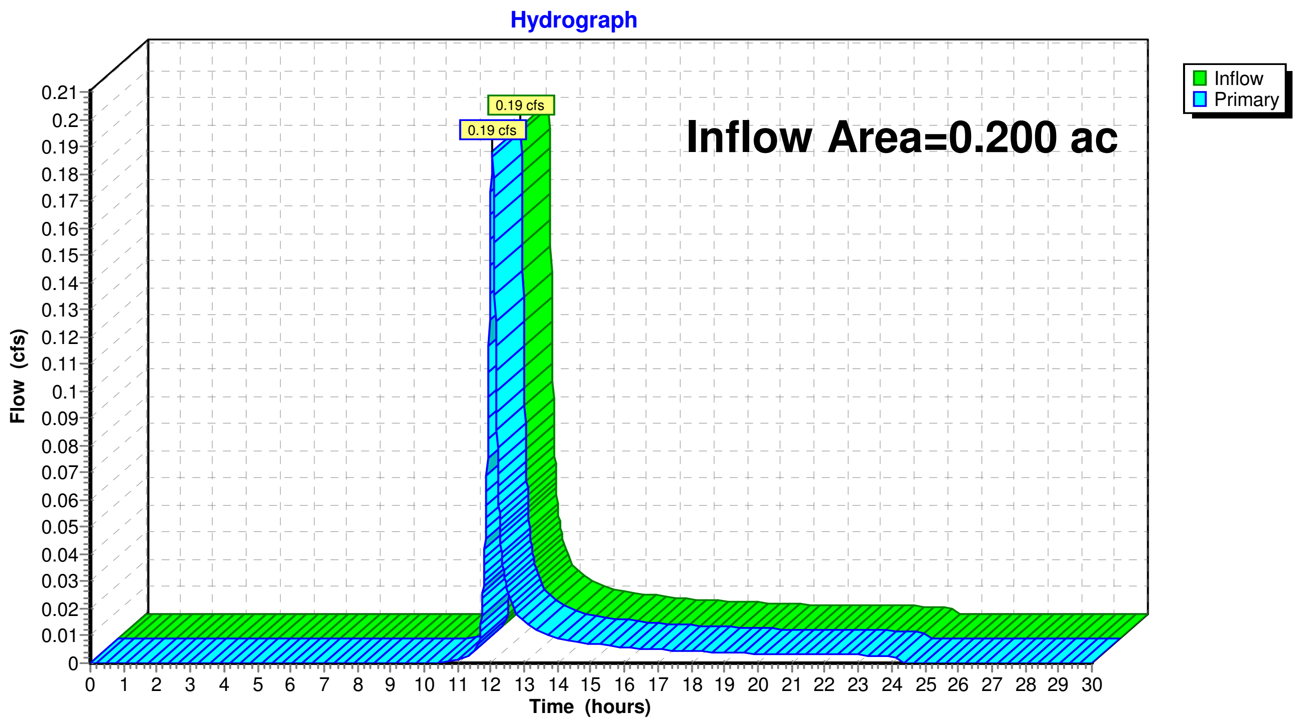
Summary for Pond 3P: Discharge to Seneca Street Drainage System

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

Inflow Area = 0.200 ac, 25.00% Impervious, Inflow Depth = 0.65" for 1-YR event
Inflow = 0.19 cfs @ 12.04 hrs, Volume= 0.011 af
Primary = 0.19 cfs @ 12.04 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Discharge to Seneca Street Drainage System



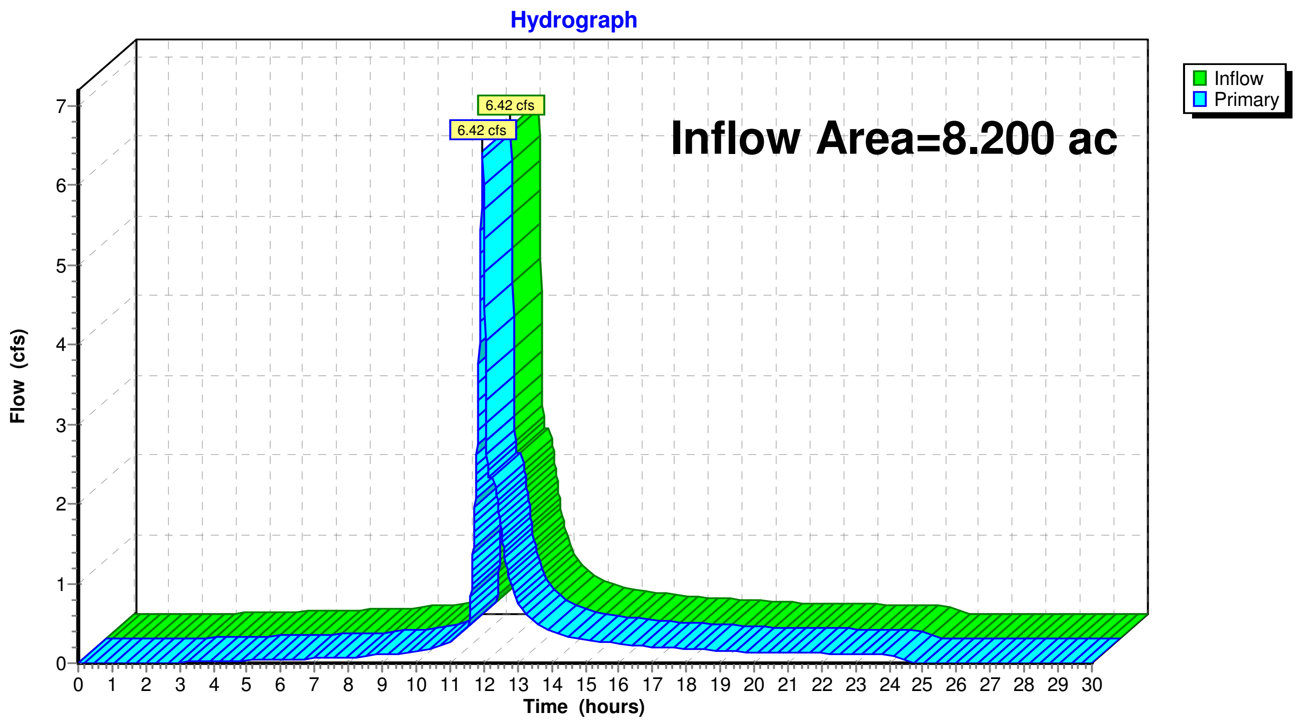
Summary for Pond 4P: Discharge to West Property

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

Inflow Area = 8.200 ac, 30.12% Impervious, Inflow Depth = 0.77" for 1-YR event
Inflow = 6.42 cfs @ 11.97 hrs, Volume= 0.525 af
Primary = 6.42 cfs @ 11.97 hrs, Volume= 0.525 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 4P: Discharge to West Property



Summary for Subcatchment 1S: North Drainage Area - Lawn Area

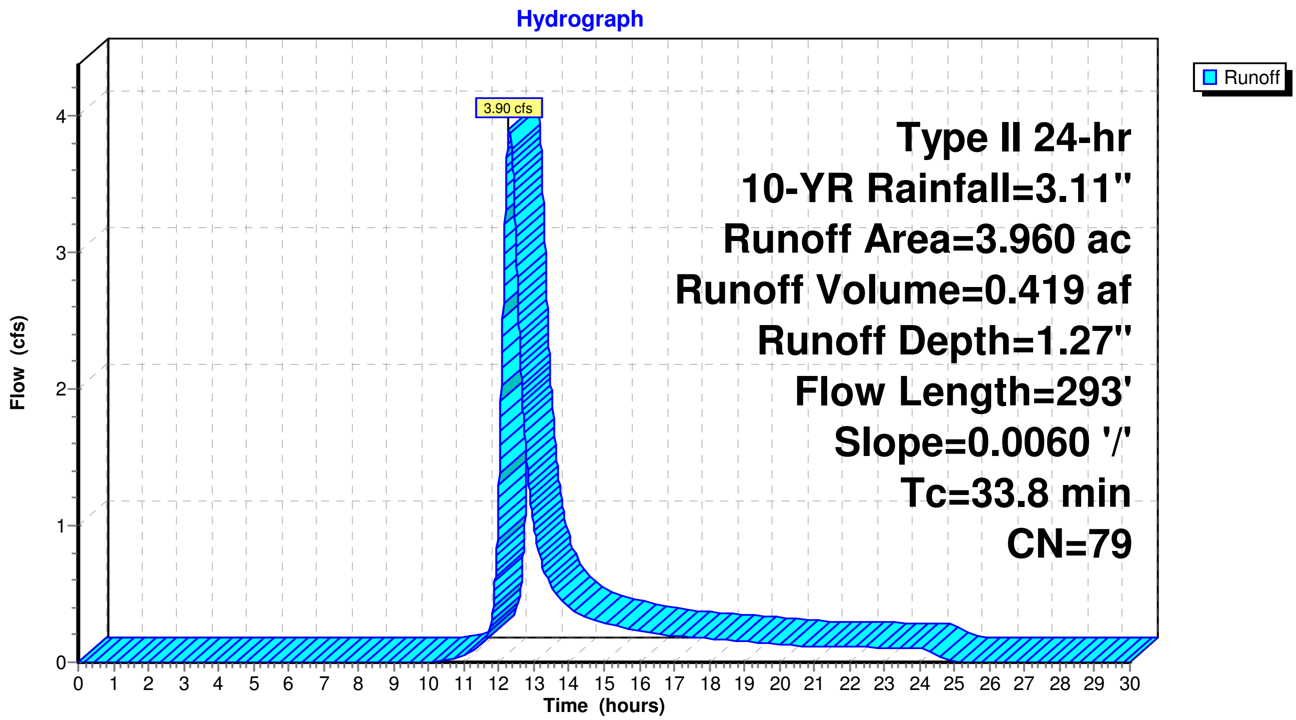
Runoff = 3.90 cfs @ 12.29 hrs, Volume= 0.419 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
2.660	80	>75% Grass cover, Good, HSG D
1.300	77	Woods, Good, HSG D
3.960	79	Weighted Average
3.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.9	100	0.0060	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
5.9	193	0.0060	0.54		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.8	293	Total			

Subcatchment 1S: North Drainage Area - Lawn Area



Summary for Subcatchment 2S: North Drainage Area - Impervious Area

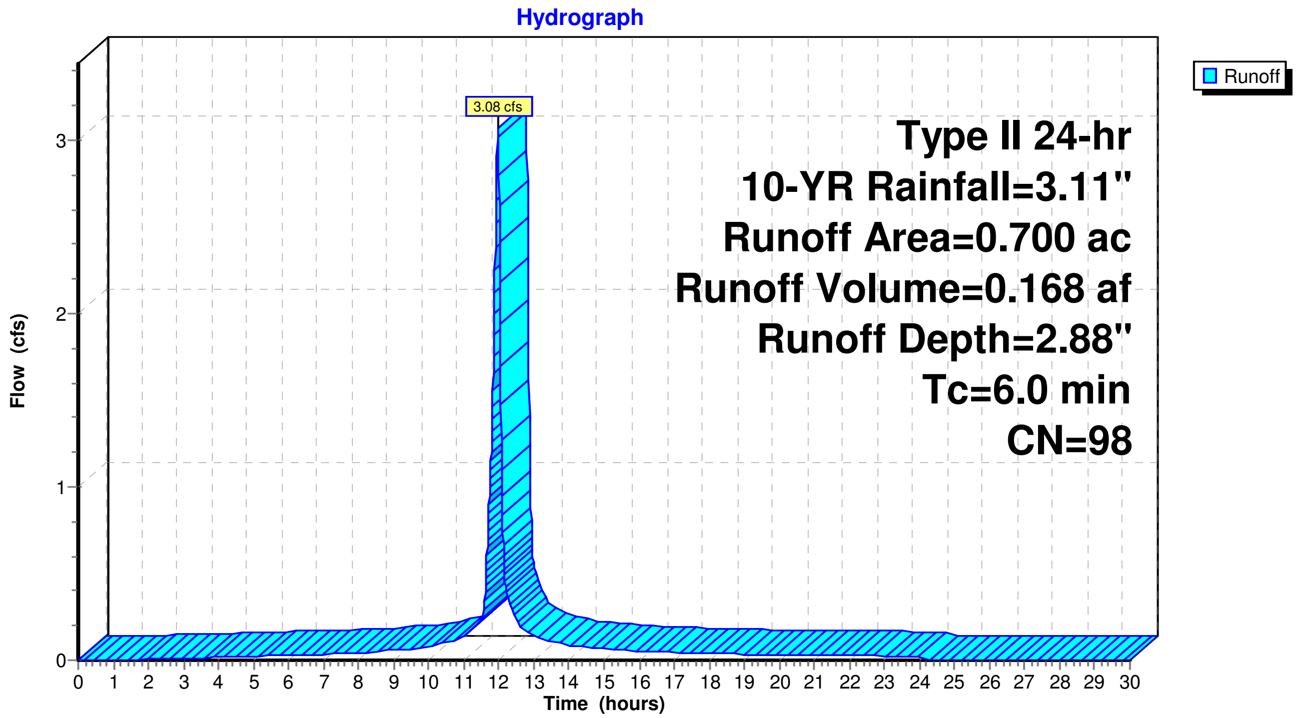
Runoff = 3.08 cfs @ 11.97 hrs, Volume= 0.168 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.700	98	Paved parking, HSG D
0.700		100.00% Impervious Area

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

Subcatchment 2S: North Drainage Area - Impervious Area



Summary for Subcatchment 3S: Middle Drainage Area - Impervious Area

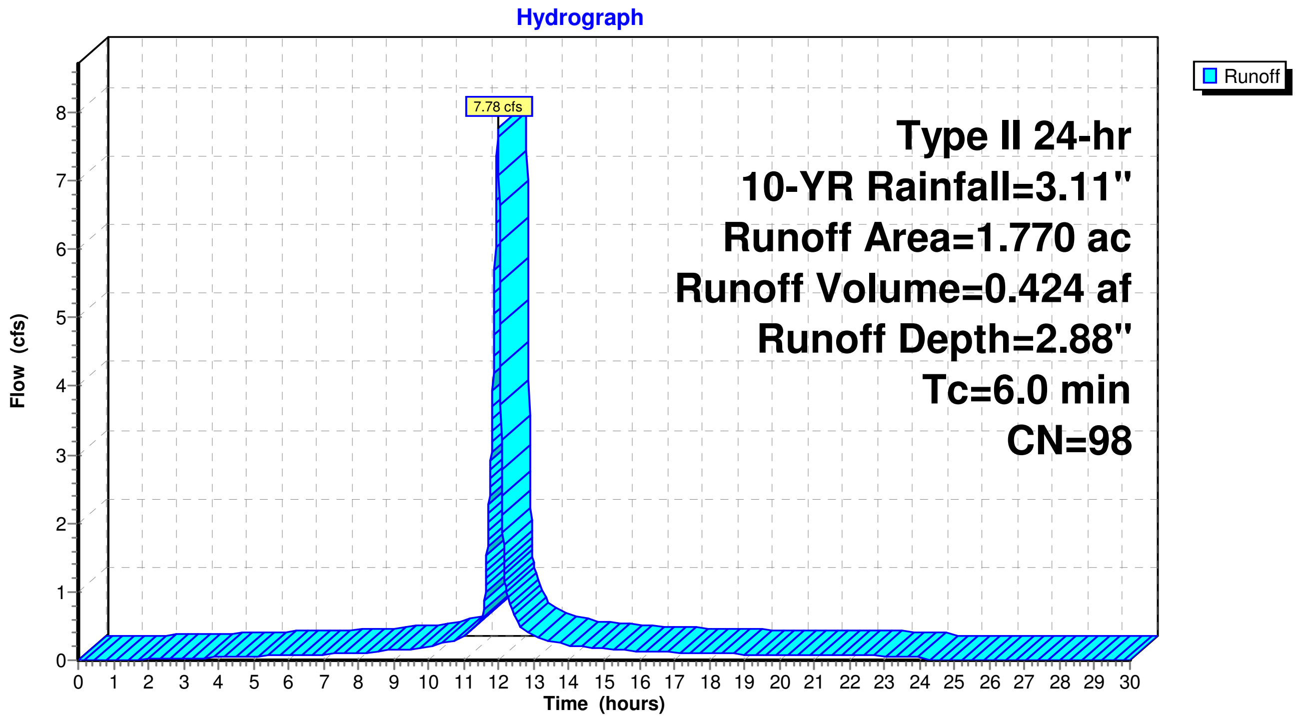
Runoff = 7.78 cfs @ 11.97 hrs, Volume= 0.424 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
1.770	98	Paved parking, HSG D
1.770		100.00% Impervious Area

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

Subcatchment 3S: Middle Drainage Area - Impervious Area



Summary for Subcatchment 4S: Middle Drainage Area - Lawn Area

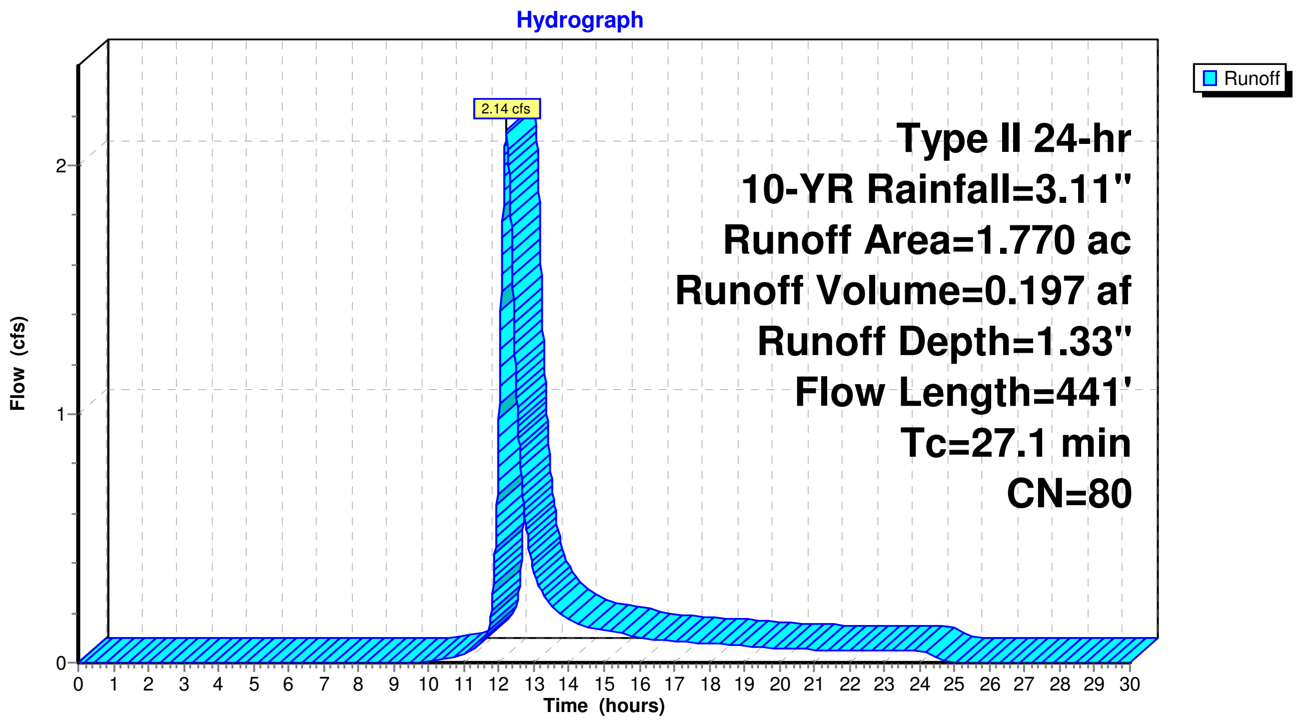
Runoff = 2.14 cfs @ 12.22 hrs, Volume= 0.197 af, Depth= 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
1.770	80	>75% Grass cover, Good, HSG D
1.770		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.0140	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
1.5	73	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	121	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	79	0.0042	1.53	1.20	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.8	68	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
27.1	441	Total			

Subcatchment 4S: Middle Drainage Area - Lawn Area



Summary for Subcatchment 5S: South Drainage Area

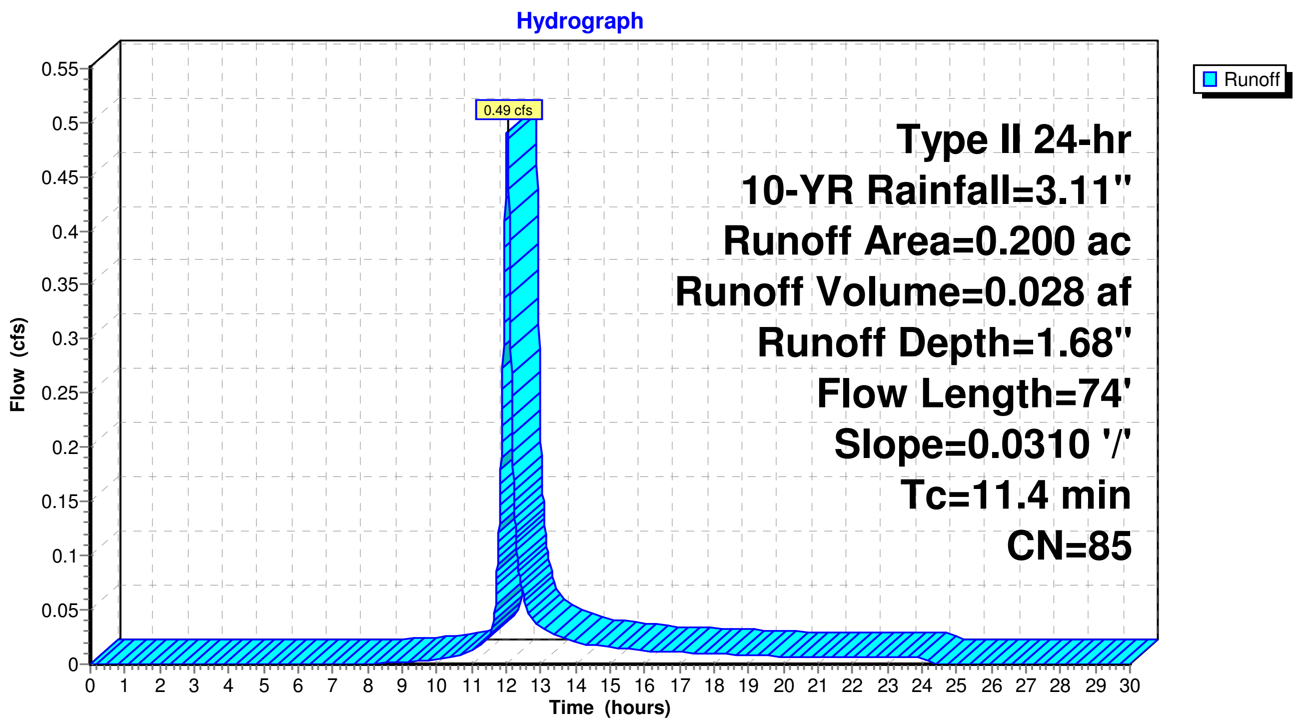
Runoff = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.050	98	Paved parking, HSG D
0.200	85	Weighted Average
0.150		75.00% Pervious Area
0.050		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	74	0.0310	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"

Subcatchment 5S: South Drainage Area



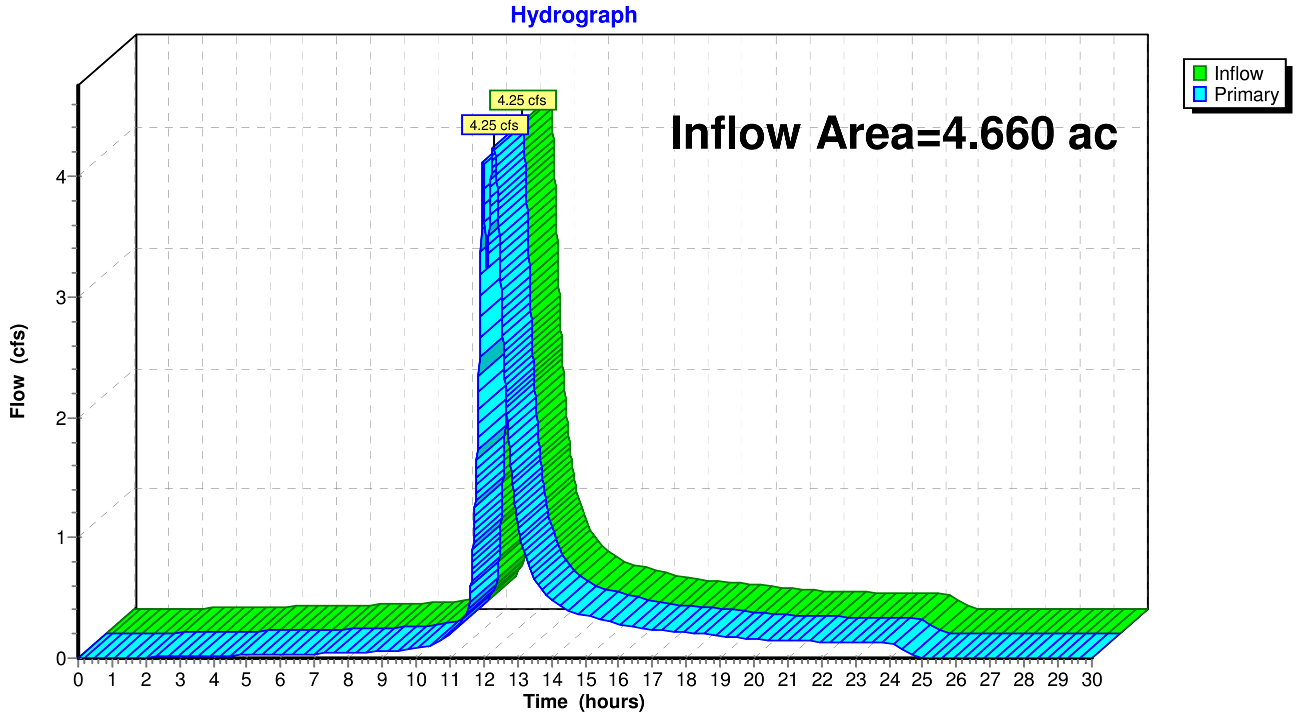
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area =	4.660 ac, 15.02% Impervious, Inflow Depth = 1.51" for 10-YR event			
Inflow =	4.25 cfs @	12.28 hrs, Volume=	0.587 af	
Primary =	4.25 cfs @	12.28 hrs, Volume=	0.587 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



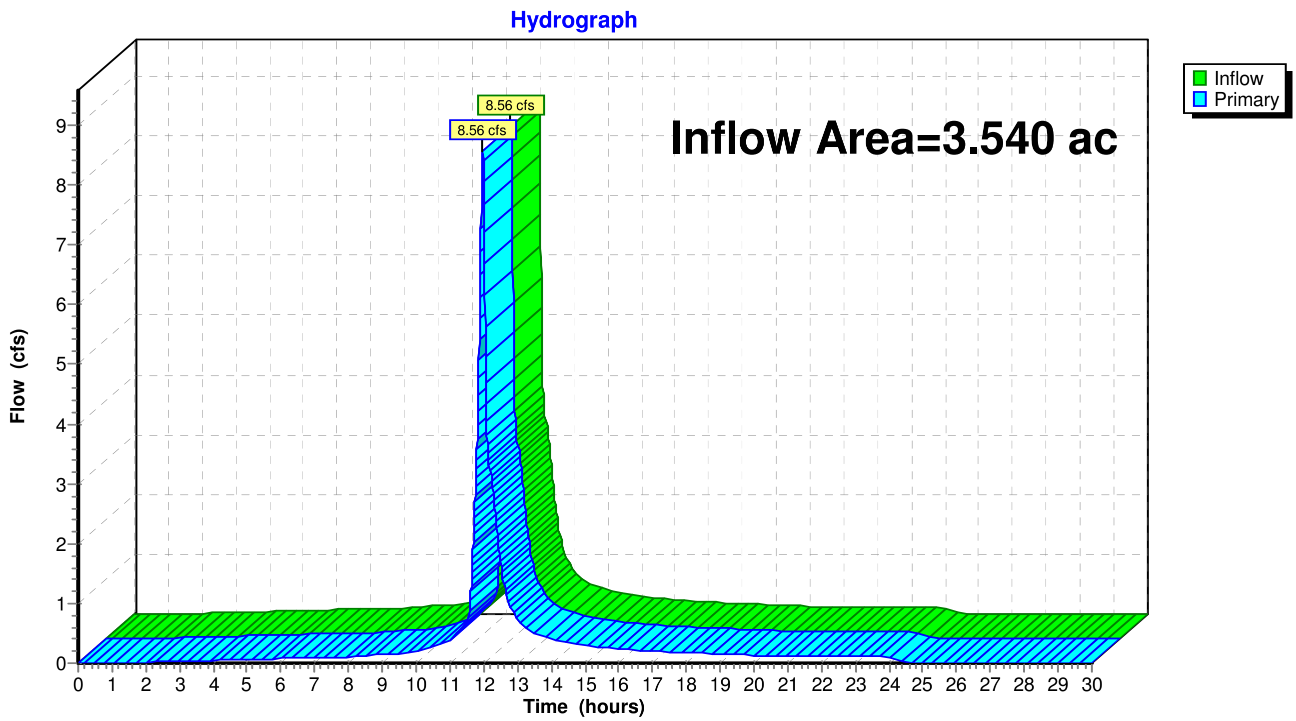
Summary for Pond 2P: Discharge from Middle Drainage Area

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

Inflow Area = 3.540 ac, 50.00% Impervious, Inflow Depth = 2.11" for 10-YR event
Inflow = 8.56 cfs @ 11.97 hrs, Volume= 0.621 af
Primary = 8.56 cfs @ 11.97 hrs, Volume= 0.621 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2

Pond 2P: Discharge from Middle Drainage Area



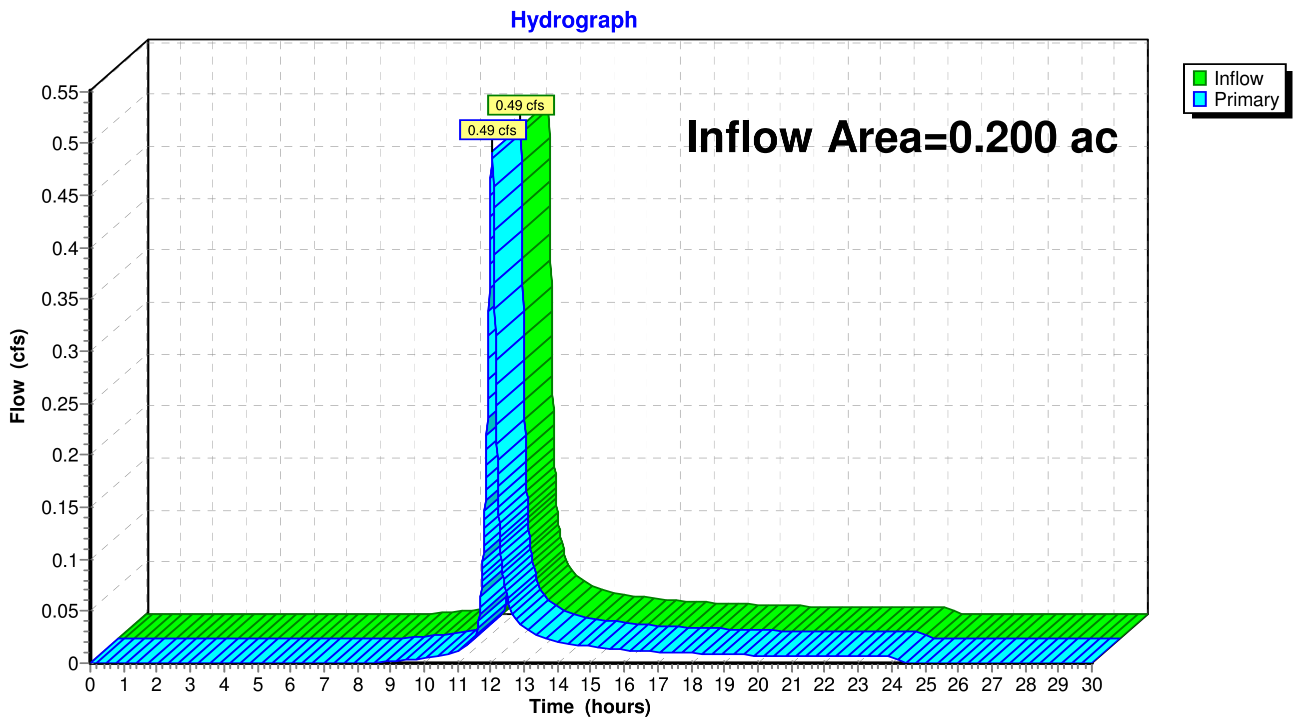
Summary for Pond 3P: Discharge to Seneca Street Drainage System

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

Inflow Area = 0.200 ac, 25.00% Impervious, Inflow Depth = 1.68" for 10-YR event
Inflow = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af
Primary = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Discharge to Seneca Street Drainage System



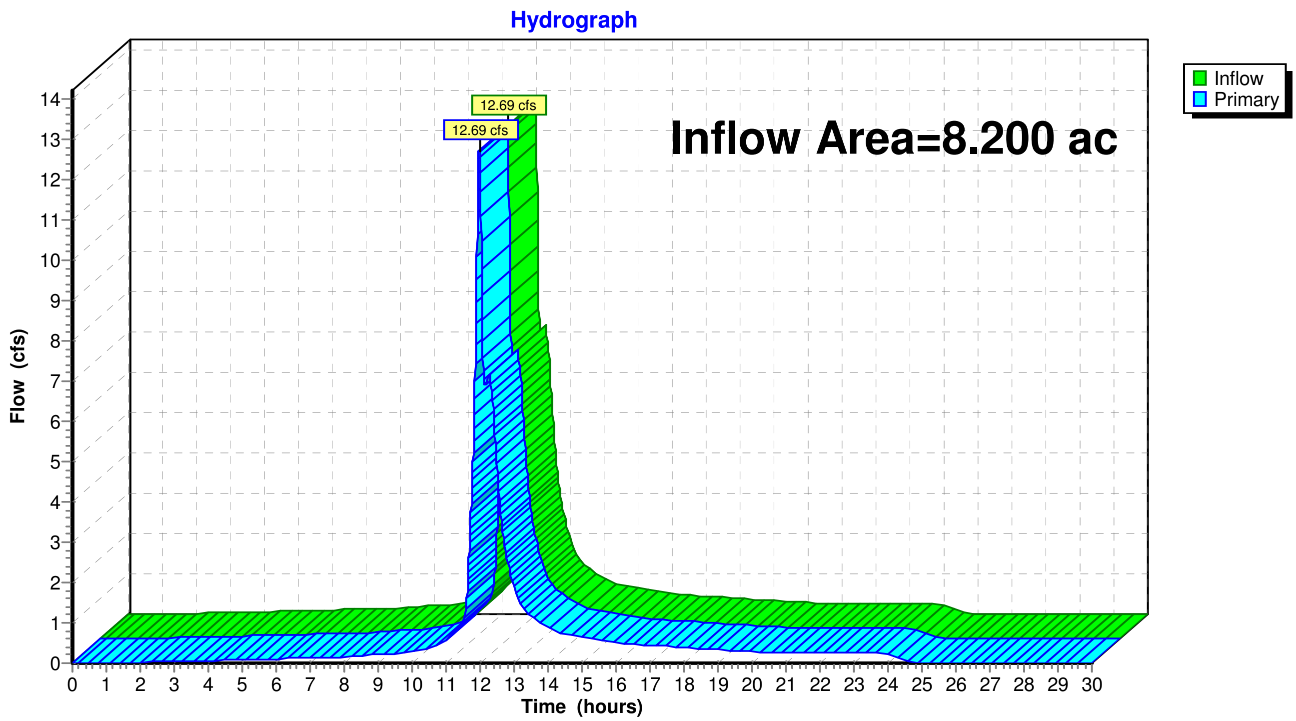
Summary for Pond 4P: Discharge to West Property

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

Inflow Area = 8.200 ac, 30.12% Impervious, Inflow Depth = 1.77" for 10-YR event
Inflow = 12.69 cfs @ 11.97 hrs, Volume= 1.208 af
Primary = 12.69 cfs @ 11.97 hrs, Volume= 1.208 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 4P: Discharge to West Property



Summary for Subcatchment 1S: North Drainage Area - Lawn Area

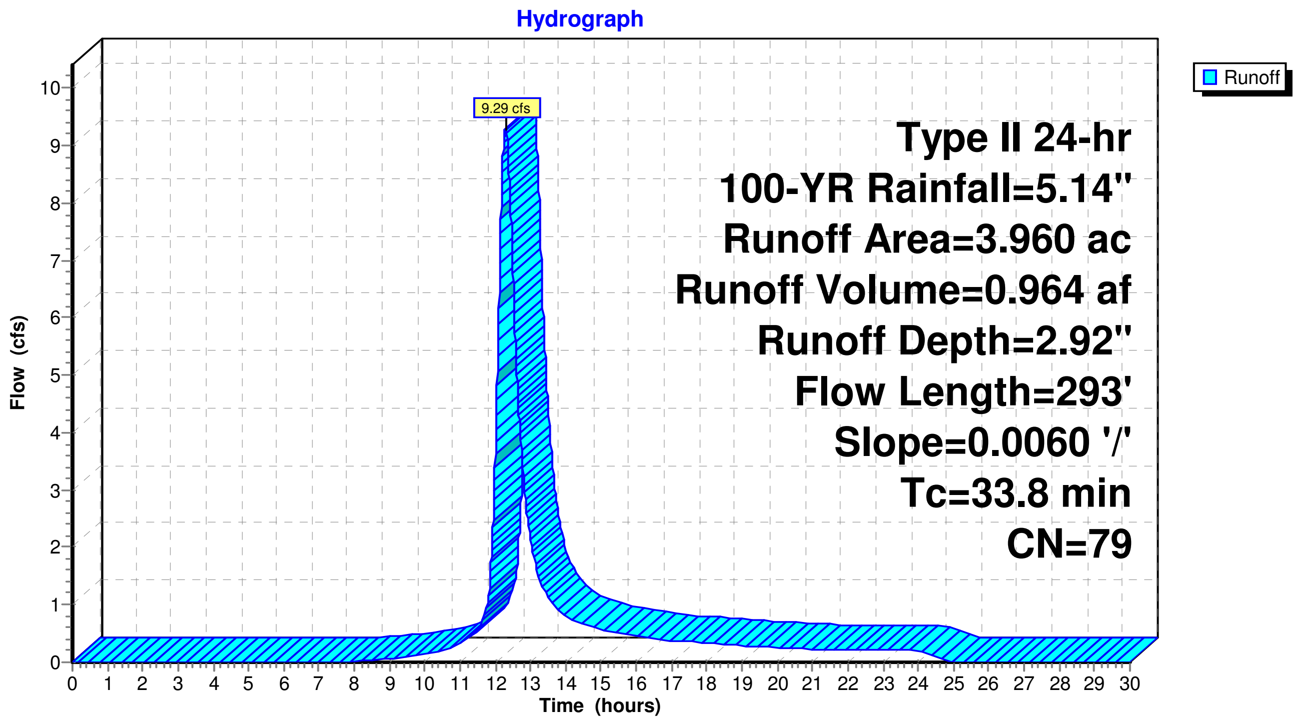
Runoff = 9.29 cfs @ 12.28 hrs, Volume= 0.964 af, Depth= 2.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
2.660	80	>75% Grass cover, Good, HSG D
1.300	77	Woods, Good, HSG D
3.960	79	Weighted Average
3.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.9	100	0.0060	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
5.9	193	0.0060	0.54		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.8	293	Total			

Subcatchment 1S: North Drainage Area - Lawn Area



Summary for Subcatchment 2S: North Drainage Area - Impervious Area

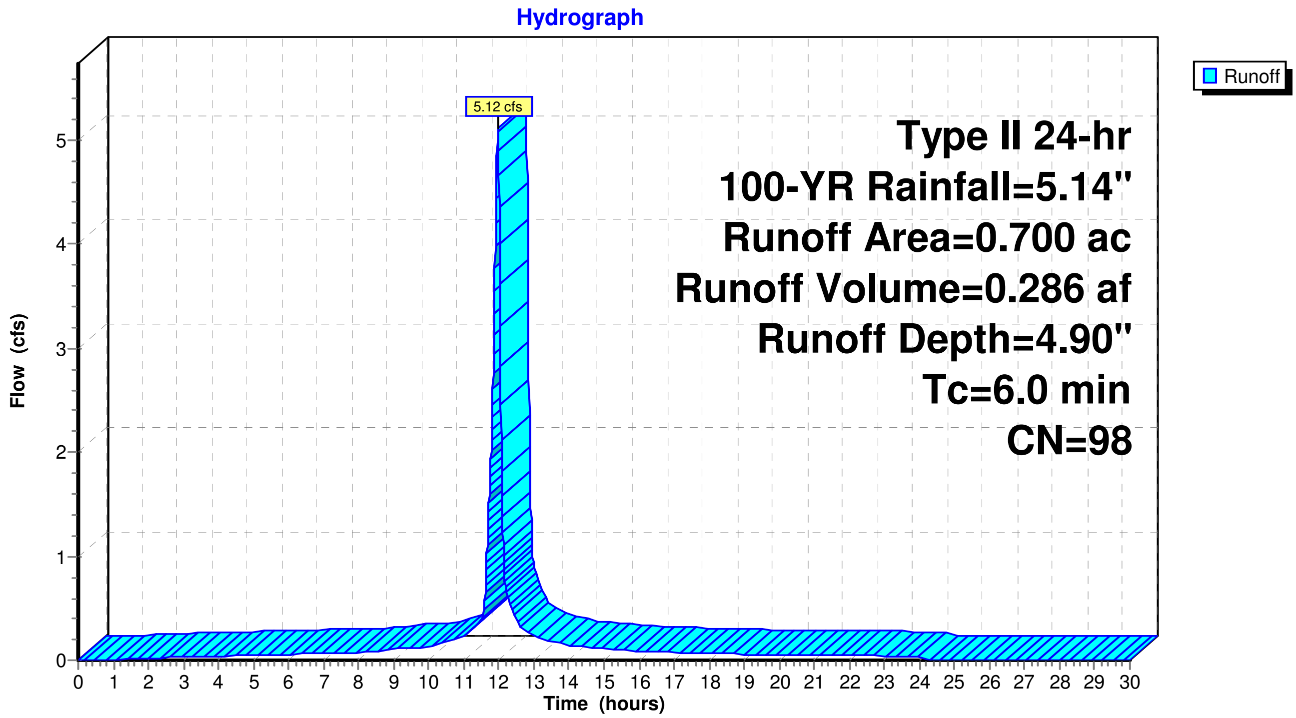
Runoff = 5.12 cfs @ 11.97 hrs, Volume= 0.286 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.700	98	Paved parking, HSG D
0.700		100.00% Impervious Area

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

Subcatchment 2S: North Drainage Area - Impervious Area



Summary for Subcatchment 3S: Middle Drainage Area - Impervious Area

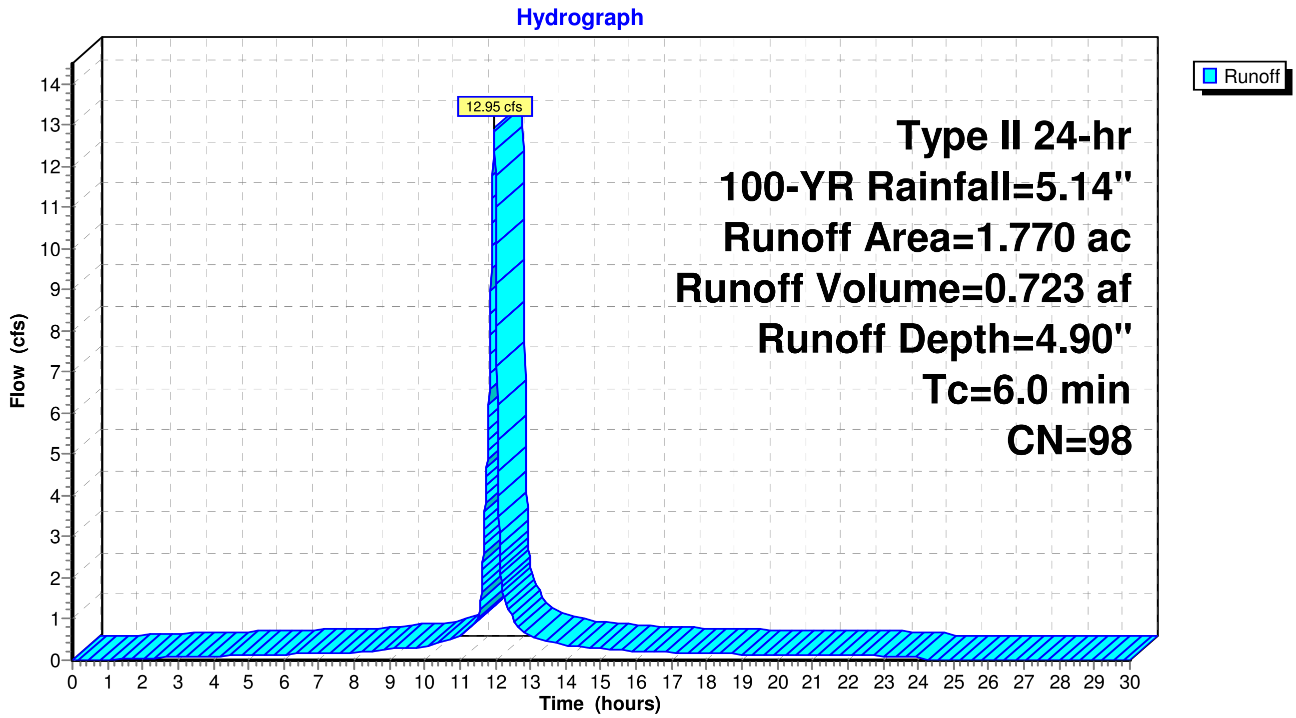
Runoff = 12.95 cfs @ 11.97 hrs, Volume= 0.723 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
1.770	98	Paved parking, HSG D
1.770		100.00% Impervious Area

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

Subcatchment 3S: Middle Drainage Area - Impervious Area



Summary for Subcatchment 4S: Middle Drainage Area - Lawn Area

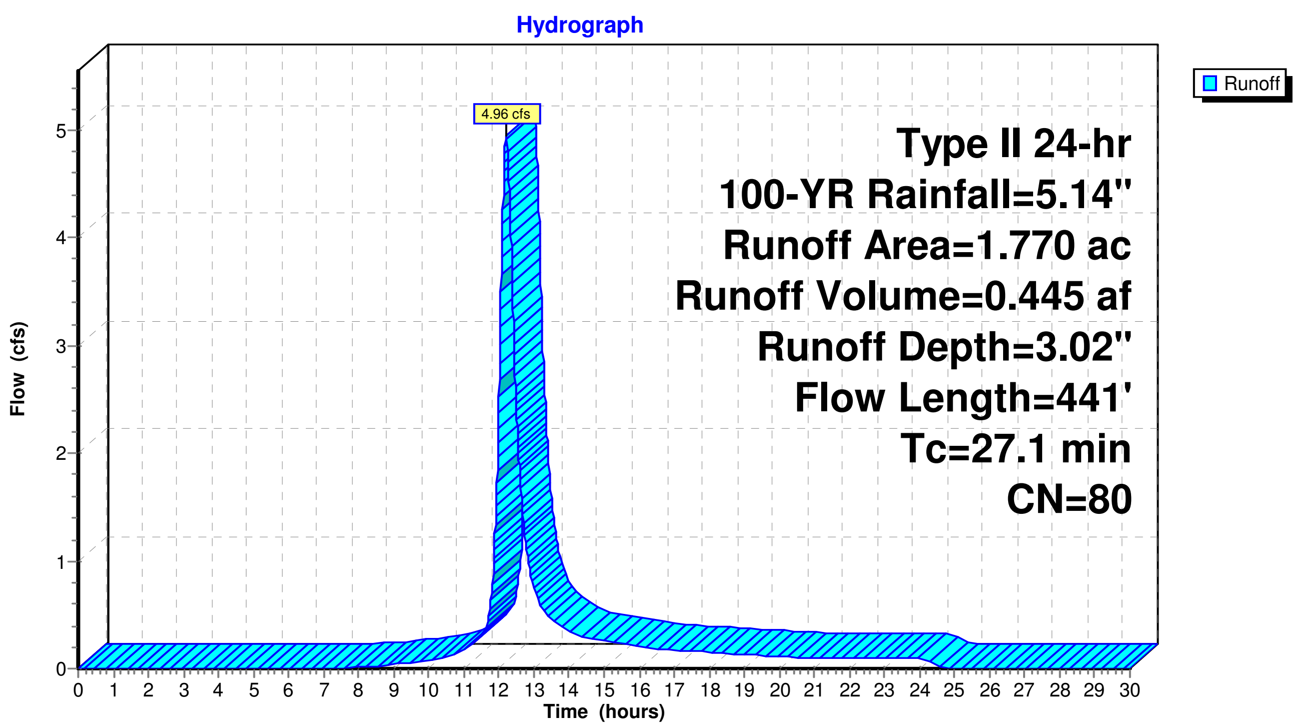
Runoff = 4.96 cfs @ 12.20 hrs, Volume= 0.445 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
1.770	80	>75% Grass cover, Good, HSG D
1.770		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	100	0.0140	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
1.5	73	0.0140	0.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.0	121	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	79	0.0042	1.53	1.20	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
1.8	68	0.0080	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
27.1	441	Total			

Subcatchment 4S: Middle Drainage Area - Lawn Area



Summary for Subcatchment 5S: South Drainage Area

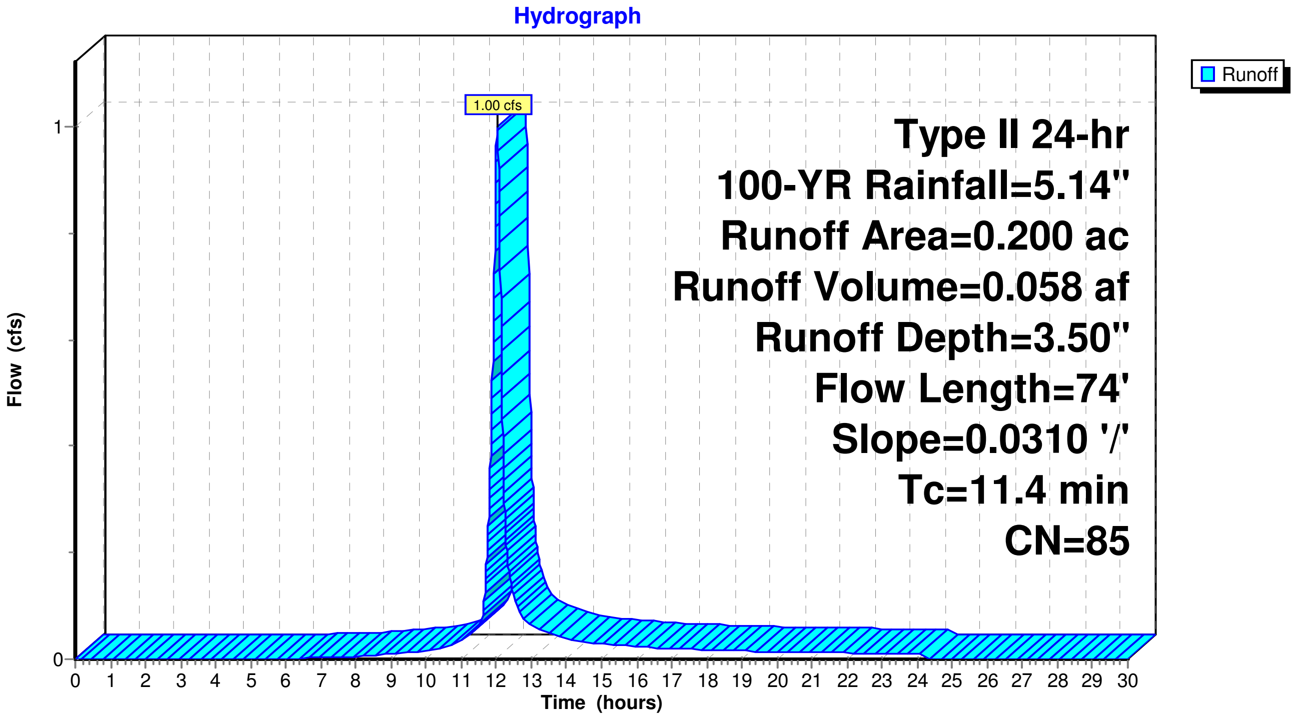
Runoff = 1.00 cfs @ 12.03 hrs, Volume= 0.058 af, Depth= 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.050	98	Paved parking, HSG D
0.200	85	Weighted Average
0.150		75.00% Pervious Area
0.050		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	74	0.0310	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"

Subcatchment 5S: South Drainage Area



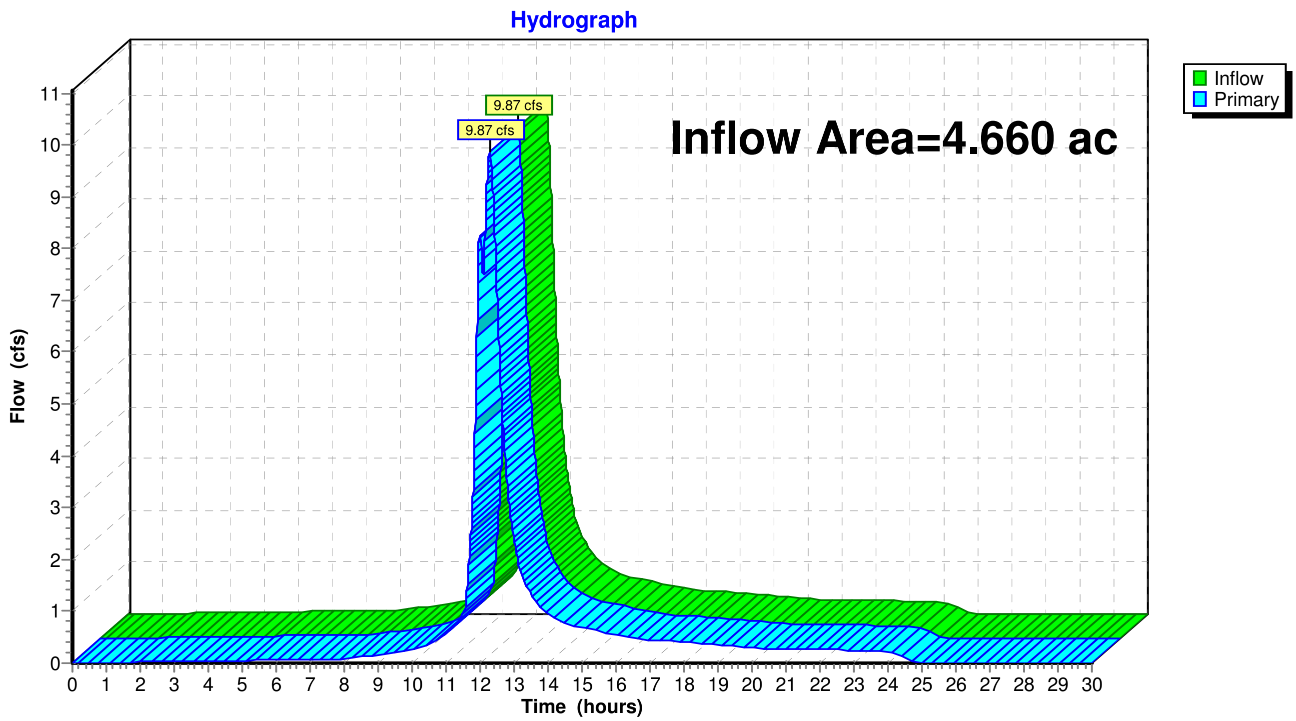
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 4.660 ac, 15.02% Impervious, Inflow Depth = 3.22" for 100-YR event
Inflow = 9.87 cfs @ 12.28 hrs, Volume= 1.250 af
Primary = 9.87 cfs @ 12.28 hrs, Volume= 1.250 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



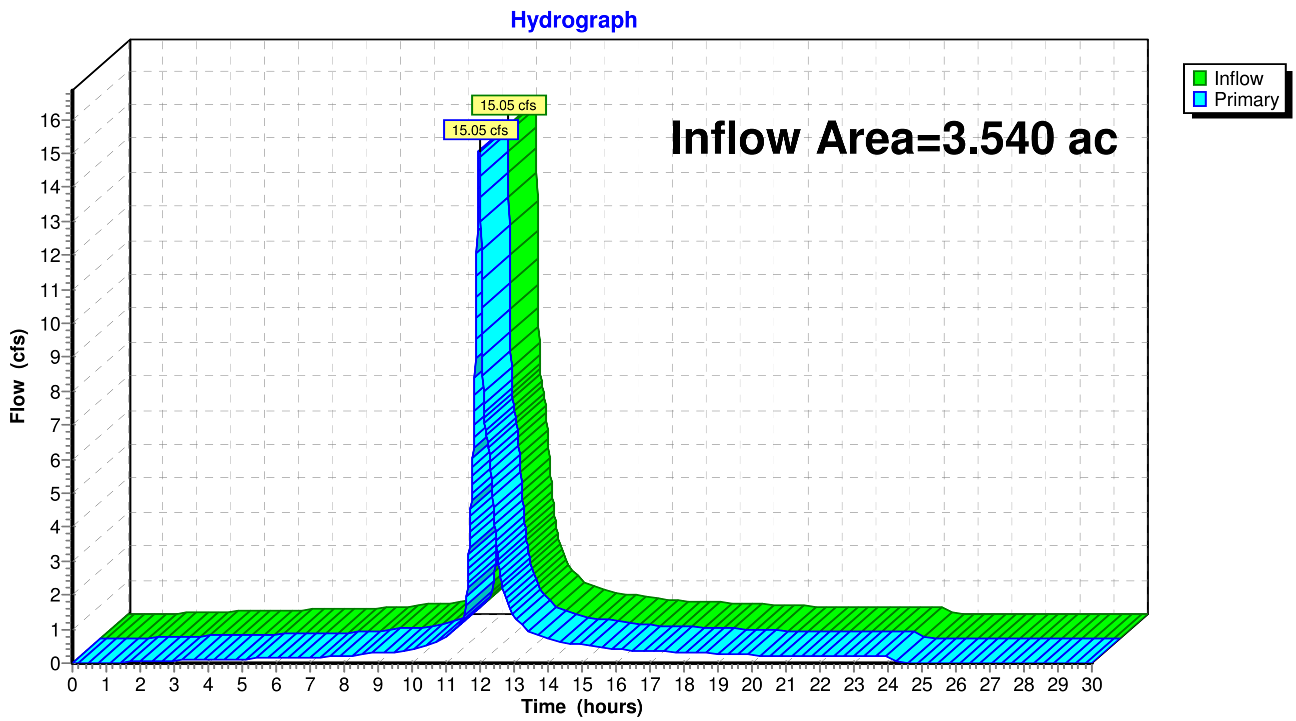
Summary for Pond 2P: Discharge from Middle Drainage Area

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

Inflow Area = 3.540 ac, 50.00% Impervious, Inflow Depth = 3.96" for 100-YR event
Inflow = 15.05 cfs @ 11.97 hrs, Volume= 1.168 af
Primary = 15.05 cfs @ 11.97 hrs, Volume= 1.168 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2

Pond 2P: Discharge from Middle Drainage Area



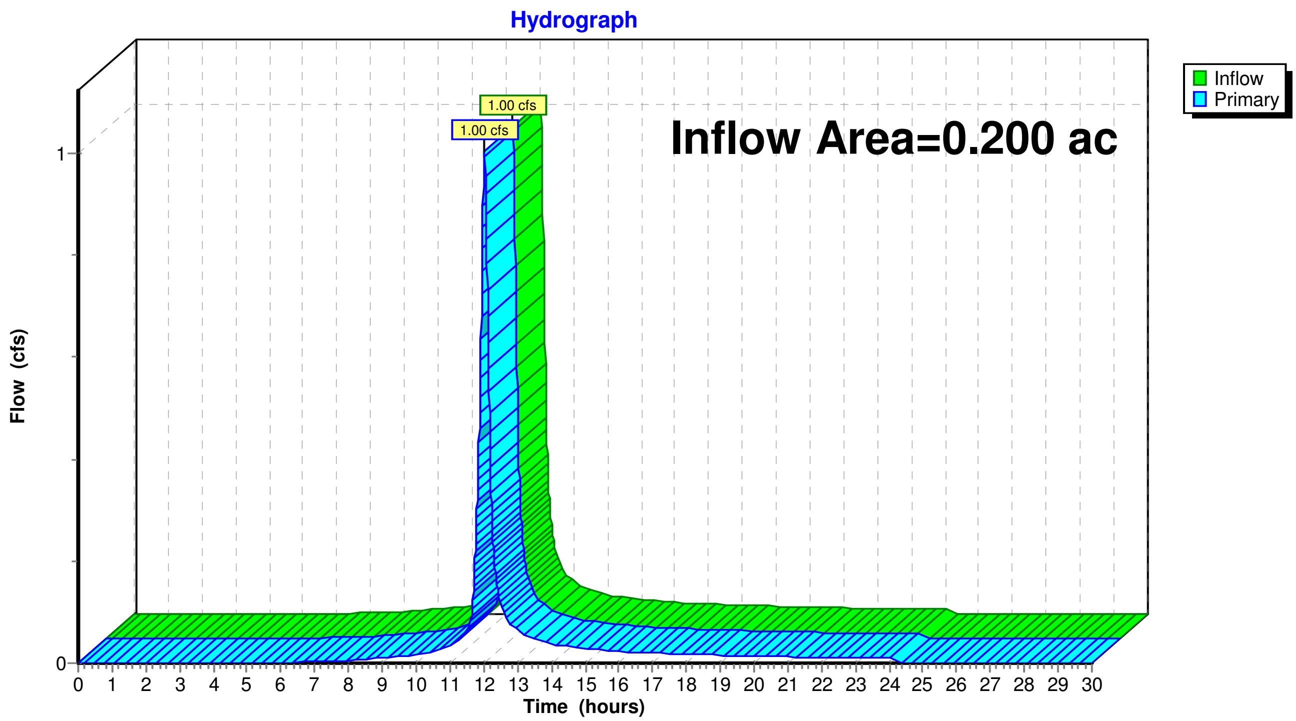
Summary for Pond 3P: Discharge to Seneca Street Drainage System

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

Inflow Area = 0.200 ac, 25.00% Impervious, Inflow Depth = 3.50" for 100-YR event
Inflow = 1.00 cfs @ 12.03 hrs, Volume= 0.058 af
Primary = 1.00 cfs @ 12.03 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 3P: Discharge to Seneca Street Drainage System



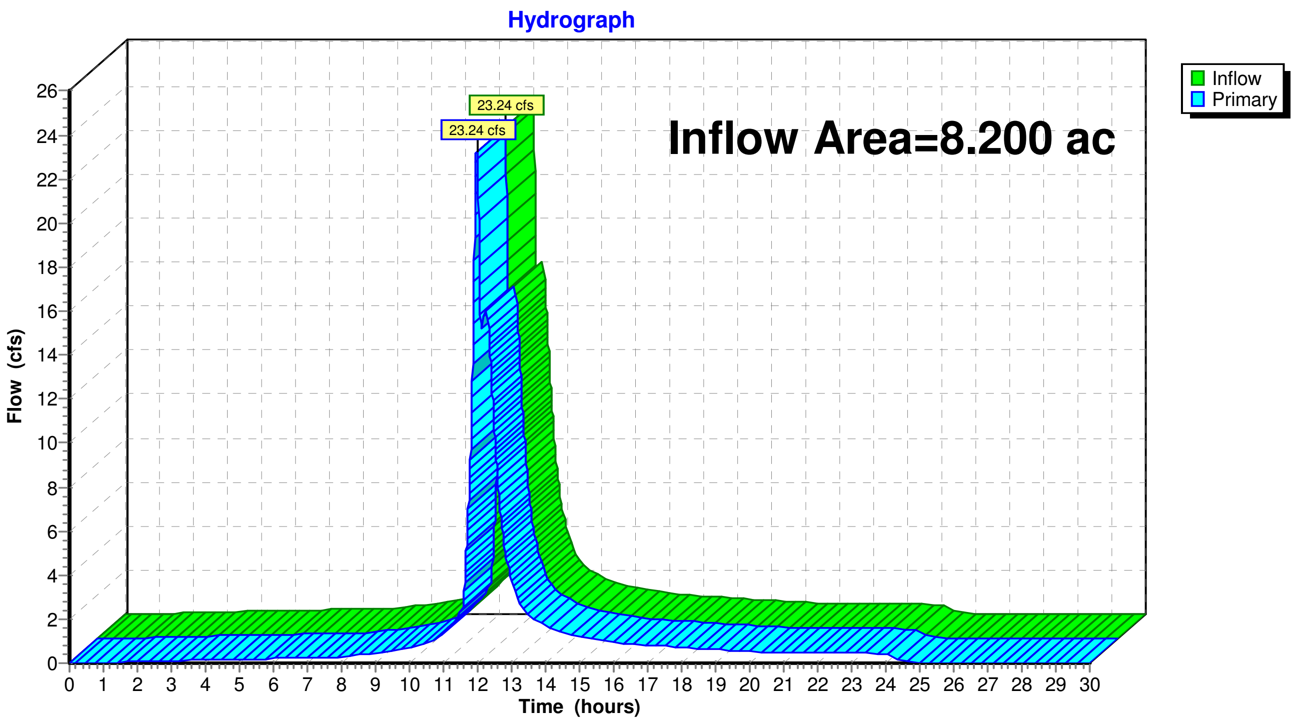
Summary for Pond 4P: Discharge to West Property

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

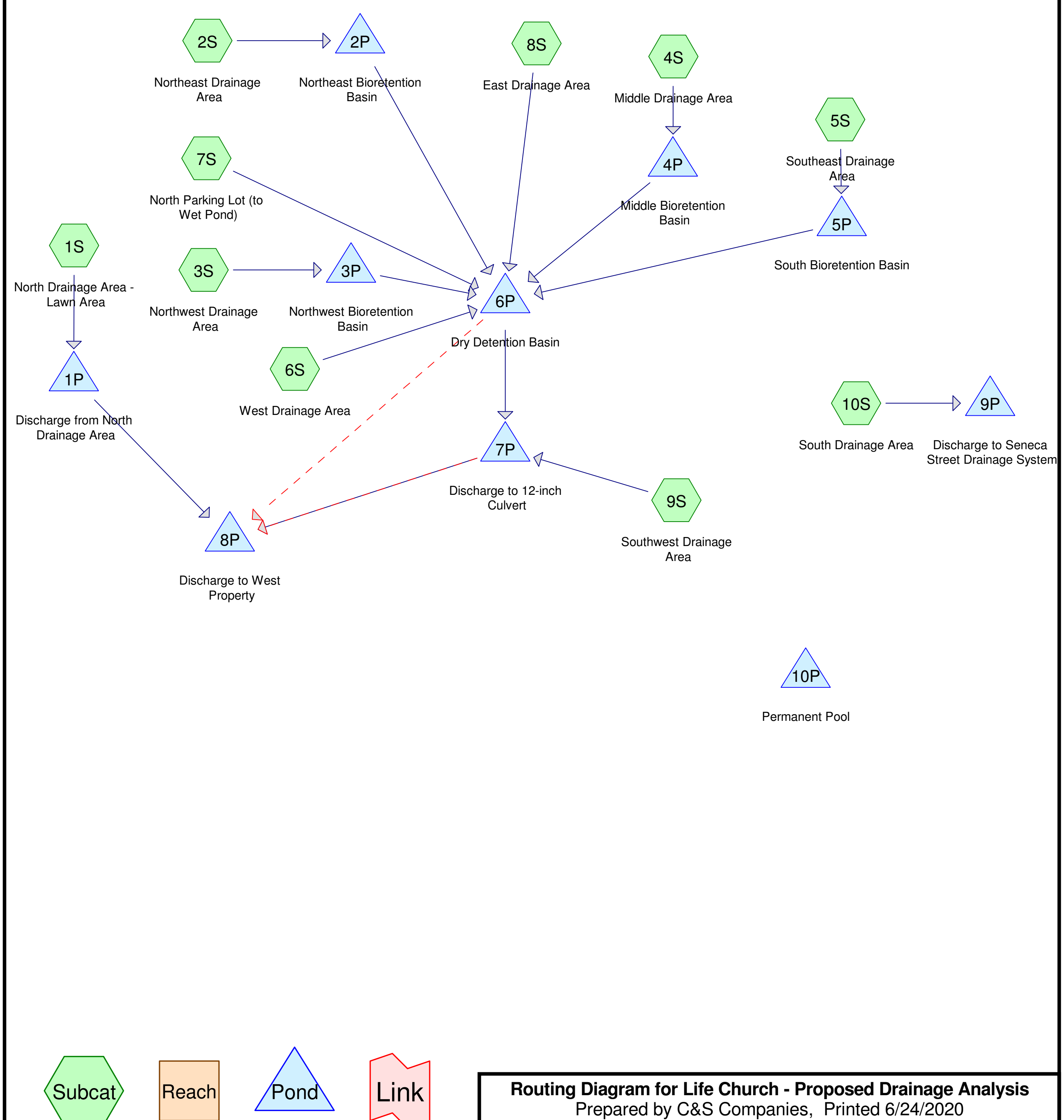
Inflow Area = 8.200 ac, 30.12% Impervious, Inflow Depth = 3.54" for 100-YR event
Inflow = 23.24 cfs @ 11.98 hrs, Volume= 2.418 af
Primary = 23.24 cfs @ 11.98 hrs, Volume= 2.418 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 4P: Discharge to West Property



PLAN NORTH
NORTH DRAINAGE AREA (NODES 1S & 2S)
MIDDLE DRAINAGE AREA (NODES 3S & 4S)
SOUTH DRAINAGE AREA (NODE 5S)
SENECA STREET
(66.0' WIDE)
LIFE CHURCH
EXISTING DRAINAGE ANALYSIS MAP
LEGEND
DRAINAGE AREA
IMPERVIOUS AREA
Tc PATH
80 0 80 160 Ft.
80'



Routing Diagram for Life Church - Proposed Drainage Analysis
Prepared by C&S Companies, Printed 6/24/2020
HydroCAD® 10.10-4a s/n 04066 © 2020 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-YR	Type II 24-hr		Default	24.00	1	1.80	2
2	10-YR	Type II 24-hr		Default	24.00	1	3.11	2
3	100-YR	Type II 24-hr		Default	24.00	1	5.14	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.102	80	>75% Grass cover, Good, HSG D (1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S)
4.310	98	Paved parking, HSG D (2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S)
1.000	77	Woods, Good, HSG D (1S)
8.412	**89**	**TOTAL AREA**

Summary for Subcatchment 1S: North Drainage Area - Lawn Area

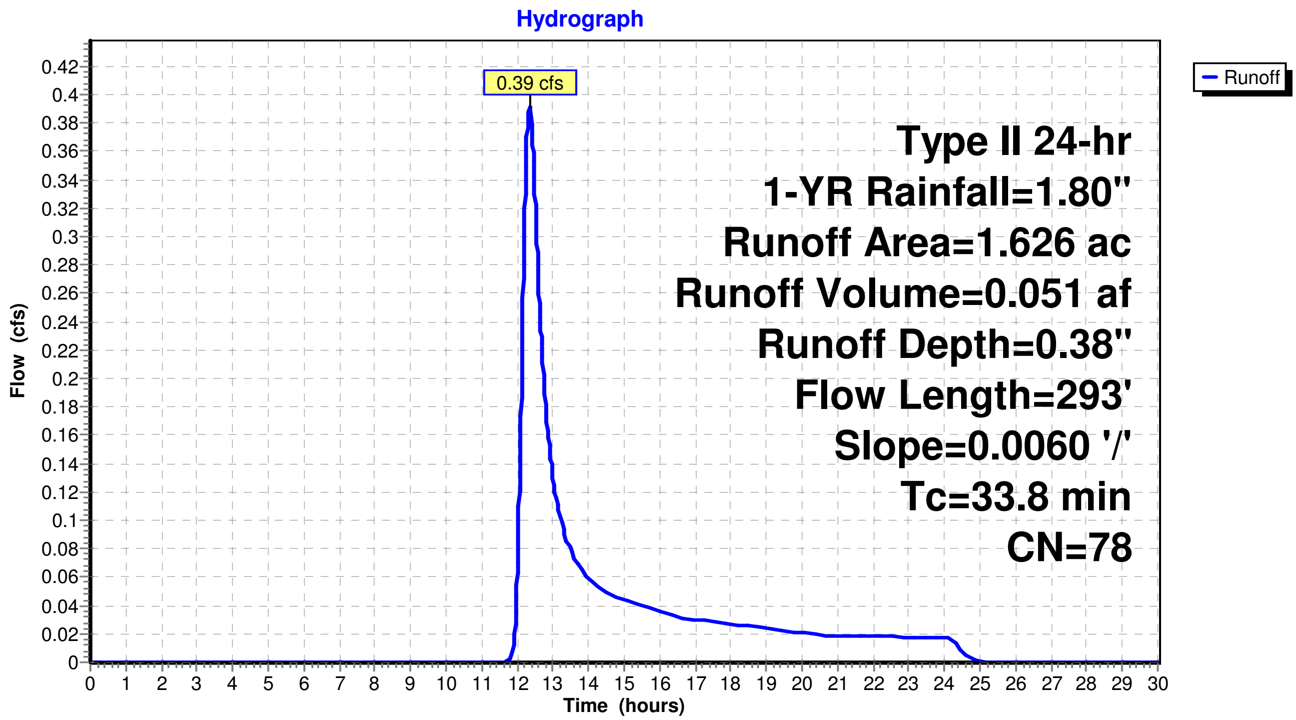
Runoff = 0.39 cfs @ 12.35 hrs, Volume= 0.051 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.626	80	>75% Grass cover, Good, HSG D
1.000	77	Woods, Good, HSG D
1.626	78	Weighted Average
1.626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.9	100	0.0060	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
5.9	193	0.0060	0.54		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.8	293	Total			

Subcatchment 1S: North Drainage Area - Lawn Area



Summary for Subcatchment 2S: Northeast Drainage Area

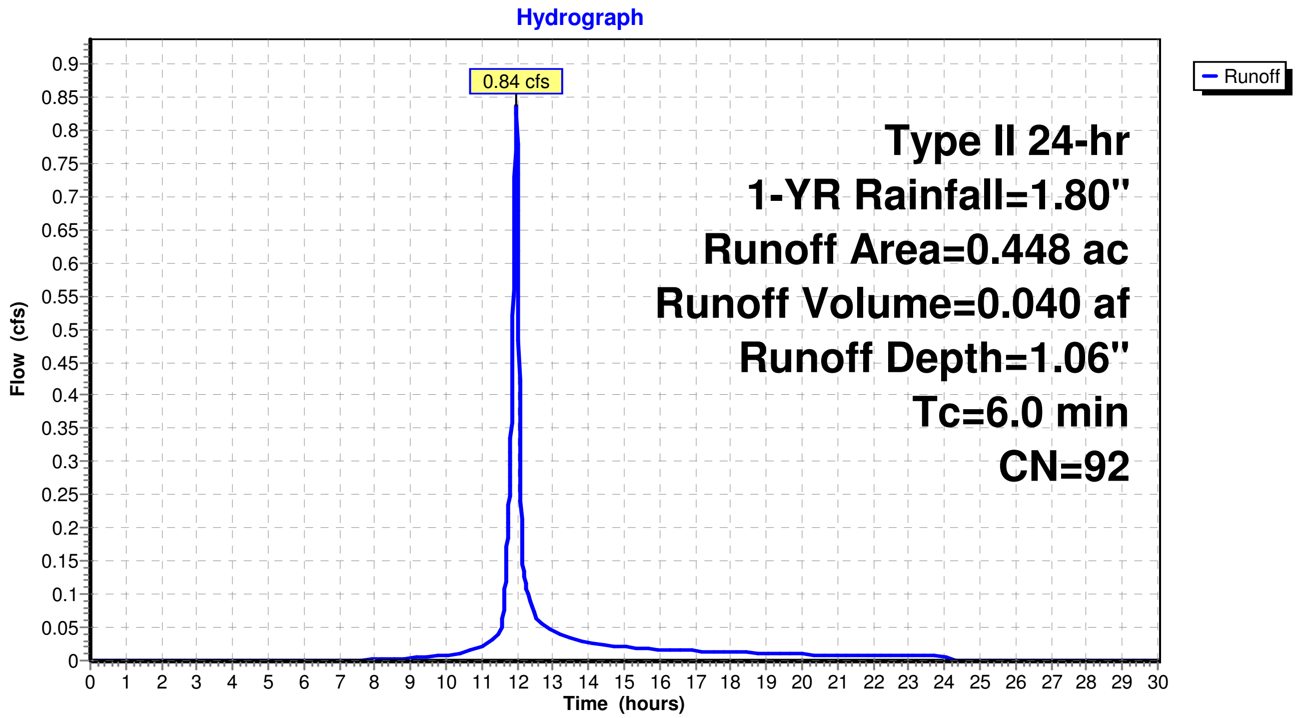
Runoff = 0.84 cfs @ 11.97 hrs, Volume= 0.040 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.306	98	Paved parking, HSG D
0.142	80	>75% Grass cover, Good, HSG D
0.448	92	Weighted Average
0.142		31.70% Pervious Area
0.306		68.30% Impervious Area

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

Subcatchment 2S: Northeast Drainage Area



Summary for Subcatchment 3S: Northwest Drainage Area

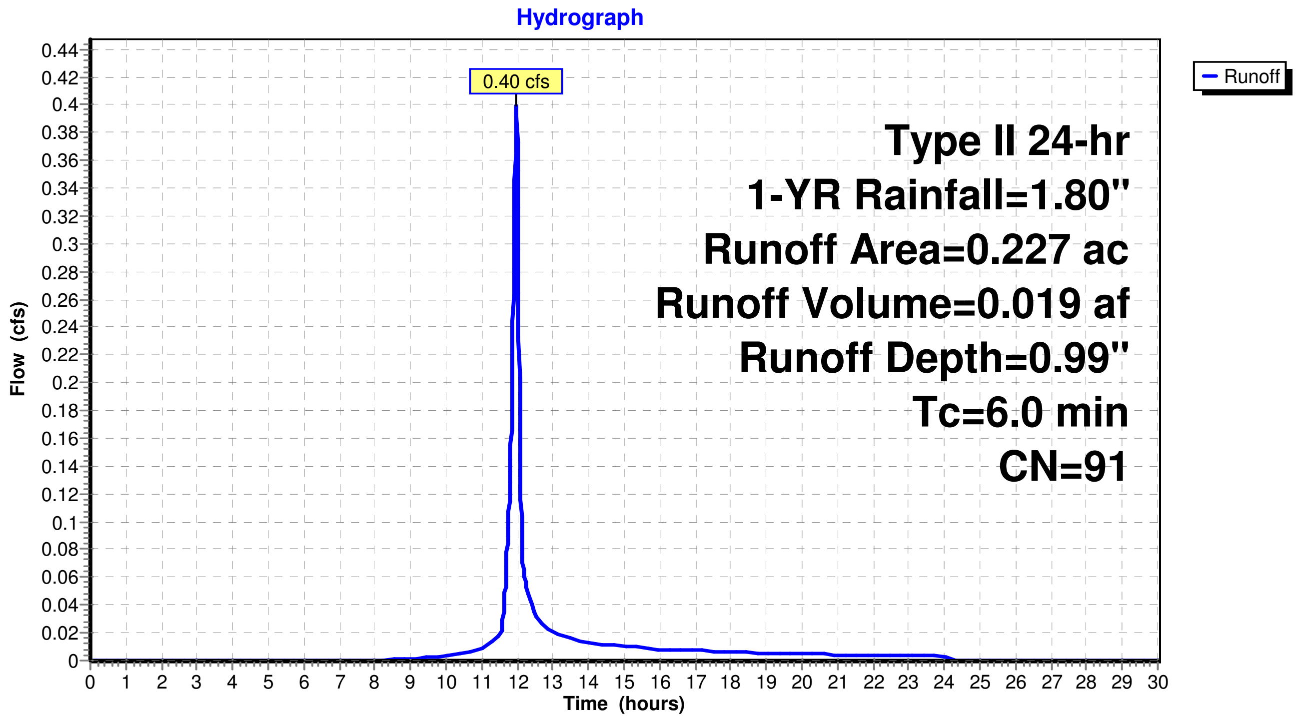
Runoff = 0.40 cfs @ 11.97 hrs, Volume= 0.019 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG D
0.094	80	>75% Grass cover, Good, HSG D
0.227	91	Weighted Average
0.094		41.41% Pervious Area
0.133		58.59% Impervious Area

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

Subcatchment 3S: Northwest Drainage Area



Summary for Subcatchment 4S: Middle Drainage Area

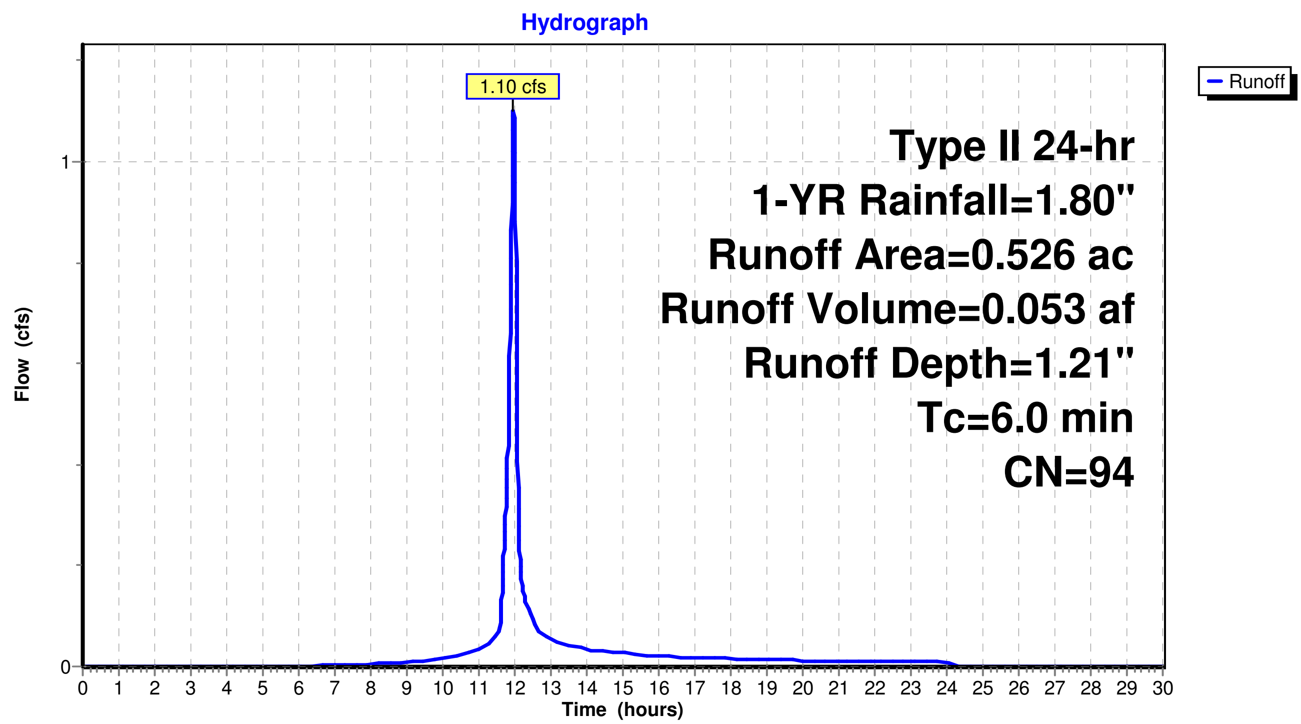
Runoff = 1.10 cfs @ 11.97 hrs, Volume= 0.053 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.406	98	Paved parking, HSG D
0.120	80	>75% Grass cover, Good, HSG D
0.526	94	Weighted Average
0.120		22.81% Pervious Area
0.406		77.19% Impervious Area

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

Subcatchment 4S: Middle Drainage Area



Summary for Subcatchment 5S: Southeast Drainage Area

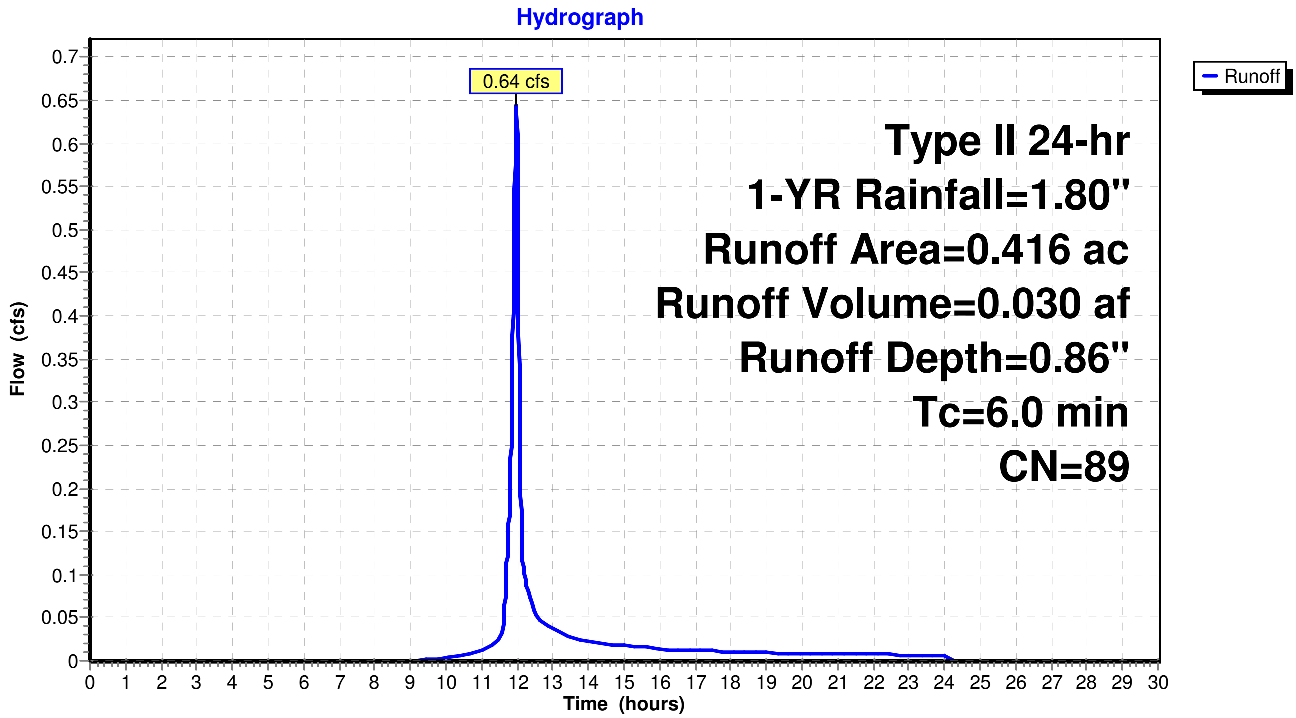
Runoff = 0.64 cfs @ 11.97 hrs, Volume= 0.030 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.201	98	Paved parking, HSG D
0.215	80	>75% Grass cover, Good, HSG D
0.416	89	Weighted Average
0.215		51.68% Pervious Area
0.201		48.32% Impervious Area

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

Subcatchment 5S: Southeast Drainage Area



Summary for Subcatchment 6S: West Drainage Area

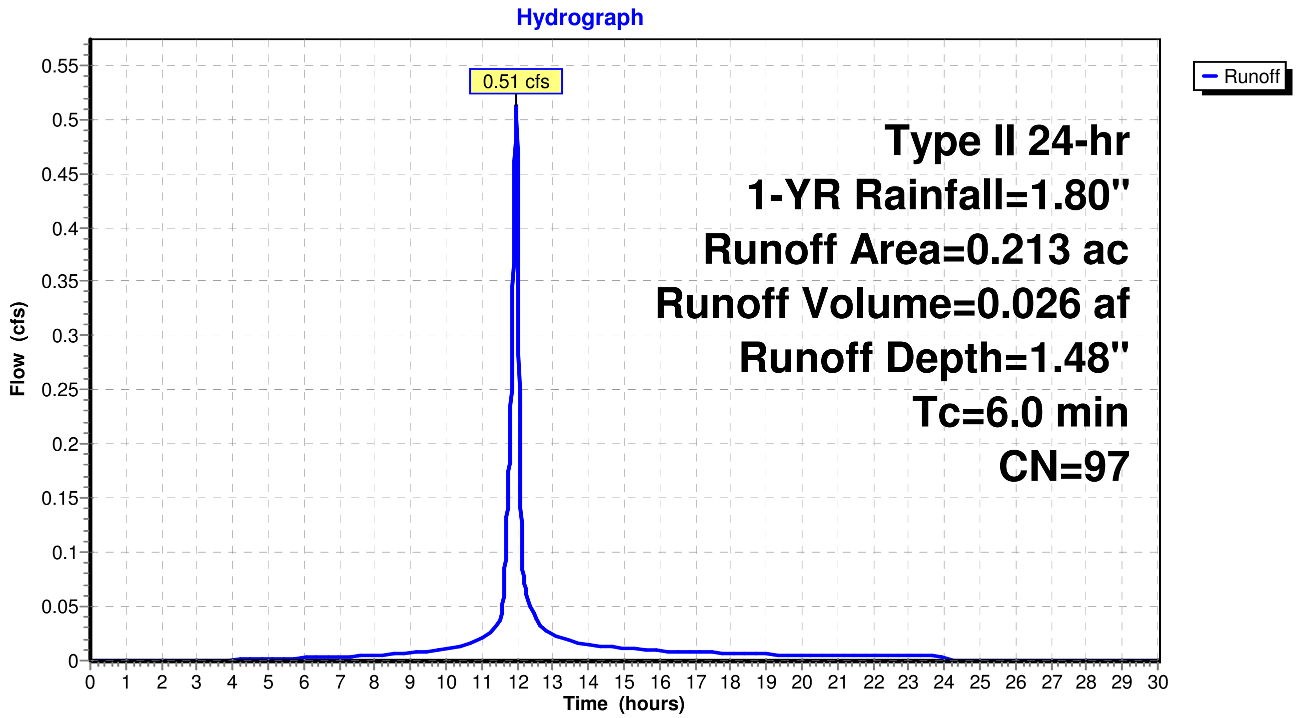
Runoff = 0.51 cfs @ 11.97 hrs, Volume= 0.026 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.196	98	Paved parking, HSG D
0.017	80	>75% Grass cover, Good, HSG D
0.213	97	Weighted Average
0.017		7.98% Pervious Area
0.196		92.02% Impervious Area

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

Subcatchment 6S: West Drainage Area



Summary for Subcatchment 7S: North Parking Lot (to Wet Pond)

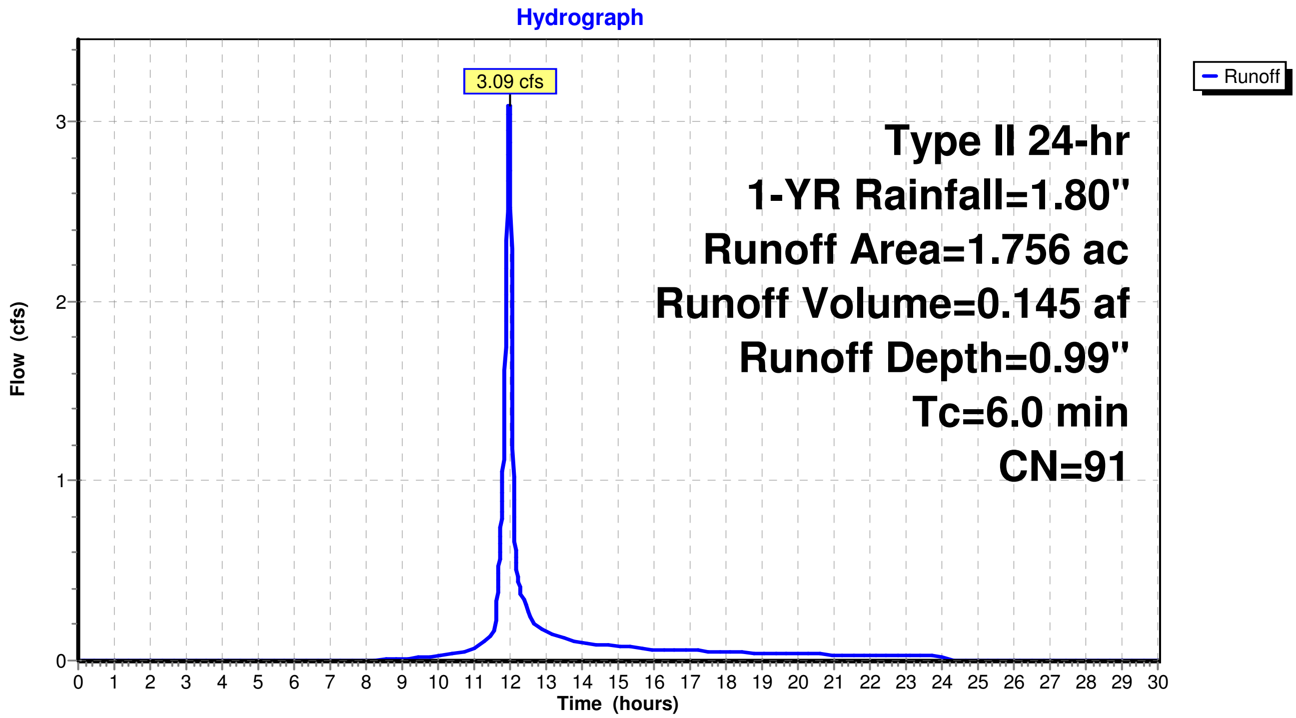
Runoff = 3.09 cfs @ 11.97 hrs, Volume= 0.145 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
1.074	98	Paved parking, HSG D
0.682	80	>75% Grass cover, Good, HSG D
1.756	91	Weighted Average
0.682		38.84% Pervious Area
1.074		61.16% Impervious Area

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

Subcatchment 7S: North Parking Lot (to Wet Pond)



Summary for Subcatchment 8S: East Drainage Area

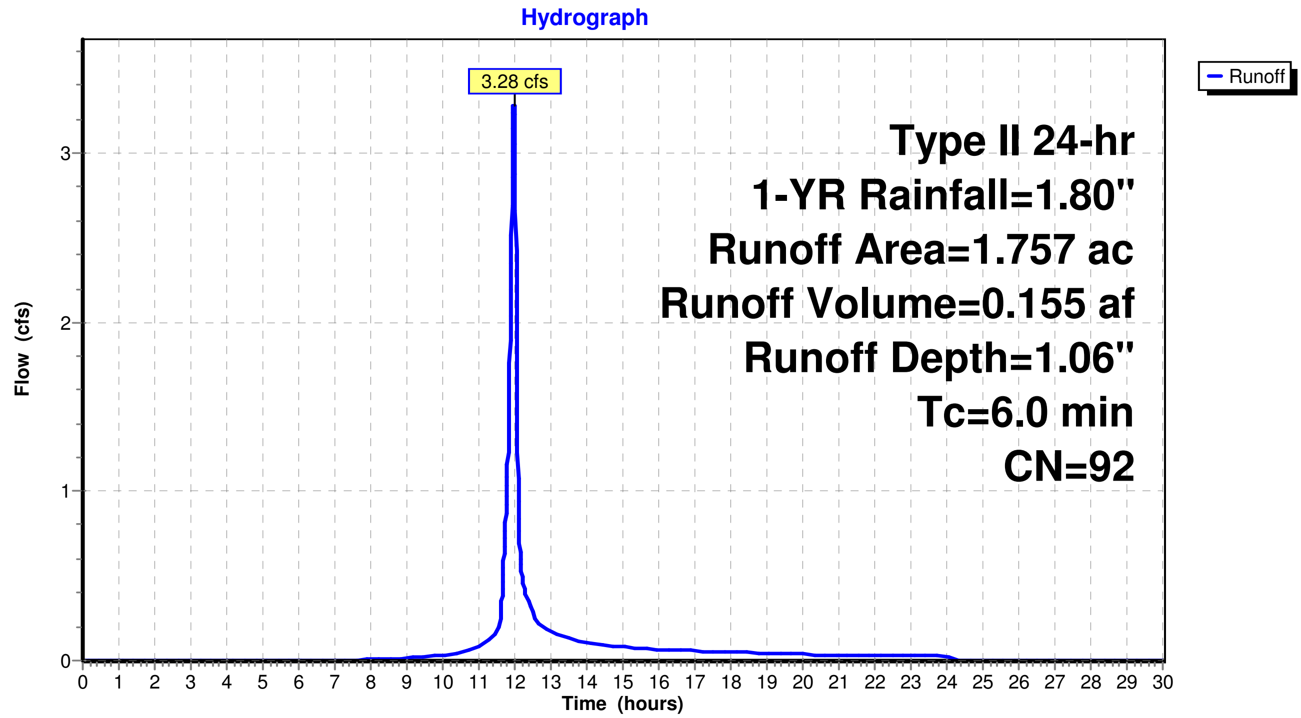
Runoff = 3.28 cfs @ 11.97 hrs, Volume= 0.155 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
1.198	98	Paved parking, HSG D
0.559	80	>75% Grass cover, Good, HSG D
1.757	92	Weighted Average
0.559		31.82% Pervious Area
1.198		68.18% Impervious Area

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

Subcatchment 8S: East Drainage Area



Summary for Subcatchment 9S: Southwest Drainage Area

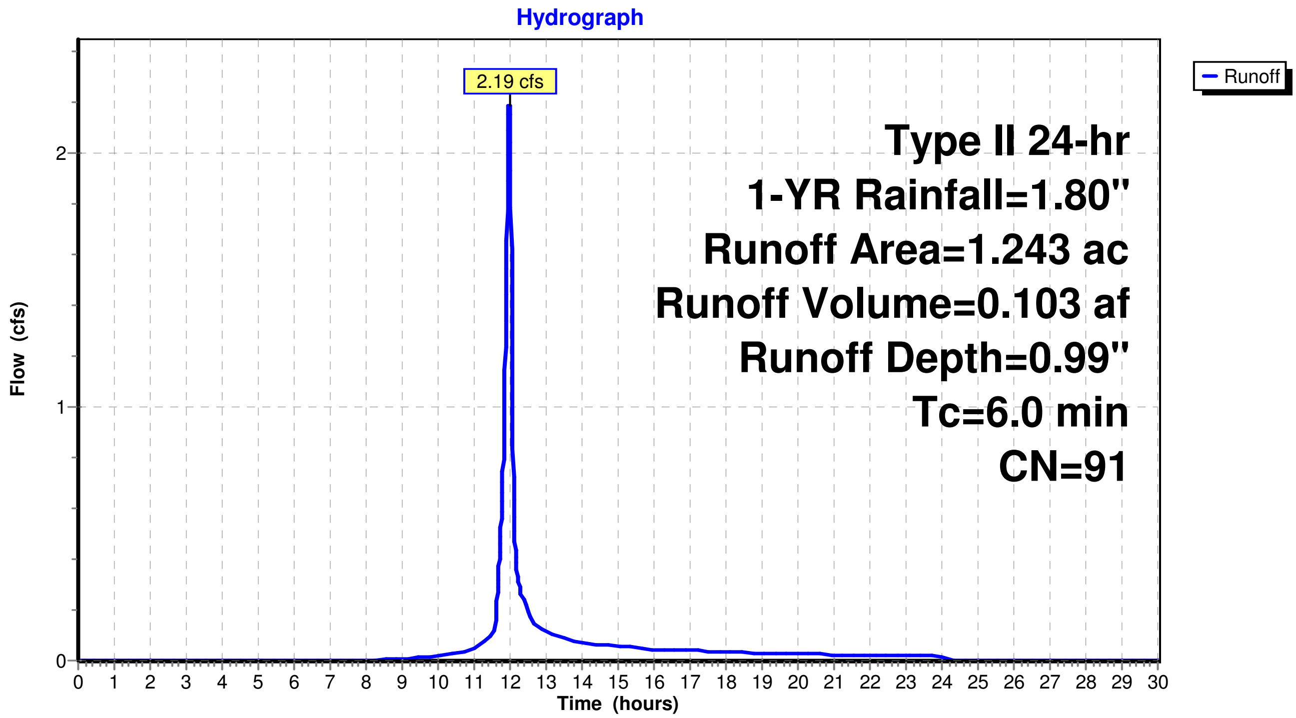
Runoff = 2.19 cfs @ 11.97 hrs, Volume= 0.103 af, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.746	98	Paved parking, HSG D
0.497	80	>75% Grass cover, Good, HSG D
1.243	91	Weighted Average
0.497		39.98% Pervious Area
0.746		60.02% Impervious Area

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

Subcatchment 9S: Southwest Drainage Area



Summary for Subcatchment 10S: South Drainage Area

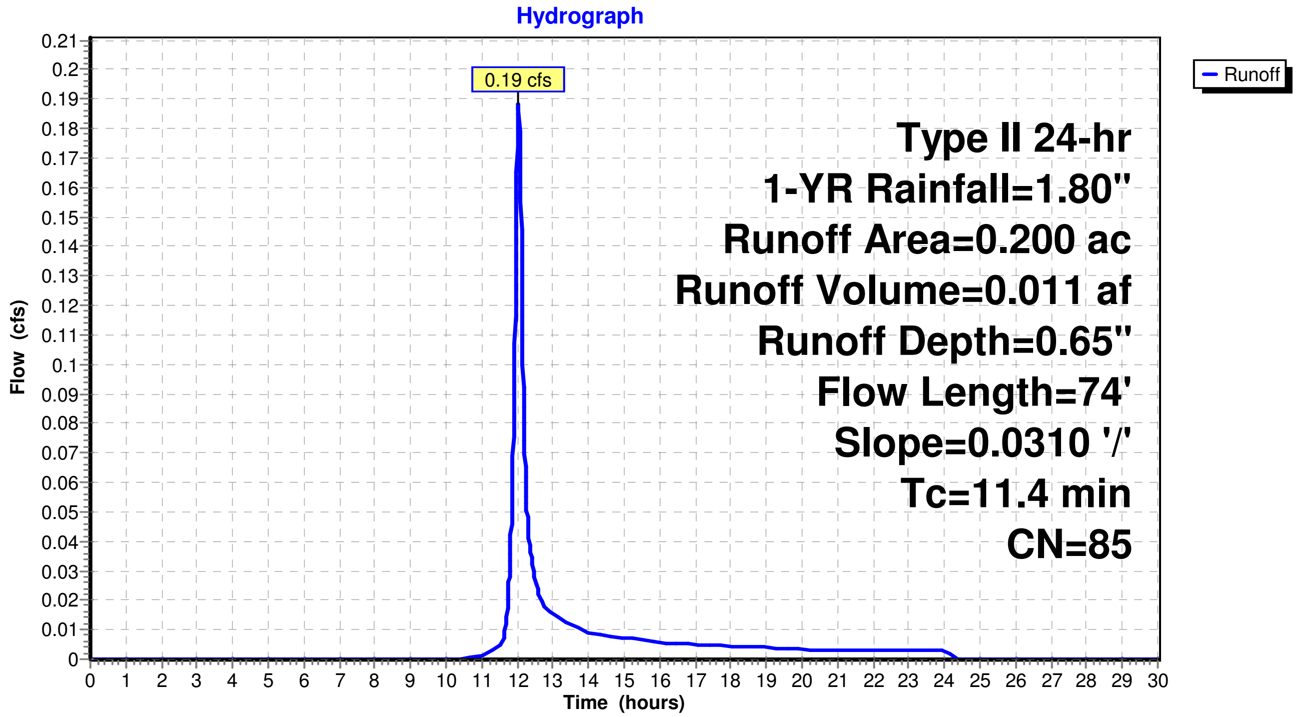
Runoff = 0.19 cfs @ 12.04 hrs, Volume= 0.011 af, Depth= 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 1-YR Rainfall=1.80"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.050	98	Paved parking, HSG D
0.200	85	Weighted Average
0.150		75.00% Pervious Area
0.050		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	74	0.0310	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"

Subcatchment 10S: South Drainage Area



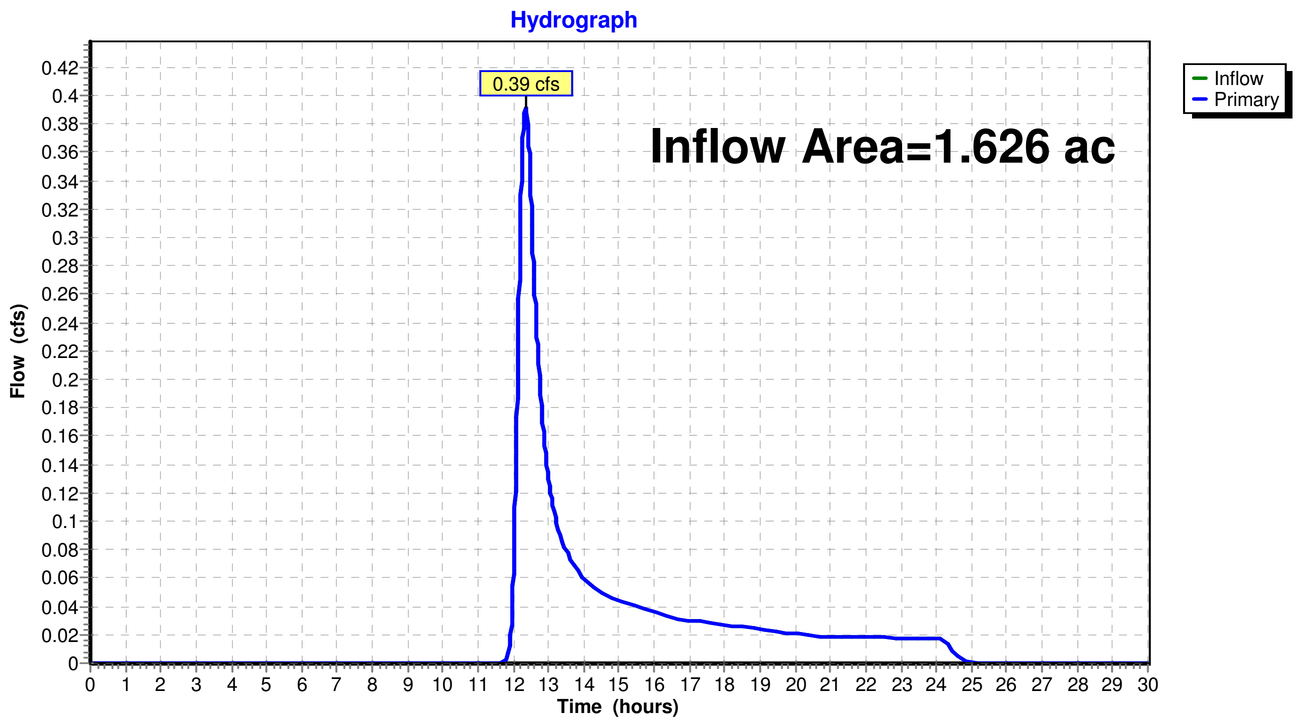
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area =	1.626 ac,	0.00% Impervious,	Inflow Depth = 0.38"	for 1-YR event
Inflow =	0.39 cfs @	12.35 hrs, Volume=	0.051 af	
Primary =	0.39 cfs @	12.35 hrs, Volume=	0.051 af, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



Summary for Pond 2P: Northeast Bioretention Basin

Inflow Area =	0.448 ac,	68.30% Impervious,	Inflow Depth = 1.06"	for 1-YR event
Inflow =	0.84 cfs @	11.97 hrs, Volume=	0.040 af	
Outflow =	0.55 cfs @	12.04 hrs, Volume=	0.026 af, Atten= 34%, Lag= 4.1 min	
Primary =	0.55 cfs @	12.04 hrs, Volume=	0.026 af	

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.58' @ 12.04 hrs Surf.Area= 1,388 sf Storage= 706 cf

Plug-Flow detention time= 198.1 min calculated for 0.026 af (67% of inflow)
Center-of-Mass det. time= 93.5 min (910.7 - 817.2)

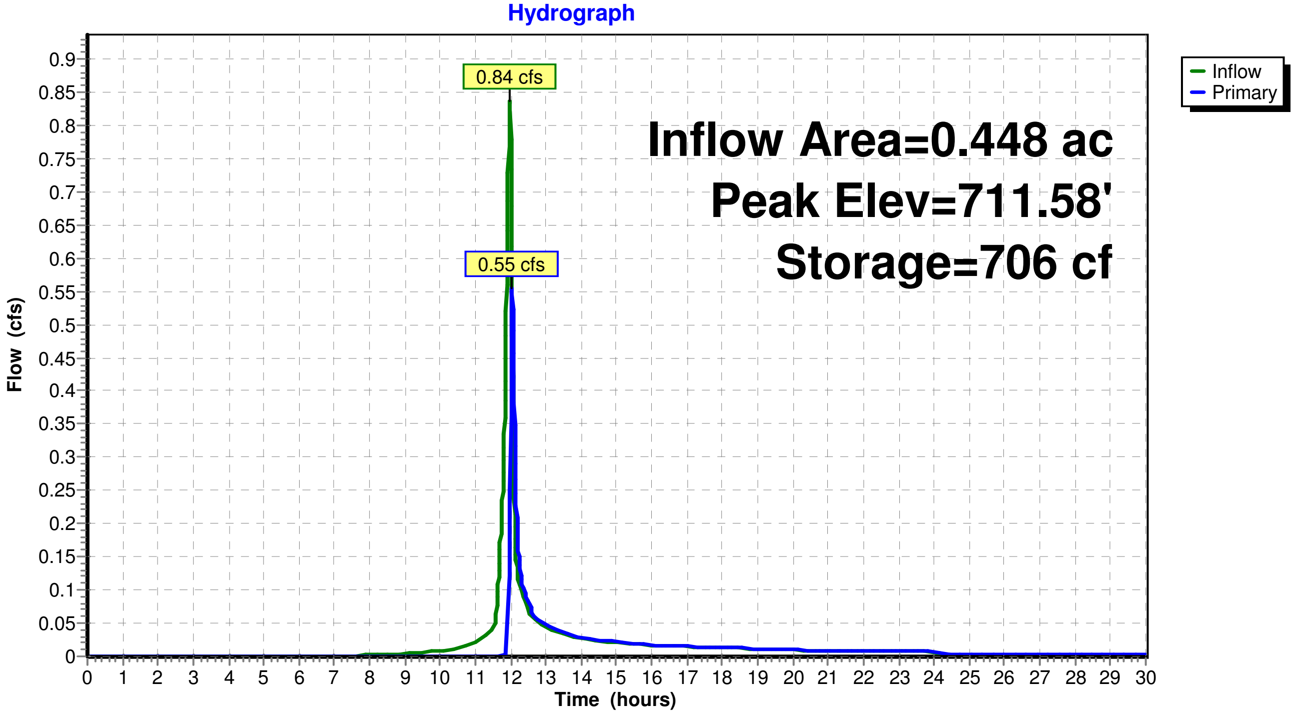
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	2,312 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	1,070	133.0	0	0	1,070
712.00	1,649	158.0	1,349	1,349	1,667
712.50	2,218	180.0	963	2,312	2,265

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 170.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 1,070 sf

Primary OutFlow Max=0.55 cfs @ 12.04 hrs HW=711.58' (Free Discharge)
└─**1=Culvert** (Passes 0.55 cfs of 3.57 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 0.55 cfs @ 0.90 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 2.27 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 2P: Northeast Bioretention Basin



Summary for Pond 3P: Northwest Bioretention Basin

Inflow Area = 0.227 ac, 58.59% Impervious, Inflow Depth = 0.99" for 1-YR event
Inflow = 0.40 cfs @ 11.97 hrs, Volume= 0.019 af
Outflow = 0.24 cfs @ 12.05 hrs, Volume= 0.012 af, Atten= 41%, Lag= 4.6 min
Primary = 0.24 cfs @ 12.05 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 712.04' @ 12.05 hrs Surf.Area= 783 sf Storage= 342 cf

Plug-Flow detention time= 228.5 min calculated for 0.012 af (66% of inflow)
Center-of-Mass det. time= 121.2 min (944.0 - 822.8)

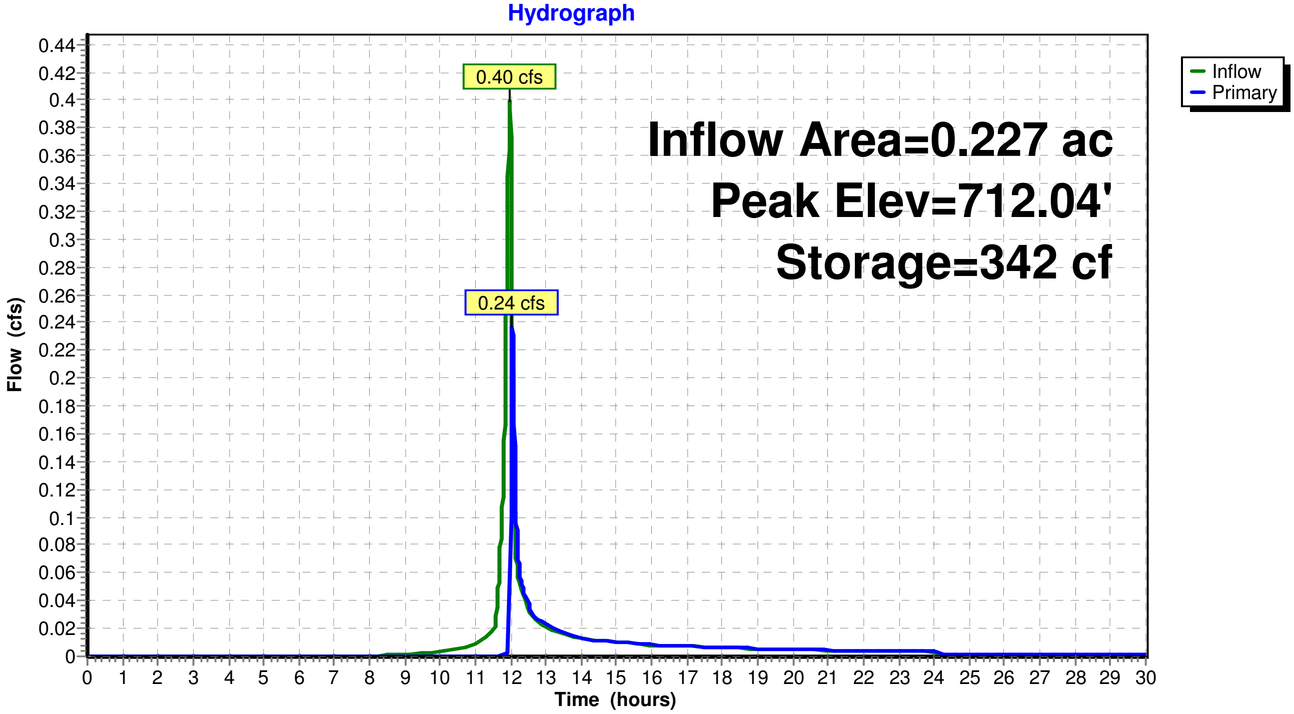
Volume	Invert	Avail.Storage	Storage Description
#1	711.50'	1,373 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.50	487	131.0	0	0	487
712.00	759	144.0	309	309	780
713.00	1,402	171.0	1,064	1,373	1,475

Device	Routing	Invert	Outlet Devices
#1	Primary	708.75'	**12.0" Round Culvert** L= 46.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.75' / 708.25' S= 0.0109 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	712.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.75'	**8.0" Round Underdrain** L= 51.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.75' / 708.75' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.50'	**0.250 in/hr Exfiltration over Surface area above 711.50'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 487 sf

Primary OutFlow Max=0.23 cfs @ 12.05 hrs HW=712.04' (Free Discharge)
└─**1=Culvert** (Passes 0.23 cfs of 4.99 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 0.23 cfs @ 0.68 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 2.11 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 3P: Northwest Bioretention Basin



Summary for Pond 4P: Middle Bioretention Basin

Inflow Area = 0.526 ac, 77.19% Impervious, Inflow Depth = 1.21" for 1-YR event
Inflow = 1.10 cfs @ 11.97 hrs, Volume= 0.053 af
Outflow = 0.37 cfs @ 12.09 hrs, Volume= 0.031 af, Atten= 67%, Lag= 7.1 min
Primary = 0.37 cfs @ 12.09 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.56' @ 12.09 hrs Surf.Area= 2,386 sf Storage= 1,162 cf

Plug-Flow detention time= 244.5 min calculated for 0.031 af (58% of inflow)
Center-of-Mass det. time= 135.8 min (940.5 - 804.6)

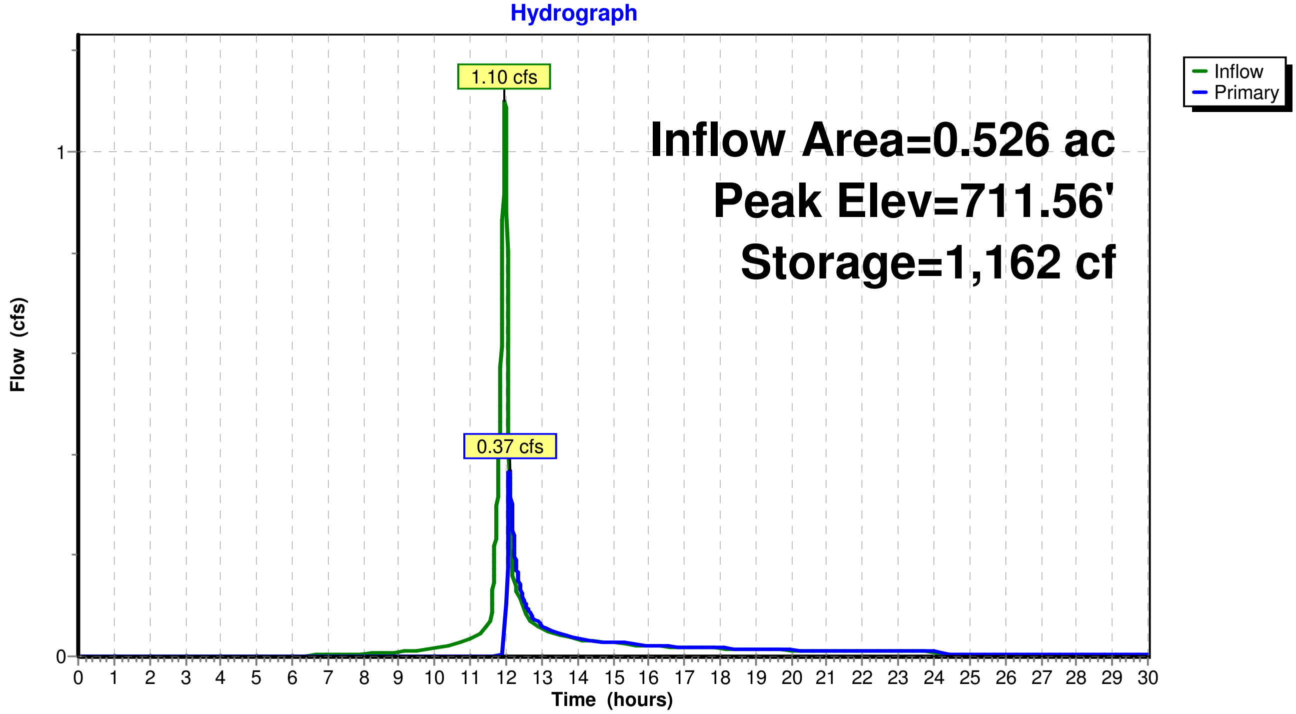
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	3,947 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	1,795	362.0	0	0	1,795
712.00	2,915	400.0	2,332	2,332	4,131
712.50	3,555	418.0	1,615	3,947	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 64.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 144.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 1,795 sf

Primary OutFlow Max=0.37 cfs @ 12.09 hrs HW=711.56' (Free Discharge)
└─**1=Culvert** (Passes 0.37 cfs of 4.84 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 0.36 cfs @ 0.78 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 1.46 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 4P: Middle Bioretention Basin



Summary for Pond 5P: South Bioretention Basin

Inflow Area = 0.416 ac, 48.32% Impervious, Inflow Depth = 0.86" for 1-YR event
Inflow = 0.64 cfs @ 11.97 hrs, Volume= 0.030 af
Outflow = 0.36 cfs @ 12.05 hrs, Volume= 0.020 af, Atten= 44%, Lag= 4.8 min
Primary = 0.36 cfs @ 12.05 hrs, Volume= 0.020 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.56' @ 12.05 hrs Surf.Area= 1,088 sf Storage= 512 cf

Plug-Flow detention time= 208.7 min calculated for 0.020 af (68% of inflow)
Center-of-Mass det. time= 100.4 min (933.5 - 833.1)

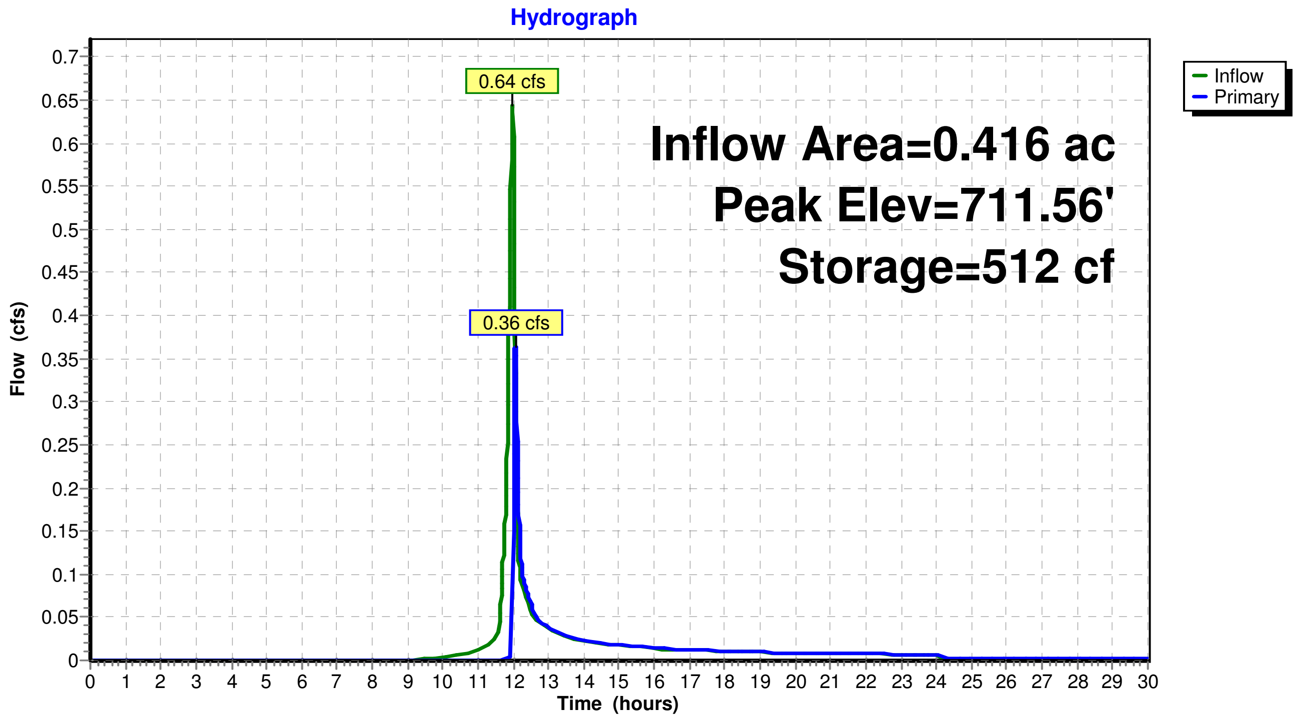
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	1,834 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	760	184.0	0	0	760
712.00	1,390	209.0	1,059	1,059	1,566
712.50	1,716	221.0	775	1,834	1,991

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 75.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 760 sf

Primary OutFlow Max=0.36 cfs @ 12.05 hrs HW=711.56' (Free Discharge)
1=Culvert (Passes 0.36 cfs of 4.64 cfs potential flow)
2=Orifice/Grate (Weir Controls 0.36 cfs @ 0.78 fps)
3=Underdrain (Passes 0.00 cfs of 1.95 cfs potential flow)
4=Exfiltration (Controls 0.00 cfs)

Pond 5P: South Bioretention Basin



Summary for Pond 6P: Dry Detention Basin

[79] Warning: Submerged Pond 2P Primary device # 1 by 0.69'
[79] Warning: Submerged Pond 3P Primary device # 1 INLET by 0.19'
[79] Warning: Submerged Pond 4P Primary device # 1 by 0.69'
[79] Warning: Submerged Pond 5P Primary device # 1 by 0.69'

Inflow Area = 5.343 ac, 65.77% Impervious, Inflow Depth > 0.94" for 1-YR event
Inflow = 6.98 cfs @ 11.98 hrs, Volume= 0.416 af
Outflow = 0.72 cfs @ 12.61 hrs, Volume= 0.377 af, Atten= 90%, Lag= 37.7 min
Primary = 0.72 cfs @ 12.61 hrs, Volume= 0.377 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 708.94' @ 12.61 hrs Surf.Area= 13,145 sf Storage= 8,430 cf

Plug-Flow detention time= 226.7 min calculated for 0.377 af (91% of inflow)
Center-of-Mass det. time= 174.4 min (1,015.7 - 841.3)

Volume	Invert	Avail.Storage	Storage Description
#1	708.25'	48,387 cf	**Dry Detention Basin (Irregular)** Listed below (Recalc)
#2	708.25'	939 cf	**12.0" Round 12" Diameter Pipe Storage** L= 1,195.0'
#3	708.25'	1,582 cf	**18.0" Round 18" Diameter Pipe Storage** L= 895.0'
		50,907 cf	Total Available Storage

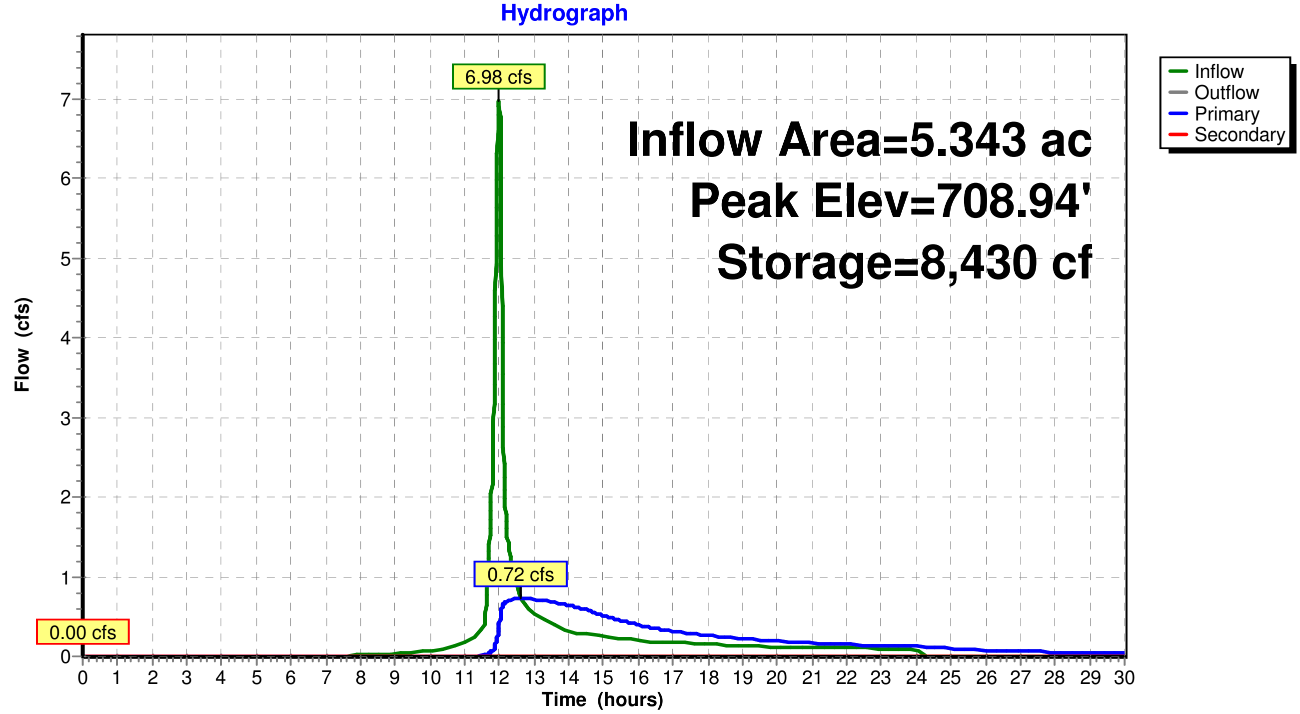
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
708.25	9,511	421.0	0	0	9,511
709.00	10,804	440.0	7,613	7,613	10,852
710.00	12,614	465.0	11,697	19,310	12,709
711.00	14,524	490.0	13,558	32,868	14,668
712.00	16,535	515.0	15,519	48,387	16,729

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	708.25'	**6.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	710.35'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.72 cfs @ 12.61 hrs HW=708.94' (Free Discharge)
└─**1=Culvert** (Passes 0.72 cfs of 0.87 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.72 cfs @ 3.13 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.25' (Free Discharge)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Dry Detention Basin



Summary for Pond 7P: Discharge to 12-inch Culvert

[81] Warning: Exceeded Pond 6P by 0.36' @ 11.98 hrs

Inflow Area = 6.586 ac, 64.68% Impervious, Inflow Depth > 0.87" for 1-YR event
Inflow = 2.54 cfs @ 11.98 hrs, Volume= 0.480 af
Outflow = 2.32 cfs @ 12.02 hrs, Volume= 0.480 af, Atten= 9%, Lag= 2.1 min
Primary = 2.32 cfs @ 12.02 hrs, Volume= 0.480 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 709.09' @ 12.02 hrs Surf.Area= 780 sf Storage= 204 cf

Plug-Flow detention time= 0.5 min calculated for 0.480 af (100% of inflow)
Center-of-Mass det. time= 0.5 min (974.9 - 974.4)

Volume	Invert	Avail.Storage	Storage Description
#1	708.21'	4,370 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

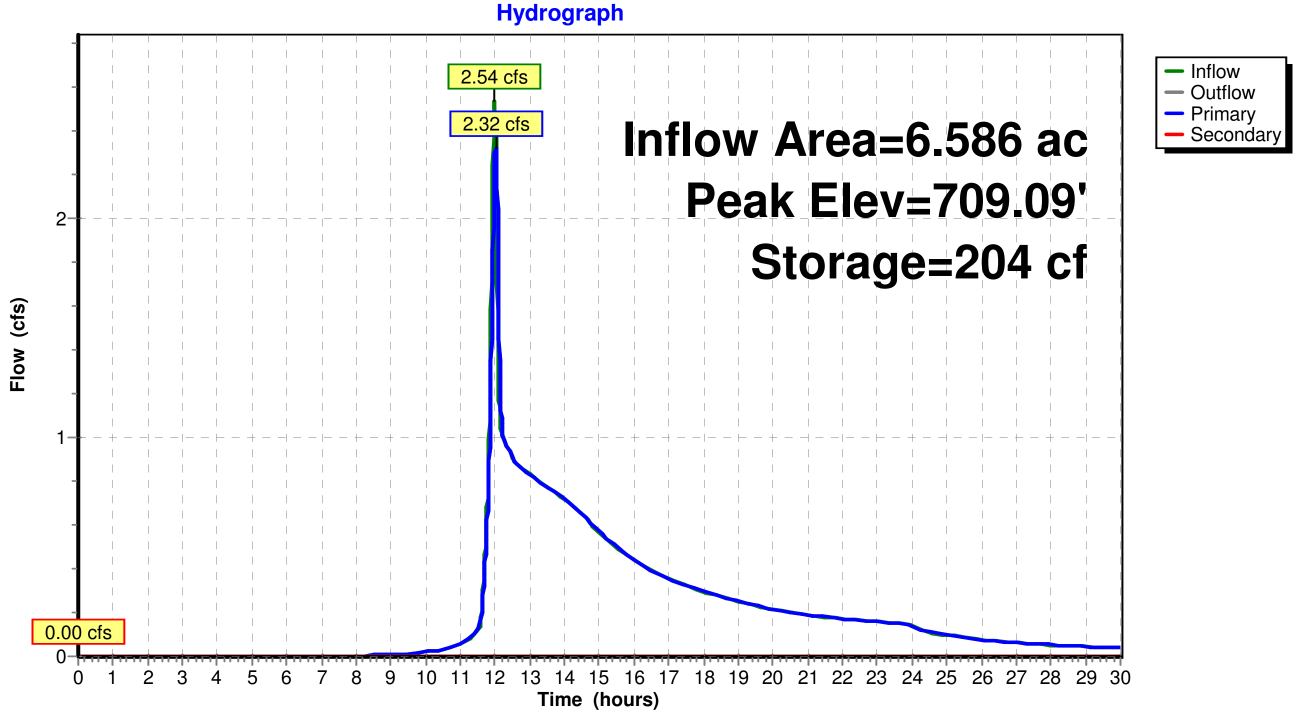
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
708.21	0	0.0	0	0	0
709.00	560	269.0	147	147	5,759
710.00	5,437	618.0	2,581	2,728	30,398
710.25	7,765	634.0	1,642	4,370	31,999

Device	Routing	Invert	Outlet Devices
#1	Primary	708.21'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	710.00'	**180.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=2.32 cfs @ 12.02 hrs HW=709.08' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 2.32 cfs @ 3.18 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.21' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Discharge to 12-inch Culvert



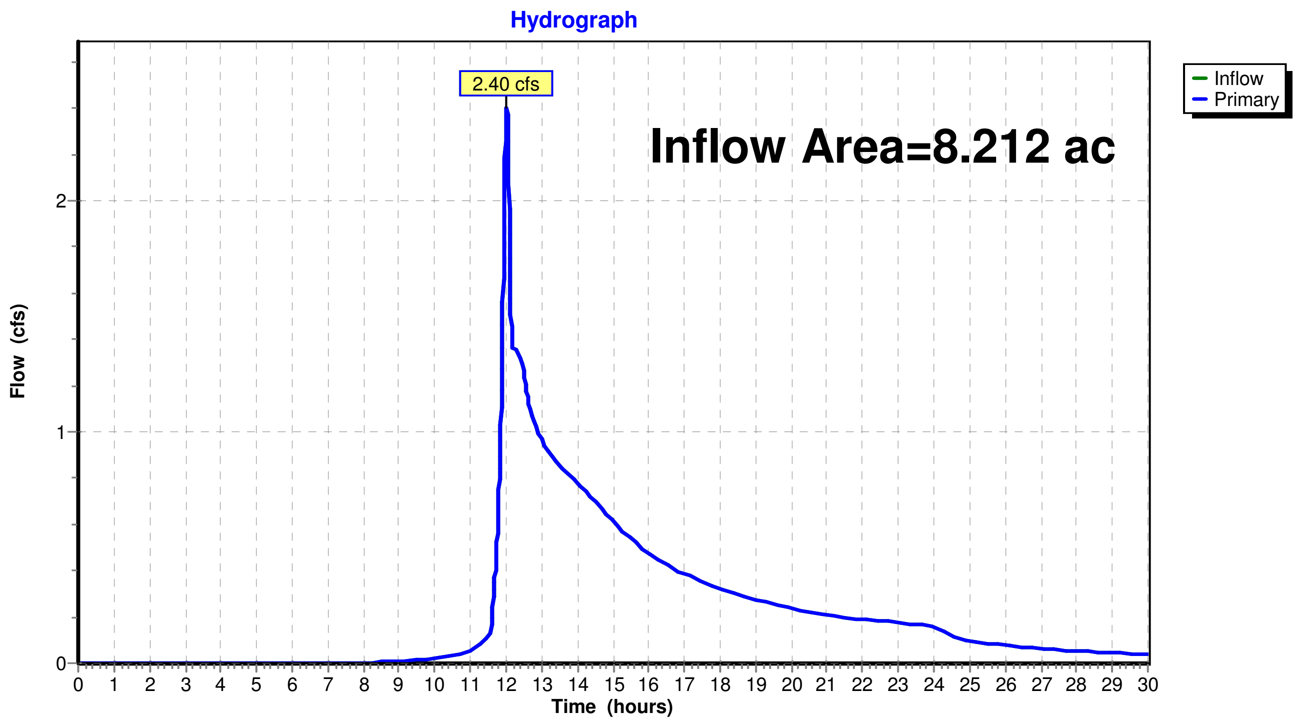
Summary for Pond 8P: Discharge to West Property

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

Inflow Area =	8.212 ac,	51.88% Impervious,	Inflow Depth > 0.78"	for 1-YR event
Inflow =	2.40 cfs @	12.02 hrs, Volume=	0.531 af	
Primary =	2.40 cfs @	12.02 hrs, Volume=	0.531 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 8P: Discharge to West Property



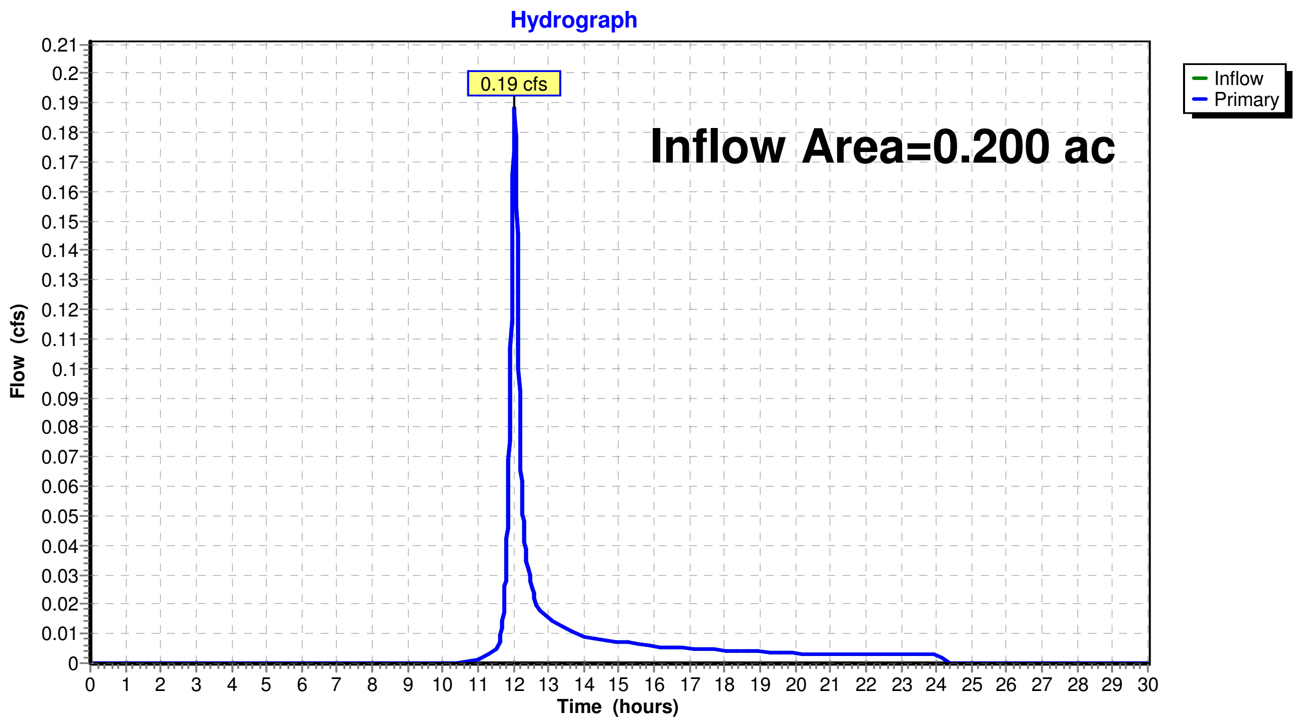
Summary for Pond 9P: Discharge to Seneca Street Drainage System

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

Inflow Area = 0.200 ac, 25.00% Impervious, Inflow Depth = 0.65" for 1-YR event
Inflow = 0.19 cfs @ 12.04 hrs, Volume= 0.011 af
Primary = 0.19 cfs @ 12.04 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 9P: Discharge to Seneca Street Drainage System



Summary for Pond 10P: Permanent Pool

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	702.00'	16,601 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
702.00	1,398	157.0	0	0	1,398
703.00	1,732	170.0	1,562	1,562	1,774
704.00	2,082	182.0	1,904	3,466	2,153
705.00	2,468	196.0	2,272	5,739	2,615
706.00	2,870	208.0	2,666	8,405	3,050
707.00	3,286	220.0	3,076	11,481	3,512
708.00	3,754	233.0	3,517	14,998	4,032
708.25	9,511	421.0	1,603	16,601	13,817

Summary for Subcatchment 1S: North Drainage Area - Lawn Area

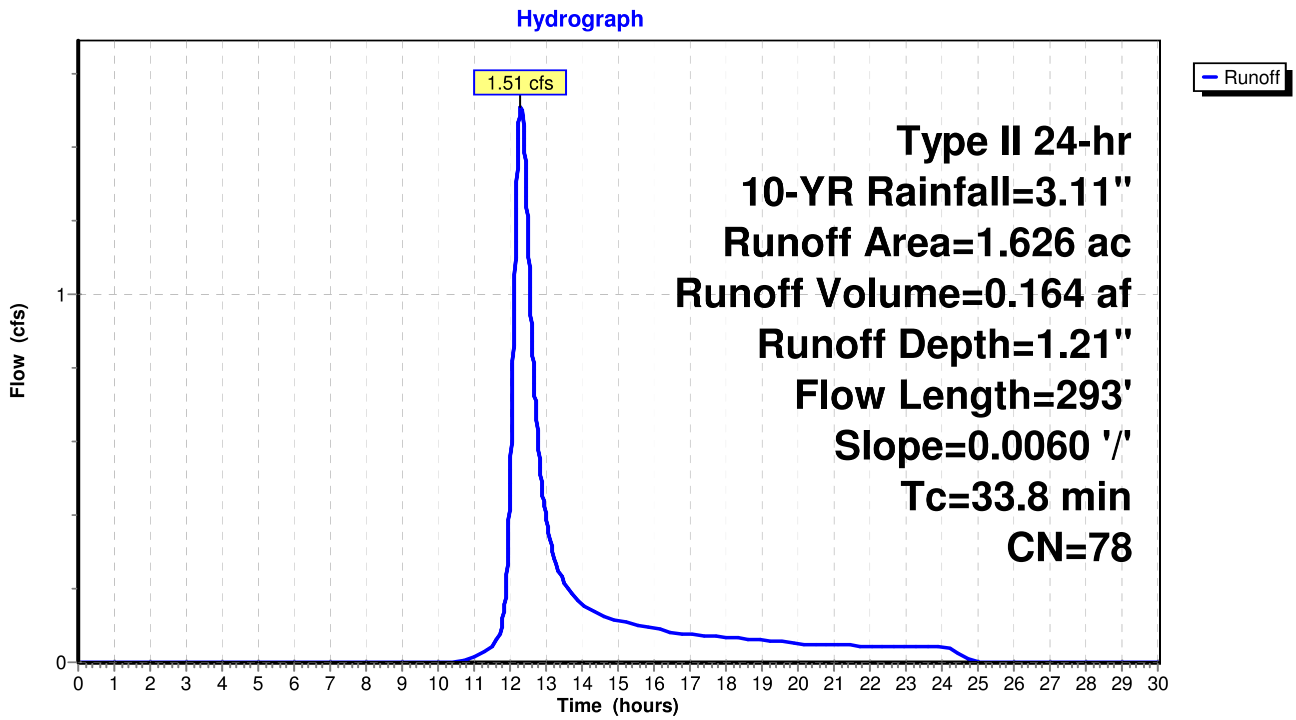
Runoff = 1.51 cfs @ 12.29 hrs, Volume= 0.164 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.626	80	>75% Grass cover, Good, HSG D
1.000	77	Woods, Good, HSG D
1.626	78	Weighted Average
1.626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.9	100	0.0060	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
5.9	193	0.0060	0.54		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.8	293	Total			

Subcatchment 1S: North Drainage Area - Lawn Area



Summary for Subcatchment 2S: Northeast Drainage Area

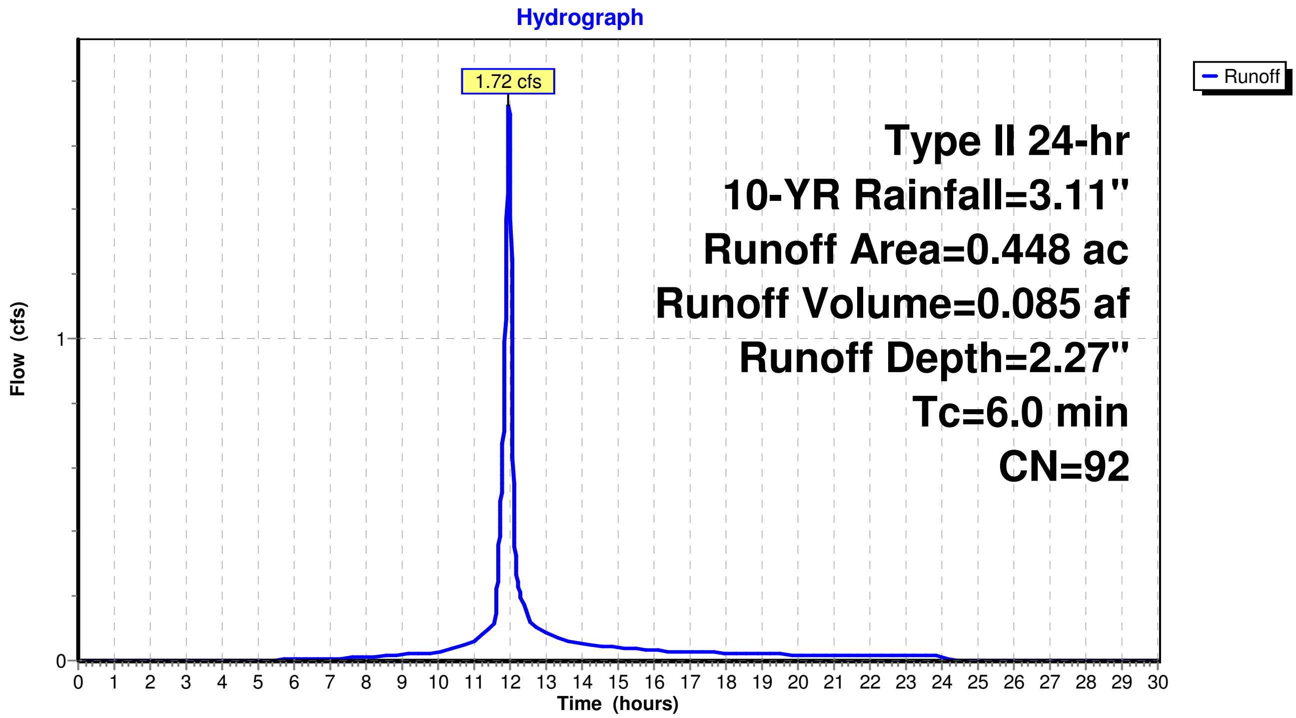
Runoff = 1.72 cfs @ 11.97 hrs, Volume= 0.085 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.306	98	Paved parking, HSG D
0.142	80	>75% Grass cover, Good, HSG D
0.448	92	Weighted Average
0.142		31.70% Pervious Area
0.306		68.30% Impervious Area

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

Subcatchment 2S: Northeast Drainage Area



Summary for Subcatchment 3S: Northwest Drainage Area

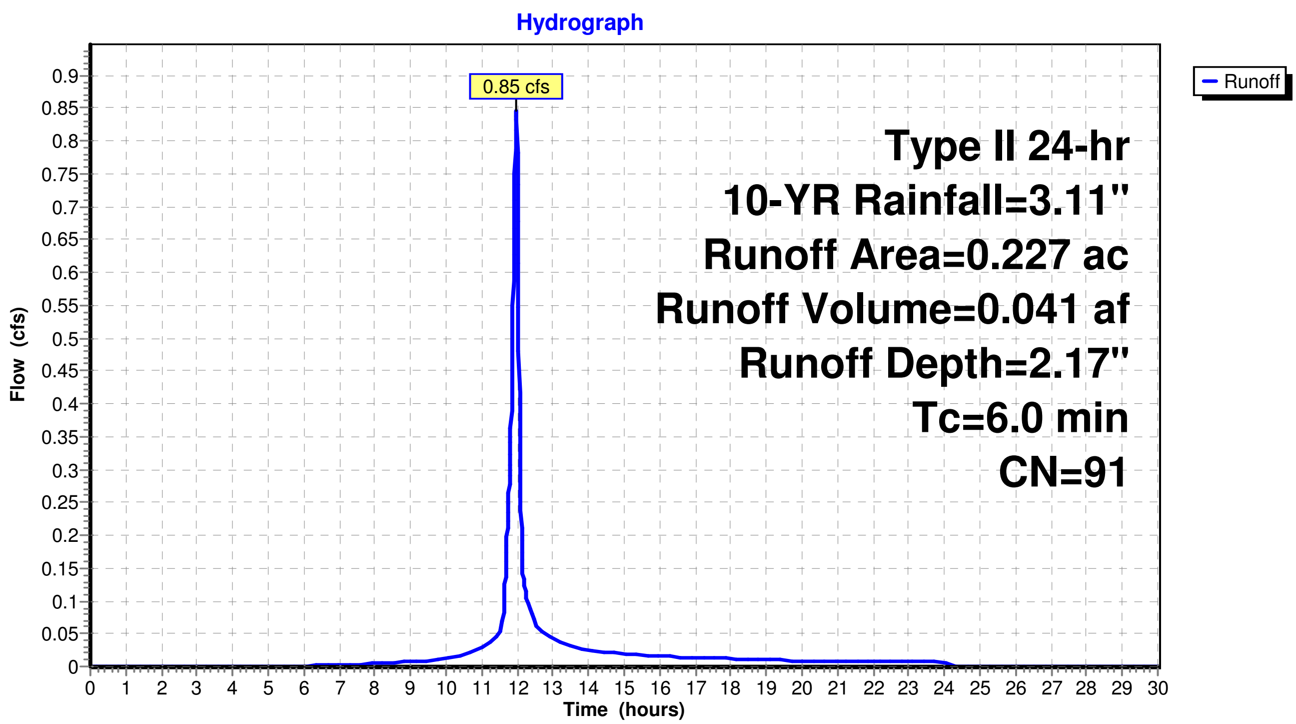
Runoff = 0.85 cfs @ 11.97 hrs, Volume= 0.041 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG D
0.094	80	>75% Grass cover, Good, HSG D
0.227	91	Weighted Average
0.094		41.41% Pervious Area
0.133		58.59% Impervious Area

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

Subcatchment 3S: Northwest Drainage Area



Summary for Subcatchment 4S: Middle Drainage Area

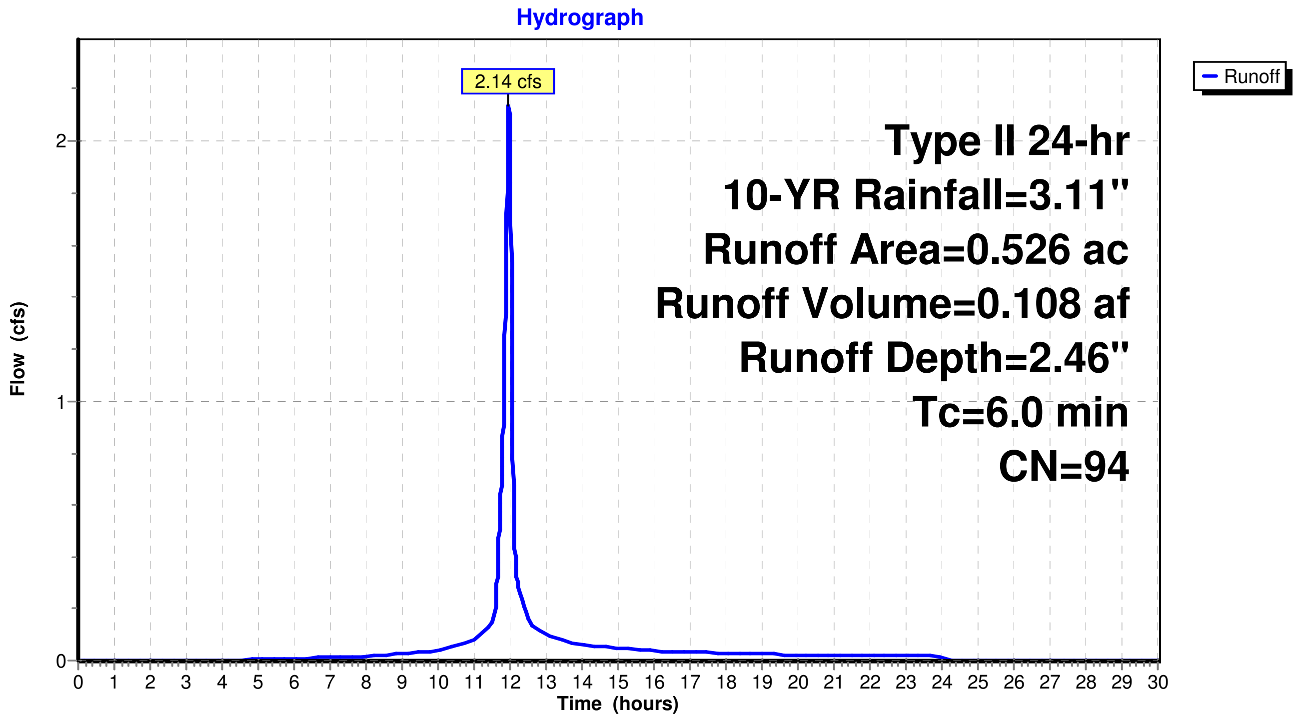
Runoff = 2.14 cfs @ 11.97 hrs, Volume= 0.108 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.406	98	Paved parking, HSG D
0.120	80	>75% Grass cover, Good, HSG D
0.526	94	Weighted Average
0.120		22.81% Pervious Area
0.406		77.19% Impervious Area

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

Subcatchment 4S: Middle Drainage Area



Summary for Subcatchment 5S: Southeast Drainage Area

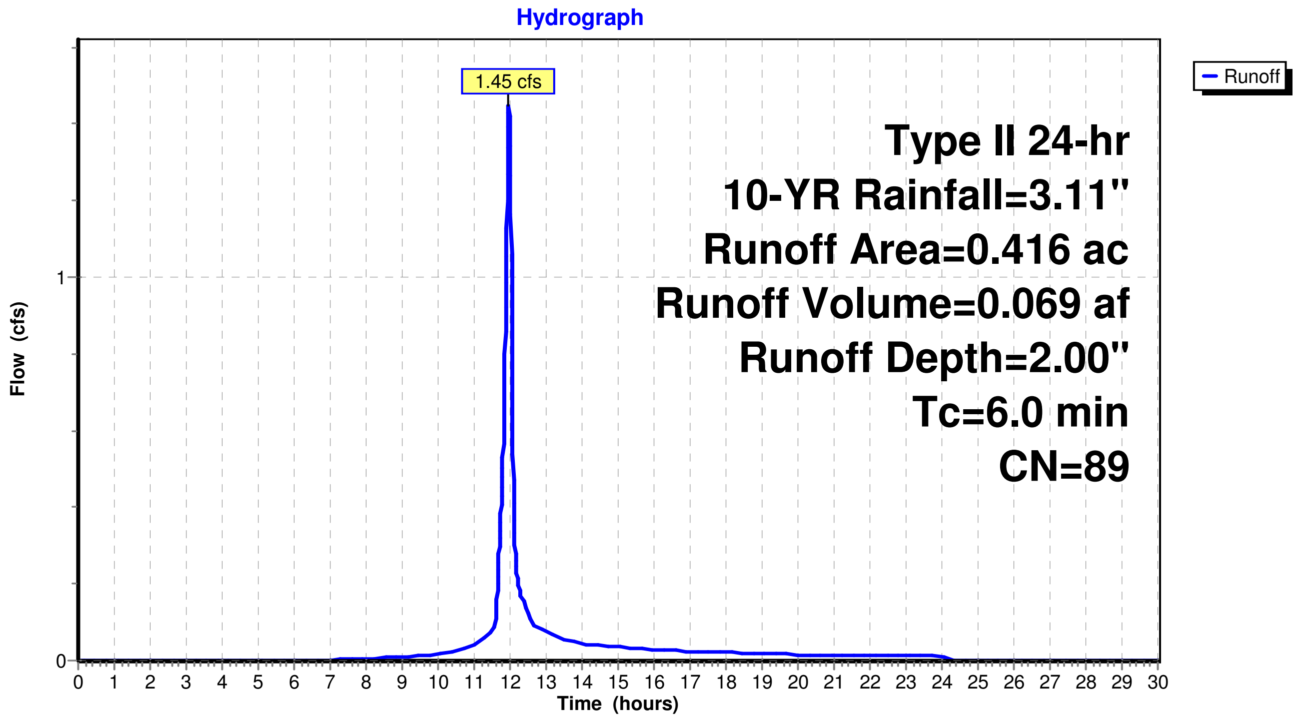
Runoff = 1.45 cfs @ 11.97 hrs, Volume= 0.069 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.201	98	Paved parking, HSG D
0.215	80	>75% Grass cover, Good, HSG D
0.416	89	Weighted Average
0.215		51.68% Pervious Area
0.201		48.32% Impervious Area

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

Subcatchment 5S: Southeast Drainage Area



Summary for Subcatchment 6S: West Drainage Area

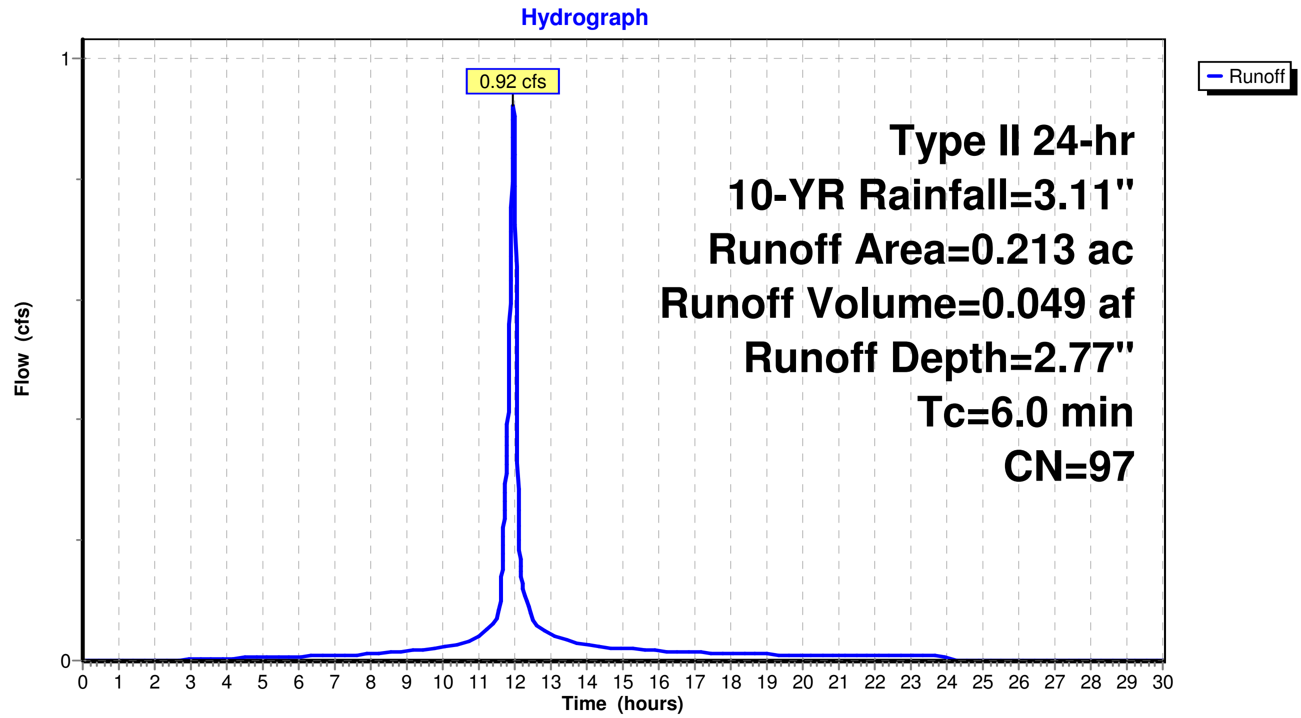
Runoff = 0.92 cfs @ 11.97 hrs, Volume= 0.049 af, Depth= 2.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.196	98	Paved parking, HSG D
0.017	80	>75% Grass cover, Good, HSG D
0.213	97	Weighted Average
0.017		7.98% Pervious Area
0.196		92.02% Impervious Area

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

Subcatchment 6S: West Drainage Area



Summary for Subcatchment 7S: North Parking Lot (to Wet Pond)

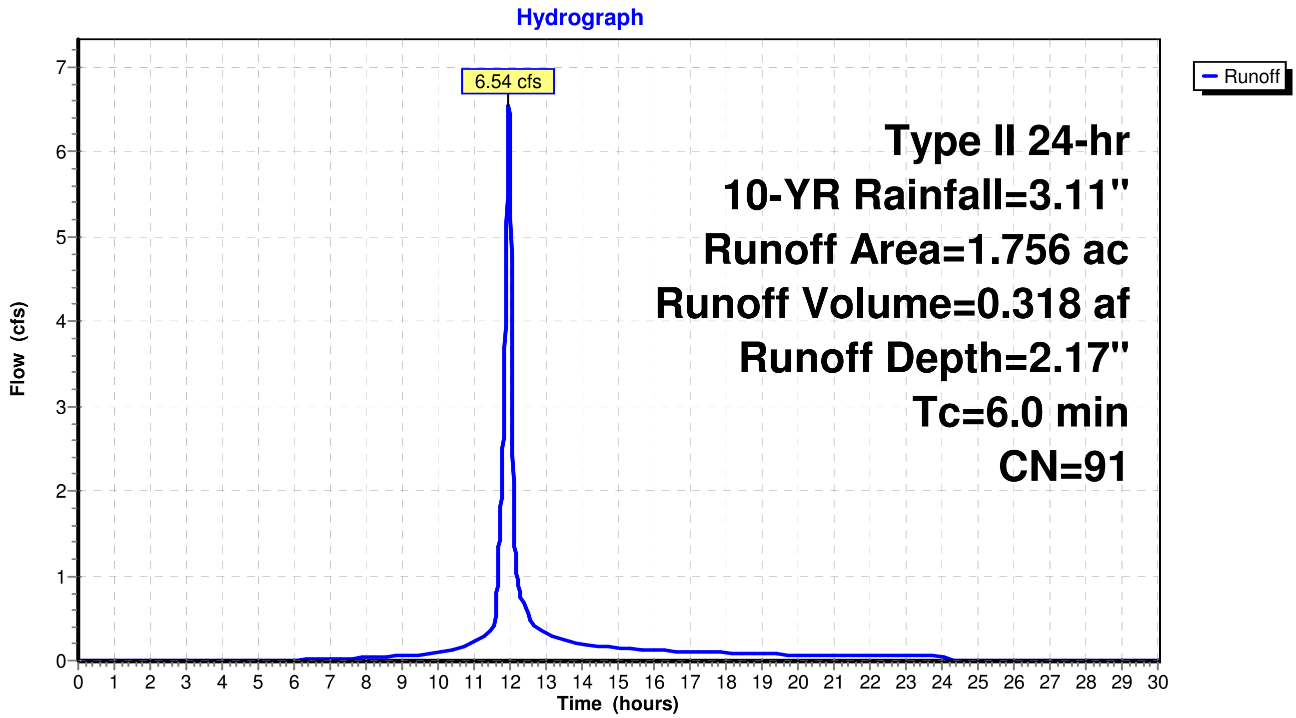
Runoff = 6.54 cfs @ 11.97 hrs, Volume= 0.318 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
1.074	98	Paved parking, HSG D
0.682	80	>75% Grass cover, Good, HSG D
1.756	91	Weighted Average
0.682		38.84% Pervious Area
1.074		61.16% Impervious Area

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

Subcatchment 7S: North Parking Lot (to Wet Pond)



Summary for Subcatchment 8S: East Drainage Area

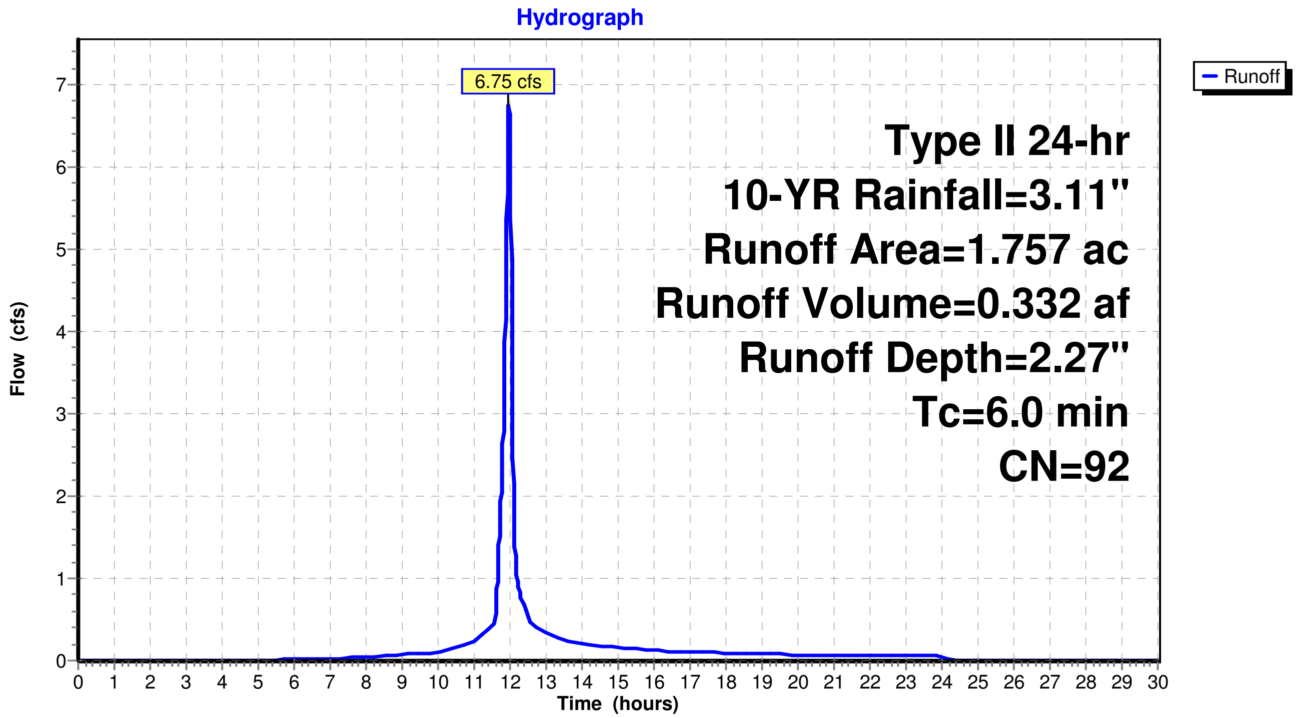
Runoff = 6.75 cfs @ 11.97 hrs, Volume= 0.332 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
1.198	98	Paved parking, HSG D
0.559	80	>75% Grass cover, Good, HSG D
1.757	92	Weighted Average
0.559		31.82% Pervious Area
1.198		68.18% Impervious Area

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

Subcatchment 8S: East Drainage Area



Summary for Subcatchment 9S: Southwest Drainage Area

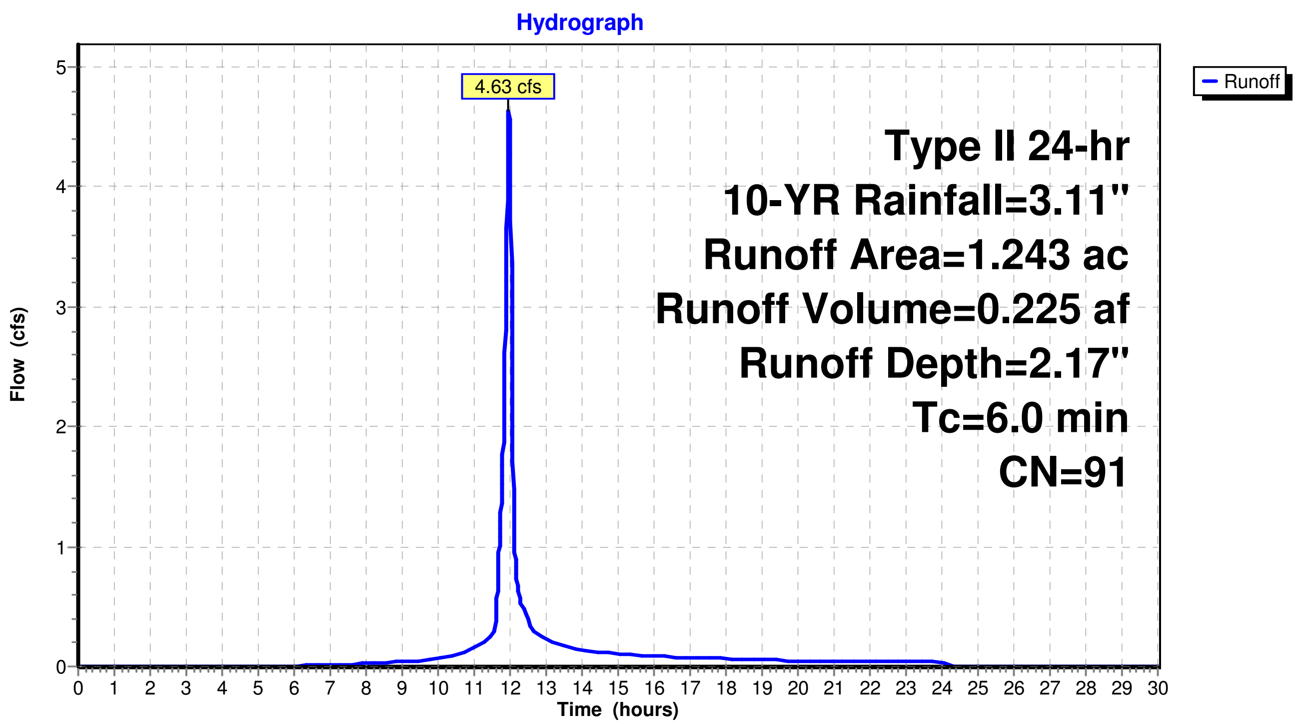
Runoff = 4.63 cfs @ 11.97 hrs, Volume= 0.225 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.746	98	Paved parking, HSG D
0.497	80	>75% Grass cover, Good, HSG D
1.243	91	Weighted Average
0.497		39.98% Pervious Area
0.746		60.02% Impervious Area

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

Subcatchment 9S: Southwest Drainage Area



Summary for Subcatchment 10S: South Drainage Area

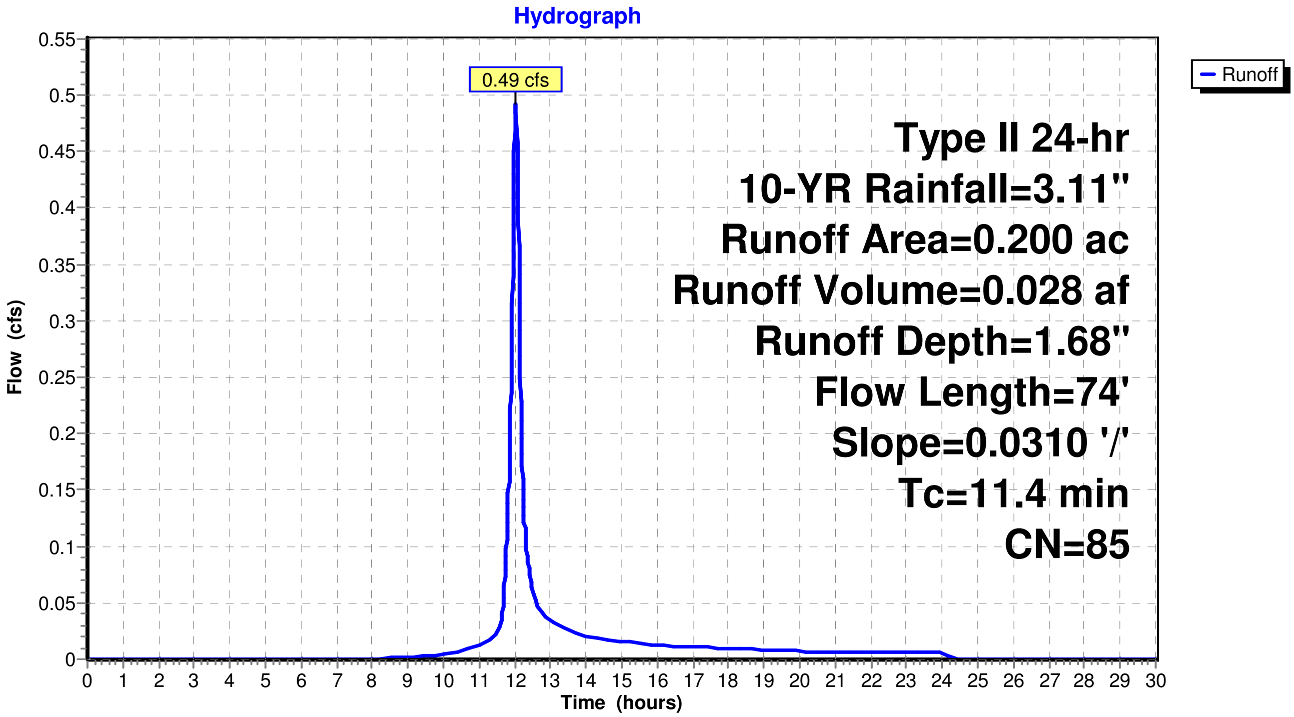
Runoff = 0.49 cfs @ 12.03 hrs, Volume= 0.028 af, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-YR Rainfall=3.11"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.050	98	Paved parking, HSG D
0.200	85	Weighted Average
0.150		75.00% Pervious Area
0.050		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	74	0.0310	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"

Subcatchment 10S: South Drainage Area



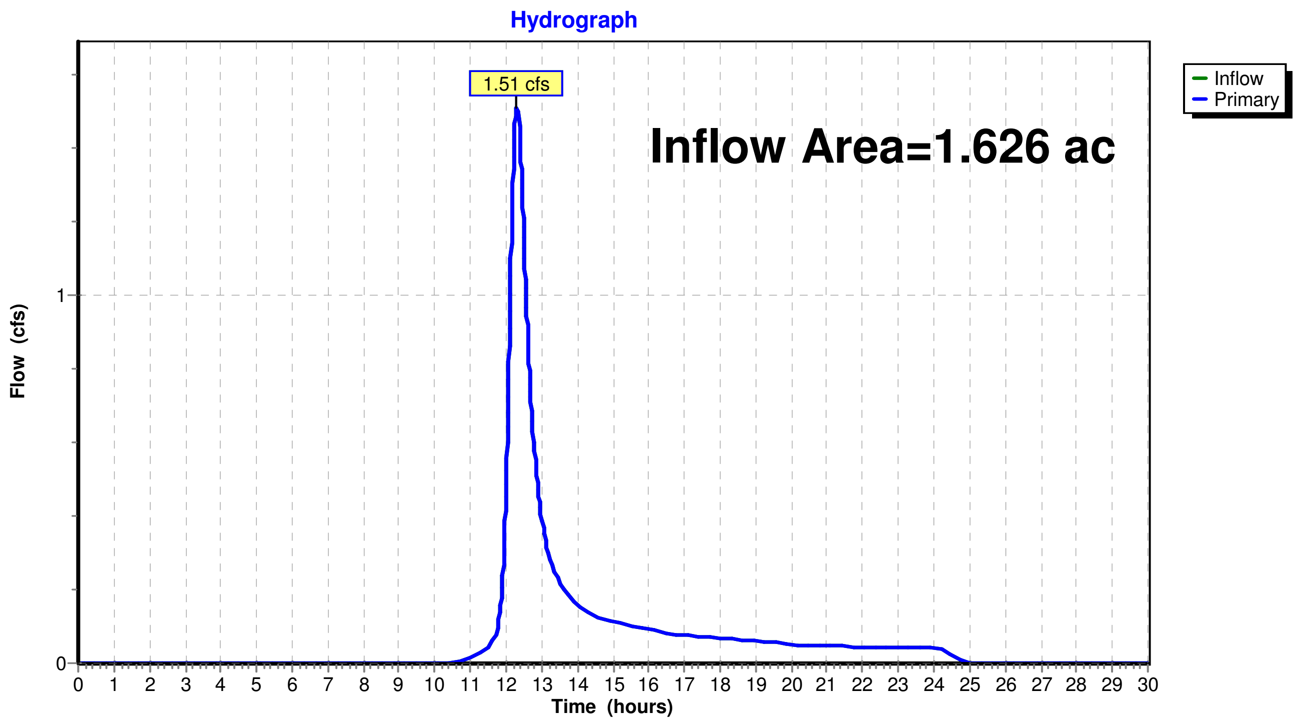
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area =	1.626 ac,	0.00% Impervious,	Inflow Depth = 1.21"	for 10-YR event		
Inflow =	1.51 cfs @	12.29 hrs,	Volume=	0.164 af		
Primary =	1.51 cfs @	12.29 hrs,	Volume=	0.164 af,	Atten= 0%,	Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



Summary for Pond 2P: Northeast Bioretention Basin

Inflow Area = 0.448 ac, 68.30% Impervious, Inflow Depth = 2.27" for 10-YR event
Inflow = 1.72 cfs @ 11.97 hrs, Volume= 0.085 af
Outflow = 1.65 cfs @ 11.99 hrs, Volume= 0.071 af, Atten= 4%, Lag= 1.3 min
Primary = 1.65 cfs @ 11.99 hrs, Volume= 0.071 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.66' @ 11.99 hrs Surf.Area= 1,437 sf Storage= 822 cf

Plug-Flow detention time= 116.2 min calculated for 0.071 af (84% of inflow)
Center-of-Mass det. time= 47.0 min (842.6 - 795.6)

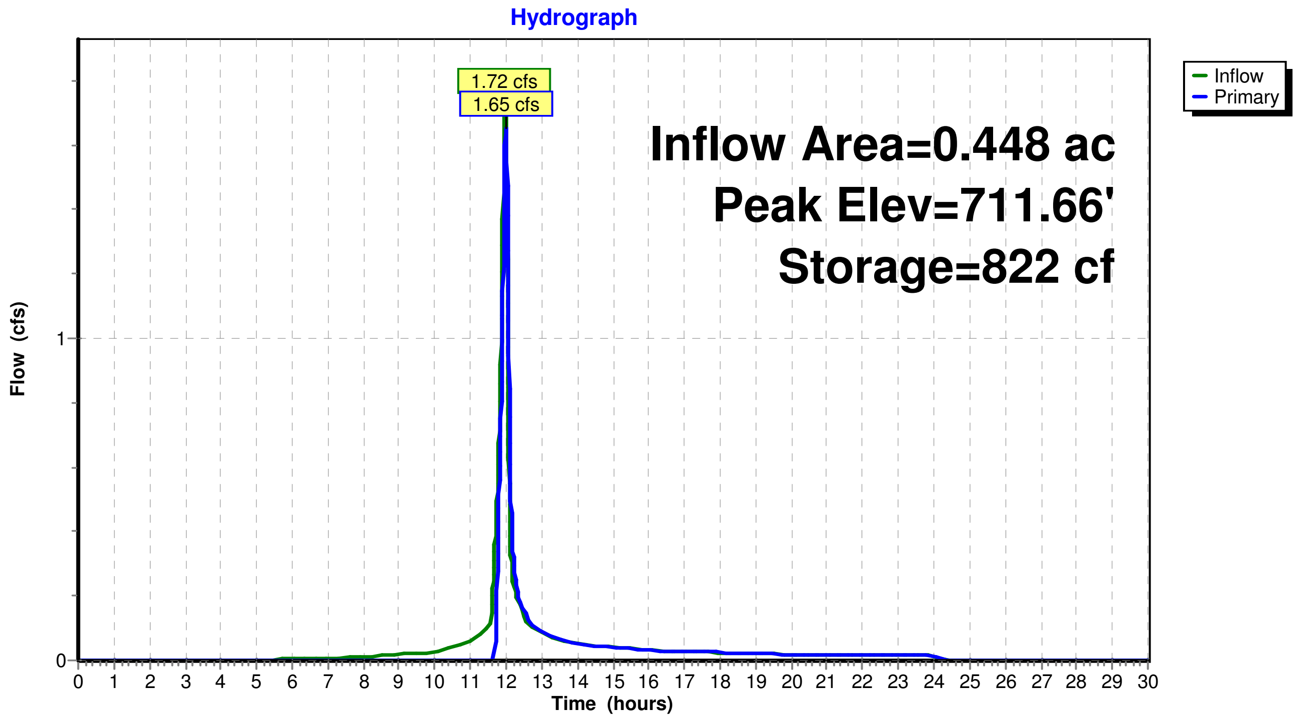
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	2,312 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	1,070	133.0	0	0	1,070
712.00	1,649	158.0	1,349	1,349	1,667
712.50	2,218	180.0	963	2,312	2,265

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 170.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 1,070 sf

Primary OutFlow Max=1.65 cfs @ 11.99 hrs HW=711.66' (Free Discharge)
1=Culvert (Passes 1.65 cfs of 3.64 cfs potential flow)
2=Orifice/Grate (Weir Controls 1.64 cfs @ 1.30 fps)
3=Underdrain (Passes 0.00 cfs of 2.30 cfs potential flow)
4=Exfiltration (Controls 0.00 cfs)

Pond 2P: Northeast Bioretention Basin



Summary for Pond 3P: Northwest Bioretention Basin

Inflow Area = 0.227 ac, 58.59% Impervious, Inflow Depth = 2.17" for 10-YR event
Inflow = 0.85 cfs @ 11.97 hrs, Volume= 0.041 af
Outflow = 0.82 cfs @ 11.99 hrs, Volume= 0.035 af, Atten= 2%, Lag= 1.0 min
Primary = 0.82 cfs @ 11.99 hrs, Volume= 0.035 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 712.10' @ 11.99 hrs Surf.Area= 814 sf Storage= 387 cf

Plug-Flow detention time= 123.0 min calculated for 0.035 af (84% of inflow)
Center-of-Mass det. time= 53.3 min (853.8 - 800.4)

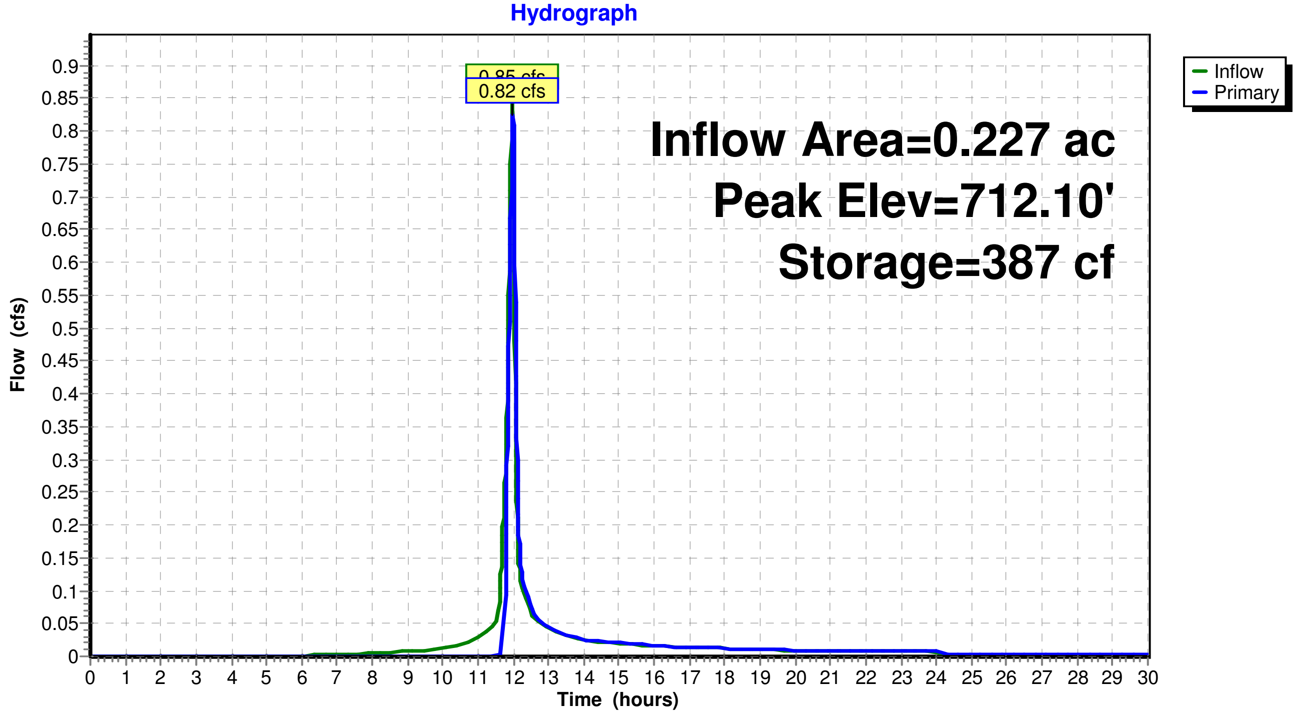
Volume	Invert	Avail.Storage	Storage Description
#1	711.50'	1,373 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.50	487	131.0	0	0	487
712.00	759	144.0	309	309	780
713.00	1,402	171.0	1,064	1,373	1,475

Device	Routing	Invert	Outlet Devices
#1	Primary	708.75'	**12.0" Round Culvert** L= 46.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.75' / 708.25' S= 0.0109 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	712.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.75'	**8.0" Round Underdrain** L= 51.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.75' / 708.75' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.50'	**0.250 in/hr Exfiltration over Surface area above 711.50'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 487 sf

Primary OutFlow Max=0.82 cfs @ 11.99 hrs HW=712.10' (Free Discharge)
- **1=Culvert** (Passes 0.82 cfs of 5.04 cfs potential flow)
  - **2=Orifice/Grate** (Weir Controls 0.82 cfs @ 1.03 fps)
  - **3=Underdrain** (Passes 0.00 cfs of 2.13 cfs potential flow)
    - **4=Exfiltration** (Controls 0.00 cfs)

Pond 3P: Northwest Bioretention Basin



Summary for Pond 4P: Middle Bioretention Basin

Inflow Area = 0.526 ac, 77.19% Impervious, Inflow Depth = 2.46" for 10-YR event
Inflow = 2.14 cfs @ 11.97 hrs, Volume= 0.108 af
Outflow = 1.94 cfs @ 12.00 hrs, Volume= 0.085 af, Atten= 9%, Lag= 2.0 min
Primary = 1.94 cfs @ 12.00 hrs, Volume= 0.085 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.68' @ 12.00 hrs Surf.Area= 2,523 sf Storage= 1,453 cf

Plug-Flow detention time= 148.2 min calculated for 0.085 af (79% of inflow)
Center-of-Mass det. time= 66.9 min (851.6 - 784.8)

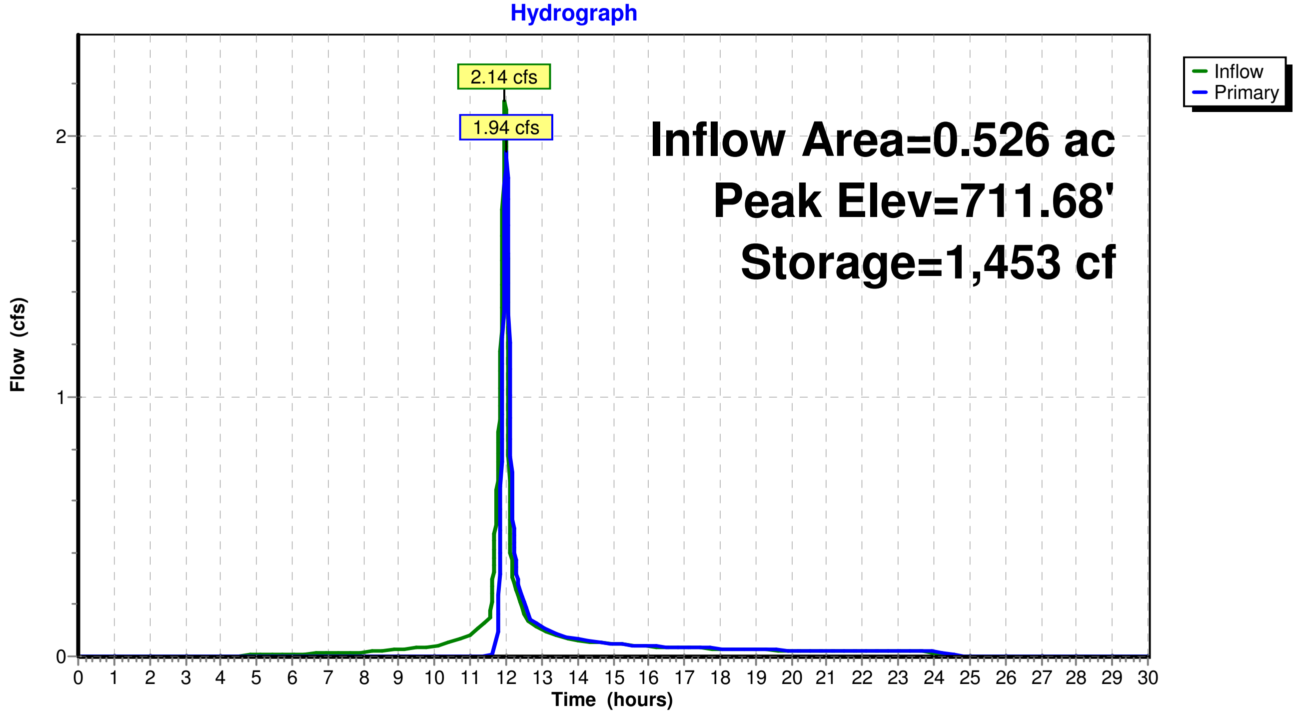
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	3,947 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	1,795	362.0	0	0	1,795
712.00	2,915	400.0	2,332	2,332	4,131
712.50	3,555	418.0	1,615	3,947	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 64.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 144.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 1,795 sf

Primary OutFlow Max=1.94 cfs @ 12.00 hrs HW=711.68' (Free Discharge)
└─**1=Culvert** (Passes 1.94 cfs of 4.97 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 1.93 cfs @ 1.37 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 1.50 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 4P: Middle Bioretention Basin



Summary for Pond 5P: South Bioretention Basin

Inflow Area = 0.416 ac, 48.32% Impervious, Inflow Depth = 2.00" for 10-YR event
Inflow = 1.45 cfs @ 11.97 hrs, Volume= 0.069 af
Outflow = 1.40 cfs @ 11.99 hrs, Volume= 0.060 af, Atten= 3%, Lag= 1.1 min
Primary = 1.40 cfs @ 11.99 hrs, Volume= 0.060 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.64' @ 11.99 hrs Surf.Area= 1,143 sf Storage= 607 cf

Plug-Flow detention time= 106.9 min calculated for 0.060 af (86% of inflow)
Center-of-Mass det. time= 42.3 min (851.5 - 809.1)

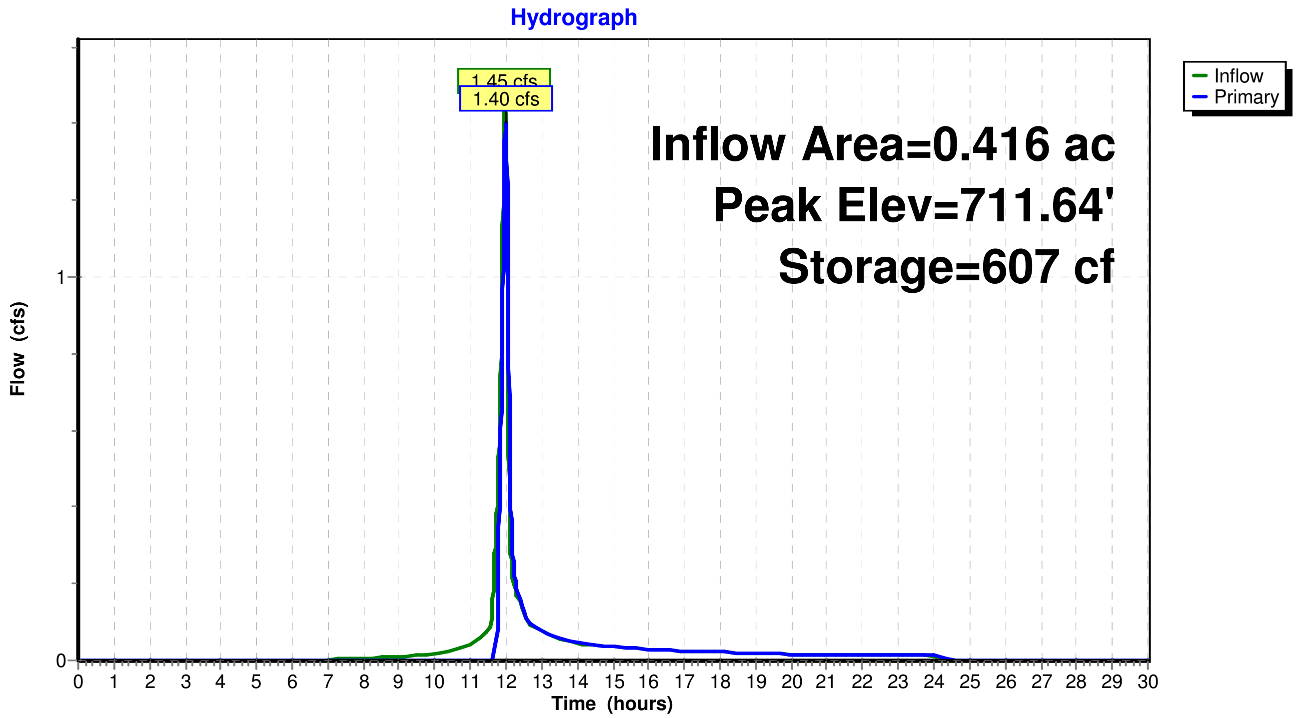
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	1,834 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	760	184.0	0	0	760
712.00	1,390	209.0	1,059	1,059	1,566
712.50	1,716	221.0	775	1,834	1,991

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 75.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 760 sf

Primary OutFlow Max=1.40 cfs @ 11.99 hrs HW=711.64' (Free Discharge)
1=Culvert (Passes 1.40 cfs of 4.73 cfs potential flow)
2=Orifice/Grate (Weir Controls 1.40 cfs @ 1.23 fps)
3=Underdrain (Passes 0.00 cfs of 1.98 cfs potential flow)
4=Exfiltration (Controls 0.00 cfs)

Pond 5P: South Bioretention Basin



Summary for Pond 6P: Dry Detention Basin

[79] Warning: Submerged Pond 2P Primary device # 1 by 1.77'
[79] Warning: Submerged Pond 3P Primary device # 1 INLET by 1.27'
[79] Warning: Submerged Pond 4P Primary device # 1 by 1.77'
[79] Warning: Submerged Pond 5P Primary device # 1 by 1.77'

Inflow Area = 5.343 ac, 65.77% Impervious, Inflow Depth > 2.13" for 10-YR event
Inflow = 19.84 cfs @ 11.98 hrs, Volume= 0.950 af
Outflow = 1.36 cfs @ 12.63 hrs, Volume= 0.905 af, Atten= 93%, Lag= 39.3 min
Primary = 1.36 cfs @ 12.63 hrs, Volume= 0.905 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 710.02' @ 12.63 hrs Surf.Area= 12,650 sf Storage= 22,080 cf

Plug-Flow detention time= 232.7 min calculated for 0.904 af (95% of inflow)
Center-of-Mass det. time= 203.8 min (1,013.6 - 809.8)

Volume	Invert	Avail.Storage	Storage Description
#1	708.25'	48,387 cf	**Dry Detention Basin (Irregular)** Listed below (Recalc)
#2	708.25'	939 cf	**12.0" Round 12" Diameter Pipe Storage** L= 1,195.0'
#3	708.25'	1,582 cf	**18.0" Round 18" Diameter Pipe Storage** L= 895.0'
		50,907 cf	Total Available Storage

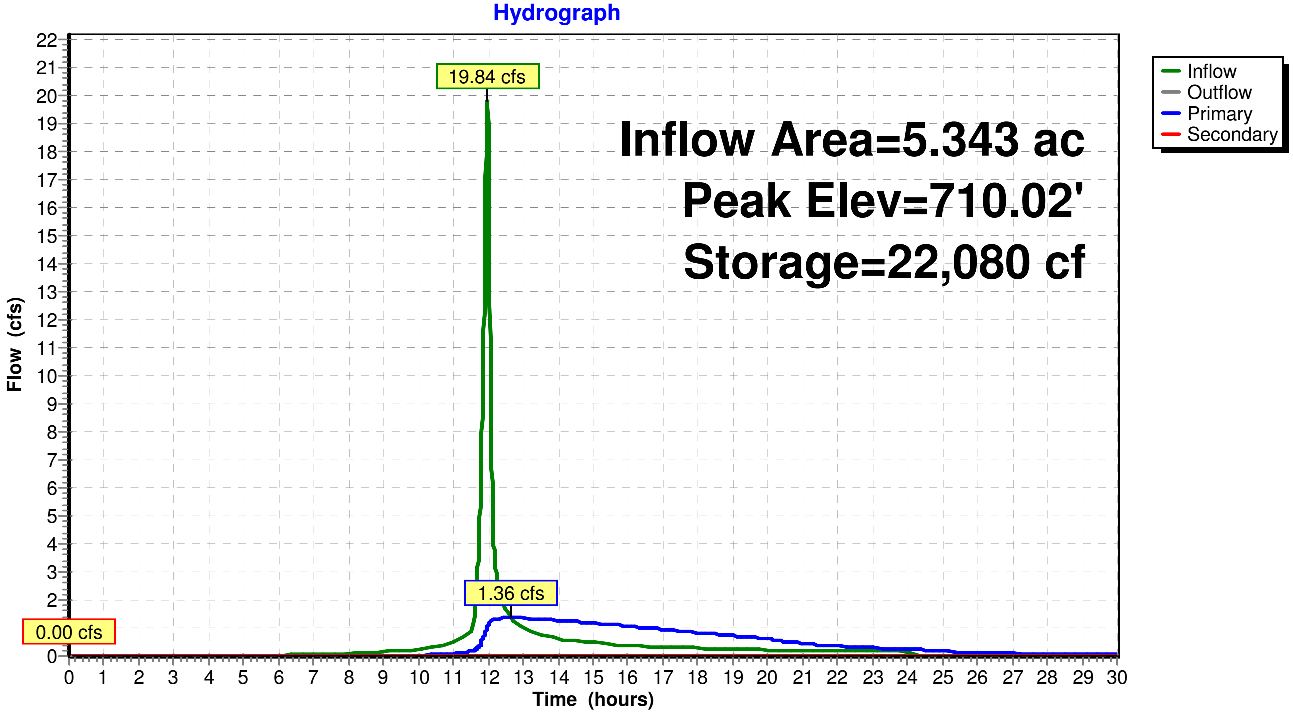
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
708.25	9,511	421.0	0	0	9,511
709.00	10,804	440.0	7,613	7,613	10,852
710.00	12,614	465.0	11,697	19,310	12,709
711.00	14,524	490.0	13,558	32,868	14,668
712.00	16,535	515.0	15,519	48,387	16,729

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	708.25'	**6.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	710.35'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.36 cfs @ 12.63 hrs HW=710.02' (Free Discharge)
└─**1=Culvert** (Passes 1.36 cfs of 3.36 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 1.36 cfs @ 5.90 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.25' (Free Discharge)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: Dry Detention Basin



Summary for Pond 7P: Discharge to 12-inch Culvert

[81] Warning: Exceeded Pond 6P by 0.25' @ 11.89 hrs

Inflow Area = 6.586 ac, 64.68% Impervious, Inflow Depth > 2.06" for 10-YR event
Inflow = 5.65 cfs @ 11.97 hrs, Volume= 1.130 af
Outflow = 3.70 cfs @ 12.05 hrs, Volume= 1.130 af, Atten= 35%, Lag= 4.8 min
Primary = 3.70 cfs @ 12.05 hrs, Volume= 1.130 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 709.67' @ 12.05 hrs Surf.Area= 3,250 sf Storage= 1,293 cf

Plug-Flow detention time= 1.1 min calculated for 1.130 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (972.2 - 971.1)

Volume	Invert	Avail.Storage	Storage Description
#1	708.21'	4,370 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

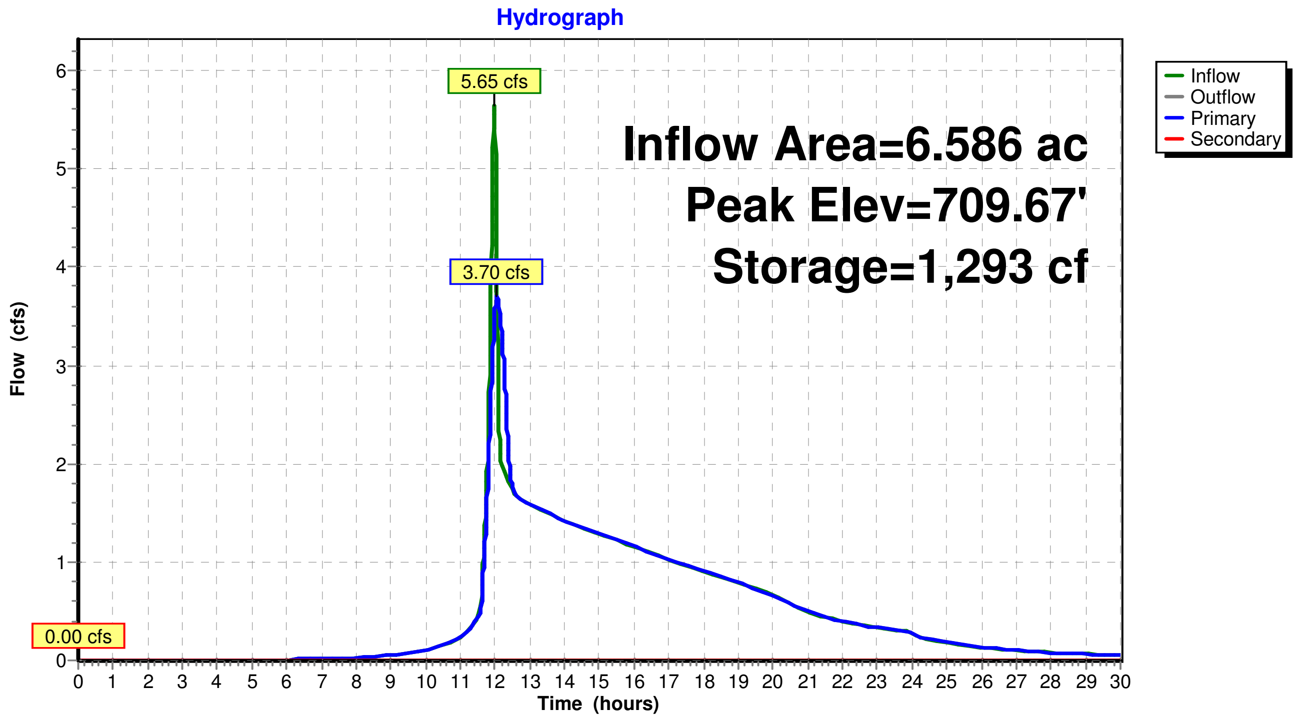
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
708.21	0	0.0	0	0	0
709.00	560	269.0	147	147	5,759
710.00	5,437	618.0	2,581	2,728	30,398
710.25	7,765	634.0	1,642	4,370	31,999

Device	Routing	Invert	Outlet Devices
#1	Primary	708.21'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	710.00'	**180.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=3.70 cfs @ 12.05 hrs HW=709.67' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 3.70 cfs @ 4.71 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=708.21' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Discharge to 12-inch Culvert



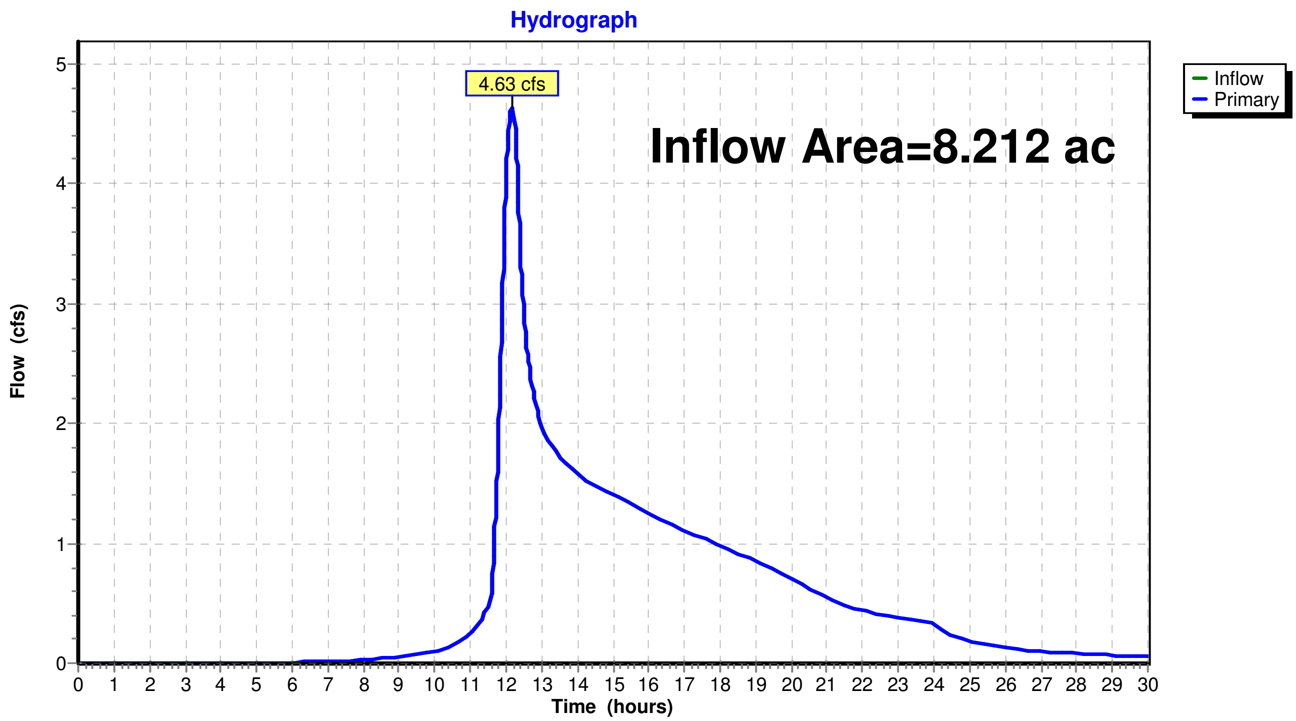
Summary for Pond 8P: Discharge to West Property

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

Inflow Area = 8.212 ac, 51.88% Impervious, Inflow Depth > 1.89" for 10-YR event
Inflow = 4.63 cfs @ 12.17 hrs, Volume= 1.293 af
Primary = 4.63 cfs @ 12.17 hrs, Volume= 1.293 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 8P: Discharge to West Property



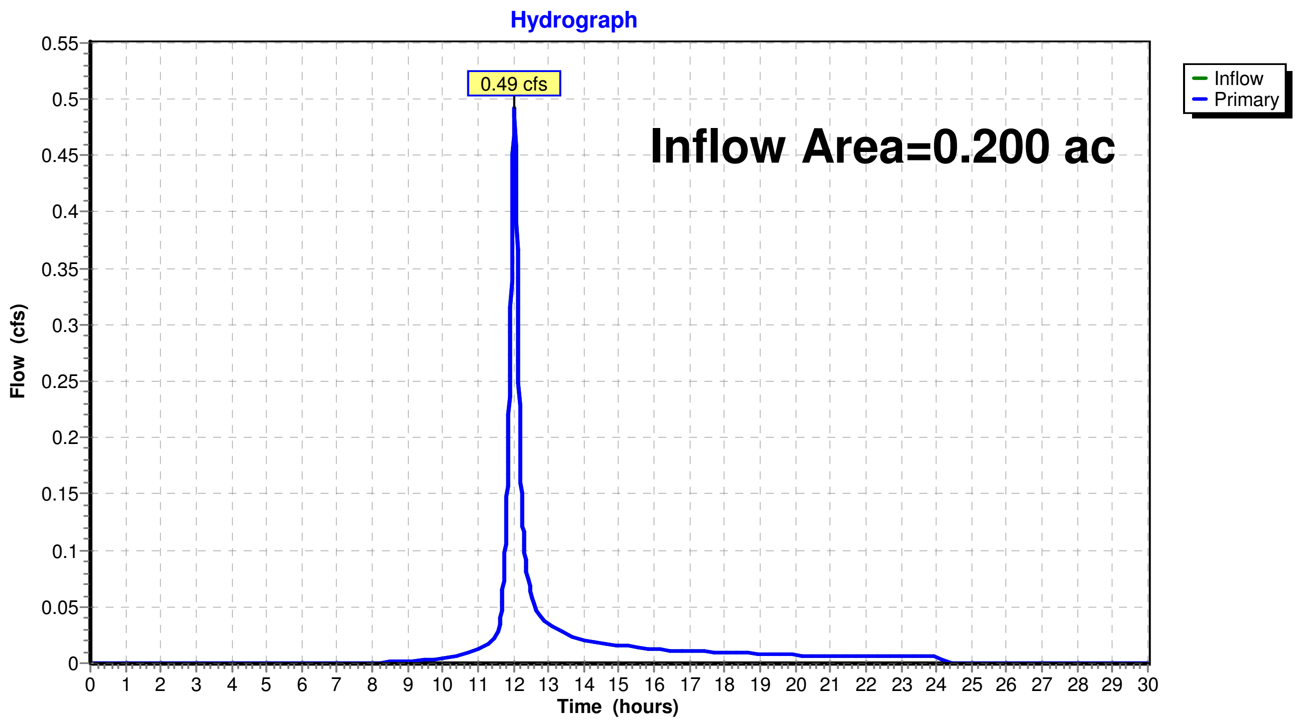
Summary for Pond 9P: Discharge to Seneca Street Drainage System

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

Inflow Area =	0.200 ac, 25.00% Impervious, Inflow Depth = 1.68" for 10-YR event			
Inflow =	0.49 cfs @	12.03 hrs, Volume=	0.028 af	
Primary =	0.49 cfs @	12.03 hrs, Volume=	0.028 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 9P: Discharge to Seneca Street Drainage System



Summary for Pond 10P: Permanent Pool

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	702.00'	16,601 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
702.00	1,398	157.0	0	0	1,398
703.00	1,732	170.0	1,562	1,562	1,774
704.00	2,082	182.0	1,904	3,466	2,153
705.00	2,468	196.0	2,272	5,739	2,615
706.00	2,870	208.0	2,666	8,405	3,050
707.00	3,286	220.0	3,076	11,481	3,512
708.00	3,754	233.0	3,517	14,998	4,032
708.25	9,511	421.0	1,603	16,601	13,817

Summary for Subcatchment 1S: North Drainage Area - Lawn Area

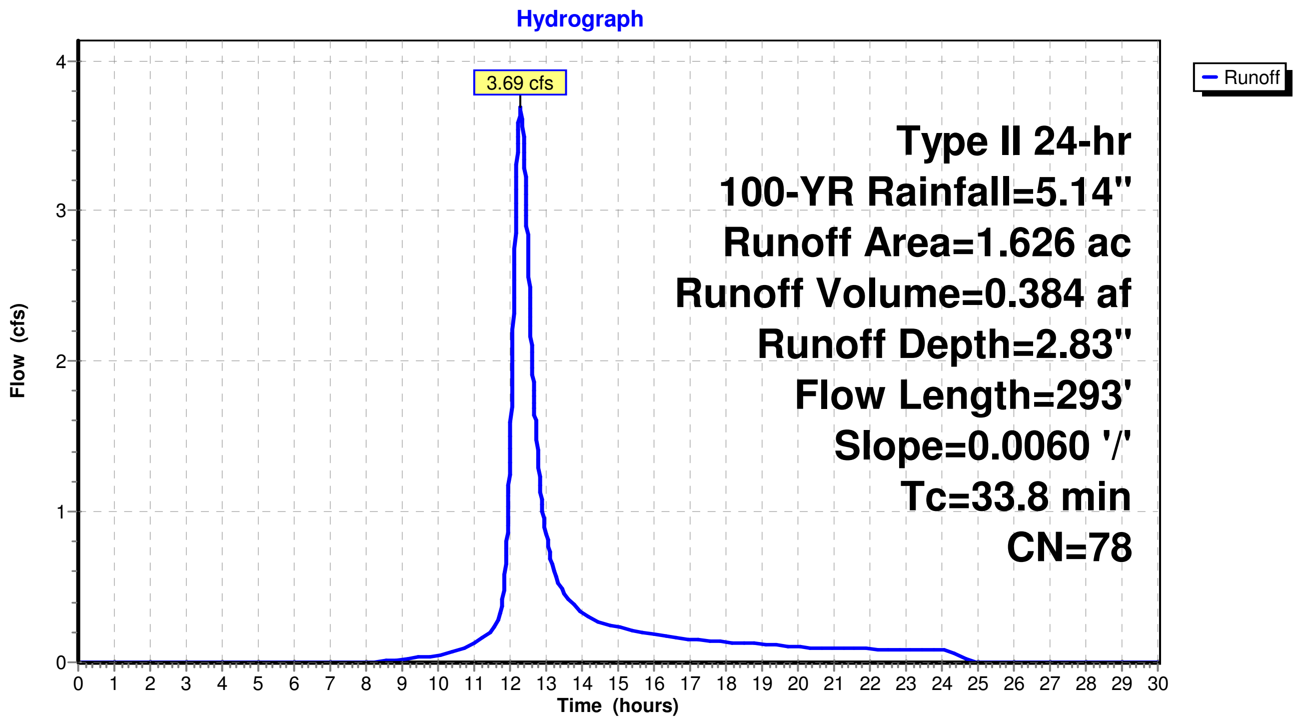
Runoff = 3.69 cfs @ 12.28 hrs, Volume= 0.384 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.626	80	>75% Grass cover, Good, HSG D
1.000	77	Woods, Good, HSG D
1.626	78	Weighted Average
1.626		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.9	100	0.0060	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"
5.9	193	0.0060	0.54		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
33.8	293	Total			

Subcatchment 1S: North Drainage Area - Lawn Area



Summary for Subcatchment 2S: Northeast Drainage Area

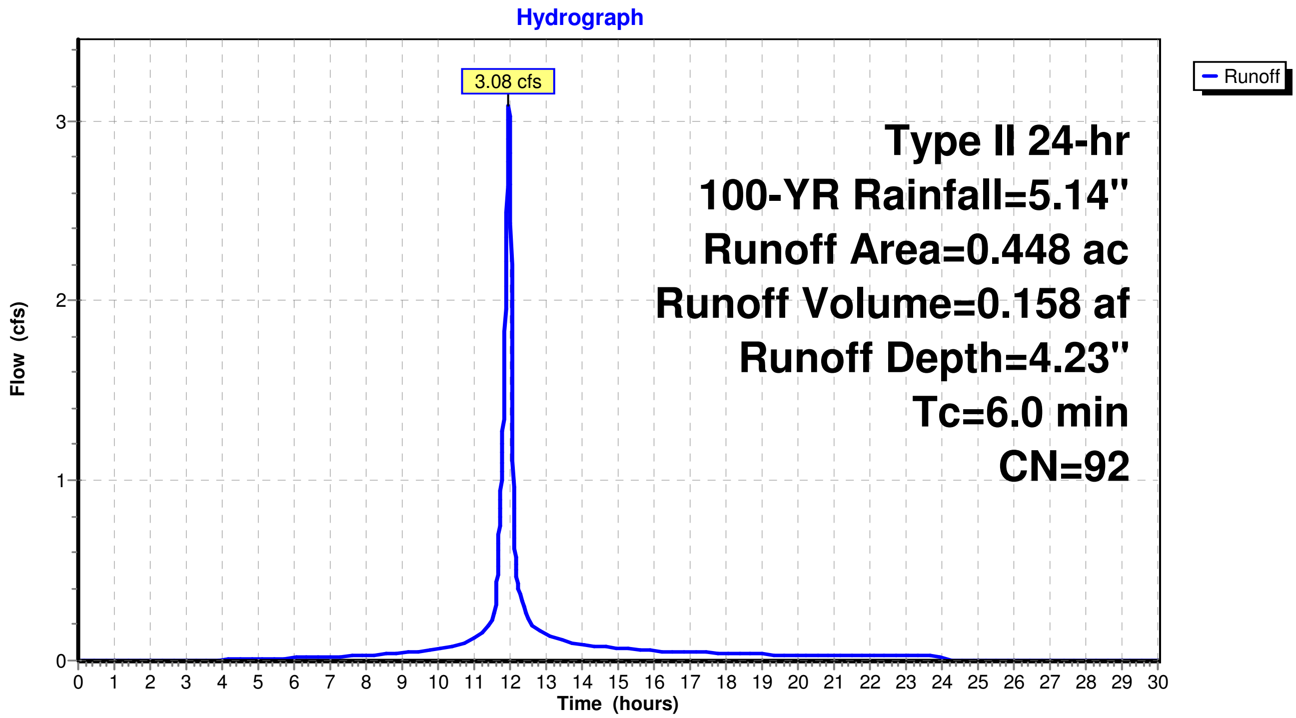
Runoff = 3.08 cfs @ 11.97 hrs, Volume= 0.158 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.306	98	Paved parking, HSG D
0.142	80	>75% Grass cover, Good, HSG D
0.448	92	Weighted Average
0.142		31.70% Pervious Area
0.306		68.30% Impervious Area

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

Subcatchment 2S: Northeast Drainage Area



Summary for Subcatchment 3S: Northwest Drainage Area

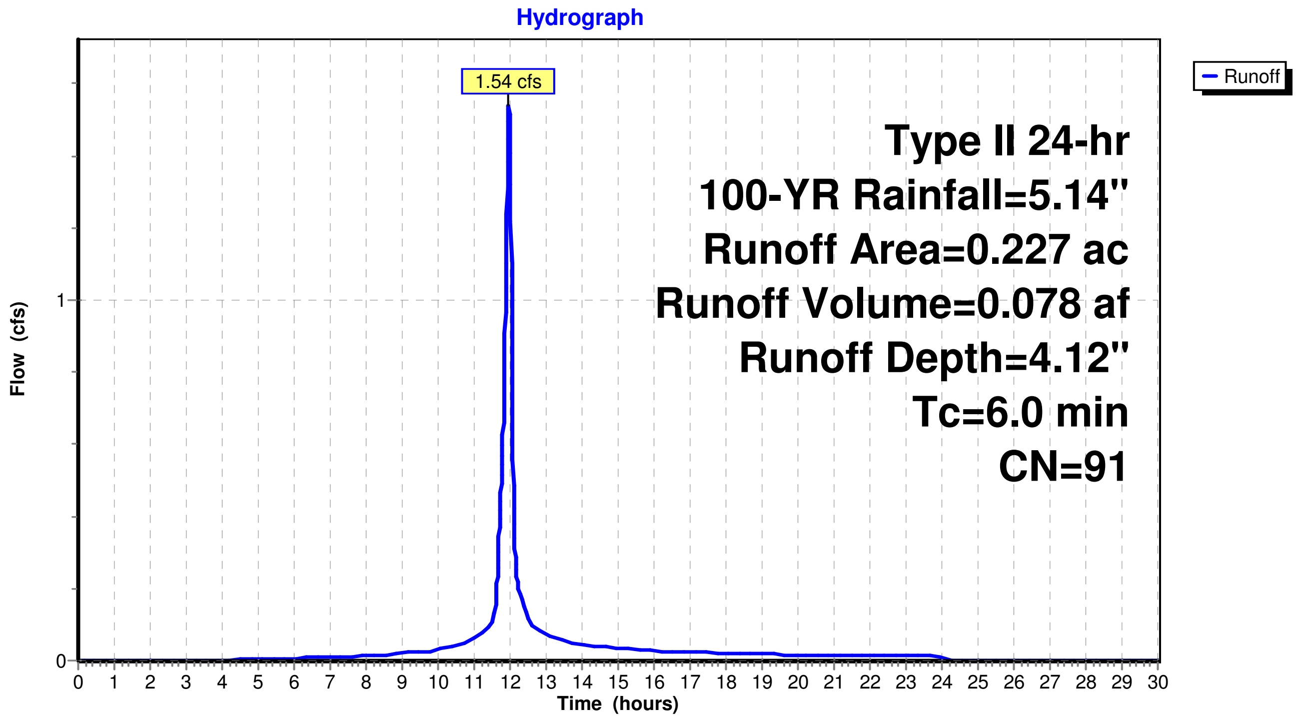
Runoff = 1.54 cfs @ 11.97 hrs, Volume= 0.078 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.133	98	Paved parking, HSG D
0.094	80	>75% Grass cover, Good, HSG D
0.227	91	Weighted Average
0.094		41.41% Pervious Area
0.133		58.59% Impervious Area

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

Subcatchment 3S: Northwest Drainage Area



Summary for Subcatchment 4S: Middle Drainage Area

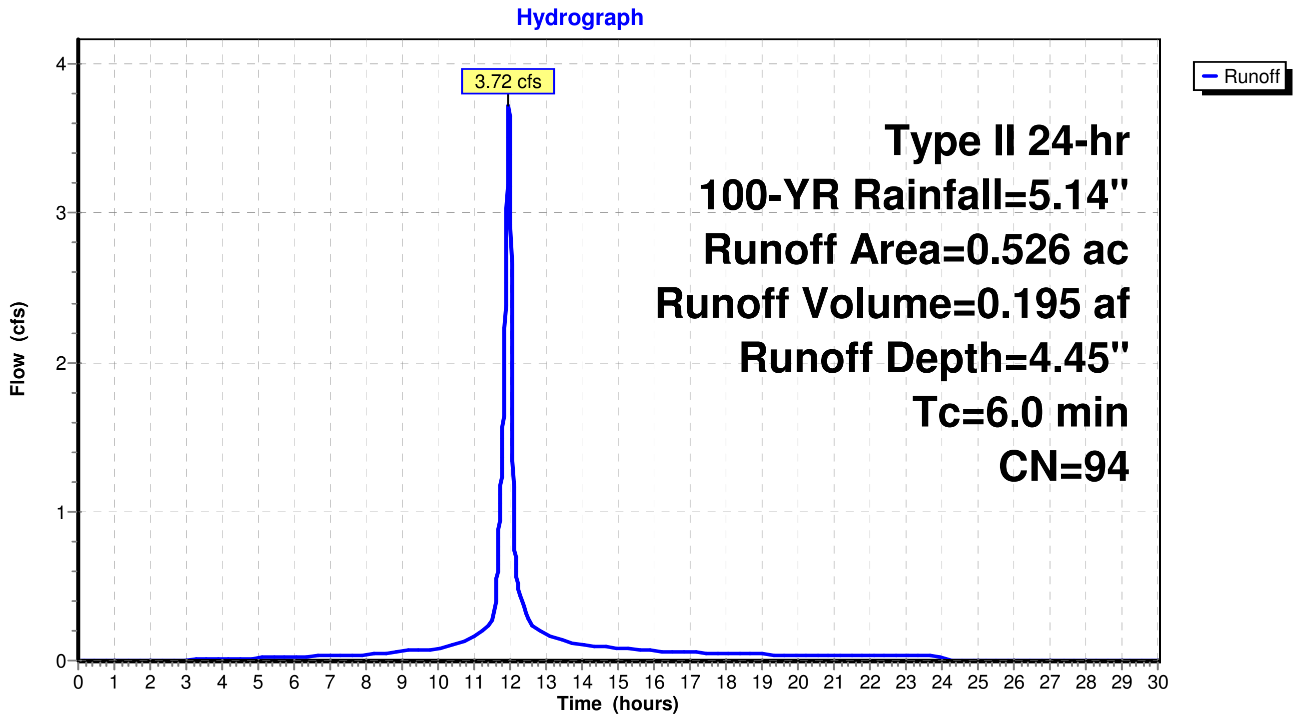
Runoff = 3.72 cfs @ 11.97 hrs, Volume= 0.195 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.406	98	Paved parking, HSG D
0.120	80	>75% Grass cover, Good, HSG D
0.526	94	Weighted Average
0.120		22.81% Pervious Area
0.406		77.19% Impervious Area

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

Subcatchment 4S: Middle Drainage Area



Summary for Subcatchment 5S: Southeast Drainage Area

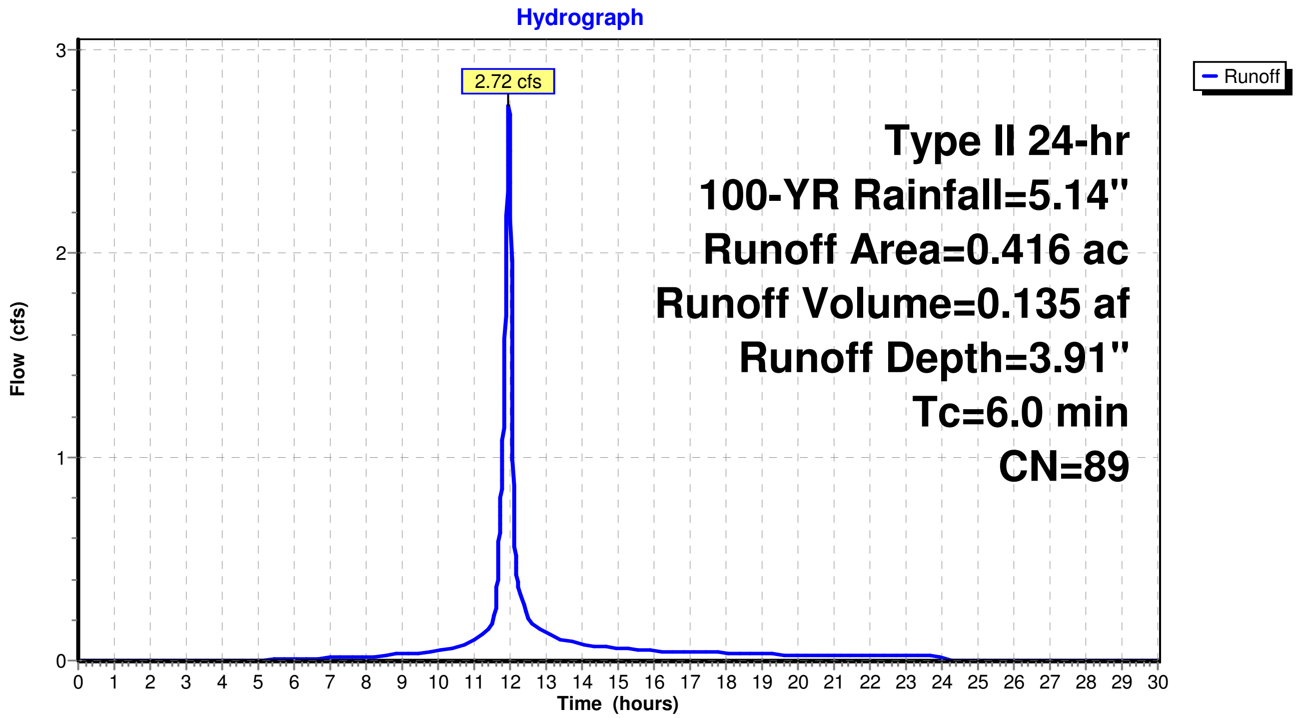
Runoff = 2.72 cfs @ 11.97 hrs, Volume= 0.135 af, Depth= 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.201	98	Paved parking, HSG D
0.215	80	>75% Grass cover, Good, HSG D
0.416	89	Weighted Average
0.215		51.68% Pervious Area
0.201		48.32% Impervious Area

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

Subcatchment 5S: Southeast Drainage Area



Summary for Subcatchment 6S: West Drainage Area

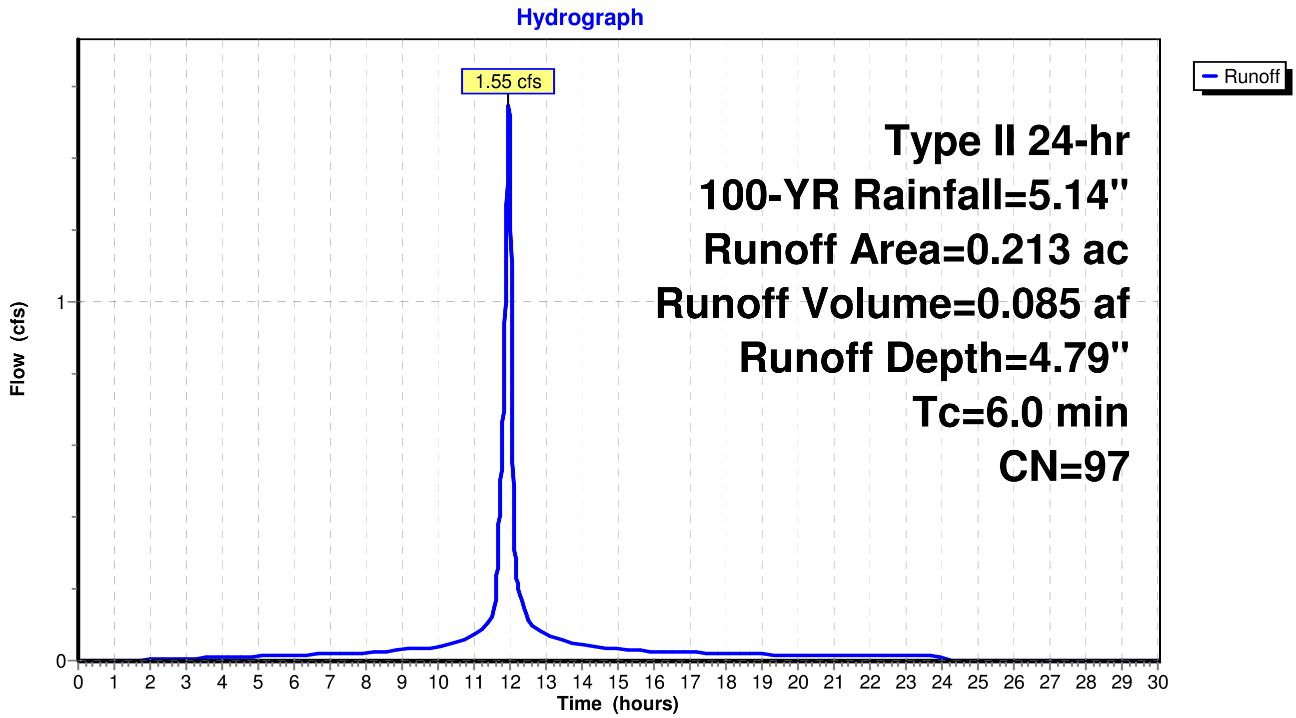
Runoff = 1.55 cfs @ 11.97 hrs, Volume= 0.085 af, Depth= 4.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.196	98	Paved parking, HSG D
0.017	80	>75% Grass cover, Good, HSG D
0.213	97	Weighted Average
0.017		7.98% Pervious Area
0.196		92.02% Impervious Area

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

Subcatchment 6S: West Drainage Area



Summary for Subcatchment 7S: North Parking Lot (to Wet Pond)

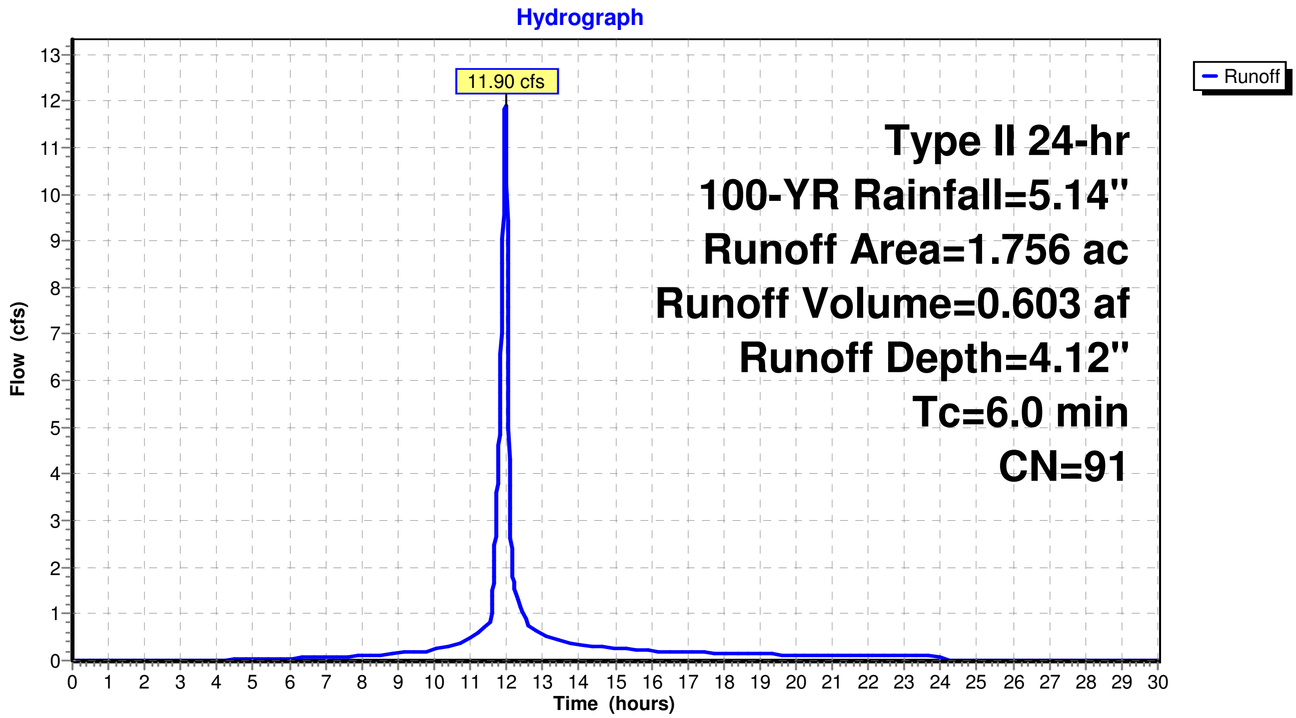
Runoff = 11.90 cfs @ 11.97 hrs, Volume= 0.603 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
1.074	98	Paved parking, HSG D
0.682	80	>75% Grass cover, Good, HSG D
1.756	91	Weighted Average
0.682		38.84% Pervious Area
1.074		61.16% Impervious Area

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

Subcatchment 7S: North Parking Lot (to Wet Pond)



Summary for Subcatchment 8S: East Drainage Area

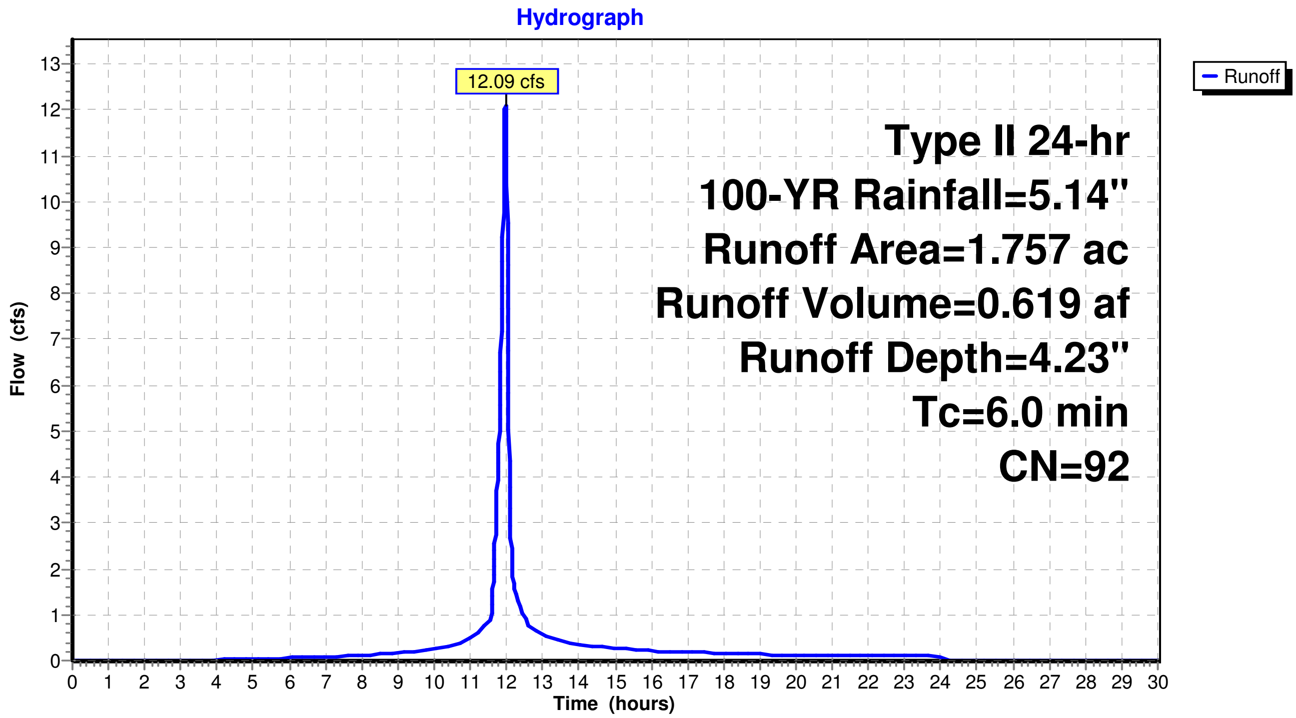
Runoff = 12.09 cfs @ 11.97 hrs, Volume= 0.619 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
1.198	98	Paved parking, HSG D
0.559	80	>75% Grass cover, Good, HSG D
1.757	92	Weighted Average
0.559		31.82% Pervious Area
1.198		68.18% Impervious Area

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

Subcatchment 8S: East Drainage Area



Summary for Subcatchment 9S: Southwest Drainage Area

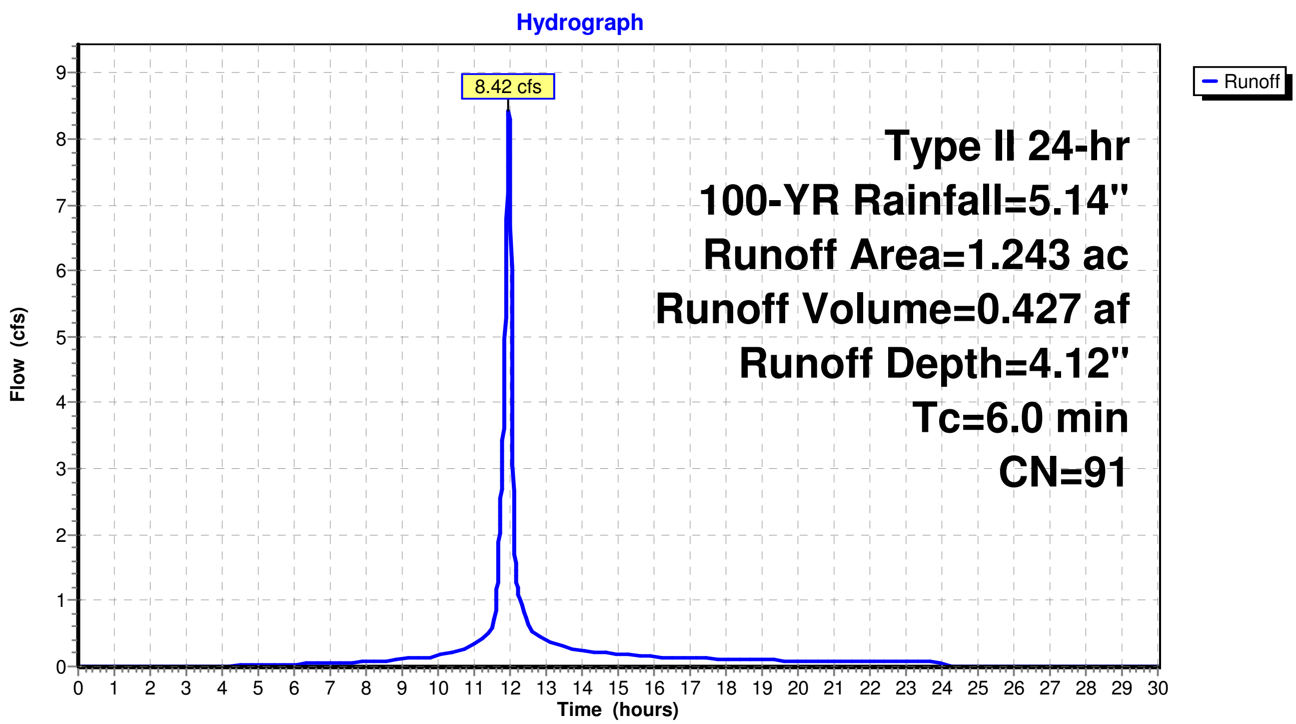
Runoff = 8.42 cfs @ 11.97 hrs, Volume= 0.427 af, Depth= 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.746	98	Paved parking, HSG D
0.497	80	>75% Grass cover, Good, HSG D
1.243	91	Weighted Average
0.497		39.98% Pervious Area
0.746		60.02% Impervious Area

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

Subcatchment 9S: Southwest Drainage Area



Summary for Subcatchment 10S: South Drainage Area

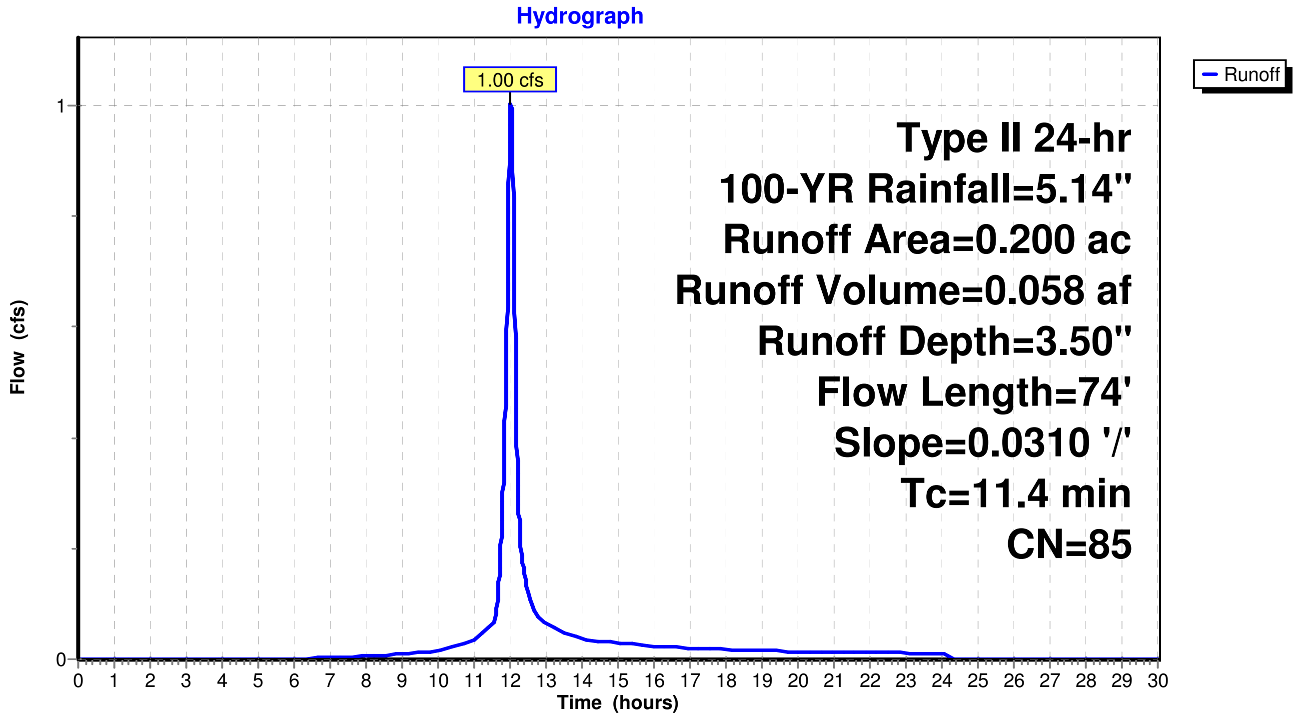
Runoff = 1.00 cfs @ 12.03 hrs, Volume= 0.058 af, Depth= 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR Rainfall=5.14"

Area (ac)	CN	Description
0.150	80	>75% Grass cover, Good, HSG D
0.050	98	Paved parking, HSG D
0.200	85	Weighted Average
0.150		75.00% Pervious Area
0.050		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	74	0.0310	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.19"

Subcatchment 10S: South Drainage Area



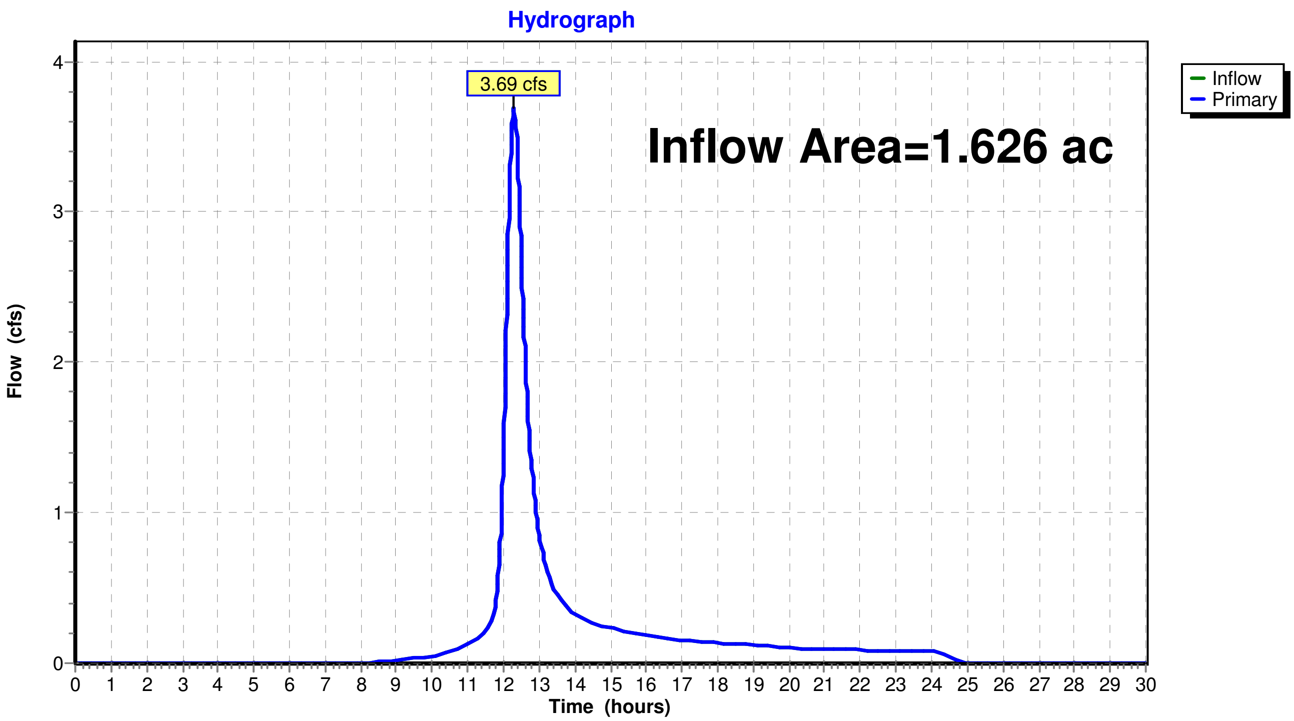
Summary for Pond 1P: Discharge from North Drainage Area

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

Inflow Area = 1.626 ac, 0.00% Impervious, Inflow Depth = 2.83" for 100-YR event
Inflow = 3.69 cfs @ 12.28 hrs, Volume= 0.384 af
Primary = 3.69 cfs @ 12.28 hrs, Volume= 0.384 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 1P: Discharge from North Drainage Area



Summary for Pond 2P: Northeast Bioretention Basin

Inflow Area = 0.448 ac, 68.30% Impervious, Inflow Depth = 4.23" for 100-YR event
Inflow = 3.08 cfs @ 11.97 hrs, Volume= 0.158 af
Outflow = 2.99 cfs @ 11.99 hrs, Volume= 0.145 af, Atten= 3%, Lag= 1.1 min
Primary = 2.99 cfs @ 11.99 hrs, Volume= 0.145 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.74' @ 11.99 hrs Surf.Area= 1,484 sf Storage= 935 cf

Plug-Flow detention time= 80.2 min calculated for 0.145 af (92% of inflow)
Center-of-Mass det. time= 35.6 min (814.1 - 778.5)

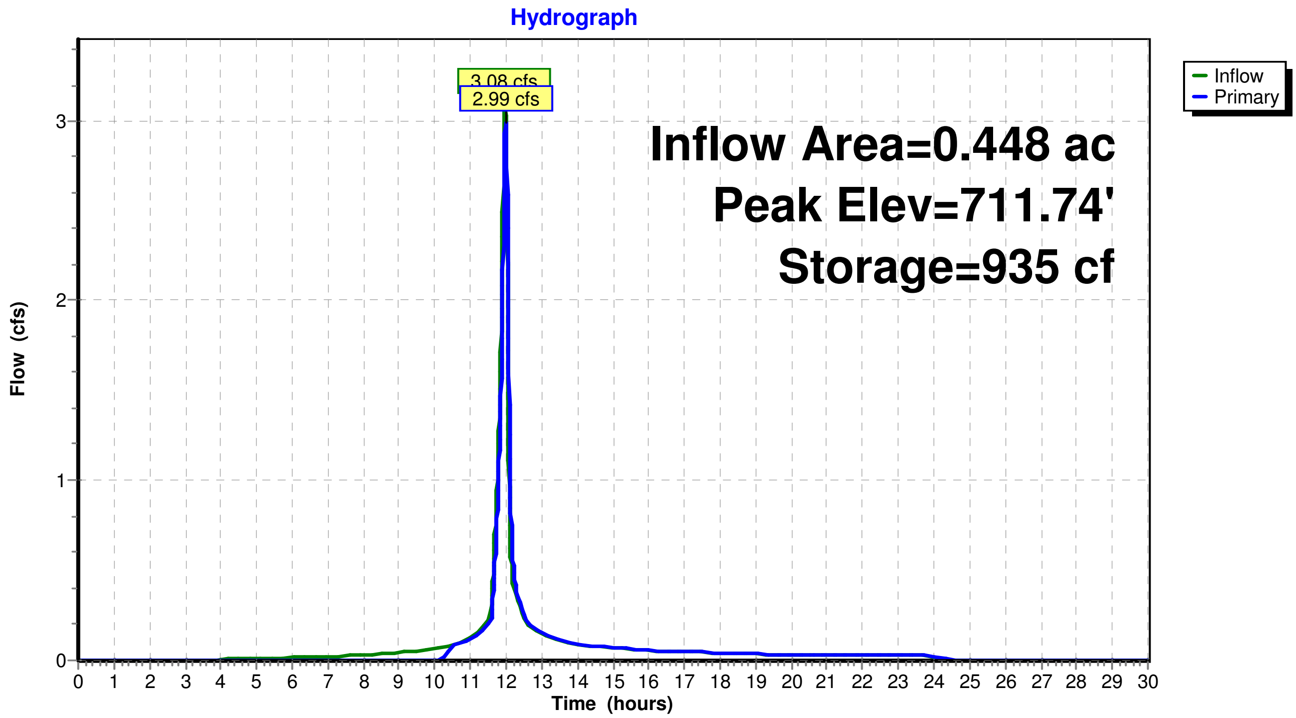
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	2,312 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	1,070	133.0	0	0	1,070
712.00	1,649	158.0	1,349	1,349	1,667
712.50	2,218	180.0	963	2,312	2,265

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 170.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 1,070 sf

Primary OutFlow Max=2.98 cfs @ 11.99 hrs HW=711.74' (Free Discharge)
└─**1=Culvert** (Passes 2.98 cfs of 3.69 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 2.98 cfs @ 1.59 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 2.34 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 2P: Northeast Bioretention Basin



Summary for Pond 3P: Northwest Bioretention Basin

Inflow Area = 0.227 ac, 58.59% Impervious, Inflow Depth = 4.12" for 100-YR event
Inflow = 1.54 cfs @ 11.97 hrs, Volume= 0.078 af
Outflow = 1.51 cfs @ 11.98 hrs, Volume= 0.072 af, Atten= 2%, Lag= 0.8 min
Primary = 1.51 cfs @ 11.98 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 712.15' @ 11.98 hrs Surf.Area= 843 sf Storage= 428 cf

Plug-Flow detention time= 81.6 min calculated for 0.072 af (92% of inflow)
Center-of-Mass det. time= 37.5 min (820.2 - 782.6)

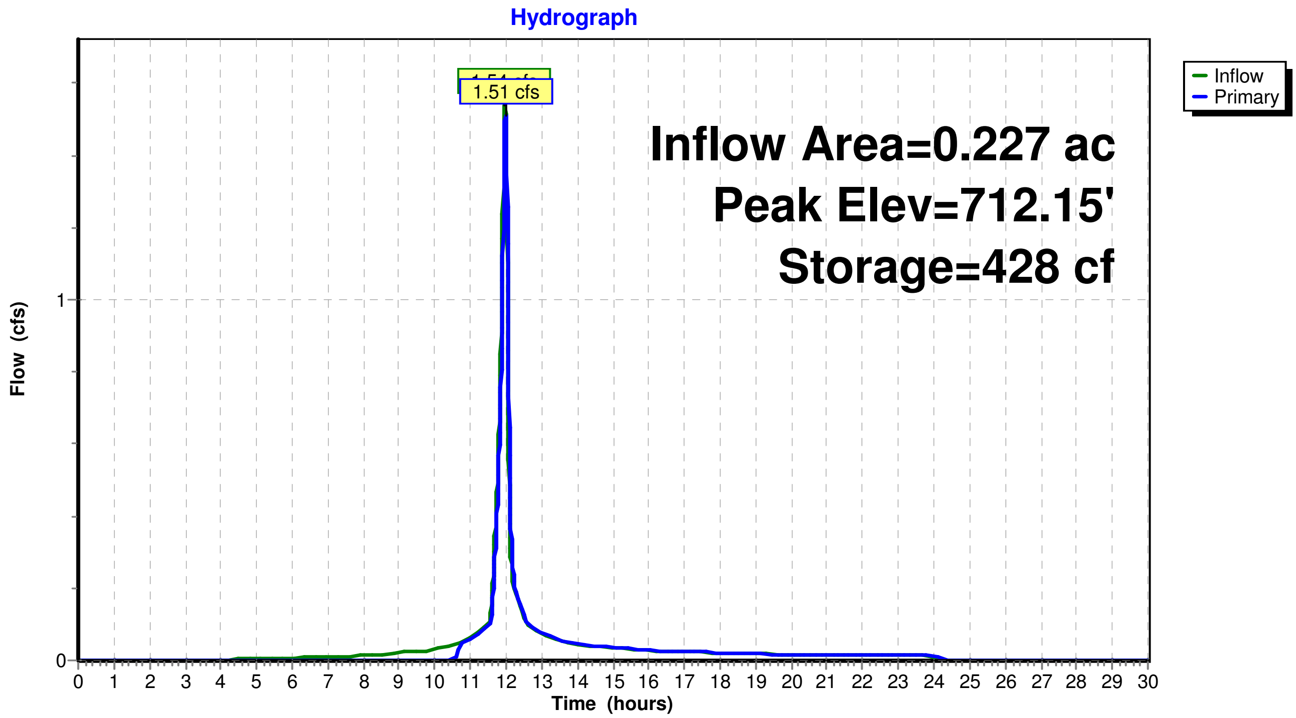
Volume	Invert	Avail.Storage	Storage Description
#1	711.50'	1,373 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.50	487	131.0	0	0	487
712.00	759	144.0	309	309	780
713.00	1,402	171.0	1,064	1,373	1,475

Device	Routing	Invert	Outlet Devices
#1	Primary	708.75'	**12.0" Round Culvert** L= 46.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.75' / 708.25' S= 0.0109 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	712.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.75'	**8.0" Round Underdrain** L= 51.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.75' / 708.75' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.50'	**0.250 in/hr Exfiltration over Surface area above 711.50'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 487 sf

Primary OutFlow Max=1.51 cfs @ 11.98 hrs HW=712.15' (Free Discharge)
└─**1=Culvert** (Passes 1.51 cfs of 5.08 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 1.51 cfs @ 1.26 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 2.15 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 3P: Northwest Bioretention Basin



Summary for Pond 4P: Middle Bioretention Basin

Inflow Area = 0.526 ac, 77.19% Impervious, Inflow Depth = 4.45" for 100-YR event
Inflow = 3.72 cfs @ 11.97 hrs, Volume= 0.195 af
Outflow = 3.47 cfs @ 12.00 hrs, Volume= 0.173 af, Atten= 7%, Lag= 1.7 min
Primary = 3.47 cfs @ 12.00 hrs, Volume= 0.173 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.76' @ 12.00 hrs Surf.Area= 2,621 sf Storage= 1,667 cf

Plug-Flow detention time= 106.7 min calculated for 0.173 af (89% of inflow)
Center-of-Mass det. time= 50.2 min (819.4 - 769.2)

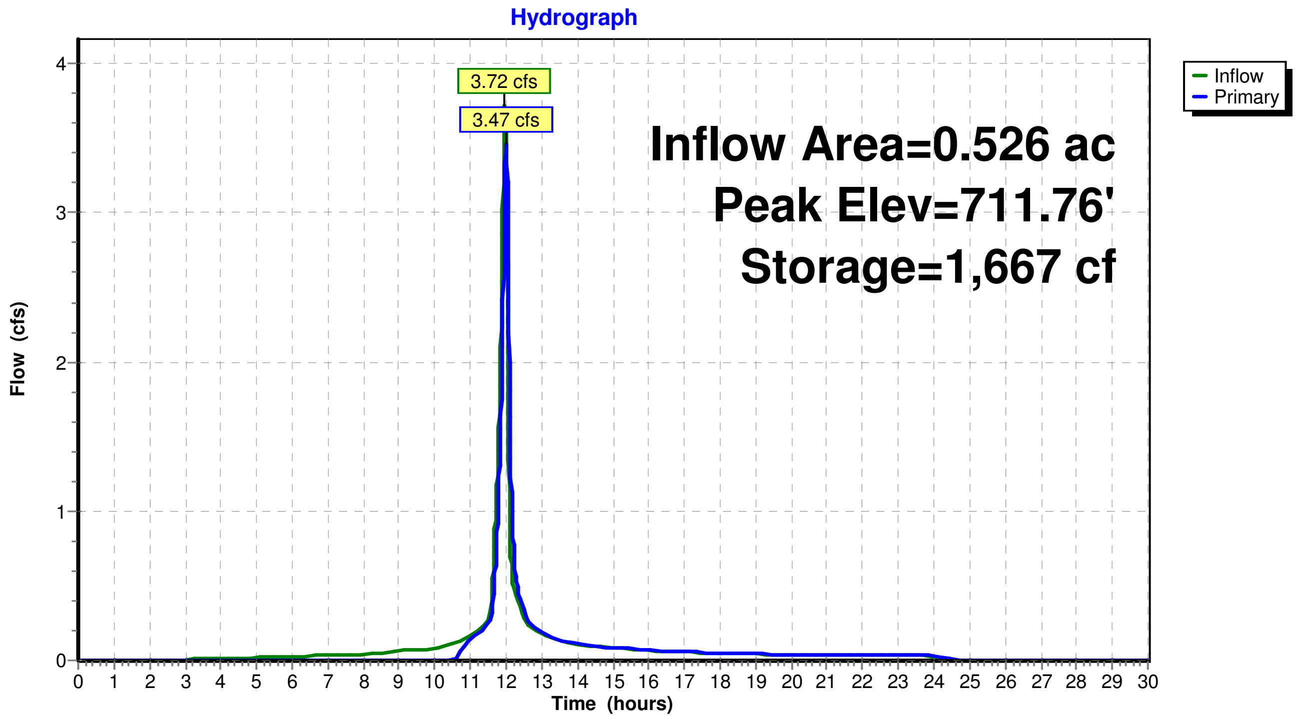
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	3,947 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	1,795	362.0	0	0	1,795
712.00	2,915	400.0	2,332	2,332	4,131
712.50	3,555	418.0	1,615	3,947	5,320

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 64.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 144.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 1,795 sf

Primary OutFlow Max=3.46 cfs @ 12.00 hrs HW=711.76' (Free Discharge)
└─**1=Culvert** (Passes 3.46 cfs of 5.05 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 3.45 cfs @ 1.67 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 1.52 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 4P: Middle Bioretention Basin



Summary for Pond 5P: South Bioretention Basin

Inflow Area = 0.416 ac, 48.32% Impervious, Inflow Depth = 3.91" for 100-YR event
Inflow = 2.72 cfs @ 11.97 hrs, Volume= 0.135 af
Outflow = 2.66 cfs @ 11.99 hrs, Volume= 0.126 af, Atten= 2%, Lag= 1.0 min
Primary = 2.66 cfs @ 11.99 hrs, Volume= 0.126 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 711.72' @ 11.99 hrs Surf.Area= 1,193 sf Storage= 695 cf

Plug-Flow detention time= 69.0 min calculated for 0.126 af (93% of inflow)
Center-of-Mass det. time= 29.9 min (820.2 - 790.2)

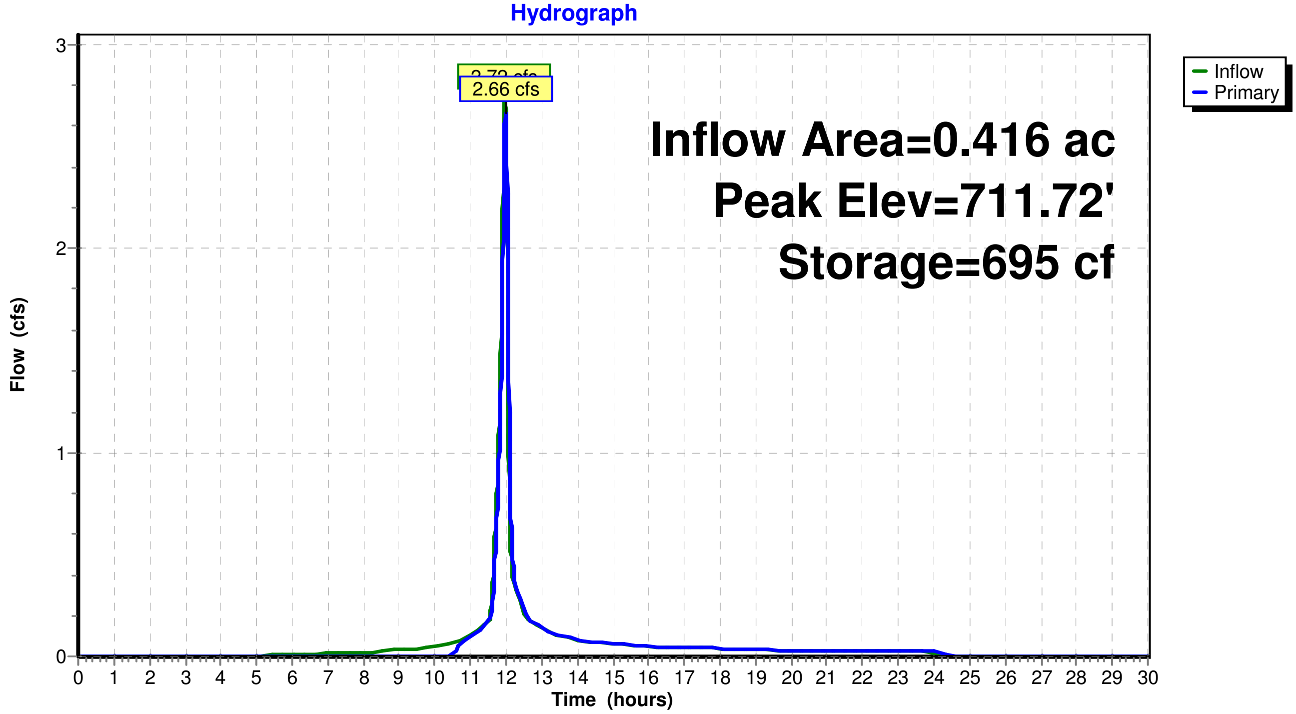
Volume	Invert	Avail.Storage	Storage Description
#1	711.00'	1,834 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
711.00	760	184.0	0	0	760
712.00	1,390	209.0	1,059	1,059	1,566
712.50	1,716	221.0	775	1,834	1,991

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 75.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	711.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	708.25'	**8.0" Round Underdrain** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#4	Device 3	711.00'	**0.250 in/hr Exfiltration over Surface area above 711.00'** Conductivity to Groundwater Elevation = 0.00' Excluded Surface area = 760 sf

Primary OutFlow Max=2.65 cfs @ 11.99 hrs HW=711.72' (Free Discharge)
└─**1=Culvert** (Passes 2.65 cfs of 4.80 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 2.65 cfs @ 1.52 fps)
  └─**3=Underdrain** (Passes 0.00 cfs of 2.01 cfs potential flow)
    └─**4=Exfiltration** (Controls 0.00 cfs)

Pond 5P: South Bioretention Basin



Summary for Pond 6P: Dry Detention Basin

[79] Warning: Submerged Pond 2P Primary device # 1 by 2.74'
[79] Warning: Submerged Pond 3P Primary device # 1 INLET by 2.24'
[79] Warning: Submerged Pond 4P Primary device # 1 by 2.74'
[79] Warning: Submerged Pond 5P Primary device # 1 by 2.74'

Inflow Area = 5.343 ac, 65.77% Impervious, Inflow Depth > 4.09" for 100-YR event
Inflow = 35.91 cfs @ 11.97 hrs, Volume= 1.821 af
Outflow = 15.24 cfs @ 12.08 hrs, Volume= 1.768 af, Atten= 58%, Lag= 6.4 min
Primary = 1.74 cfs @ 12.08 hrs, Volume= 1.332 af
Secondary = 13.50 cfs @ 12.08 hrs, Volume= 0.436 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 710.99' @ 12.08 hrs Surf.Area= 14,511 sf Storage= 35,290 cf

Plug-Flow detention time= 186.9 min calculated for 1.768 af (97% of inflow)
Center-of-Mass det. time= 168.6 min (958.4 - 789.8)

Volume	Invert	Avail.Storage	Storage Description
#1	708.25'	48,387 cf	**Dry Detention Basin (Irregular)** Listed below (Recalc)
#2	708.25'	939 cf	**12.0" Round 12" Diameter Pipe Storage** L= 1,195.0'
#3	708.25'	1,582 cf	**18.0" Round 18" Diameter Pipe Storage** L= 895.0'
		50,907 cf	Total Available Storage

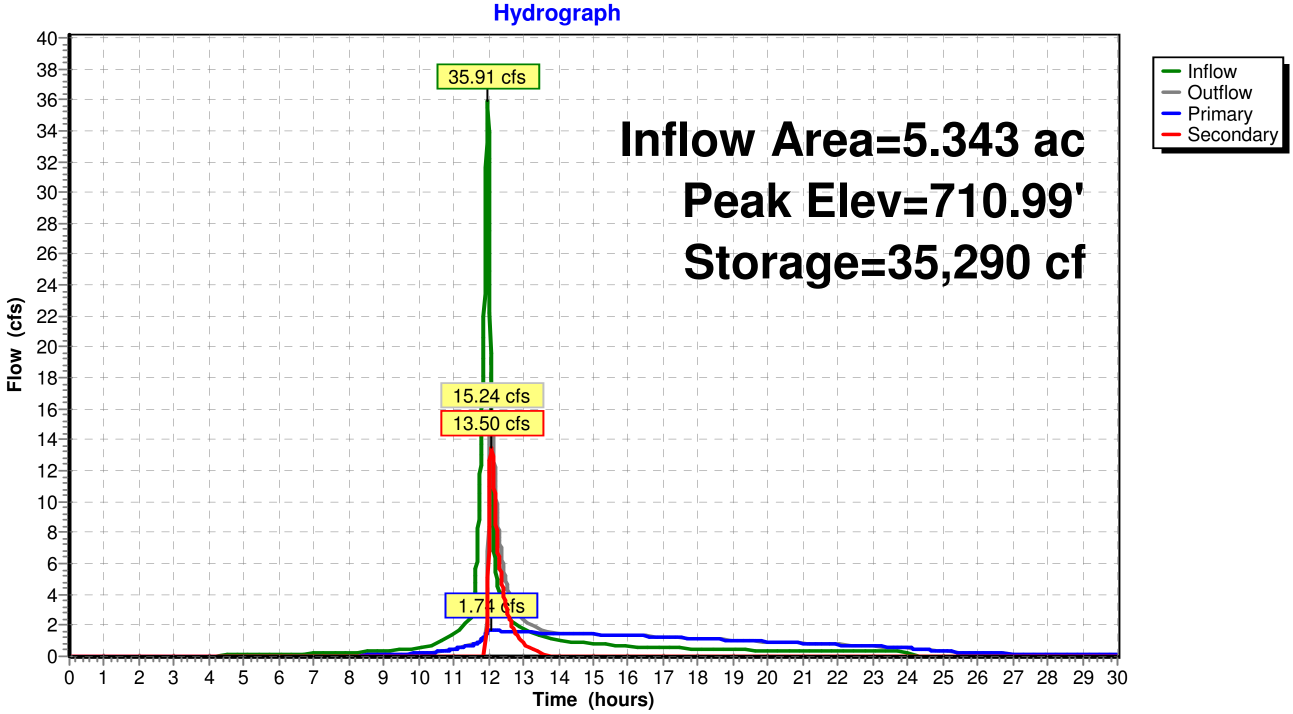
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
708.25	9,511	421.0	0	0	9,511
709.00	10,804	440.0	7,613	7,613	10,852
710.00	12,614	465.0	11,697	19,310	12,709
711.00	14,524	490.0	13,558	32,868	14,668
712.00	16,535	515.0	15,519	48,387	16,729

Device	Routing	Invert	Outlet Devices
#1	Primary	708.25'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 708.25' / 708.25' S= 0.0000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	708.25'	**6.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	710.35'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.74 cfs @ 12.08 hrs HW=710.99' (Free Discharge)
└─**1=Culvert** (Passes 1.74 cfs of 4.47 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 1.74 cfs @ 7.57 fps)

Secondary OutFlow Max=13.49 cfs @ 12.08 hrs HW=710.99' (Free Discharge)
└─**3=Orifice/Grate** (Weir Controls 13.49 cfs @ 2.62 fps)

Pond 6P: Dry Detention Basin



Summary for Pond 7P: Discharge to 12-inch Culvert

[79] Warning: Submerged Pond 6P Primary device # 1 by 1.80'

Inflow Area = 6.586 ac, 64.68% Impervious, Inflow Depth > 3.20" for 100-YR event
Inflow = 9.99 cfs @ 11.97 hrs, Volume= 1.759 af
Outflow = 9.15 cfs @ 12.01 hrs, Volume= 1.759 af, Atten= 8%, Lag= 2.1 min
Primary = 4.37 cfs @ 12.01 hrs, Volume= 1.728 af
Secondary = 4.77 cfs @ 12.01 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 710.05' @ 12.01 hrs Surf.Area= 5,854 sf Storage= 3,000 cf

Plug-Flow detention time= 1.8 min calculated for 1.758 af (100% of inflow)
Center-of-Mass det. time= 1.8 min (971.8 - 970.0)

Volume	Invert	Avail.Storage	Storage Description
#1	708.21'	4,370 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

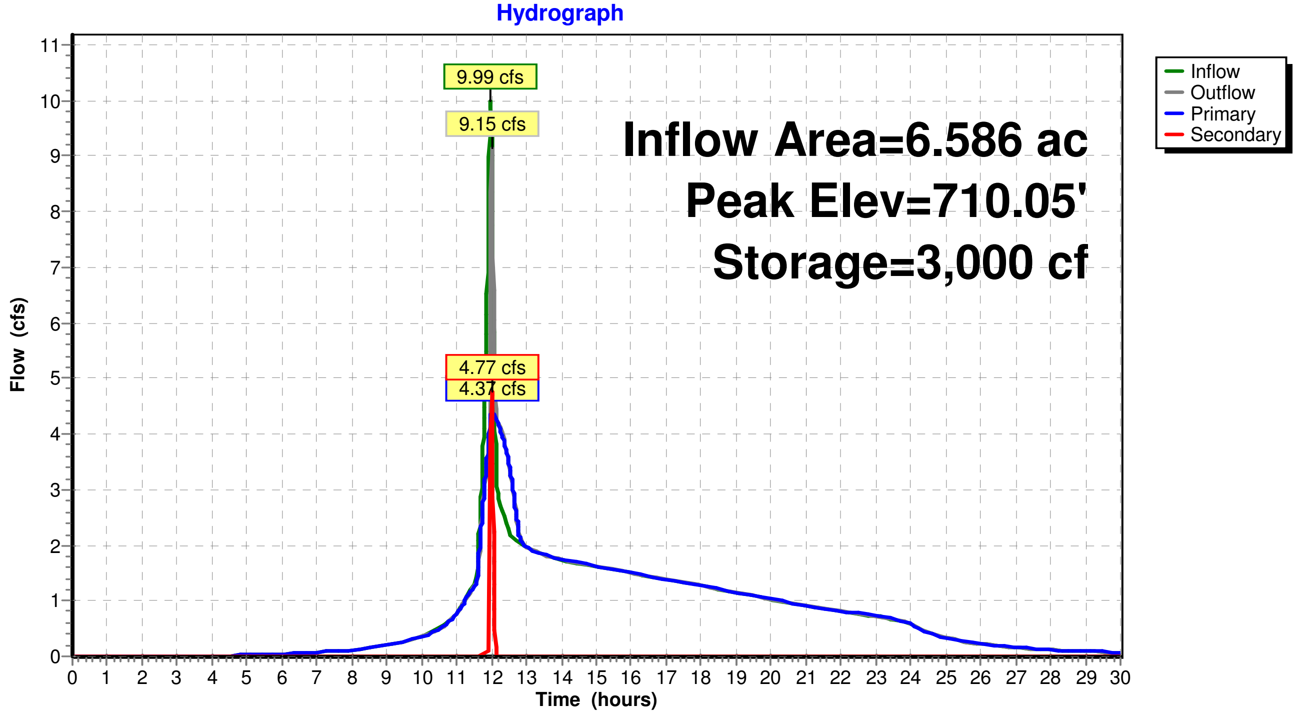
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
708.21	0	0.0	0	0	0
709.00	560	269.0	147	147	5,759
710.00	5,437	618.0	2,581	2,728	30,398
710.25	7,765	634.0	1,642	4,370	31,999

Device	Routing	Invert	Outlet Devices
#1	Primary	708.21'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	710.00'	**180.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.37 cfs @ 12.01 hrs HW=710.05' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 4.37 cfs @ 5.57 fps)

Secondary OutFlow Max=4.70 cfs @ 12.01 hrs HW=710.05' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 4.70 cfs @ 0.55 fps)

Pond 7P: Discharge to 12-inch Culvert



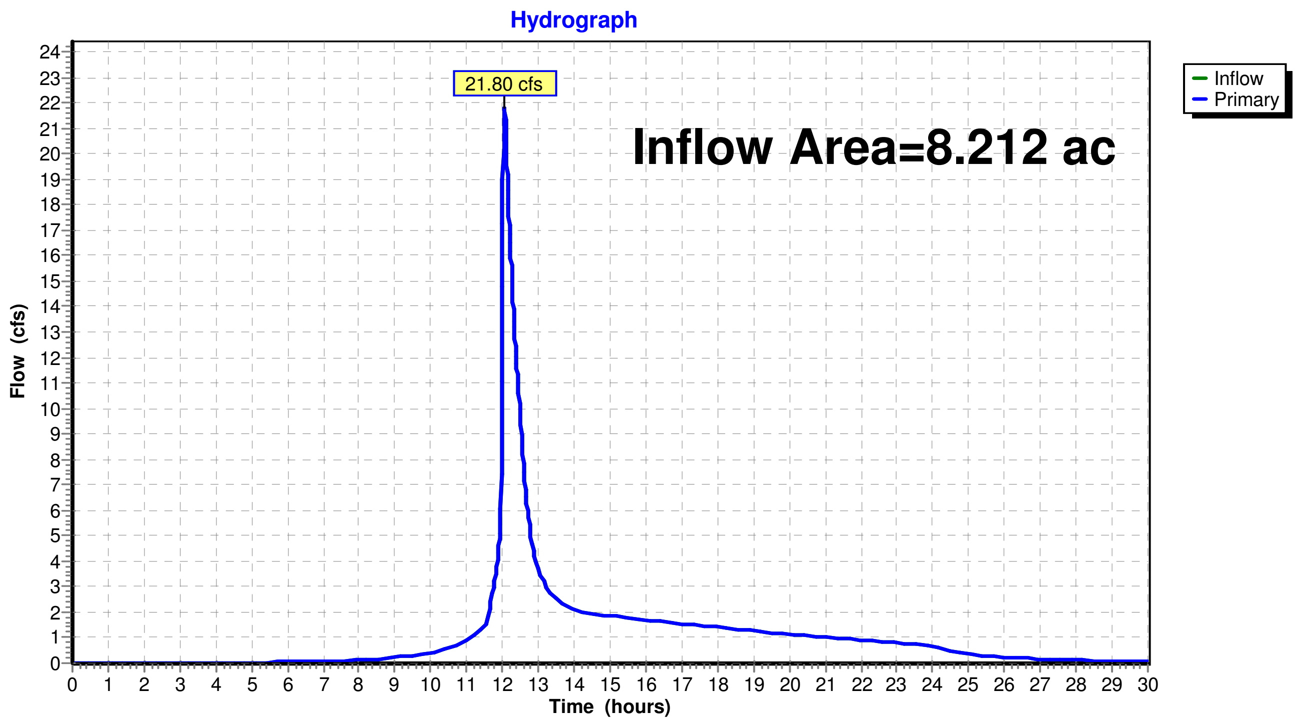
Summary for Pond 8P: Discharge to West Property

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

Inflow Area = 8.212 ac, 51.88% Impervious, Inflow Depth > 3.77" for 100-YR event
Inflow = 21.80 cfs @ 12.05 hrs, Volume= 2.578 af
Primary = 21.80 cfs @ 12.05 hrs, Volume= 2.578 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 8P: Discharge to West Property



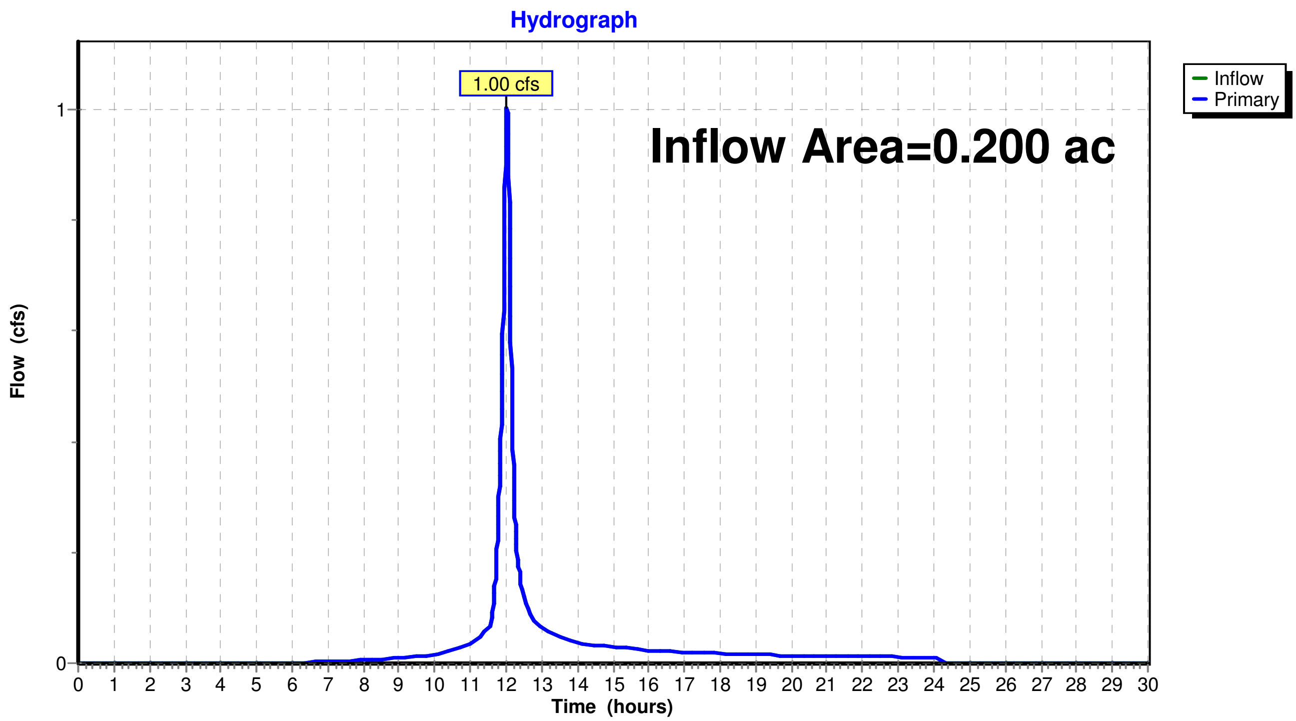
Summary for Pond 9P: Discharge to Seneca Street Drainage System

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

Inflow Area = 0.200 ac, 25.00% Impervious, Inflow Depth = 3.50" for 100-YR event
Inflow = 1.00 cfs @ 12.03 hrs, Volume= 0.058 af
Primary = 1.00 cfs @ 12.03 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Pond 9P: Discharge to Seneca Street Drainage System

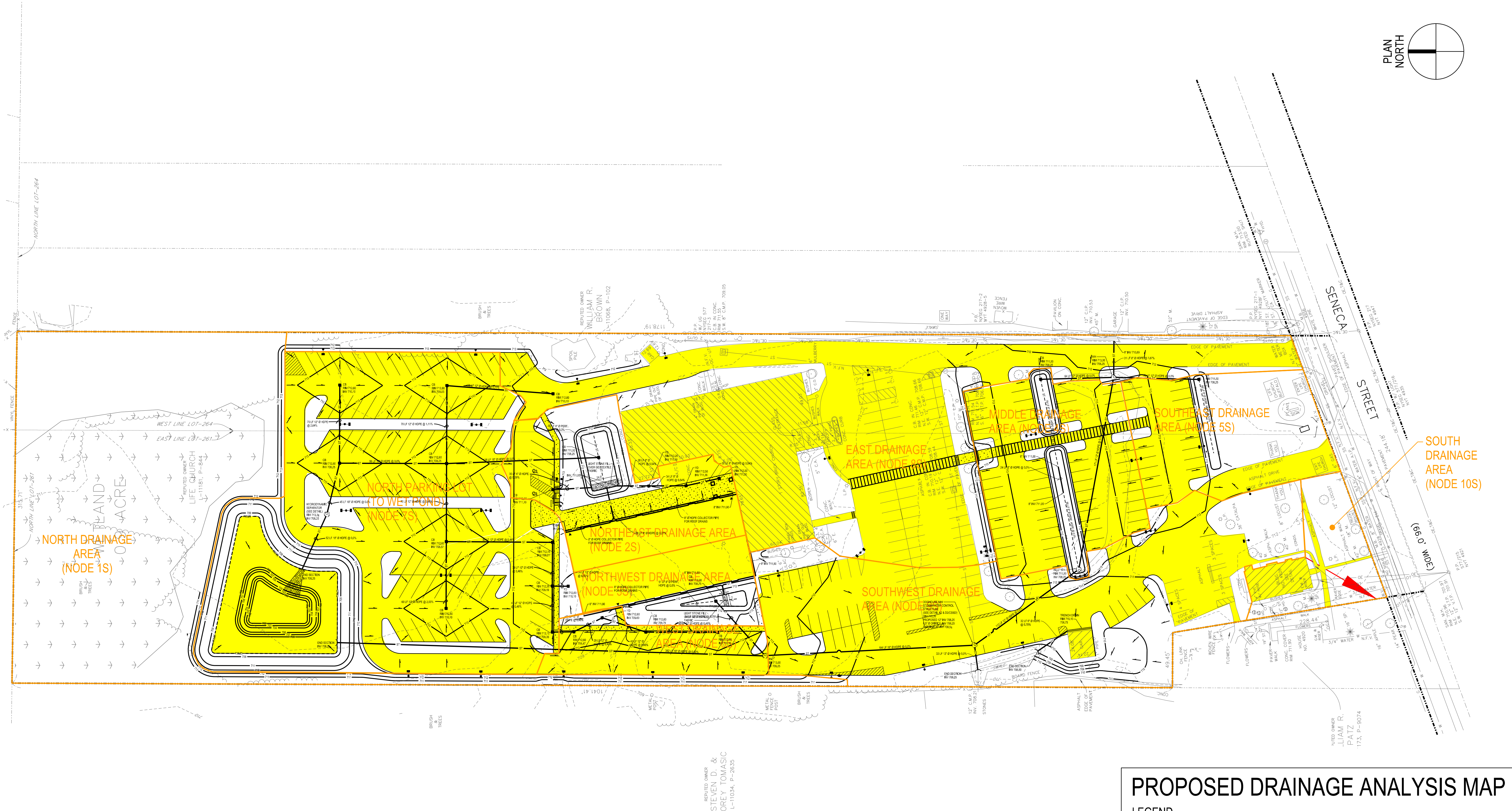


Summary for Pond 10P: Permanent Pool

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	702.00'	16,601 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
702.00	1,398	157.0	0	0	1,398
703.00	1,732	170.0	1,562	1,562	1,774
704.00	2,082	182.0	1,904	3,466	2,153
705.00	2,468	196.0	2,272	5,739	2,615
706.00	2,870	208.0	2,666	8,405	3,050
707.00	3,286	220.0	3,076	11,481	3,512
708.00	3,754	233.0	3,517	14,998	4,032
708.25	9,511	421.0	1,603	16,601	13,817



PROPOSED DRAINAGE ANALYSIS MAP

LEGEND

DRAINAGE AREA

IMPERVIOUS AREA

Tc PATH

80' 80 0 80 160 Ft.

C&S COMPANIES®

Project	LIFE CHURCH	Sheet	1 of
	STORMWATER CALCS	File #	
Prepared by	JU	Date	10/4/19
Checked by		Date	REV 6/24/20

DRAINAGE AREAS

EXISTING IMPERVIOUS AREA = 2.52 ACRES (SEE EXISTING DRAINAGE ANALYSIS MAP)

PROPOSED IMPERVIOUS AREA = 4.53 ACRES (SEE PROPOSED DRAINAGE ANALYSIS MAP)

NEW IMPERVIOUS AREA = PROPOSED − EXISTING = 4.53 − 2.52 = 2.01 ACRES

EXISTING IMPERVIOUS AREA TO REMAIN = 1.51 ACRES

RECONSTRUCTED IMPERVIOUS AREA = PROPOSED IMPERV. AREA − (NEW IMPERV AREA + EXISTING IMPERV. AREA TO REMAIN)

= 4.53 ACRES − (2.01 ACRES + 1.51 ACRES)

= 1.01 ACRES

WATER QUALITY VOLUME REQ'D (WQ_v REQUIRED)

1. NEW IMPERVIOUS AREA

$$WQ_v = \frac{P(R_v)(A)}{12}$$

$$= \frac{(1.0)(0.95)(2.01 \text{ ACRES})}{12}$$

= 0.159 AC-FT

= 6,926 CF

WHERE: P = 90% RAINFALL EVENT

= 1.0 INCH

A = 2.01 ACRES

I = 100%

$R_v = 0.05 + 0.009(I)$

$= 0.05 + 0.009(100)$

$= 0.95$

2. RECONSTRUCTED IMPERVIOUS AREA

$$WQ_v = \frac{P(R_v)(A)}{12}$$

$$= \frac{(1.0)(0.95)(1.01 \text{ ACRES})}{12}$$

= 0.080 AC-FT

= 3,485 CF

WHERE: P = 1.0 INCH

A = 1.01 ACRES

I = 100%

$R_v = 0.95$

C&S COMPANIES®	Project LIFE CHURCH	Sheet 2 of
	STORMWATER CALCS	File #
	Prepared by JU	Date 10/4/19
	Checked by	Date REV 6/24/20

⇒ THIS PROJECT IS CONSIDERED A REDEVELOPMENT PROJECT W/ AN INCREASE IN IMPERVIOUS AREA. THEREFORE, CHAPTER 4 AND 9.2.B.II OF THE NYSDEC WILL BE USED

WQ_V TO BE TREATED W/A STANDARD SMP = 100% NEW IMPERV. WQ_V + 25% RECONST. IMPERV WQ_V

= 1.0(6,926 CF) + 0.25(3,485 CF)

WQ_V REQ'D = 7,797 CF

RUNOFF REDUCTION VOLUME MINIMUM (RR_V MIN)

⇒ ONLY APPLIES TO NEW IMPERVIOUS AREA

$$RR_V \text{ MIN.} = \frac{P(\bar{R_V})(AiC)(S)}{12}$$

WHERE: P = 1.0 INCH

AiC = TOTAL AREA OF NEW IMPERV. COVER = 2.01 ACRES

$\bar{R_V}$ = 0.05 + 0.009(I) WHERE I = 100% = 0.95

S = HSG SOIL REDUCTION FACTOR = 0.20 (HSG 'D' SOILS)

$$= \frac{1.0(0.95)(2.01\text{ AC})(0.20)}{12}$$

= 0.032 AC-FT

RR_V MIN. = 1,394 CF

CHANNEL PROTECTION VOLUME (CP_V)

⇒ FOR REDEVELOPMENT PROJECTS, CP_V IS RELAXED
(NYSDEC SMDM, CH. 9.2)

C&S COMPANIES®

Project	LIFE CHURCH STORMWATER CALCS	Sheet	4 of
		File #	
Prepared by	JU	Date	10/9/19
Checked by		Date	REV 6/24/20

WATER QUALITY VOLUME (WQ_v) & RR_v PROVIDED

NORTHEAST BIORETENTION BASIN

$WQ_v = \frac{P(R_v)(A)}{12}$ WHERE: $P = 1.0$ INCH

$A = 19{,}521$ SF $= 0.448$ AC

$I = \frac{13{,}317 \text{ SF}}{19{,}521 \text{ SF}} \times 100 = 68.2\%$

$R_v = 0.05 + 0.009(68.2)$

$= 0.6638$

$WQ_v = \frac{1.0(0.6638)(0.45 \text{ AC})}{12}$

$= 0.025$ AC-FT

$= \underline{1{,}089 \text{ CF}}$

WQ_v REQUIRED $= 1{,}089$ CF

RR_v PROVIDED $= 40\% \, WQ_v = 0.40(1{,}089 \text{ CF}) = \underline{436 \text{ CF}}$

WQ_v PROVIDED $= 1{,}089$ CF $- 436$ CF $= \underline{653 \text{ CF}}$

REQ'D FILTER BED AREA (A_f)

$A_f = \frac{WQ_v(d_f)}{K(h_f + d_f)t_f}$

WHERE: $WQ_v = 1{,}089$ CF

A_f = SURFACE AREA OF FILTER BED (SF)

d_f = DEPTH OF FILTER BED = 2.5 FT

K = COEFF OF PERMEABILITY

= 0.5 FT/DAY (BIORET. SOIL)

h_f = AVG. HT OF WATER ABOVE BED

= 0.5 FT

t_f = DESIGN FILTER BED DRAIN TIME

= 2 DAYS

$= \frac{(1{,}089 \text{ CF})(2.5 \text{ FT})}{0.50 \frac{\text{FT}}{\text{DAY}}(0.5 \text{ FT} + 2.5 \text{ FT})(2 \text{ DAYS})}$

$= 908$ SF

A_f PROVIDED $= 1{,}070$ SF

NORTHWEST BIORETENTION BASIN

$$WQ_V = \frac{P(R_V)(A)}{12}$$

WHERE: $P = 1.0$ INCH
$A = 9{,}884$ SF $= 0.227$ ACRES
$I = \frac{5{,}789 \text{ SF}}{9{,}884 \text{ SF}} \times 100\% = 59\%$

$$WQ_V = \frac{1.0(0.581)(0.227 \text{ AC})}{12}$$

$R_V = 0.05 + 0.009(59)$
$= 0.581$

$= 0.011$ AC-FT
$= 479$ CF

WQ_V REQUIRED $= 479$ CF
RR_V PROVIDED $= 40\%(WQ_V) = 0.40(479 \text{ CF}) = \underline{192 \text{ CF}}$
WQ_V PROVIDED $= 479 \text{ CF} - 192 \text{ CF} = \underline{\underline{287 \text{ CF}}}$

REQ'D FILTER BED AREA

$$A_f = \frac{WQ_V(d_f)}{K(h_f + d_f)t_f}$$

WHERE: $WQ_V = 479$ CF
$A_f = ?$
$d_f = 2.5$ FT
$K = 0.5$ FT/DAY
$h_f = 0.5$ FT
$t_f = 2$ DAYS

$$= \frac{(479 \text{ CF})(2.5 \text{ FT})}{(0.5 \text{ FT/DAY})(0.5 \text{ FT} + 2.5 \text{ FT})(2 \text{ DAYS})}$$

$= 399$ SF

A_f PROVIDED $= 487$ SF

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MIDDLE BIORETENTION BASIN

$$WQ_v = \frac{P(R_v)(A)}{12}$$

WHERE: $P = 1.0$ INCH
$A = 22{,}918$ SF $= 0.526$ ACRES
$I = \frac{17{,}676\text{ SF}}{22{,}918\text{ SF}} \times 100 = 77.1\%$
$R_v = 0.05 + 0.009(77.1)$
$= 0.7439$

$$= \frac{1.0(0.7439)(0.526\text{ Ac})}{12}$$

$= 0.0326$ AC-FT
$= 1{,}420$ CF

WQ_v REQUIRED $= 1{,}420$ CF

RR_v PROVIDED $= 40\%(WQ_v) = 0.40(1{,}420\text{ CF}) = \underline{568\text{ CF}}$
WQ_v PROVIDED $= 1{,}420$ CF $- 568$ CF $= \underline{852\text{ CF}}$

REQ'D FILTER BED AREA (A_f)

$$A_f = \frac{WQ_v(d_f)}{K(h_f + d_f)t_f}$$

WHERE: $WQ_v = 1{,}420$ CF
$A_f = ?$
$d_f = 2.5$ FT
$K = 0.5$ FT/DAY
$h_f = 0.5$ FT
$t_f = 2$ DAYS

$$= \frac{(1{,}420\text{ CF})(2.5\text{ FT})}{(0.5\text{ F/DAY})(0.5\text{ FT} + 2.5\text{ FT})(2\text{ DAYS})}$$

$= 1{,}183$ SF

A_f PROVIDED $= 1{,}645$ SF

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SOUTH BIORETENTION BASIN

$$WQ_v = \frac{P(R_v)(A)}{12}$$

WHERE: P = 1.0 INCH

A = 18,124 SF = 0.416 ACRES

$I = \frac{8,760\ SF}{18,124\ SF} \times 100 = 48.3\%$

$R_v = 0.05 + 0.009(I)$

$= 0.05 + 0.009(48.3)$

$= 0.4847$

$$= \frac{1.0(0.4847)(0.416\ AC)}{12}$$

= 0.017 AC-FT

= 741 CF

WQ_v REQUIRED = 741 CF

RR_v PROVIDED = 40%(WQ_v PROVIDED) = 0.40(741 CF) = 297 CF

WQ_v PROVIDED = 741 CF − 297 CF = 444 CF

REQ'D FILTER BED AREA (A_f)

$$A_f = \frac{WQ_v(d_f)}{K(h_f + d_f)t_f}$$

WHERE: WQ_v = 741 CF

A_f =

d_f = 2.5 FT

K = 0.50 FT/DAY

h_f = 0.5 FT

t_f = 2 DAYS

$$= \frac{(741\ CF)(2.5\ FT)}{(0.5\ FT/DAY)(0.5\ FT + 2.5\ FT)(2\ DAYS)}$$

= 618 SF

A_f PROVIDED = 640 SF

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REMAINING WQ_V = WQ_V REQ'D − (WQ_V + RR_V PROVIDED IN BIORETENTION)
= 7,797 CF − (1,089 + 479 + 1,420 + 741)
= 7,797 CF − 3,729 CF
= 4,068 CF

REMAINING WQ_V TO BE PROVIDED IN WET POOL OF STORMWATER POND

WQ_V PROVIDED IN WET POND (ELEV. 702 TO ELEV 708.25) = 16,601 CF

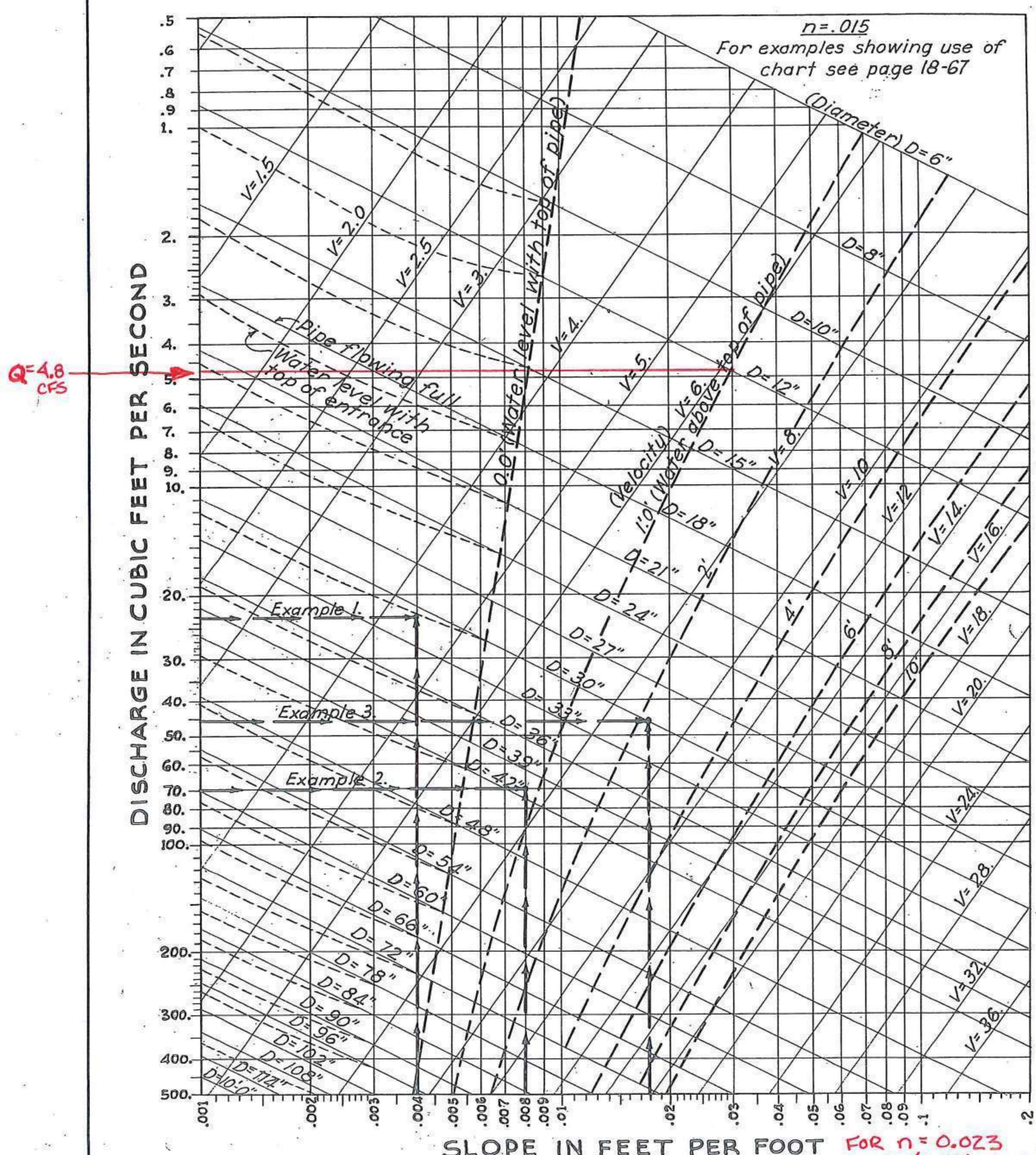
WQ_V + RR_V SUMMARY

WQ_V REQUIRED = 7,797 CF
WQ_V PROVIDED = BIORETENTION + WET POND
= (653 CF + 287 CF + 852 CF + 444 CF) + 16,601 CF
= 18,837 CF

RR_V MIN = 1,394 CF
RR_V PROVIDED = IN BIORETENTION
= 436 CF + 192 CF + 568 CF + 297 CF
= 1,493 CF

TOTAL WQ_V PROVIDED = WQ_V PROVIDED + RR_V PROVIDED
= 18,837 CF + 1,493 CF
= 20,330 CF

DRAINAGE & SEWERAGE – PIPE CAPACITIES–I



FOR $n = 0.023$

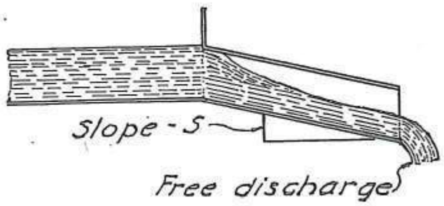
$Q = 4.8\left(\frac{0.015}{0.023}\right) = 3.1$

* Adapted from Gohi Culvert Manufacturing Corp.

DRAINAGE & SEWERAGE – PIPE CAPACITIES-2

EXAMPLES SHOWING USE OF CHART PG. 18-66

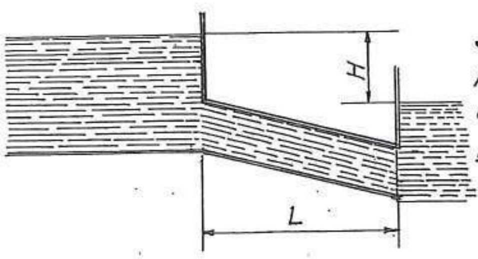
Capacities and velocities in chart page 18-66 are for $n = 0.015$. For other values of n, given on page 5-26, multiply charted values by $\frac{0.015}{n}$



Case 1.

Dash lines to left of 0-0 line give values when water is level with top of pipe at entrance. Velocity of approach and entrance loss neglected.

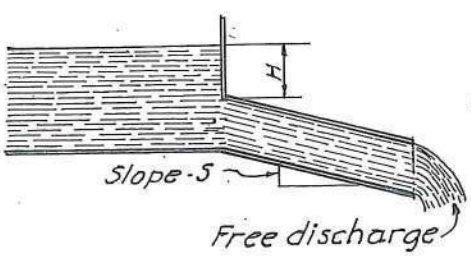
Example 1. - Given: $Q = 23$ c.f.s.; $S = 0.004$; $n = 0.015$.
Required: D and V.
Solution: Enter Chart at 23 c.f.s.; read D=30" at S=0.004, and V= 4.4 Ft./Sec.



Case 2.

Solid D lines give values by Manning Formula (see page 18-69) for pipe flowing full. In this case $S = \frac{H}{L}$ = slope of hydraulic gradient. Minor losses neglected.

Example 2. - Given: $Q = 70$ c.f.s.; $H = 4$ ft.; $L = 500$ ft. $\therefore S = \frac{H}{L} = 0.008$
Required: D and V.
Solution: Enter Chart at 70 c.f.s. intersect. S=0.008. Read D=42" (nearest adequate size).
V= 7.5 Ft./Sec.



Case 3.

Dash lines to right of 0-0 line indicate limits of capacities with inlets submerged to depths shown, from orifice formula $Q = a \times 0.62\sqrt{2gh}$

Example 3. - Given: $Q = 46$ c.f.s.; $S = 0.018$.
Required: D with a back up H not more than 3 ft.
Solution: Enter Chart at 46 c.f.s. intersect. S=0.018 - Read D = 30" (H= 2.3 ft.).

Notation:

- Q = Discharge in cubic feet per second.
- V = Velocity of flow in feet per second.
- S = Slope or hydraulic gradient.
- H = Hydraulic head.
- D = Diameter of pipe.
- L = Length of pipe.
- n = Coefficient of roughness.
- g = Acceleration of gravity = 32.16.

INLET TO DETENTION BASIN

Q = 100-YR INFLOW FROM NORTH PARKING LOT, NE D.A. + NW D.A. = 16.3 CFS

① ASSUME MINIMUM TAILWATER CONDITION

$$\left.\begin{array}{l} w/\ Q = 16.3\ \text{CFS} \\ D_o = 18\text{-INCH} \end{array}\right\} \text{FIGURE 3.16} \Rightarrow \begin{array}{l} d_{50} = 6\ \text{INCH} \\ L_a = 14\ \text{FT} \end{array}$$

$W = D_o + L_a = 1.5 + 14 = 15.5$ FT ⇒ SAY 16 FEET

w/ D_{50} = 6 INCHES ⇒ d_{MAX} = 9 INCHES, MIN BLANKET THICKNESS = 14 INCHES

② ASSUME MAX TAILWATER CONDITION

$$\left.\begin{array}{l} w/\ Q = 16.3\ \text{CFS} \\ D_o = 18\text{-INCH} \end{array}\right\} \text{FIGURE 3.17} \Rightarrow \begin{array}{l} d_{50} = \text{R-3} = 0.25 = 3\ \text{INCH} \\ L_a = 24\ \text{FT} \end{array}$$

$W = D_o + 0.4 L_a = 1.5 + 0.4(24') = 11.1$ ⇒ SAY 11-FEET

w/ D_{50} = 3 INCHES ⇒ d_{MAX} = 1.5(3-IN) = 4.5 INCHES = 5 INCHES

MIN BLANKET THICKNESS = 1.5(D_{MAX}) = 1.5(5 INCHES)
= 7.5 INCHES
= 8 INCHES

STANDARD AND SPECIFICATIONS FOR
ROCK OUTLET PROTECTION

Definition & Scope

A **permanent** section of rock protection placed at the outlet end of the culverts, conduits, or channels to reduce the depth, velocity, and energy of water, such that the flow will not erode the receiving downstream reach.

Conditions Where Practice Applies

This practice applies where discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This applies to:

1. Culvert outlets of all types.
2. Pipe conduits from all sediment basins, dry storm water ponds, and permanent type ponds.
3. New channels constructed as outlets for culverts and conduits.

Design Criteria

The design of rock outlet protection depends entirely on the location. Pipe outlet at the top of cuts or on slopes steeper than 10 percent, cannot be protected by rock aprons or riprap sections due to re-concentration of flows and high velocities encountered after the flow leaves the apron.

Many counties and state agencies have regulations and design procedures already established for dimensions, type and size of materials, and locations where outlet protection is required. Where these requirements exist, they shall be followed.

Tailwater Depth

The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. If the tailwater depth is less than half the diameter of the outlet pipe, and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition; see Figure 3.16 on page 3.42 as an example. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition; see Figure 3.17 on page 3.43 as an example. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition; see Figure 3.16 on page 3.42 as an example.

Apron Size

The apron length and width shall be determined from the curves according to the tailwater conditions:

Minimum Tailwater – Use Figure 3.16 on page 3.42
Maximum Tailwater – Use Figure 3.17 on page 3.43

If the pipe discharges directly into a well defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less.

The upstream end of the apron, adjacent to the pipe, shall have a width two (2) times the diameter of the outlet pipe, or conform to pipe end section if used.

Bottom Grade

The outlet protection apron shall be constructed with no slope along its length. There shall be no overfall at the end of the apron. The elevation of the downstream end of the apron shall be equal to the elevation of the receiving channel or adjacent ground.

Alignment

The outlet protection apron shall be located so that there are no bends in the horizontal alignment.

Materials

The outlet protection may be done using rock riprap, grouted riprap, or gabions. Outlets constructed on the bank of a stream or wetland shall not use grouted rip-rap, gabions or concrete.

Riprap shall be composed of a well-graded mixture of rock size so that 50 percent of the pieces, by weight, shall be larger than the d_{50} size determined by using the charts. A well-graded mixture, as used herein, is defined as a mixture composed primarily of larger rock sizes, but with a sufficient mixture of other sizes to fill the smaller voids between the rocks. The diameter of the largest rock size in such a mixture shall be 1.5 times the d_{50} size.

Thickness

The minimum thickness of the riprap layer shall be 1.5 times the maximum rock diameter for d_{50} of 15 inches or less; and 1.2 times the maximum rock size for d_{50} greater than 15 inches. The following chart lists some examples:

D_{50} (inches)	d_{max} (inches)	Minimum Blanket Thickness (inches)
4	6	9
6	9	14
9	14	20
12	18	27
15	22	32
18	27	32
21	32	38
24	36	43

Rock Quality

Rock for riprap shall consist of field rock or rough unhewn quarry rock. The rock shall be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual rocks shall be at least 2.5.

Filter

A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap. Riprap shall have a filter placed under it in all cases.

A filter can be of two general forms: a gravel layer or a plastic filter cloth. The plastic filter cloth can be woven or non-woven monofilament yarns, and shall meet these base requirements: thickness 20-60 mils, grab strength 90-120 lbs; and shall conform to ASTM D-1777 and ASTM D-1682.

Gravel filter blanket, when used, shall be designed by comparing particle sizes of the overlying material and the base material. Design criteria are available in Standard and Specification for Anchored Slope and Channel Stabilization on page 4.7.

Gabions

Gabions shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening shall not exceed 4 ½ inches and the area of the mesh opening shall not exceed 10 square inches.

Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions shall be of single unit construction and shall be installed according to manufacturer's recommendations.

The area on which the gabion is to be installed shall be graded as shown on the drawings. Foundation conditions shall be the same as for placing rock riprap, and filter cloth shall be placed under all gabions. Where necessary, key, or tie, the structure into the bank to prevent undermining of the main gabion structure.

Maintenance

Once a riprap outlet has been installed, the maintenance needs are very low. It should be inspected after high flows for evidence of scour beneath the riprap or for dislodged rocks. Repairs should be made immediately.

Design Procedure

1. Investigate the downstream channel to assure that nonerosive velocities can be maintained.

2. Determine the tailwater condition at the outlet to establish which curve to use.

3. Use the appropriate chart with the design discharge to determine the riprap size and apron length required. It is noted that references to pipe diameters in the charts are based on full flow. For other than full pipe flow, the parameters of depth of flow and velocity must be used to adjust the design discharges.

4. Calculate apron width at the downstream end if a flare section is to be employed.

Design Examples are demonstrated in Appendix B.

Construction Specifications

1. The subgrade for the filter, riprap, or gabion shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density of approximately that of the surrounding undisturbed material.

2. The rock or gravel shall conform to the specified grad-

ing limits when installed respectively in the riprap or filter.

3. Filter cloth shall be protected from punching, cutting, or tearing. Any damage other than an occasional small hole shall be repaired by placing another piece of cloth over the damaged part or by completely replacing the cloth. All overlaps, whether for repairs or for joining two pieces of cloth shall be a minimum of one foot.

4. Rock for the riprap or gabion outlets may be placed by equipment. Both shall each be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. The rock for riprap or gabion outlets shall be delivered and placed in a manner that will ensure that it is reasonably homogenous with the smaller rocks and spalls filling the voids between the larger rocks. Riprap shall be placed in a manner to prevent damage to the filter blanket or filter cloth. Hand placement will be required to the extent necessary to prevent damage to the permanent works.

Figure 3.16
Outline Protection Design—Minimum Tailwater Condition Chart (Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)

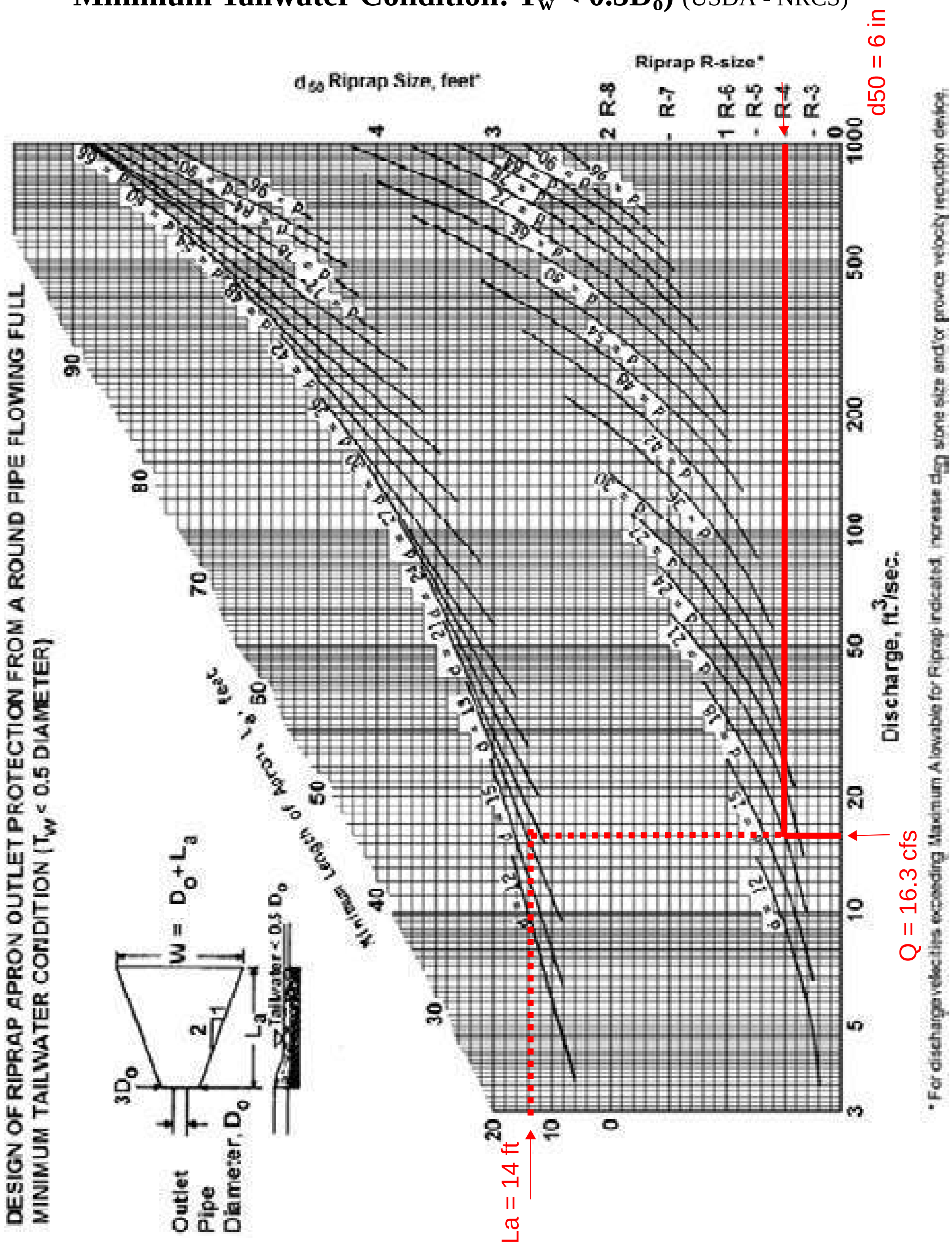


Figure 3.17
Outlet Protection Design—Maximum Tailwater Condition Chart (Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_w \geq 0.5D_o$) (USDA - NRCS)

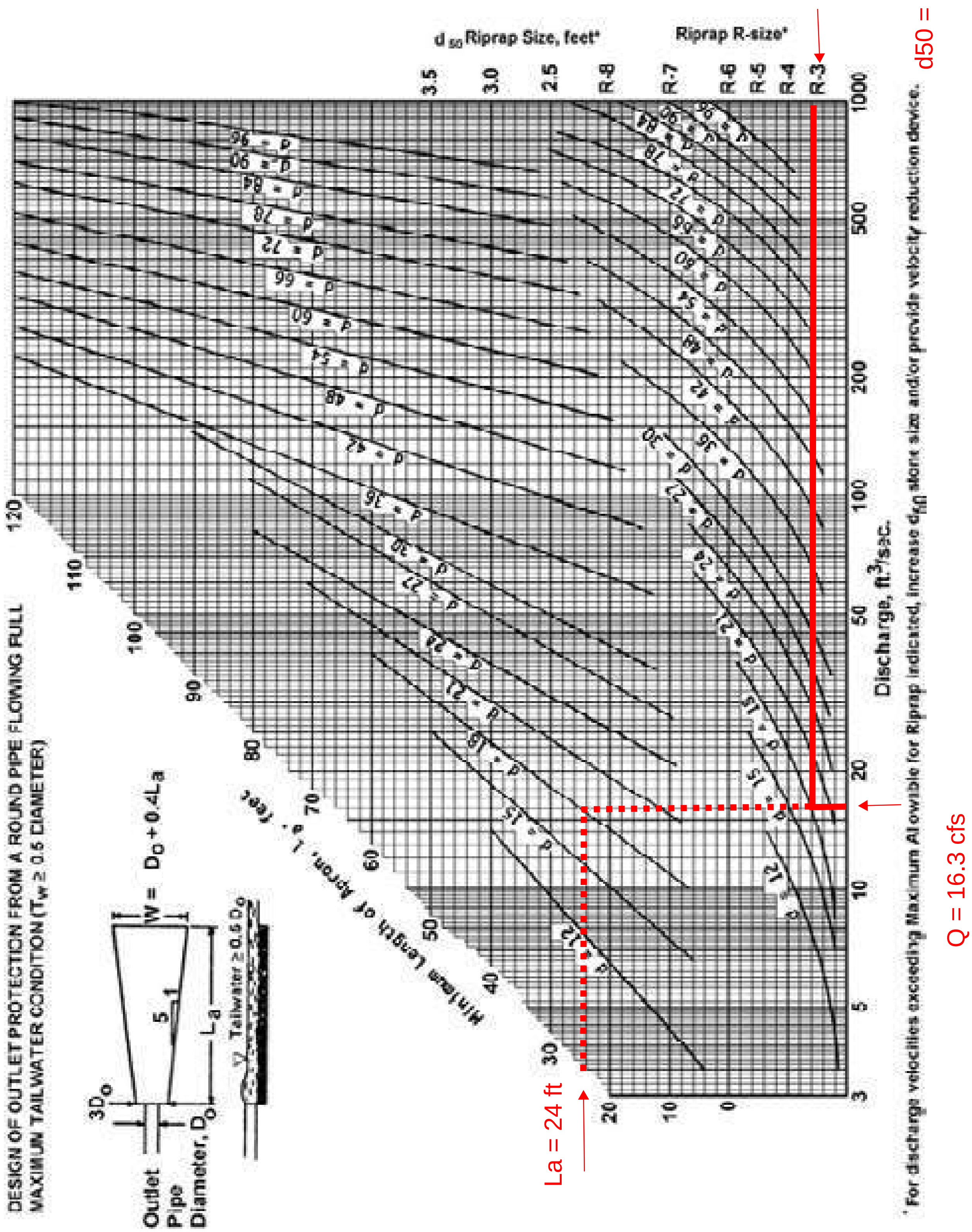


Figure 3.18
Riprap Outlet Protection Detail (1)

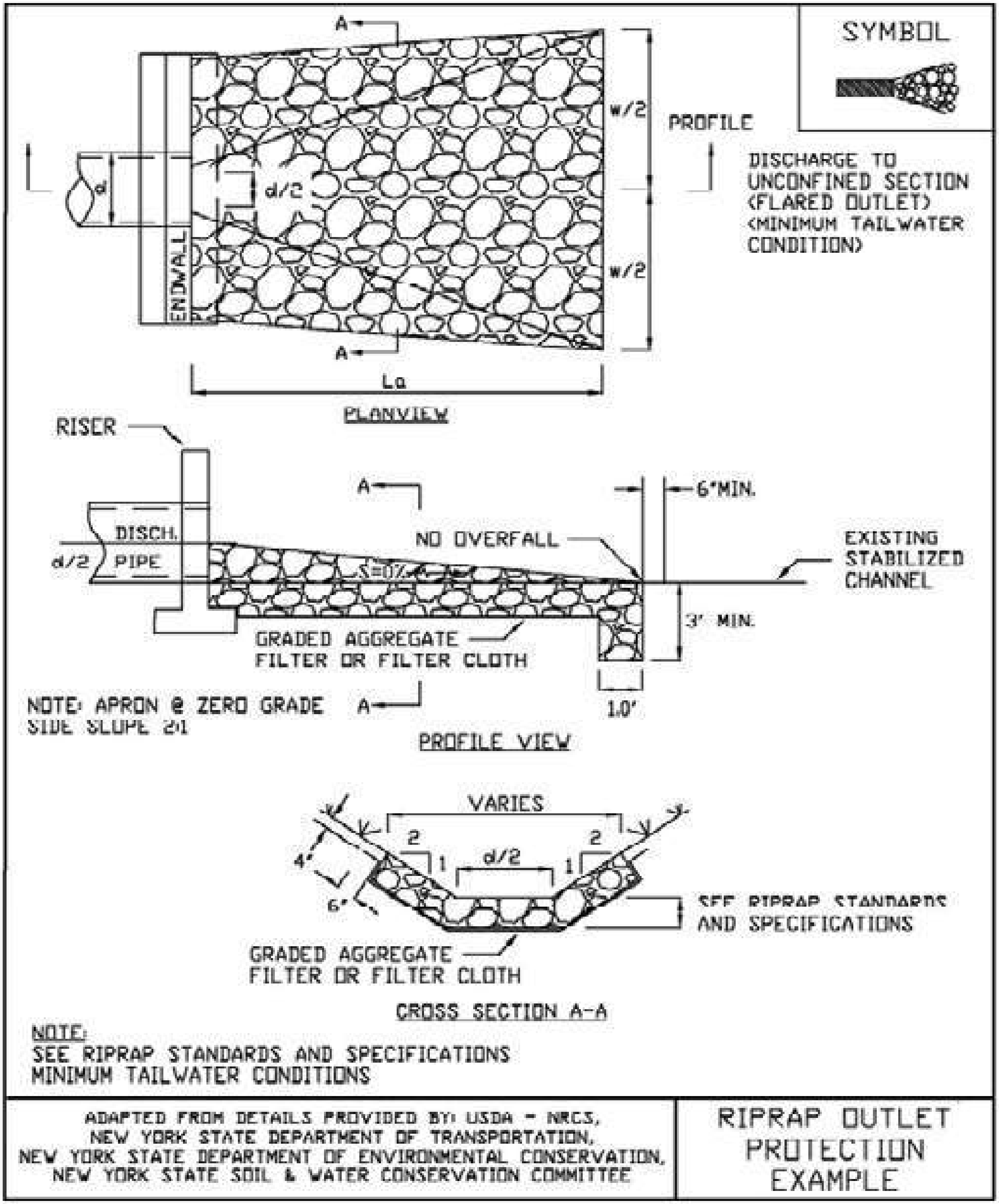


Figure 3.19
Riprap Outlet Protection Detail (2)

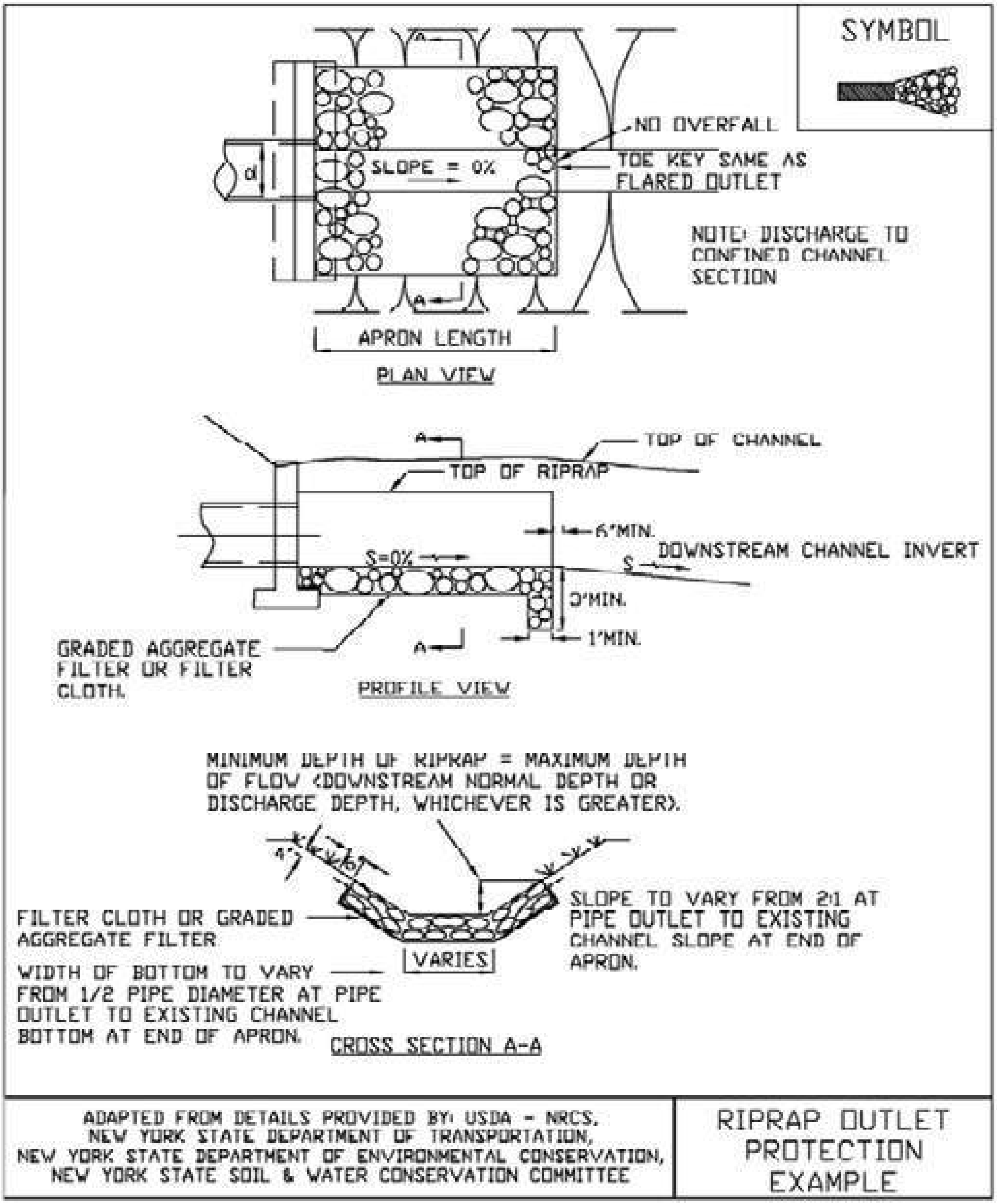
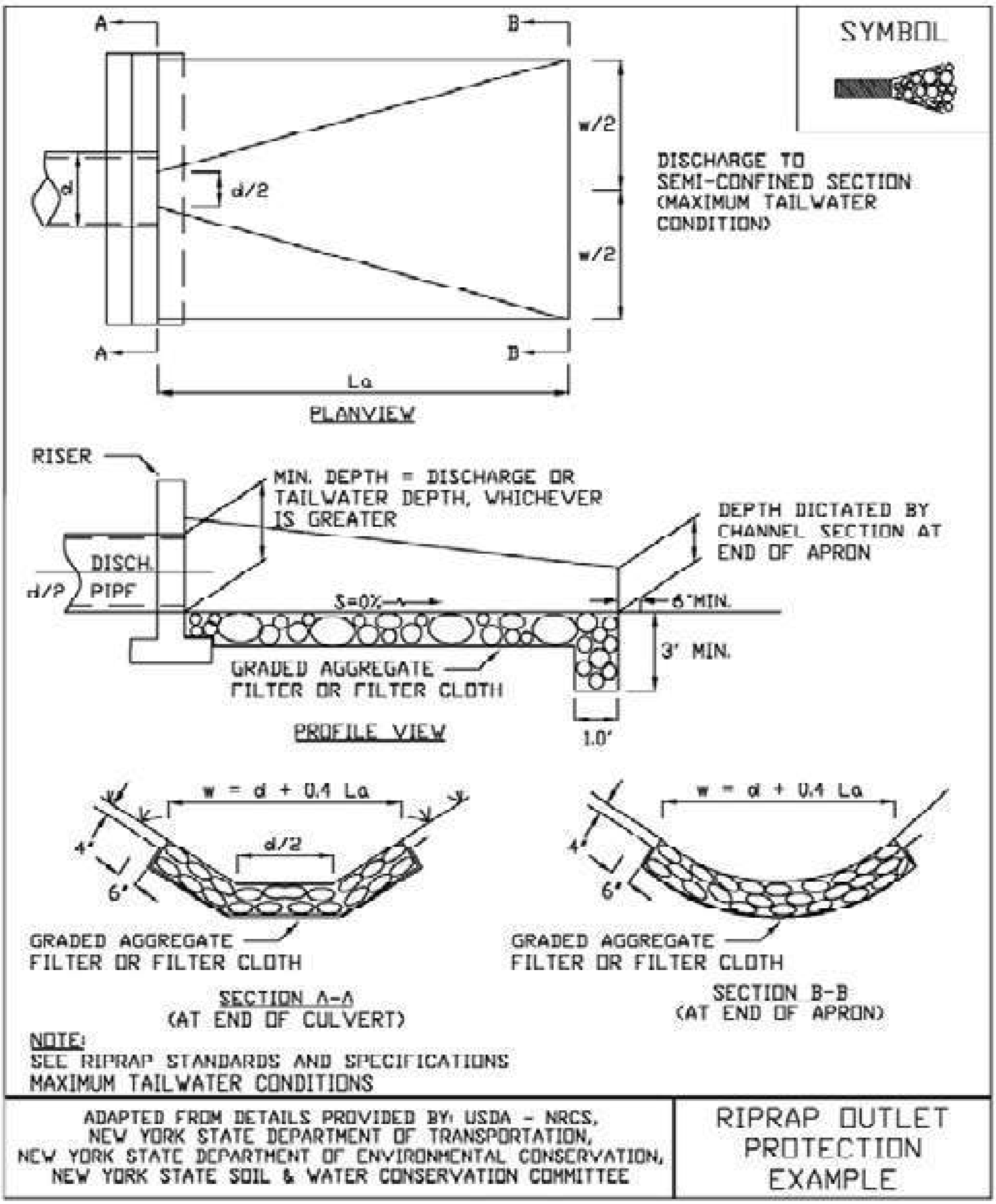


Figure 3.20
Riprap Outlet Protection Detail (3)



Hydrologic Soil Group—Erie County, New York
(Life Church - 4928 Seneca Street, West Seneca, NY)

Map Scale: 1:2,020 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 25, 50, 100, 150

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Erie County, New York
Survey Area Data: Version 18, Sep 2, 2018

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

Date(s) aerial images were photographed: Jul 29, 2011—Oct 18, 2016

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ca	Canadice silt loam	D	2.3	32.8%
CfB	Cayuga silt loam, 3 to 8 percent slopes	D	0.2	2.4%
CoA	Churchville silt loam, 0 to 3 percent slopes	C/D	1.8	25.3%
RgA	Rhinebeck silt loam, 0 to 3 percent slopes	C/D	2.8	39.5%
Totals for Area of Interest			**7.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX D-1

WEEKLY SOIL EROSION AND SEDIMENT CONTROL INSPECTION CHECKLIST

EROSION AND SEDIMENT CONTROL INSPECTION CHECKLIST

Project Name:	**Date & Time of Inspection:**
Project Title:	**Current Conditions (Temp., etc.):**
Project No.:	**Reason for Inspection:**
Inspector' Name:	**Contractor:**

Project E&SC Inspection Report No. ____

(Date of Last Inspection - ___________**)**

The State Pollutant Discharge Elimination System General Permit for Construction Activity (Permit) requires site inspections to be conducted at least every 7 calendar days.

Prior to conducting site inspection, review the previous site inspection report to identify reported deficiencies and the proposed corrective actions to address these deficiencies. During the site inspection, evaluate whether the implemented corrective actions proposed in the previous site inspection adequately addressed reported deficiencies.

Are the SWPPP, NOI, Acknowledgment of NOI, MS4 Acceptance Form and Contractor Certifications on site and available to review?	**Yes** ☐ **No** ☐ **N/A** ☐
Are the weekly SWPPP inspection reports on site and available to review (either in a SWPPP mailbox or job trailer?	**Yes** ☐ **No** ☐ **N/A** ☐
Did you review the previous site inspection report?	**Yes** ☐ **No** ☐ **N/A** ☐
Did the previous site inspection require an update to the Storm Water Pollution Prevention Plan (SWPPP)?	**Yes** ☐ **No** ☐ **N/A** ☐
If so was the SWPPP updated?	**Yes** ☐ **No** ☐ **N/A** ☐

Project Site Activities

Provide a description of the construction activities that have occurred on site since the last inspection, what activities are currently occurring, and what activities are planned over the course of the next week. The description should consist of general activities, with specific activities identified where appropriate, and as they relate to the implementation and maintenance of Erosion and Sediment Control Measures.

Prior Activities:
Current Activities:
Planned Activities:

Site Map

The project site map shall be utilized as part of the site inspection process. The site map shall be used to visually depict various construction stages of the site, as well as to identify specific areas requiring attention. The various stages are to be depicted by the use of different color highlighters. The following outlines the color to be used for the selected construction activity:

Blue will indicate all disturbed site areas and drainage pathways that have undergone active site work within last 14 days.

Green will indicate site areas which have been temporarily or permanently stabilized.

Yellow will indicate site areas which have not undergone construction activity within the last 14 days but will within the next seven days.

Pink will indicate site areas which have not undergone construction within the last 14 days and will not undergo construction within the next 7 days. Notify contractor that this site area needs to be temporarily or permanently stabilized.

Approximately how many acres are within the Blue area**?**	______ Acres
Approximately how many acres are within the Yellow area?	______ Acres
Approximately how many acres are within the Pink area?	______ Acres
Add all of the acreage from the three areas	______ Acres

If the total area is greater than five (5) acres, then the portion of the site in excess of five acres shall be temporarily or permanently stabilized, unless written permission has been obtained from the NYSDEC in advance for any land disturbance of five acres or greater.

INSPECTION ITEM	YES	NO	PHOTO #	COMMENTS
a. Is there any evidence of sediment deposition or the discharge of sediment laden water to adjacent properties or drainage facilities?				
b. Is there any evidence of sediment deposition in a sediment trapping device? Record percentage _______% (SPDES permit requires sediment to be removed once it exceeds 50% of the sediment storage volume.)				
Is the sediment trapping device in need of maintenance?				
c. Are protected areas such as wetlands, property boundaries, and vegetation preservation areas, properly delineated?				
d. Is there evidence of erosion at the outlet of pipes, swales or ditches?				
e. Is the construction entrance stabilized and operating correctly?				
f. If Diversion Berms and/or Earth Dikes are required, have they been installed?				
If so, are they in need of maintenance?				
g. If Check Dams are required, have they been installed?				
If so, are they in need of maintenance?				
h. Do catch basins and drainage inlets have proper protection - i.e., filter fabric, stone and block, etc. - inlet protection?				
If so, are they in need of maintenance?				
i. Is there any loss of stabilizing vegetation, or seeding and mulching?				
j. Is there evidence of rill or gully erosion occurring on slopes?				

Were the Corrective Action(s) Identified in Last Inspection Report Implemented? **Yes** ☐ **No** ☐ **N/A** ☐ **If yes, Did the Corrective Actions Rectify the Problem?** **Yes** ☐ **No** ☐ **N/A** ☐
Indicate Deficiencies Identified During the Current Site Inspection (which were not already identified in this report):
Who was Notified of Problem(s) and When Were They Notified?
Corrective Actions to be Taken by Whom and When:
Are the Corrective Actions to be taken consistent with the current SWPPP? **Yes** ☐ **No** ☐ **N/A** ☐ **If no, update the SWPPP prior to the next site inspection to reference the inclusion of these corrective actions**

Contractor Signature: ____ **Date:** ___________________

Inspector's Signature: ____ **Date:** ___________________

Reviewing P.E.: ____ **Date:** ___________________

APPENDIX E-1

CONTRACTOR'S CERTIFICATION FORM

CONTRACTOR'S STORM WATER POLLUTION PREVENTION CERTIFICATION FORM

Project Address/Location:____

Project Name:____

Contractor's Official Name: ____

Address: ____

Telephone Number: ____

Contractor's Responsibilities: ____

Trained Individual(s) Responsible for SWPPP Implementation

Printed Name of Trained Individual	Title
Printed Name of Trained Individual	Title

Certification Statement:

"I hereby certify that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the *owner or operator* must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings."

Printed Name	Signature
Title	Date

APPENDIX F-1

NOTICE OF TERMINATION (NOT)

FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE SPDES GENERAL PERMIT

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505
(NOTE: Submit completed form to address above)

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity

Please indicate your permit identification number: NYR ___ ___ ___ ___ ___ ___

I. Owner or Operator Information

1. Owner/Operator Name:	
2. Street Address:	
3. City/State/Zip:	
4. Contact Person:	4a.Telephone:
4b. Contact Person E-Mail:	

II. Project Site Information

5. Project/Site Name:

6. Street Address:

7. City/Zip:

8. County:

III. Reason for Termination

9a. □ All disturbed areas have achieved final stabilization in accordance with the general permit and SWPPP. ***Date final stabilization completed** (month/year): ______________________________

9b. □ Permit coverage has been transferred to new owner/operator. Indicate new owner/operator's permit identification number: NYR ____ ____ ____ ____ ____ ____
(Note: Permit coverage can not be terminated by owner identified in I.1. above until new owner/operator obtains coverage under the general permit)

9c. □ Other (Explain on Page 2)

IV. Final Site Information:

10a. Did this construction activity require the development of a SWPPP that includes post-construction stormwater management practices? □ yes □ no (If no, go to question 10f.)

10b. Have all post-construction stormwater management practices included in the final SWPPP been constructed? □ yes □ no (If no, explain on Page 2)

10c. Identify the entity responsible for long-term operation and maintenance of practice(s)?

____

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity - continued

10d. Has the entity responsible for long-term operation and maintenance been given a copy of the operation and maintenance plan required by the general permit? □ yes □ no

10e. Indicate the method used to ensure long-term operation and maintenance of the post-construction stormwater management practice(s):

□ Post-construction stormwater management practice(s) and any right-of-way(s) needed to maintain practice(s) have been deeded to the municipality.

□ Executed maintenance agreement is in place with the municipality that will maintain the post-construction stormwater management practice(s).

□ For post-construction stormwater management practices that are privately owned, a mechanism is in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan, such as a deed covenant in the owner or operator's deed of record.

□ For post-construction stormwater management practices that are owned by a public or private institution (e.g. school, university or hospital), government agency or authority, or public utility; policy and procedures are in place that ensures operation and maintenance of the practice(s) in accordance with the operation and maintenance plan.

10f. Provide the total area of impervious surface (i.e. roof, pavement, concrete, gravel, etc.) constructed within the disturbance area? ______________________________ (acres)

11. Is this project subject to the requirements of a regulated, traditional land use control MS4? □ yes □ no

(If Yes, complete section VI - "MS4 Acceptance" statement

V. Additional Information/Explanation:

(Use this section to answer questions 9c. and 10b., if applicable)

VI. MS4 Acceptance - MS4 Official (principal executive officer or ranking elected official) or Duly Authorized Representative (Note: Not required when 9b. is checked -transfer of coverage)

I have determined that it is acceptable for the owner or operator of the construction project identified in question 5 to submit the Notice of Termination at this time.

Printed Name:	
Title/Position:	
Signature:	Date:

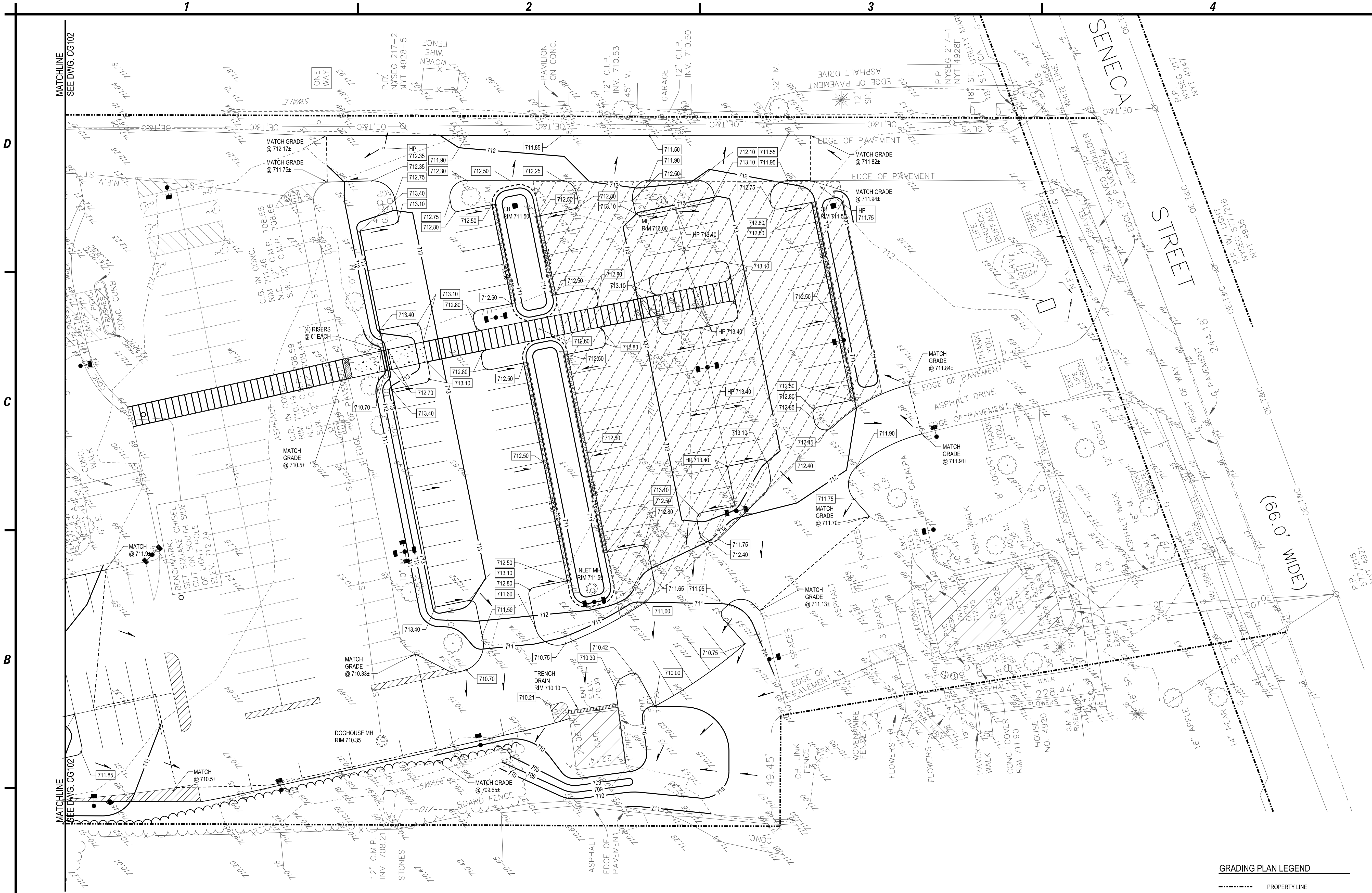
NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity - continued

VII. Qualified Inspector Certification - Final Stabilization:	
I hereby certify that all disturbed areas have achieved final stabilization as defined in the current version of the general permit, and that all temporary, structural erosion and sediment control measures have been removed. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.	
Printed Name:	
Title/Position:	
Signature:	Date:
VIII. Qualified Inspector Certification - Post-construction Stormwater Management Practice(s):	
I hereby certify that all post-construction stormwater management practices have been constructed in conformance with the SWPPP. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.	
Printed Name:	
Title/Position:	
Signature:	Date:
IX. Owner or Operator Certification	
I hereby certify that this document was prepared by me or under my direction or supervision. My determination, based upon my inquiry of the person(s) who managed the construction activity, or those persons directly responsible for gathering the information, is that the information provided in this document is true, accurate and complete. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.	
Printed Name:	
Title/Position:	
Signature:	Date:

(NYS DEC Notice of Termination - January 2015)

APPENDIX G-1

SWPPP PLANS & DETAILS



GRADING PLAN LEGEND

	PROPERTY LINE
	PROPOSED CURB
710.00	PROPOSED POINT ELEVATION
	EXISTING CONTOUR
710	PROPOSED CONTOUR
TC	TOP OF CURB
BC	BOTTOM OF CURB
HP	HIGH POINT
	FLOW DIRECTION

PLAN NORTH

20 0 20 40 FT.

20'

A1 **GRADING PLAN - SOUTH**

SCALE: 1"=20'

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Fax: 716-847-1454
www.cscos.com

LIFE CHURCH - NEW GATHERING & WORSHIP SPACE 4928 SENECA STREET WEST SENECA, NEW YORK

MARK	DATE	DESCRIPTION

REVISIONS

PROJECT NO: D19.001.003

DATE: 6-29-2020

SCALE: AS NOTED

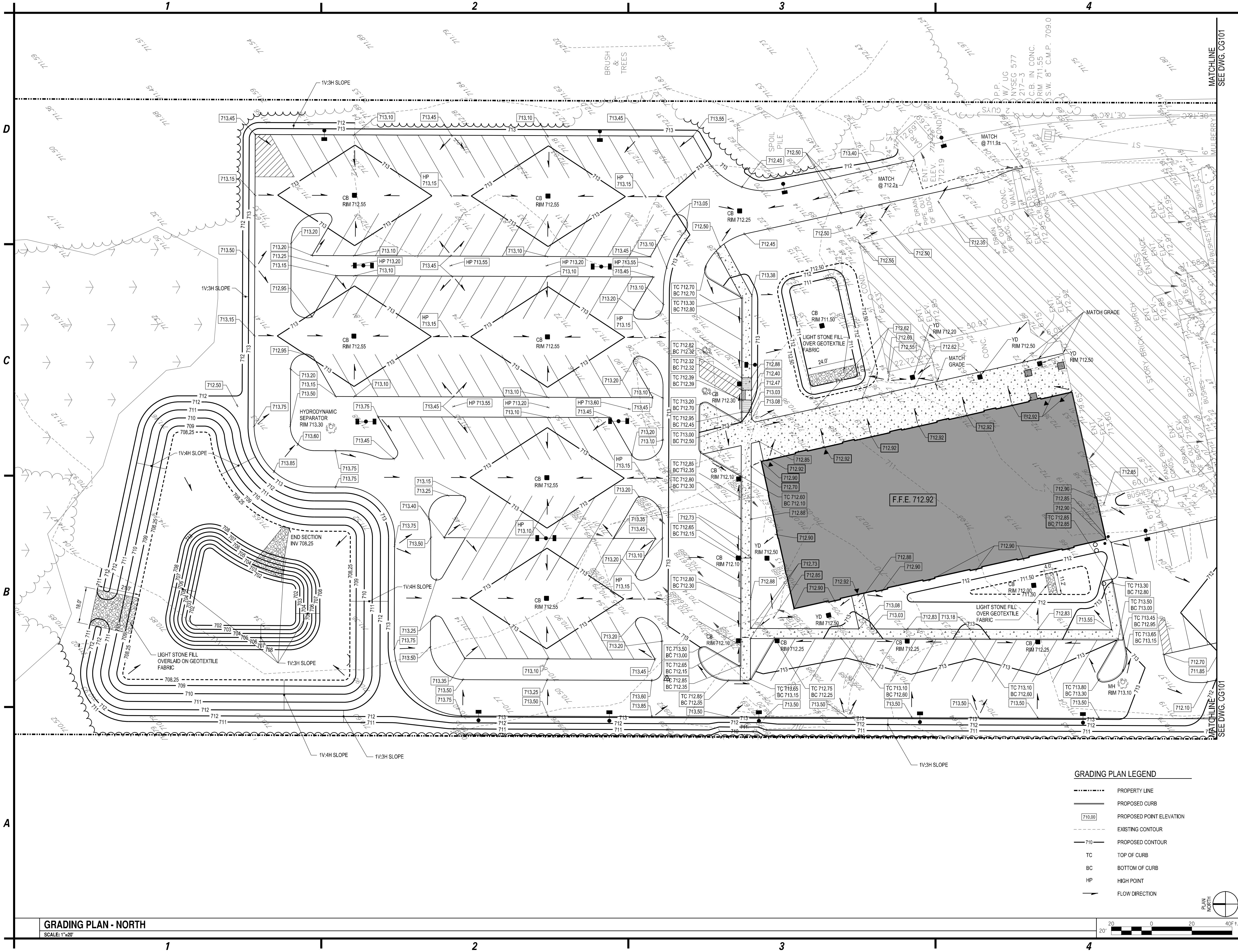
DRAWN BY: S. SCHIENER/J. HURLEY

DESIGNED BY: J. UTZIG

CHECKED BY: J. UTZIG

GRADING PLAN SOUTH

CG101



GRADING PLAN - NORTH
SCALE: 1"=20'

GRADING PLAN LEGEND

	PROPERTY LINE
	PROPOSED CURB
710.00	PROPOSED POINT ELEVATION
	EXISTING CONTOUR
710	PROPOSED CONTOUR
TC	TOP OF CURB
BC	BOTTOM OF CURB
HP	HIGH POINT
	FLOW DIRECTION

PLAN NORTH

20' 20 0 20 40Ft.

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DESIGNED BY: J. UTZIG
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GRADING PLAN NORTH

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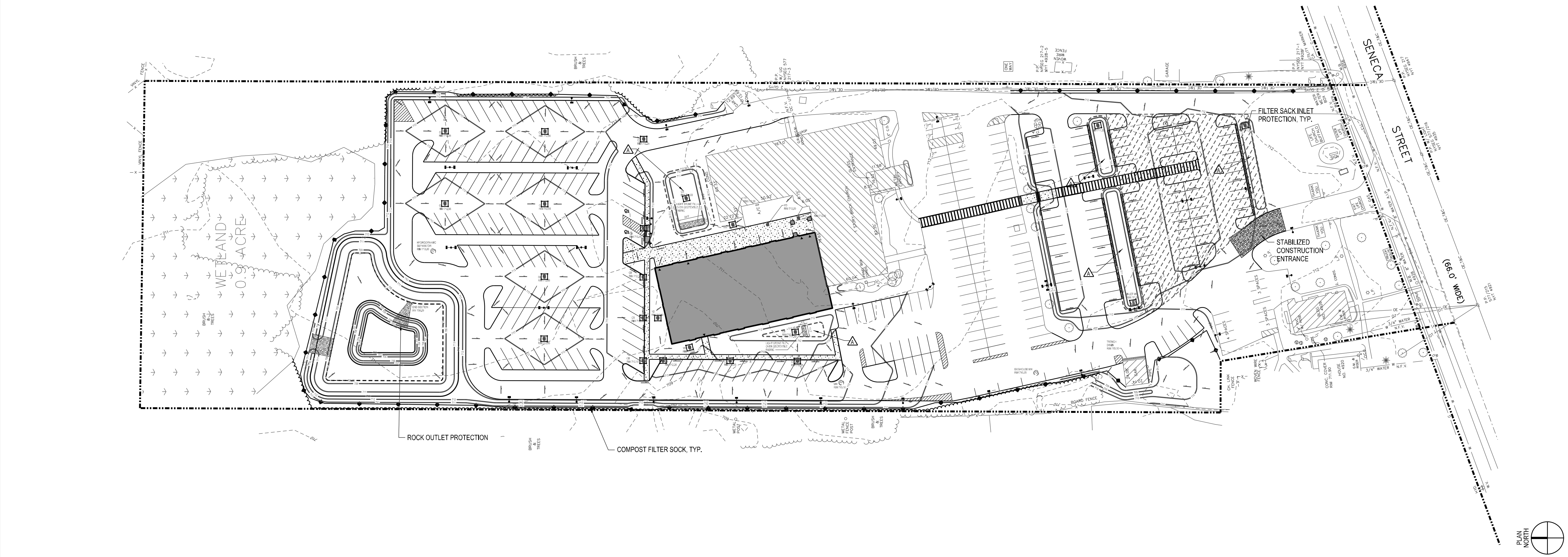
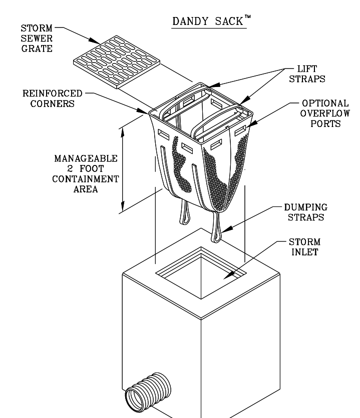


C1 EROSION & SEDIMENT CONTROL PLAN
SCALE: 1"=50'



REGULAR FLOW DANDY SACK™ (BLACK)

Mechanical Properties	Test Method	Units	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.78 (400) x 1.40 (315)
Grab Tensile Elongation	ASTM D 4632	%	15 x 15
Puncture Strength	ASTM D 4833	kN (lbs)	0.67 (150)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	5506 (800)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.67 (150) x 0.73 (165)
UV Resistence	ASTM D 4355	%	90
Apparent Opening Size	ASTM D 4751	Mm (US Std Sieve)	0.425 (40)
Flow Rate	ASTM D 4491	$1/min/m^2$ $(gal/min/ft^2)$	2852 (70)
Permittivity	ASTM D 4491	Sec^{-1}	0.90

HI-FLOW DANDY SACK™ (SAFETY ORANGE)

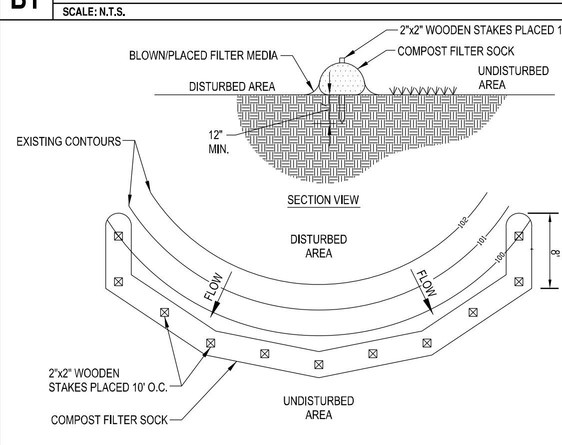
Mechanical Properties	Test Method	Units	MARV
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.62 (365) X 0.89 (200)
Grab Tensile Elongation	ASTM D 4632	%	24 X 10
Puncture Strength	ASTM D 4833	kN (lbs)	0.40 (90)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	3097 (450)
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.51 (115) X 0.33 (75)
UV Resistence	ASTM D 4355	%	90
Apparent Opening Size	ASTM D 4751	Mm (US Std Sieve)	0.425 (40)
Flow Rate	ASTM D 4491	$1/min/m^2$ $(gal/min/ft^2)$	5907 (145)
Permittivity	ASTM D 4491	Sec^{-1}	2.1

*Note: All Dandy Sacks™ can be ordered with our optional oil absorbent pillows

DANDY SACK™ SPECIFICATIONS

NOTE: THE DANDY SACK™ WILL BE MANUFACTURED IN THE U.S.A. FROM A WOVEN MONOFILAMENT FABRIC THAT MEETS OR EXCEEDS THE FOLLOWING SPECIFICATIONS:

B1 FILTER SACK INLET PROTECTION
SCALE: N.T.S.



1. SOCK FABRIC SHALL MEET STANDARDS OF TABLE 5.1. COMPOST SHALL MEET THE STANDARDS LISTED ON OF TABLE 5.2.

2. COMPOST FILTER SOCK SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE SOCK SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN SOCK ALIGNMENT (FIGURE 5.2). MAXIMUM SLOPE LENGTH ABOVE ANY SOCK SHALL NOT EXCEED THAT SHOWN ON FIGURE X.X. STAKES MAY BE INSTALLED IMMEDIATELY DOWNSLOPE OF THE SOCK IF SO SPECIFIED BY THE MANUFACTURER.

3. TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.

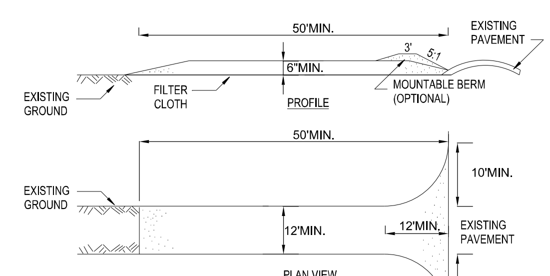
4. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES HALF THE ABOVEGROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.

5. SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.

6. BIODEGRADABLE FILTER SOCKS SHALL BE REPLACED AFTER 6 MONTHS; PHOTODEGRADABLE SOCKS AFTER 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

7. UPON STABILIZATION OF THE AREA TRIBUTART TO THE SOCKS, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.

A1 COMPOST FILTER SOCK
SCALE: N.T.S.



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. FILTER CLOTH - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

A3 STABILIZED CONSTRUCTION ENTRANCE
SCALE: N.T.S.

EROSION & SEDIMENT CONTROL NOTES

THE FOLLOWING EROSION CONTROL PROCEDURE SHALL BE ADHERED TO BY THE CONTRACTOR:

1. INSTALL TEMPORARY SILT FENCE BARRIERS AS SHOWN ON THE PLAN AND AT ALL EXISTING STORMWATER CATCH BASINS WITHIN THE WORK AREA TO PREVENT SEDIMENT MIGRATION. ALL SILT FENCE BARRIERS SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS.
2. THE TOPSOIL SHALL BE STRIPPED AND STOCKPILED ON SITE FOR RE-USE AS DIRECTED BY THE OWNER. ALL LOCAL ORDINANCES REGARDING THE SALE AND/OR REMOVAL OF TOPSOIL FROM SITE MUST BE FOLLOWED.
3. ALL SILT FENCE BARRIERS SHALL BE REPLACED WHEREVER THEY BECOME CLOGGED OR INOPERABLE.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE AND REMOVAL OF TEMPORARY SEDIMENTATION CONTROLS.
5. THE CONTRACTOR MUST CONTROL DUST DURING CONSTRUCTION. DURING EARTHWORK OPERATIONS, WATER-SPREADING EQUIPMENT SHALL BE PROVIDED BY THE CONTRACTOR, AND WATER SPREAD AS NECESSARY AND AS DIRECTED BY THE OWNER IN ORDER TO CONTROL DUST.
6. DIRT OR DEBRIS LEFT ON LOCAL PUBLIC ROADS AS A RESULT OF THIS CONSTRUCTION PROJECT SHALL BE REMOVED AND ROAD SURFACES CLEANED BY THE CONTRACTOR ON A DAILY BASIS.
7. ALL DISTURBED AREAS (EXCEPT AREAS TO BE PAVED OR BUILT UPON) SHALL BE TOPSOILED TO A MINIMUM 4" DEPTH AND SEEDED IMMEDIATELY AFTER FINE GRADING TAKES PLACE AND AS SOON AS PHYSICALLY POSSIBLE.
8. THE CONTRACTOR IS RESPONSIBLE FOR THE MAINTENANCE OF DOWNSTREAM STORM SEWERS, DITCHES, AND CULVERTS. SILT BUILDUP FOUND TO BE A RESULT OF THIS SITE CONSTRUCTION WORK SHALL BE REMOVED FROM DOWNSTREAM CULVERTS BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER OR THE TOWN.
9. IN ADDITION TO STORM WATER DISCHARGES, THE FOLLOWING NON-STORM WATER DISCHARGES MAY CONTRIBUTE TO THE RUNOFF FROM THE SITE:
   * WATER FROM WATER SERVICE FLUSHINGS
   * WATER USED TO WASH DOWN CONSTRUCTION VEHICLES (NO DETERGENTS)
   * WATER USED FOR DUST CONTROL
   * UNCONTAMINATED GROUNDWATER

THE ABOVE NON-STORM WATER FLOWS SHALL BE TREATED IN THE SAME MANNER AS STORM WATER FLOWS INDICATED HEREIN.

NOTE LEGEND

A EXCAVATE BIORETENTION AREA TO BOTTOM ELEVATION INDICATED TO ACT AS TEMPORARY SEDIMENT TRAP. DO NOT INSTALL BIORETENTION SOIL, PLANTINGS OR MULCH UNTIL UPSTREAM DRAINAGE AREAS ARE FULLY STABILIZED AND SEDIMENT IS REMOVED.

EROSION & SEDIMENT CONTROL PLAN LEGEND

INLET PROTECTION
COMPOST FILTER SOCK
STABILIZED CONSTRUCTION ENTRANCE

A4 LEGEND & NOTES
SCALE: N.T.S.

MARK	DATE	DESCRIPTION

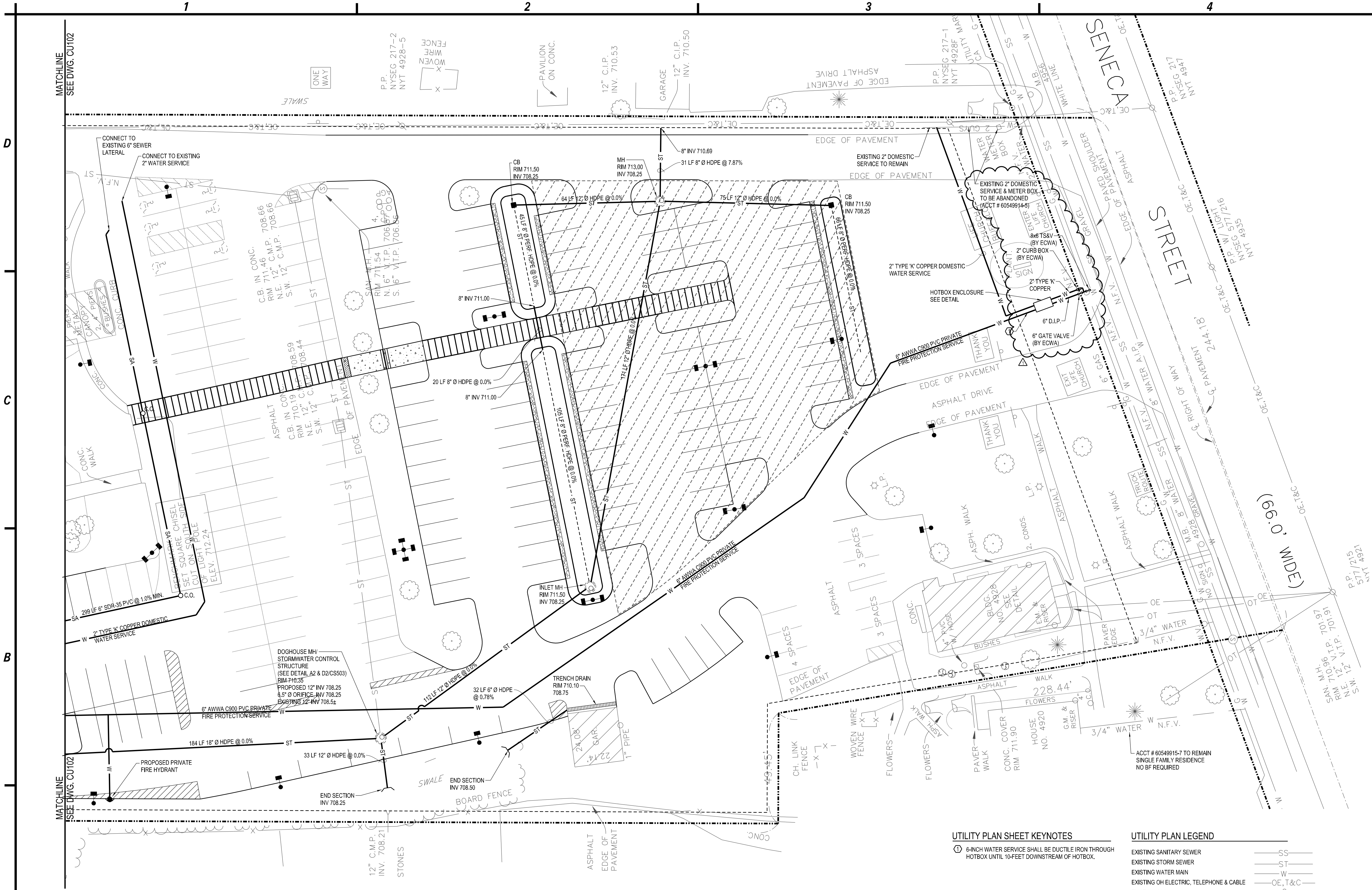
REVISIONS

PROJECT NO: D19.001.003
DATE: 6-29-2020
SCALE: AS NOTED
DRAWN BY: S. SCHIENER/J. HURLEY
DESIGNED BY: J. UTZIG
CHECKED BY: J. UTZIG

EROSION & SEDIMENT CONTROL PLAN, NOTES & DETAILS

CG103

USER **DATE** **SYTIME** **TIME**



UTILITY PLAN SHEET KEYNOTES

1. 6-INCH WATER SERVICE SHALL BE DUCTILE IRON THROUGH HOTBOX UNTIL 10-FEET DOWNSTREAM OF HOTBOX.

UTILITY PLAN LEGEND

EXISTING SANITARY SEWER	SS
EXISTING STORM SEWER	ST
EXISTING WATER MAIN	W
EXISTING OH ELECTRIC, TELEPHONE & CABLE	OE,T&C
EXISTING GAS	G
PROPOSED SANITARY SEWER	SA
PROPOSED STORM SEWER	ST
PROPOSED WATER MAIN	W
PROPOSED HYDRANT	
PROPOSED MANHOLE	MH
PROPOSED CATCH BASIN	CB
PROPOSED YARD DRAIN	YD
PROPOSED CLEAN OUT	C.O.
PROPOSED LIGHT STANDARD	

A1 UTILITY PLAN - SOUTH

SCALE: 1"=20'

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PROJECT NO: D19.001.003
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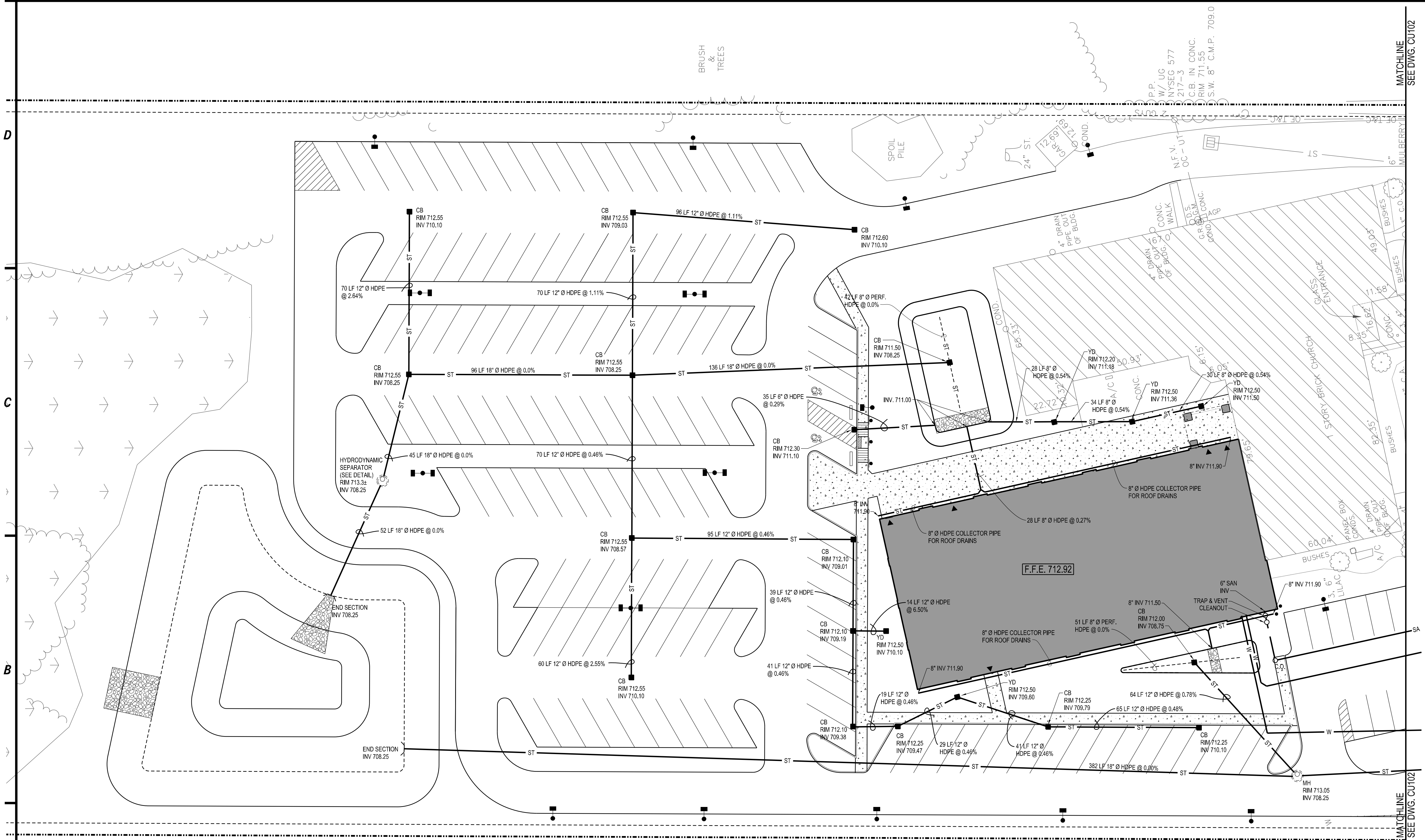
DRAWN BY: S. SCHIENER/J. HURLEY
DESIGNED BY: J. UTZIG
CHECKED BY: J. UTZIG

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK EDUCATION LAW

UTILITY PLAN SOUTH

CU101



UTILITY PLAN - NORTH
SCALE: 1"=20'

UTILITY PLAN LEGEND

EXISTING SANITARY SEWER	SS
EXISTING STORM SEWER	ST
EXISTING WATER MAIN	W
EXISTING OH ELECTRIC, TELEPHONE & CABLE	OE, T&C
EXISTING GAS	G
PROPOSED SANITARY SEWER	SA
PROPOSED STORM SEWER	ST
PROPOSED WATER MAIN	W
PROPOSED HYDRANT	
PROPOSED MANHOLE	MH
PROPOSED CATCH BASIN	CB
PROPOSED YARD DRAIN	YD
PROPOSED CLEAN OUT	C.O.
PROPOSED LIGHT STANDARD	

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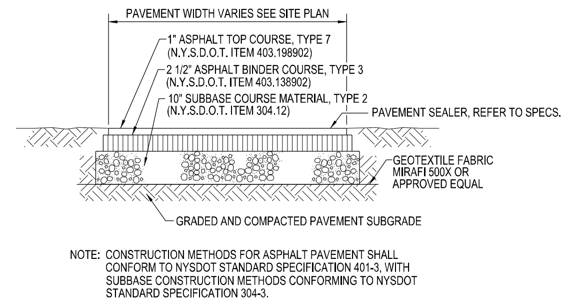
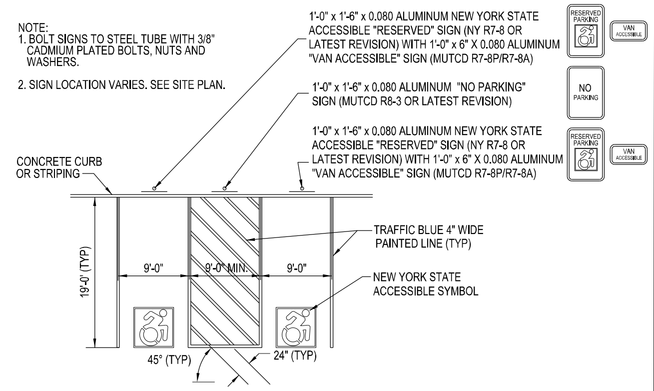
DESIGNED BY: J. UTZIG
CHECKED BY: J. UTZIG

UTILITY PLAN NORTH

CU102



D1 STANDARD DUTY ASPHALT SECTION
SCALE: N.T.S.



D2 ACCESSIBLE SIGNS & MARKINGS
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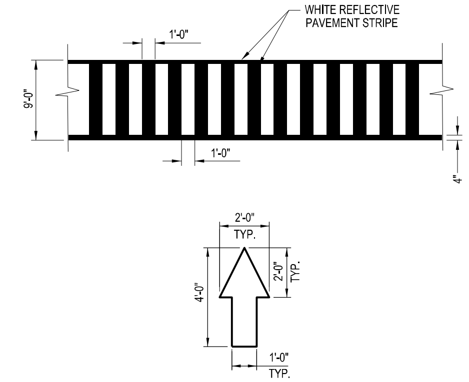

D3 PAINTED PEDESTRIAN CROSSWALK & TRAFFIC ARROW
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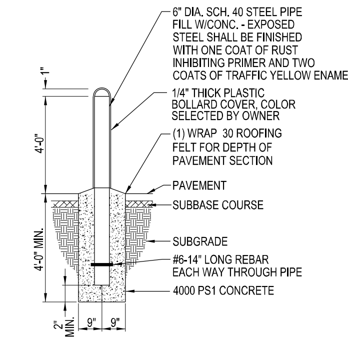

D4 BOLLARD DETAIL
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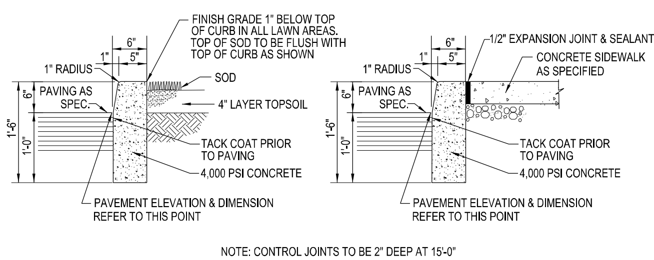
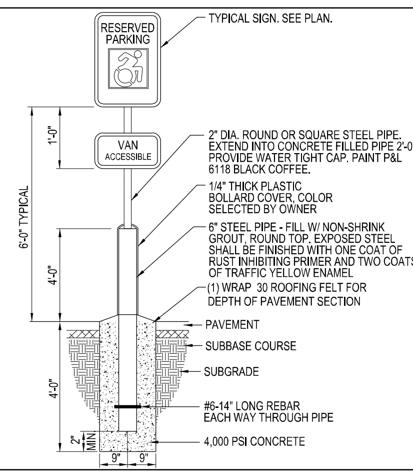
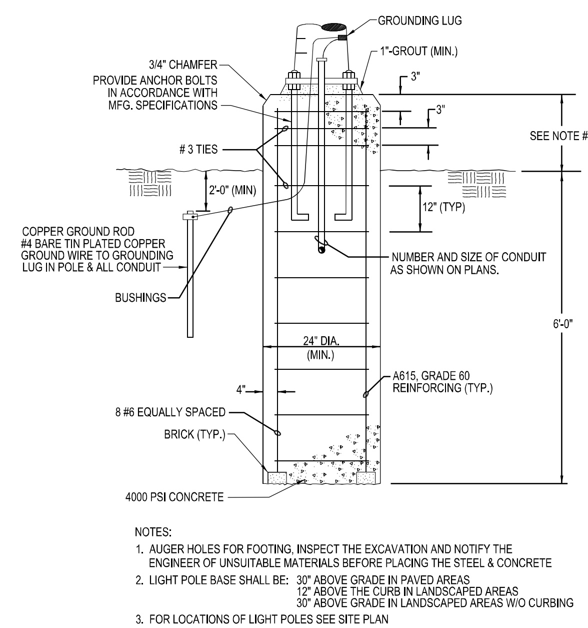


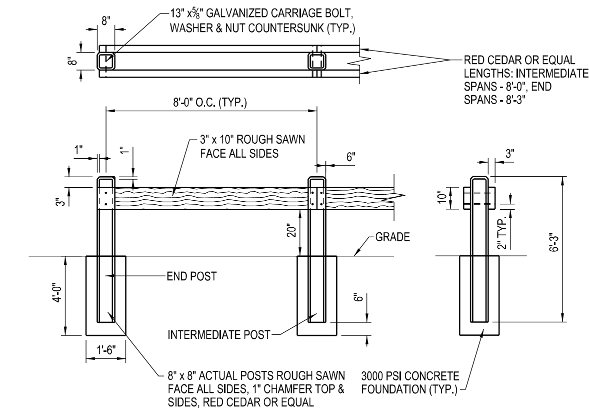
C1 CONCRETE CURB
SCALE: N.T.S.



C2 SIGN POST "A"
SCALE: N.T.S.



B3 LIGHT POLE FOUNDATION
SCALE: N.T.S.



C4 DECORATIVE TIMBER GUIDERAIL
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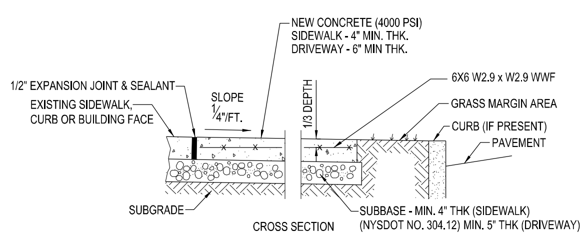

B1 CONCRETE SIDEWALK
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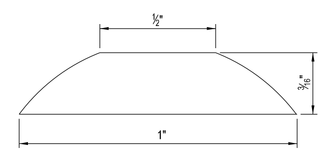
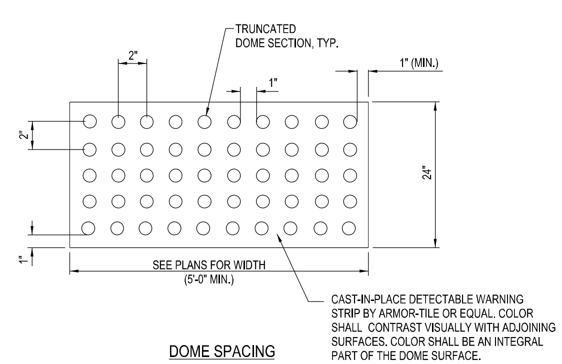


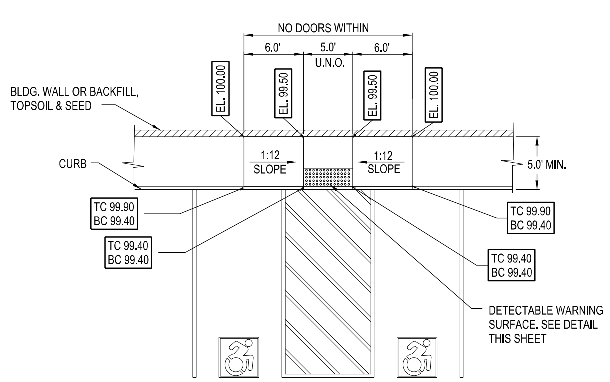
TRUNCATED DOME SECTION



DOME SPACING

NOTE:
DETECTABLE WARNING DEVICES SHALL BE PER 2010 ADA STANDARDS SECTION 705 OR THE MOST CURRENT UPDATE

A2 DETECTABLE WARNING SURFACE
SCALE: N.T.S.



A1 ACCESSIBLE CURB RAMP "B"
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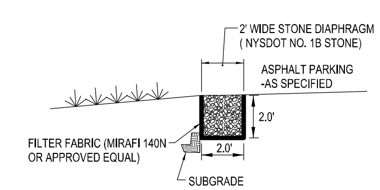

A3 STONE DIAPHRAGM
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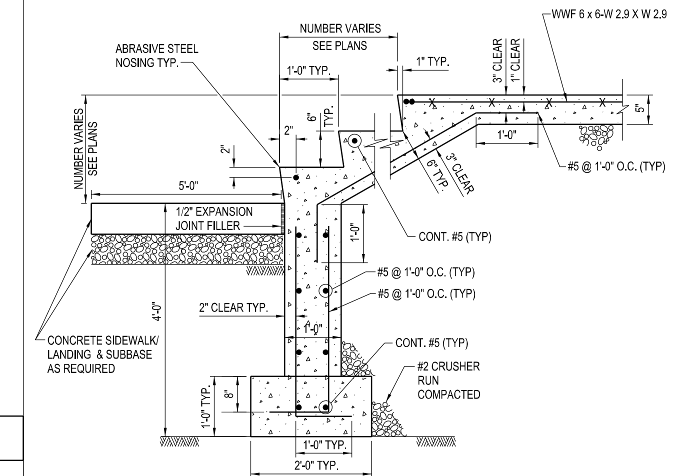
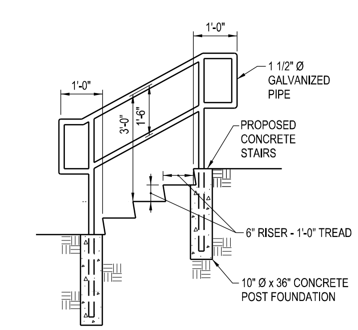


STAIR SECTION



RAILING DETAIL

A4 CONCRETE STAIRS & RAILING
SCALE: N.T.S.

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WEST SENECA, NEW YORK

MARK	DATE	DESCRIPTION

REVISIONS

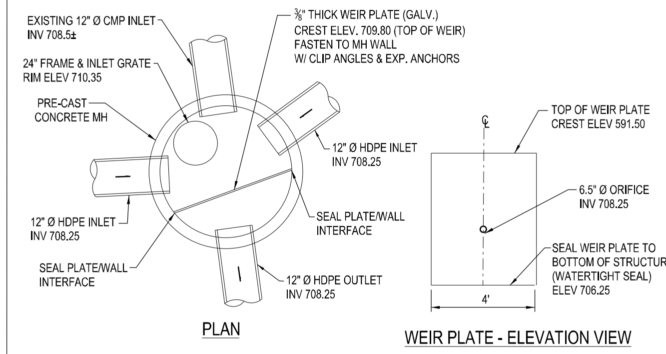
PROJECT NO: D19.001.003
DATE: 6-29-2020
SCALE: AS NOTED
DRAWN BY: S. SCHIENER/J. HURLEY
DESIGNED BY: J. UTZIG
CHECKED BY: J. UTZIG

SITE DETAILS

CS501

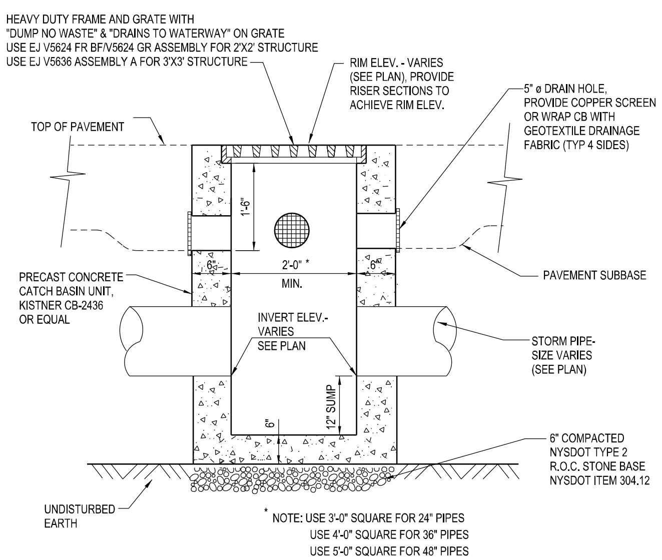
USER **DATE** **SYTIME** **TIME**

D2 STORMWATER CONTROL STRUCTURE
SCALE: N.T.S.



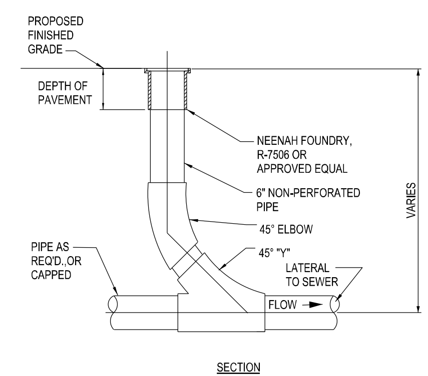
D4 NOT USED
SCALE: N.T.S.

C1 TYPICAL PRECAST CATCH BASIN
SCALE: N.T.S.



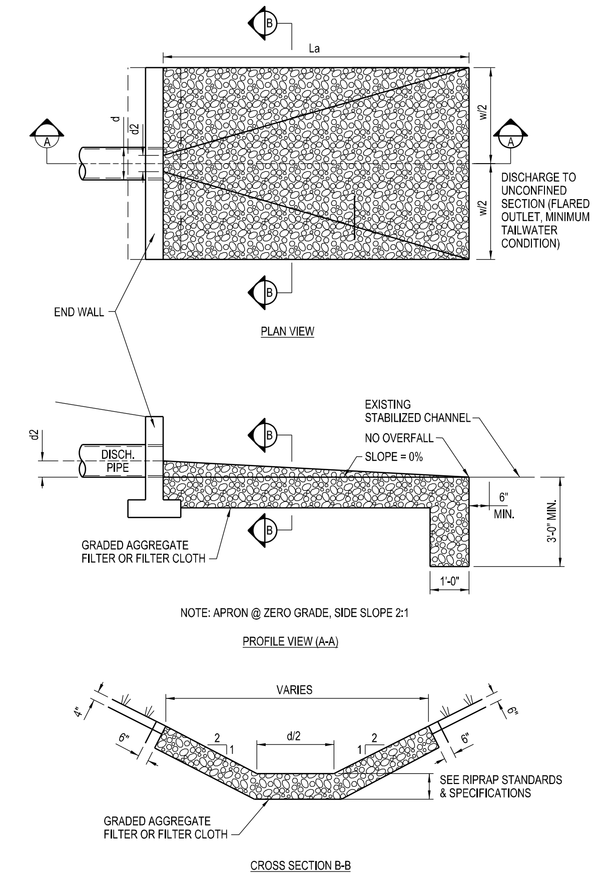
* NOTE: USE 3'-0" SQUARE FOR 24" PIPES
USE 4'-0" SQUARE FOR 36" PIPES
USE 5'-0" SQUARE FOR 48" PIPES

C2 TYPICAL SEWER CLEANOUT
SCALE: N.T.S. N.T.S.



C4 NOT USED
SCALE: N.T.S.

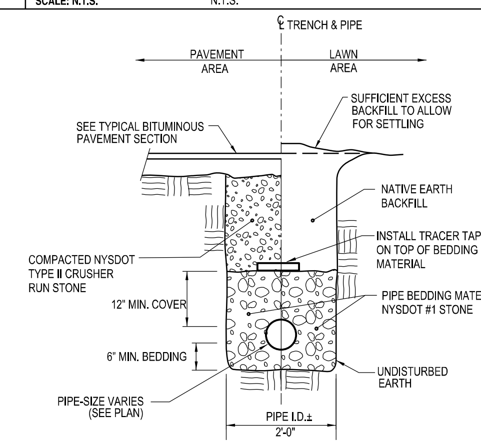
B3 RIPRAP OUTLET PROTECTION DETAIL
SCALE: N.T.S.



NOTE: SEE RIPRAP STANDARDS & SPECIFICATIONS MINIMUM TAILWATER CONDITIONS.

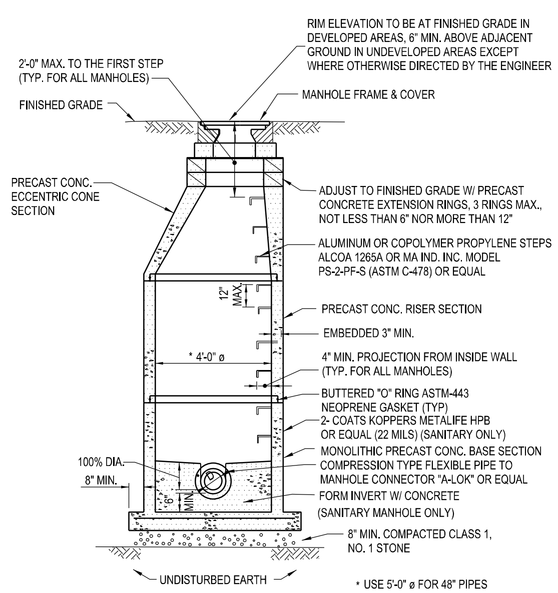
ROCK OUTLET PROTECTION							
R.O.P. #	D_0 (in)	DISCHARGE (cfs)	L_a (ft)	MEDIAN STONE SIZE, d_{50}(in)	MAX. STONE SIZE, d (in) max.	MIN. RIPRAP LAYER THICKNESS (in)	w/2 (ft)
	18	16	24	6	9	14	8

B2 UTILITY TRENCH SECTION
SCALE: N.T.S.



B4 NOT USED
SCALE: N.T.S.

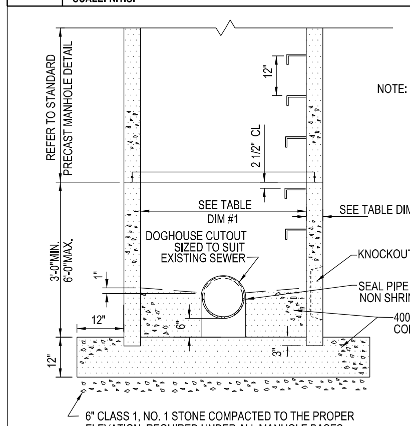
A1 PRECAST CONCRETE MANHOLE DETAIL
SCALE: N.T.S.



* USE 5'-0" ø FOR 48" PIPES
6'-0" ø FOR PIPE ARCHES

NOTE: PROVIDE HEAVY DUTY NEENAH R-1792-FG OPEN GRATE AND FRAME FOR ALL STORM MANHOLES

A2 PRECAST DOGHOUSE BASE MANHOLE
SCALE: N.T.S.

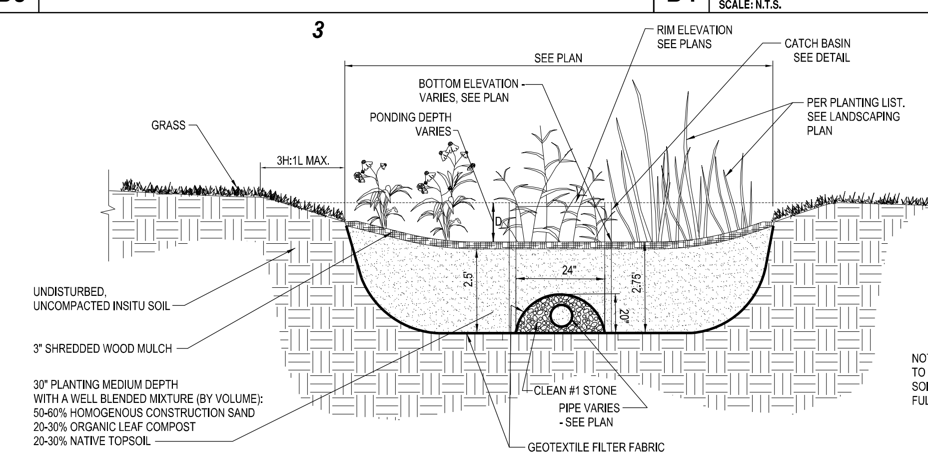


NOTE:
AREA AROUND DOGHOUSE CUTOUT & PIPE TO BE MADE WATERTIGHT UTILIZING A HYDRAULIC CEMENT MIXTURE (WATERPLUG,PRECO-PATCH, OR APPROVED EQUAL).

PIPE SIZE	DIMENSION #1	DIMENSION #2
8"-16"	4'-0"	5"
18"	5'-0" *	6"
21"-27"	5'-0"	6"
30"-36"	6'-0"	7"

* FOR DROP CONNECTIONS INSIDE DIAMETER SHALL BE 5'-0"

A3 BIO-RETENTION AREA X-SECTION
SCALE: N.T.S.



NOTE: EXCAVATE BIORETENTION AREA TO BOTTOM ELEVATION INDICATED TO ACT AS TEMPORARY SEDIMENT TRAP. DO NOT INSTALL BIORETENTION SOIL, PLANTINGS OR MULCH UNTIL UPSTREAM DRAINAGE AREAS ARE FULLY STABILIZED AND SEDIMENT IS REMOVED.

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Fax: 716-847-1454
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WEST SENECA, NEW YORK

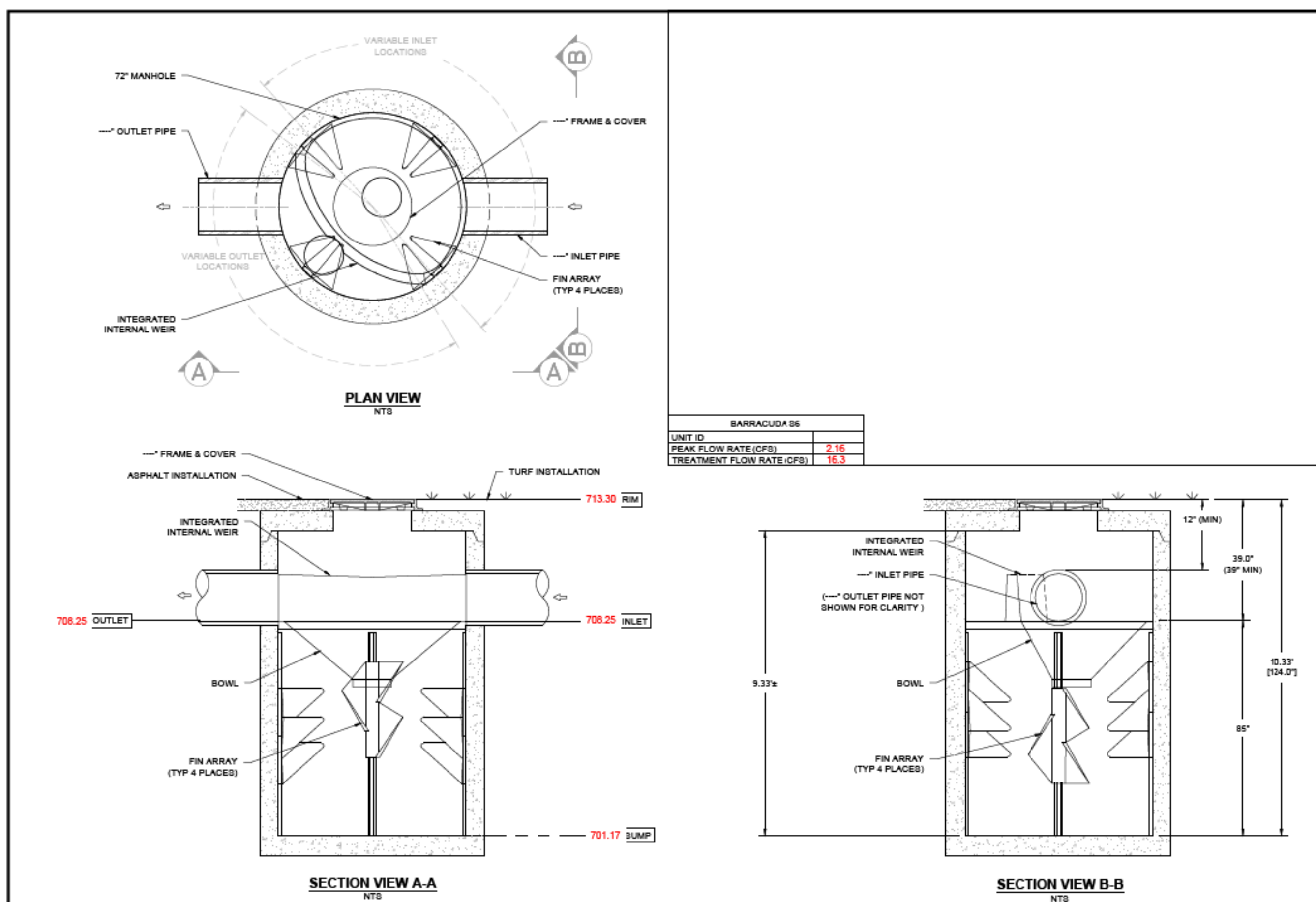
MARK	DATE	DESCRIPTION
REVISIONS		

PROJECT NO: D19.001.003
DATE: 6-29-2020
SCALE: AS NOTED
DRAWN BY: S. SCHIENER/J. HURLEY
DESIGNED BY: J. UTZIG
CHECKED BY: J. UTZIG

STORM DETAILS

USER **DATE** **SYTIME** **TIME**

CS503



BARRACUDA S6	
UNIT ID	
PEAK FLOW RATE (CFS)	2.16
TREATMENT FLOW RATE (CFS)	16.3

BARRACUDA S6

BARRACUDA S6

DATE: 5/10/18 DRAWN: PR

PROJECT #: S CHECKED: EKH

REV	DWN	CKD	DESCRIPTION

ADS ADVANCED DRAINAGE SYSTEMS, INC. 4640 TRUEMAN BLVD HILLIARD, OH 43026

barracuda 1080 Deer Hollow Drive Mount Airy, MD 21771 1-800-BAYSAVER 1-800-229-7283

NOT TO SCALE

SHEET 1 OF 1

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A1 HYDRODYNAMIC SEPARATOR
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REVISIONS

PROJECT NO: D19.001.003
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SCALE: AS NOTED
DRAWN BY: S. SCHIENER/J. HURLEY
DESIGNED BY: J. UTZIG
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NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK EDUCATION LAW

STORM DETAILS

CS504

USER **DATE** **TIME** **SYTIME**

APPENDIX H-1

POST CONSTRUCTION MAINTENANCE SCHEDULE

NEW YORK
STATE OF OPPORTUNITY.

Department of Environmental Conservation

MAINTENANCE GUIDANCE

Stormwater Management Practices

March 31, 2017

FINAL

Table of Contents

Section 1. Introduction

1.1. Stormwater Management Practice (SMP) Groups

Stormwater management has become an important function for municipalities to address the quality of local water resources and to adhere to state standards. Increasingly, stormwater management practices (SMPs) are constructed as part of new development or redevelopment projects as retrofits to existing infrastructure and/or as part of local watershed restoration plan efforts.

While SMPs are proliferating, municipalities are charged with a certain level of implementation and oversight. Whether this is a new function for a municipality or an expansion of existing programs, it is important for these local programs to have some degree of guidance to successfully meet the challenge. One important area where guidance has been lacking is how to properly operate and maintain the wide range of SMPs that are constructed. This chapter was developed to address this need. It is widely understood that SMPs will not function properly to protect water resources without attention to operation and maintenance (O&M), and that O&M tasks and responsibilities must be identified and assumed by various stakeholders.

The chapter is structured around a hierarchy concept where O&M responsibilities are addressed by SMP owners/property managers, municipal staff, landscape contractors and professionals with knowledge in stormwater management (Qualified Professional). The hierarchy approach, explained in more detail below in Section 1.2, strives for a cost-efficient way to ensure long-term performance of SMPs.

The maintenance procedures described in this chapter are applied to ten separate SMP groups (**Table 1.1**). These same ten groups are used to separate maintenance inspection guidance, costs, and other guidance in the chapter.

Table 1.1 Practices Discussed in this Chapter, by Group

SMP Group	Practices Included
Rainwater Harvesting	• Rain Barrel • Cistern
Disconnection and Sheetflow	• Rooftop Disconnection • Sheetflow to Filter Strip • Sheetflow to Riparian Buffers
Swales	• Vegetated Swale • Wet Swale
Tree Planting	• Tree Planting
Bioretention	• Bioretention Cell • Dry Swale • Rain Garden • Stormwater Planters • Tree Pits
Green Roofs	• Green Roofs
Permeable Pavements	• Permeable Pavers • Porous Asphalt/Concrete
Ponds and Wetlands	• Wet Pond Design Options • Stormwater Wetland Design Options
Infiltration	• Infiltration Trench • Infiltration Basin • Dry Well
Sand and Organic Filters	• Surface Sand Filters • Underground Sand Filters • Underground Organic Filters

1.2. Maintenance Hierarchy

SMPs require inspections and maintenance to identify small problems before they become more serious and expensive to repair. For example, removing a small amount of sediment from a filtering medium or permeable pavement surface is much less expensive than replacing a surface that has already become clogged. However, it can be cost prohibitive for most communities or SMP owners to hire highly trained staff or contractors to inspect these practices or to carry out the actual maintenance tasks. This can be especially true with the advent of "micro-scale" Green Infrastructure practices, which may be distributed across many individual public and private properties, and where the absolute number of SMPs within a municipality may exceed local government inspection and maintenance capabilities.

Many SMP maintenance problems start out as fairly small, easily rectified issues as long as they are detected early enough through an inspection. For these issues, property owners or managers can likely take care of the issue in an expedient and cost-effective manner.

However, at some point, property owners or managers will encounter an issue where diagnosing the problem and knowing the appropriate remedy will exceed their technical capabilities. At this point, an individual with training in SMP inspection, operation and maintenance, such as a municipal inspector or landscape contractor, may have to be called in for assistance.

Similarly, some problems escalate to the point where a Qualified Professional (i.e. professional engineer or landscape architect) is needed to bring the SMP back to a good functioning condition. The Qualified Professional may need to bring in other experts to assess problems with the SMP. For instance, they may call in a horticulturalist to assess problems with the planting plan.

Figure 1.1 The SMP Maintenance Hierarchy Pyramid

Acknowledging this step-wise approach to SMP inspection and maintenance, the SMP Maintenance Hierarchy concept was developed. The concept uses a combination of skill levels (**Figure 1.1**) as explained in more detail below.

Level 1: Property Owners and Managers, Interns, etc.

This category includes property owners, property managers, or HOA representatives, for privately owned SMPs. For municipally owned SMPS, this could include municipal maintenance staff or interns, and volunteers. These individuals would typically have no or only very limited training in stormwater maintenance and inspection but can use available guidance to quickly identify and rectify common and simple issues with SMP performance. This level completes routine inspections and maintenance activities. For most SMPs, the majority of inspection and maintenance activities can be conducted at this skill level, thus Level 1 forms the base of the Maintenance Hierarchy pyramid. Many well-functioning SMPs can be adequately maintained for long periods of time using Level 1 capabilities.

Although many issues can be addressed at Level 1, these inspectors and maintainers need a relief valve when the SMP problems become harder to diagnose and/or the remedies require a higher level of resources and expertise. Such issues are referred to in this chapter as "kick-outs to Level 2." For instance, an SMP may have a minor amount of sediment that has accumulated at inlets or on the practice bottom. A Level 1 person may be able to take care of this with a flat shovel and wheel barrow. However, a Level 2 inspection would be triggered if the sediment is deep, widespread, keeps recurring, and/or requires more sophisticated equipment to remove.

Level 2: Trained Municipal Staff

This level of inspection and maintenance is conducted primarily by municipal employees or landscape contractors who have completed training on SMP, inspection, operation and maintenance. Level 2 inspections can take place in response to two circumstances:

1. As part of an ongoing, routine municipal inspection program whereby SMPs are visited on a rotating basis at a frequency established by the local program, or

2. In response to a “kick-out” from a Level 1 inspector based on a specific problem or problems.

Circumstance #2 obviously will require coordination and communication between the Level 1 and Level 2 inspectors, with documentation and background provided by the Level 1 inspector. This is an essential part of making the hierarchy approach successful. In the example above, the Level 2 inspector can better diagnose the sources of the sediment, whether the sediment is affecting performance of the SMP, and the specific tasks needed to remove the sediment and abate the source.

As with kick-outs from Level 1 to Level 2, the same can exist from Level 2 to Level 3. It may be that the Level 2 inspector encounters a problem where a Qualified Professional is needed to re-design certain components of the SMP, and a qualified contractor is needed to undertake a more serious repair. This is when Level 3 is activated.

Level 3: Qualified Professionals

Qualified professionals include professional engineers and landscape architects, who can revisit design issues associated with chronic or serious problems. For repair and maintenance of the SMPs at this level, individuals with specific skills and certifications, such as a certified plumber who has experience working with rainwater harvesting practices or a horticulturalist with knowledge on proper plantings may need to be called in by the Qualified Professional. Level 3 inspection or maintenance is triggered in response to specific problems identified during a Level 2 inspection.

Continuing with the example above, the Level 2 inspector identifies that the sediment is accumulating in the SMP because of the lack of pre-treatment or that the practice is not sized properly for its drainage area. The Level 2 inspector at this point should consult a Qualified Professional (Level 3) who can go back to the original or as-built plan and develop workable solutions.

Table 1.2 further describes how maintenance and inspection activities differ among the three levels of the SMP Maintenance Hierarchy.

Table 1.2 Maintenance/Inspection Hierarchy Levels

	Level 1: Owners and Untrained Staff	**Level 2: Trained Municipal Staff**	**Level 3: Qualified Professionals**
Qualifications/ Training of Inspectors	No special training, but person is provided educational materials	On-the-job training and/or short workshops Define adequate training or provide examples	Professional License such as a PE or RLA
Frequency of Inspection	At least annually	Routine as determined by the local program OR as kick-out from Level 1 inspection	Only as needed from Level 2 inspection
Inspection Guidance	Checklists are included for each practice group in **Section 2** of this chapter and in **Appendix A**.	Guidance for the inspection is included in **Section 3**, and checklists are included in **Appendix B.**	**Section 4** includes guidance for diagnosing typical problems.
Typical Maintenance Activities	Routine mowing. Trash removal. Plant care and upkeep. Mulching as needed. Removal of small amounts of sediment from pretreatment areas of the practice.	Removal of larger amounts of sediment. Structural damage repair. Minor regrading and scarification of soil surface to restore permeability.	Redesign an improperly functioning practice. Includes re-grading of the contributing drainage area, replacing soil media and plantings (new planting plan), or modifying conveyance structures.
Triggers for Inspection or Maintenance by this Level	Regular inspection (no trigger)	Level 1 Inspection Sheets (**Section 2**) describe triggers that warrant a Level 2 Inspection.	Level 2 Inspection Guidance (**Section 3**) describes triggers that warrant a Level 3 Inspection.

1.3. Using the Remainder of this Chapter

This chapter provides guidance for maintaining SMPs, including inspection, maintenance activities, and maintenance planning. The chapter includes four sections as follows:

- **Section 2** outlines Level 1 inspection and maintenance procedures in the form of visual checklists. This includes guidance for inspection of each of the 10 SMP groups/categories included in this chapter, as well as specific kick-outs for Level 2.
- **Section 3** provides guidance for Level 2 inspections as to observed conditions, remedies, and triggers for Level 3.
- **Section 4** is most relevant to Level 3 and includes diagnostic measures for specific problems, as well as guidance for performing repair activities.
- **Section 5** provides an overview of planning for maintenance, including techniques for estimating maintenance costs and elements of a maintenance plan.

Section 2. Level 1 Inspections

2.1. How to Use this Section

Section 2 provides guidance for Level 1 inspections of 10 groups of stormwater management practices (SMPs). See Section 1 of this chapter for an explanation of Level 1 in the Maintenance Hierarchy.

- **Section 2.2** provides general guidance for Level 1 inspections.
- **Sections 2.3 through 2.12** provide detailed Level 1 inspection guidance and inspection forms for each of the 10 practice categories:
  - 2.3 Rainwater Harvesting
  - 2.4 Disconnection and Sheetflow
  - 2.5 Swales
  - 2.6 Tree Planting
  - 2.7 Bioretention
  - 2.8 Green Roofs
  - 2.9 Permeable Pavement
  - 2.10 Ponds and Wetlands
  - 2.11 Infiltration
  - 2.12 Sand and Organic Filters

2.2. General Guidance for Level 1 Inspections

Regardless of which practice you are inspecting, some key procedures and equipment are necessary. Read through this guidance before going on an inspection, and use the specific guidance in **Sections 2.3 through 2.12** for the particular practice type you are inspecting. The Level 1 Inspection can be completed with minimal previous training. Typical Level 1 inspectors may include a property owner or manager (for private SMPs) or perhaps an intern or maintenance or landscape crew members in the case of a publicly owned practice. Level 1 inspections are the most frequent inspections. They are designed to identify key maintenance issues before they become more serious and to help keep up with routine maintenance tasks.

When to Conduct a Level 1 Inspection

The Level 1 Inspection should be conducted at least annually for all practices and is often supplemented with additional visits after large storms, winter salting and sanding, or other seasonal changes. In addition, it is recommended that inspections take place more frequently during the first few years after installation of an SMP. Many issues can be identified and corrected during this early period so that they do not lead to larger problems in subsequent years. Plant establishment and health is one of these key issues. Once the SMP is stable and seems to be functioning properly, the inspections can become less frequent.

What to Take into the Field

The Level 1 Inspection is fairly simple, and it is assumed that very little measurement will be needed. However, the inspector should take pictures to document findings and should also keep a record of the inspections. The list of needs for the Level 1 Inspection includes the following:

1. Safety vest (if SMP is located in an area near traffic)
2. Notes or records from past inspections
3. Digital camera or phone
4. Clipboard and pencils (if using paper forms), or Tablet or smartphone if using digital forms
5. Bug spray (if needed)
6. Sun block (if needed)
7. Tape measure (optional, to measure pipe sizes and SMP dimensions)
8. Letter of permission to access property if the inspector is from an outside agency (e.g., summer intern working for the municipality)
9. Site Plan showing SMPs, Planting Plan (includes planting/seed mixes) and details
10. Engineers scale
11. Flagging/stakes and waterproof marker (to mark problem areas that need to be visited again)

Checklist and Follow-Up Actions

The Level 1 Inspection checklists included in **Sections 2.3 through 2.12** describe follow-up actions for each observed condition (See **Figure 2.2.1** for an example). A Level 1 Inspection Table is available for each component or key area of the particular SMP group. Use as follows:

- Check the box in the LEFT column if the problem is present at the site.
- Check the appropriate follow-up actions in the RIGHT column, or add your own as needed to fix the problem.
- DOCUMENT all your actions. Keep copies of the Level 1 inspection tables, plus notes, photos, or other documentation of corrective measures to fix problems. Record dates of actions and any follow-up inspections. This will be important for communicating with Level 2 inspectors and/or the local stormwater program.
- Activate a Level 2 Inspection (**Section 3**) as guided by the table (shown in blue cells): These blue cells identify conditions when a more detailed inspection will be needed to further diagnose problems. As the problem becomes more severe, it will be necessary to activate a Level 2 inspection. Consult the local stormwater program authority for the most appropriate Level 2 inspection option.

2.7. Bioretention

Areas of Bioretention

Key areas to inspect for Bioretention include the following:

- BR 1. Drainage Area
- BR 2. Inlets
- BR 3. Bioretention Ponding Area
- BR 4. Vegetation
- BR 5. Outlets

Figure 2.7.1. Key Areas for Level 1 Inspection of Bioretention

Note: The category of Bioretention includes:

- Bioretention cells – areas of soil, mulch, and vegetation that treat runoff
- Dry swales – long, linear bioretention cells, sometimes with check dams along a mildly sloping swale
- Rain gardens – usually small-scale bioretention practices on residential or small commercial properties
- Stormwater planters – usually in more urban settings, with soil and plants in a concrete box that receives roof runoff or perhaps other water from the site
- Tree pits – also a more urban practice where the bioretention is confined within some sort of box (e.g., concrete) and places along road curbs or other areas to treat runoff

For the purposes of this chapter, the term “Bioretention cell” will be used to generally describe these practices.

Bioretention Level 1 Inspection

The Level 1 Inspection focuses on the Drainage Area (BR1), Inlets (BR2), Bioretention Ponding Area (BR3), Vegetation (BR4), and Outlets (BR5). This inspection should be conducted on a regular basis, with an early spring inspection to ensure that the practice has survived the winter, particularly if there has been a significant amount of snow. An inspection during the growing season or in the early fall is also recommended to check on the health of vegetation.

BR 1. Drainage Area

Description: The drainage area sends runoff to and is uphill from the Bioretention cell. When it rains, water runs off and flows to the Bioretention cell and ponds within the cell temporarily (usually for no more than 48 hours). Sometimes, the runoff will contain dirt, grit, grass clippings, oil, or other substances that SHOULD NOT be directed to the Bioretention area.

Instruction: Look for areas that are uphill from the Bioretention cell. Consult **Table 2.7.1** below.

Table 2.7.1 BR Drainage Area

Problem (Check if Present)		Follow-Up Actions
	☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and mulch areas of bare soil to establish vegetation. ☐ Fill in erosion areas with soil, compact, and seed and straw to establish vegetation. ☐ If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Large areas of soil have been eroded, or larger channels are forming. May require rerouting of flow paths.
	☐ Piles of grass clippings, mulch, dirt, salt, or other materials	☐ Remove or cover piles of grass clippings, mulch, dirt, etc. ☐ Other:
	☐ Open containers of oil, grease, paint, or other substances	☐ Cover or properly dispose of materials; consult your local solid waste authority for guidance on materials that may be toxic or hazardous. ☐ Other:

BR 2. Inlets

Description: The inlets to a Bioretention cell are where water flows into the cell. Depending on the design, water can flow in through:

- Curb cuts or openings in a parking lot or roadway
- Pipes or ditches that carry water into the Bioretention cell from the drainage area
- Flow directly over the land surface (known as “sheetflow”), sometimes across a strip of rock or stone

Figure 2.7.2 Bioretention Cell Inlets

CSN, 2013

Instruction: Stand in the Bioretention cell itself and look for all the places where water flows in. Often there will be multiple points of inflow to the practice. Consult **Table 2.7.2** below for possible problems.

Table 2.7.2 BR Inlets	
Problem (Check if Present)	**Follow-Up Actions**
 ☐ Inlets collect grit and debris or grass/weeds. Some water may not be getting into the Bioretention cell. The objective is to have a clear pathway for water to flow into the cell.	☐ Use a flat shovel to remove grit and debris (especially at curb inlets or openings). Parking lots generate fine grit that will accumulate at these spots. ☐ Pull out clumps of growing grass or weeds and scoop out the soil or grit that the plants are growing in. ☐ Remove any grass clippings, leaves, sticks, and other debris that is collecting at inlets. ☐ For pipes and ditches, remove sediment and debris that is partially blocking the pipe or ditch opening where it enters the Bioretention cell. ☐ Dispose of all material properly where it will not re-enter the Bioretention cell. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Inlets are blocked to the extent that most of the water does not seem to be entering the Bioretention cell.
 ☐ Some or all of the inlets are eroding so that rills, gullies, and other erosion is present, or there is bare dirt that is washing into the Bioretention cell.	☐ For small areas of erosion, smooth out the eroded part and apply rock or stone (e.g., river cobble) to prevent further erosion. Usually, filter fabric is placed under the rock or stone. ☐ In some cases, reseeding and applying erosion-control matting can be used to prevent further erosion. Some of these materials may be available at a garden center, but it may be best to consult a landscape contractor. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Erosion is occurring at most of the inlets, and it looks like there is too much water that is concentrating at these points. The inlet design may have to be modified.

BR 3. Bioretention Ponding Area

Description: The ponding area fills up with water during a rainstorm. If you picture the Bioretention cell as a bathtub, there is the *bottom* (usually flat surface), *side slopes* (areas that slope down to the bottom from the surrounding ground), and *berms or structures that control the depth to which water ponds.*

Instruction: Examine the entire Bioretention surface and side slopes. Consult the table below for possible problems.

<table>
<tr><th colspan="2">Table 2.7.3 BR Ponding Area</th></tr>
<tr><th>Problem (Check if Present)</th><th>Follow-Up Actions</th></tr>
<tr><td>
☐ Mulch (if used) needs to be replaced or replenished. The mulch layer had decomposed or is less than 1-inch thick.</td><td>☐ Add new mulch to a total depth (including any existing mulch that is left) of 2 to 3 inches. The mulch should be shredded hardwood mulch that is less likely to float away during rainstorms.
☐ Avoid adding too much mulch so that inlets are obstructed or certain areas become higher than the rest of the Bioretention surface.
☐ Other:</td></tr>
<tr><td rowspan="2">

☐ Minor areas of sediment, grit, trash, or other debris are accumulating on the bottom.</td><td>☐ Use a shovel to scoop out minor areas of sediment or grit, especially in the spring after winter sanding materials may wash in and accumulate. Dispose of the material where it cannot re-enter the Bioretention cell.
☐ If removing the material creates a hole or low area, fill with soil mix that matches original mix and cover with mulch so that the Bioretention surface area is as flat as possible.
☐ Remove trash, vegetative debris, and other undesirable materials.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: Sediment has accumulated more than 2-inches deep and covers 25% or more of the Bioretention surface.
☐ Kick-Out to Level 2 Inspection: The Bioretention cell is too densely vegetated to assess sediment accumulation or ponding; see BR-4, Vegetation.</td></tr>
</table>

<table>
<tr><td rowspan="2">
☐ There is erosion in the bottom or on the side slopes. Water seems to be carving out rills as it flows across the Bioretention surface or on the slopes, or sinkholes are forming in certain areas.
☐ Source: Stormwater Maintenance, LLC.</td>
<td>☐ Try filling the eroded areas with clean topsoil or sand, and cover with mulch.
☐ If the problem recurs, you may have to use stone (e.g., river cobble) to fill in problem areas.
☐ If the erosion is on a side slope, fill with clay that can be compacted and seed and mulch the area.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: The problem persists or the erosion is more than 3-inches deep and seems to be an issue with how water enters and moves through the Bioretention cell.
☐ Kick-Out to Level 2 Inspection: The problem does not seem to be caused by flowing water, but a collapse or sinking of the surface (e.g., “sinkhole”) due to some underground problem.</td></tr>
<tr><td rowspan="2">
☐ The bottom of the Bioretention cell is not flat, and the water pools at one end, along an edge, or in certain pockets. The whole bottom is not uniformly covered with water. See design plan to verify that Bioretention surface is intended to be flat. Check during or immediately after a rainstorm.</td>
<td>☐ If the problem is minor (just small, isolated areas are not covered with water), try raking the surface OR adding mulch to low spots to create a more level surface. You may need to remove and replace plantings in order to properly even off the surface.
☐ Check the surface with a string and bubble level to get the surface as flat as possible.
☐ Other:</td></tr>
<tr><td>☐ Kick-Out to Level 2 Inspection: Ponding water is isolated to less than half of the Bioretention surface area, and there seem to be elevation differences of more than a couple of inches across the surface.</td></tr>
<tr><td>
☐ Water stands on the surface more than 72 hours after a rainstorm and /or wetland-type vegetation is present. The Bioretention cell does not appear to be draining properly.</td>
<td>☐ Kick-Out to Level 2 Inspection: This is generally a serious problem, and it will be necessary to activate a Level 2 Inspection.</td></tr>
</table>

BR 4. Vegetation

Description: The health of vegetation within the Bioretention cell is perhaps the most critical maintenance item for the property owner or responsible party. Many Bioretention cells become overgrown, and “desirable” vegetation becomes choked out by weeds and invasive plants. It is important to know what the Bioretention cell is supposed to look like and what plants seem to be thriving or doing poorly. Periodic maintenance of vegetation will prevent larger problems that are more difficult and costly to manage.

Instruction: Examine all Bioretention cell vegetation. Consult the table below for possible problems.

Table 2.7.4 BR Vegetation

Problem (Check if Present)	Follow-Up Actions
 ☐ Vegetation requires regular maintenance—pulling weeds, removing dead and diseased plants, replacing mulch around plants, adding plants to fill in areas that are not well vegetated, etc.	☐ If you can identify which plants are weeds or not intended to be part of the planting plan, eliminate these, preferably by hand pulling. ☐ If weeds are widespread, check with the local stormwater authority and/or Extension Office about proper use of herbicides for areas connected with the flow of water. ☐ Even vegetation that is intended to be present can become large, overgrown, and/or crowd out surrounding plants. Prune and thin accordingly. ☐ If weeds or invasive plants have overtaken the whole Bioretention cell, bush-hog the entire area before seedheads form in the spring. It will be necessary to remove the root mat manually or with appropriate herbicides, as noted above. ☐ Re-plant with species that are aesthetically pleasing and seem to be doing well in the Bioretention cell. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: You are unsure of the original planting design, or the vegetation maintenance task is beyond your capabilities of time, expertise, or resources. If you are unsure of the health of the vegetation (e.g. salt damage, invasives, which plants are undesirable) or the appropriate season to conduct vegetation management, consult a landscape professional before undertaking any cutting, pruning, mowing, or brush hogging.
 ☐ Vegetation is too thin, is not healthy, and there are many spots that are not well vegetated.	☐ The original plants are likely not suited for the actual conditions within the Bioretention cell. If you are knowledgeable about plants, select and plant more appropriate vegetation (preferably native plants) so that almost the entire surface area will be covered by the end of the second growing season. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: For all but small practices (e.g., rain gardens), this task will likely require a landscape design professional or horticulturalist.

BR 5. Outlets

Description: Outlets are where water leaves the Bioretention cell when there is too much ponded water. There are various ways that outlets are configured. They can be a yard drain type of structure in the Bioretention cell itself or a rock weir where water flows during large storms. Many Bioretention practices have an underdrain, which is like a French drain, that helps the Bioretention cell drain properly after storms. The underdrain pipe may “daylight” (come to the ground surface) at some point downhill from the Bioretention cell.

Instruction: Examine outlets that release water out of the Bioretention cell. Consult the table below for possible problems.

Table 2.7.5 BR Outlets

Problem (Check if Present)	Follow-Up Actions
☐ Erosion at outlet	☐ Add stone to reduce the impact from the water flowing out of the outlet pipe or weir during storms. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Rills have formed and erosion problem becomes more severe.
 ☐ Outlet obstructed with mulch, sediment, debris, trash, etc.	☐ Remove the debris and dispose of it where it cannot re-enter the Bioretention cell. ☐ Other:
	☐ Kick-Out to Level 2 Inspection: Outlet is completely clogged or obstructed; there is too much material to remove by hand or with simple hand tools.

2.8. Green Roof

Areas of the Green Roof

Key areas to inspect for green roofs include the following:

GR 1. Vegetation and Surface
GR 2. Overflows and Drains

Note: Green Roofs consist of green infrastructure practices applied on rooftops, wherein stormwater is filtered through a vegetated planting bed. Green Roofs are a unique practice in that they are often covered by a professional ongoing maintenance contract, and their design is highly variable depending on the specific product. This section highlights some key inspection items.

Figure 2.8.1. Key Areas for Level 1 Inspection of Green Roof

2.10. Ponds and Wetlands

Areas of Ponds and Wetlands

Key areas to inspect for ponds and wetlands include the following:

- PO 1. Drainage area
- PO 2. Inlet pipes and swales
- PO 3. Pond area and embankments
- PO 4. Pond outlet

Note: This category includes the following practices:

- *Wet ponds* – have a permanent pool of water and may be divided into various "cells"
- *Stormwater wetlands* – have a variety of depth zones ranging from deep pools to shallow wetlands and are characterized by wetland vegetation

It is recommended strongly to have as-built drawings and copies of previous inspections at hand, if available. Aerial photos may be needed to help direct the inspector to the pond or wetland location if it is obscured by vegetation.

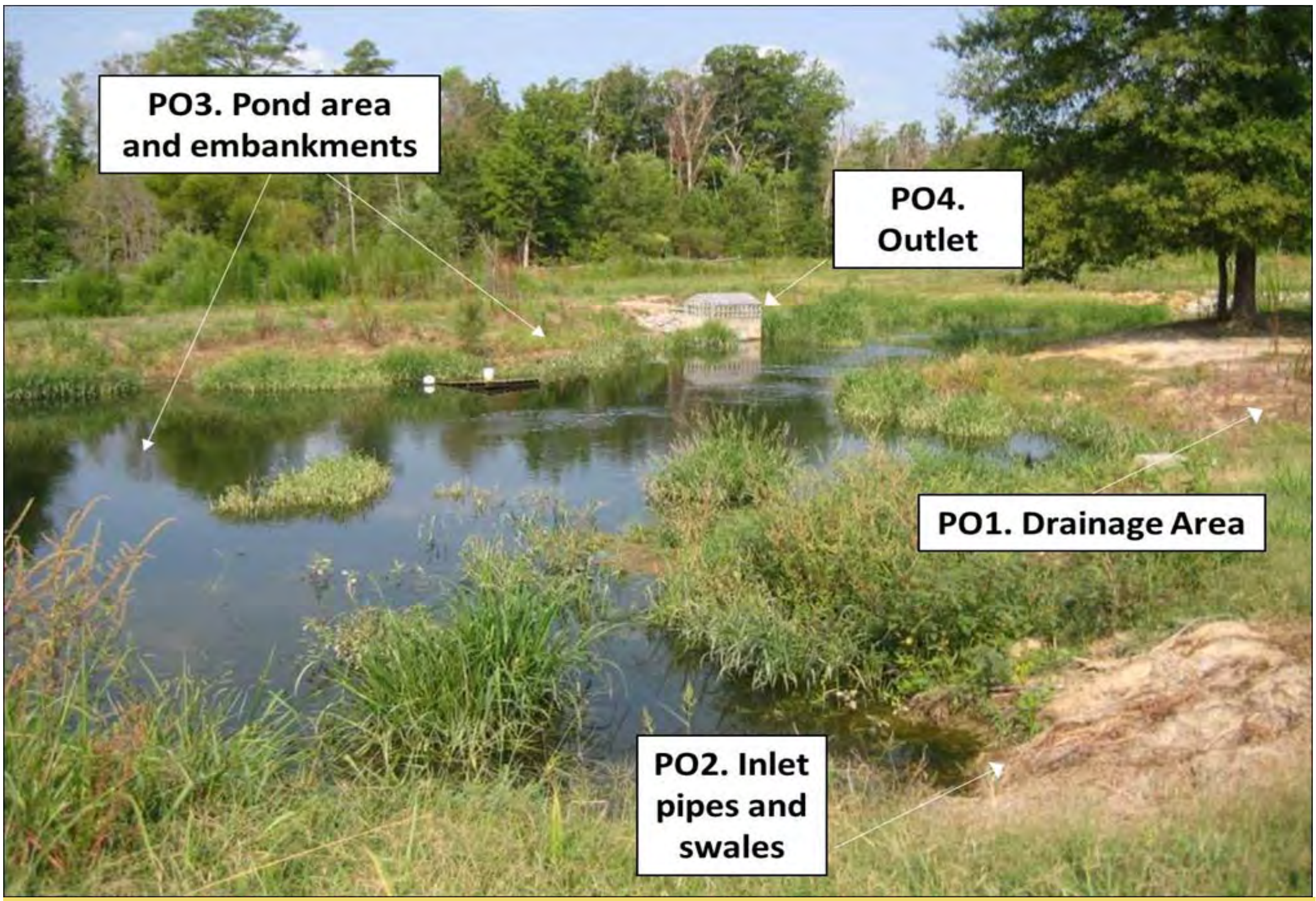


Figure 2.10.1. Key Areas for Level 1 Inspection of a Pond/Wetland

Pond and Wetland Level 1 Inspection

The Level 1 Inspection focuses on the drainage area (PW 1), inlet pipes or swales (PW 2), pond area and embankments (PW 3) and pond outlet structures and outfall (PW 4). This inspection should be conducted on a regular basis to ensure that a buildup of trash, vegetation, or sediment does not interfere with the pre-treatment, pond or wetland, and the outfall's normal flow or function. Pond embankments and dams should be regularly inspected for evidence of erosion, burrowing or tunneling animals, and large woody vegetation growing on the dam.

PW 1. Drainage Area

Description: The drainage area conveys runoff to and is uphill from the pond inlet. When it rains, water runs off through roof drains, yard drains, parking lots, roadways and underdrains to the ponds. Flow is through underground piping systems, overland via swales, or across the ground as sheetflow. Sometimes, the runoff will contain dirt, grit, grass clippings, leaves and woody debris that can collect in the drainage system. If left alone, blockages can occur and increase the chance of shallow flooding or standing water. Standing water in drainage systems foster mosquitos, pipe corrosion, and possible nuisance and odor conditions.

Instruction: Look for areas that are uphill from the pond. Consult **Table 2.10.1** below:

Table 2.10.1 PW Drainage Area

Problem (Check if Present)	Follow-Up Actions
☐ Bare soil, erosion of the ground (rills washing out the dirt)	☐ Seed and straw areas of bare soil to establish vegetation. ☐ Fill in eroded areas with soil, compact, seed and mulch with straw to establish vegetation. ☐ Other: ☐ Kick-Out to Level 2 Inspection: If a rill or small channel is forming, try to redirect water flowing to this area by creating a small berm or adding topsoil to areas that are heavily compacted. ☐ If large areas of soil have been eroded or larger channels are forming, this may require rerouting of flow paths or use of an erosion-control seed mat or blanket to reestablish acceptable ground cover or anchor sod where it is practical.
 ☐ Piles of grass clippings, mulch, dirt, salt, or other materials	☐ Remove or cover piles of grass clippings, mulch, dirt, etc. ☐ Remove excessive vegetation or woody debris that can block drainage systems. ☐ Other:
 ☐ Open containers of oil, grease, paint, or other substances exposed to rain in the drainage area	☐ Cover or properly dispose of materials; consult your local solid waste authority for guidance on materials that may be toxic or hazardous. ☐ Other:

PW 2. Pond Inlets

Description: Free, unobstructed flow from the drainage area to stormwater ponds is necessary to prevent shallow flooding and even structural damage from flooding. Pond inlets can consist of pipes, ditches, swales, or other means to convey stormwater to the pond or wetland.

Instruction: Look for all areas where water flows into the pond during storms. Note that there may be multiple points of inflow and types of structures (e.g., pipes, open ditches, etc.). Consult **Table 2.10.2** below:

Table 2.10.2 Pond Inlets

Problem (Check if Present)		Follow-Up Actions
 	☐ Inlets are buried, covered or filled with silt, debris, or trash, or blocked by excessive vegetation.	☐ If the problem can be remedied with hand tools and done in a safe manner, remove vegetation, trash, woody debris, etc. from blocking inlet structures. ☐ Other: ☐ Kick-Out to Level 2 or 3 Inspection: If the amount of material is too large to handle OR there are ANY safety concerns about working in standing water, soft sediment, etc., the work will likely have to be performed by a qualified contractor.
	☐ Inlets are broken, and, with pieces of pipe or concrete falling into the pond, there is erosion around the inlet, there is open space under the pipe, or there is erosion where the inlet meets the pond	☐ Kick-Out to Level 2 Inspection: These types of structural or erosion problems are more serious and will require a qualified contractor to repair.

PW 3. Pond Area and Embankments

Description: The pond area and embankment can consist of the following elements:

- Pre-treatment cell or small holding area where water first flows into the pond from the various inlets. These are commonly referred to as “forebays” and will be demarcated from the main pond area by small dams made of earth or rock. The purpose of forebays is to capture some of the sediment and pollutants before they reach the deep pool, making maintenance easier over time. Not all ponds will have forebays.
- The pond surface can be open water or a combination of open water and areas with wetland vegetation. Sometimes there is a shallow bench around the perimeter of a pond, known as an “aquatic bench.”
- The “side slopes” are areas around the perimeter of the pond where the surrounding land slopes down to the pond surface.
- Most ponds will have a “riser structure,” where the water exits a pond during storms. This can be a concrete or metal pipe that is open at the top, often with some type of trash rack. Some ponds also have an “emergency spillway,” which is an open, rock-lined channel that carries water from large storms safely across the embankment.
- The dam or embankment holds water in the pond and is constructed of compacted soil, such as clay. There is often a pipe through the embankment that carries water from the riser structure safely through the embankment to the downstream channel.

The pond’s pre-treatment areas or forebays should not be choked with vegetation or full of sediment. Removal of excessive vegetation and sediment and selective replanting are often annual maintenance activities.

Likewise, the pond’s deep pool should not to be choked with vegetation or filled with sediment. Vegetation and sediment bars can restrict flow and cause short circuiting that reduces capture of sediment. Pond volume is to be maintained at the original design capacity and free of sediment bars or debris piles. Sometimes ponds are over-maintained and have no vegetation. Algae and turbidity (muddy water) are common problems in many ponds.

Instruction: Examine both interior and exterior pond banks as well as the pond body. Observe from the inlet pipes to the outfall structure and emergency overflow.

Table 2.10.3 PW Pond Area and Embankments

Problem (Check if Present)		Follow-Up Actions
	☐ The pretreatment area(s) or forebay(s) are filled with sediment, trash, vegetation, or other debris.	☐ If the problem can be remedied with hand tools and done in a safe manner, use a flat shovel or other equipment to remove small amounts of sediment. ☐ Remove trash and excessive vegetation from forebays if this can be done in a safe manner. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Large amounts of sediment or debris will have to be removed by a qualified contractor. ANY condition that poses a safety concern for working in standing water or soft sediments should be referred to a Level 2 Inspection or qualified contractor.

Table 2.10.3 PW Pond Area and Embankments		
Problem (Check if Present)		**Follow-Up Actions**
	☐ The pond area itself has accumulated sediment, trash, debris, or excessive vegetation that is choking the flow of the water, OR the pond area is covered with algae or aquatic plants.	☐ Level 1 includes handling only small amounts of material that can be removed by hand, or with rakes or other hand tools. Do not attempt any repair that poses a safety issue. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Most cases will call for a Level 2 Inspection and/or a qualified contractor. ☐ You are not sure what type and amount of vegetation is supposed to be in the pond. ☐ The algae or aquatic plants should be identified so that proper control techniques can be applied.
	☐ The side slopes of the pond are unstable, eroding, and have areas of bare dirt.	☐ If there are only minor areas, try filling in small rills or gullies with topsoil, compacting, and seeding and mulching all bare dirt areas with an appropriate seed. Alternatively, try using herbaceous plugs to get vegetation established in tricky areas, such as steep slopes. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Erosion and many bare dirt areas on steep side slopes will require a Level 2 Inspection and repair by a qualified contractor.
 	☐ The riser structure is clogged with trash, debris, sediment, vegetation, etc., OR is open, unlocked, or has a steep drop and poses a safety concern. The pond level may have dropped below its “normal” level.	☐ If you can safely access the riser on foot or with a small boat, clear minor amounts of debris and remove it from the pond area for safe disposal. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: The riser cannot be accessed safely, the amount of debris is substantial, or the riser seems to be completely clogged and the water level has risen too high. ☐ There are safety issues with the riser and concern about access to pipes, drops, or any other life safety concern. ☐ The riser is leaning, broken, settling or slumping, corroded, eroded or any other structural problem.

Table 2.10.3 PW Pond Area and Embankments

Problem (Check if Present)		Follow-Up Actions
	☐ The dam/embankment is slumping, sinking, settling, eroding, or has medium or large trees growing on it.	☐ If there are small isolated areas, try to fix them by adding clean material (clay and topsoil) and seeding and mulching. ☐ Periodically mow embankments to enable inspection of the banks and to minimize establishment of woody vegetation. ☐ Remove any woody vegetation that has already established on embankments. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Most of these situations will require a Level 2 Inspection or evaluation and repair by a qualified contractor. Seepage through the dam or problems with the pipe through the dam can be a serious issue that should be addressed to avoid possible dam failure.
	☐ The emergency spillway or outfall (if it exists) has ☐ erosion, settlement, or loss of material. Rock-lined spillways have excessive debris or vegetation.	☐ Clear light debris and vegetation. ☐ Other:
		☐ Kick-Out to Level 2 Inspection: Displacement of rock lining, excessive vegetation and erosion/settlement may warrant review and decision by Level 2 Inspector to check against original plan. ☐ Any uncertainty about the integrity of the emergency spillway should be referred to a Level 2 Inspector. ☐ Erosion or settlement such that design has been compromised should be reviewed by an engineer.

PW 4. Pond Outlet

Description: The pond's outlet enables the ponded water to discharge to downstream drainage systems or stream channels. The outlet is often at the base of the dam/embankment on the downstream side. Inspection of this point can help prevent flooding of the pond and upstream drainage systems and prevent pond failure at a weak point of a pond's containment system.

Instruction: Examine the outlet of the pipe on the downstream side of the dam/embankment where it empties into a stream, channel, or drainage system. Consult the table below for possible problems.

Table 2.10.4 PW Pond Outlet

Problem (Check if Present)	Follow-Up Actions
 ☐ The pond outlet is clogged with sediment, trash, debris, vegetation, or is eroding, caving in, slumping, or falling apart.	☐ If there is a minor blockage, remove the debris or vegetation to allow free flow of water. ☐ Remove any accumulated trash at the outlet. ☐ Outlet: ☐ Kick-Out to Level 2 Inspection: ☐ If the area at the outlet cannot be easily accessed or if the blockage is substantial, a Level 2 Inspection is warranted. ☐ Erosion at and downstream of the outfall should be evaluated by a qualified professional. ☐ Any structural problems, such as broken pipes, structures falling into the stream, or holes or tunnels around the outfall pipe, should be evaluated by a Level 2 Inspector and will require repair by a qualified contractor. ☐ The pool of water at the outlet pipe is discolored, has an odor, or has excessive algae or vegetative growth.

2.11. Infiltration

Areas of Infiltration

Key areas to inspect for Infiltration include the following:

- IN 1. Drainage Area
- IN 2. Inlets
- IN 3. Infiltration Area
- IN 4. Outlets

Note: The category of Infiltration includes:

- Infiltration Trench – Long, narrow infiltration practice, usually with small gravel at the surface and a reservoir of larger gravel or stone beneath
- Infiltration Basin – Larger practice, usually covered with grass and highly permeable soil beneath

Figure 2.11.1 Key Areas for Level 1 Inspection of Infiltration Practice

- Dry Well – Small pit filled with stone or gravel, or precast concrete chamber surrounded by stone that receives and stores runoff to enable it to infiltrate into the underlying ground.

Section 3. Level 2 and 3 Inspections

3.1. How to Use this Section

This section provides guidance for Level 2 and 3 inspections for 10 groups of stormwater management practices (SMPs). See Section 1 of this chapter for an explanation of the Maintenance Hierarchy approach.

- Section 3.2 provides general guidance for Level 2 and 3 inspections.
- Sections 3.3 through 3.12 provide detailed Level 2 and 3 inspection guidance for each of the 10 practice categories:
    - 3.3 Rainwater Harvesting
    - 3.4 Disconnection and Sheetflow
    - 3.5 Swales
    - 3.6 Tree Planting
    - 3.7 Bioretention
    - 3.8 Green Roofs
    - 3.9 Permeable Pavement
    - 3.10 Ponds and Wetlands
    - 3.11 Infiltration
    - 3.12 Sand and Organic Filters
- Each section has **tables** containing guidance for Level 2 inspectors on specific SMP conditions and possible repairs for those problems (in left column), as well as lists of conditions that would likely trigger a Level 3 evaluation or maintenance action (right column). In addition, **Appendix B** contains detailed checklists for Level 2 inspectors to use in the field during their inspections.
- **Section 3.13** provides a brief overview for Level 3 inspections and how these fit into the overall hierarchy. However, most of the content for Level 3 maintenance actions is contained in **Section 4.**

3.2. General Guidance for Level 2 and 3 Inspections

The Level 2 inspection will typically be performed by a municipal employee or landscape contractor with some training in stormwater operations and maintenance. Regardless of which type of practice is being inspected, some key procedures and equipment are necessary. Read through this guidance before going on an inspection, and use the specific guidance in **Sections 3.3 through 3.12** for the practice you are inspecting. While much of the equipment and general procedures are somewhat similar to Level 1 inspections, additional information is provided for Level 2 inspectors below.

When to Conduct a Level 2 Inspection

The Level 2 Inspection is needed for two reasons. First, routine inspections to comply with local stormwater regulations typically require a Level 2 inspector. In addition, a Level 2 inspection may be triggered to address or diagnose problems identified during a Level 1 inspection. In this situation, the Level 2 inspector should confer with the Level 1 inspector about problems they have identified and then conduct a follow-up inspection that focuses more on diagnosing the causes of the problems and possible solutions. The checklists in **Appendix B** and other resources cited in **Sections 3.3 through 3.12** can be used as tools.

The frequency of this type of inspection may be defined by the municipality. As with Level 1 inspections, the frequency may change with the age of the SMP, with higher frequencies the first couple of years after installation. Well-established and well-maintained practices may only need to be inspected every few years.

Notifying the Responsible Party

Consult the plan file and maintenance agreement to ascertain the responsible party. Confirm that there is right of access through the local code, signed maintenance agreement, or other means. Contact the responsible party at least three business days in advance of the proposed inspection. If the responsible party cannot be found or contacted, make a reasonable effort through file research to contact a property representative, and document these efforts in writing. If the inspection is in response to a Level 1 inspection and referral to your agency, try to speak with the person who conducted the Level 1 inspection and get any documentation they may have. For publicly owned and managed SMPs, the responsible party will likely be the municipality or other regulated MS4.

What to Take in the Field

Level 2 inspections may require more measurement and, as a result, need some additional materials. In addition, the Level 2 inspection may involve gaining access to private property. Consequently, additional identification is needed for these inspections. A list of recommended items to take in the field is provided in **Table 2.2.1**.

Table 3.2.1 What to Take in the Field for a Level 2 Inspection
• Safety equipment: safety vest, steel-toe shoes, traffic cones if working near traffic, etc. • Approved plan and as-built (record drawing) if available • Records of previous inspections if available • Engineering scale • Hand level and pocket rod if needed to measure relative elevations • Digital camera • Several copies of SMP checklist if paper forms are used (**Appendix B**) • Clipboard and pencils if paper forms are used • Dry erase white board and marker (optional) to include in photos to keep track of SMP tracking # in municipal database (see **Figure 3.2** as example) • Letter on municipal letterhead granting access and/or agency photo badge • Pipe wrench to open underdrain clean-out caps • Flashlight to look into underdrain cleanouts and/or manholes • Manhole puller • Soil probe or auger • 100' measuring tape • Shovel • Bug spray

Conducting the Inspection

In general, the inspection should follow a consistent, logical approach, such as outlined below.

- Conduct a quick tour of the practice to identify any obvious issues and important components: inlets (number, location), surface area, overflow structures, berms or impoundments, outfalls, downstream conveyance channels or receiving waters. Check these components against the design plan or as-built drawing (if available).
- Starting at the outlet or low point, use the checklists provided in Appendix B to evaluate the practice. The inspection will proceed from the outlet or outfall to the stormwater treatment area, berms, side slopes, inlets, and drainage area. Make sure to fill in key information on the inspection form, such as SMP identifier number, site name, inspector name, date, and weather conditions.

Figure 3.2. A white board and digital camera can be handy to note SMP tracking #, date of inspection, and other forms of documentation. Note that an inspector may alternatively tag photographs, particularly if they are recorded on a smartphone or Tablet.

- Take photos of important components or maintenance concerns, and mark photo locations and direction on a sketch.
- Review the inspection form before leaving the site to make sure that all necessary information has been collected.

Follow-Up Actions

Immediate follow-up actions include entering the inspection information in the appropriate database or hard copy file, downloading and labeling photos, and providing other necessary documentation.

Another possible follow-up action would be to activate a Level 3 inspection in certain situations. The Level 2 inspector will have to make a judgement call as to whether observed problems warrant a Level 3 investigation, and will also have to coordinate with the responsible party to pursue such an investigation. The Level 2 guidance in this chapter summarizes follow-up actions associated with various observations of SMP condition. Note that these tables are divided into “Level 2” and “Triggers for Level 3” follow-up actions, with Level 2 actions in *blue* cells and Level 3 in *green* cells. Consult **Section 4** of this chapter for more guidance on how to diagnose and correct some of the maintenance items included in these tables.

Another follow-up action involves communicating problems and corrective measures to the responsible party (private or public). This may involve instructing the responsible party to undertake a Level 3 inspection or to provide a timeframe for correcting simpler issues that do not require Level 3 involvement. Many local programs have existing procedures for sending letters or activating a compliance procedure. These procedures include verifying that repairs and corrections are completed by the responsible party.

Level 3 Inspection Guidance

The Level 3 inspection is typically conducted by a Qualified Professional such as a professional engineer or Landscape Architect. It is assumed that the Level 3 inspector is knowledgeable in stormwater management, as well as engineering and construction practices. The Level 3 inspector will not typically be completing a full practice inspection. This inspection is conducted only in response to problems identified during the Level 2 inspection, is more diagnostic in nature, assumes a greater degree of initial knowledge, and may require more extensive intervention.

The Level 3 inspection is also more results based in that it will lead to a specific repair to address the issue that triggered the inspection. **Section 4** identifies 12 problems typically addressed in a Level 3 inspection and discusses measures to diagnose the cause of the problem, as well as repairs needed to address it. It should be noted that the problems addressed in each **Section 4** subsection can occur in a variety of SMPs (e.g., erosion is a common issue in almost every type of SMP). As a result, each subsection identifies the SMPs where the problem most commonly occurs and, in some cases, an SMP-specific diagnosis procedure.

3.6. Tree Planting – Level 2 Inspections and Triggers for Level 3

A Level 2 Tree Planting inspection should be conducted periodically during the growing season by the Cooperative Extension or an arborist.

Table 3.6.1 Level 2 Inspection: TREE PLANTING	
Recommended Repairs	**Triggers for Level 3 Inspection**
Observed Condition: Appearance of fungus or pest damage	
Condition 1: Fungus, discoloration, browning leaves or holes in leaves Check with arborist or other tree professional about the best way to proceed. This requires a Level 3 inspection. Condition 2: Burrowing insects, holes Check with arborist or other tree professional about the best way to proceed. This requires a Level 3 inspection.	• Any concerns about how to address infestation or disease

3.7. Bioretention – Level 2 Inspections and Triggers for Level 3

The most likely triggers for a Level 3 Inspection for Bioretention are:

- Standing water, clogged media
- Vegetation management
- Bioretention does not conform to original design plan in surface area or storage.
- Severe erosion of filter bed, inlets, or around outlets
- Significant sediment accumulation, indicating an uncontrolled source of sediment

Table 3.7.1 Level 2 Inspection: BIORETENTION NOTE: Key Source for this Information *(CSN, 2013)*	
Recommended Repairs	**Triggers for Level 3 Inspection**
Observed Condition: Water Stands on Surface for More than 72 Hours after Storm	
Condition 1: Small pockets of standing water Use a soil probe or auger to examine the soil profile. If isolated areas have accumulated grit, fines, or vegetative debris or have bad soil media, try scraping off top 3 inches of media and replacing with clean material. Also check to see that surface is level and water is not ponding selectively in certain areas. Condition 2: Standing water is widespread or covers entire surface Requires diagnosis and resolution of problem: • Clogged underdrain? • Filter fabric between soil media and underdrain stone? • Need to install underdrain if not present? • Too much sediment/grit washing in from drainage area? • Too much ponding depth? • Improper soil media?	• Soil media is clogged and problem is not evident from Level 2 inspection. • Level 2 inspection identifies problem, but it cannot be resolved easily or is associated with the original design of the practice.

Observed Condition: Vegetation is sparse or out of control	
Condition 1: Original design planting plan seems good but has not been maintained, so there are many invasives and/or dead plants Will require some horticultural experience to restore vegetation to intended condition by weeding, pruning, removing plants, and adding new plants. Condition 2: Original design planting plan is unknown or cannot be actualized A landscape architect or horticulturalist will be needed to redo the planting plan. Will likely require analysis of soil pH, moisture, organic content, sun/shade, and other conditions to make sure plants match conditions. Plan should include invasive plant management and maintenance plan to include mulching, watering, disease intervention, periodic thinning/pruning, etc.	• Vegetation deviates significantly from original planting plan; Bioretention has been neglected and suffered from deferred maintenance. • Owner/responsible party does not know how to maintain the practice.
Observed Condition: Bioretention does not conform to original design plan in surface area or storage	
Condition 1: Level 2 Inspection reveals that practice is too small based on design dimension, does not have adequate storage (e.g., ponding depth) based on the plan, and/or does not treat the drainage area runoff as indicated on the plan Small areas of deviation can be corrected by the property owner or responsible party, but it is likely that a Qualified Professional will have to revisit the design and attempt a redesign that meets original objectives or that can be resubmitted to the municipality for approval.	• More than a 25% departure from the approved plan in surface area, storage, or drainage area; sometimes less than this threshold at the discretion of the Level 2 inspector.
Observed Condition: Severe erosion of filter bed, inlets, or around outlets	
Condition 1: Erosion at inlets The lining (e.g., grass, matting, stone, rock) may not be adequate for the actual flow velocities coming through the inlets. First line of defense is to try a more non-erosive lining and/or to extend the lining further down to where inlet slopes meet the Bioretention surface. If problem persists, analysis by a Qualified Professional is warranted. Condition 2: Erosion of Bioretention filter bed This is often caused by "preferential flow paths" through and along the Bioretention surface. The source of flow should be analyzed and methods employed to dissipate energy and disperse the flow (e.g., check dams, rock splash pads). Condition 3: Erosion on side slopes Again, the issue is likely linked with unanticipated flow paths down the side slopes (probably overland flow that concentrates as it hits the edge of the slope). For small or isolated areas, try filling, compacting, and re-establishing healthy ground cover vegetation. If the problem is more widespread, further analysis is required to determine how to redirect the flow.	• Erosion (rills, gullies) is more than 12 inches deep at inlets or the filter bed or more than 3 inches deep on side slopes. • If the issue is not caused by moving water but some sort of subsurface defect. This may manifest as a sinkhole or linear depression and be associated with problems with the underdrain stone or pipe or underlying soil.
Observed Condition: Significant sediment accumulation, indicating an uncontrolled source of sediment	
Condition 1: Isolated areas of sediment accumulation, generally less than 3-inches deep Sediment source may be from a one-time or isolated event. Remove accumulated sediment and top 2 to 3 inches of Bioretention soil media; replace with clean material. Check drainage area for any ongoing sources of sediment. Condition 2: Majority of the surface is caked with "hard pan" (thin layer of clogging material) or accumulated sediment that is 3-inches deep or more This can be caused by an improper construction sequence (drainage area not fully stabilized prior to installation of Bioretention soil media) or another chronic source of sediment in the drainage area. Augering several holes down through the media can indicate how severe the problem is; often the damage is confined to the first several inches of soil media. Removing and replacing this top layer (or to the depth where sediment incursion is seen in auger holes) can be adequate, as long as the problem does not recur.	• More than 2 inches of accumulated sediment cover 25% or more of the Bioretention surface area. • "Hard pan" of thin, crusty layer covers majority of Bioretention surface area and seems to be impeding flow of water down through the soil media. • New sources of sediment seem to be accumulating with each significant rainfall event.

3.10. Ponds & Wetlands – Level 2 Inspections and Triggers for Level 3

The most likely triggers for a Level 3 Inspection for Ponds and Wetlands are:

- Severe erosion
- Excessive algae or aquatic plants
- Settlement and pipe corrosion
- Major sediment buildup

Table 3.10.1 Level Inspection: PONDS and WETLANDS	
Recommended Repairs and Required Skills	**Triggers for Level 3 Inspection**
Observed Condition: Bare Soil or Erosion in the Drainage Area	
Condition 1: Extensive problem spots, but no channels or rills forming Reseed problem areas. If problem persists or grass does not take, consider hiring a landscape contractor. Condition 2: Problem is extensive, and rills/channels are beginning to form May be necessary to divert or redirect water that is causing the erosion problem. If it appears that simple regrading—such as installing a berm or leveling a low spot–will fix the problem, make repairs and ensure that the problem is repaired after the next storm.	• Large rills or gullies are forming in the drainage area. • An attempt to regrade the drainage area has been unsuccessful. • Fixing the problem would require major regrading (i.e., redirecting more than a 100-square-foot area. • It is not clear why the problem is occurring.
Observed Condition: Manholes or Inlet Pipe Buried or Covered with Vegetation	
Condition 1: Nearest manhole and inlet pipe not found Consult as-built drawings to get to closest suspected location and use metal detector to search for metal manhole cover. If unsuccessful, identify nearest drain inlets and approximate pipe direction to locate next manhole. Condition 2: Manhole located and inspected Never enter a manhole, except by following confined-space entry protocols. If outlet pipe is not visible or greater than 25% full of sediment/debris or trash, it will typically require a qualified contractor to flush, clean and clear blockages. Condition 3: Inlet pipe not found at pond Clear vegetation and brush that may be covering the inlet pipe. Buried inlet pipes may be found through use of a metal probe. Condition 4: Inlet pipe buried in sediment or blocked by vegetation Once located, the pipe path can be cleared of vegetation with brush hook or other brush tools. Light digging may clear sediment from the end of the pipe.	• To locate buried manholes and lost storm lines, it is sometimes necessary to hire a pipeline inspection contractor with televising equipment or ground-penetrating radar and enter at the closest upstream access point. • Locating a buried inlet pipe may require wading in the edge of the pond and using a metal probe and brush axe to find and expose the pipe. • If other than light digging is necessary to remove accumulated sediment, a contractor with heavy equipment may be required.

Table 3.10.1 Level Inspection: PONDS and WETLANDS	
Recommended Repairs and Required Skills	**Triggers for Level 3 Inspection**
Observed Condition: Pipe or Headwall Settlement, Erosion, Corrosion or Failure	
Condition 1: Pipe or headwall settlement or failure Severe sinkholes, settlement or corrosion should be kicked out to Level 3 Inspection. Condition 2: Flow not confined to pipe and visible outside pipe wall With flashlight, observe the inside of the pipe and note its condition. Take photographs. Look for sinkholes developing that indicate pipe failure beneath the surface. Kick out to Level 3 inspection.	• Where blockages are visible, a decision is needed on whether to clear them or leave in place. If a third of the pipe is full of sediment, it should be removed by a contractor with pipe-cleaning equipment. • Corrosion of inlet pipes that allows flow around the pipe exterior is a structural concern because it can lead to settlement, sinkholes and undermining pond embankment. Evidence of this type of failure may require specialized pipe-inspection equipment and investigation by an engineer.
Observed Condition: Pond Conditions	
Condition 1: Pond pre-treatment zone is full of sediment or not constructed as shown on as-built drawings. Condition 2: Excessive buildup of sediment or overgrowth If the pre-treatment area or pond pool is overgrown or filled with sediment so that the original design is compromised, corrective measures are required. If plants have died, then replanting is necessary. If none of the original design exists due to alteration or sediment, kick out to Level 3 inspection.	• It may require inspection by an engineer to determine next steps for clearing, replanting or reconstruction. • Erosion or settlement such that design has been compromised should be reviewed by an engineer. Recurring erosion may require redesign and/or regrading to direct flow away from eroding area. • If sediment has filled more than 50% of the pond's capacity, dredging is likely needed and should be evaluated by a qualified contractor. • Removal or control of excessive algae or aquatic plants can be assessed by a qualified pond maintenance company.

Section 4. Diagnostics and Maintenance Measures

4.1. About this Section

Section 4 summarizes the most common problems found in SMPs, as well as typical maintenance or repair solutions. The guidance provided in this section has some similarities to **Section 3** but differs in the following ways:

1. The primary audience for Section 4 is the Level 3 inspector, often a professional engineer, or landscape architect tasked with diagnosing and repairing SMPs that are not working properly. However, the information in Section 4 may also be quite useful for a Level 2 inspector seeking to diagnose a particular problem.
2. The maintenance measures described in this section are more detailed and focus on repairs to specific problems rather than on routine maintenance such as weeding or minor sediment removal.
3. Because the problems described in this section can be applied to several different practices, this section is organized by the type of problem rather than the practice type.

Problems addressed during Level 3 inspection/maintenance are summarized in **Table 4.1**. This list is not exhaustive but does address the most common issues in the SMPs that require some advanced knowledge and skill to inspect and fix. Each problem category is discussed in a separate sub-section.

Table 4.1: Common Inspection/Maintenance Issues for Level 3

Sub-Section/Category	Description
4.2 Contributing Drainage Area – Pollutant Sources	Sediment or pollution sources in the Drainage Area
4.3 Physical Obstructions	Physical obstructions to maintenance access, overflow, or emergency spillway
4.4 Erosion	Erosion on side slopes, practice bottom, at inlet or outlets. Rills and gullies forming where there should be sheetflow
4.5 Departures from Design Dimensions	Practice dimensions have been altered, either due to filling with sediment, redesign or filling in, or improper implementation.
4.6 Improper Flow Pathways	Flow is shortcircuiting the practice, or drainage pathways have been otherwise modified.
4.7 Sediment Buildup	Sediment has accumulated in a pool, practice bottom, pre-treatment area, or vault.
4.8 Clogging	The soil media or other components are clogged, and there may be standing water for longer than intended.
4.9 Vegetation	Excessive, inadequate, and/or unhealthy vegetation to support a practice
4.10 Embankment and Overflow Condition	Issues with an embankment or overflow weir or channel
4.11 Structural Damage	SMP infrastructure, such as concrete or metal elements, have been damaged.
4.12 Pool Stability	Permanent pool of water is at the improper elevation.
4.13 Pool Quality	Permanent pool of water suffers from poor quality due to algal growth or other issues.

4.2. Contributing Drainage Area – Pollutant Sources

Issue applies most commonly to: Sheetflow/Disconnection, Swales, Bioretention, Permeable Pavement, Ponds/Wetlands, Infiltration, and Sand/Organic Filters.

Problem #1: Bare soil washing into SMP from drainage area

General Approach for All Practices:

- Identify the specific source(s) of sediment in the drainage area by tracking sediment flow during a rainfall or looking for a track of sediment staining during dry weather.
- For an active sedimentation event, attempt to filter incoming runoff if conditions allow (e.g., enough space upstream of the practice for temporary ponding). Consider installing a silt fence, silt socks (at curb inlets), staked straw bales, or other filtering material at the inlets of the SMP. This will keep at least some of the sediment from getting into the practice.
- Runoff from active construction should not enter the SMP; divert to a temporary and approved sediment control practice.
- For areas of bare soil *not* due to active construction **(bottom photo)**, prep the soil and re-seed/plant with grass species or other thick ground cover appropriate for the region. May also need starter fertilizer, topsoil, and/or compost.
- For steep slopes with bare soil, consider also installing erosion-control matting to hold soil, seed, and straw in place until the vegetation becomes well established.
- For fill and topsoil stockpiles in the drainage area, provide temporary or permanent cover as soon as possible. Alternatively, surround the base of the stockpile with silt fence, or equivalent, to prevent the transport of sediment-laden runoff.

Helpful Skills:

- Erosion and sediment control knowledge and skills
- Landscaping knowledge to understand appropriate ground cover species for re-vegetating bare areas

Equipment Typically Used for Fixing Sediment Sources:

- Silt fencing and other sediment barriers
- Erosion-control matting and/or straw
- Rakes and shovels
- Light excavation or grading equipment for larger jobs
- Equipment to deliver topsoil or compost as needed
- Plants and/or seed mix, plus a way to move and store plant stock without damaging it or drying it out
- Starter fertilizer, topsoil, and/or compost

Problem #2: Other pollution sources in the drainage area

General Approach for All Practices:

- Pollutants may include: road salt, oils, fuels, food grease, wash water, paints and solvents, trash, and many others.
- Identify the source(s) of pollution.
- For pollutants spilled on the ground, remove by hand or use absorbents to soak up wet material. Absorbents and other waste materials shall be disposed of properly.
- For materials stored outside, move them to a covered area or build/add cover over the materials. Provide secondary containment, if possible.
- Make sure all waste containers have lids and fix any leaks (**see poor practices in photo at right**).
- For sites prone to frequent oil leaks and staining (e.g., vehicle maintenance yards), consider installing an oil/water separator to pre-treat runoff that enters the SMP.
- For routine dumping of wash water, grease, paints, or other pollutants, enforce behavior change and explain good housekeeping practices.
- Develop a pollution prevention plan for the site to ensure that hazardous materials and other potential pollutants are not stored where they are exposed to rainfall.
- For areas that receive a heavy salt and/or sand load during the winter, consider diverting upslope runoff, especially for practices such as permeable pavement. Some monitoring of winter road or parking lot clearing activities may also be warranted.

Helpful Skills:

- Knowledge of good housekeeping and pollution prevention practices
- Good communication with employees and managers at site (e.g., for correcting bad site operations)

Equipment Typically Used for Correcting Other Pollutant Sources:

- Tarps to cover stockpiles
- Absorbents to soak up spills
- Secondary containment barriers that will hold back any liquids or solids that may leak out of their primary container
- Storage barns, sheds, pole barns and other permanent cover for potential pollutants

4.3. Physical Obstructions

Issue Applies Most Commonly To: Rainwater Harvesting, Sheetflow/Disconnection, Swales, Bioretention, Green Roofs, Ponds/Wetlands, Infiltration, and Sand/Organic Filters

Problem #1: Maintenance access is obstructed

Ground-Level SMPs:

- Where a path for vehicles and construction equipment to access the practice was established during construction but is now overgrown, remove woody vegetation and any other tall vegetation. This path should be bush hogged once or twice a year.
- If the SMP needs a large quantity of trash and/or sediment removed in areas where access is limited due to steep grades, overgrown vegetation, etc., it will be necessary to establish safe vehicular access by clearing and possibly re-grading the area. It is advisable to have a maintained, all-weather surface to critical parts of the SMP.
- It is most important to provide access nearest to parts of the practice where sediment and trash tend to accumulate the most: forebay and riser structure.
- For an SMP blocked by fences **(photo at right)**, install a gate that is wide enough for vehicles to enter for any current or future maintenance.
- Sometimes access is blocked by unauthorized structures, such as sheds, property fences, retaining walls, etc. Confer with the local stormwater authority on the presence of any maintenance easements and means to gain access to the practice.
- The solutions above should also provide for safe foot access for routine inspection and maintenance.

Rainwater Harvesting:

- Ensure that no structures are covering the filter or the tank's access/inspection port.

Green Roofs

- Ensure that individuals can safely reach the roof with tools in hand (e.g., buckets, pruners, hoses). If the roof cannot be accessed via a walk-through door, this may require installing a wide ladder or fire escape-style stairs on the inside or outside of the building.
- If there is a concern of getting too close to the roof's edge while doing maintenance, install a railing around the edge for safety. Alternatively, for sloped roofs, workers may need to use harnesses during maintenance activities.

Helpful Skills:

- Use of motorized landscaping equipment
- Chainsaw skills
- Use of grading equipment for larger jobs
- *Note*: OSHA safety requirements and certifications may apply to green roof maintenance.

Equipment Typically Used to Regain Proper Access:

- Mower, trimmer
- For very overgrown areas, chainsaw and/or bush hog
- For areas that need to be regraded, excavator, skid steer, or other grading equipment

Problem #2: Flow is obstructed in or out of the practice

General Approach for All Practices:

- Flow can bypass an SMP when there is too much sediment/debris buildup near the inlets or due to grading changes in the drainage area (e.g., repaving of parking lot). If the cause of blockage or bypass is not obvious, inspect the practice during rainfall to watch the flow paths. (See **Section 4.6 – Improper Flow Pathways** for additional guidance.)

- Obstruction of overflow or emergency spillway structures is most often due to buildup of debris, such as trees, sticks, trash. It is *very* important to keep these structures clear of such blockages in order to avoid flooding or a dam breach (**avoid conditions caused by beaver activity - top photo**).

- Where debris cannot easily be cleared by hand, special equipment and skills may be needed. An obstructed riser structure in a wet pond may need to be accessed by boat **(bottom photo)**. In cases where large sticks, tree branches, trash, or other debris obstruct the overflow or spillway, they may need to be cut up by chainsaw. Large debris will usually need to be hauled away with a truck.

Helpful Skills:

- Chainsaw skills
- Muscle strength to haul large debris
- Boating capabilities

Equipment Typically Used to Clear Obstructions:

- Gloves, shovels, pruners, rakes, and other hand tools
- Waders for wetlands
- Chainsaw for large sticks and branches
- Cable puller (come-along) to remove large branches that cannot be pulled out by hand
- Boat and personal floatation device for riser structures in wet ponds
- Truck to haul away debris

4.4. Erosion

Issue Applies Most Commonly To: Sheetflow/Disconnection, Swales, Bioretention, and Ponds/Wetlands

Problem: Erosion on practice surface, inlets, and/or outlets

General Approach for All Practices:

- See **Section 4.10 – Embankment and Overflow Condition** for how to repair erosion on side-slope embankments.
- Rill and gully erosion occurs when runoff flow is concentrated. Deep rills and gully erosion on the practice surface **(top photo)** will require the surface to be regraded to make uniform again. Use the lightest equipment possible in order to minimize soil compaction during excavation.
- After excavation, reseed/plant the area with ground cover that is appropriate for the moisture conditions of the practice. Amend or enhance soil as needed according to a soil test; soil may need more organic material to support plants.
- To prevent further erosion on the surface of the practice, ensure that flow from the inlets can spread out adequately and has enhanced energy dissipation features. This may require installing or enhancing a stone apron outlet protection that flares out and down to the level of the practice to slow and spread out the flow. Other options include check dams, energy dissipation devices, or an armored low-flow channel. A stilling basin **(bottom photo)** can also dissipate flow as it comes out of an inlet or outlet pipe. Apply similar treatments to any outlets that are experiencing erosion.
- Any sloped soils that are disturbed during excavation will likely need erosion-control matting to hold it in place while vegetation becomes established.

Helpful Skills:

- Landscaping/Gardening
- Consult with Cooperative Extension Office or independent laboratory for soil testing
- Skills with excavation equipment
- Knowledge of sediment and erosion control practices and resources appropriate for the area

Equipment Typically Used for Fixing Erosion:

- Rakes, shovels, wheelbarrows, and other “landscaping” equipment
- Light excavation or grading equipment for larger jobs
- Equipment to deliver, unload, and move stone and other materials around
- Plants and/or seed mix, plus a way to move and store plant stock without damaging it or drying it out

4.5. Departure from Design Dimensions

Issue Applies Most Commonly To: Swales, Bioretention, Ponds/Wetlands, Infiltration, and Sand/Organic Filters

Problem: Practice dimensions have been altered

General Approach for All Practices:

- Once constructed, the dimensions of an SMP may become altered from the original design for a variety of reasons. These reasons can include:
- The SMP was not constructed to the proper dimensions at initial installation.
- Sediment accumulation in the SMP reduces the intended storage volume of the practice **(top photo).**
- Redevelopment or regrading of the site encroaches into the footprint of the SMP.
- Dumping of leaves, trash, or other debris into the SMP reduces the intended storage volume of the practice.
- If it appears that the dimensions of an SMP have been altered, proceed as follows:
- Consult the original design or as-built plans and sizing computations for the SMP to identify the intended dimensions and storage volume of the practice. Measure the length, width, and depth of the practice to estimate the current storage volume. Calculate the difference in volume to determine whether it is significant enough to warrant restoring the practice to its original dimensions. If the loss in volume is greater than about 10%, this likely warrants action.
- If the SMP's original storage volume cannot practically be restored because of current site conditions, an additional SMP may need to be built elsewhere on the site in order to regain adequate storage and treatment volume for the site.
- For problems of dumping by individuals on or near the site, install "No Dumping" or similar signage to inform people that this is not an appropriate place to dispose of debris. Any debris that has already been dumped should be removed from the practice either by hand or with equipment.

Helpful Skills:

- Basic surveying
- Understanding stormwater design plans and sizing computations
- Stormwater management design
- Skills with excavation equipment and erosion and sediment control

Equipment Typically Used to Investigate and Fix Dimensions:

- Simple level or survey equipment, tape measure, and other tools to measure SMP dimensions
- Light excavation or grading equipment for larger jobs
- Rakes, shovels, wheelbarrows, and other "landscaping" equipment for small jobs
- Soil stabilization materials

4.6. Improper Flow Paths

Issue Applies Most Commonly To: Rainwater Harvesting, Sheetflow/Disconnection, Swales, Bioretention, Infiltration, and Sand/Organic Filters

Problem #1: Flow intended to go into a practice is diverted by debris or grit buildup or capacity issues at inlets

Bioretention, Swales, Infiltration, Sand/Organic Filters:

- Grit, sediment, leaves, and other debris builds up at curb inlets or other inlets, sometimes to the point where flow is diverted completely around the practice (photos above). This is a common issue for practices that rely on curb cuts or other small inlet structures to get water into the practice for treatment. A minor amount of debris may be OK and not affect the ability of water to enter the practice. However, be aware of conditions where flow *that is supposed to be treated* is diverted to a downgradient storm drain or other structures in such a way that the stormwater treatment is entirely or partially bypassed.

- In many cases, correcting the problem may simply involve removing debris or unclogging the inlet.
- However, this problem can be chronic if the inlet design is susceptible to clogging. This can occur if the slope from the inlet into the practice is flat and/or there are controllable sources of sediment and debris in the drainage area.
- For chronic problems, consider redesigning inlets to be more clog proof. One solution is to build in a 2 to 3-inch drop from the curb inlet onto a gravel or stone diaphragm along the edge of the practice (see example in photo are right).
- Inlets that are undersized for the flow coming to them should be enlarged and armored with an appropriate erosion-resistant lining.

Rainwater Harvesting:

- Water intended to be collected in rainwater harvesting systems is sometimes not delivered to the tank or cistern if the system of gutters, downspouts, pipes, etc. is not sized properly or if the first-flush diverter or vortex filter is not functioning correctly and diverting too much water away from the tank.
- As with inlets, this may simply be a matter of routine cleaning of gutters, downspouts, vortex filters, etc.
- It may also be a design or capacity issue, in which case, installing larger gutters or a more robust piping system may be in order.

Source: Rainwater Management Solutions 1
Example of enhancing the gutter and piping system leading to a rainwater harvesting system

Helpful Skills:

- Basic surveying
- Typical landscaping skills using materials such as soil, rock/stone, edging material, mulch, etc.
- Light construction of gutters, downspouts, piping
- Some knowledge of first-flush diverter and vortex filter products

Problem #2: Flow is not uniformly accessing the entire treatment area

Bioretention, Swales, Infiltration, Disconnection and Sheetflow, Sand/Organic Filters:

Improper flow path issues in this category include:

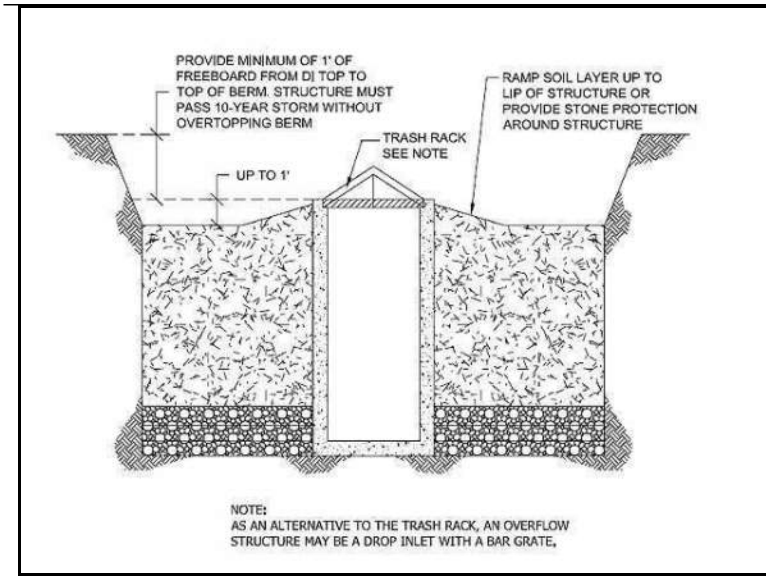
- Water forming channels or rills through the treatment bed of bioretention, swales, infiltration, or surface sand filters, and thus not spreading out across the treatment area surface
- Water ponding only at one end of the treatment area because the surface is not level
- Water piping through weak spots to an outlet or underdrain, such as where soil media meets a concrete structure
- See Section 4.4, Erosion for issues of channeling or erosion on the treatment surface.
- For uneven treatment area and preferential ponding, assess the severity of the problem. Compare the relative elevations of the "high" part of the treatment area (the area where water does NOT seem to pond) and any overflow structure or weir where high water flows will leave the practice. If there is still some freeboard (such that the overflow structure is higher than ALL of the treatment bed surface), then there will still be some ponding for larger rainfall events. Try some minor raking or moving soil media and mulch around to even out the filter bed.
- However, the problem is more serious if parts of the treatment area are higher than the overflow structure. These areas will never be valuable for treatment purposes. The treatment area is supposed to fill up like a bathtub, so some regrading is needed to level out the treatment area.
- If water is piping or shortcircuiting through the soil or sand media, forming sinkholes or otherwise bypassing the intended treatment mechanism, it will be necessary to repair these spots. Around concrete or metal overflow structures, use soil material right around the structure that can be compacted (bioretention soil media tends to be light, sandy, and fluffy and won't compact very well). Another option is to "ramp up" the soil layer to the lip of the structure so that there won't be a hydraulic jump at this potentially weak point. See the figure below.

These three issues are illustrated below:

Water from the inlet at top of photo is channeling through the bioretention area.

Water is preferentially ponding only at one end of the bioretention because the surface is not flat.

Water is "piping" down to the underdrain at the weak spot where the soil media meets the concrete overflow structure.

	Ramp up soil layer to the lip of the structure to address this being a weak interface where water can work down and create bypassing. (Source: Virginia 2013 Stormwater BMP Specifications, Specification #9, Bioretention, Figure 9.13.)

Impervious Disconnection:

The most likely flow path issues with Impervious Disconnection are: (1) owners intentionally diverting downspouts away from pervious area and onto impervious area **(left photo below),** and (2) slight grading issues diverting the water away from the intended pervious receiving area **(right photo below).**

Both issues are fairly straightforward to address but involve communicating and working with property owners to explain the purpose of disconnection and how to properly maintain it. The second issue may involve some minor regrading or building low-profile berms to get water to flow to the intended disconnection area.

Helpful Skills:

- Rudimentary surveying
- Typical landscaping skills—using materials such as soil, rock/stone, edging material, mulch, etc.

Equipment Typically Used for Inspecting and Fixing Flow Paths

- Surveying equipment (i.e. Site level or total station) to get relative elevations among different parts of treatment area, inlets, overflow structures, etc.
- Small, simple tools—flat shovels, wheelbarrows, rakes, other common landscape/gardening tools
- Large, more complicated equipment—small excavators to move material around or do regrading. Always work from the side of the practice and NOT within the practice itself.

4.7. Sediment Buildup

Issue Applies Most Commonly To: Swales, Bioretention, Permeable Pavement, Ponds/Wetlands, Infiltration, and Sand/Organic Filters

Problem: Sediment accumulation more than 2-inches thick covering 25% or more of the practice surface area

Bioretention, Swales:

- Determine the source(s) of sediment. The most likely sources are: (1) premature installation of the practice during the construction process and discharge of construction site sediment loads; (2) erosion in the contributing drainage area *after* construction is complete; and (3) erosion along the practice side slope or within the practice itself. If it is an ongoing source, it must be abated (see **Sections 4.2, Contributing Drainage Area, and 4.4, Erosion).**
- Use a soil auger to auger holes in various places across the Bioretention or Swale surface area, especially in areas where sediment is accumulating. Determine how deep the sediment is penetrating into the soil media layer. Usually, it will be the top 2 to 3 inches that are most affected. Note that for swales *without* an engineered soil media, the sediment layer will likely be confined to the surface.
- Remove the “fouled” soil media to the affected depth (using flat shovels or small excavators and working from the side) and replace with clean material from an approved vendor (bioretention soil media or equivalent). If no vendors are available in your area, use the soil media specifications from the **Design Manual** to replicate the right mix of sand, topsoil, and composted organic material.
- Check to ensure that the practice is filtering at the proper rate after the next several storm events.

Infiltration:

- For infiltration practices excavated to a suitable infiltrating soil layer (e.g., not stone reservoir layer), use the same procedures as for Bioretention/Swales above.
- For infiltration trenches and basins that have a stone reservoir layer, use similar procedures, but use a shovel to dig into the stone layer to ascertain how deep the sediment incursion is into the stone. Remove down to this layer and replace with clean material.
- If the infiltration practice is clogged, see **Section 4.8: Clogging.**
- As with Bioretention, check for controllable sources of sediment in the Drainage Area (**Section 4.2**).

Permeable Pavement:

- NOTE: Routine sweeping with a regenerative air vacuum (maximum power 2,500 rpm) is important to avoid more costly repairs that result from deferred maintenance. It is best to sweep the pavement surface in the early spring after winter sanding/salting materials or snow piles have led to sediment or winter slag accumulation. Also, if the area is surrounded by tree canopy, fall cleanup is essential, as vegetative debris tends to get pulverized by vehicle traffic and ground into the pavement surface.
- Observe the pavement surface during a storm event to see whether the sediment is clogging the pavement (i.e., standing water on the surface after the storm stops). If so, see **Section 4.8: Clogging.**
- Remove several of the paver blocks in different parts of the structure to ascertain how deep the sediment is penetrating into the bedding and reservoir layers. Most of the time, sediment incursion will be limited to the top 1 or 2 inches of the pavement bedding layer (for permeable interlocking concrete pavers and concrete grid pavers).
- Based on the above observations, it may be worthwhile to quantify the infiltration rate using ASTM C-1701/1701M. This is most useful in conducting the test in the *same place within the pavement surface through the course of several years* to document reduction in infiltration rates. Repair or restorative sweeping is warranted when infiltration rates drop below around 10 inches per hour. NOTE: As stated above, this can likely be avoided if routine annual sweeping is conducted.
- If sediment covers more than 25% of the surface, is deeper than 2 inches, or vegetation is starting to grow where sediment has accumulated, consult a street-sweeping vendor about *restorative* sweeping. In this case, it will be necessary to use a higher RPM sweeper or vacuum sweeper to suck out more of the bedding pea gravel that has been fouled, then replace with clean material.

Infiltration test using ASTM C-1701

Pulling grass and weeds from the joints can damage parking surface if roots are firmly established in the bedding layer.

- Vegetation growing in the pavement joints should be removed either manually or with a water-safe herbicide (e.g., glysophate without surfactants). It is important to not let weeds proliferate in the pavement surface because pulling them out by the roots may damage the pavement structure. (Note: The application of herbicides to control invasive or undesirable vegetation within wetlands or other waters of the U.S. may require an Aquatic Pesticide Permit from the NYS DEC)
- Check the pavement surface after a storm event to ensure that it is draining properly.

The North Carolina State University (NCSU) Stormwater Engineering Group has an informative Urban Waterways publication, *Maintaining Permeable Pavements (2011):*
http://www.bae.ncsu.edu/stormwater/pubs.htm

Routine, air-vacuum sweeping in the early spring and fall is the best approach for permeable pavement maintenance (Photo source: Toronto and Region Conservation)

Ponds and Wetlands:

- Sedimentation is an inevitable process in ponds and wetlands. NOTE that upstream erosion, especially along stream channels or ditches leading to the practice will accelerate the sedimentation process and lead to more frequent and costly sediment removal operations. Whenever possible, it is important to mitigate any upstream erosion issues.
- Forebays and/or pre-treatment areas should be cleaned out when they reach 50% of their design capacity. Once cleanout is complete, it will be worthwhile to install a graduated rod into the forebay with a clear marking of future sediment clean-out levels.
- The main body of a pond or wetland may need to be dredged on an infrequent basis or when sediment has replaced 50% of the design capacity. There are many dredging methods available. Excavators with long arms can handle most small or moderate-sized ponds. Other methods may be necessary for larger facilities. Dredging can be a complicated operation involving dewatering, storage of wet sediment, and possibly hauling to on-site or off-site disposal or reuse areas. Consult a qualified contractor to explore available methods and costs for the particular application. Once again, installation of a graduated rod can help mark future clean-out levels. Note: The dredging of accumulated sediment within regulated wetlands, ponds or at outlet structure may require permits from NYS DEC and/or USACE. In addition, removed sediment should be properly disposed of in a regulated solid waste management facility or in an upland area that is at least 100 feet from regulated wetlands or streams. Sediment managed in upland disposal areas shall be graded, seeded and mulched.

Sand/Organic Filters:

- See the section above on Bioretention/Swales as some of the procedures will be similar, especially for above-ground filters. It is important to determine whether the drainage area is generating a controllable source of sediment that can be abated.
- Underground trench or vault filters will require routine maintenance to: (1) remove accumulated sediment, trash, and floatables from the sedimentation chamber, usually with a vac truck; and (2) remove sediment, grit, and sludge from the top layer of the filter media and replace with clean material. NOTE: Depending on the configuration of the underground filter, confined-space procedures may apply. For a normally operating practice, these maintenance tasks should be conducted every two to three years. If the filter is treating a stormwater hotspot or a particularly dirty drainage area (e.g., vehicle maintenance, washing, repair), the frequency may increase to annually or more often, as dictated by Level 2 inspections. Also, in these cases, it may be warranted to test the material to ensure proper disposal.
- Some proprietary filters require replacement of special cartridges or filter material. Consult the vendor or manufacturer for special maintenance procedures.

Routine cleaning of a perimeter or “Delaware” sand filter. This can be done from the surface, but deeper, vault-type filters will require confined-space entry procedures.

Helpful Skills:

- Most common contracting skills
- Excavation, dewatering, and sediment disposal in some cases
- Knowledge of maintenance equipment, such as vac trucks, street sweepers, etc.
- Knowledge of preferred conditions for bioretention soil media
- Soil testing in some cases where sediment is being removed from stormwater hotspots

Equipment Typically Used for Sediment Removal Activities:

- Small, simple tools—flat shovels, wheelbarrows, rakes, other common tools
- Larger jobs—small or large excavators, loaders, dewatering equipment (pumps, dirt bags, etc.), trucks to haul material to on-site or off-site disposal or reuse areas, erosion and sediment-control supplies.

4.8. Clogging

Issue Applies Most Commonly To: Bioretention, Permeable Pavement, Infiltration, and Sand/Organic Filters

Problem: Filter media clogged; water standing on practice surface for 48 to 72 hours or longer after a storm

Bioretention:

Standing water on the bioretention surface 48 to 72 hours after a storm event is a sure indication of clogging (top photo). Clogging of bioretention practices can be tricky to diagnose as there are several probable causes:

a. Clogged underdrain
b. Filter fabric between soil media and underdrain stone
c. Too much sediment/grit washing in from drainage area
d. Too much ponding depth
e. Improper soil media

The following procedure can be used to work through diagnosing the most common causes, beginning with the simplest and easiest to fix and progressing through more complex remedies:

1. Look for a thin, crusty layer of sediment that covers some or all of the soil media. It is often grayish in color. This thin layer can sometimes be enough to cause slow drainage. Scrape this crust off and ascertain sources of sediment in the drainage area (see Section 4.2, Contributing Drainage Area). Often, this problem can be caused by the bioretention soil media being installed too early in the construction process, but other chronic sediment sources should also be checked.
2. Open the underdrain cleanout and pour water in to verify that the underdrains are functioning and not clogged or otherwise in need of repair. The purpose of this check is to see whether there is standing water all the way down through the soil. If there is standing water on the surface, *but not in the underdrain*, then there is clogging somewhere in the soil layer. If the underdrain and cleanout have standing water and there is not water coming out the other end (outlet) of the underdrain pipe, then the underdrain is clogged and will need to be rooted out.
3. Use a soil auger to auger several holes down through the soil media to the underdrain layer (if present) or underlying soil. Check to see whether there is a layer of filter fabric at the bottom of the soil layer. The auger will pierce through any filter fabric that is present, and pieces of fabric in the auger bucket should be removed. Notice if the fabric is “blinded” or clogged with sediment. This is a common issue with older bioretention practices. If the practice has a clogged the filter fabric layer, go to step #6, install wick drain.

Filter fabric, where present, is a likely source of clogging.

4. While checking for filter fabric in auger holes, also note whether there is a layer of saturated soil media or bad soil media (e.g., too much clay content) that may be on top of a good media layer. This will be fairly obvious as the top 3 or 4 inches will be mucky and saturated, with dry and sandy media below. If this is the case, it will be necessary to remove the bad material and replace with good, clean bioretention soil media in accordance with the design specifications. Till or incorporate the good material into the underlying existing soil media to establish a good contact.

5. If the entire profile of soil media is bad, has too much clay content, or does not appear to meet the specifications for soil media, it will be worthwhile to test the soil and compare against the recommended specifications (e.g., clay content, particle sizes, etc.). If the soil does NOT meet specifications, see steps #6 and #9 below.
6. If the problem appears to be filter fabric or bad soil media (steps #3 or #5 above), there is a critical decision to be made. It is an expensive proposition to dig up the entire facility to either remove the filter fabric or replace the entire soil layer. If the clogging problem is not severe in nature, an intermediate (and much cheaper) option may be to install wick drains. Using a 6-inch auger bucket, auger numerous vertical holes around the practice surface area, making sure to auger all the way down to the underdrain stone or underlying soil (if there is no underdrain). Hammer 6-inch perforated PVC or other type of pipe into these holes. Perforations should be about 3/8-inch diameter. Fill the pipes with clean underdrain gravel (#57 stone) mixed in with coarse construction sand. These drains will serve to wick fines from the surrounding soil media and will provide alternative drainage. Check after the next several storm events to see whether the wick drains improve drainage.

Adding sand to a wick drain. The vertical perforated PVC pipe has already been placed in the auger hole.

7. Sometimes the cause of saturated soil media is springs or some type of baseflow coming into the practice. This is a more difficult problem as bioretention is not supposed to receive this type of constant flow. It will be necessary to identify and reroute springs or baseflow or perhaps replace the bioretention practice with a different type of practice.
8. Another possible source of poor drainage or clogging is that there can be too much water on top of the soil media when the bioretention practice fills up. Most specifications call for a maximum ponding depth of 12 inches, but sometimes the ponding depth can be 18 or even 24 inches. While this increases the amount of head pushing water down through the soil media, it can also lead to compaction or too much sediment building up. If the bioretention practice has a ponding depth greater than 12 inches, consider configuring the outlet or large storm overflow to reduce the ponding depth to 12 inches or less. Check with the local stormwater authority to ensure that doing this will not compromise the required treatment volume of the practice.
9. If clogging is too severe to be fixed with wick drains or other remedies listed above, it may be necessary to rebuild the bioretention practice by digging up the existing soil, taking out any filter fabric that is between the soil media and underdrain stone, and rebuilding and replanting according to the design specifications.
10. Whatever the chosen remedy, check to ensure that the practice is filtering at the proper rate after the next several storm events.

The Chesapeake Stormwater Network (CSN) has produced an excellent reference guide for inspecting and diagnosing Bioretention issues, *Technical Bulletin #10, Bioretention Illustrated.* This tool can be used as an additional reference and can be downloaded using this link: http://chesapeakestormwater.net/category/publications/

Infiltration:

- Clogging of infiltration practices can be simple to resolve or fatal:
- On the *simple* side, clogging (or poor drainage) may arise from sediment, vegetative debris, parking lot grit, or other debris clogging the top few inches of soil or stone.
- With luck, the practice will have an observation well (vertical perforated PVC pipe with cap that extends through the stone reservoir in an infiltration trench or basin). Check the observation well three days after a storm event of ½-inch or more. If water is standing in the observation well to the surface, then the whole profile may be clogged (see below under *fatal*). If the observation well has only a few inches or no water and there is still water standing on the surface, then surface clogging is a likely culprit.
- For infiltration practices in soil (no stone reservoir), auger several holes around the infiltration surface area. If saturated soil seems to be on top of good, clean, dry soil, then surface clogging seems likely.
- For infiltration trenches and basins with a gravel reservoir, dig several holes around the surface to determine, again, whether there seems to be a layer of gravel clogged with sediment, leaves, vegetative debris, parking lot grit, etc. If possible, dig down to where the gravel meets the underlying soil to see whether a layer of filter fabric is present (which may be common with older practices). If this is the case, blinding of the filter fabric may be a cause of the clogging.
- For surface clogging, remove the affected material down to the level where the soil or gravel seems clean, and replace with clean material. If filter fabric seems to be a problem, it will be necessary to dig up the gravel, remove the filter fabric, and rebuild the reservoir layer in accordance with the current design specifications. In either case, check after a storm event to ensure that this has resolved the issue.
- On the *fatal* side, the underlying soil may not be suitable for infiltration, either due to soil characteristics, compaction during construction, or other causes. Check the original design package to see whether any soil testing was done at the time. It may be worthwhile to auger down to the infiltration interface layer (e.g., where stone reservoir meets the underlying soil and then another several inches below this interface), and take several soil samples for lab analysis to compare to current soil specifications (see information below about infiltration soil analysis).

- It may be that a geotechnical analysis would reveal that there is a good infiltration soil layer, but it is lower than the existing interface. This would still require a complete rebuild and excavation down to the suitable soil layer. Restoring porosity at the designed elevation would require replacing soil above this suitable layer and avoiding compaction.
- Another option would be to convert the practice to a bioretention practice with an underdrain. Check with the local stormwater authority to see whether this would require any site plan or stormwater plan amendments or other permits.
- Many updated state stormwater manuals and specifications include protocols for infiltration soil testing and analysis that reference various ASTM standards. For example, see: *Virginia 2013 BMP Standards & Specifications, Specification #8: Infiltration, Appendix 8-A, Infiltration and Soil Testing* at: **http://www.deq.virginia.gov/fileshare/wps/2013_DRAFT_BMP_Specs/**

Permeable Pavement:

- AS NOTED IN SECTION 4.7 – sediment buildup, routine sweeping with a regenerative air vacuum (maximum power 2,500 rpm) is important to avoid more costly repairs that result from deferred maintenance. Preventative maintenance is the best and most cost-effective way to prevent clogging in the first place.
- If there is standing water on the pavement surface 48 to 72 hours after a storm event of ½-inch or more, then the pavement surface is clogged.
- Check the design plan or as-built plan to see whether the permeable pavement design includes an underdrain. There may also be underdrain cleanouts at the edge of the permeable pavement.
- If there is an underdrain, the first thing to check is whether the underdrain is clogged, crushed, or broken. Check to see whether there is standing water in the underdrain cleanout 48 to 72 hours after a storm event. If the underdrain is dry, pour water into the underdrain with a hose and see whether it comes out the other end. If the underdrain is clogged, snake it out, as this is the first and easiest thing to try.
- If the underdrain is working, then clogging may be due to: (1) clogged surface or bedding layer; or (2) underlying soil is not suitable for infiltration for designs with no underdrain. First, refer to the guidance in Section 4.7 – Sediment Buildup, and then proceed as follows:
- IF THERE IS NO UNDERDRAIN AND THE DESIGN IS BASED ON SOIL INFILTRATION UNDER THE PAVEMENT, it will be worthwhile to check the soil because unclogging the surface layer will likely not fix the problem. Check the original design package for any soil infiltration testing. It is likely worthwhile to remove the entire pavement section in several places down to the soil layer and to do a geotechnical investigation of the soil profile. See: ASTM C-1701/1701M and/or *Virginia 2013 BMP Standards & Specifications, Specification #8: Infiltration, Appendix 8-A, Infiltration and Soil Testing* for examples of soil infiltration protocols (URL above).
- If the soil is not suitable for an infiltration design, it will probably be necessary to rebuild the pavement using an underdrain design or possibly adding subsurface drainage along the perimeter of the parking area.
- IF THERE IS AN UNDERDRAIN OR THE SOIL IS SUITABLE FOR INFILTRATION, the best approach to try to unclog the pavement is restorative sweeping with a vacuum sweeper. Regenerative air sweepers may not have enough suction to relieve the clogging.
- If vacuum sweeping is not successful, it may be necessary to rebuild any layers fouled with sediment and fines. It is likely that this will be confined to the bedding layer and gravel used in the paver stone joints, but some clogging can possibly move down into the underlying stone reservoir layer.
- The North Carolina State University (NCSU) Stormwater Engineering Group has an informative Urban Waterways publication, *Maintaining Permeable Pavements (2011):* **http://www.bae.ncsu.edu/stormwater/pubs.htm**

Water standing on the parking surface 48 to 72 hours after a storm is an indication of clogging. Snow piles at the edge of the photo point to possible clogging from winter sanding or plowing.

Sand/Organic Filters:

- See the section above on Bioretention/Swales as some of the procedures will be similar, especially for above-ground filters.
- Also see Section 4.7 – Sediment Buildup for guidance on routine maintenance of the sedimentation and filter chambers.
- As with Bioretention, there can be various causes for clogged filters:
- Filter fabric layer under the filter media that has blinded or clogged
- Clogging of the surface of the filter layer or filter cartridges
- Bad filter media (e.g., sand or organic media)
- “Plumbing” issues with configuration of overflow and underdrain pipes
- Fortunately, filters are usually confined within concrete vaults or manholes, so diagnosing and rectifying clogging problems should be more straightforward. Check the original design or as-built plans. Some of the following guidance may also be helpful:
- For proprietary cartridge or special filter media structures, consult the vendor or manufacturer for recommended solutions.
- See Section 4.7 for guidance on removing the top layer of filter media and replacing with clean material, as well as vacuuming out any sedimentation chambers.
- If it is suspected that overflow or outlet pipes are not configured correctly, check against the design plans and also standard drawings from the manufacturer.
- Chronic clogging problems are likely due to excessively dirty drainage areas, including uncontrolled sources of sediment, oil and grease washoff, vegetative debris from surrounding trees or shrubs, or other sources. It will be important to check and resolve any controllable sources of clogging in the drainage area (see **Section 4.2 – Contributing Drainage Area**).

Standing water on the parking lot is evidence that this perimeter sand filter (under the sidewalk) is clogged.

Helpful Skills:

- Soil infiltration analysis techniques as per ASTM and/or current BMP design specifications
- Excavation, dewatering, and sediment disposal in some cases
- Knowledge of maintenance equipment, such as vac trucks, street sweepers, etc.
- Knowledge of preferred conditions for bioretention, sand/organic filter media, or standard permeable pavement types and bedding layers
- General practice of trying easier or less expensive strategies before jumping right to wholesale reconstruction of a practice

Equipment Typically Used for Unclogging Activities:

- Soil infiltration testing or geotechnical equipment
- Small or large excavators, loaders, dewatering equipment (pumps, dirt bags, etc.), trucks to haul material to on-site or off-site disposal or reuse areas, erosion and sediment control supplies
- Pavement demolition and repair equipment
- Mulch, plants, filter media, and other materials needed to rebuild practices

4.9. Vegetation

Issue Applies Most Commonly To: Swales, Tree Planting, Bioretention, Green Roofs, and Ponds/Wetlands

Problem #1: Not enough vegetation; vegetation *is unhealthy*

Bioretention, Swales, Tree Planting:

- Test soil/media to ensure proper conditions exist for plant survival.
- Check water drawdown after a storm to make sure that wet/saturated conditions are not the cause of plant failure. If this IS an issue, see **Section 4.8 – Clogging.**
- Amend or enhance soil as needed; soil may need more organic material to support plants, but do NOT use uncomposted organic material or animal waste, as it will likely export undesirable nutrients to the stormwater system.
- If plants have continued to die, consider a different species or entire planting palette or revised planting plan **(photo to right shows the need for a whole new planting plan)**. Also consider using an appropriate bioretention or swale native seed mix to supplement use of plugs or other nursery stock.
- Consult a horticulturalist or plant nursery if there is evidence of disease or pests.
- Replant and add mulch or ground cover as needed.

Ponds and Wetlands:

- See **Section 4.13 – Pool Quality** for general guidance on pond and wetland vegetation maintenance, as well as the following.
- For emergent vegetation, determine whether water depths are too deep or shallow for survival (i.e., depths are different from design depths, or original design included improper vegetation).
- If a small amount of supplemental vegetation is needed, plant wetland plugs per nursery guidance.
- For large-scale plantings, drain the permanent pool and plant during the early spring.

Green Roof:

- Consult with a green roof plant vendor about possible causes of plant failure. Lack of watering during initial establishment could be the main culprit.
- Work with a qualified vendor to develop and install a new planting plan.
- Speak with building facilities maintenance personnel to ensure they understand need for watering and caring for new plants after they are installed.

Helpful Skills:

- Landscaping/gardening
- Consult with Cooperative Extension Office or independent laboratory for soil testing
- If original planting plan is deemed inadequate, consult a landscape architect or horticulturalist to determine whether a revised planting plan is needed.
- Knowledge of native plant and/or wetland plant nurseries in general region

Problem #2: Too much vegetation, overgrown (with invasive species), not maintained

General Approach for All Practices:

- Determine which invasive plants are present. For a list of regulated and prohibited invasive plants in New York State, see *New York State Prohibited and Regulated Plants* (NYS DEC, NYS Agriculture and Markets, 2014) at: http://www.dec.ny.gov/docs/lands_forests_pdf/isprohibitedplants2.pdf . Invasive plants shall be properly disposed of in a manner that renders them non-living and non-viable to prevent the establishment, introduction or spread of disposed species.
- Review whether the original planting plan relied on these plants; for example, some wetland plans may rely on "aggressive colonizers" such as cat tails.
- For more detailed information regarding appropriate control measures for each species, consult the Cornell Cooperative Extension Invasive Species Program at the following link: http://ccetompkins.org/environment/invasive-nuisance-species/invasive-plants. If invasives have taken over the facility, wholesale removal and replanting with desirable species may be necessary.
- If (non-invasive) plants are overgrown, (**example in photo to right**), remove, thin, or trim back excessive vegetation.
- If an entire new planting plan is deemed necessary, use SMP-Specific Guidance in the remainder of this manual, along with landscaping goals for the site location, to devise a plan that allows for adequate growth over a long period of time. A simple, clear planting design (**example in photo below**) with a long-term plan has the best chance of being maintained through time. Maintenance crews need to know which plants are part of the design versus weeds and how the practice should look from year to year.
- Develop a plan to ensure proper weeding, pruning, trimming, and replanting to maintain the plan over time.
- See **Section 4.13 – Pool Quality** for general guidance on pond and wetland vegetation maintenance, as well as the following.

Helpful Skills:

- Knowledge of exotic and invasive species is needed. Consult a local Cooperative Extension Office.
- Specific measures may include mechanical hand pulling, regrading (requires construction equipment), or herbicide/pesticide application *safe for aquatic environments*.
- Landscape architect
- Knowledge of wetland plants (for ponds/wetlands)
- Knowledge of SMP design (to understand hydrologic regime for plant selection)

Equipment Typically Used for Vegetation Maintenance Activities

- Soil auger to diagnose issues of soil drainage that may affect vegetation health
- Rakes, shovels, wheelbarrows, and other "landscaping" equipment
- Light excavation or grading equipment for larger jobs
- Equipment to deliver, unload, and move soil media, mulch, and other materials
- Plants and/or seed mix, plus a way to move and store plant stock without damaging it or drying it out
- Planting bars, soil drills, etc.
- For planting in standing water (e.g., ponds, wetlands), pumps or pump-around systems and dirt bags or other ways to temporarily dewater planting area

4.10. Embankment and Overflow Condition

Issue Applies Most Commonly To: Swales, Bioretention, and especially Ponds/Wetlands

Problem #1: Rill and channel erosion and bare dirt areas of embankments

Bioretention, Swales:

- Erosion and areas of bare dirt indicate two basic issues: 1) soils and moisture levels are not suitable for the plants or turf used; and 2) vegetation cannot take hold because of concentrated flow, physical wear, or poor soil conditions. Address these issues first with a soil/media test to ensure proper conditions exist for plant survival.
- High salt content from winter deicing of pavement is a common culprit of poor soil conditions for roadside plants. If this is the case, restore area with plant species that can tolerate salt levels, or replace edge plants with a stone diaphragm to intercept runoff from road.
- Amend or enhance soil as needed; soil may need more organic material to support dense ground cover.
- For concentrated flow and physical wear, redirect concentrated flow so that it disperses in mulched and vegetated areas. Stake in mulch and replant with vigorous plants recommended through the soils test.
- If plants have continued to die, consider a different species or entire planting palette or a revised planting plan (see **Section 4.9 – Vegetation and photo to right)**. Also consider using an appropriate bioretention or swale native seed mix to supplement use of plugs or other nursery stock.
- Consult a horticulturalist or plant nursery if there is evidence of disease or pests.
- Replant and add mulch or ground cover as needed.

Ponds and Wetlands:

- Where erosion has deposited soil within the pond or wetland water line, remove this material and reshape the slope.
- If a small amount of supplemental vegetation is needed, plant wetland plugs per nursery guidance.
- To address rill and channel erosion, first obtain a soil sample test to get soil amendment recommendations. Undercut the eroded sections and replace with clean amended soil, based on the soil test, and reseed as appropriate for the season.
- It may be necessary to stake in seed blankets or erosion-resistant lining (e.g., erosion-control matting or even rock in extreme situations) to stabilize eroded areas. Again, choose seed types appropriate for the season.
- Based on soil test guidance, reseed bare areas to prevent further erosion.
- For persistent problems, reroute the flow to more stable receiving areas using berms, diversions, etc.

Helpful Skills:

- Landscaping/gardening
- Consult with Cooperative Extension Office or independent laboratory for soil testing.
- If original planting plan is deemed inadequate, consult a landscape architect or horticulturalist to determine whether a revised planting plan is needed.
- Knowledge of sediment and erosion control practices and resources appropriate for the area

Problem #2: Settlement, loss of armoring material, erosion of emergency overflow

General Approach for All Practices:

- Settlement, loss of armoring material, erosion and accumulated debris can affect the dimension, water velocity or capacity of the emergency overflow such that embankment failure could occur in flood events (**photos below**).
- Inspect for exposure of soil or geotextile base material in the overflow and rearmor areas of exposure.
- In cases of settlement, a qualified engineer should be sought to assess its capacity and impact on pond capacity.
- Erosion of spillways should be repaired and revegetated as described for embankments.


Helpful Skills:

- Knowledge of sediment and erosion control practices for the area
- Completion of self-guided training on dam safety through Association of State Dam Safety Officials: http://www.damsafety.org

Problem #3: Impounding structure (embankment or dam) integrity issues due to tunneling or digging animals, woody vegetation or seepage

Ponds/Wetlands:

- Impounding structure stability is a serious concern, especially where trees have become established on the slopes, or there's evidence of animal burrows or seepage.
- The best approach for trees on the crest, slopes, and adjacent to an impounding structure or embankment is to cut them down before they reach significant size. If large trees have been cut down but their root systems not removed, carefully monitor the area around the remaining stumps for signs of seepage.
- Exercise judgement for trees on the surrounding side slopes that are NOT impounding structures (not designed to hold back water in the pool). Sometimes a forested edge can enhance the appeal of a pond, but access for maintenance must also be available, and some trees can drop debris into ponds, leading to quality issues.
- Animal burrows can be dangerous to the structural integrity of the embankment because they weaken it and can create pathways for seepage. Professional exterminators may be needed to trap and remove animal pests.
- Seepage as water flow or boiling sand on the lower portion of the exterior slope or toe area of an impounding structure should be brought to the attention of a qualified engineer.
- Leakage around conveyance structures such as barrel pipes or spillways should be monitored for increase since the last inspection. A qualified engineer is needed to resolve issues of piping or seepage along the barrel pipe through a dam.
- Turbidity or cloudiness in seepage should also be brought to the attention of a qualified engineer.

Helpful Skills:

- Completion of self-guided training on dam safety through the Association of State Dam Safety Officials: http://www.damsafety.org

Equipment Typically Used for Embankment and Overflow Maintenance Activities

- Excavation or grading equipment for larger jobs
- Equipment to deliver, unload, and move soil media, mulch, and other materials
- Plants and/or seed mix, seed blanket and erosion control materials
- Rod and level for settlement measurements
- Clear glass bottle for seepage visual test

4.11. Structural Damage

Issue Applies Most Commonly To: Any Practice

Problem: Structural damage to pipes, headwalls, standpipes, inlet/outlet structures, grates, curbs, and other structural components

- Structural components are necessary for water to flow into and out of stormwater practices as intended. This is a broad category that involves components composed of concrete, metal, plastic, and other materials. Some common examples include:
- Deteriorated or broken curbs that allow water to bypass a practice
- Slumping or sinkholes where soil meets a concrete drop inlet or outlet structure
- Broken or collapsed inlets
- Connections in an inlet or manhole structure that are not parged and are leaky
- Collapsed or crushed pipes (especially corrugated metal)
- Missing or broken steps or other safety features in a manhole or riser structure
- Root penetration and clogging of underdrain or other pipes
- Broken check dams
- There are too many particular instances to mention here, but the general idea is to inspect and repair any structural components that are affecting the performance of a practice or leading to a potential health or safety issue.

Helpful Skills:

- General contracting skills—concrete work, metal, proper joint sealing
- Routing out clogged pipes
- Perhaps CCTV experience to look for broken or clogged pipes

Equipment Typically Used for Fixing Erosion:

- General contracting
- CCTV

4.12. Pool Stability

Issue Applies Most Commonly To: Ponds/Wetlands

Problem: Flooded or dry pond – outlet issues

General Approach for Ponds and Wetlands:

- Note high-water marks on structures or pond banks and compare with outlet structure weir.
- If the outlet weir is submerged, investigate downstream for plugs such as beaver dams, woody debris or sediment bars. Refer to **Section 4.3 – Physical Obstructions** for removal of obstructions.
- If the pond is retaining more water than it is supposed to and there is no flow from the outlet with no visible blockages in the outlet pipe, look for obstructions above the weir or outlet pipe. Woody debris, vegetation and silt can plug outfall weirs or blind rock outfall protection. Removal of such blockages tends to be a hand exercise. A jet/vacuum truck or other heavy equipment may be needed to clear excessive or precarious blockages (**photo on right**).
- If the pond is too low and not holding water in the designated pool, the outlet structure should be closely inspected to see whether it has settled from the original construction or there is leakage through joints or cracks. Finding no deficiencies with the structure, investigate the pond embankment as described in **Section 4.10** for evidence of seepage.
- If there is no evidence of seepage and the outlet structure has no apparent structural defects, an engineer should be consulted to review the pond design and determine the proper outlet elevation.

Helpful Skills:

- The ability to navigate uneven surfaces, to follow ditch banks and to sight drainage obstructions is implicit with this task.
- Ability to use a level to sight adequate elevation fall is helpful.

Equipment Typically Used for Pool Stability Evaluations

- Bright flashlight for pipe inspection
- Manhole hook for manhole cover access
- Brush hook to clear debris and walking surfaces
- Rod and level to check elevation differentials

4.13. Pool Quality

Issue Applies Most Commonly To: Ponds/Wetlands

Problem #1: Littoral shelves and pond edge: not enough vegetation; vegetation *is unhealthy;* invasive plants have taken over

Ponds and Wetlands:

- If there is not enough vegetation or no vegetation, determine whether maintenance practices have killed the plants. If so, work with the owner to educate those responsible for pond maintenance on correct methods. Consult plans for original planting and replant.
- For emergent vegetation, determine whether water depths are too deep or shallow for survival (i.e., depths are different from design depths, or original design included improper vegetation).
- If a small amount of supplemental vegetation is needed, plant wetland plugs per nursery guidance.
- For large-scale plantings, drain the permanent pool and plant during the early spring.If ponds are overgrown so that less than 25% of the surface area is visible, the pond water level should be lowered to enable selective plant removal.
- Invasive plants, such as phragmites or common reed, should be removed with their roots. Be sure to restore areas that have been disturbed with replacement vegetation because root removal exposes soil to erosion. Invasive plants shall be properly disposed of in a manner that renders them non-living and non-viable to prevent the establishment, introduction or spread of disposed species.
- Native plants selected based on environmental conditions have the greatest chance for survival.
- Consult a horticulturalist or plant nursery if there is evidence of disease or pests.

Helpful Skills:

- Landscaping/gardening
- If original planting plan is deemed inadequate, consult a landscape architect or horticulturalist to determine whether a revised planting plan is needed.
- Knowledge of native plants and/or wetland plant nurseries in general region
- Familiarity with New York invasive terrestrial and wetland plants and their control: http://nyis.info/

Problem #2: Pond color, scum, odor, algae and plant overgrowth

- Ponds that have algae covering more than 20% of the surface should have maintenance to remove it. Raking or mechanical harvesting of filamentous algae offers short-term control, but feasible long-term strategies should be considered.
- Pond maintenance companies should be relied on to identify the algae and appropriately control them. Pond specialists can control the algae growth in ponds, but its growth and reproduction are dependent on nutrients. When nutrients are in abundance, so will be the algae or vegetation.
- Plants can be used in shallow shelfs at inlets to take up nutrients, but they must be maintained and cuttings removed to take nutrients out of the pond system.
- If (non-invasive) plants are overgrown, remove or trim back excessive vegetation. Remove cuttings and trimmings. Do not allow vegetative debris to remain in the pond.
- Pond clarity and color can be impacted by excessive sediment discharge or flow shortcircuiting. For issues of clarity and color, follow the recommendations in **Section 4.7 – Sediment Buildup**.
- If invasive aquatic plants are identified, follow DEC guidelines for reporting and controlling invasives (see **Section 4.9 – Vegetation**).
- Some color, odor, and pond quality issues can be caused by leaks, spills, and other releases in the drainage area. Any petroleum odor or oily sheen (aside from natural rainbow sheen associated with decomposition of organic matter) should be reported to the appropriate state or local response agency. Other peculiar colors or odors can be investigated in collaboration with relevant agencies. Common issues are grease, paint, or other substances poured into storm drains, dumpster management, and stockpiles of various materials exposed to rainfall.

Helpful Skills:
• Ability to recognize invasive aquatic plants • Specific measures may include mechanical hand pulling, regrading (requires construction equipment), or herbicide/pesticide application *safe for aquatic environments*. • Knowledge of wetland plants and common types of algae and aquatic weeds • Knowledge of types of pond maintenance practices
Equipment Typically Used for Pool Quality Investigations
• High-top rubber boots • Canoes or small boats • Brush hook to clear vegetation and access pond bank • Secchi disk to check and compare pond color and clarity • Large-mouth bottle to collect algae and water quality samples • Various materials to control aquatic weeds and algae

Section 5. Planning for Stormwater Maintenance

Often, stormwater practices fall into disrepair because there is no plan in place for ensuring that they are maintained over time. As a result, maintenance can become reactive in nature, resulting in high costs for repairing damaged practices or practices becoming ineffective over time. This section outlines some key elements of stormwater maintenance planning, including:

1. Program models for stormwater maintenance
2. Inspection and maintenance checklists
3. Planning for the costs of stormwater maintenance
4. Identifying the need for infrequent maintenance items

5.1. Program Models for Stormwater Maintenance

The Maintenance Hierarchy concept (See Section 1) is discussed throughout this chapter, but the individuals who will conduct the Level 1, Level 2 and Level 3 inspections and maintenance will vary depending on how the local program is administered. While this chapter does not focus on program elements, it is important to note that the local program requirements will influence who performs ongoing maintenance. This will play an important role in how to develop a comprehensive maintenance plan.

Although there are many options for implementing a stormwater plan, they can be described by three broad categories, including: 1) Private Maintenance; 2) Local Program; and 3) Hybrid Approach. Understanding the program in the local community will influence the best techniques for developing the maintenance plan (**Table 5.1**).

Option 1: Private Maintenance

In this option, maintenance is the responsibility of the private land owner. In regulated MS4s, however, the land owner will periodically report to the local government. In this model, it is important to ensure that the maintenance plan is very easy to understand and includes pictures of key practice elements. If possible, include a list of contractors who will be able to perform maintenance items and how much these will cost. Finally, materials should point homeowners to resources so that they can learn more about the practices on their property. DEC’s Maintenance Photo Library and Training Materials webpage (link) can be useful tools for this purpose.

Option 2: Local Government Maintenance

In this option, the local government takes over maintenance responsibility for all stormwater practices. While it is still important to develop a clear and simple plan, the designer can assume some level of training or supervision for the individuals conducting inspections and maintenance. For publicly maintained practices, it is helpful to find out what resources the local government has in place for developing the plan. These resources may be in the form of existing reporting and tracking procedures, which can be modified for the specific practice, or equipment such as vacuum sweepers. Maintenance access should be made available to local government staff through official easements.

Option 3: Hybrid Approach

In the hybrid approach to stormwater maintenance, larger practices or practices on public land are maintained by the local government, and smaller practices on private property are maintained by the owner. There are other hybrid models, however. For example, the local government may take responsibility for inspections but leave the owner responsible for maintenance items identified during the inspection.

Table 5.1 Maintenance Considerations for Three Program Options

Program Option	Inspection/Maintenance Performed By:	Key Considerations for the Designer
Option 1: Private	Level 1: Property owner or HOA Level 2: Private Contractor Level 3: Certified Contractor	Make the plan very simple and graphic intensive. Include a list of contractors if applicable. Provide links to educational materials.
Option 2: Local Program	Level 1: Interns or Untrained Staff Level 2: Trained Local Staff Level 3: City/Town Engineer or other individual hired by the city or town	Learn about the resources the local program has at its disposal. If government staff are being trained, develop a maintenance plan that is consistent with their knowledge and understanding. Be aware of equipment and materials on hand in this community.
Option 3: Hybrid Approach	Inspection is typically divided, where larger practices or those on private property are maintained by the public entity.	Understand how this maintenance is divided, and develop a plan that is consistent with this arrangement.

Special Considerations for Green Infrastructure Practices

Because many of the Green Infrastructure practices included in this manual, such as Tree Planting, Rain Gardens and Sheetflow and Level Spreaders, are implemented at a very small scale, they present a unique challenge in terms of stormwater maintenance. These practices are more likely to be located on private property. As a result, the designer needs to consider the *Private Maintenance* model. Maintenance plans for these small practices should be as simple as possible, and the designer should ensure that maintenance can be completed with readily available materials.

5.2. Inspection and Maintenance Checklists and Documentation

The checklists included in this chapter are specific to the maintenance hierarchy. The maintenance plan should include inspection checklists for all three hierarchies. In addition, these checklists should be modified to identify the specific practice elements included in each design. The materials developed as a part of the maintenance plan should be provided to the practice owner and local government. (See **Table 5.2**)

Table 5.2. Customizing Checklists and Guidance

Hierarchy	Checklist/Checklist Guidance	Tips for Customizing
Level 1	**Section 2** includes both the checklists and guidance.	Add photographs of the practice (once installed), and include a simple aerial photograph of the site to locate the practice. Include key local government contacts and contractors along with the checklist.
Level 2	**Section 3** includes guidance on how to respond to the Level 1 Inspection and/or activate a Level 3 investigation. **Appendix B** includes routine inspection checklists for the Level 2 Inspector.	Modify to remove elements that are not in this particular practice.
Level 3	Guidance is included in **Sections 3 and 4**.	Typically, this will not need to be modified.

5.3. Budgeting for Maintenance

A maintenance plan should include a budget for annual maintenance. In the Public Maintenance model, a single entity (the local government) will be responsible for maintenance of many practices, so the cost of maintenance for an individual practice may not be as important as estimating the average cost of maintenance across all practices. For privately maintained practices, on the other hand, it is very helpful to develop a cost estimate that is as accurate as possible for the specific location. As a result, two options for estimating costs are presented here, including:

- **Option 1**: Average or Unit Costs
  Generalized cost data are used to estimate an annual cost. This option may be used for a municipality or other institution that manages a large number of practices.
- **Option 2:** Detailed Individual Practice Budget
  Annual costs are estimated using more detailed practice information, as well as more detailed estimates of labor and materials costs.

Option 1: Average or Unit Costs

In this option, annual maintenance costs are estimated on a per-acre basis or based on a percentage of the construction costs. These prices typically range from about 1% to 4% of the construction costs (King and Hagan, 2011; **Table 5.3**).

Table 5.3 Typical Maintenance Costs
(Source: King and Hagan, 2011; Adjusted to 2015 Costs)

Practice	Annual Maintenance Cost (% of Construction)	Annual Maintenance Cost ($/cubic foot of the water quality volume–WQV—treated)
Buffers	4%	$0.25-$0.35
Tree Planting	4%	$0.35
Ponds and Wetlands	4%	$0.22-$0.35
Infiltration Trench/ Basin	2%	$0.25
Filtering Practices	4%	$0.41-$0.47
Bioretention	4%	$0.44
Swales	3%	$0.18-$0.26
Permeable Pavement	1%	$0.64-$0.89

While the costs in **Table 5.3** may be a reasonable starting point, it is important to note that the actual data will vary greatly, depending on labor rates and materials costs. For example, the hourly “Open Shop” labor rate for rough grading is approximately $27/hour in Elmira and $38/hour in New York City (Means, 2015). In addition, costs for labor, materials and equipment will vary depending on the maintenance arrangement (**Table 5.4**).

Table 5.4 Variability in Maintenance Costs Based on Maintenance Arrangement			
Maintenance Arrangement	**Labor**	**Materials**	**Equipment**
Public Maintenance (Municipality)	Level 1: Intern Wage Level 2: Staff Salary Level 3: Professional Staff or Contractor	Low: Materials bought in bulk.	Low: Typically owned by Public Works or similar department.
Private Maintenance (Homeowner)	Level 1: Homeowner (Free) or Contractor Level 2: Private Landscaper or Contractor Level 3: Professional Contractor	High: Materials purchased in small quantities.	High: Specialized equipment needs to be rented if needed.
Private Maintenance (Commercial or HOA)	Level 1: Free (with HOA volunteers) or Contracted Labor Rate Level 2: Private Landscaper or Contractor Level 3: Professional Contractor	Varies: Materials may be bought in bulk or on a small scale, depending on the size of the private entity.	High: Specialized equipment needs to be rented if needed.

Option 2: Site-Based Costs

Because both the unit costs of labor and materials and the average annual costs of maintenance can be so highly variable, more detailed data will be needed to estimate costs at a particular site. One approach for estimating these costs is to generate a list of routine maintenance items, along with associated unit costs for labor, materials and equipment. This approach requires the user to enter basic design data for the practice, as well as information regarding local labor rates and other general costs. In the bioretention example below, unit costs are used to estimate routine maintenance costs, including inspections and regular maintenance.

Example Annual Cost Estimation: Bioretention

An example cost estimation for a bioretention cell follows below. The cost estimation tool used in the Maintenance Chapter will be automated. This example demonstrates how the unit cost and typical frequency data will be used to estimate average annual maintenance costs. In it, we are estimating annual maintenance costs for a bioretention practice with characteristics summarized in **Table 5.5**. **Table 5.6** then summarizes activities, their frequency and extent, and associated labor costs.

Using the assumptions for this practice, the annual costs for routine maintenance would be $1,828 ($1.15/cubic foot of Water Quality Volume) in the first year and $1,468 ($0.90/cf WQv) in subsequent years. This value is much higher than the $0.44/cf estimated using general cost data (**Table 5.3**). However, significant cost savings could be realized by using volunteer or intern-level labor for Level 1 inspections and routine maintenance.

Table 5.5. Assumptions for Bioretention Cost Example

Practice Design		**Unit Costs**	
Water Quality Volume (cf)	1,600	Level 1 Labor ($/hr)	$15
Forebay Volume (cf)	400	Level 2 Labor ($/hr)	$35
Total Practice Area (sf)	2,000	Mulch ($/cy)	$10
Filter Area (sf)	1,000	Plants ($/plant)	$1
Ponding Area (sf)	1,500	Trash Tipping Fee	$25
Slope Area (sf)	500	Seed/Mulch for a small area	$10
Turf Area (sf)	No Turf	Average Cost for a PVC Replacement Part (Planning Level)	$100
Inlets (#)	1		

Table 5.6. Bioretention Example - Routine Maintenance Costs

Task	Frequency (x/year, Decimal)	Typical Extent	Extent	Hours (Unit)	Hours/yr	Level	Materials and Equipment	Annual Costs		
								Labor	Materials and Equipment	Total
Level 1 Inspection - 1 to 5-acre drainage	1	Practice	1	1 per inspection	1	1		$15		$15
Level 2 Inspection - 1 to 5-acre drainage	0.2	Practice	1	2 per inspection	0.4	2		$14		$14
Watering - grass and plants: Year 1	16	Weekly for first growing season, over filter surface area	1,000	0.5 per 400 sf area	24	1	Assume minimal cost for water	$360		$360
Trash and Debris Removal	4	Ponding area	1,500	1 per 400 sf practice surface area	15	1	Assume $25 Tipping Fee for Each Trip	$225	$100	$325
Weeding	2	Assume 50% of practice area	1,000	4 per 400 sf practice surface area	20	1		$300		$300
Mulching	1	Ponding area	1,500	4 per 400 sf area	15	1	Bark mulch; assume 15 cy/application	$225	$150	$375
Sediment Removal (minor)	1	Assume one small area per inlet	1	1 per small area	1	1		$15		$15
Erosion Repair (minor)	1	Inlets; assume 25 sf/practice	25	1 per 25 sf	1	1	Seed, mulch and topsoil	$15	$10	$25
Erosion Repair (minor)	1	10% of slope area	50	1 per 25 sf	2	1	Seed, mulch and topsoil	$30	$20	$40
Minor Regrading	0.5	1 spot per 400 sf of practice area	5	1 per repair	2.5	2	Assume done by hand	$88		$88
Planting (plants)	0.2	Assume 50% of practice area	1,000	8 per200 sf	8	1	Assume 500 plants/planting	$120	$100	$220
Minor PVC or Metal Repairs (observation well cap, PVC riser, grates)	0.2	1 per practice	1	1 per repair	0.2	2	Assume about a $100 piece of equipment	$7	$20	$27
Sediment Removal (small forebay)	0.2	per forebay	1	2 per forebay	0.4	2	Assume removal by hand	$14		$14
							Total Costs - Year 1	**$1,428**	**$400**	**$1,828**
							Total Costs - Subsequent Years	**$1,068**	**$400**	**$1,468**

5.4. Planning for “Non-Routine” Maintenance

If the guidance provided in this chapter is followed and practices are designed properly, the routine maintenance (and budget guidance in **Section 5.3**) should be sufficient to keep a practice functioning indefinitely, but planning is needed for infrequent maintenance items. In the initial maintenance plan, identify a few of the most likely infrequent items. If initial routine inspections start to identify a more serious problem, develop a plan and budget for performing the repairs. To be more conservative, another option is to provide a contingency budget to plan for non-routine repairs over the life of the practice.

Note: Maintenance and repairs that rise to a Level 3 inspection may require permits from the NYS DEC and/or US Army Corps of Engineers if they are undertaken within or adjacent to regulated wetlands or other waters of the U.S.

Maintenance Guide

BaySaver Barracuda™

July 2017

One of the advantages of the BaySaver Barracuda is the ease of maintenance. Like any system that collects pollutants, the BaySaver Barracuda must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The systems were designed to minimize the volume of water removed during routine maintenance, reducing disposal costs.

Contractors can access the pollutants stored in the manhole through the manhole cover. This allows them to gain vacuum hose access to the bottom of the manhole to remove sediment and trash. There is no confined space entry necessary for inspection or maintenance.

The entire maintenance procedure typically takes from 2 to 4 hours, depending on the size of the system, the captured material, and the capacity of the vacuum truck.

Local regulations may apply to the maintenance procedure. Safe and legal disposal of pollutants is the responsibility of the maintenance contractor. Maintenance should be performed only by a qualified contractor.

Inspection and Cleaning Cycle

Periodic inspection is needed to determine the need for and frequency of maintenance. You should begin inspecting as soon as construction is complete and thereafter on an annual basis. Typically, the system needs to be cleaned every 1-3 years.

Excessive oils, fuels or sediments may reduce the maintenance cycle. Periodic inspection is important.

Determining When to Clean

To determine the sediment depth, the maintenance contractor should lower a stadia rod into the manhole until it contacts the top of the captured sediment and mark that spot on the rod. Then push the probe through to the bottom of the sump and mark that spot to determine sediment depth.

Maintenance should occur when the sediment has reached the levels indicated in the Storage Capacity Chart.

BaySaver Barracuda Storage Capacities

Model	Manhole Diameter	Treatment Chamber Capacity	Standard Sediment Capacity (20” depth)	NJDEP Sediment Capacity (50% of standard depth)
S3	36”	212 gallons	0.44 cubic yards	0.22 cubic yards
S4	48”	564 gallons	0.78 cubic yards	0.39 cubic yards
S5	60”	881 gallons	1.21 cubic yards	0.61 cubic yards
S6	72”	1269 gallons	1.75 cubic yards	0.88 cubic yards
S8	96”	3835 gallons	3.10 cubic yards	1.55 cubic yards
S10	120”	7496 gallons	4.85 cubic yards	2.43 cubic yards

Maintenance Instructions

1. Remove the manhole cover to provide access to the pollutant storage. Pollutants are stored in the sump, below the bowl assembly visible from the surface. You’ll access this area through the 10” diameter access cylinder.

2. Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment. See figure 1.
3. Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
4. Fill the cleaned manhole with water until the level reaches the invert of the outlet pipe.
5. Replace the manhole cover.
6. Dispose of the polluted water, oils, sediment and trash at an approved facility.
    - Local regulations prohibit the discharge of solid material into the sanitary system. Check with the local sewer authority for authority to discharge the liquid.
    - Some localities treat the pollutants as leachate. Check with local regulators about disposal requirements.
    - Additional local regulations may apply to the maintenance procedure.

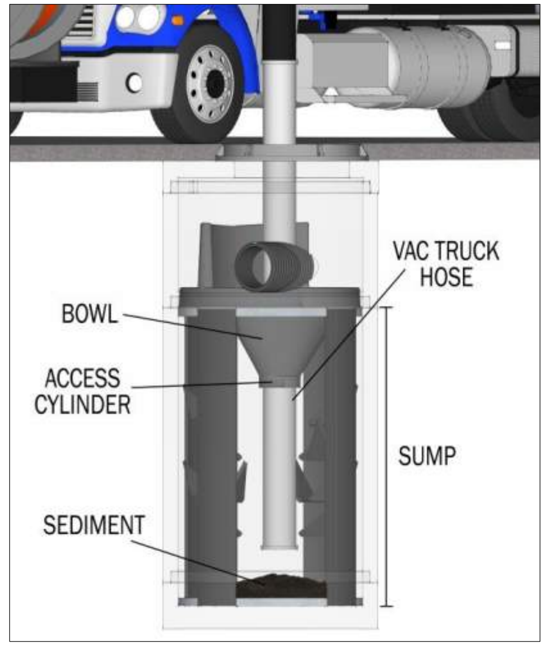


Figure 1

APPENDIX I-1

STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL

STANDARD AND SPECIFICATIONS FOR COMPOST FILTER SOCK

Definition & Scope

A **temporary** sediment control practice composed of a degradable geotextile mesh tube filled with compost filter media to filter sediment and other pollutants associated with construction activity to prevent their migration offsite.

Condition Where Practice Applies

Compost filter socks can be used in many construction site applications where erosion will occur in the form of sheet erosion and there is no concentration of water flowing to the sock. In areas with steep slopes and/or rocky terrain, soil conditions must be such that good continuous contact between the sock and the soil is maintained throughout its length. For use on impervious surfaces such as road pavement or parking areas, proper anchorage must be provided to prevent shifting of the sock or separation of the contact between the sock and the pavement. Compost filter socks are utilized both at the site perimeter as well as within the construction areas. These socks may be filled after placement by blowing compost into the tube pneumatically, or filled at a staging location and moved into its designed location.

Design Criteria

1. Compost filter socks will be placed on the contour with both terminal ends of the sock extended 8 feet upslope at a 45 degree angle to prevent bypass flow.
2. Diameters designed for use shall be 12" – 32" except that 8" diameter socks may be used for residential lots to control areas less than 0.25 acres.
3. The flat dimension of the sock shall be at least 1.5 times the nominal diameter.
4. The **Maximum Slope Length** (in feet) above a compost filter sock shall not exceed the following limits:

Dia. (in.)	Slope %						
	2	**5**	**10**	**20**	**25**	**33**	**50**
8	225*	200	100	50	20	—	—
12	250	225	125	65	50	40	25
18	275	250	150	70	55	45	30
24	350	275	200	130	100	60	35
32	450	325	275	150	120	75	50

* Length in feet

5. The compost infill shall be well decomposed (matured at least 3 months), weed-free, organic matter. It shall be aerobically composted, possess no objectionable odors, and contain less than 1%, by dry weight, of man-made foreign matter. The physical parameters of the compost shall meet the standards listed in Table 5.2 - Compost Standards Table. **Note: All biosolids compost produced in New York State (or approved for importation) must meet NYS DEC's 6 NYCRR Part 360 (Solid Waste Management Facilities) requirements. The Part 360 requirements are equal to or more stringent than 40 CFR Part 503 which ensure safe standards for pathogen reduction and heavy metals content. When using compost filter socks adjacent to surface water, the compost should have a low nutrient value.**
6. The compost filter sock fabric material shall meet the minimum requirements provided in Table 5.1 - Compost Sock Fabric Minimum Specifications Table.

7. Compost filter socks shall be anchored in earth with 2" x 2" wooden stakes driven 12" into the soil on 10 foot centers on the centerline of the sock. On uneven terrain, effective ground contact can be enhanced by the placement of a fillet of filter media on the disturbed area side of the compost sock.

8. All specific construction details and material specifications shall appear on the erosion and sediment control constructions drawings when compost filter socks are included in the plan.

Maintenance

1. Traffic shall not be permitted to cross filter socks.

2. Accumulated sediment shall be removed when it reaches half the above ground height of the sock and disposed of in accordance with the plan.

3. Socks shall be inspected weekly and after each runoff event. Damaged socks shall be repaired in the manner required by the manufacturer or replaced within 24 hours of inspection notification.

4. Biodegradable filter socks shall be replaced after 6 months; photodegradable filter socks after 1 year. Polypropylene socks shall be replaced according to the manufacturer's recommendations.

5. Upon stabilization of the area contributory to the sock, stakes shall be removed. The sock may be left in place and vegetated or removed in accordance with the stabilization plan. For removal the mesh can be cut and the compost spread as an additional mulch to act as a soil supplement.

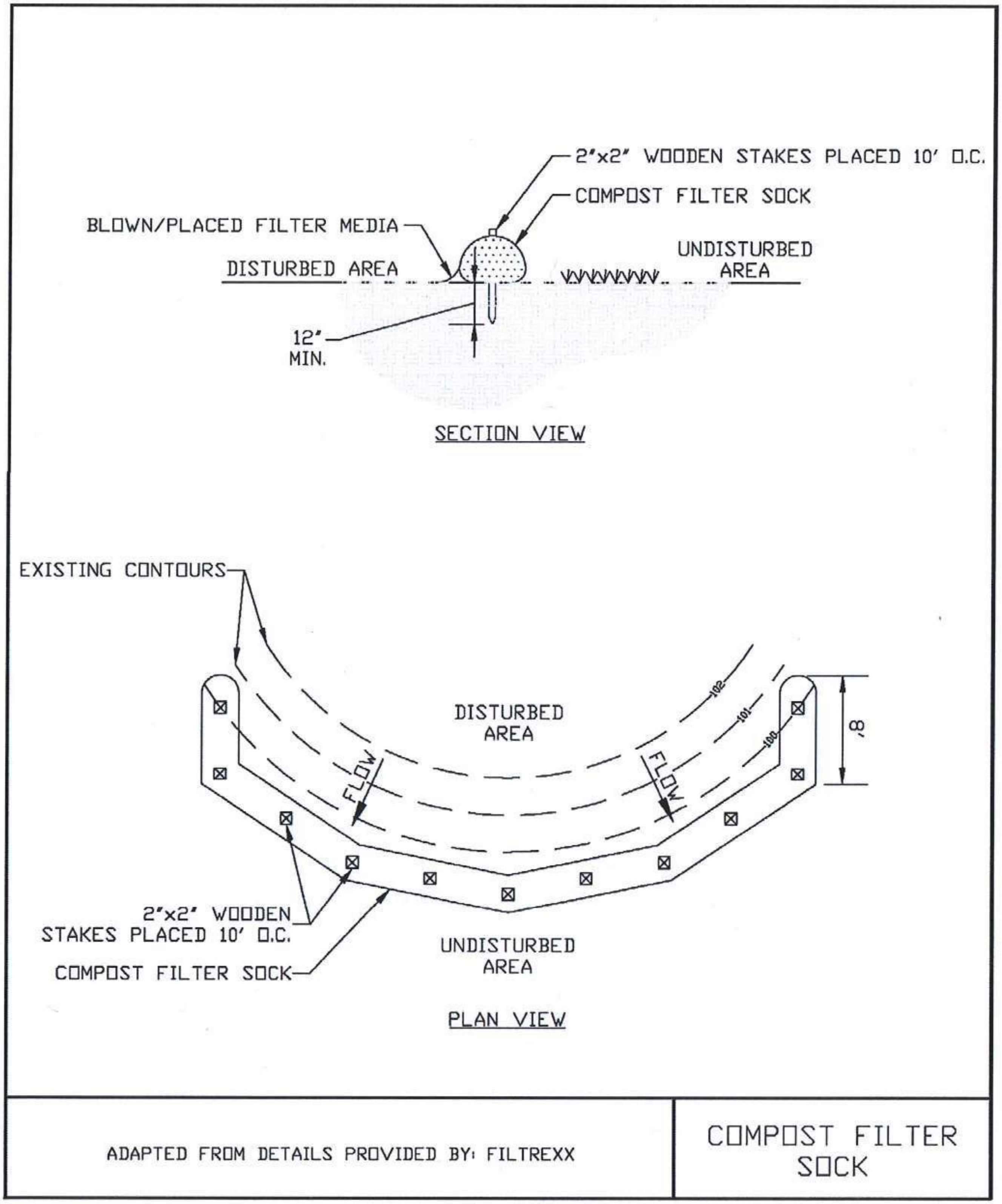
Table 5.1 - Compost Sock Fabric Minimum Specifications Table

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photodegradable	Photodegradable	Biodegradable	Photodegradable	Photodegradable
Sock Diameters	12" 18"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"	12" 18" 24" 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years

Table 5.2 - Compost Standards Table

Organic matter content	25% - 100% (dry weight)
Organic portion	Fibrous and elongated
pH	6.0 – 8.0
Moisture content	30% - 60%
Particle size	100% passing a 2" screen and 10 - 50% passing a 3/8" screen
Soluble salt concentration	5.0 dS/m (mmhos/cm) maximum

Figure 5.2
Compost Filter Sock



STANDARD AND SPECIFICATIONS FOR STORM DRAIN INLET PROTECTION

Definition & Scope

A **temporary** barrier with low permeability, installed around inlets in the form of a fence, berm or excavation around an opening, detaining water and thereby reducing the sediment content of sediment laden water by settling thus preventing heavily sediment laden water from entering a storm drain system.

Conditions Where Practice Applies

This practice shall be used where the drainage area to an inlet is disturbed, it is not possible to temporarily divert the storm drain outfall into a trapping device, and watertight blocking of inlets is not advisable. **It is not to be used in place of sediment trapping devices.** This practice shall be used with an upstream buffer strip if placed at a storm drain inlet on a paved surface. It may be used in conjunction with storm drain diversion to help prevent siltation of pipes installed with low slope angle.

Types of Storm Drain Inlet Practices

There are five (5) specific types of storm drain inlet protection practices that vary according to their function, location, drainage area, and availability of materials:

I. Excavated Drop Inlet Protection
II. Fabric Drop Inlet Protection
III. Stone & Block Drop Inlet Protection
IV. Paved Surface Inlet Protection
V. Manufactured Insert Inlet Protection

Design Criteria

Drainage Area – The drainage area for storm drain inlets shall not exceed one acre. Erosion control/temporary stabilization measures must be implemented on the disturbed drainage area tributary to the inlet. The crest elevations of these practices shall provide storage and minimize bypass flow.

Type I – Excavated Drop Inlet Protection

This practice is generally used during initial overlot grading after the storm drain trunk line is installed.

Limit the drainage area to the inlet device to 1 acre. Excavated side slopes shall be no steeper than 2:1. The minimum depth shall be 1 foot and the maximum depth 2 feet as measured from the crest of the inlet structure. Shape the excavated basin to fit conditions with the longest dimension oriented toward the longest inflow area to provide maximum trap efficiency. The capacity of the excavated basin should be established to contain 900 cubic feet per acre of disturbed area. Weep holes, protected by fabric and stone, should be provided for draining the temporary pool.

Inspect and clean the excavated basin after every storm. Sediment should be removed when 50 percent of the storage volume is achieved This material should be incorporated into the site in a stabilized manner.

Type II – Fabric Drop Inlet Protection

This practice is generally used during final elevation grading phases after the storm drain system is completed.

Limit the drainage area to 1 acre per inlet device. Land area slope immediately surrounding this device should not exceed 1 percent. The maximum height of the fabric above the inlet crest shall not exceed 1.5 feet unless reinforced.

The top of the barrier should be maintained to allow overflow to drop into the drop inlet and not bypass the inlet to unprotected lower areas. Support stakes for fabric shall be a minimum of 3 feet long, spaced a maximum 3 feet apart. They should be driven close to the inlet so any overflow drops into the inlet and not on the unprotected soil. Improved performance and sediment storage volume can be obtained by excavating the area.

Inspect the fabric barrier after each rain event and make repairs as needed. Remove sediment from the pool area as necessary with care not to undercut or damage the filter fabric. Upon stabilization of the drainage area, remove all materials and unstable sediment and dispose of properly. Bring the adjacent area of the drop inlet to grade, smooth and compact and stabilize in the appropriate manner to the site.

Type III – Stone and Block Drop Inlet Protection

This practice is generally used during the initial and intermediate overlot grading of a construction site.

Limit the drainage area to 1 acre at the drop inlet. The stone barrier should have a minimum height of 1 foot and a maximum height of 2 feet. Do not use mortar. The height should be limited to prevent excess ponding and bypass flow.

Recess the first course of blocks at least 2 inches below the crest opening of the storm drain for lateral support. Subsequent courses can be supported laterally if needed by placing a 2x4 inch wood stud through the block openings perpendicular to the course. The bottom row should have a few blocks oriented so flow can drain through the block to dewater the basin area.

The stone should be placed just below the top of the blocks on slopes of 2:1 or flatter. Place hardware cloth of wire mesh with ½ inch openings over all block openings to hold stone in place.

As an optional design, the concrete blocks may be omitted and the entire structure constructed of stone, ringing the outlet ("doughnut"). The stone should be kept at a 3:1 slope toward the inlet to keep it from being washed into the inlet. A level area 1 foot wide and four inches below the crest will further prevent wash. Stone on the slope toward the inlet should be at least 3 inches in size for stability and 1 inch or smaller away from the inlet to control flow rate. The elevation of the top of the stone crest must be maintained 6 inches lower than the ground elevation down slope from the inlet to ensure that all storm flows pass over the stone into the storm drain and not past the structure. Temporary diking should be used as necessary to prevent bypass flow.

The barrier should be inspected after each rain event and repairs made where needed. Remove sediment as necessary to provide for accurate storage volume for subsequent rains. Upon stabilization of contributing drainage area, remove all materials and any unstable soil and dispose of properly.

Bring the disturbed area to proper grade, smooth, compact and stabilize in a manner appropriate to the site.

Type IV – Paved Surface Inlet Protection

This practice is generally used after pavement construction has been done while final grading and soil stabilization is occurring. These practices should be used with upstream buffer strips in linear construction applications, and with temporary surface stabilization for overlot areas, to reduce the sediment load at the practice. This practice includes sand bags, compost filter socks, geo-tubes filled with ballast, and manufactured surface barriers. Pea gravel can also be used in conjunction with these practices to improve performance. When the inlet is not at a low point, and is offset from the pavement or gutter line, protection should be selected and installed so that flows are not diverted around the inlet.

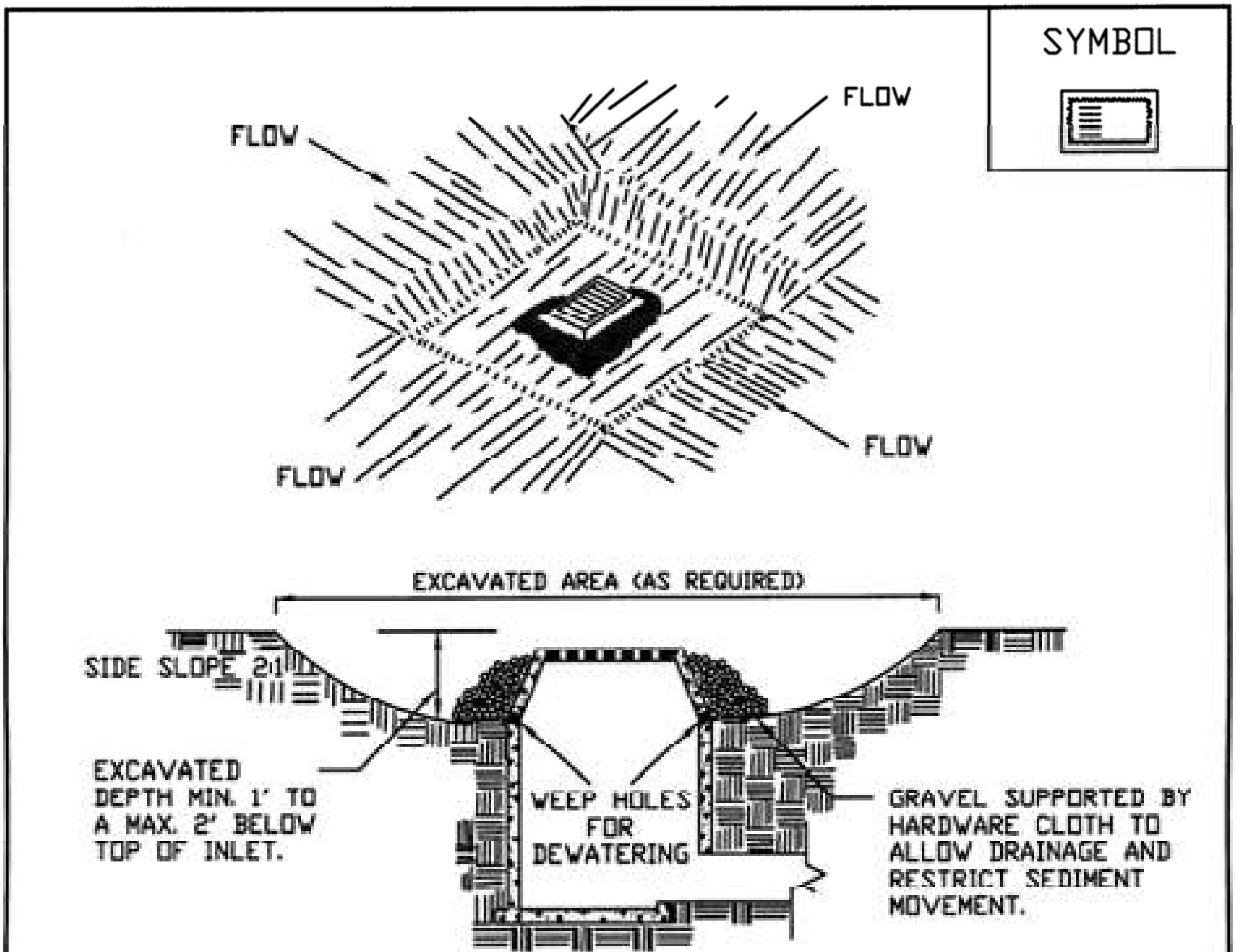
The drainage area should be limited to 1 acre at the drain inlet. All practices will be placed at the inlet perimeter or beyond to maximize the flow capacity of the inlet. Practices shall be weighted, braced, tied, or otherwise anchored to prevent movement or shifting of location on paved surfaces. Traffic safety shall be integrated with the use of this practice. All practices should be marked with traffic safety cones as appropriate. Structure height shall not cause flooding or by-pass flow that would cause additional erosion.

The structure should be inspected after every storm event. Any sediment should be removed and disposed of on the site. Any broken or damaged components should be replaced. Check all materials for proper anchorage and secure as necessary.

Type V - Manufactured Insert Inlet Protection

The drainage area shall be limited to 1 acre at the drain inlet. All inserts will be installed and anchored in accordance with the manufacturers recommendations and design details. The fabric portion of the structure will equal or exceed the performance standard for the silt fence fabric. The inserts will be installed to preserve a minimum of 50 percent of the open, unobstructed design flow area of the storm drain inlet opening to maintain capacity for storm events.

Figure 5.31
Excavated Drop Inlet Protection



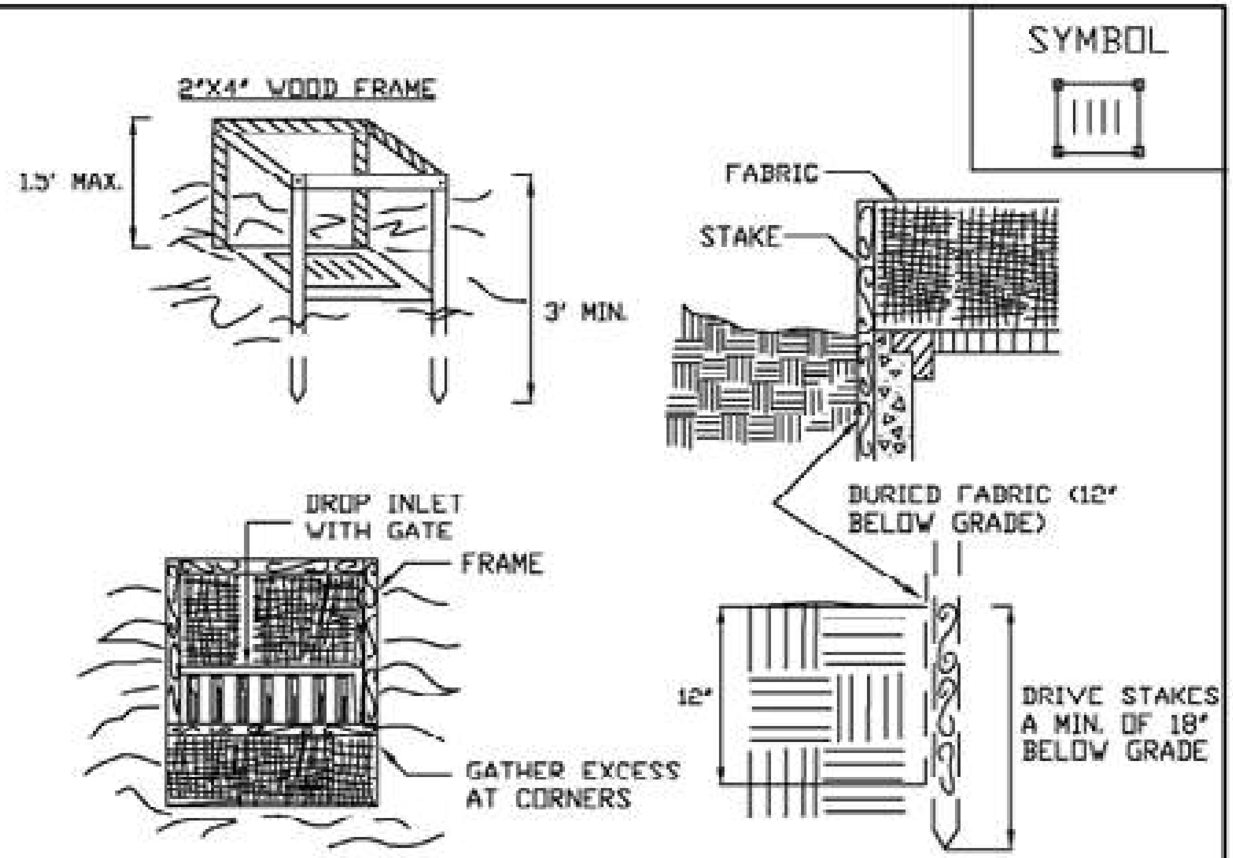
CONSTRUCTION SPECIFICATIONS

1. CLEAR THE AREA OF ALL DEBRIS THAT WILL HINDER EXCAVATION.
2. GRADE APPROACH TO THE INLET UNIFORMLY AROUND THE BASIN.
3. WEEP HOLES SHALL BE PROTECTED BY GRAVEL.
4. UPON STABILIZATION OF CONTRIBUTING DRAINAGE AREA, SEAL WEEP HOLES, FILL EXCAVATION WITH STABLE SOIL TO FINAL GRADE, COMPACT IT PROPERLY AND STABILIZE WITH PERMANENT SEEDING.

MAXIMUM DRAINAGE AREA 1 ACRE

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	EXCAVATED DROP INLET PROTECTION

Figure 5.32
Fabric Drop Inlet Protection



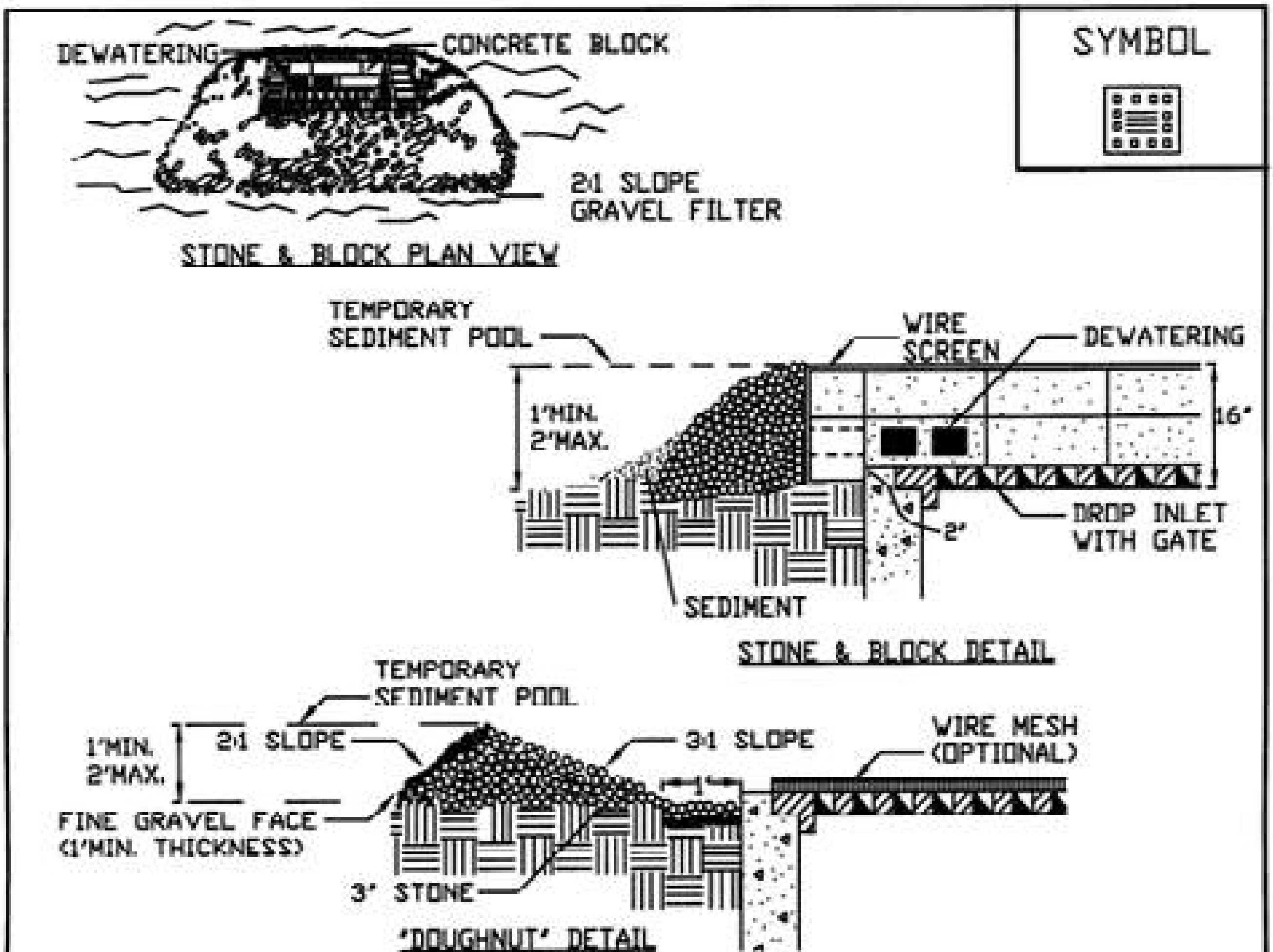
CONSTRUCTION SPECIFICATIONS

1. FABRIC SHALL HAVE AN EOS OF 40-85. BURLAP MAY BE USED FOR SHORT TERM APPLICATIONS.
2. CUT FABRIC FROM A CONTINUOUS ROLL TO ELIMINATE JOINTS. IF JOINTS ARE NEEDED THEY WILL BE OVERLAPPED TO THE NEXT STAKE.
3. STAKE MATERIALS WILL BE STANDARD 2" x 4" WOOD OR EQUIVALENT. METAL WITH A MINIMUM LENGTH OF 3 FEET.
4. SPACE STAKES EVENLY AROUND INLET 3 FEET APART AND DRIVE A MINIMUM 18 INCHES DEEP. SPANS GREATER THAN 3 FEET MAY BE BRIDGED WITH THE USE OF WIRE MESH BEHIND THE FILTER FABRIC FOR SUPPORT.
5. FABRIC SHALL BE EMBEDDED 1 FOOT MINIMUM BELOW GROUND AND BACKFILLED. IT SHALL BE SECURELY FASTENED TO THE STAKES AND FRAME.
6. A 2" x 4" WOOD FRAME SHALL BE COMPLETED AROUND THE CREST OF THE FABRIC FOR OVER FLOW STABILITY.

MAXIMUM DRAINAGE AREA 1 ACRE

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	FABRIC DROP INLET PROTECTION

Figure 5.33
Stone & Block Drop Inlet Protection



CONSTRUCTION SPECIFICATIONS

1. LAY ONE BLOCK ON EACH SIDE OF THE STRUCTURE ON ITS SIDE FOR DEWATERING. FOUNDATION SHALL BE 2 INCHES MINIMUM BELOW REST OF INLET AND BLOCKS SHALL BE PLACED AGAINST INLET FOR SUPPORT.
2. HARDWARE CLOTH OR 1/2" WIRE MESH SHALL BE PLACED OVER BLOCK OPENINGS TO SUPPORT STONE.
3. USE CLEAN STONE OR GRAVEL 1/2-3/4 INCH IN DIAMETER PLACED 2 INCHES BELOW TOP OF THE BLOCK ON A 2:1 SLOPE OR FLATTER.
4. FOR STONE STRUCTURES ONLY, A 1 FOOT THICK LAYER OF THE FILTER STONE WILL BE PLACED AGAINST THE 3 INCH STONE AS SHOWN ON THE DRAWINGS.

MAXIMUM DRAINAGE AREA 1 ACRE

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	STONE & BLOCK DROP INLET PROTECTION

STANDARD AND SPECIFICATIONS FOR STABILIZED CONSTRUCTION ACCESS

Definition & Scope

A stabilized pad of aggregate underlain with geotextile located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk, or parking area. The purpose of stabilized construction access is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets.

Conditions Where Practice Applies

A stabilized construction access shall be used at all points of construction ingress and egress.

Design Criteria

See Figure 2.1 on page 2.31 for details.

Aggregate Size: Use a matrix of 1-4 inch stone, or reclaimed or recycled concrete equivalent.

Thickness: Not less than six (6) inches.

Width: 12-foot minimum but not less than the full width of points where ingress or egress occurs. 24-foot minimum if there is only one access to the site.

Length: As required, but not less than 50 feet (except on a single residence lot where a 30 foot minimum would apply).

Geotextile: To be placed over the entire area to be covered with aggregate. Filter cloth will not be required on a single-family residence lot. Piping of surface water under entrance shall be provided as required. If piping is impossible, a mountable berm with 5:1 slopes will be permitted.

Criteria for Geotextile: The geotextile shall be woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals, hydro-carbons, mildew, rot resistant, and conform to the fabric properties as shown:

Fabric Properties[3]	Light Duty[1] Roads Grade Subgrade	Heavy Duty[2] Haul Roads Rough Graded	Test Method
Grab Tensile Strength (lbs)	200	220	ASTM D1682
Elongation at Failure (%)	50	60	ASTM D1682
Mullen Burst Strength (lbs)	190	430	ASTM D3786
Puncture Strength (lbs)	40	125	ASTM D751 Modified
Equivalent	40-80	40-80	US Std Sieve
Opening Size			CW-02215
Aggregate Depth	6	10	-

[1]Light Duty Road: Area sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Acceptable materials are Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

[2]Heavy Duty Road: Area sites with only rough grading, and where most travel would be multi-axle vehicles. Acceptable materials are Trevira Spunbond 1135, Mirafi 600X, or equivalent.

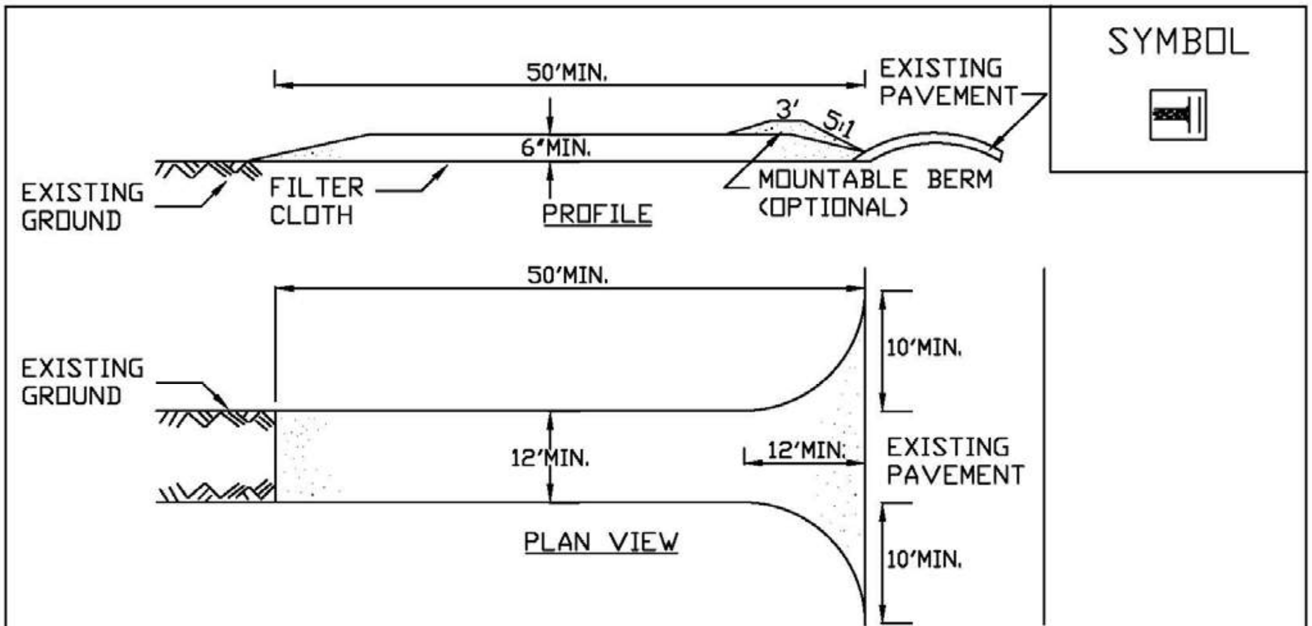
[3]Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

Maintenance

The access shall be maintained in a condition which will prevent tracking of sediment onto public rights-of-way or streets. This may require periodic top dressing with additional aggregate. All sediment spilled, dropped, or washed onto public rights-of-way must be removed immediately.

When necessary, wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment-trapping device. All sediment shall be prevented from entering storm drains, ditches, or watercourses.

Figure 2.1
Stabilized Construction Access



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE - USE 1-4 INCH STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ACCESS SHALL BE PIPED BENEATH THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON A AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

ADAPTED FROM DETAILS PROVIDED BY: USDA - NRCS, NEW YORK STATE DEPARTMENT OF TRANSPORTATION, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION, NEW YORK STATE SOIL & WATER CONSERVATION COMMITTEE	STABILIZED CONSTRUCTION ACCESS

STANDARD AND SPECIFICATIONS FOR ROCK OUTLET PROTECTION

Definition & Scope

A **permanent** section of rock protection placed at the outlet end of the culverts, conduits, or channels to reduce the depth, velocity, and energy of water, such that the flow will not erode the receiving downstream reach.

Conditions Where Practice Applies

This practice applies where discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This applies to:

1. Culvert outlets of all types.
2. Pipe conduits from all sediment basins, dry storm water ponds, and permanent type ponds.
3. New channels constructed as outlets for culverts and conduits.

Design Criteria

The design of rock outlet protection depends entirely on the location. Pipe outlet at the top of cuts or on slopes steeper than 10 percent, cannot be protected by rock aprons or riprap sections due to re-concentration of flows and high velocities encountered after the flow leaves the apron.

Many counties and state agencies have regulations and design procedures already established for dimensions, type and size of materials, and locations where outlet protection is required. Where these requirements exist, they shall be followed.

Tailwater Depth

The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. If the tailwater depth is less than half the diameter of the outlet pipe, and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition; see Figure 3.16 on page 3.42 as an example. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition; see Figure 3.17 on page 3.43 as an example. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition; see Figure 3.16 on page 3.42 as an example.

Apron Size

The apron length and width shall be determined from the curves according to the tailwater conditions:

Minimum Tailwater – Use Figure 3.16 on page 3.42
Maximum Tailwater – Use Figure 3.17 on page 3.43

If the pipe discharges directly into a well defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less.

The upstream end of the apron, adjacent to the pipe, shall have a width two (2) times the diameter of the outlet pipe, or conform to pipe end section if used.

Bottom Grade

The outlet protection apron shall be constructed with no slope along its length. There shall be no overfall at the end of the apron. The elevation of the downstream end of the apron shall be equal to the elevation of the receiving channel or adjacent ground.

Alignment

The outlet protection apron shall be located so that there are no bends in the horizontal alignment.

Materials

The outlet protection may be done using rock riprap, grouted riprap, or gabions. Outlets constructed on the bank of a stream or wetland shall not use grouted rip-rap, gabions or concrete.

Riprap shall be composed of a well-graded mixture of rock size so that 50 percent of the pieces, by weight, shall be larger than the d_{50} size determined by using the charts. A well-graded mixture, as used herein, is defined as a mixture composed primarily of larger rock sizes, but with a sufficient mixture of other sizes to fill the smaller voids between the rocks. The diameter of the largest rock size in such a mixture shall be 1.5 times the d_{50} size.

Thickness

The minimum thickness of the riprap layer shall be 1.5 times the maximum rock diameter for d_{50} of 15 inches or less; and 1.2 times the maximum rock size for d_{50} greater than 15 inches. The following chart lists some examples:

D_{50} (inches)	d_{max} (inches)	Minimum Blanket Thickness (inches)
4	6	9
6	9	14
9	14	20
12	18	27
15	22	32
18	27	32
21	32	38
24	36	43

Rock Quality

Rock for riprap shall consist of field rock or rough unhewn quarry rock. The rock shall be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual rocks shall be at least 2.5.

Filter

A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap. Riprap shall have a filter placed under it in all cases.

A filter can be of two general forms: a gravel layer or a plastic filter cloth. The plastic filter cloth can be woven or non-woven monofilament yarns, and shall meet these base requirements: thickness 20-60 mils, grab strength 90-120 lbs; and shall conform to ASTM D-1777 and ASTM D-1682.

Gravel filter blanket, when used, shall be designed by comparing particle sizes of the overlying material and the base material. Design criteria are available in Standard and Specification for Anchored Slope and Channel Stabilization on page 4.7.

Gabions

Gabions shall be made of hexagonal triple twist mesh with heavily galvanized steel wire. The maximum linear dimension of the mesh opening shall not exceed 4 ½ inches and the area of the mesh opening shall not exceed 10 square inches.

Gabions shall be fabricated in such a manner that the sides, ends, and lid can be assembled at the construction site into a rectangular basket of the specified sizes. Gabions shall be of single unit construction and shall be installed according to manufacturer's recommendations.

The area on which the gabion is to be installed shall be graded as shown on the drawings. Foundation conditions shall be the same as for placing rock riprap, and filter cloth shall be placed under all gabions. Where necessary, key, or tie, the structure into the bank to prevent undermining of the main gabion structure.

Maintenance

Once a riprap outlet has been installed, the maintenance needs are very low. It should be inspected after high flows for evidence of scour beneath the riprap or for dislodged rocks. Repairs should be made immediately.

Design Procedure

1. Investigate the downstream channel to assure that nonerosive velocities can be maintained.

2. Determine the tailwater condition at the outlet to establish which curve to use.

3. Use the appropriate chart with the design discharge to determine the riprap size and apron length required. It is noted that references to pipe diameters in the charts are based on full flow. For other than full pipe flow, the parameters of depth of flow and velocity must be used to adjust the design discharges.

4. Calculate apron width at the downstream end if a flare section is to be employed.

Design Examples are demonstrated in Appendix B.

Construction Specifications

1. The subgrade for the filter, riprap, or gabion shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density of approximately that of the surrounding undisturbed material.

2. The rock or gravel shall conform to the specified grad-

ing limits when installed respectively in the riprap or filter.

3. Filter cloth shall be protected from punching, cutting, or tearing. Any damage other than an occasional small hole shall be repaired by placing another piece of cloth over the damaged part or by completely replacing the cloth. All overlaps, whether for repairs or for joining two pieces of cloth shall be a minimum of one foot.

4. Rock for the riprap or gabion outlets may be placed by equipment. Both shall each be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. The rock for riprap or gabion outlets shall be delivered and placed in a manner that will ensure that it is reasonably homogenous with the smaller rocks and spalls filling the voids between the larger rocks. Riprap shall be placed in a manner to prevent damage to the filter blanket or filter cloth. Hand placement will be required to the extent necessary to prevent damage to the permanent works.

Figure 3.16
Outlet Protection Design—Minimum Tailwater Condition Chart (Design of Outlet Protection from a Round Pipe Flowing Full, Minimum Tailwater Condition: $T_w < 0.5D_o$) (USDA - NRCS)

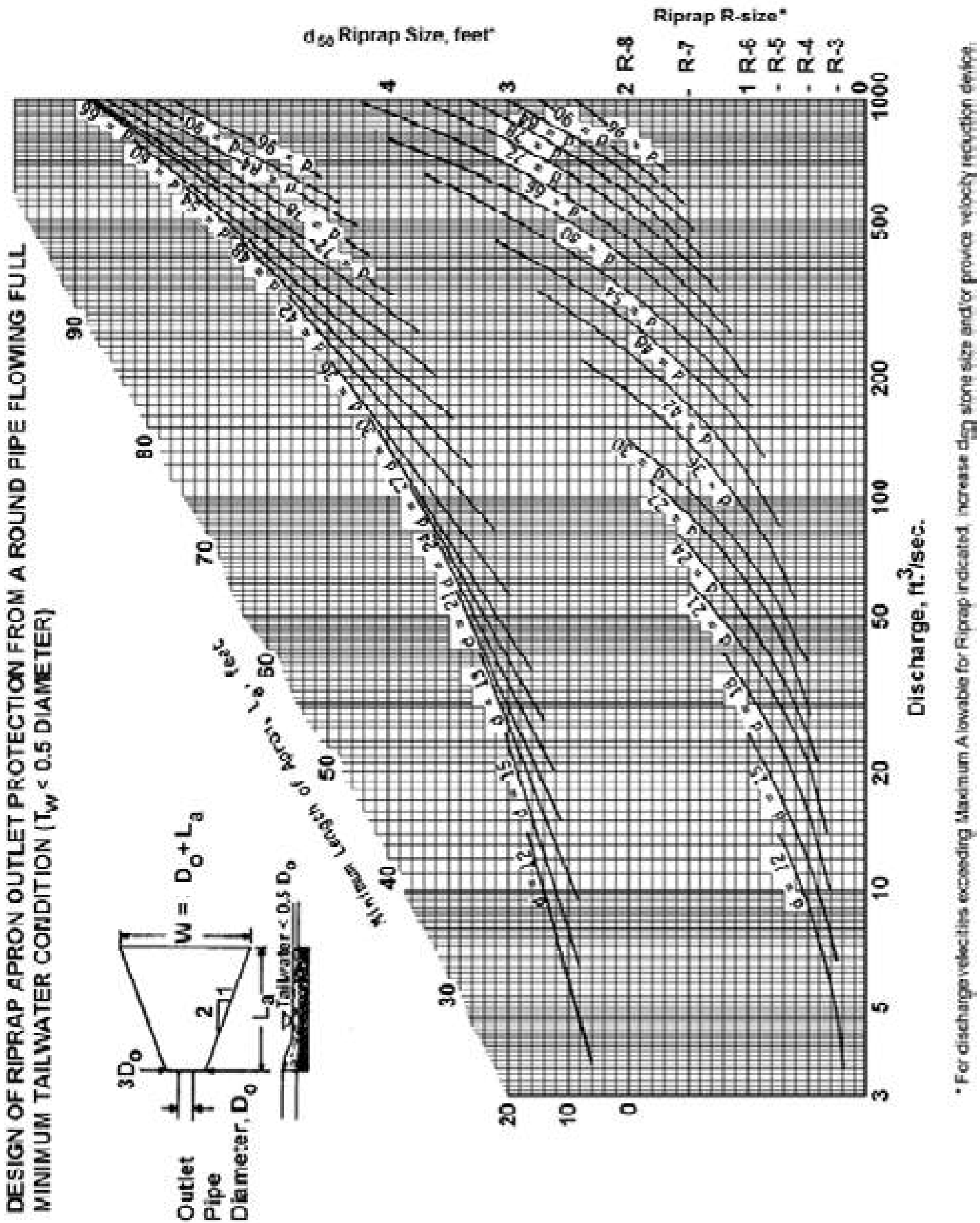


Figure 3.17
Outlet Protection Design—Maximum Tailwater Condition Chart
(Design of Outlet Protection from a Round Pipe Flowing Full, Maximum Tailwater Condition: $T_w \geq 0.5D_o$) (USDA - NRCS)

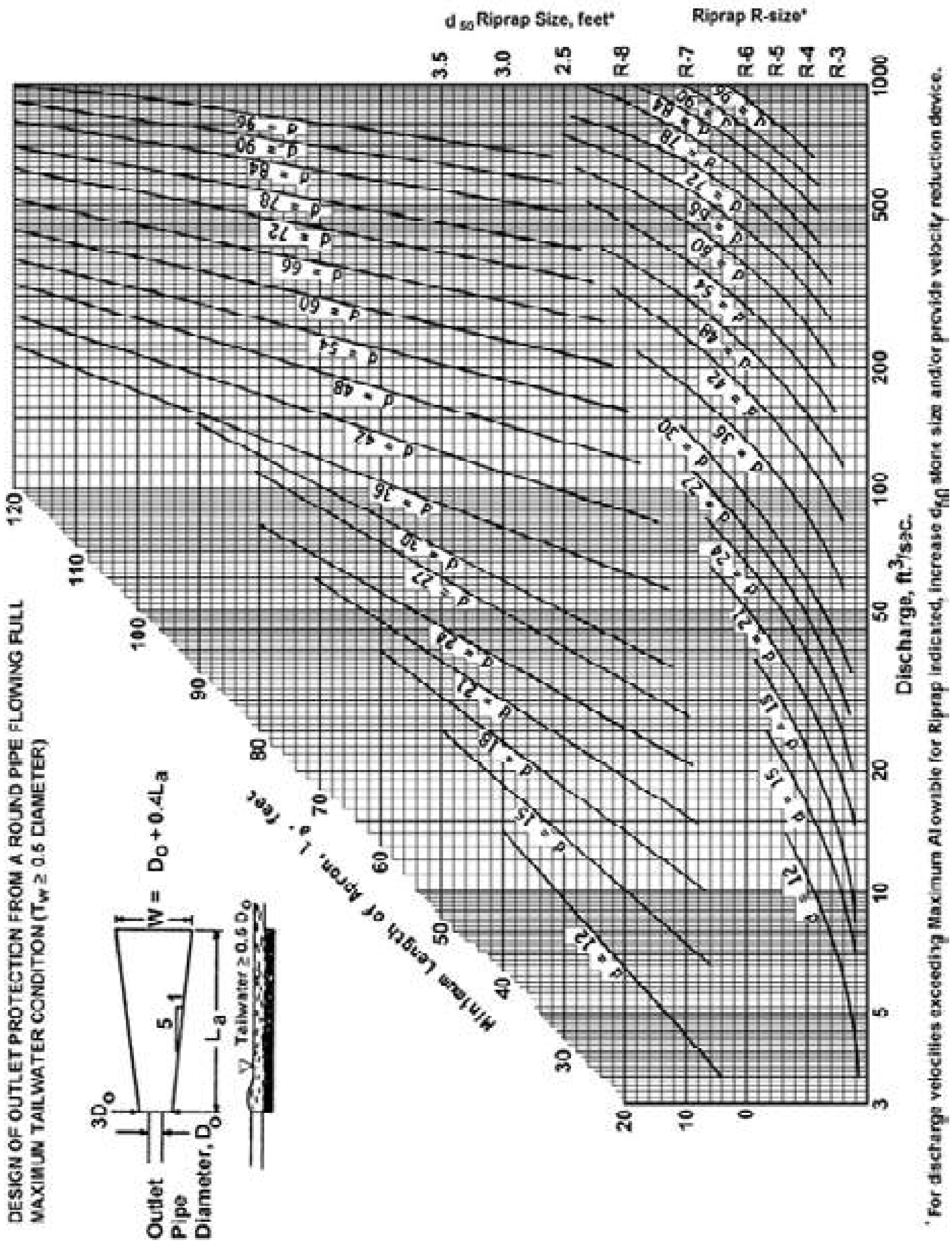


Figure 3.18
Riprap Outlet Protection Detail (1)

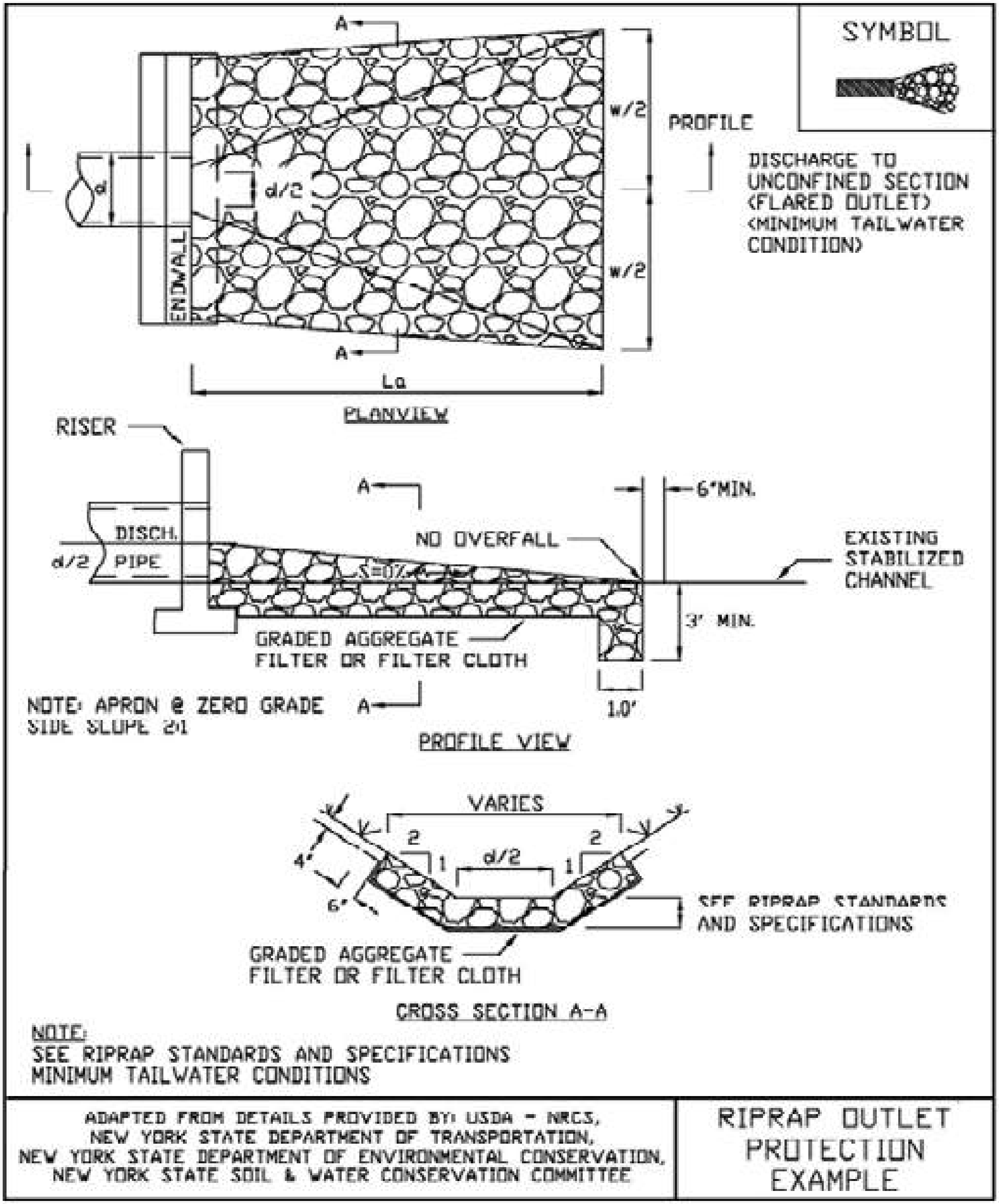


Figure 3.19
Riprap Outlet Protection Detail (2)

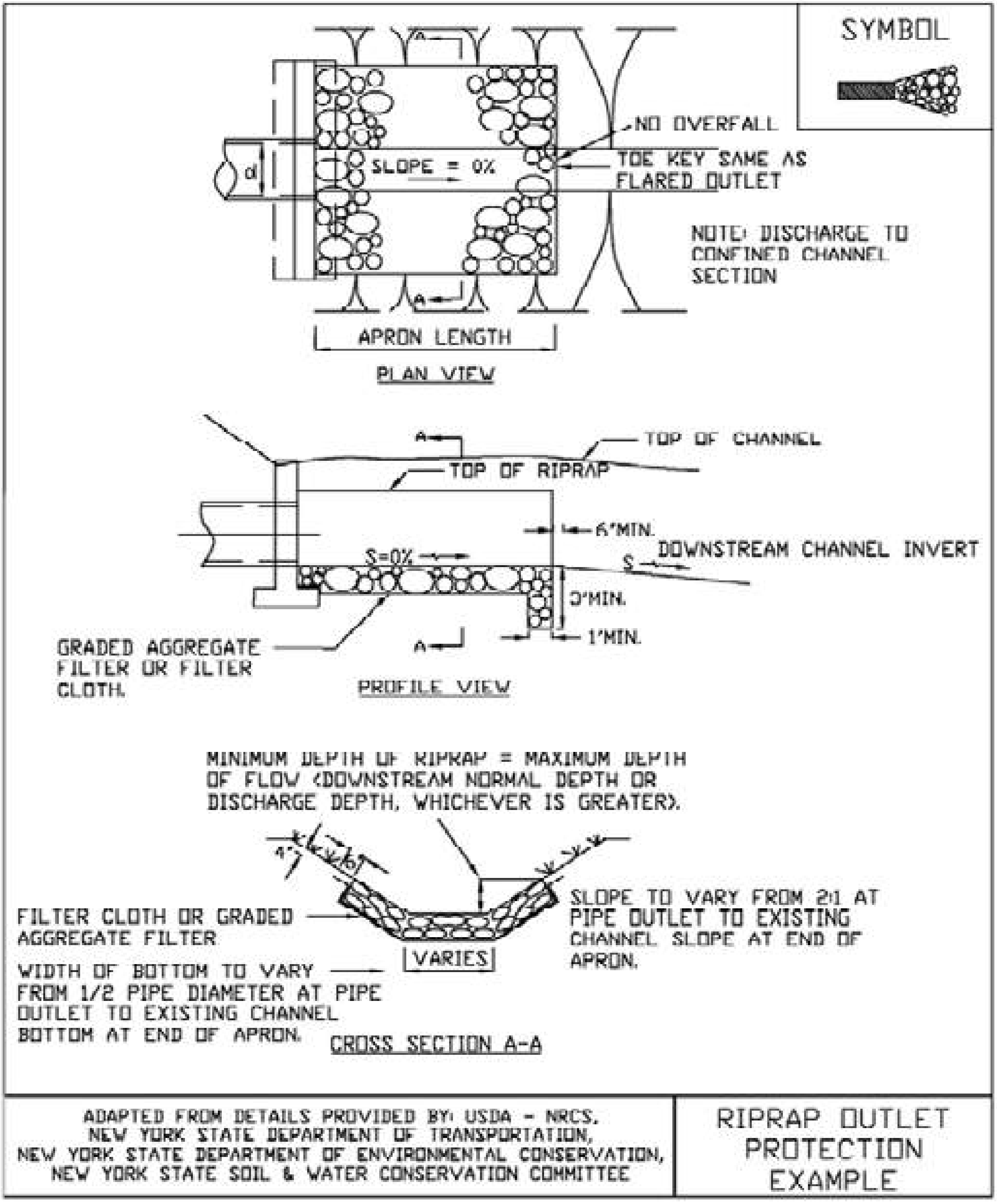
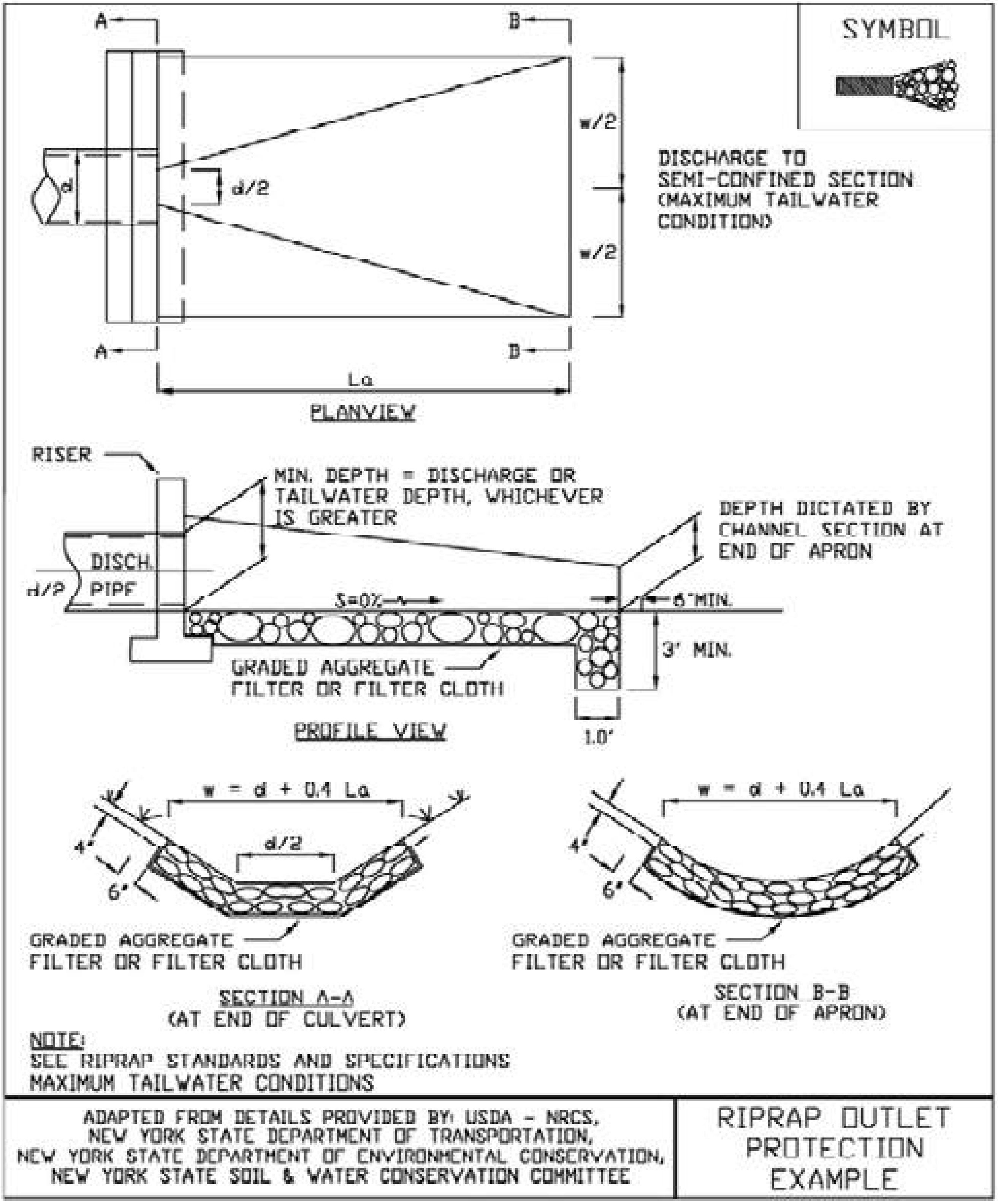


Figure 3.20
Riprap Outlet Protection Detail (3)



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